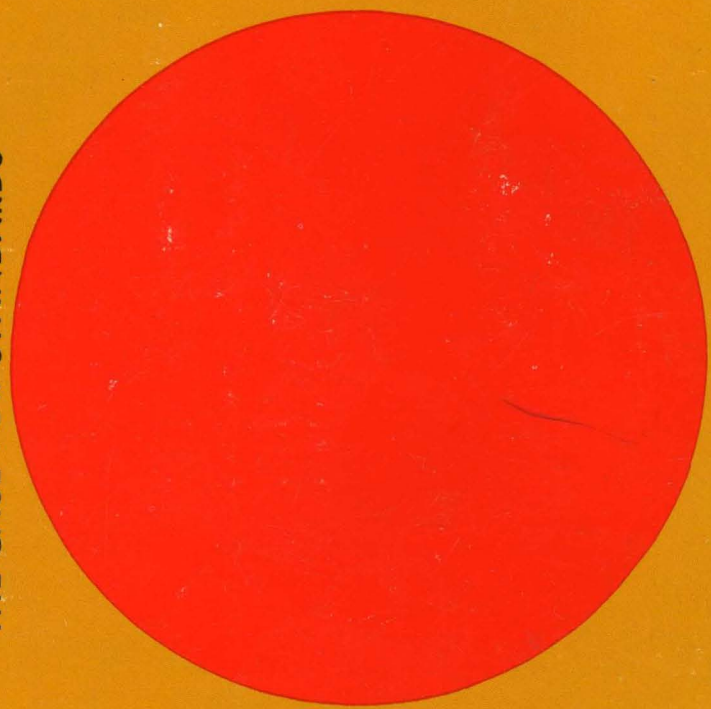
DATAMATION®

69

February

THE CASE FOR STANDARDS



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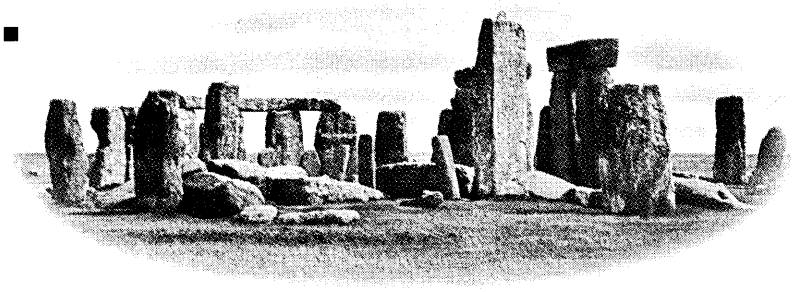

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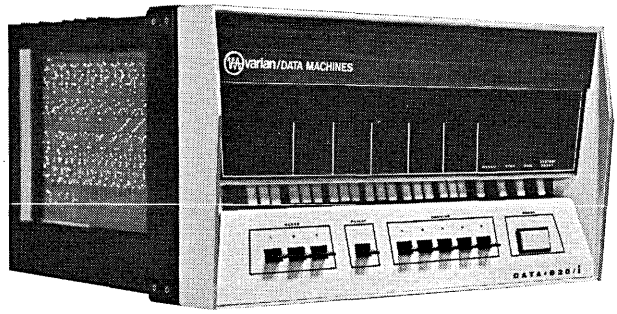

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CIRCLE 1 ON READER CARD

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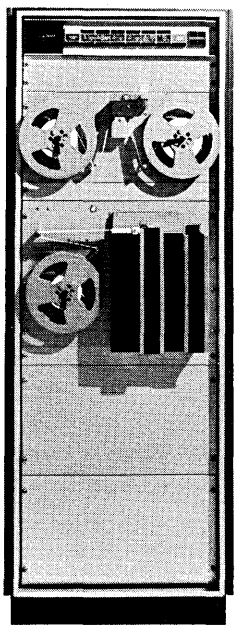

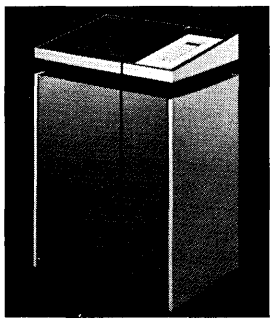

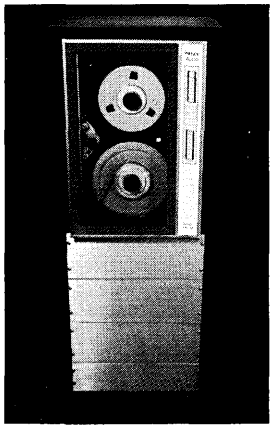

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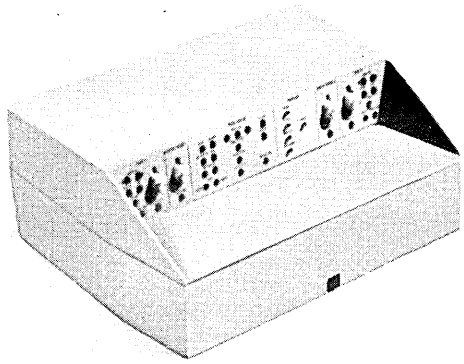

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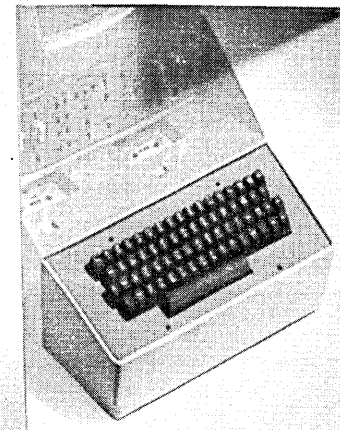

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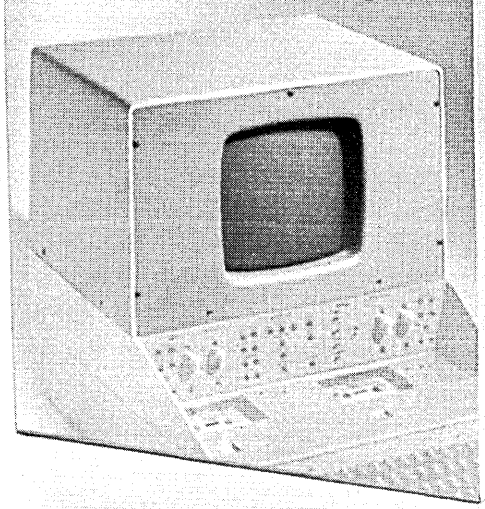

$5 a month

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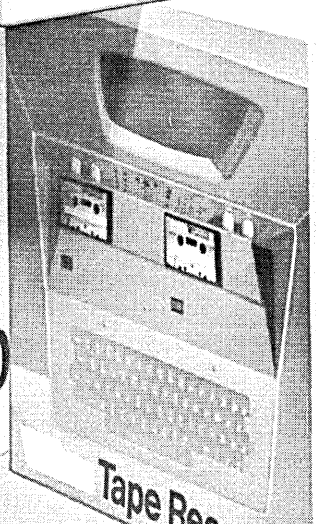

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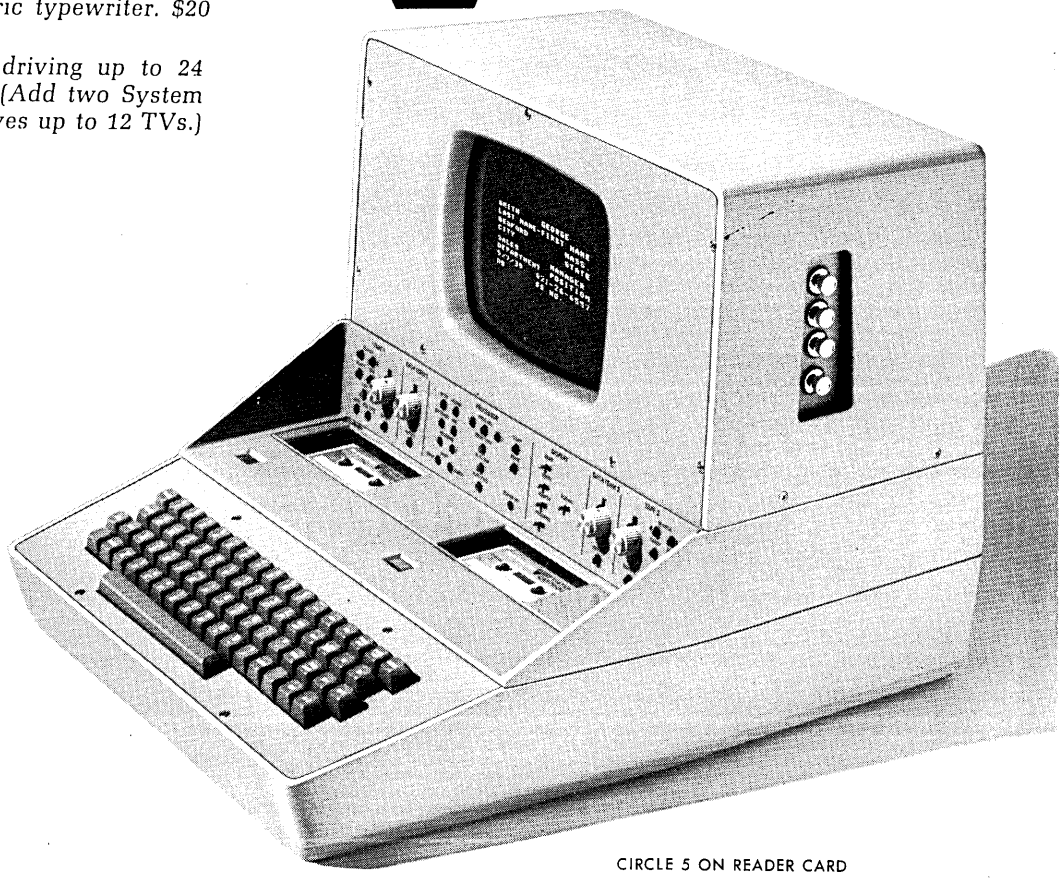
SYSTEM 21



CIRCLE 5 ON READER CARD

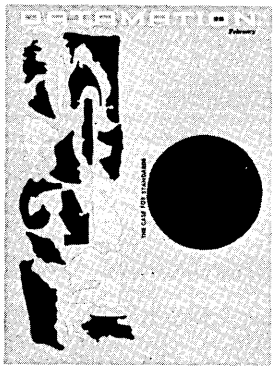
VIATRON System 21 puts the logic where the problem is

CIRCLE 6 ON READER CARD

DATAMATION

february 1969

volume 15 number 2



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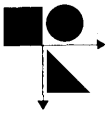

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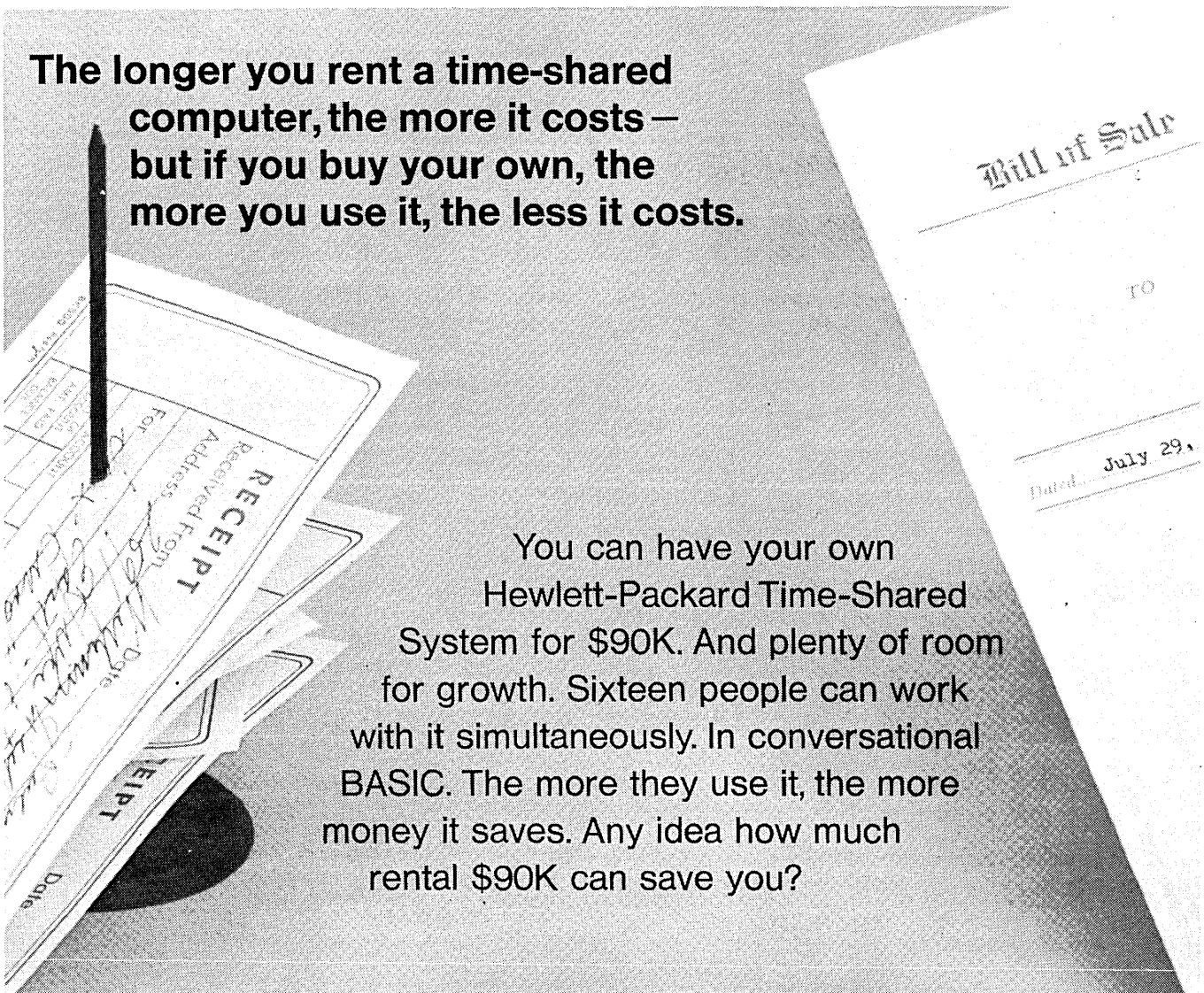

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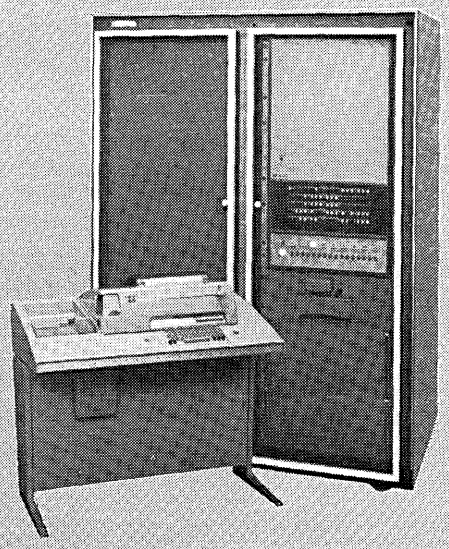

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february
1969

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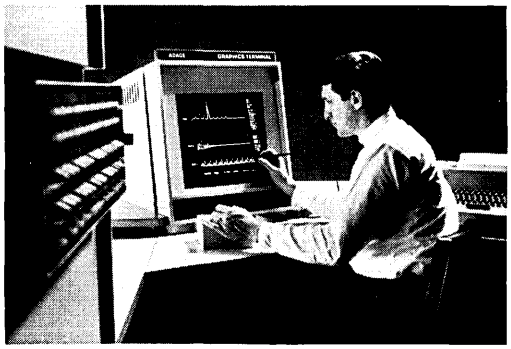
the $188,000 graphics terminal



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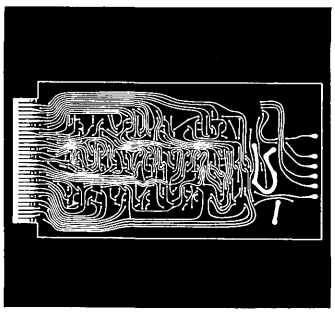
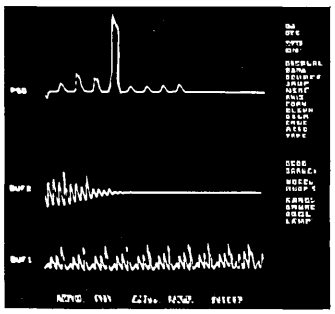
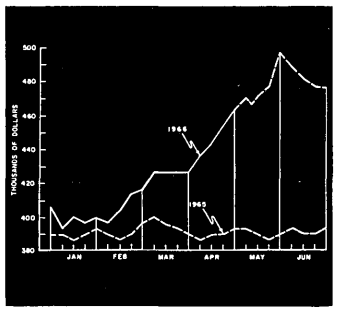


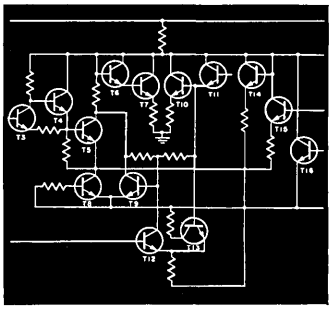
printed circuit layout



on-line signal analysis



business management systems



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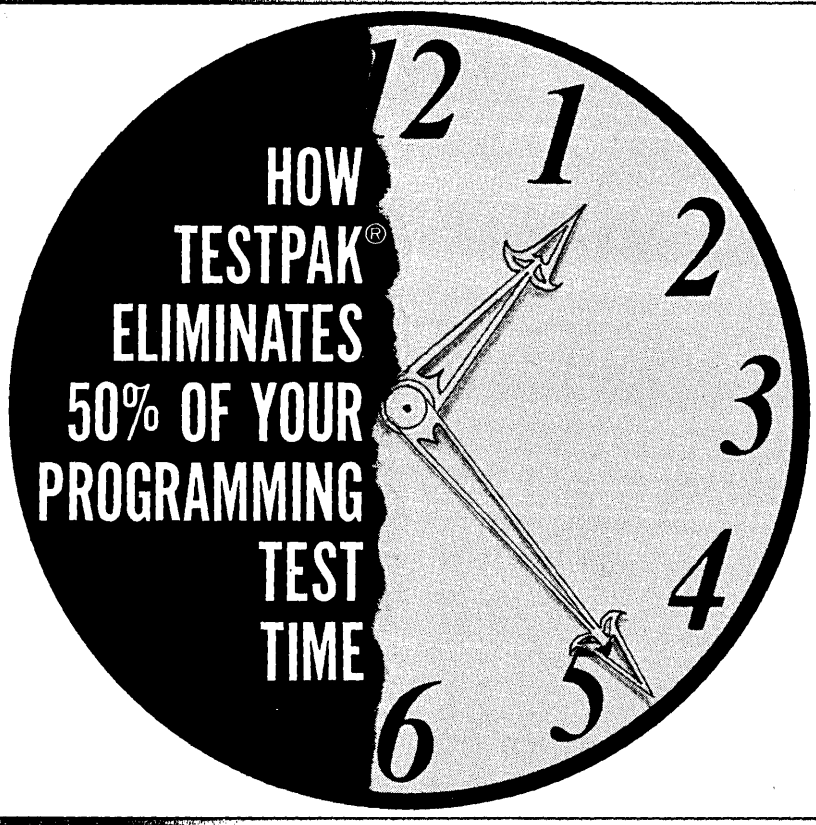
calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
Mar. 26-28	7th Annual Symposium on Biomathematics and Computer Science in the Life Sciences	Houston	Dean, Univ. of Texas Grad School of Biomedical Sciences, Div. of Continuing Educ., P.O. Box 20367, Houston, Texas 77025
May 7-9	Int'l Joint Conf. on Artificial Intelligence	Wash., D.C.	D. E. Walker, The MITRE Corp., Bedford, Mass. 01730
May 14-16	Spring Joint Computer Conference	Boston	AFIPS, 210 Summit Ave., Montvale, N.J. 07645
May 19-21	National Aerospace Electronics Conf.	Dayton	NAECON, 124 E. Monument Ave., Dayton, Ohio 45402
June 16-18	Int'l Symposium on Computer Applications in Earth Sciences	Lawrence, Kansas	Kansas Geological Survey & Int'l Assn. for Mathematical Geology/ D. F. Merriam, Univ. of Kansas, Lawrence 66044
June 16-19	Int'l DP Conference & Business Exposition	Montreal	DPMA, 505 Busse Hwy., Park Ridge, Ill. 60068
June 30-July 1	Conf. on Applications of Continuous System Simulation Languages	San Francisco	SHARE, ACM, IEEE, SCi/H. Hixson, Simulation Center (ACLS), Wright Patterson AFB, Ohio 45433
Aug. 5-8	World Conference on Records	Salt Lake City	The Genealogical Society, World Conf. on Records, 79 S. State St., Salt Lake City, Utah 84111
Aug. 19-22	Western Electronic Show and Convention	San Francisco	WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005
Aug. 25-29	Datafair 69	Manchester, England	The British Computer Society, 23 Dorset Sq., London, N.W. 1, England
Aug. 26-28	National Conf. & Exposition	San Francisco	ACM 69, P.O. Box 2867, San Francisco, Calif. 94126
Sept. 1-5	Int'l Congress on Cybernetics	London, England	The Inst. of Computer Sciences/J. Rose, College of Technology and Design, Blackburn, BB2 1 LH, Lancashire, England



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letters

more on pl/I

Sir:

At the time of this writing (early December '68), the technical question of PL/I's adequacy as stated in the December Editor's Readout is still unanswered. Indeed, it will remain unanswered until USASI—and the association of computer manufacturers that sponsor it—are coerced into conducting and publishing a comprehensive, objective report on the suitability of PL/I for standardization.

Notwithstanding my personal belief that the above will never occur, I would like to attempt to clarify a basic point of potential confusion. This involves the "technical question" mentioned in your December editorial and alluded to in the January letter by the SHARE PL/I Project Manager. Essentially the muddle concerns the difference between the adequacy of PL/I as a language for the specification of solutions for a large variety of computer-based problems versus the suitability of PL/I as a language for standardization. All of the so-called technical questions fall within the former category and this category is only one input to the latter question.

The question that must be decided is whether PL/I should be standardized now. Not whether it is a sufficiently rich, powerful and marketable commodity. Certainly a case could be developed for the linguistic elegance, richness, semantic balance, etc., of Esperanto. However, the consideration of its standardization involves additional factors.

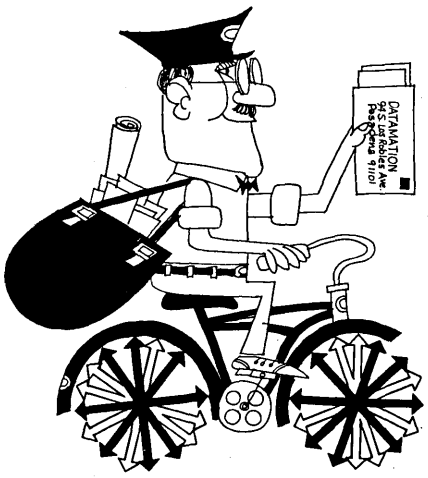
So must it be with PL/I. We know what these additional factors are. For some reason, we persist in avoiding them. Perhaps the decision concerning the suitability of PL/I for standardization should be accomplished by a different organization than the one responsible for the actual standardization effort.

HOWARD BROMBERG
San Francisco, California

Sir:

Despite the fact that I was one of the original 3x3 and therefore in your eyes biased, I must take exception to your December editorial which endorses the delay of the PL/I standardization effort. The main objective of standardization is to attain program compatibility. This compatibility will ease program exchange and increase longevity by making the program transition to new environments economic and less traumatic. Thus the earlier a language can be standardized, the more effective the standards will be. Experience with the time-consuming efforts needed to standardize FORTRAN and COBOL certainly can be traced in large measure to the large vested interests in dialects and implementation peculiarities that were in existence when the efforts were begun. Standardization is arduous at best, but the sooner it is begun the smaller the backlog of programs to form a millstone around our necks.

Up to now PL/I has only been available on a very small number of systems — primarily those available to SHARE and GUIDE members. While this certainly leaves a great part of the data processing community without accessibility to the language, those that can use it cover the broad spectrum of user functions. While most SHARE and GUIDE attendees are primarily oriented toward



large computer systems, many also have the responsibilities of small and intermediate systems within their organizations (this has been true of four of the last six SHARE Presidents). The language's acceptance and use by these people despite the initial implementation drawbacks speaks well for its capabilities. A standardization effort now will broaden the user base by involving users and implementors who haven't yet been involved.

Finally, I must correct a small detail in your editorial concerning the initial language specifications. While we had been briefed on the 360 architecture, our designs did not reflect either its attributes or shortcomings. We would never have introduced, for example, interrupt handling, the great proliferation of internal formats, nor dynamic storage allocation, if it had. Rather we hoped to show the need for certain facilities regardless of machine. While it is true that some items dealing with data ranges peculiar to the 360 did inadvertently appear in our initial draft, these were corrected in the second version.

Let me end therefore with an urge that you reconsider your position and work toward a start on standardization for PL/I.

B. A. ROSENBLATT
San Francisco, California

matter of tact

Sir:

I enjoyed Mr. Hearn's article "TACT Will Improve Your Input Data" in the December issue. It is unfortunate that Mr. Hearn did not cover more fully the human factors in implementing TACT. I assume that a system named TACT places special emphasis on the human aspects of tact. Perhaps Mr. Hearn can write a follow-up article discussing the human factors.

I would be particularly interested in learning if there was any employee resentment to being impartially "rated" by a machine. How has the new rating system affected morale? I have met some excitable people who become very upset if their chances for advancement or possibly their jobs were jeopardized by a grade from a computer.

Another interesting area for Mr. Hearn's next article would be TACT's procedure for handling incorrect error rates. How does TACT inform employees that an error charged to a document was actually caused by a program logic error or an operator loading input out of sequence? An employee with a high TACT error rate could mistakenly blame isolated program bugs for his poor performance. Subsequent discussions on the matter with local union officials or employee representatives would require TACT to live up to its name.

One final topic Mr. Hearn could write about is controls. I wonder if any unscrupulous employee has been caught resubmitting old data in order to improve his error rate.

NATHAN PARTOS
Dublin, California

not in seattle

Sir:

In the December 1968 issue, you printed an item in the Look Ahead Section under the title "Putting the

7.25 million bit capacity, no bigger than a breadbox.

No kidding.
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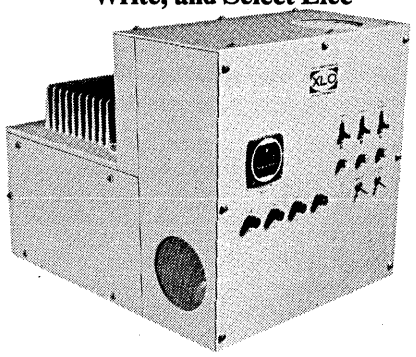

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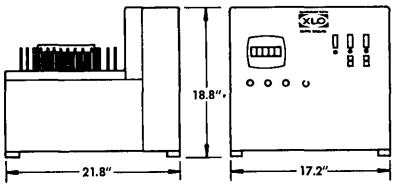

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CIRCLE 12 ON READER CARD

letters

Tiny Businessman On-Line." While we appreciate the informative nature of the piece, we wish to correct what appeared to be misunderstandings.

Geran Applied Systems, Inc., has its headquarters in New York City and does not have offices in Seattle. Geran has acquired the exclusive rights for service bureau use of a proprietary system from a Seattle-based manufacturer. The system uses a Honeywell process control computer, with a proprietary high-speed scanner.

We have definite plans to open in other major cities besides Los Angeles in the very near future. In fact, the next three offices are scheduled to open in the first quarter of 1969.

ANDREW GYENES, PRESIDENT
Geran Applied Systems, Inc.
New York, New York

re-reaction

Sir:

In response to a letter to the editor (Jan., '69) from Mr. Gil Mohr regarding my article on the time-sharing market (Nov., '68).

I'm not sure whether Mr. Mohr is more displeased with my methodology or conclusions. Concerning the latter,

my finding that time sharing has limited attractiveness *is* highly qualified; it is *not* an across-the-board generalization. Essentially, I believe that the individual who has not used a computer previously, in any form, will not readily become a time-sharing subscriber. This would apply to the overwhelming population of business and professional types but probably not to the engineer, scientist, or, generally, the mathematically-oriented individual. This "uninformed" market, as I called it, will require some hard marketing. Apparently, Mr. Mohr agrees, since he states, "I would starve by wasting my time on them."

Concerning technique, I clearly specified the major mechanical details of the study. Of course, it has its limitations but I doubt if a nationwide survey would introduce many changes. For the significant conclusions, there was total reinforcement. And the survey information, both statistically and qualitatively, formed only part of the analysis. Discussions with personnel from on-line time sharing centers and some sober reflection on the subject all concur: for the audience depicted, time sharing is not a "natural."

Mr. Mohr has reinforced my argument by seeking clientele where the marketing task is minimal. I wonder if time sharing can ever fulfill its original potential unless someone moves into the uncongenial environment where the user has had no previous dialogue with the computer community?

HERBERT S. KLEIMAN
Columbus, Ohio

keeping it simple

Sir:

This is in response to Prof. T. R. Hoffman's Letter to the Editor (Jan. '69, p. 13). The following comments are not in the way of a "rebuttal" but possibly an elucidation.

I appreciate, and agree with, the comments made by Prof. Hoffman. His solutions are simpler in some cases by virtue of having effectively re-introduced the "don't cares" in my *Step 4* (page 48). This will not affect $S_A, R_A, T_A, J_A, K_A, D_A, S_B, R_B, J_B, K_B, S_C, R_C, J_C, K_C$, and D_C. It *will*, though, change

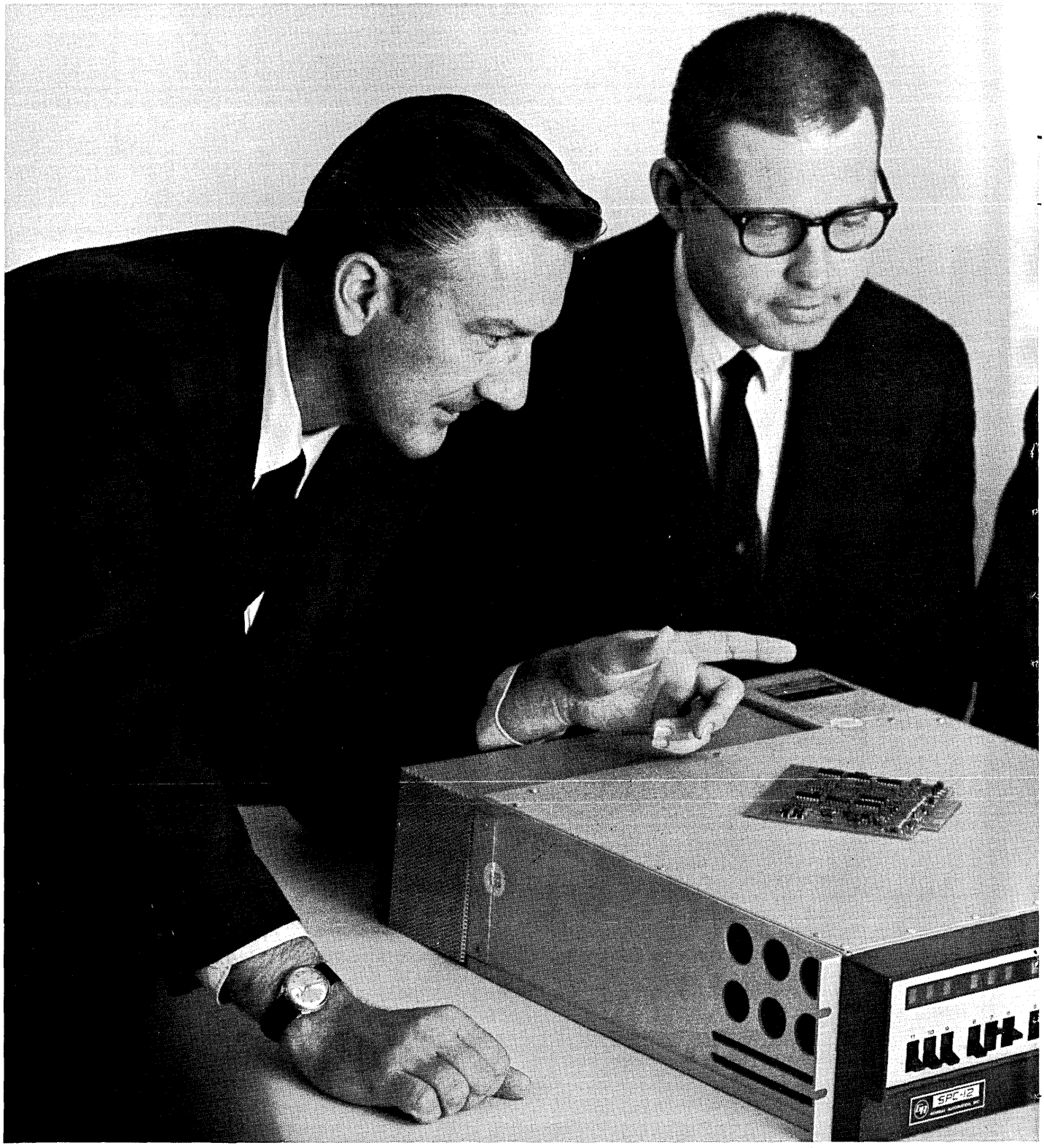
T_B from $\overline{A}\,\overline{B} + B\,\overline{C}$ to $\overline{A}\,C$ (saving 4 diodes)

D_B from $\overline{A}\,\overline{B} + B\,C$ to $\overline{A}\,\overline{B} + C$ (saving 2 diodes)

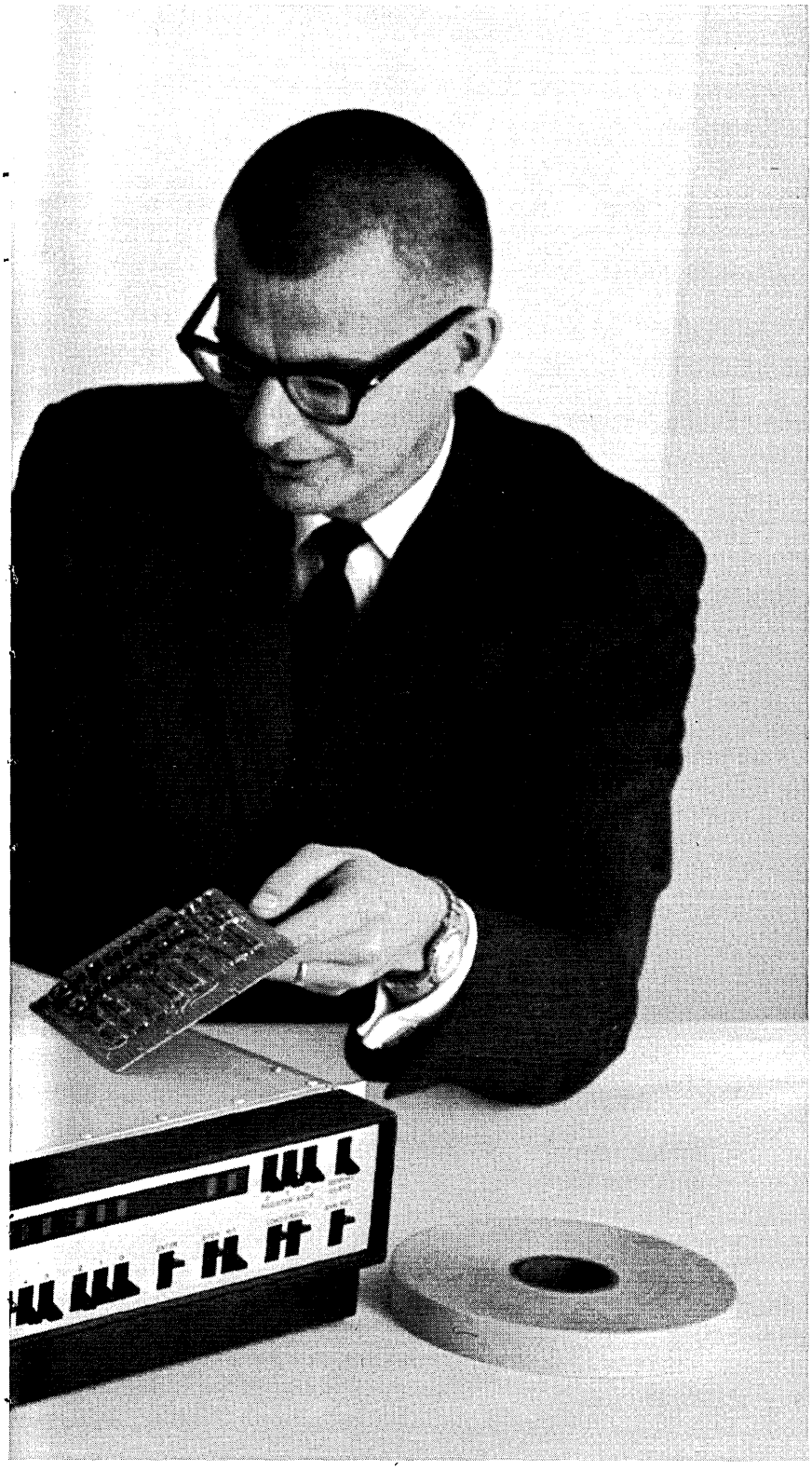
T_C from $\overline{A}\,\overline{B}\,\overline{C} + A\,C$ to $\overline{A}\,\overline{B} + A\,B$ or $\overline{A}\,\overline{B} + A\,C$ (saving 1 diode either way)

I did not take what in my presentation would have been this additional step, mainly in order to keep it as simple as possible—in the non-Boolean sense. I made a point of developing, independently, the Application Equations and the Characteristic Equations, and only *then* merging them. An experienced logical designer can be more efficient in both writing and the use of

(Continued on page 185)



We took engineering, software and our middle name:



Our name, General Automation, Inc., covers a lot of ground. So we put a lot into it. In all three important areas, engineering, hardware, and software, we have automation experts of national stature, supported by outstanding talent; structured organizations, each operating as a separate division. All dedicated to providing definitive service in any automation project.

Directed by William Beyer (Left), our engineering service covers feasibility studies, process analyses, system syntheses, and design, development, installation and "turn key" of all elements for an automated function. Mr. Beyer is well known for his management of major system developments in the utility, petro-chemical and steel process fields.

Dr. Robert Jackson (Center),is responsible for the development of our powerful family of digital automation hardware. Including the SPC-12 Automation Computer, the smaller SPC-8 digital computer, the uniquely conceived family of economical system interface units, and the selection of versatile system accessories. Dr. Jackson has gained wide recognition for his inventive contributions to the development of computers and controllers in many major installations.

Under Tomas Glass (Right), our software department performs solution programming, automation programming, and product software development. Dr. Glass has earned a national reputation for his theoretical and applied work in systems and computer programming.

Each of the activities represented by these men and their associates is available to you separately or together to meet your individual requirements. If you are contemplating an automation project, or would like assistance on any aspect of such a project, engineering, hardware, software, or all three, call on General Automation, your automation partner.

Pictured is our SPC-12, a byte-oriented automation computer. It's powerful and reliable, easy to program and easy to use — only $6400. Write for our new SPC-12 brochure.

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hardware, and combined them into General Automation, Inc.

look ahead

IBM FACES JUSTICE AT LAST

The ramifications of the Justice Dept. antitrust suit against IBM are manifold and various. Antitrust experts and other sources pose the following:

IBM is expected to push for a "quick" settlement, meaning a consent judgment, probably taking four years. Once the government decides what specific release it wants (dissolution, divestiture or reorganization of IBM activities), it will then have to decide whether a consent judgment or trial will achieve it. While consent judgments usually net more than the courts are willing to grant, one source who believes IBM has violated the consent decree of 1956 thinks the government may not trust IBM to uphold another decree.

Would the Justice Dept. agree to a decree just to protect IBM from countless treble damage suits from the industry? (A court win is admissible as evidence in a private suit; a consent decree generally is not.) Well, treble damages are tax deductible, says a lawyer, and IBM could "probably cough up at least a billion without doing irreparable damage to itself," and he doubts Justice will softpedal for that reason.

Will Control Data and DPF&G hold off on their suits? DPF&G is happy that the government has filed but notes the charges are not identical. Thus the lessor intends to continue with its suit and will use any government win as evidence if it occurs before the DPF&G action is completed. CDC had no comment at press time.

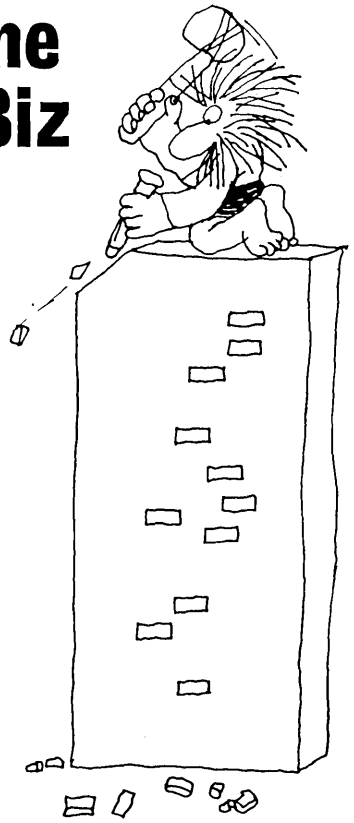
The disposition of the White House, Congress and the new Attorney General (and the leeway given him) will affect the suit. IBM, characterized in political circles as a Kennedy-family firm, may not be favored by the Republican Administration, yet stiff government action may be discouraged by big business pressures. Unlikely but fearful prospect: Congress, if it decided that IBM is an "unnatural monopoly," could try to legislate regulation of the computer industry.

And what if IBM voluntarily changes its ways (having indicated it will separately price some support services)? The government, we're told, will still press on since "what is company policy in July may be changed in August."

Finally, IBM may not have Nicholas Katzenbach's services in this case, if its new legal counsel was "cognizant of" the preparation of the suit while Attorney General, since this may be interpreted as government conflict of interest.

Before anything can happen in the suits, IBM must "answer" all three suits against it, meaning admit and/or deny the various statements made in them. IBM will be asked for information on its activities, some of which may be refused, given for public record, or provided in secret if it is shown to be trade secret data. Each plaintiff and IBM must make known to each other what evidence and witnesses will be used and in about a year the process of public questioning or depositions of the witnesses will begin. All this is prior to any trial or judgment and is likely to take four to seven years.

BC 1400 and the Data Service Biz



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

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

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

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

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

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

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

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

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CIRCLE 16 ON READER CARD

For the near future, IBM's pending new policies (and no one knows what effect the suits are having on their formulation) have postponed several current equipment purchases and rentals.

(For additional reactions, see Washington Report.)

SCAN-DATA TO OFFER FIRST MODULAR OPR

Scan-Data Corp., Norristown, Pa., is readying what's said to be the first "modular" single-font optical page reader. The new mod 200, starting at about $175K, can be upgraded to the multifont reading 300 ($375K), announced last fall. With the same general design and reading speed (400 cps) as the larger system, the i.c. 200 will: read any one font selected by the customer, as well as hand-printed numerics; accept journal tape input (optional); and output onto IBM-compatible 7- and 9-channel mag tape, other media. The basic system has a feeder, scanner, PDP-8-size cpu, and tape unit. Document size: 6-16" wide, 8-14" long. Deliveries begin fourth quarter '69.

Competition for the 200 includes the IBM 1288, Farrington 3030, and CDC 915, but Scan-Data claims the only price-competitive model is CDC's. This unit doesn't have features like hand-print reading and the journal tape option and reads a single stylized (CDC) font.

The 90-man OCR firm currently has an order backlog for over $2.5 million worth of 300's and 100's (multifont reader for graphic arts application); 10 of these models are installed or on order.

Other activities include a new service bureau in Beverly Hills, Calif., Scan-Data West, which installs a 300 this month; and a printed-circuit maker, Lectro-Print, Inc. European distributor for the firm, Realtime Systems, Ltd., will also have a mod 300 service bureau by midyear. With these moves, the firm is expecting to have a $7 million (gross) in '69, wiping out a megabuck loss.

NEW FIRM HUNGRY FOR EATERY BUSINESS

An infant 13-man hardware house thinks it has the edp answer for franchised restaurant chains with a new self-contained computer-scanner the size of a typewriter.

Formed by three Raytheon Computer refugees last July, Documentor Sciences Corp. has developed a unit which reads mark-sensed order slips, records transactions and prepares a receipt. Binary-coded programs on optically-scanned cards also permit payroll and inventory control. Built for simplicity, the unit has nary a button.

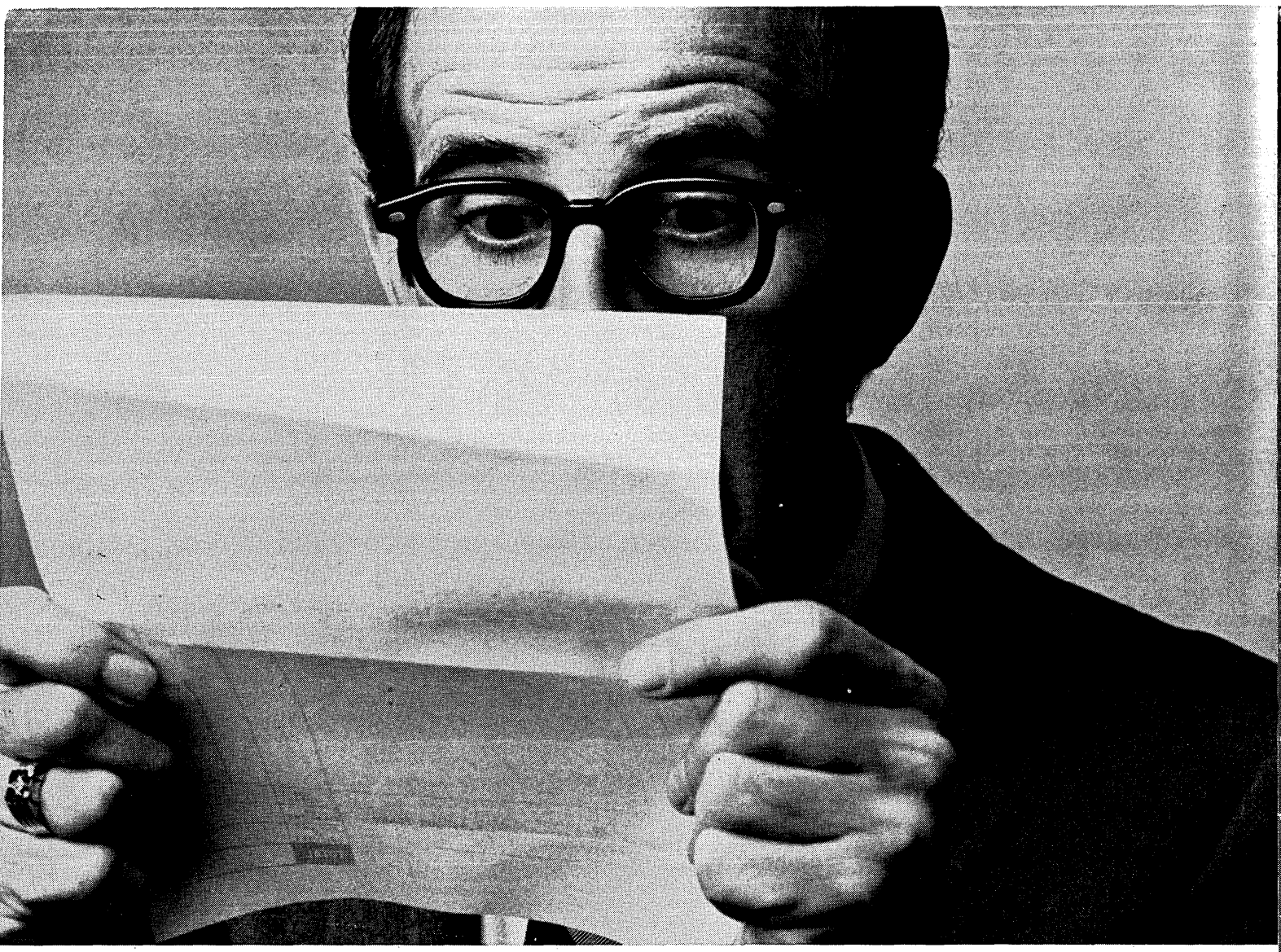
A nationwide restaurant franchiser is evaluating a couple of Documentors now, might just order hundreds if all goes well. Other chains are interested, too. Market size is indicated by the fact that there are over 100 thou restaurants averaging over $100K/yr. But other applications seem naturals for adapted versions of the 16K-bit core (10 usec) memory computer which will market for around $5K.

President of the Santa Ana, Calif., firm is Bob Crain. Co-founders include Don Rea and Henry Call.

ASK NOT WHAT THE SYSTEM CAN DO FOR YOU...

Everybody talks about making computers easy to use—and then they come up with Cobol and PL/I. A small (12-man) company in Northridge, Calif., has taken a wholly different tack: their systems are so easy to use that they don't require edp managers, programmers,

(Continued on page 203)



Most Linear Programming is "free."

Ours costs less.

Until now you've had to buy a huge machine if you wanted linear programming. But you got the program at no extra charge.

We charge for it. Just the same, the Sigma 5 & 7 are so less expensive than the monsters that you'll still save money.

But you aren't kicking power out the door to save a few dollars. With this package the Sigma will be able to do process optimization. And Sigma is famous for on-line, real-time plant control, of course.

And because it's being completed now, the Sigma Functional Mathematical Programming System will take advantage of software evolution.

Developed jointly with Bonner and Moore, FMPS will have MPS 360, LP/90/94, UNIVAC 1108 LP and CDC CDM4 LP compatible input and output. The new Gamma III matrix generator/report writer will even accept lists and English language texts for documentation and report titling in addition to data tables.

If you order a Sigma today, by the time it's installed FMPS will have an established track record for all its variations, ranging from a basic LP solution algorithm through a comprehensive package that includes the Gamma III matrix generator/report writer, post-optimization extensions and separable programming mode.

So pay for linear programming. You'll find it pays.

SDS

Scientific Data Systems,
El Segundo, California

CIRCLE 17 ON READER CARD

editor's read*ut

THE VITAL, YAWN, STIMULATING TOPIC OF — UM, AH — STANDARDS

Some people get up dizzy, weak in the knees and nauseous when the subject of standards is brought up. It's often the source of a kind of technical Hong Kong flu. More often it produces a fervent ennui. The apathy it engenders can probably be matched only by that with which the citizens of Tasmania will greet the news that the California Angels plan to win a pennant this year.

Even the folks who have the most at stake approach standards with all the intensity of a three-toed sloth. One manufacturer told us he participates in standards work to keep an eye on IBM. The user—that poor bloke who has to try to apply the standards developed under the benign and biased sponsorship of the hardware makers—reacts to the subject with the fervor of a four-year-old working over a fudgcicle while watching a performance of *Medea.*

It's all a little strange, when you consider the importance of standards, which can make it easier, more economical and efficient to use different kinds of equipment . . . to move freely from one to the other, or to transmit data between systems of different makes, allowing the most appropriate system or subsystem to be used at a particular site. Standards can do a great deal to loosen—if not smash—those one-source shackles.

One explanation of all this is that grand old catch-all: "human nature." But out there in the real world we've seen people get excited about safety, education, foreign policy. We don't believe that "human nature"—whatever that is—is the explanation.

As with most problems—and we're talking about the lack of a well-planned, coordinated and managed standards development, effort, widely represented and supported—there are several causes.

One is the top-heavy structure of the standardization effort, as represented by the USA Standards Committee Computers and Information Processing (X3), representing 43 organizations with extremely weak and tenuous links to the grassroots level, that crummy world where information processing is done, computers and standards applied or misapplied.

Another is the nature of the technical working committees. A sometime committee of part-time, high-turnover, casually selected people who do their standards work when the boss isn't watching is no way to tackle a big, important and complex job.

The manner in which proposed standards are submitted to the edp world is lousy. Highly verbose and technical documents are printed—when they are published at all—in a professional journal with readership representing a small and inadequate sample of that world. This doesn't give much chance for the technical community to voice its criticisms. There is no attempt to explain the technical and economic consequences of specific standards features.

User lethargy is certainly a cause, but it is brought about in large part by the combination of all the other causes we've just described. And if standards work is to continue to operate within its present environment and in its present format, it seems to us important that some way be found to enroll the direct, active participation of more and more broadly representative users than now exists.

But we hope that standards work will not have to continue in this way. For one thing, it appears that the existing organization is incapable of passing on *de facto* standards which may come from an individual company, thanks to the political structure of X3. The recent squabble over PL/I indicates that this will be so.

In an article in this issue of DATAMATION, Howard Bromberg considers alternative methods of developing standards. His ideas are worth noting. In the meantime, we feel that the development of standards calls for a full-time staff of highly competent, well-managed technical people representing the full range of information processing interests. Only then will standards attract the attention and respect they deserve.

TOWARD A STANDARD STANDARD

by HOWARD BROMBERG

In the United States there is a rather active program for achieving standards in the areas of computers and information processing. As with many activities, the rewards are not always commensurate with the effort. Large sums of money are spent unnecessarily, great amounts of effort are duplicated, substantial talent lies untapped and trivia runs rampant. Weeks run quickly into years, and the urge to standardize grows in momentum while the tools of the trade remain crude and unimaginative.

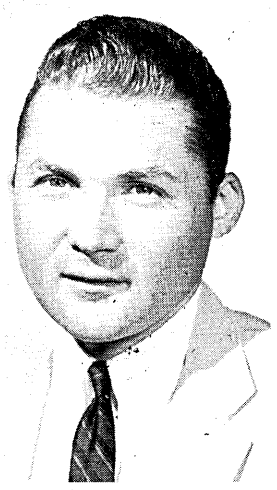
Without getting involved in a discussion of the necessity for and/or the wisdom of standardization, suffice it to say that the effort accounts for a significant amount of activity within the technical community. This being the case, is it not reasonable to suggest that standardization be approached in a standard manner?

Traditionally, standards are recognized rather than created. This is the case whether the standard was achieved through a concerted effort or by a "de facto" recognition. Activities involving the USASI committee method result in "conscious" standards wherein committee consensus is established on the content of a standard. The classical example of the "de facto" standard is the situation whereby long term availability and continued use establishes a standard. However, because of the relative youth of the computer industry, we can point to very few instances of "de facto" standards. Perhaps the closest we have is the case of FORTRAN.

Another way of achieving a standard is through regulation and legislation. Fortunately, or not, here in the United States standardization is a voluntary practice. Consequently, when one tallies the list of standards by country, one finds the Soviet Union having by far the greatest number. Virtually all definitions of standardization include, as part of their descriptions, an admonition concerning the requirement for an authority to enforce the standard. The voluntary practice of standardization in this country, therefore, does little to assure the success of any standardization program.

The method that has become the most popular and successful in achieving a standard is the committee method. This requires a group of individuals expert on the subject, a convenient place in which to meet and a very healthy travel budget. The committee approach employed to prepare standards is conducted under the auspices of the United States of America Standards Institute, which pursues standards for many topics under the concept of the sponsor technique. This involves identifying an organization with significant interest in the particular area for standardization to serve as the administrative body under which technical committees function.

For the subject of computers and information processing, the committee established is named X3 and the sponsor for the work is the Business Equipment Manufacturers Association. It is the sponsor's responsibility to identify the areas for standardization, attract the required number of experts, see to the financing and conduct the business of the committees in accordance with the USASI operating procedures. While the standardization effort appears to work primarily



Mr. Bromberg is executive vice president of Information Management Inc. and a contributing editor of Datamation. He is chairman of the USASI COBOL standardization activity and chief of the U.S. delegation to the International Standards Organization's Technical Committee on Programming Languages Standardization.

due to its own inertia, the sponsor supplies a significant amount of fuel. There are, however, several recognized inequalities in its approach.

the sponsor's advantage

Sponsorship itself must carry certain privileges. Why else would an organization undertake the tremendous burden of being a sponsor? No doubt, an important benefit to the sponsor is the ability to see that its or its members' interests are properly represented within a specific subject area under standardization. Now this may in itself not be a bad situation, but it does seem to be a bit discriminatory. There are probably other organizations equally interested in the particular topic being standardized, yet their involvement and privilege is limited to lower level participation.

A member of a sponsor organization, on the other hand, is represented both by the sponsor on the administrative level and by his own participation on the technical level. Thus certain organizations may participate in a hierarchy of committees. Consequently, when their position is defeated at a lower level, they may introduce the same point at the next higher level until they are able to achieve success. In computer standards parlance, this may be referred to as adding one to the counter and going on to the next committee.

Another interesting inequality is the balance of representation of the various segments and special interest groups of the information processing community on the standardizing committees. While it is probably not feasible to secure proportional representation of each interest, it is imperative to make certain that the committees are not topheavy or lopsided with respect to representation. For example, not only do the independent software companies have no official voice in standards activities, but very few of them even participate in the technical activities. It is far too easy to fill the committee ranks exclusively with sponsor members, or to have representation based upon an interest in standardization rather than in the product of standardization.

The problem of balanced representation, however, poses an interesting dichotomy. Theoretically, participants on technical standardization committees are invited to participate based upon their individual expertness in the particular area of standardization. However, very few technical experts are independently wealthy and, as a result, they serve on these committees at the pleasure of their employers. Often, this creates a conflict between the man's technical judgment and his company's interests. As an example, consider the individual who likes PL/I, but works for a company unwilling to spend the funds required to implement it. Without conducting a national survey I assert that it is impossible to separate the man from his company. Thus, this type of representative who serves as an expert on a technical standardization committee operates under both corporate and technical biases. Now again, this may not be bad, but if his company pays an annual tithe to the sponsor organization, the technical expert is further handicapped.

The current standardization procedures have been responsible for the creation of a new and different person. This is an individual with a compulsion to work on standards committees and whose technical capability is subordinated to trivial things. His drive is reduced to parliamentary aggression and competitive possessiveness. The effect is to substitute an abstraction, "homo standardicus," for the concrete totality of technical competence and thus to render useless the standardization effort.

Another area of potential inequality involves the acceptance procedure for the technical experts. Many committees have rather strict membership requirements, while others have none. Some committees are so happy to find participants that they care little about the participant's technical qualifications. Some committees operate under the premise that, because they are a USASI committee, participation cannot be withheld from any citizen. Some committees make attendance a requirement for continued membership, and some require active participation, while others feel an occasional appearance is satisfactory. Some committees have voting procedures based upon a complex attendance/quorum procedure, while others operate under the simple majority and no quorum concept.

choosing the candidates

Aside from the foregoing list of potential and actual inequalities in committee representation and balance, consider for a moment the more severe problem concerning the selection of candidates for standardization. Should there not be a formalized procedure for identifying candidates within each subject area for standardization? In programming languages, it required over five years to produce a standard and this was the situation when the selection was based upon a choice of existing candidates. Consider the differences when the committee is obliged to create a standard (e.g., USASCII) because no choice exists. Certainly in this latter case the absence of a standard procedure severely handicaps standardization activity.

In spite of all the foregoing inequalities the standardization activity lumbers on to successful conclusions. Without much forethought, without great foresight, with great cost and greater delays, standards have been produced for many important technical topics within the computer industry.

As the tools of our industry become more complicated, the process of the recognition of standards, and standards themselves, will become more complex. An obvious solution is to surround the standardization activity with the most talented people concerned with the subject under consideration. The problem of attracting this kind of high level talent is, however, immense. Rather than risk having the standardization effort fail because of a lack of talent, consideration must be given to other procedures. For example, it is not unreasonable to suggest that for certain standardization activities outside expert organizations could be funded to perform that specific service. Universities by and large represent an untapped source of talent as far as standardization activities are concerned. It should also be obvious that any technical group composed of knowledgeable experts able to meet for a consistent period of time in a single place would be able to produce a better result at far less cost than the current committee procedure allows.

If for one reason or another it is impossible to create more effective, less ambiguous procedures for standardization, then by all means consideration must be given to streamlining the cumbersome current committee concept. Along the same line it is imperative to insure the broadest possible industry participation. This means not only computer manufacturers, but users from all aspects of the particular topic under standardization. An outside independent standardization body could further this objective by conducting regular meetings with various industry and user representatives in private without the requirement of divulging corporate motivations and direction around a USASI committee conference table.

In conclusion, what is required is a standard means for creating standards. This standard means must include streamlined procedures, faster response to development activities, and a reasonable maintenance procedure. More important is that the standards pursuit be based on a fundamental desire for fair and equal representation—and on the highest technical level. In such a way we will be able to approach a more professional solution to the immense problem of standardization. ■

THE FEDERAL GOVERNMENT AND COMPUTER COMPATIBILITY

featuring PL 89-306

by CONGRESSMAN JACK BROOKS

During the past several years, the House Government Activities Subcommittee, which I serve as chairman, has pushed for more efficient and effective use of computers in government operations. Our interest in computers and computer compatibility arose in the early 1960's when the vast potential of computer use in government operations was becoming evident. In the opinion of the subcommittee, computers are now absolutely necessary if we are to make efficient, effective, responsive government possible for a nation of more than 200 million people.

To provide the proper management of the federal government's computer systems, I introduced legislation in March 1963 that became Public Law 89-306. This law is designed to insure that computers in government are managed and utilized effectively. Operations effectiveness and the attainment of the broadest possible flexibility in computer use also demanded that the government coordinate on a businesslike basis the vast inventory of computers—an inventory that has been doubling every three years and which is expected to increase indefinitely.

Before passage of this legislation, government policy directed that edp capacity be acquired on an agency-by-agency basis. This independent approach was even followed among sub-units of some of the larger departments. Our Navy Yards, for example, acquired computer capacity in the late fifties and early sixties independent of one another and without regard to the compatibility of their systems.

In the early 1960's, the only agency of government with formal computer compatibility or standardization responsibilities was the National Bureau of Standards. The bureau, under its charter, had authority to undertake leadership in a government-wide computer effort. Yet, the bureau did little to implement its responsibility. In July 1962, in a series of government "efficiency" hearings before the subcommittee, Bureau of Standards officials were queried about computer compatibility efforts and the need for "input and output" computer standardization. The attitude of the bureau was perhaps best expressed by one of its top computer specialists: "You mean you want to freeze the state of the art!"

In this early period, the Department of Defense made the only meaningful effort toward compatibility in the federal government. Defense has always been our dominant user of computers. Even in these earlier days, those officials who had to make the decisions and were responsible for the results began to feel the "pinch" of incompatibility. The efforts of a few key officials, particularly in the development of COBOL, were noteworthy. Unfortunately, efforts toward greater compatibility received only passive support even in this department.

Public Law 89-306 delegates specific responsibility to the National Bureau of Standards to head up the government's computer compatibility/standardization effort. The bureau is directed to develop computer standards for use within the government, and to represent and coordinate the government's efforts in dealing with business and industry in joint standardization programs.

signs of progress

When this law passed in October 1965, an opportunity arose for a new beginning in computer compatibility and standardization within the federal government. Under authority of this statute, the Bureau of the Budget issued broad policy directives to the Bureau of Standards to bring the government's participation in standardization up to an acceptable level. Earlier this year, these efforts began to pay off when the President adopted the USASI data interchange

Congressman Brooks began promoting standards for federal use of computers in the summer of 1962 with hearings on the Commerce Dept. activities. He introduced HR 1571 in March 1963, the predecessor of PL 89-306, approved by the President in October 1965. He is chairman of the House Government Activities Subcommittee, and a member of the House Judiciary Committee. A Democrat, Brooks has been in Congress since 1952 and represents the 9th District of Texas.

standard as a federal standard. Meanwhile, other federal agencies, notably the Departments of the Navy and the Air Force, confronted with mounting procurement and operational problems in which incompatibility is a contributory cause, have been working in certain areas of edp standardization, particularly as they relate to higher level languages.

It would appear to me that the technical problems in achieving what might be characterized as "optimum" compatibility are not insurmountable. The computer community has proved its technical capability. This is evident in the advances in computer technology of the past decade. Furthermore, we recognize that in many respects computers are today "more" compatible than computers of the past. But, despite the progress that has been made, there is no room for complacency. The whole compatibility effort in government, in private business and industry, merits greater effort. There seems to be a lack of urgency on the part of many individuals who should be concerned. There seems to be a lack of understanding of the value of compatibility among many organizations whose operations would benefit.

As I see it, the real problem today is defining in precise terms what specifically should be done, the alternative means available for accomplishing these carefully defined goals, and the establishment of necessary priorities for the tasks to be accomplished.

I believe that the most important objective is the free interchange of data. Although in a narrow sense computers will always be used simply to process data within some limited or controlled environment, the full impact of the computer on society is much more profound. Computers allow for the identification and communication of information buried in large masses of data. Full exploitation of the computer in this broader sense, within a large organization such as the federal government, or a large private business concern, or society as a whole, requires that the data processed in one computer be readily accessible through the use of a different system.

Up to this point, we have adopted data interchange standards, and it is said that these standards allow for the transmission of data between computer systems of varying design and manufacture. It is my understanding that standardization of punched cards is no longer a problem. Furthermore, the Bureau of Standards, the Department of Agriculture, and private industry are involved in the standardization of optical scanning. In addition, we have standard tape reels, and I understand that there is a great deal of commonality between tape drives of different manufacture.

The problem is that despite all these standards a data tape from one system will not necessarily "read out" on the tape drive of another system.

Especially in the larger user organization, such as the federal government, the magnitude of operations and the diverse needs for data—current as well as historical—require that at some reasonable time in the future there be full compatibility in data access and storage. Data on a card, a tape, or a removable disc should be "hardware independent" and accessible through use of any modern general-purpose computer system without translation.

A second basic objective of the compatibility effort should be, as I view the problem, to obtain some acceptable degree of interchangeability in programs among computer systems of the same general capabilities or sophistication. This interchange must be with minimum loss of program efficiency and without extensive cost or delay in computer operations. Available hardware capacity should be more efficiently utilized to meet changing workloads, to level out peaks in demand for computer usage, and, in general, allow for more flexibility, more efficient and effective use of computer hardware that may be available.

More efficient programming is another facet of this same objective. The federal government has managed to pay for and maintain more than 100 different payroll programs. An acceptable level of software compatibility should allow us to avoid such wasteful duplications in the next general cycle of system development. With compatibility, standard or stock application programs can be used more extensively. Because of this greater use potential, users such as the federal government can afford to spend extra funds to make these programs more efficient. If the federal government, for example, through greater equipment compatibility, could fill its needs with a limited number of uniform payroll programs in lieu of the more than 100 now in use, greater resources could be applied to the design and maintenance of these programs so as to obtain the benefit of increased efficiency in systems operation.

expected benefits

From these immediate advantages would come additional secondary benefits. Compatibility would significantly increase competition among computer manufacturers. This would mean better computers at lower cost. As a result of compatibility, computer users who formerly had substantial sums invested in programs "bound" to the hardware of a particular manufacturer would be free to acquire new systems in a more competitive environment. Large government computer procurements, such as we have witnessed in the Defense Department in recent years, could be split up among computers of various manufacture. This would permit the government to increase over-all computer capability through the selection of the best computers at various capability levels, rather than having to accept the entire line of one particular vendor.

It is vital to remember the nature of the government's standardization effort. Throughout the Government Activities Subcommittee's efforts in the computer field, we have stressed cooperation with business and industry. We have recognized that the principal efforts toward compatiblity must come from the private sector. This concept is reflected in Public Law 89-306 and the programs the National Bureau of Standards and other federal agencies have undertaken pursuant to this authority.

There is no question that we will ultimately attain optimum compatibility among computers. The real question is when. At this time, we have the opportunity, through meaningful problem definition, to determine with greater exactitude the true nature of this problem. With greater interest among those participating in the effort we can speed up the process. Optimum compatibility among computers is the key to their fullest exploitation. We must do more than we have done in the past, and we must give compatibility the highest priority. In terms of the benefits computer techniques can bring to our society, we can move this nation forward decades in but a few years.

Unfortunately, computer standardization is not a simple process of evolution, allowing selection of standards as they evolve. Standards must be developed. At this time, there are concerted efforts under way to make this effort more effective and to otherwise speed up the standardization process. If these efforts fail or fall short of the result we seek, then it will be up to the users to force effective standardization upon the industry.

Ironically, while it is the computer users who pay for the computers, users generally—with the notable exception of the federal government—have taken up to this point relatively little part in the standardization effort, despite the dominant nature of their interest. In the ultimate sense, the power of the pursestrings, the ability of users to select equipment affording them the advantages of compatibility, should bring about the results we seek.

The federal government will continue to take a decisive role in standards development. We will cooperate and fully participate in the development of voluntary standards. ■

THE NEED FOR ADP STANDARDS IN THE FEDERAL COMMUNITY

by JOSEPH F. CUNNINGHAM

"Standards for adp: Who needs them?" This expression typifies the attitude of a large segment of the computer community, government and nongovernment, toward the subject of standards. Whether user, supplier, contractor, software house, programmer, systems analyst, etc., people are willing to paraphrase this comment, generally accompanied by a shrug of the shoulders indicating a lack of concern; or by a shake of the head to deplore the very idea of standards at this point of time in technological development; or accompanied by a furrowed brow indicating an honest search for an answer to the question. These attitudes suggest that the need for standards is not yet sufficiently understood to spark a widespread clamor to achieve them and, having achieved them, to use them.

It is when these same people experience the need for compatibility and/or flexibility, and they begin to argue about the feasibility, compatibility and interchangeability of systems, peripheral units, input/output mechanisms, programming languages, supplies and even spare parts, that they recognize that the lack of coordination in design is at least in part due to the lack of standards which would promote such coordination.

This is not new. The need has been recognized in some quarters since early in the second generation. The result has been a limited success in the development of standards and practically no success in their implementation.

The most notable exception to this latter statement was the development of the "Magnetic Ink Character Recognition Standard" (MICR) by the American Banking Association and its adoption and use throughout the banking industry. A serious problem of major economic proportions and a common interest led to a workable solution. This success also provides some grist for the mill of those who argue about premature standardization stifling development in that it is numeric only, whereas today alphanumeric techniques for character sensing are available and in use. While the latter is true, banks have used MICR for at least 10 years and have created a level of acceptance and discipline which will make the transition to the next concept (if and when) more orderly and rapid. In the meantime, automation of check handling has been made a reality.

the government's computers

The federal government's inventory of computers has grown, as shown in the following table, between delivery of the first general purpose computer in 1951 and the current large inventory.

1951	3	1962	1,030
1954	10	1964	1,862
1956	90	1966	3,007
1958	250	1968	4,232
1960	531	1969	4.620 (estimated)

The procurement policies of the federal government are designed to secure the most effective product for the task at the least possible cost. This procurement policy, combined with the variability of time (concepts which are currently most stimulating are usually well in advance of implementation), product availability, and technological advancement, has resulted in a pattern of computers within the federal establishment—at least according to manufacturer and method of acquisition—that is at variance with the characteristics of the national computer census. The table on the next page compares the inventory of federal computers with a national computer census:[1]

The distribution of the federal inventory over the range of manufacturers, as opposed to the concentration of the national inventory in one supplier, dramatizes the need for

Mr. Cunningham is deputy director, general government management division, and chief, adp management staff, at the Bureau of the Budget. The adp management staff was set up to carry out the bureau's responsibilities under Public Law 89-306 and the 1965 approval by the President of a task force report on data processing management. Before this appointment, he was associate director of data automation for the Air Force.

[1] Source: Computers and Automation, October, 1968

standards if optimum flexibility in the use of the federal computer inventory is to be provided to the federal manager. Nationally adopted standards for information recording and programming languages will go a long way toward providing this flexibility.

Manufacturer	Percent of Federal Inventory in Place as of 6/30/68 (Actual)	Percent of National Census
Burroughs	4.6	2.1
CDC	9.4	3.3
DEC	5.0	4.1
GE	1.7	2.8
Honeywell	5.8	4.3
IBM	28.4	61.8
NCR	5.9	6.8
RCA	4.2	2.0
SDS	4.4	1.6
Univac	21.3	8.6
Others (23)	4.8	2.6
Special	4.5	
TOTAL	100.0	100.0

An analysis of the federal inventory reveals the following additional characteristics:

DISTRIBUTION OF COMPUTER POPULATION BY CHARACTERISTICS

Number of computers	4232
Number of manufacturers	33
Number of computer models	215
Number of physical tape sizes	3
Number of recording notations	60+

The impact of these equipment variations in the federal government has been recognized and emphasized in many official documents. Among these are:

1. The Comptroller General in his report of March 6, 1963, stated: "In addition, more attention needs to be given to obtaining more complete utilization of the equipment acquired."
2. The House Post Office and Civil Service Committee in its report of Oct. 16, 1963, concluded: "Standardization of electronic data processing systems is vital to the efficient and expeditious use of the systems by the Federal Government, and the serious need exists for a dynamic standardization program."
3. The federal government's need for standardization is emphasized in Chapter 7, "Report to the President on the Management of Automatic Data Processing in the Federal Government," prepared by the Bureau of the Budget and submitted by John L. McClellan, Chairman of the Committee on Government Operations, U.S. Senate, published on March 4, 1965, as Document No. 15 of the 89th Congress, 1st Session. It indicates significant differences in design of data processing equipment and programming techniques place a severe limitation on the opportunities for transferring work from one computer system to another—because of the extensive and costly conversion processes that are often necessary and have adverse effects on achieving optimum utilization of the entire federal inventory.

As a summary of much discussion on the relative merits of standardization, this report makes the following statement: "Thus, our objective should be to achieve compatibility among computer systems, in order to facilitate direct communication. At the same time, manufacturers should be allowed complete freedom in the design of the internal structure of their equipment as long as the compatibility requirements are met."

4. Report of the Committee on Government Operations on H.R. 4045 (this is the report that accompanied Public Law 89-306 when it was passed) observed that the federal government had some 500,000 hours of unused capacity in 1965 which could be used in lieu of acquiring additional capacity. It went on to recognize that data and programs could not be transferred *readily* from one computer to another, a situation which resulted in considerable inflexibility. These observations resulted in the rather unique provision of P.L. 89-306 that "The Secretary of Commerce is authorized . . . (2) to make appropriate recommendations to the President relating to the establishment of uniform Federal automatic data processing standards."

Computers in the federal government are used to discharge the programs of agencies. They are always acquired by a competitive procurement process. In attempting to maximize the efficiency of the computer operation, many installations become captive to the characteristics of the computer system used. Data are recorded in a form sometimes unique to the particular computer system; data are defined in a manner sometimes unique to the particular application; and programs are frequently written in the language of the computer or in some second-level (assembly) language, likewise unique to the computer or the family of computers—all in an attempt to optimize or maximize the combined efficiency of the equipment and people in achieving the objective of the installation. As a result, two computers in close physical proximity frequently do not have sufficient compatibility to assist each other in the solution of common application problems. Sometimes these computers are of the same general class and are provided by the same manufacturer.

first attempts

This situation is not unique to the federal government. What is unique is the fact that in the late 50's and early 60's agencies of the federal government, being large users, took steps to solve some phases of the compatibility problem. Defense, for example, sponsored development of a common language (JOVIAL) for programming of the command and control type of application; and it took further steps to solve the large-volume problem associated with the business applications through the sponsorship of the development of COBOL.

Other elements of the computer community recognized the need and fostered the development of the national standards effort now known as the United States of America Standards Institute (USASI) X3 Committee. The agencies of the government have given strong technical support through the years to the various committees working on the development of USASI standards. While some standards have been developed, implementation to provide the user with a reasonable degree of compatibility has not been achieved. Probably the reason is that management generally is inclined to think only in terms of a specific installation or a homogeneous family of installations and its applications and has not, therefore, pushed implementation through the market place.

The pressure of the day's work and the technological challenge of optimizing core, multiprocessing, or using blocking techniques to optimize the capabilities of a particular system by moving records in and out fast, etc., have over time frequently obscured the major problems associated with conversion to a new model in a new generation. The suppliers, ever alert to the needs of the market place, have developed techniques such as translation, simulation, and emulation to facilitate this conversion. Since such techniques perpetuate a product line, they are inconsistent with competitive procurement policies of the federal government.

Many installations which have chosen this route of con-

version have continued to translate, simulate, or emulate for several years after conversion. This situation is less prevalent in the federal government since the competitive policy forces a rethinking of the system prior to wholesale conversion. The use of these techniques may be contributory to the cliche: "Third-generation hardware using second-generation software on first-generation systems."

It is probably an increasing recognition of the problems of transition that resulted in the shift toward machine-independent programming, demonstrated by the International Data Corp. which shows the following:

COMPILER-LEVEL LANGUAGES—	42%	LOWER-LEVEL LANGUAGES—	58%
COBOL (29%)	69%	Assembly language (48%)	83%
FORTRAN (12%)	28%	Report generator (9%)	16%
PL/I (1%)	3%	Machine language (1%)	1%
	100%		100%

This study emphasizes that the transition from machine- or product-oriented programming techniques to compiler-level languages became significant to individual installations only when they were faced with the problem of converting to newer equipment. This is borne out by the analysis accompanying the table which stated:

"As probably would be expected, the level of programming language used was found to vary considerably with the size and generation of computer under consideration. For example, among medium-scale computers ($5,000 to $10,000 average monthly rental) just over half the third-generation machines have COBOL as the major programming language, with about another one-third using assembler type language. In contrast, over 90% of the second-generation computers in this category have assembly language as the major programming language, with less than 5% of them using COBOL.

"Thus the trend toward the use of COBOL in third-generation machines is clear. And in the larger of the new machines, the use of COBOL is even more pronounced. For machines in the intermediate rental range ($15,000 to $30,000 average monthly rental) the survey shows that about two-thirds of the users have selected COBOL as their major programming language."

In other cases, just as the basic records of the agencies represent a formidable investment and a considerable cost in converting from these records in their present second-generation structure to a third generation concept.

	Reels of Tape
Internal Revenue Service	110,000
Social Security Administration	125,000
Veterans Administration	28,000
Military Logistics System	240,000

This record conversion is a time-consuming and expensive task. When the time and cost of rewriting programs is added, the payoff in efficiency from updating an installation is a long way off.

what's needed

Instead of moving on toward the solution of other problems and the development of application systems which take advantage technologically of progress, time must be used to re-do that which has already been done. Through use of appropriate standards, as identified below, we can strive to eliminate or at least mini-minimize conversion costs, thereby achieving optimum flexibility with greater economy.

To achieve this optimum flexibility for management, to ease and reduce the cost of conversion, we need:

1. *Standard application packages for common applications or systems* to eliminate recreating the same programs over and over.
2. *Standard data element definitions and standard code representation* to facilitate interchange of data among systems.
3. *Standard recording media* to eliminate the need to convert magnetic tapes (or other media) when updating equipment, interchanging data among systems or providing inputs to one system from the output of another, and to provide common file structure for inter-computer or console-to-computers communication.
4. *Programming languages* to facilitate transition to new generations of hardware, to permit interchange of work and programs among computers, and to permit capitalizing on technological advances without reprogramming.

Providing the optimum range of flexibility consistent with the government's basic procurement policy, which fosters and promotes a competitive industry, requires the development of a meeting ground so that the federal government as a user can protect its investment in data files and programs and move on to use the latest products of our industrial development.

Standards are necessary in a current operating environment to overcome the foregoing kinds of problems which limit the users' flexibility. As we look to the technological promises of the future with consoles available in the laboratory, office, production line, classroom, home, and elsewhere, one cannot visualize a separate console for each service or product offered. To use one multipurpose console will be dependent upon the availability and use of generally accepted standards which will permit interface with many centrally operated services. Likewise, as computers of one activity interact with computers of another activity, file definitions, codes, structures, etc., will need to be uniform and understood across the range of systems which will interact.

It is not only in recognition of the current problem but also the need to prepare for the future that the President of the United States on March 11, 1968, wrote:

"I have today approved a recommendation by the Secretary of Commerce, submitted under provisions of Public Law 89-306, that the United States of America Standard Code for Information Interchange be adopted as a Federal standard . . .

"All computers and related equipment configurations brought into the Federal Government inventory on and after July 1, 1969, must have the capability to use the Standard Code for Information Interchange and the formats prescribed by the magnetic tape and paper tape standards when these media are used.

"The standard code will be used as the basic code in those networks of the National Communications System whose primary function is either the transmission of record communications or the transmission of data related to information processing. The standard will be implemented on a time-phased basis that is to be specified in National Communications System long-range plans.

"The heads of departments and agencies are authorized to waive the use of these standards only under compelling circumstances of particular applications. Such waiver is to be coordinated with the Department of Commerce (National Bureau of Standards) before it is exercised so that the Department may effectively accomplish the goals of the Federal computer equipment standards program conducted under Public Law 89-306." ■

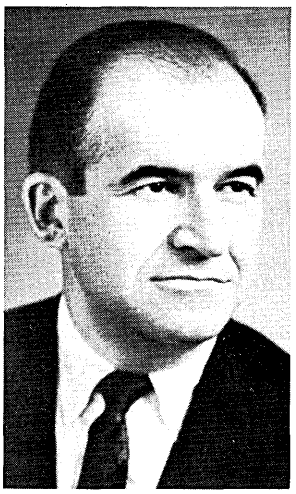
INFORMATION PROCESSING STANDARDIZATION: AN EVALUATION

by ALEXANDER C. GROVE

"Information interchange." Say it softly and it may come out sounding like "motherhood." This phrase is attached to many of the USA Standards in the information processing area and it might be assumed by the uninitiated that the concept did not exist before 1940. But information interchange standardization is now known to be at least 6,000 years old. In Mesopotamia, the Sumerians developed a system of writing about the middle of the fourth millenium B.C. This invention accompanied an urban revolution in Sumer. Later the Egyptians went through the same cycle, developing a rather complex grammar. The spoken language, the alphabet or symbology and the grammar, all were the information interchange standards of the periods. One realizes that the information which was interchanged had much to do with commerce and science (astronomy and measurement). Today's motivations are similar to those of the past when taxes had to be collected and records kept, accounts for payment to landlords needed some uniform method of recording. Any new motivations?

Of course, many of the older pictograms and alphabets were ordained by the local priesthood or king and no further decisions as to their use were required by the users. After the Magna Carta, the French Revolution and the First World War the procedures for imposing standards on people were somewhat democratized with a consequent increase in the cost of standardization but probably higher quality standards.

Prior to the computer age hundreds of languages (codes)



Mr. Grove is director of standards for the data processing group of BEMA. He was formerly with USASI as the secretary of the Information Processing Systems Standards Board and has had responsibility for the X3 and X4 national standards committees sponsored by BEMA. He has a BS in mechanical engineering from Cooper Union School and an MS in management science from Columbia.

were standardized. This led to national rivalries whenever decisions had to be made for any international code. But French was adopted as the official diplomatic language and lasted for over a century. The Morse code was accepted and still is universally used in international communications. What we are entering now with the computer is only the newest segment of a very long continuum.

Traditionally, the goals of standardization are to reduce the number of variants of a product, permit interchangeability within and between product lines and encourage producer competition relative to those product parameters that do not affect interchangeability. The electrical and electronic components industries are examples where classic standardization has permitted the users to choose from among many competing products without being concerned about incompatibility of dimensions, ratings, color coding, etc. Connectors, cables, chassis, racks and cases can now be obtained in standard sizes. The automobile industry is another case where, despite the multitude of models available to the consumer, many items in the mechanical and electrical systems are standardized and are marketed by numerous competing companies.

usasi's role

In the United States the focal point for all national and international standardization is the United States of America Standards Institute (USASI). Now in its 50th year, USASI is a privately supported organization acting as the national clearinghouse and coordinating agency for voluntary standardization, actually a federation of approximately 150 trade associations and professional societies and 750 companies. USASI's main functions are:

1. To provide systematic means for the development of USA Standards.
2. To promote the development and use of national standardization in the United States.
3. To approve standards as USA Standards provided they are accepted by a consensus of all national groups substantially concerned with their scope and provisions.
4. To coordinate standardization activities in the United States.
5. To serve as a clearinghouse for information on USA and foreign standards.
6. To represent American interests in international standards work.

Almost 3000 USA Standards have been developed and approved under USASI procedures. These standards apply in the fields of engineering, industry, safety and consumer goods. USASI does not compete with any of the hundreds of industry, labor and government groups engaged in standards-making. It is the vehicle through which they can coordinate and integrate their efforts at the national level.

The history of USASI goes back to 1918 when the federal Departments of Commerce, War and Navy joined with the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Mining and Metallurgical Engineers and the American Society for Testing and Materials to establish the American Engineering Standards Committee. In 1928 the group was reorganized and named the American Standards Association (ASA). Effective Sept. 1, 1966, ASA became the USA Standards Institute.

About 500 standards projects are currently active. Approximately 10,000 engineering and government officials and representatives of various national groups are participating in these projects.

USA Standards come into existence through two basic methods, the Existing Standards Method and the Standards Committee Method. Under the former method an existing standard may be submitted for approval by any responsible body and may be approved by USASI provided:

1. It is shown that the standard is supported by the necessary consensus of those substantially concerned with it.
2. It does not conflict with any other USA Standard.

Approximately one-third of the standards approved by USASI have been considered under this method.

The Standards Committee Method (used for computer standardization) consists in the formation, at the beginning of a project, of a committee to develop one or more standards under an assigned scope. The committee is composed of representatives accredited for the purpose by the various organized groups concerned with the project and, when desirable, companies and specially qualified individuals with a general interest.

The special utility of the Standards Committee Method consists in the provision, in advance, of such representation that a consensus will be assured and self-evident when the members have approved the proposed standard. This method is used in cases where a written request is received from a group which, in the opinion of the USASI Member Body Council, has a substantial interest in the proposed areas of standardization. It shall also be used in cases where, in the opinion of the council, the Standard is intended to be used as mandatory rules of regulatory bodies having policy powers.

By its constitution, USASI is prohibited from formulating standards. It is not a technical society engaged in standardization work. It, therefore, cannot "own" any committees that formulate standards. Thus standards committees can only be considered as belonging to the group of organizations having representation on the committee and which have agreed to cooperate, under USASI procedures, in the development of standards they all desire.

One or more of the organizations principally concerned with the work assigned to a standards committee may be designated to provide administrative support and direction to the committee. The sponsor organization is responsible for the administration and direction of the standards project itself. It organizes the committee with the advice and assistance of USASI and ensures that the work is carried out continuously and effectively. It provides the necessary administrative services and keeps USASI informed on the progress of the work.

information processing standards

Computer and information processing standardization, on a national level, came to the United States via Europe. In 1959, the Swedish Member Body of the International Organization for Standardization (ISO), of which USASI is the American Member Body, proposed that a round-table conference be held for those international bodies interested in computers and data processing. In June, 1960, the ISO Council approved the formation of Technical Committee 97, Digital Computers and Data Processing Machines. But no USA national group existed to support American participation in TC 97. The then ASA called a General Conference on Office Machines and Data Processing Machines and in August, 1960, ASA Sectional Committee X3, Data Processing Machines, held its first meeting in New York. The Data Processing Group of the then Office Equipment Manufacturers Association, predecessor to the Business Equipment Manufacturers Association Data Processing Group (BEMA/DPG), was accepted as the sponsor of X3.

Thirty-two meetings later, in October, 1968, the now USA Standards Committee X3 (USASC X3) reported that USASI had approved 25 of its standards as USA Standards and that approximately 56 proposed USA Standards were in development. In order to reach this stage of accomplishment USASC X3 had evolved to a structure encompassing 8 subcommittees and 39 working groups. Two standing com-

mittees and three ad hoc committees were also established. Fig. 1 (pages 32, 33) illustrates the present structure of USASC X3. The Systems Advisory Committee (SAC) considers the work of each subcommittee as it impacts on the entire system and advises as to the coordination of effort among the USASC X3 subgroups. The second standing committee, the International Advisory Committee, consists of the international representatives of the USASC X3 subcommittees to their counterpart ISO/TC 97 subcommittees and acts as a liaison body between USASC X3 and TC 97.

The following paragraphs describe the present scope, membership and structure of USASC X3. The sponsor has attempted to achieve substantial balance among the three membership categories, i.e., producers (14), users (16), and general interest (13). It should be noted that it is the *organizations* which are the members of USASC X3 and not the representatives which the organizations appoint: The representatives vote on behalf of the organizations. This is, however, not true on the subcommittees and working groups where the members participate as individuals.

scope and membership

The present scope of the USA Standards Committee X3 Computers and Information Processing is:

"Standardization related to computers, equipments, devices and media for information processing systems. N.B. A full understanding of the committee's scope requires reference to the committee's program of work which will be reviewed and approved quarterly by the IPSSB."

The membership of this committee as of this date is as follows:

Producers (14):
Addressograph Corporation
Burroughs Corporation
Control Data Corporation
General Electric Company
Honeywell, EDPD
IBM Corporation
Litton Industries, Inc.
National Cash Register Company
Olivetti Underwood Company
Pitney Bowes Inc.
RCA
Standard Register Company
Tally Corporation
Univac

Users (16):
Air Transport Association
American Bankers Association
American Gas Association
American Library Association
American Newspaper Publishers Association
American Petroleum Institute
Association of American Railroads
Department of Defense
Edison Electric Institute
General Services Administration
Insurance Accounting & Statistical Association
Life Office Management Association
National Machine Tool Builders Association
National Retail Merchants Association
Printing Industries of America Inc.
Scientific Apparatus Makers Association

General Interest (13):
Administrative Management Society, Inc.
American Institute of Certified Public Accountants
American Society of Mechanical Engineers
Association for Computing Machinery
Association for Educational Data Systems
Data Processing Management Association
Electronic Industries Association
International Communications Association
Institute of Electrical and Electronic Engineers
Joint Users Group
National Bureau of Standards
Systems and Procedures Association
Telephone Group

organization

X3 has organized eight subcommittees, responsible for technical standardization work in several specific areas of information processing.

Each subcommittee has defined its range of technical responsibilities and activities in the form of scopes and programs of work approved by X3. In most subcommittees further subdivision into working groups has been necessary for the accomplishment of the technical work. In all subcommittees and working groups, members function as individuals rather than as official representatives of organizations, although a reasonable balance of interests is desirable. An outline of the organization is shown in Fig. 1.

What distinguishes USASC X3 from its sister USA Standards Committees is its consideration of anticipatory standards which apply to hardware and software types that are not commonly used today but are likely to make up the bulk of applications in the near and intermediate future; 1600 cpi and 3200 cpi magnetic tape fall into this category. Many USA Standards Committees are ratifying de facto standards relative to items which have been in use for 30 years, such as couplings and incandescent lamp bases. But it is because the data processing technology has such a high rate of change that anticipatory standards are almost mandatory.

the delay problem

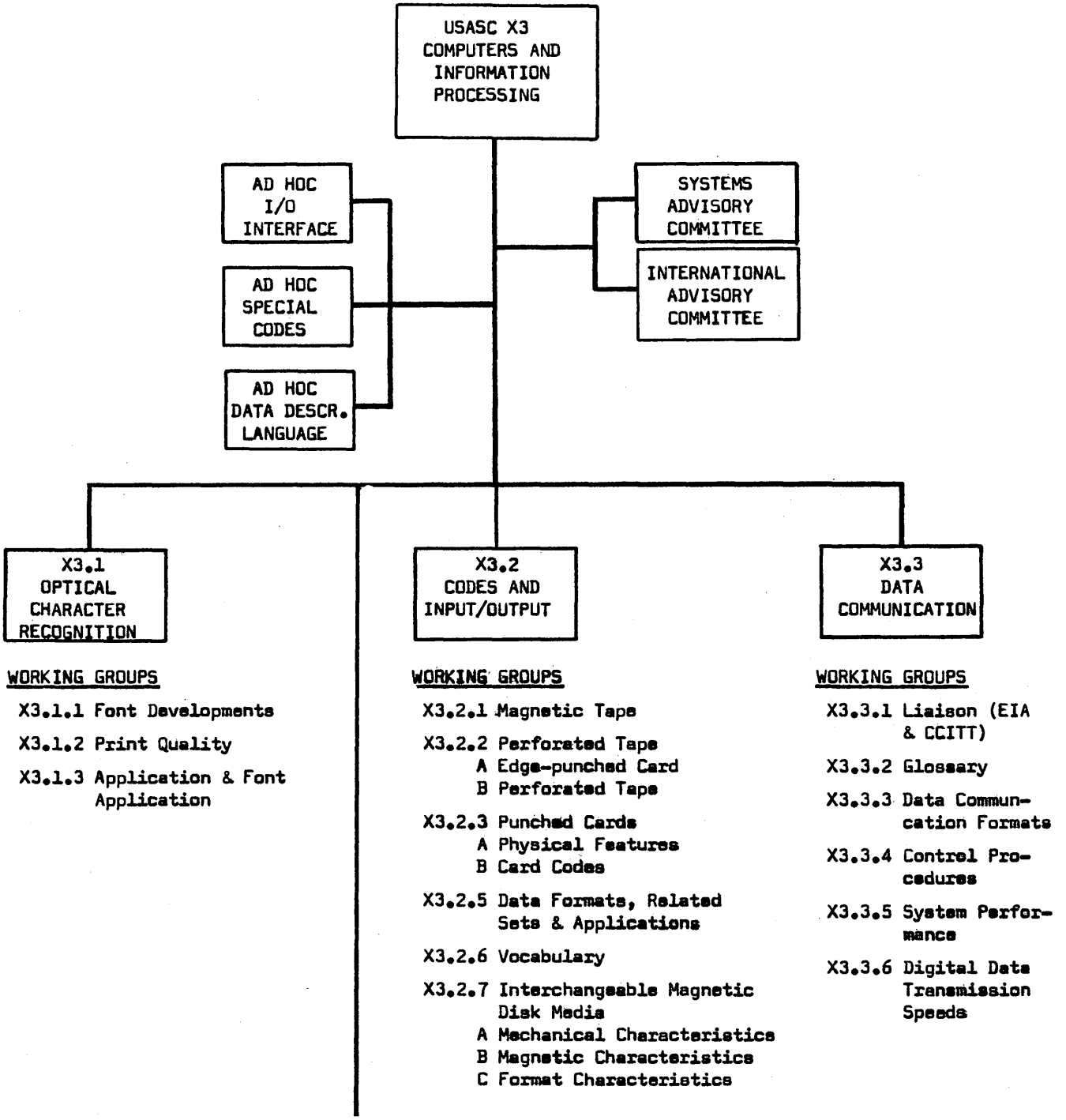
There are some segments of the information processing community, in and out of government, which believe that standardization is not proceeding fast enough, that there are too many delays in the route towards a USA Standard. While one cannot make a general statement that will fit all cases, it appears that this charge is true in many instances. How to ascribe the reasons for delays and how to eliminate them is much more difficult than to make the charge. In part, USASI procedures may be to blame but for a good reason. With the restraint-of-trade laws in our country and with the Justice Department looking towards their enforcement, the standards-making bodies must be very careful about the methods used to generate and approve standards. Above all, USASI must be assured that every interested party willing to be heard was indeed heard before a document receives the USASI label. This caution does not mean that any given standard must reflect the practices of each member of the community or must be broad and weak enough so that even the novice "loft operator" with a one-week business history can meet its requirements. We are not after "bucket standards" which are meaningless. But because standards *can* engineer a company out of the market or can prevent a user from obtaining the products he desires, it is urgently important to at least listen to and even go out of the way to solicit contributions from those competent and willing to cooperate. Therefore the Information Processing Systems Standards Board, USASI's overseer of USASC X3, is extremely careful in its scrutiny of the handling of any document submitted for its approval. The disposition of any negative votes and any critical comments must be to the satisfaction of the IPSSB.

One can next look to the procedures of USASC X3 for any further delaying items. Both BEMA/DPG, as sponsor, and USASC X3/SCA have been reassessing the present structure and procedures of USASC X3. Both have suspected redun-

dancies and incipient delays. BEMA/DPG appointed an ad hoc Procedures Committee and charged it with examination of the 1965 Procedures and the recommendation of new procedures if required. The committee, formed in February, 1967, has met 17 times and has taken testimony from a wide spectrum of sources, including USASC X3/SAC. It decided to prepare a new USASC X3 Operating Procedures Manual. The manual will consist of an introduction, three main sections and tutorial appendixes. The first of the main sections will deal with the organization, administration and policies of USASC X3 and will cover the complete and detailed structure of the group. The second section will describe the method of domestic standards processing via the USASC X3 Committee. Here the flow of a proposed USA Standards will be charted from the initial idea, through the development phase to its final approval by USASI. The Procedures Committee believes that the flowcharting will reveal just where certain delays and redundancies appear and how they could be eliminated. For example, there are opinions that several levels of voting could be omitted without affecting the quality or application of the standard.

At this point it might be apropos to advise the reader as to what might happen if he were to try to propose a standards project for development within the USASI procedures. It will be assumed that the reader represented an organization that had an intimate technical and/or financial interest in the area of information processing covered by the project and he himself was technically competent in this area. We will also assume that he knows nothing about USASC X3 or

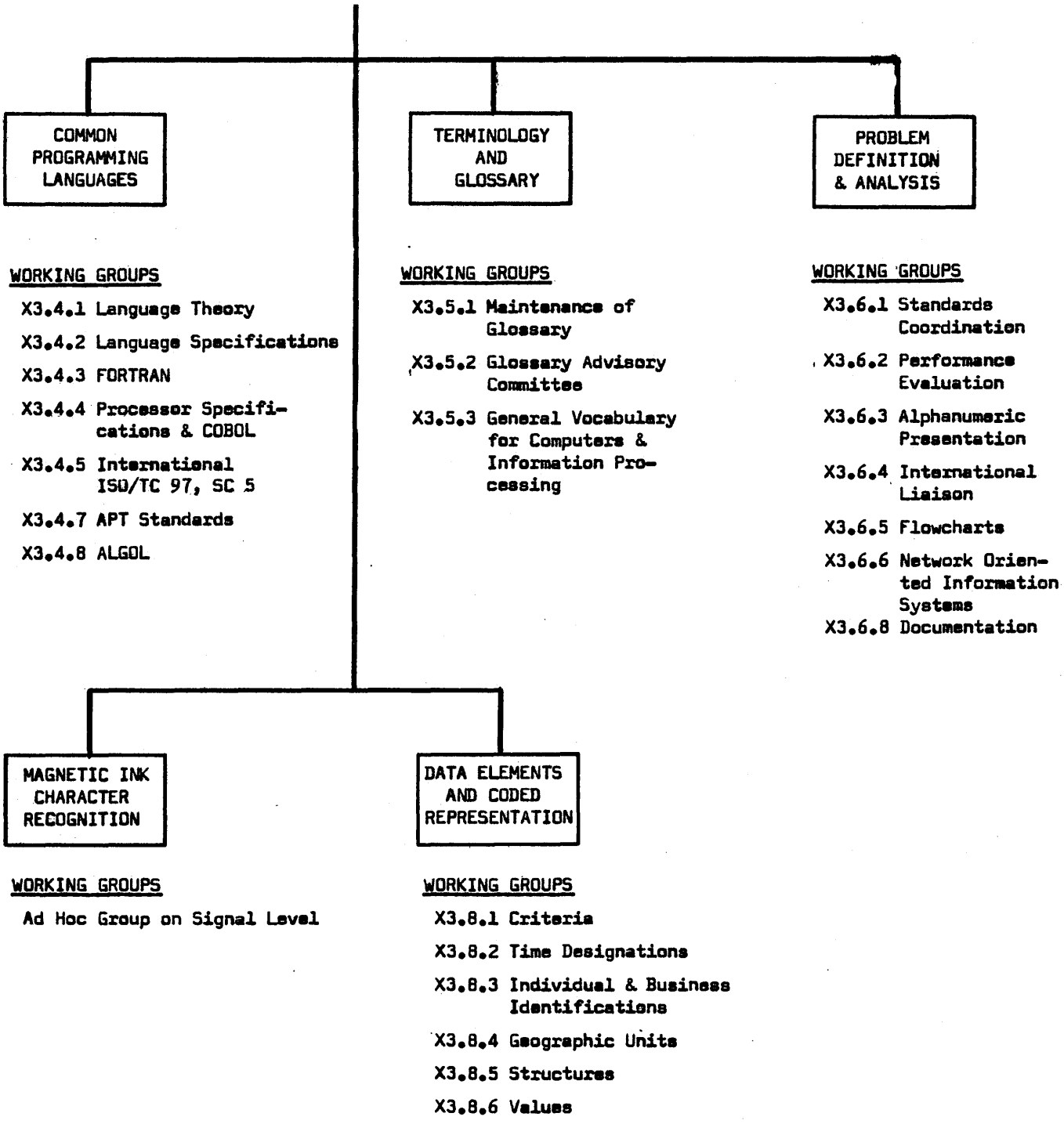
Fig. 1



BEMIA/DPG but is vaguely aware that USASI is concerned with national standardization. The first phase of his quest is to find a contact point where he could interest others in his idea. The scenario might read as follows:

1. The reader, now called the proponent, writes to USASI requesting that his idea be given consideration as a standards project. He includes all supporting material including any similar standards in use in the USA or other countries. The need is outlined and documented.
2. The USASI management directs the request to an appropriate Standards Board, in our case the IPSSB, which, in turn, examines the scope of its Standards Committees (X3, X4, C85, Z39) to determine if the proposed project can be placed with an existing group.
3. If there is no existing committee within whose scope the proposed project falls, USASI will call a general conference to determine whether a real need for the project exists. If a need is determined to exist, USASI will establish a new USA Standards Committee to handle the project. This committee will require a sponsor to underwrite the expenses and to ensure that progress ensues. USASI could also request that one of the interested organizations establish a proprietary committee or use one of its existing proprietary committees to develop the standard and then submit it via one of the IPSSB Standards Committees or to then publish the standard as an industry document and submit it for USASI approval under the existing standards method.
4. Assuming that the IPSSB allocates the work to USASC, X3 will circulate the proposal to X3/SAC, X3/IAC and the sponsor's DPG Standards Committee. These groups will report back to USASC X3 after examining

Fig. 1 (continued)



the proposal for technical content, impact on the users and manufacturers, economic feasibility, cost of implementation, related work in the U.S., in other countries and in the international standardizing organizations.

5. USASC X3, after studying and discussing all of the evidence, takes a letter ballot. If the vote is affirmative, three alternatives are available. USASC X3 can assign the project to an existing subcommittee, establish a new subcommittee or, if the proposal requires further definition, establish an ad hoc committee to report after more detailed investigation.

if a subcommittee exists

6. Going down the route of the "existing subcommittee" alternative, a specific working group may be formed to handle the draft of the proposed USA Standard (PUSAS). The working group (WG) will develop the first draft after considering most of the available documentation, domestic and international. At this stage the draft might be in the form of a working paper. After a number of meetings and correspondence, the group may decide to put the document to a vote. At this level the members vote as individual experts and not as an instructed voting representative of an organization or company. If the draft PUSAS is approved by the working group it will be sent up to the subcommittee. If the draft is not approved it will either die or be redrafted in the light of comments received.
7. The subcommittee (SC) receives the draft and considers it not only relative to its technical content but its technical and economic feasibility, impact and cost of implementation to producers and users, relationship to domestic, foreign and international approved and proposed standards. Comments and critiques will usually be generated at this point and heavy correspondence will be exchanged within the subcommittee and between subcommittee members and outside interested parties. A report will often arrive from ECMA (European Computer Manufacturers Assoc.) indicating its reactions as well as its progress on similar work. Again a number of meetings will carry the subject of the draft PUSAS on their agendas, discussions may be protracted and second-order correspondence (comments on comments) may be circulated to the members. The subcommittee may decide to prepare a new draft itself or to send it back to the working group with instructions based upon the comments it deems most relevant. Eventually a draft PUSAS will be brought up for a vote by the subcommittee members, who also vote as individuals, and will, at some time, be passed up to USASC X3 for publication and/or letter ballot. The document has passed through a critical juncture because the "technical people" have decided to stop engineering the document and start it on its way to production.
8. Now it must be recalled that USASC X3 is in reality an administrative and not a technical group in the sense that the spectrum of individual representative special expertise is very wide and only a small number of representatives have a depth of knowledge and experience about any single PUSAS. Judgments from this group tend to reflect considerations of the impact of the PUSAS on the area of work carried on by the organizations which are the *real* members of the Committee. While it is assumed that the average USASC X3 representative is instructed, no data exists about the depth or extent of this instruction or the manner by which the instruction is given.
9. When a PUSAS arrives for consideration by USASC X3, copies are sent to SAC for evaluation relative to its application in and impact on data processing systems. What is the relationship to software, media, system environment, codes, vocabulary, etc.? Will the users be forced into an expensive retrofit program? Is an ECMA committee taking a different tack? SAC will report its findings to the Committee. USASC X3 may take a voice vote (at a meeting) or circulate a letter ballot (30 day) on publication of the PUSAS. If approved, the document will be published in the Communications of the Association for Computing Machinery. The publication period runs four and one-half months from the date of availability of the specific issue of the Communications. If not approved, the PUSAS may be returned to the subcommittee for rework or re-editing.
10. During the publication period, it is hoped by USASC X3 that the "outside world" will be aware of the imminent issuance of the PUSAS and submit comments on the document and its application. In this way the Committee seeks to enlarge the critique that has started in the working group. All comments are directed to the Secretary of USASC X3 and forwarded to the relevant subcommittee chairman. He, in turn, circulates them to the subcommittee and working group members. At a subsequent meeting the comments are resolved (accepted or rejected). Further editorial work on the PUSAS may be in order.
11. Now USASC X3 must decide whether to send the PUSAS to the sponsor for submission to IPSSB and USASI to be approved and published as a USA Standard. Again a voice vote or a 30-day letter ballot will be taken as to whether a six-week letter ballot shall be circulated to members for approval of the PUSAS and its subsequent submission to the sponsor and USASI. A six-week letter ballot is circulated to all USASC X3 member representatives and their alternates. Attached is the PUSAS and all relevant documents. During the balloting period and up to the time when the Secretary of the IPSSB certifies the result of IPSSB ballot, all votes are secret and the Secretary of USASC X3 does not disclose any information on individual votes. If the vote tally indicates a consensus, and this elusive term is undefined by USASI, the Chairman of USASC X3 forwards the document to the sponsor who then prepares a submittal package for USASI and the IPSSB. This item consists of the final copy of the PUSAS, a brief history of its development including actions by the working group and the subcommittee, and the vote tally of USASC X3. Further, if any negative votes were cast by USASC X3, the submittal must indicate what the chairman has done to try to resolve the negative votes. "Resolve" means seeking required actions by USASC X3 or changes in the PUSAS which might cause a member to change its vote from no to yes.

checking

12. In judging the procedural correctness of the development of a PUSAS, the IPSSB considers the following "test":
    a. Were the views of all substantially concerned parties heard and considered?
    b. Was evidence presented relative to the potential use of the PUSAS?
    c. Were any conflicts with other USA Standards resolved?
    d. Was consideration given to other nationally accepted standards in the field of the PUSAS?
    e. Is there any conflict between the PUSAS and the national interest?
    f. Is there any unfair discrimination inherent in the PUSAS?

(Continued on page 37)

g. Is there adequate assurance of the technical quality of the PUSAS?

In addition, IPSSB considers two other factors: first, that the membership of the USA Standards Committee was balanced, representative of those parties concerned with the PUSAS and possessed the necessary technical knowledge and competence in the area covered by the PUSAS; second, that the sponsor accepts the regulation of the institute with respect to maintenance, publication and revision of the Standard.

An affirmative vote of 12 of the 16 IPSSB members is sufficient to approve a PUSAS if no negative votes were cast. Otherwise the PUSAS will go before the Executive Standards Board.

13. If the PUSAS is approved by IPSSB, the vote tally will be certified, notifications will be sent to the sponsor and the proponent and USASI will publish the new USA Standard.
14. If the PUSAS is not approved by IPSSB, a report on the vote with all relevant documentation, including reasons for the disapproval, is sent to the sponsor, proponent and USASC X3.
15. The proponent must then decide whether he wants to appeal to the Executive Standards Board within 10 days of the IPSSB action. If he does not appeal, the PUSAS is dead unless USASC X3 decides to continue work on it.
16. USASC X3 then considers the state of affairs relative to the defeated PUSAS and decides whether or not there is a justifiable reason to continue work on it. The document may have been turned down on procedural grounds and there still may be a definite need for it. Years of committee work may yet be salvaged. If USASC X3 decides in the affirmative, the document may return to the subcommittee or to that point in the process where the IPSSB felt that a procedure was not adhered to. If the vote is negative, a notice will be sent to the sponsor who prepares a final report to be submitted to the IPSSB which in turn reports to USASI. USASI notifies the proponent who then must decide whether or not to appeal to the Executive Standards Board.

thorough enough?

From the aforementioned scenario, which, if anything, is somewhat abridged, the reader may judge whether or not standardization, under USASI procedures, is handled thoroughly. If anything the procedure may be too thorough. As was previously stated, there are shades of opinion that the process could be accelerated without detracting from the impartiality of the procedure and quality of the Standards. The sponsor's ad hoc procedures committee is exploring the possibility of eliminating some of the balloting points.

The revised domestic USASC operating procedures will, it is hoped, remove some of the voting levels by the elimination of working groups and subcommittees. The new Section Two should be concise and its accompanying Standardization Flow Chart should be shorter.

The third section will treat the international standards processing as it relates to ISO, the International Electrotechnical Commission (IEC) and the European Computer Manufacturers Association (ECMA). Again the flow of the proposed draft recommendation will be charted in order to detect unnecessary delays. Here the method of change, if any is required, is more complex than for domestic standardization because the consent of the ISO is required for any basic procedural change. When the manual is completed, it will permit any person operating at any level in the USASC X3 hierarchy to quickly identify his place in the picture, to know his responsibilities and the obligations of others in the hierarchy to him.

A longer range project, partially considered by USASC X3/SAC, approaches the development of an information processing standards structure so that the interdependencies among existing and proposed standards can be noted and the general priorities for standards development can be established. At the present time both ECMA and BEMA/DPG have appointed in-house committees to examine their respective proposed standards and to set up priorities for the development of these standards. In effect, a table of standards, similar to a periodic table of the elements, would be set up. Each standard would have a coordinate position relative to its place in the information processing system, its impact on the users and producers and its location in a family of standards relating to a specific technical area, i.e., MICR, OCR, magnetic tape, codes, etc.

how we got here

Looking back at the maturation years of USASC X3, in the 1960's, one wonders why so many participants spent so much time and money and got so deeply involved in standards. What is the payoff to producers, users and the general interest groups? Has the old cry, "If we don't get into the operation, the government will ram its standards down our throats," actually worked with the non-government groups? Partially, perhaps, but this is not necessarily the entire story.

Remember the inheritance of a standardization tradition from the electrical and electronic industry. A number of the present-day computer manufacturers were first in the electronics business and thought of standards long before the government hierarchy included any boxes marked "data processing" in its organization charts. Also it must be noted that both civilian and military government agencies are cooperating actively in the USASC X3 and ISO/TC 97 programs, thereby indicating that an adequate vehicle exists for achieving voluntary standardization. Further to the point of government satisfaction with the document output of the voluntary program is the federalization of four of the 25 Standards produced by USASC X3.

There are plans to federalize almost all of the USASC X3 Standards. Here we can view the government as a user who, in common with other users, wants to select from a variety of competing products (hardware or software) which will have certain "common denominators" that will permit him to interchange them in his application wherever it might be. The user feels that standardization is a tool that will give him some degree of control over his inventory and ease his maintenance and training problems. Lack of standards for such items as keyboards, paper sizes, paper and magnetic tapes, programming languages and codes would put the user at the mercy of sole source procurements and, in some cases, force the user to reprocure entire systems if a manufacturer decided to discontinue production of spare parts or went out of business altogether.

The payoff to the producer, domestically, is, in a sense, the complement of that to the user. The manufacturer can compete on terms of accuracy, speed, reliability and specific customer-oriented performance features rather than being concerned with special sizes, shapes, fonts, codes, etc. His internal production planning, quality control and documentation support become less complex and costly. His investment in tooling and materials decreases and his employees are trained less expensively. The training and maintenance software for the customer are also less expensive. Thus the producer may exercise design innovation in his equipment or system when he is sure of the programming language, the interface requirements, the physical and other properties of the media to be used, the codes to be used for information

interchange and the environment in which the equipment will be operated.

Most, if not all, of the aforementioned items have been standardized. Perhaps it should be noted here that more than one standard may be required in certain areas of application. Thus it becomes reasonable that there be more than one standard programming language, more than one magnetic tape character density allocation and a set of codes for interchange of information internal and external to the data processing system. Furthermore, it must be emphasized that standards change, grow, are replaced and die. A standard is only as good as it is useful and must not be immortalized because it has received a USASI label. Into each document must be built a method encouraging and providing for change.

By this time it should be obvious to the reader that the payoff to both the producer and the user from the domestic standardization effort is money. Money saved during the production process, saved via a smaller inventory or stockpile and money saved in the employee training and maintenance operations. The producer knows that his market is larger when he can conform to agreed-upon standards. The federal and state governments, as users, readily admit the cost savings of standardization. In areas where cost savings were not involved, government and private standardization programs lagged far behind and encompassed inadequate de facto standardization, e.g., labor safety standards.

the problems

We have taken a brief look at the recent past and present and, if we are not to emulate ostriches, the problems in standardization stand out quite clearly.

1. Even with the new USASC X3 operating procedures, adequate participation from the user and general interest groups will be difficult to obtain. Unless the cost of participation, in the form of direct attendance at meetings and time required for evaluation of documents, is reduced, these groups will continue to lag in participation.
2. A system of enforceable priorities must be established. The present concept that USASI or USASC X3 must take on almost any standards project put to them must be scrapped in favor of an equitable method of priority assignment.
3. USA Standards must be published without copyright. At present, USASI derives approximately 40% of its income from the sale of its Standards and a copyright-free policy would put the institute in the red. But there is some incongruity in a setup where all categories of participants spent millions of dollars to develop 25 information processing standards and, after approval by USASI, must then pay an inflated price for the documents. The fault is not USASI's but that of its members and of those groups who ride free but who should be members. Some of our major corporations, the U.S. government and most of the middle-sized companies are among the free riders. It is almost impossible to believe that a way could not be found to assure proper support of USASI so that its (and really our) Standards could be practically given away or at least put into the public domain.
4. There are no reporting vehicles for the impact of approved USA Standards on the producer and user communities. Occasionally one of the trade of professional magazines does a report on a specific Standard but this may not reach those who are in the process of developing similar documents. Such a vehicle should be a part of the standards-development machinery.
5. We have yet to establish a consistent and viable timeframe for the development of Standards. This timeframe together with a priority allocation system and a method of assignment of control bench marks would, for the first time in the history of USASC X3, permit an effective standards management program.
6. A set of quality criteria is required to assure USASC X3 that the Standards which it has developed do indeed meet the goals set up by the committee. USASI procedures demand that each USA Standard be reviewed at least once every five years subject to withdrawal, reaffirmation or change. Remember that USASC X3 told IPSSB that the PUSAS was of high technical quality. Where is the post-approval confirmation provided for in an orderly manner? The new USASC X3 Procedures must include quality control provisions and feedback channels from the users to the developers.
7. One of the most critical deficiencies in the entire standardization program is the lack of upper management cognizance and participation. In government, industry and user organizations, standardization policy is scarce and sparse. Management in most cases just does not give a damn until a crisis erupts. Such a crisis could take the form of a particular Standard forcing extensive redesign or perhaps wiping out a market for a firm. The answer is not to put vice presidents of engineering on USASC X3 but to upgrade the internal reporting system of the participating organizations. The standards groups in the various companies and government agencies could handle the reporting job but most of the time they are undermanned and overworked. For example, the Defense Communications Agency, operating a global communications system with a fixed plant worth about $5 billion, with a 35,000 man work force, with about $600 million operating expenses, maintains a "Standards Division" of six professionals, some "borrowed" from the military departments. Comparable situations exist in industry. There are few companies where the standards department does not report to the same "industrial services" division that handles document reproduction. Perhaps an in-depth look at the entire standards picture is necessary before any patchwork repairs are made.

Special committees of BEMA/DPG and ECMA are examining these problem areas and more. Reports should begin to come forth sometime next spring. The situation could be helped if government and the user groups would address the same problems from the point of their own self-interest. It is quite obvious that no over-all and clear standardization policy has yet been promulgated by either the government or private users.

When the studies of domestic standardization have been completed, recommendations made and programs revised, perhaps the committees could get on with a jaded-eye look at international standardization methods. Here they could question whether there might be a better way to achieve international consensus. Today's global picture is that perhaps six to ten national bodies set up committees to solve an identical problem, a regional body again considers the same problem and finally an ISO committee deliberates for a few years in an attempt to resolve the different solutions reached by the national bodies. It is the contention of this writer that improvements in the international procedures for standardization can be even more dramatic than those at home.

No, standardization is far from dull. It offers one of the most fertile areas for both technical and managerial innovation. All of us, from government, industry and the professional groups must make an investment in its future, an investment which will pay off in lower costs, better and more timely standards and, most important, more efficient and compatible information processing systems. ■

COMPUTER SYSTEM STANDARDS FOR A LARGE ORGANIZATION

westinghouse chooses theirs

by W. BARKLEY FRITZ

With the continuing rapid evolution of the computer field, the need for standards has been apparent for some time. Although national and international computer standardization activities have been under way for about a decade, until recently it has been difficult for a large organization using computers to properly interface these developments and fully exploit the advantages of the "right" standards.

In a large organization, the development of a consensus as to what specific standards should exist requires a considerable amount of communication and interchange of ideas among various groups with somewhat diverse requirements and goals. By associating the reasons for standards with the actual standard, the on-going standardization program can be sold to the individual members of the organization and be highly successful in spite of a variety of problems.

By any measure, the Westinghouse Electric Corp. is among the largest industrial organizations in the world. Its diversity of products, its unique over-all engineering orientation and its success as a major factor in a wide variety of fields provide an organizational environment particularly suited to highly effective use of modern computer technology.

As a user of the Univac I in the early 1950's, Westinghouse was one of the first industrial organizations to use digital computers successfully as an integral part of its operations. That usage has expanded rapidly over the years and today this organization relies heavily on a wide variety of computational equipment. Westinghouse ranks as one of the major industrial customers of several U.S. computer manufacturers.

The effective use of this ever-expanding computer power did not just happen. Behind this use has been extensive planning to search out and implement new and profitable application areas.[1,2] Also because of the pace of the fast changing computer technology, it has been necessary to develop an environment for rapid equipment change in order to efficiently implement major new technical developments.[3]

A major factor in this effective computer use and rapid exploitation of new technology has been the development of corporate standards. It is the subject of computer standards—including our corporate *standards policy, areas* for standardization, *procedures* for development, and the *benefits* of such standardization—that is discussed in this article.

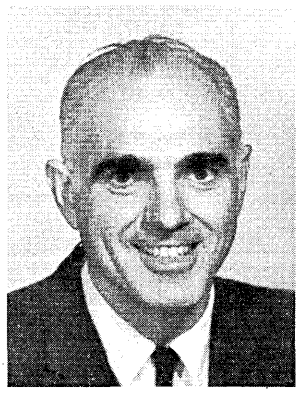
From the entire spectrum of the national and international standardization program, those specific areas that are most critical to an industrial organization are outlined. Specific corporate computer standards of the Westinghouse Electric Corp. are listed with some indication of the motivation that led to the standards adopted. The closing emphasis is on the changing nature of standards resulting from the dynamic nature of the computer industry and the economic advantages of the kind of program presented in the paper.

As recently as 1966, the Westinghouse Electric Corp. was moving in the direction of a single "super" computer to handle the workload of the major divisions of the corporation. This concept is no longer considered feasible for the following reasons:

1. The continuing extremely *rapid growth* in total Westinghouse computer requirements.
2. The *limitations* of existing state-of-the-art *hardware* and *software* to implement such a plan.
3. The Westinghouse divisional *profit center organizational structure* that is not especially appropriate for a single "super" system, because it would constrict the profit center manager.
4. The over-all *risk* involved in the "all eggs in one basket" concept, too great a risk to take for an organization so highly dependent on computers.

Replacing this "super" computer concept is a computer-direction that supports both strong centralized systems and effective decentralized division-based equipment. What is involved is the familiar "check and balance" concept, i.e., each division uses in-house equipment when this is justified from an economic point of view, but uses central computer or time-sharing facilities when this is desirable. Usually each operating unit or profit center does not take one path or the other, but uses in-house equipment for a portion of its computer load, and also uses a Teletype or batch type terminal to time-sharing or corporate tele-computer center facilities for another portion. Economics, turnaround, load conditions, nature of the load with respect to corporate involvement with the information and other factors determine where the application is run. However, in a very real sense, the use of Teletype or line-at-a-time data communications brings the capability of the time-sharing computer or the corporate tele-computer center directly to the remote user, thus minimizing any real difference between the two approaches. At the present time there are in excess of 500 Teletype and about 20 line-at-a-time terminals within the corporation.

Consistent with this policy on computer direction is the policy to make use of multiple vendors with competitive hardware. Such a policy is dependent upon the fact that various suppliers introduce new competitive equipment at different times. Such announcements followed up by suc-



Mr. Fritz is Manager of Systems and Operations in the recently established Westinghouse Electric Corp. entry into the computer-based information services market. He formerly headed the information systems and programming department at the Westinghouse Defense and Space Center. He has an MA in mathematics from Johns Hopkins Univ.

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These simulations are so complex, the elements so numerous that a 24-hour forecast for the northern hemisphere can take 10 hours of computing.

Despite this scientists are optimistic. In fact, current results indicate that reliable 14-day forecasts are a distinct future possibility. Also, the observational network must be expanded to the whole of the earth.

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cessful software and hardware deliveries provide a means for a continual reduction in the cost per unit of computation. In addition, such a policy results in an excellent opportunity to obtain better contract conditions and improved delivery, thus making it possible to exploit new developments in the field rapidly and with limited risk.

This multiple supplier policy (both serial and parallel) requires standards in a variety of areas and essentially provides the motivation for the development and implementation of corporate computer system standards that are independent of any single supplier. Thus, Westinghouse does not have standards for their own sake, but as a necessary means of supporting corporate policy.

Another type of organization might be willing, and even find it desirable, to live with one supplier, adopt that supplier's software and hardware as it exists, and not be concerned with other equipment now or in the future. Such an organization has thus dictated for itself the "standards" of that supplier and thereby runs the risk that fast-paced changes in computer technology will cause them to become locked in to obsolescent computer equipment or to an expensive transition to the next generation of the same supplier.

Westinghouse policy has been established to prevent a lock-in to any single supplier or generation of equipment. Computer standards and guidelines are thus a necessary requirement to implement a more fundamental policy—that is, an ability to use a variety of suppliers and to be able to change to the newer, more effective, lower price per unit computation equipment as dictated by the requirements of the dynamic economy in which the corporation operates.

areas for standardization

To implement this policy and to control our development of information systems, it is necessary to adopt and use standards—the right standards. The national and international standardization activities provide an over-all outline of the areas where standards are being developed and thereby serve as a guide to appropriate areas for corporate standards. Based on the USASI, IFIP and ISO activities, the following areas are suitable for organization standards:

1. Optical character recognition (OCR)
2. Codes and input/output
3. Data transmission
4. Common programming languages
5. Vocabulary
6. Problem definition and analysis
7. Magnetic ink character recognition (MICR)
8. Data elements
9. Program documentation

At the USA level, some standards have been adopted in essentially all of the above areas including, for example, the following: a code for information interchange, perforated tape, punched cards, magnetic tape, vocabulary, flowchart symbols, MICR, COBOL and FORTRAN. ALGOL and certain data elements are in the pipeline of the standardization process.

It is almost obvious that if a national or international standard exists in a particular area, then any large organization should adopt that standard or at least be working toward its adoption. The assumption is that the standard is a good standard and that it will be generally adopted. However, corporate adoption of even the "wrong" standard is usually better in the long run than inconsistent use of various nonstandards.

It is this requirement for national and international "communication" and an effective "working together" capability that led to effective USASI, IFIP, and ISO standards activity in the first place. Corporate entities and other large organizations have many of these same requirements and can benefit from such broader effort; however, each organization must evaluate and implement standards in such a way as to support its own objectives.

As the title of this paper implies, standardization is a developmental process, an on-going process. The standardization progress of the Westinghouse Electric Corp., including a brief listing of our corporate computer standards, is provided later following a discussion of the procedures involved in the standardization process.

procedures for developing a consensus

The development of standards at the national or international level is extremely time-consuming and, in general, because of the length of time it takes to get agreement, somewhat of a frustrating experience. Standards, in the context of a large, diversified industrial corporation with essentially autonomous division profit centers, present a similar problem. Guidelines and good practices must be "sold" to those who must comply. Each division must agree that adoption of a particular standard is "good" for his operation. The advantages of corporate standards must be understood by each level of management in terms of why adherence to the standard is desirable for his operation.

The adoption of a new standard usually requires change from existing local conventions. Change, in general, has some cost associated with it. In some cases, the cost of change can be quite high. The advantage of that change must therefore have a greater value than the cost of making the change. Personnel must be available to make the change. Because of schedule requirements, local operating functions may bypass a corporate standard. Standards thus in a practical way may be regarded as a "direction to go" or a guideline rather than a rigid edict. Local management, in order to meet other objectives, must have the authority not to adhere, when the "not adhering" has greater advantages such as higher immediate profits or an ability to meet a committed schedule. However, the longer-term consequences of not adhering to the standards must also be recognized. The *direction* indicated by the standard *must* be accepted by all levels and the "deviation" recognized for what it is, a temporary expedient.

A problem with standards is that they are not rigid. An argument against their adoption is that the standard will probably be changed "someday." The fact that the standard may be changed, however, is no reason not to adopt the standard as a self-consistent mode of operation, thereby simplifying change to that new standard when and if the change takes place. Standards thus provide a basis for getting to new standards.

A major influence in the development of standards is the environment in which the operation exists. Of course, the major input in a large organization is the need of the various units to communicate effectively with one another. This need for a standard and the requirement that the parts of the organization be sold on the fact that the standard adopted is the "best standard" requires a consensus—that is, a general agreement as to the desirablility of using this single way of doing things.

But the units of the organization, and the organization as a whole, must deal with the outside world and this is where the trade associations and the national and international groups carry heavy weight. Economics dictate that organizational standards not be in conflict with the national and international standard, assuming, of course, that the standard is sufficiently well defined and accepted. However, local practice and the corporate standard must come first, at least in the chronological sense. The large organization cannot sit back and wait until "*the* standard" is agreed to at the international level. The requirement for an in-house standard, before the fact, that is hopefully not inconsistent with

later national and international efforts almost forces the organization to work closely with the various industry and government standardization bodies in order to contribute to the direction that will be taken and take advantage of the knowledge gained as to the direction in which "things are going." As indicated in the previous section, Westinghouse, by being fairly active in USASI activities, has been able to move in directions consistent with the direction later taken by USASI. Of course USASI is being influenced by ISO and IFIP activities.

Another factor involved in the standardization activity in the computer field is the role played by the one dominant supplier, IBM. The role of the "de facto" standard cannot be overlooked as one attempts to reach a consensus. Although, as I have mentioned, Westinghouse uses equipment made by nearly all of the major suppliers in the USA, the influence of IBM on Westinghouse as a user and on the other computer equipment suppliers to Westinghouse is considerable. The 80-column punched card and the one-half-inch magnetic tape represent two areas where Westinghouse and most other computer users had standards long before formal acceptance of these "de facto" standards by a standards body.

A formal means for getting standards agreement within an organization is difficult to define. Certainly formal seminars, meetings, committees, policy letters, standards manuals, and related activities and documentation can, and do, all play a part. Indeed even agreement by a "duly appointed committee," while desirable, is not the complete answer. As most of you know, large American corporations are not generally "dictated to" by committees, even inside committees. The *existence of* a complete standards manual does not assure *adherence to* standards. Essentially, standards represent what is being done, rather than dictate what is to be done. Standards represent a direction, and in the traditional sense provide a means of measuring performance toward achievement of the organization's objectives.

In another sense, standard performance generally will not be the best possible performance, however it will be a "standard" to which any variation from standard can be compared. If a truly better way is developed, then this new approach should be made the basis of a new standard. The economic benefits of the change can then be evaluated in terms of the cost to make the change. The existence of, and adherence to, standards are thus not to be a means of limiting progress, but a means of evaluating, controlling and promoting progress.

westinghouse standards

Before concluding, I would like to give an indication of Westinghouse progress to date; I shall list briefly those areas where effective Westinghouse corporate computer center standards now exist.

1. FORTRAN and COBOL are the standard programming languages. The specifications of these languages are as defined by USASI.
2. Standard equipment selection procedures and guidelines have been adopted. Corporate approval procedures are consistent throughout the corporation.
3. The standard character set in Westinghouse is that of USASCII. The character sets used by FORTRAN and COBOL are both subsets of this code which has been implemented by different bit configurations by various computer and communication equipment suppliers. Hopefully the suppliers will eventually adapt a single code representation; however, in the meantime automatic hardware and software conversion can be used.
4. The USA Standard Flowchart Symbols as published by USASI are standard.
5. For purposes of standardized written and oral communications, the USA Standard Vocabulary for Information Processing has been adopted as a base.
6. In the area of data elements, standard machine formats have been adopted for the following: date, time, individual and business designation, location, and phone number.
7. The USASI tape labeling standard has been adopted.
8. Standard formats for data files are defined.
9. A standard library of subroutines has been adopted and is being maintained on most computational equipment operational within the corporation.
10. Standard program documentation procedures have been developed and implemented.
11. The ACM Guidelines on "Professional Conduct in Information Processing" have been adopted as a means of providing a standard in this area.

At the present time 1 and 2 are published corporate standards. The others indicate the corporate direction and as such are documented at the corporate computer center by means of a loose leaf document entitled "The Tele-Computer Center Standards and Facilities Manual." This document has proven to be extremely valuable not only in serving as a general guide in the training of new personnel but also as a reference for experienced personnel. In addition, good practices and conventions are defined and included with the manual. Emphasis is on modular programming.

An adjunct to Westinghouse standards are its standard hiring practices for personnel in the computer and management systems area. Adherence to educational requirements and a specified level of performance on a standard battery of tests also help provide a basis for the effective interchange of personnel within the divisions and staff function activities. This commonality of approach gives the corporation a depth of back-up for key positions that makes it possible to find qualified candidates from within for openings created by the establishment of new divisions and expanded computer system activities.

conclusion

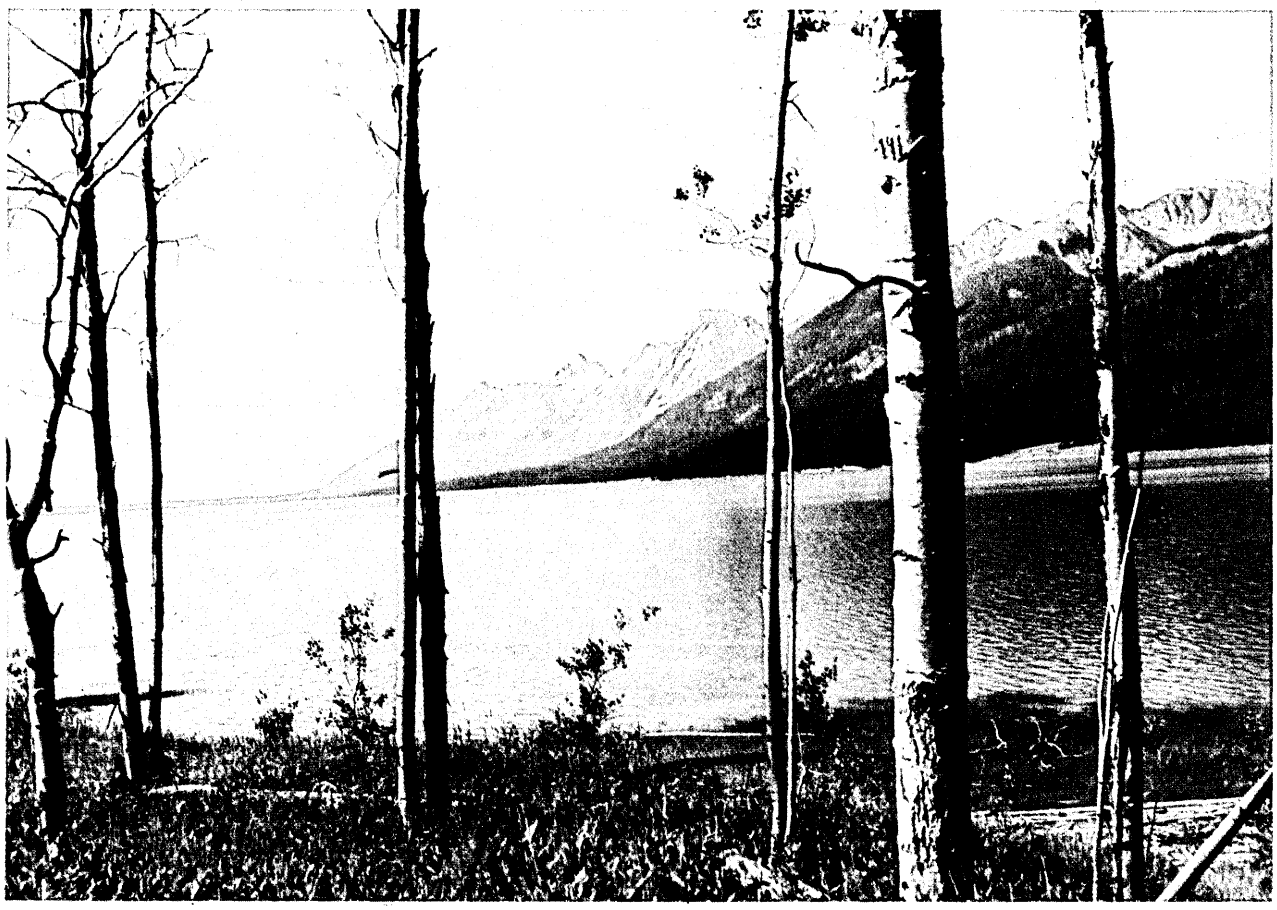
An organization-wide set of computer system standards provides support to the achievement of the organization's prime objective. In the computer systems area that goal might be stated as providing the best possible computer operation at the lowest possible cost.

Experience at Westinghouse in the use of COBOL and FORTRAN has simplified programmer training and increased programmer productivity. With respect to the training phase, our experience has shown that the new inexperienced employee begins to become productive during the first month of his employment period following some 40 hours of on-the-job training. Both languages are well documented themselves and are essentially self-documenting for ease in program maintenance. Each provide a fair amount of machine independence and each provides a useful base for program exchange between different groups having the same or very similar applications.

The existence of standard data elements, file structures, tape labeling, and related standards helps reduce redundant effort, simplify the preparation of new programs, reduce the program maintenance effort and ease the program debugging problem. Because of the variety of factors which influence performance it is difficult to prove, but not difficult to demonstrate, that effective standards provide at least a 20% increase in overall productivity. Westinghouse being a profit-minded organization has converted this increased productivity to increased profit.

In conclusion, an effective standards program provides a means for the best possible on-going utilization of men and machines to effectively solve the problems for which modern computers were designed. ■

Privacy...



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SERVICE BULLETIN

Feb. 11, 1974

Subject: Software and Hardware
Modifications to Support the
Basic Fuel Injection Computer
Models Affected: 1600 TL, 1600 TL 4 II/
VW/Mods 1, 2, and 3

A degree of concern has been expressed by various dealerships with regard to the requirement for a 3000-square-foot air-conditioned addition to house the 360/65 and staff of 20 programming personnel. This engineering notice clarifies the in-car data processing system mission objectives. Some historical perspective may be of assistance in assessing the merits of our current configuration.

The initial in-car computer installation functioned in conjunction with the fuel injection system. It served to improve fuel economy and reduce air pollution by sensing temperature, vacuum and other parameters and computing the injection rate.

Modification One was initiated by our advertising agency to stress the fact that we were the first manufacturer to utilize in-car computers. This modification resulted in the now standard miles per gallon computation and was limited to a 50% size expansion of the basic computer by the utilization of LSI.

Mod Two represented a quantum leap in automotive data processing and all now agree that allocation of the front trunk space to house the liquid cooled 4 II/VW system was a cost/effective trade-off. The feature of automatic credit balance determination including gasoline purchase, restaurant bills and shopping charges was well received by the driving public. The 75% reduction in fuel economy as a function of compressor/power requirements and increased vehicle weight were viewed by the normal customer as an opportunity for reverse snobbery. They had tired of boasting about the high number of miles per gallon their little car attained and the opportunity to comment on the reduction in economy which was directly related to in-car computer size and utilization rate caught on. In retrospect, the drive-through department stores were the pivotal point in Mod Two sales. When the external credit card slot and package slot were incorporated the housewife no longer had to leave her car to make purchases. The heads-up display indicating real-time credit balance was the feature for which we received the annual award from Road and Driver magazine. As you will recall, the diagnostic set for the Mod Two computer required but one service stall.

The Mod Three computer necessitates the previously mentioned 360/65 support facility. Some have questioned the in-car space requirements of the Mod Three, i.e., the allocation of the total rear seat and front passenger seat for core and disc-pack installation. However, the features of Mod Three software far override the space requirements of the processor. These include: automatic route selection; parking space and entertainment ticket reservation; enroute CAI programs in German, and real-time stock quotations. As a consequence our automobile is first in sales in the nation (and German is the national language). Seen in this light, the provision of on-site software modifications to meet the needs of the individual customer/driver is of benefit to every dealership.

Advance Announcement

The Mod Four computer, to be announced in the fall as a feature of the 1975 model, will require the space now occupied by the driver. This is not viewed as a problem for the 1975 model will be able to reach its destination without a driver.

--A. F. KOCHMAN

Does your printout fade out faster than it should?

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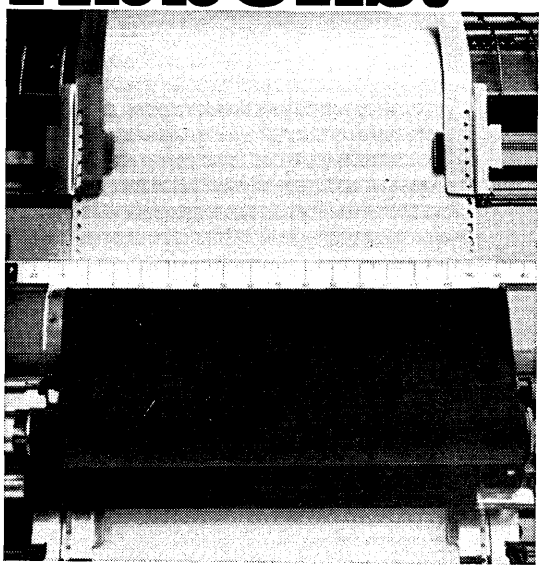

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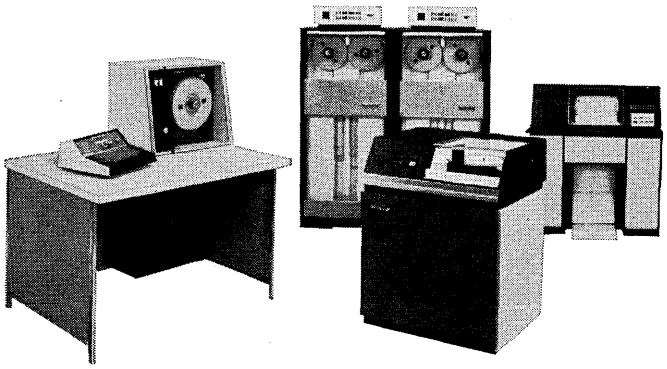

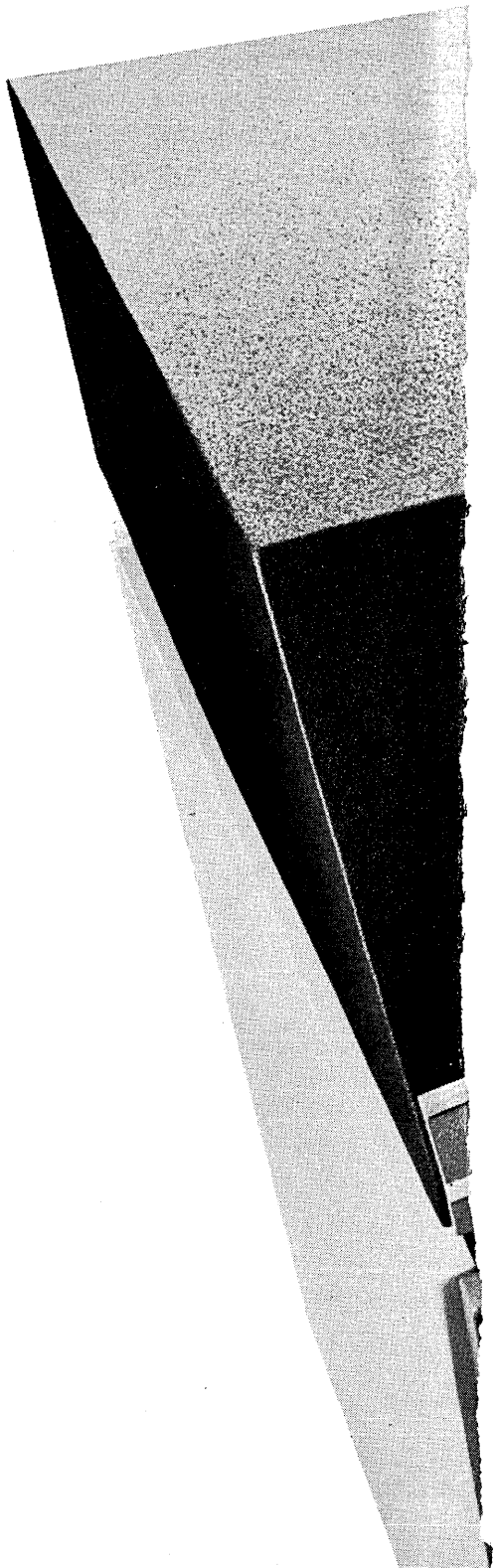

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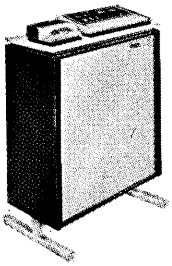


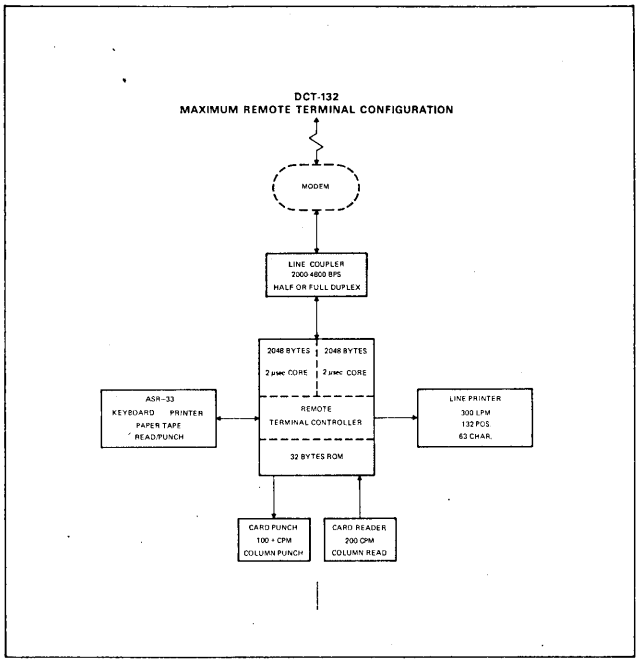
Scientific Control Corporation, long a recognized leader in small scientific computers, now offers a Data Communications Terminal to solve remote batch processing problems. The DCT-132 is capable of interfacing with a dial-up switched network or with a dedicated line, sending and receiving data at 2000 to 4800 bits per second. Because of its internally stored program, it is the most powerful and most flexible remote batch communications terminal available today. The modularity of the DCT-132 allows the user to have high speed printing capability as well as card reading, card punching, paper tape reading, paper tape punching, keyboard input and low speed printer output. The modular design of the DCT-132 allows the peripheral controllers and peripheral devices to be added only when the peripherals are required.

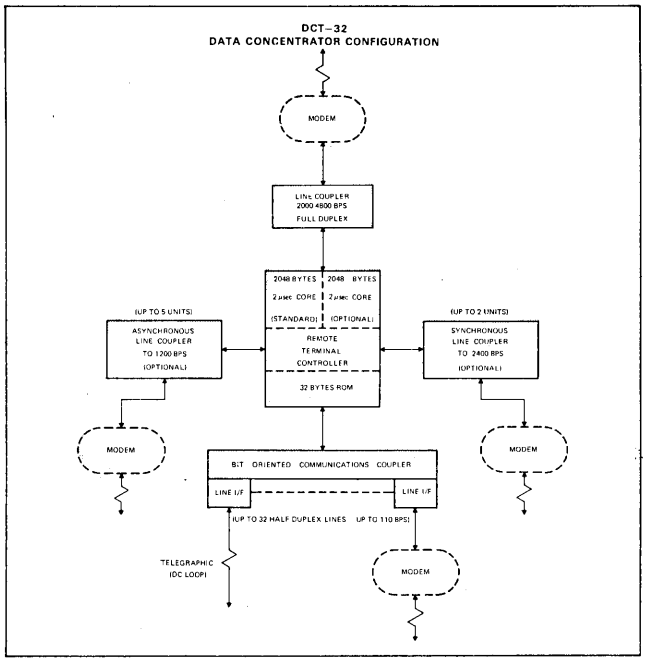
In addition to the powerful on-line capability, the DCT-132 provides unparalleled off-line conversion power. Under control of an internally stored program, the DCT-132 may perform the following off-line functions:

Card Reader to Card Punch
Card Reader to ASR Paper Tape
Card Reader to High Speed Printer
Card Reader to ASR Printer
ASR Paper Tape to ASR Printer
ASR Paper Tape to Card Punch
ASR Keyboard to Card Punch
ASR Keyboard to ASR Paper Tape

When configured as a communication line concentrator, the capability of the DCT-32 is limited only by the quantity and speed of the communication lines connected. Up to 32 low speed (110 bits per second or less) asynchronous communication lines can be concentrated into one 4800 bit per second synchronous communication line. Medium speed (up to 1200 bits per second) asynchronous communication lines as well as high speed (up to 2400 bits per second) synchronous communication lines can also be concentrated to significantly reduce communication line costs in most communication systems.

Although the DCT-132 and DCT-32 are sold with all of the necessary programs for running the applicable peripheral devices, the fact that it is an internally programmed machine allows the user to reprogram to use any data format or any block format he so desires.





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COMPUTING AT STANFORD

for 5000 users

by EDWARD A. FEIGENBAUM and NORMAN R. NIELSEN

The themes of computing are scale, size, speed, growth, dollars, and universality. Stanford University has paid the price and is now harvesting the rewards and problems of leadership in computer science and technology. Its computer science department was one of the first to be accorded full academic departmental status; there are now dozens around the country. The university's computer service activities have grown enormously in recent years in order to serve the burgeoning demands of the Stanford academic, research, and administrative programs.

The Stanford computation center now manages and operates three major computer facilities: a central campus facility, a facility for real-time applications, and a facility for the linear accelerator center. Over 5000 members of the Stanford community—students, faculty, and staff—are active users of these facilities. During the past academic year, 2000 new computer users received instruction from the computer science department, from other departments in the university, and from the computation center. About 1800 students each quarter do some part of their assigned homework on a computer; 1500 student jobs and 1200 research jobs are handled by the central campus computing facility alone on a busy day during the academic year.

In addition to the several large-scale systems necessary to service the academic and research demands for computing, there is an abundance of small computers in university laboratories used for controlling instruments and data flow. Further, a major portion of the university's administrative information processing is handled by computers in the administrative data processing computer facility. The computer, as an instrument for calculation and information processing, has found application in virtually every instructional, research, and administrative activity at the university. Yet the range of application of this tool to the university's life has hardly begun.

The remainder of this article attempts a brief guided tour of the computing and computer science activities at Stanford.

computer science department

The computer science department of the school of humanities and sciences began as a division of the mathematics department in 1962. Under the leadership of Professor George E. Forsythe, past president of the Association for

Dr. Feigenbaum is director of the Stanford computation center and an associate professor in the computer science department. He was co-editor of the book Computers and Thought and has a PhD from the Carnegie Institute of Technology.

Computing Machinery, it was accorded departmental status in January, 1965. The department's faculty now consists of six professors, two associate professors, four assistant professors, and five lecturers. The departments' own students are entirely graduate students, most of them announced PhD aspirants. During 1968-69 there are 98 students of computer science. Of these, 22 are at the stage of candidacy, writing dissertations. Demand for computer science education at the graduate level is very great but, because of the problems of funding growth, new admissions are quite limited. Of the 287 applications for admission, only 30 students were accepted for entrance in the fall of 1968.

In addition to its graduate student focus, the department offers many courses at the undergraduate level. These courses are primarily introductory and rank among the most popular elective courses offered at the university. There seems to be no limit to the demand for these courses, but slow faculty growth limits the number that can be adequately staffed.

The department's graduate students prepare in three of the following five areas, specializing in one for the dissertation: programming systems; hardware; logic; computational mathematics and numerical analysis; and advanced nonnumeric applications, particularly artificial intelligence research.

Faculty research and graduate student research training is focused on various research projects. Funding for computer science research, as might be expected, is derived from a number of sources. By far the largest and most heavily funded project is the artificial intelligence project, whose principal investigator is professor John McCarthy. The research is being conducted on a Digital Equipment Corp. PDP-6, located at the Donald C. Power Laboratory in the foothills of the Stanford campus.

To the observer, one of the project's most interesting activities is the hand-eye program. Using a television camera as an eye, the computer scans the incoming video signals to "recognize" objects in the field of view and then transmits control signals to a mechanical arm in order to appropriately manipulate these objects. Unfortunately this also means that when the computer throws a "tantrum" it is now able to wave its arm and throw things. After surviving a few close calls, the researchers added a protective wall to their equipment list.

A second endeavor lies in the area of chemical hypothesis formulation. The problem of determining the structure of a chemical molecule from its fragmentation pattern in a mass spectrometer is very difficult. There are no completely rigorous rules for doing this, and the evaluation of all possible structures can be prohibitively time consuming, even on the world's fastest computers. Thus, reliance must be placed upon heuristics or "guidelines" in order to attempt to isolate plausible formulations and to discard search paths which are not promising. Already this type of program is of significant assistance to the research chemist. Other work at the project is concerned with the development of programs to assist the computer in recognizing and interpreting human speech directly from audio inputs.

In another laboratory, research on the problems of graphical input and output for computers, and the theory and techniques of picture processing by computer, is carried out by professor W. F. Miller, his students, and the professional staff of the graphics study group. This group is part of the SLAC (Stanford Linear Accelerator Center) computer research group headed by professor Miller, who holds a joint appointment between the computer science department and the linear accelerator center.

Recently the computer science department was the recipient of a gift from the Hewlett-Packard Corp. of one of their small, general-purpose digital computers, the HP-2116A, which is used primarily for specialized "hands-on" applications by computer science students.

Last, but not least, the department makes an important contribution to the vigor and health of the university's computation center, through participation by its faculty and students and, more importantly, by virtue of the stimulating intellectual environment it provides and nurtures. The present and past directors of the computation center are all faculty members of the computer science department.

stanford computation center

Until 1965 the Stanford computation center was synonymous with the central computer facility in Pine Hall. This facility had undergone a major expansion in 1962, under the leadership of professor George Forsythe, acquiring an IBM 7090 for research computing and a Burroughs B-5500 for the heavy student work load. In 1965 the charter of the computation center was expanded to incorporate the management, programming, and operation of other major computer service facilities planned for the medical school, the linear accelerator center, and other locations on campus.

The computer field is characterized by two opposing forces.

First, there are the great economies of scale which provide a centripital force toward centralization. These economies apply not only to the computing machinery itself, but also to the programming of the machines. Talented and highly trained system programmers are an expensive and scarce resource.

Second, there is an opposing centrifugal force toward a proliferation of computers, some small and some large, among the various projects and laboratories at the university. This is due to the funding policies of granting agencies, the desire of some principal investigators for operational independence, the nature of certain applications, and in some cases the limitation of present technology in providing special services at points remote from the central computer location.

The university has attempted to capture the hardware economies of scale by centralizing computer service. However, where the centrifugal tendencies have proved to be irresistible, other economies of scale have been realized

Dr. Nielsen is deputy director of the Stanford computation center and an assistant professor in the graduate school of business. He is the author of several articles in the field of simulation and computer system management and has a PhD in operations and systems analysis from Stanford.

through the mechanism of the centralization of computer management in the computation center. In over three years of operating under the multi-facility charter, the economic and intellectual benefits of the joint central management have proven to be large. To our knowledge, no other university has achieved this high level of integration among its computer facilities.

The campus facility is the name now given to the central computer service facility located in Pine Hall. Associate director Rod Fredrickson heads a programming and operations staff of more than 50 people. To keep up with rapidly rising demand and with new technology, this facility has expanded its computer resources. In May, 1967, it installed an IBM 360/Model 67 computer, and arranged to sell its "last generation" computers. The system has subsequently been upgraded to one million bytes of high speed memory, two 2301 drums, and three 2314 discs with a total storage capacity of more than 600 million bytes.

A 1966 study of IBM's (then proposed) TSS/360 time-sharing system for the 360/67 had indicated that this software would initially be inadequate to serve the campus user community in an appropriate manner. Accordingly the systems staff went into high gear on system development, enabling Stanford to avoid many of the problems suffered by other installations that had intended to use the ill-fated 360/67. As a result of this forewarning, a rather complete remote access computing service was ready to be offered shortly after installation of the hardware. A comprehensive text editor (WYLBUR)[1] permits the user to interact directly and immediately from IBM 2741 typewriter terminals. Not only can he input, edit, and manipulate files, but he can also submit jobs to and retrieve output from the regular batch processing service.

Although turnaround averages less than an hour, a priority system with graded prices enables users to obtain better service if required (or much cheaper computing with poorer service). Recently a "high speed" partition was added using a set of "quickie" compilers (e.g., WATFOR) for jobs requiring minimal I/O capability. This service now provides turnaround in a matter of two or three minutes.

Beginning last September a fully conversational time-sharing service was made available to the user community. Users can now interact with their programs during both compilation and execution. Such interactive service has greatly enhanced the productivity and problem-solving capability of both students and researchers. More than 125 terminals with access to this system are now installed around the Stanford campus in laboratories, classrooms, and offices. Further, there are additional terminals located around the San Francisco Bay Area which provide access to students and faculty members of other schools and colleges.

real-time applications

Another important area of computer application is real-time data acquisition and process control. The computation center offers a variety of such services through its recently re-organized real-time facility. The primary "constituency" for these services is, at present, the medical school, though the service will be made available to all as required. The laboratory of the real-time facility handling medical school needs is called ACME (Advanced Computer for MEdical Research) and is under the direction of associate director Gio Wiederhold.

The ACME project was established in the medical school with the aid of grants from the National Institutes of Health and the Macy Foundation. It is chartered as a research project to explore the frontiers of the application of newly developing computer equipment and techniques to medical science laboratory problems. In this sense, though ACME will be providing a unique data acquisition and control service to medical school laboratories, it is not primarily a service operation but rather a research endeavor. The principal investigator is professor Joshua Lederberg, Nobel Laureate and chairman of the genetics department. The computation center has the responsibility for implementing the computer-related goals of the ACME research.

The ACME programmers and engineers have developed a new and excellent time-shared programming system, new data acquisition techniques, and various devices for monitoring, controlling, and manipulating the flow of data to and from laboratories. The time-sharing system, presently permitting simultaneous interaction by 31 users, operates on an IBM 360/Model 50 computer with two million bytes of slow speed magnetic core memory. The data acquisition and process control functions are handled primarily by an IBM 1800 computer which is linked to the Model 50. Data from many laboratories can be acquired in real time by the 1800 under the control of programs that are simultaneously sharing the Model 50.

The ACME time-shared interactive programming system (called ACME/PL) is based upon a subset of the PL/I language. As can be guessed from the hardware configuration, the system is a core resident one. Because it is a single language system, there is no time-sharing mechanism. Rather, the compiler inserts "releases" back to the system at logically appropriate points in the user's program. Special attention has been devoted to the user interface: the line-at-a-time compilation, the instructive diagnostics, and the large number of helpful system prompts all contribute toward making the system an easy one to use. Even nonprogramming doctors at the hospital have found it very easy to learn to compute on the ACME system. It is interesting to note that the ACME system itself was written in FORTRAN and compiled using the IBM H level optimizer. This enabled a fairly efficient system to be developed in approximately one year by a staff of only eight.

The degree to which time-sharing services require reliable computer service was made very clear last spring. The defective manufacture of one of the memory modules led to increasingly frequent system crashes. User productivity not only went to zero but actually became negative as system crashes resulted in greater amounts of lost personal time, higher levels of frustration, etc. The manufacturer agreed to replace the memory, but that is not the end of the story. Because of the urgency of the situation, the new memory was to be air-freighted to the west coast. Unfortunately, the first replacement was speared by a New York forklift driver, and the second replacement was "dropped" in transit. However, after a complete outage of more than six weeks, a usable memory was fashioned out of the three boxes of "parts."

The experience vividly demonstrated the appalling effects which an unreliable system can have upon the course of research and development work. Even the subsequent repair of the system could not rapidly or adequately erase the damage. The collection and processing of data from medical laboratories is an application in which reliability is of paramount importance. Even in so-called non-critical areas using ordinary time-sharing service (such as that provided by the campus facility), the operational reliability requirement is an order of magnitude greater than that needed for standard batch processing service.

The hybrid computer laboratory in the engineering department is an emerging arm of the real-time facility. This laboratory is acquiring new high speed data acquisition equipment complementary to that in operation at ACME. At the heart of this system is an SDS Sigma 5 computer. In addition to serving as a hybrid computer, this system will

[1] Contrary to popular practice, WYLBUR is not an acronym. We are, however, open to suggestions.

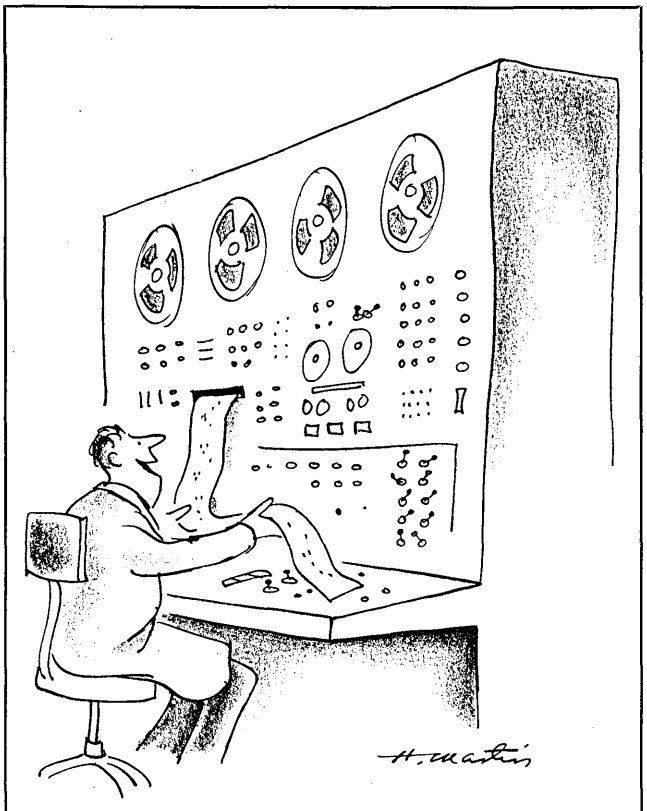
acquire voluminous amounts of data from experimental equipment and prepare this data for subsequent reduction on the large campus computer.

One of the largest applications of computing at Stanford may be found at the recently completed Stanford Linear Accelerator Center (SLAC). Experimental physics done with the aid of the two-mile-long electron accelerator requires a prodigious amount of computation. For example, bubble chamber photographs of particle collisions must be scanned and recorded in a form processable by a computer. Complex procedures involving millions of computer operations are then required to analyze the resultant stream of information.

In order to satisfy these computational requirements, the Atomic Energy Commission has recently installed an IBM 360/Model 91 for use at SLAC. The SLAC facility of the computation center, under the direction of associate director Charles Dickens, is charged with the responsibility for the operation and system programming of this new system.

Despite the fact that the Model 91 was installed only last fall, it has already turned out to be a surprisingly productive machine. The two-million-byte high speed memory has been divided into a number of different partitions, each serving a different category of user. Thus, there appears to be a set of computers serving the accelerator, permitting good service to be provided to each function. Nevertheless, despite the much greater productivity of the Model 91 relative to the Model 75 which it replaced, there is plenty of room for improvement.

Although the staff has been preoccupied to date with working out the bugs in the IBM OS/MVT software for the 360/91, there are plans to mount a remote job entry system (working from 2741 terminals), a text editor, and subsequently a small time-sharing system which will occupy a single partition. This will permit physicists to participate directly in the analysis of their data without having to monopolize valuable memory space.



"Well done, thou good and faithful servant!"

administrative data processing center

Although some of the scientific computer applications are more glamourous, this should not detract from the importance of computation in such other areas as the day-to-day operation of the university. Not only are such things as payroll checks machine prepared, but the bulk of the university's student and financial records are in machine readable form and are processed and updated by computer. Because of the speed and the cost-efficiency of this form of data processing, the university has been moving quite rapidly in the direction of further computerized applications. In 1967, a second IBM 1401 was added to assist with the increasing workload. In less than one year it was replaced by a 360/30, and already this latter system is being used around the clock.

information retrieval

One of the newer areas of development involves the problems of information handling—information storage and retrieval and management information systems. To date the work in these areas has been carried out on the aforementioned service computers, but some thoughts are now beginning to be raised concerning the acquisition of a file management computer for information retrieval and file handling tasks. Although this would be a separate system, it is envisioned that it would be closely integrated with the systems and services provided by the campus facility of the computation center.

Work in the information handling area has been progressing for some months on several fronts. The Stanford Public Information Retrieval System (SPIRES) has already reached the prototype stage and provides capability for storing, modifying, and retrieving information. BALLOTS (Bibliographic Automation of Large Library Operations using a Time-sharing System) is initially harnessing this system for the automation of the acquisition and cataloging procedures of the Stanford libraries. INFO (Information Network For Operations) is concerned with the development of an on-line management information system to assist in the operation of the university. These are but the forerunners of activities forthcoming in this rapidly growing area.

mathematical studies in the social sciences

Of all the computing activities at Stanford, the work of the institute for mathematical studies in the social sciences is probably the most widely publicized. Under the direction of professor Patrick Suppes, great advances have been made in the techniques of computer-aided instruction. Using a Digital Equipment Corp. PDP-1 computer, professor McCarthy's time-sharing project in a pioneering effort developed a very efficient time-sharing system. This has served for a number of years as the base for an on-line drill system to assist local elementary school students in learning such subjects as arithmetic and logic from remote Teletypes. This same system is still in use today, serving students not only in the Palo Alto area, but also in Kentucky, Mississippi, and elsewhere (with the assistance of cross-country telephone lines and the differences in time zones). However, the growth in usage has pushed the PDP-1 to the limit, and it is now being augmented by a PDP-10.

One of the projects of this group used an IBM 1500 instructional system located at the Brentwood Elementary

(continued on page 59)

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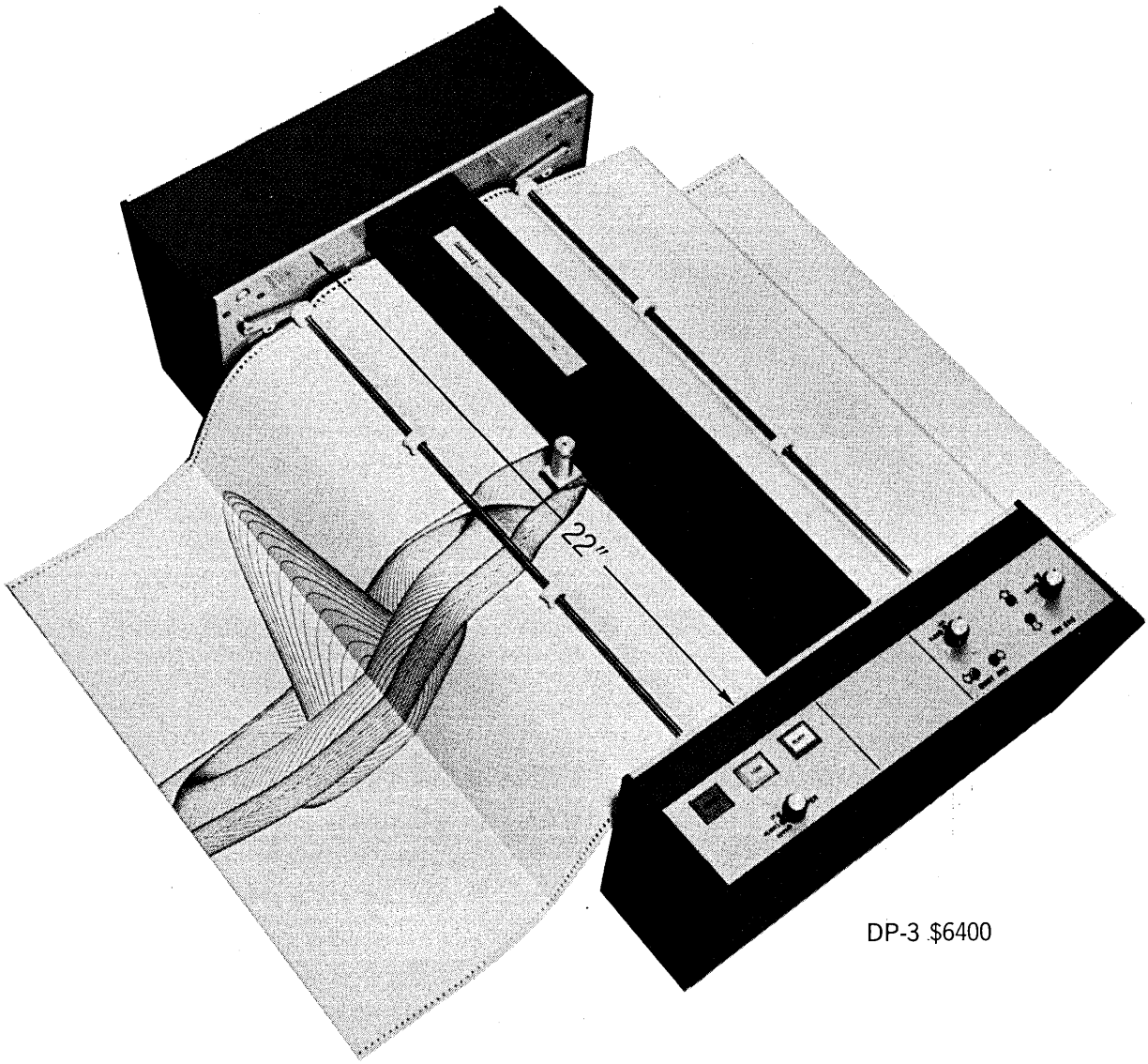

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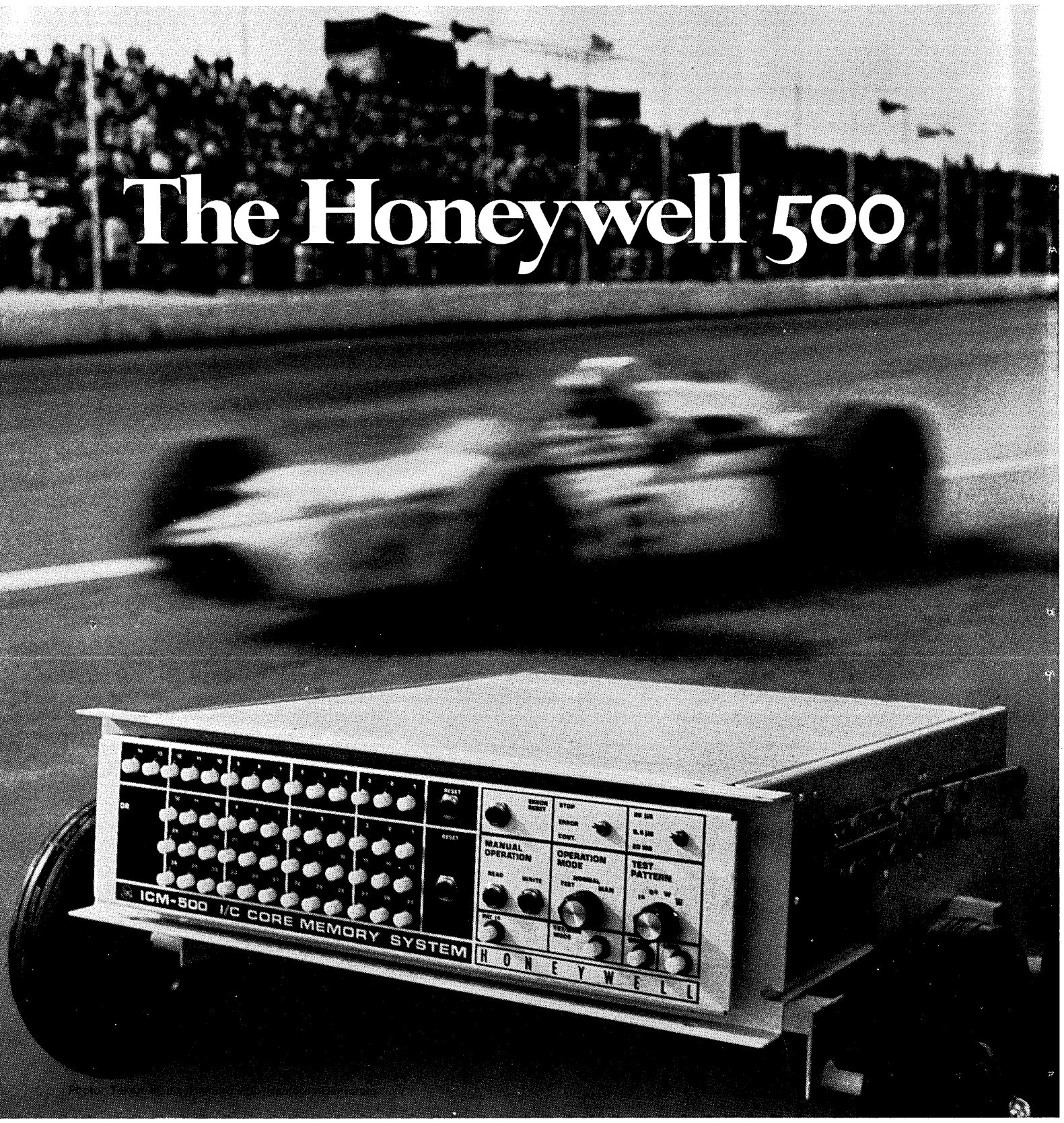

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CIRCLE 28 ON READER CARD

School in East Palo Alto. The computer communicated with up to 16 children at once via both audio and visual means—individual crt displays, colored slides, and earphones. The children, working at their own speed on a variety of lessons, responded via a microphone, a typewriter keyboard, and a light pen. Although the computer tailored the lessons to match the progress of each individual student, this was not its sole function for a wealth of data was also gathered about the progress and responses of the students in an effort to shed additional light upon the learning process itself.

These techniques are also being applied at the university level. There is currently a first year Russian language course being offered at Stanford which has no instructor other than a computer program and six computer terminals that have been augmented for audio output. Some 30 students are now taking the course for credit, spending 50 minutes per day, five days per week, working at a computer console rather than sitting in a classroom.

regional computing network

In recent months there has been a great deal of discussion concerning the merits of computing networks or large centralized regional computing facilities. In order to evaluate the need for and the requirements of such a service, an experimental network, supported in large measure by the National Science Foundation, was set up in the Bay Area. This network is now serving one private university, one private college, two state colleges, and one public high school. The full range of batch and conversational services is made available to these schools via IBM 2741 terminals connected to the campus facility of the Stanford computation center.

The network is playing several roles. On some campuses it represents the only computing power available; on other campuses it supplements a local computer center. The users themselves present a wide variety of ages, interests, and backgrounds. Despite the fact that the network was only set up late last summer, it was used in more than 35 courses given by the participating schools during the fall term. Network services were also employed for curriculum development and faculty research. It is anticipated that the experience gained both in the operation and in the use of the network will provide some valuable insights into the worth of developing and expanding such remote computing services in the future.

instrumentation computers

In addition to the large computer facilities described on the preceding pages, there are a host of small computers which are dedicated to specific applications. For example, an SDS 925 is used at SLAC to control the electron beam as it is switched back and forth between the various target areas. Another small system, employing an SDS 930, is used to guide the antenna disc for the radio telescope installation which can be seen atop the hills behind the campus. A host of PDP-8's are employed in various research laboratories. Despite their diminutive size, these instrumentation and control computers play a very important role in many of the research projects being conducted at Stanford.

paying for computers

Having illustrated the variety of work being performed on computers at Stanford, it is appropriate to consider how all of these systems can be supported. Although unit costs of computing are falling as larger and faster machines are constructed, these high performance systems are becoming more and more costly in absolute terms. Further, the expanding computer requirements for academic, administrative, and research purposes alike put a severe strain on university budgets. In many areas, such as the computer science department, a shortage of funds has been holding back further growth and new developments.

In a few cases funding has not posed a serious problem since the original project grants provided sufficient funds to purchase a large modern computer. Thus, the Atomic Energy Commission provided the 360/91 for SLAC, and the Advanced Research Projects Agency of the Department of Defense provided the PDP-6 for the artificial intelligence project. However, most projects are not of sufficient size to be able to afford or use a large system effectively. Yet, both students and researchers would like to take advantage of the economies of scale and advanced features offered by these computing systems. The solution to this dilemma is the creation of a "user-supported" facility such as the campus facility of the computation center. Individual projects purchase the small amounts of service they need on the large computer according to a rate schedule. Because of the large number of such users, these recharges are sufficient to cover the cost of acquiring and operating the system.

From the user's point of view this is a very satisfactory solution to the problem. However, from a management point of view, it causes no end of difficulty. First, sufficient computation capacity must be provided so that computing needs can be satisfied without delay as they arise. On the other hand, if too much capacity is installed or if usage does not develop as expected, the operation must either suffer a loss or raise its rates (perhaps thereby further reducing usage). Thus, million-dollar commitments must be made for new equipment without specific knowledge of where that money will come from, relying solely upon forecasts that at the proper time there will be sufficient usage by the myriad of research projects to support the system. To the extent that the university's contribution in support of instructional computer use and unsponsored research use is budgeted in advance, this "guarantee" adds stability to the financial picture. However, since approximately 70% of the computing at the campus facility is by small, separately funded research projects, the financial risk can still be substantial.

As an example of the risks involved, consider the recent cutbacks on research projects funded by the federal government. The impact upon computing of a reduction in a project's budget goes far beyond the magnitude of that reduction, since such cuts strike computing in a nonlinear fashion. That is, project leaders try first to fulfill personal obligations such as the continued employment of present staff members. As a result an even greater reduction must be spread over the remaining budget categories, including computing.

the future

The tremendous growth of computing at the university during the last few years marks only the beginning. Not only are present applications growing and expanding, but new areas are appearing. Such fields as history, linguistics, and music are now beginning to explore these possibilities. New services and capabilities such as time-sharing are opening up fields for students and faculty alike. Because of the rapid growth and development of computing at Stanford and because of the diversity of computing requirements, the provost has created a new position, the associate provost for computing, to co-ordinate all the computing activities of the university. Professor W. F. Miller was recently appointed to this post and is already endeavoring to see that computing plans and requirements are developed in a unified and economical manner so that the university's computing needs will continue to be satisfied adequately and efficiently. ■

DATA TRANSMISSION AND THE FOREIGN ATTACHMENTS RULE

by PHILIP M. WALKER, STUART L. MATHISON and MALCOLM M. JONES

The attachment of customer-provided devices to the public telephone network has long been forbidden by the telephone companies, and a customer who used such a "foreign attachment" risked having his exchange telephone service terminated.[1] This foreign attachments prohibition, always the subject of disagreement between the common carriers and their customers, has recently become the focus of attention in two proceedings before the Federal Communications Commission.[2]

The first proceeding, the FCC's inquiry into the interdependence of computers and communications, addresses several questions, one of which is "foreign attachments." Interested parties were invited to file comments on this and a number of other issues by March 5, 1968. In the more than 60 filings the foreign attachments restriction was commented upon by a larger number of respondents than any other issue and revealed the sharpest dichotomy of opinion between the communications common carriers and all other respondents—communications users, computer equipment manufacturers, data processing service firms, and several government agencies, including the Antitrust Division of the U.S. Department of Justice. The results of the FCC inquiry are still pending; Stanford Research Institute was engaged by the FCC to evaluate the responses and submit a report by the end of December 1968. However, the foreign attachments question *may* have been resolved in the second FCC proceeding—the Carterfone case, in which the commission recently issued its decision.[3]

In the Carterfone decision, the FCC found the blanket foreign attachments prohibition to be illegal, and ordered the carriers to permit the attachment of harmless customer-supplied equipment. This decision is likely to have two significant effects upon the data communications user: (1) the costs of data communications interface equipment (modems or data sets) will be reduced, and (2) higher performance and special purpose interface equipment will become available. Both of these benefits will result from the natural competitive forces as new suppliers of modems enter the market. Before further discussion of the advantages that will accrue to the user if this prohibition is relaxed, let us review the history and recent modifications of the rule.

The common carriers have traditionally emphasized that they provide a communications "service" as opposed to simply communication channels; that they are responsible for providing end-to-end communications capability and, therefore, in order to maintain the quality and reliability of the *service*, they must have end-to-end control of the facilities. If a subscriber were to provide a portion (albeit small) of the communications equipment, the carriers would no longer be able to control the entire communications network for which they are responsible. Therefore, the carriers have prohibited subscribers from attaching non-carrier devices or interconnecting private communications systems directly to the public switched telephone network. (The foreign attachments prohibition does not apply to private communication lines leased from the carriers.)

Restrictions prohibiting the use of foreign attachments have long occurred in both the interstate and intrastate carrier tariffs.[4] The following example of the foreign attachment prohibition—in effect until replaced by AT&T's recently announced tariff liberalizations—is cited from the AT&T tariff for long distance telephone service:

"No equipment, apparatus, circuit or device not furnished by the Telephone Company shall be attached to or connected with the facilities furnished by the Telephone Company, whether physically, by induction or otherwise, except as provided in 2.6.2 through 2.6.12 following. In case any such unauthorized attachment or connection is made, the Telephone Company shall have the right to remove or disconnect the same; or to suspend the service during the continuance of said attachment or connection; or to terminate the service."[5]

The effect of this provision has been to prohibit the use of customer provided voice telephone equipment entirely, and —much more important to the data communications com-

[1] This article is based upon a chapter from S. L. Mathison and P. M. Walker, *Computers and Telecommunications: Issues in Public Policy*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (in press). For additional information see M. R. Irwin, "The Computer Utility," *Datamation*, November 1966, pp. 22-27.

[2] Foreign attachments have also been prohibited on the TWX and Telex exchange teletypewriter networks provided by AT&T and Western Union, respectively.

[3] See P. Hirsch and A. Pantages, "FCC Carterphone Decision Unsettles Carriers, Encourages Modem Makers," *Datamation*, August 1968, pp. 86-87.

[4] The provisions of the Communications Act of 1934 require that communications common carriers file tariff schedules, which must be non-discriminatory, with the FCC showing all charges, practices, classifications, and regulations for interstate communication services offered to the public. Similarly, tariff schedules for intrastate services are filed with the state regulatory commissions. A tariff, when filed, automatically becomes effective unless suspended or explicitly disapproved by the commission.

[5] AT&T Tariff FCC No. 263, Para. 2.6.1.

Mr. Walker is an operations research analyst in the Office of the Secretary of Defense. He has been a consultant to the Antitrust Division of the Department of Justice and to the President's Task Force on Communications Policy. He has a BS from Yale and an MS from the Sloan School of Management, MIT.

munity—to require that the customer who would use his business machine (computer or terminal) for data transmission on the switched network do so only through the use of a carrier-supplied interface device for modulation/demodulation called a modem or data set. The modem converts the electrical impulses originating from a business machine into a series of audible tones suitable for transmission over the analog telephone channel (modulation), and it performs the inverse funcion (demodulation) for data received from the channel. AT&T has required that only its modems, called DATA-PHONES, be used on the public exchange network. For data transmission the AT&T tariff has specified:

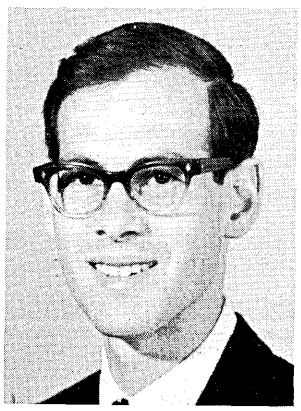
"Long distance message telephone service is available for use on a two-point service basis with data transmitting and receiving equipment (includes teletypewriter equipment) and teletypewriter equipment for the transmission and reception of data signals.

"Data transmitting and receiving equipment will be provided by the customer. Teletypewriter equipment may be provided by the customer or the Telephone Company, at the option of the customer.

"The data transmitting and receiving equipment and teletypewriter equipment shall be connected to the facilities of the Telephone Company through a DATA-PHONE data set provided by the Telephone Company."[6]

the hush-a-phone case

Prior to the recent FCC Carterfone ruling, the legality of the blanket foreign attachment restriction quoted above was examined by the U.S. Court of Appeals, in *Hush-A-Phone Corporation v. United States* (1956). In that case, the court held that a prior version of the present AT&T interstate long distance tariff was illegal under the Communications Act of 1934. The foreign attachment in question in the Hush-A-Phone case was a rubber cuplike device to be attached to the microphone portion of the telephone handset to provide privacy in conversation. The court held specifically that the existing tariffs ". . . are an unwarranted interference with the telephone subscriber's right to use his telephone in ways which are privately beneficial without being publicly detrimental." This conclusion resulted from the fact that the general prohibitions of the tariffs are more restrictive than necessary to insure the preservation of the quality of telephone service, which could be achieved by tariffs containing *minimum technical specifications* for equipment to be attached to the telephone network. AT&T was ordered to revise its tariff to permit use of the Hush-A-Phone device. This was done, but the general foreign attachment prohibition remained in effect. Shortly thereafter the Carterfone episode began.



Mr. Mathison is a member of the information systems group at Arthur D. Little, Inc. He has been a consultant to the Antitrust Division of the Department of Justice and to the President's Task Force on Communications Policy. He has a BS from Cornell and MS from the Sloan School of Management, MIT.

[6] *Ibid.*, Para. 2.6.4.

the carterfone case

The Carter Electronics Corp. of Dallas, Texas, developed and sold an acoustic/inductive coupling device for interconnection of the base station of a mobile radio system (or other private communications system) with the dial telephone network. From 1959 through 1966, approximately 3500 Carterfones were sold in the United States and overseas. Customer reaction was favorable in spite of considerable pressure to discontinue use of the Carterfone exerted upon Carter's actual and potential customers by the Bell System and General Telephone System. The telephone companies warned that use of the Carterfone violated the tariffs and that customers who persisted in using the Carterfone would have their telephone service disconnected. In 1966, Carter brought an antitrust suit against the Bell System and General Telephone Company of the Southwest, which was referred by the U.S. District Court in Texas to the FCC because of the commission's primary jurisdiction in communications matters.

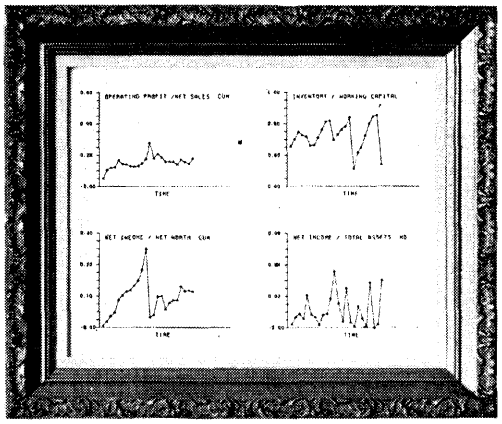
In testimony before the FCC, AT&T and GT&E opposed use of the Carterfone on the grounds that it violated both the "foreign attachment" and "interconnection" tariff provisions for message toll telephone service. Several technical arguments were given to support the position that "telephone system integrity" necessitated the use of only carrier-supplied attachments, whether acoustically coupled or directly wired to the telephone network. Overruling these objections, an FCC hearing examiner, in August 1967, approved the Carterfone for use on the dial-telephone network, and ordered the carriers to modify their tariffs to specifically allow its use. Upon appeal, the full commission, in a unanimous opinion issued on June 26, 1968, upheld this decision and broadened it to include all harmless customer-provided attachments, finding that the tariff provisions prohibiting foreign attachments "are, and have since their inception been, unreasonable, unlawful, and unreasonably discriminatory under the Communications Act of 1934." The commission stated further:

". . . Our conclusion here is that a customer desiring to use an interconnecting device to improve the utility to him of both the telephone system and a private radio system should be able to do so, so long as the interconnection does not adversely affect the telephone company's operations or the telephone system's utility for others. A tariff which prevents this is unreasonable; it is also unduly discriminatory where, as here, the telephone company's own interconnecting equipment is approved for use. The vice of the present tariff . . . is that it prohibits the use of harmless, as well as harmful devices . . . In view of the unlawfulness of the tariff, there would be no point in declaring it invalid as applied to the Carterfone and permitting it to continue in operation as to other interconnection devices. This would also put a clearly improper burden upon the manufacturers and users of other devices. The appropriate remedy is to strike the tariff and permit the carriers, if they so desire, to propose new tariffs which will protect the telephone system against harmful devices, and they may specify technical standards if they wish."[7]

The Bell System, General Telephone System, and U. S. Independent Telephone Association initially responded to the FCC's ruling by filing petitions for reconsideration of the decision. Calling the telephone network "an intricate and delicately balanced mechanism," AT&T claimed that "the cumulative effect, especially over an extended period of time, of the proliferation of [customer-provided] devices, each of which in and of itself might be found to be 'harmless,' can be very injurious to the performance of the network." Moreover, AT&T stated, "a particular device de-

[7] FCC, "Memorandum Opinion and Order," *Carter Electronics Corporation v. AT&T, et al.*, FCC Docket Nos. 16942 and 17073, June 26, 1968, p.p. 7, 9.

Teach your computer to draw



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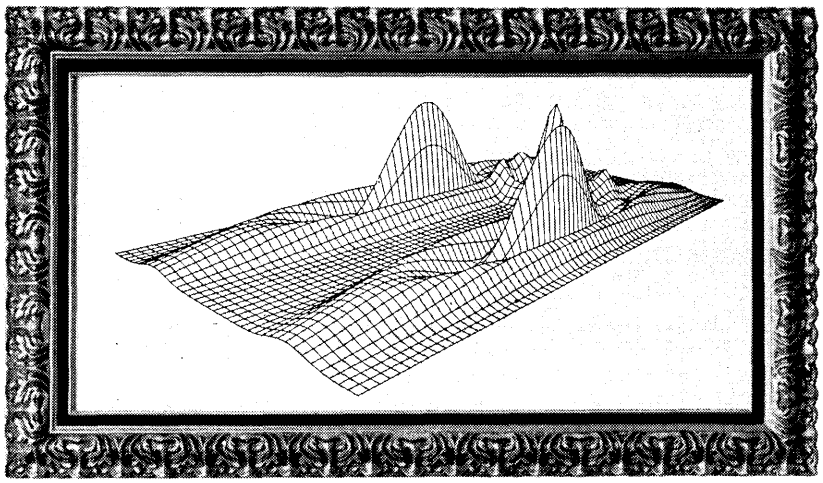
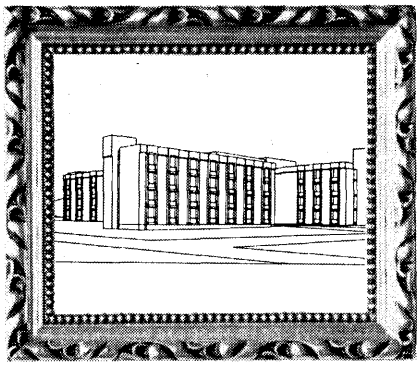
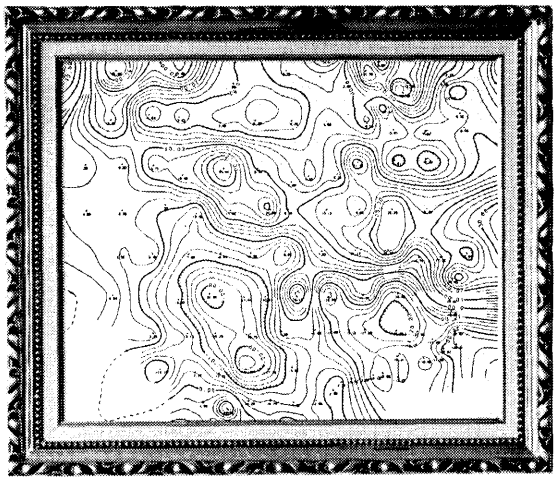


PERSPECTIVE DRAWINGS



ARCHITECTURAL DRAWINGS



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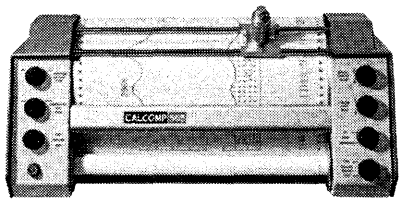

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signed and manufactured to be 'harmless' can become 'harmful' because of the way in which it is used or because it is not properly maintained. . ."

In September 1968 the commission announced its decision not to reconsider its original order, forcing the carriers to go to the courts if they wished to object further. Shortly thereafter, both the Bell and General Systems appealed the decision to the U.S. Court of Appeals for the Second Circuit, in New York City. The chairman of AT&T had previously stated that an appeal would be taken with respect to the FCC's finding of past unlawfulness of the tariff (which, if unchanged, would permit Carter Electronics to collect triple damages in its pending antitrust suit against AT&T), but not with respect to the FCC's order that the tariff restrictions be liberalized. After the FCC's refusal to reconsider its decision, AT&T filed with the FCC revised interstate long distance and WATTS tariffs, which specifically permitted use of customer-provided equipment heretofore barred. As of this writing, these will become effective on Jan. 1, 1969.

tariff revisions

The revised AT&T tariffs permit the attachment of customer-provided data modems and voice telephone equipment to the switched telephone network with, essentially, three restrictions: First, the tariffs require that such attached devices limit maximum total power output and maximum energy distribution through the audio spectrum (including certain frequency limitations to avoid interference with the proper operation of the telephone companies' automatic switching equipment). Secondly, data or voice equipment may be attached by direct electrical connection only through an appropriate "protective connecting arrangement" supplied at nominal cost by the telephone company (discussed in more detail below). Subject to the limitations on signal output described above, acoustic or inductive coupling of customer equipment would be permitted without a "connecting arrangement." Thirdly, the tariffs require that all "network control signaling" functions, i.e., the hook switch and conventional rotary or Touch-Tone dialing, be performed by an AT&T-furnished unit.

AT&T also modified its tariff provisions relating to interconnection of private communication systems. These changes, along with the foreign attachment rule changes, at the time of this writing were scheduled to go into effect on Jan. 1, 1969. Permission to interconnect with the public telephone network will be extended to include all classes of private communication networks. However, the required use of telephone company-provided protective interface devices and network control signaling (dialing) units—established for the attachment of customer-owned equipment—will cover interconnected private systems as well. While the connection of private communication systems to the public telephone network will be a significant departure from the modus operandi of the past, its impact will be drastically reduced by the seemingly innocuous requirement that carrier-supplied system protection and signaling devices be used.

A number of interested parties, however, filed protests with the FCC, charging that the tariff revisions only partially complied with the commission's Carterfone decision. Criticisms were directed to all of the restrictive provisions outlined above, by more than 35 organizations—including the Department of Justice, the Department of Defense, Business Equipment Manufacturers Association (BEMA), Electronic Industries Association (EIA), Collins Radio Co., International Telephone and Telegraph Corp., Bethlehem Steel Corp., E. I. Dupont de Nemours and Co., Inc., Ford Motor Co., Monsanto Co., Northrop Corp., Olin Mathieson Chemical Corp., Republic Steel Corp., Union Carbide Corp., United States Steel Corp., and Westinghouse Electric Co. In light of this organized opposition, the FCC may hold further hearings on specific restrictive provisions of the new tariff—such as the provision that the telephone company perform all network control signaling.

A full discussion of the impact of the revised interconnection rules is beyond the scope of this article. Let us now consider, first, several factors which have conditioned the relaxation of the foreign attachments rule; and, secondly, the significance of that relaxation for the data communications user.

The carriers have given three specific reasons for the necessity of the foreign attachments prohibition. First, the prohibition is necessary to preserve the "system integrity" of the national communications network; to avoid impairment of the communications service of other subscribers using the public network, and to protect the safety of customers and telephone company personnel. Secondly, in order to avoid "divided responsibility" for the proper operation and maintenance of the national communication network, it is necessary for the carrier to retain control over all equipment attached to the public network. Thirdly, the use of customer supplied attachments could "hamper" carrier innovation—it could reduce the telephone company's freedom to introduce modifications into the national network.

system integrity

There are basically two ways in which a user's attached equipment could affect the "integrity" of the telephone system. First, excessive signal levels from a user's attached equipment can cause "crosstalk," which interferes with the telephone service to other subscribers. Secondly, a user's improperly functioning attachment may interfere with the carrier's automatic switching, signaling and charging equipment.

Crosstalk occurs when signals from one communication channel are inadvertently introduced into a parallel channel. For transmission over distances greater than 10 or 20 miles, channels are "stacked" together onto a composite higher frequency carrier signal; although the individual voice channels are often thought of as separate "pipes," the carriers prefer to think of the subchannels as "troughs," such that if the signal level of a particular subchannel is too high, it will "wash over" into an adjacent "trough" and degrade the quality of another subscriber's connection. This phenomenon is called intermodulation distortion. Interference can also occur in local transmission, by electrical induction between parallel wire pairs. The background voices

Dr. Jones is assistant director of Project MAC at MIT and assistant professor of management in the information systems group at the Sloan School of Management. He has an SB in mechanical engineering and economics, an SM in economics, and a PhD in computer science from MIT.

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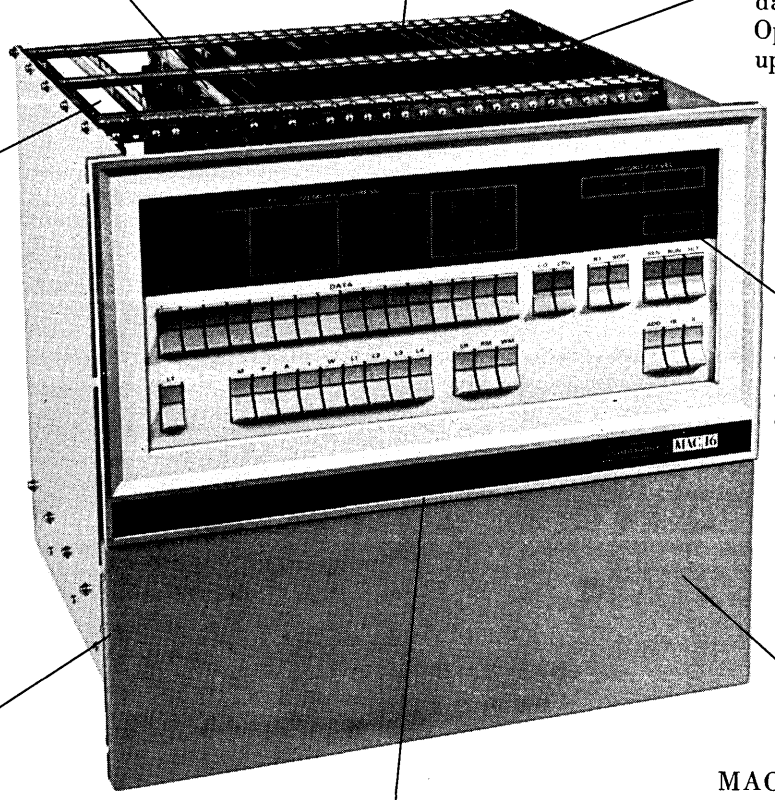

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that are sometimes heard during telephone conversations are examples of crosstalk. The telephone companies argue that improperly designed or poorly maintained devices attached to the communication network may produce excessive signal levels and cause crosstalk.

The revised AT&T tariffs minimize this danger by specifying the maximum signal output levels of customer-provided equipment, and by requiring that such equipment be attached via the "protective connecting arrangement" mentioned above, supplied by the telephone company. AT&T uses a protective connecting device for this purpose—installed on the subscriber's premises, at nominal monthly cost.[8] This device (1) limits in-band signal power or voltage, and eliminates out-of-band signals through use of a band-pass filter, and (2) provides low-frequency and direct current isolation between customer-provided equipment and the line. The first of these functions minimizes crosstalk, noise or distortion in shared transmission elements of the network, which could interfere with other users; the second prevents interference with network signaling, or harm to people or equipment, due to possible improper voltages.[9]

The second way in which user-provided equipment might adversely affect the communication system is by interfering with the automatic switching, signaling and charging equipment associated with dial telephone service. Faulty or fraudulently designed devices attached to the public switched network could result in (1) frequent dialing of wrong numbers, (2) inadvertent disconnection of subscribers using this equipment, (3) tying up of expensive shared central exchange equipment (e.g., switching registers), and (4) defeating the automatic billing equipment used for toll calls.

AT&T has reacted to this danger by exempting "network control signaling"—i.e., dialing—apparatus from the relaxation of the foreign attachments rule. The new tariff provides that the subscriber must continue to use a network control signaling unit rented from the telephone company. This rotary dial or Touch-Tone keyboard unit would be installed on or near the customer-provided modem and data terminal equipment, or voice telephone equipment. For the data user, this could result in a certain degree of inconvenience and added cost relative to the forbidden alternative of a dialing unit incorporated into the terminal/modem itself. With this restriction the user could not employ his own tone-generation keyboard for both dialing and transmitting data. In addition, the use of customer-provided voice telephone equipment is for all practical purposes excluded, except for special-purpose applications, because of the diseconomy and physical inconvenience associated with the requirement that today's telephone, if provided by the customer, be "split" into two parts—the dialing apparatus controlled by the telephone company, and the voice transmission equipment supplied by the subscriber.

The carriers have a legitimate fear of switching, signaling and charging difficulties if unrestricted attachment of customer-provided equipment were permitted, particularly in light of consumer tendencies to compromise in the quality of their equipment purchases and their maintenance procedures. On the other hand, AT&T's approach to the problem—prohibiting customer-provided "network control signaling" equipment altogether—imposes added cost and inconvenience upon the user. As noted by most of the respondents in the current FCC Computer Inquiry, and the FCC itself in its recent Carterfone decision, properly set and enforced equipment standards could minimize most of these potential problems. There has been little evidence to show that customer-provided equipment would, with any significant frequency, cause the above-mentioned difficulties. AT&T has informally admitted that all of the dangers described above could be "defended against" by the replacement or addition of certain central office equipment—however, they also claim that the cost of such measures would probably outweigh the possible benefits to the subscriber. Unfortunately, no cost data is available to substantiate this claim.

Some of the possible switching, signaling and charging difficulties associated with the use of customer-provided equipment are the result of the present use of certain central exchange signaling conventions employing "in-band" tone signals. These are audible tones which are transmitted on the subscriber's telephone circuit between central offices to indicate the initiation and termination of a call and billing period. These signaling conventions were designed under the assumption that non-carrier attachments to the network would not be allowed. The widespread use of customer-provided attached equipment could make it advantageous for the telephone companies to convert to the use of invulnerable "out-of-band" signaling conventions. Such new techniques are being phased into the telephone network at present, and the new AT&T Electronic Switching Systems are designed to be impregnable to the difficulties described above.

The second argument in support of the foreign attachment rule is that a relaxation of the rule would result in "divided responsibility" for the operation of the national communication system. That is, the carrier would no longer control all the equipment used in the customer's end-to-end communications path; equipment manufactured and maintained by another organization would perform the communications interface and network control signaling functions at the end of the line. However, some customers regard the carrier as having total responsibility for the end-to-end communication line, including attached devices—with the result that the carrier may be blamed for any difficulties, from whatever source. This could have two undesirable effects upon the carrier: a poor public image, and the cost which is incurred when the customer calls carrier maintenance personnel for a difficulty which turns out to be caused by a non-carrier attachment. The practical problem of costs incurred in "false alarm" service calls can, however, be solved fairly easily. For example, the intrastate tariff filed by the Bell Telephone Co. of Pennsylvania includes a $10 charge should a telephone repairman called to a customer's premises discover the trouble to be in customer-owned equipment rather than telephone company facilities.[9]

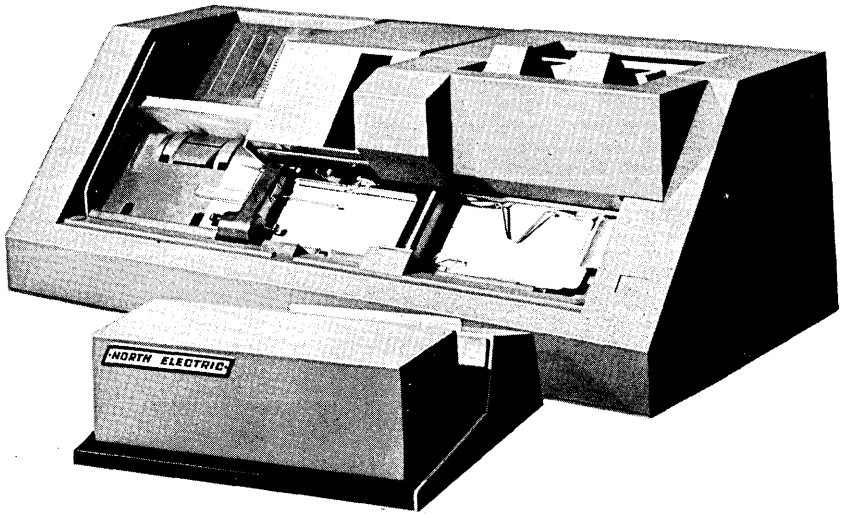
carrier freedom to innovate

The third argument which has been used in support of the foreign attachments prohibition is that it is necessary to protect the carrier's freedom to innovate and to introduce improvements into the network. Customer-provided network interface equipment (for modulation and/or dialing functions) might be adversely affected by a carrier-initiated change in the network, and modification or replacement of the customer equipment might be required. Customers

[8] The FCC's Carterfone decision suggested that technical standards would be required for attached devices. AT&T chose to require the use of a protective device, in lieu of specifying comprehensive equipment standards and attempting to enforce these standards. Several equipment manufacturers and others protested this move, claiming that a more satisfactory approach could be worked out, including the development of more comprehensive standards. (See Telecommunications Reports, Oct. 21, 1968, pp. 1-5, 16-22.) At the time of this writing the issue remains unresolved.

[9] *Statement of American Telephone and Telegraph Company with Respect to Network Control Signaling*, (submitted to the FCC, November 15, 1968), p. 22.

[9] *Telecommunications Reports*, Sept. 3, 1968, p. 4.



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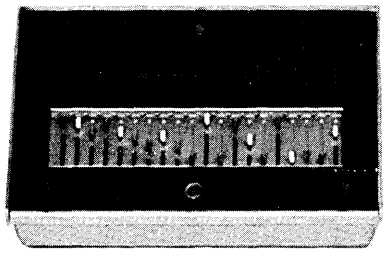

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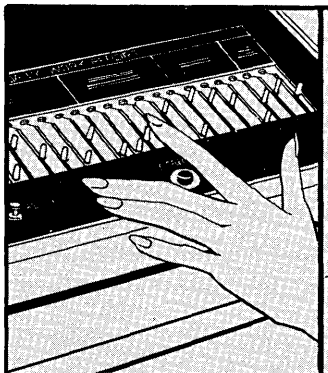

The keyboard of the system permits an unskilled operator to encode a message and scan it visually for accuracy, before transmitting.

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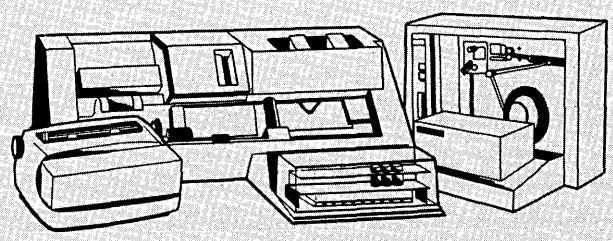

The Message-ComposeR System, can compose and transmit messages to any point of conversion, automatically operating a North solenoid pack to produce punch cards, key tapes or typewritten copy – all three if required.

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would oppose such network modifications.

On the other hand, very few of the equipment changes and upgrades which the carrier makes to the network are likely to have this effect upon customer equipment. Such changes would also obsolete much of the carrier's own equipment which was designed, similar to the customers' attachments, to be compatible with the prior system. Also, change comes very slowly to the telephone network—more slowly than the technology of the devices attached to the network—because of (1) the huge capital investments required for major conversions, (2) the carrier's necessity to maintain compatibility with existing equipment, and (3) the absence of a competitive spur in the telephone industry. The telephone subscriber may, in most cases, use his attached equipment for many years, probably to the limit of its economic lifetime, without difficulties caused by network change affecting him. Finally, network changes are introduced gradually in one geographic area at a time, so that customers can be warned years in advance of forthcoming changes. The customer may then make equipment purchase decisions accordingly, and/or plan for the modification of existing equipment.

impact of the revised rule

The impact of the relaxed foreign attachment rule upon the data communications user falls primarily upon the modem, which, until the recent tariff revisions, had to be obtained from the communications common carriers if used on the switched communication network.

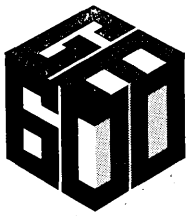
Modems are produced by manufacturing subsidiaries of the communications common carriers—principally, Western Electric—by computer manufacturers, and by a number of independent electronics manufacturers; previously the non-carrier firms could sell modems only for use on private, leased lines. Many varieties of modems exist, differing in transmission speed, modulation method, mode of transmission (serial or parallel), automatic or manual line equalization capability, error rate, design lifetime and price. Although Western Electric supplies a number of these different types, it tends to restrict itself to those modems for which there is a large and assured market, and Bell generally prices these modems, which it will only lease, at levels substantially higher than units with similar performance characteristics offered by the non-carrier suppliers.[10]

The cost of the modulation/demodulation function often may be reduced by incorporation of the modem circuitry into the terminal or computer with which it is used, rather than forcing its separate implementation. For example, modems are incorporated as an integral part of the Teletype terminals leased by the carriers to their customers. Since the relaxed foreign attachment provisions permit the use of customer-provided modems, independent manufacturers may integrate modem and terminal or computer equipment into a single unit, thereby eliminating redundant circuitry (e.g., by sharing logical components, power supply, and clocks), permitting reduced packaging size and cost, and improving the appearance and physical layout of computer centers—especially multiple-line installations, such as remote accessed computer centers, which typically have several racks filled with modems.

The availability of "special purpose" modems for use on the switched telephone network was also promoted by the relaxation of the foreign attachment rule. Western Electric data sets have generally been designed for "typical" applications and mass markets; submarkets have usually been

[10] See P. Hirsch, "The Carterphone Case Again—It may be too Early to Rejoice," *Datamation*, October 1968, p. 72.

But it has other things on its mind.



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ignored. The relaxation of the rule allows independent modem manufacturers to respond to market requirements for modems of varying and unusual transmission speeds, error rates, reliability, and costs.

The carriers' application of advances in modem design has suffered not from lack of technical expertise but from lack of incentive to innovate, as the foreign attachment rule on the dial network gave the telephone company a protected monopoly market for modems. Further, application of laboratory developments may have been retarded by the fact that modem design improvements which effectively increase line capacity tend to reduce the customer's required line holding time (and therefore reduce the carrier's revenues) for a given volume of communications—a fact which, under the present telephone pricing structure, is contrary to the carrier's interests. In addition, telephone company policy is to design equipment for long lifetimes and to avoid the use of accelerated depreciation methods (which would encourage more rapid equipment replacement). Digital technology is changing at such a rapid rate that the expected technological lifetime of a new modem is only a few years. Therefore, it is uneconomic to design it for a longer physical life—both because of the added manufacturing expense and because in a monopoly market it may tend to retard the introduction of future design improvements.

The relaxation of the foreign attachment rule, allowing unrestricted equipment procurement by users, will stimulate the carriers and the computer industry alike to adjust equipment design lifetimes and depreciation policies to more closely correspond to the technological obsolescence rate—thus promoting innovation and efficiency.

Under the revised tariff it is still impossible to employ a customer-owned tone-generation keyboard, functionally similar to a Touch-Tone keyboard but with additional keys as determined by the specific application—requiring no modem and therefore possibly very inexpensive—for both dialing and transmitting data once the connection is established. The conventional keyboard terminal generates a unique digital bit pattern for each depression of a key, which is converted by the modem into an audio signal for transmission over the telephone network. An alternative approach is to generate audio tones directly with each key depression, as is done by the Touch-Tone telephone. This method, which does not require the use of a modem at the transmitting end, is an economical alternative for the design of low-cost or special purpose terminal devices. A terminal designed for use with the switched network could employ the numeric keys on a tone-generation keyboard for the dual purposes of dialing and data entry. However, the original foreign attachments rule prohibited *all* such direct attachments to the dial network, and the revised tariff prohibits customer-provided "network control" equipment—i.e., dialing equipment—on the switched network.

A low-cost tone generation terminal, perhaps in conjunction with audio answerback for output information, might for example serve as the basis for a household terminal. Special-purpose designs could accommodate such remote-access computer services as keyboard calculators for the home, instructional terminals for on-line testing and tutoring of children and adults (e.g., career advancement) and various information services—stock market trading prices, bank account information, etc. Innovation in terminal design for these consumer services which require low-cost terminals is inhibited by present and revised foreign attachment regulations.

Acoustic coupling is the process by which electrical sig-

nals (from, e.g., a modem connected to a terminal device) are converted to audible sounds which are then picked up by the microphone in the ordinary telephone handset, reconverted to electrical signals, and finally transmitted over the telephone network. At the receiving end of the telephone channel, the process is inverted. (Reception of the signal from the telephone network may be by means of inductive instead of acoustic coupling, but two-way coupling devices which employ acoustic coupling *to* the telephone network, and inductive coupling *from* the network are often referred to as "acoustic couplers.")

Acoustic coupling for data communications has been employed for two reasons: First, it was an expedient to permit the use of an inexpensive or special-purpose modem supplied by an independent electronics manufacturer on the switched network. Secondly, the use of an acoustically coupled modem is necessary today if portability of a data terminal is desired. This may be important for computer applications such as remote conversational time-sharing, for which some users have "portable" teletypewriter terminals. They use the terminal in many unanticipated locations—e.g., different engineers' offices in a company—and therefore need the ability to connect to the telephone network from a variety of access points.

Although the foreign attachment provisions of the domestic carriers' public network tariffs have prohibited the use of non-carrier supplied equipment, whether attached to the carrier network by direct electrical connection or by acoustic or inductive coupling, the rule has not been generally enforced as applied to acoustic/inductive coupling. The revised common carrier tariffs explicitly allow acoustic/inductive coupling of customer equipment—provided a telephone company supplied "network signaling unit" is used.

Telephone users often encounter busy trunk conditions and consequently must re-dial until a trunk becomes available. Were a call-control computer available, the caller could dial his number only once, and the call would be placed over his organization's leased network, WATTS lines, or ordinary long-distance lines according to a pre-programmed priority schedule and cost-minimizing algorithm.

A record of call duration and the extension which originated each call would be kept automatically rather than manually, as done presently.

This call-control computer would, however, be a sophisticated "network control signaling unit"—forbidden under the revised AT&T tariffs.

conclusion

The FCC has decided in the *Carterfone* case that the common carriers' long-standing foreign attachment rule is an unwarranted restriction upon the communication user's ability to use the network "in ways which are privately beneficial without being publicly detrimental." In compliance with this landmark decision, the rule has been relaxed—allowing the attachment of customer-provided modems to the switched telephone network, provided certain technical criteria are met, and telephone company-supplied protective connecting devices and network control signaling units are used. While some questions remain with respect to the necessity of the latter restrictions, the over-all result of this tariff relaxation will be clearly beneficial for the data processing community, as new sources of data interface equipment become available, and as the carriers are forced to bring their equipment pricing policies into line with their new competitors. ■

ADP SUPPORT OF GOVERNMENT LOGISTICS SERVICES

by C. R. NIEMANN

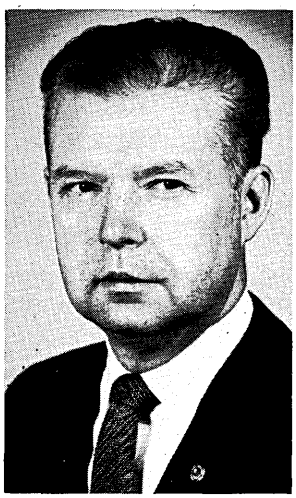
In 1962, the Defense Logistics Services Center (DLSC) moved from Washington, D.C., to the well-known cereal city of Battle Creek, Michigan. The former Battle Creek Sanitarium Building (purchased by the Government in 1942 for use as the Percy Jones Army General Hospital) is now the home office of this agency. Under the command of Navy Captain R. A. Porter, DLSC is a major field activity of the Defense Supply Agency.

DLSC receives a continuous flow of requests for logistics services. Many of these requests are for data about items of supply. The agency processes the inquiries and distributes the results, usually in the form of information packages, to customers throughout the Defense establishment, to other U.S. Government agencies, to NATO and to other friendly foreign countries. DLSC's product line influences an item of supply from cradle to grave. Its "manufacturing" process is dependent upon a large adp oriented data bank. Its primary distribution system is a world-wide data communications network known as AUTODIN (Automatic Digital Information Network).

Although AUTODIN is the major communications network used at DLSC, a second network called the DLSC Data Net provides direct dial-up service to 35 major customers through AT&T 202A Dataphones and IBM Type 1944 or Type 7701 Transceivers. Total in and out communications traffic over both networks approaches a daily load of over 10 million characters.

i/o facilities

To accommodate the thousands of industrial, government, individual citizen and foreign customers who request services by other than wire communications, DLSC also provides complete input-output facilities for those who mail their data requests, or deliver them by carrier. The avenues of entry to interrogate or update the DLSC bank of vital supply item and management data (in addition to wire communications), consists of: keyboard input from source



Mr. Niemann is the deputy director of the Defense Logistics Services Center's office of data systems. A management analyst who at one time influenced the management of three world-wide logistics programs, he has been working in ADP since 1954. He attended Northwestern Univ. and the Univ. of Chicago.

documents, paper tape, punched cards, magnetic tape and our latest addition, a Control Data CDC-915 Optical Character Recognition System. On the output side, the data is communicated in a mode suggested by the customer. These modes are paper tape, magnetic tape, punched cards, line printer and adp prepared microfilm utilizing a Stromberg Datagraphics SD4400, Computer Document Recorder. As a continuation from that latter system, the processed microfilm images can also be "blown-up" through optics on a Copy Flo-11 and different size card prints (4x6, 5x8, etc.) can be produced for those customers who operate with manual card files. Major printed publications are produced at DLSC as camera-ready copy from our computer systems and then sent to commercial printers or volume-printed by the Electronic Composing System installed at the Government Printing Office, Washington, D.C.

The data bank itself is contained in a library of 14,000 reels of conventional magnetic tape and slightly less than 1,900 Hypertape cartridges. Twenty Type 2316 Disc Packs represent our initial progress toward mass-storage, random-access files. The computer line-up consists of three Type 1401 systems each with card read/punch unit, line printer and six Type 729V Tape Drive Units, an IBM Type 7080 System and an IBM System 360/65I.

We have upgraded the Type 7080 System twice since its installation in January 1963. It is equipped with 160K core memory, 12 Type 729VI's and eight Type 7340 Hypertape drives. In December 1966 the System 360/65I was installed (524K byte memory) with card read/punch and high speed printer, Type 2314 Direct Access Storage Facility and 16 Type 2402-3 tape drives.

Together, this battery of adp equipment operating around the clock, seven days a week, provides a full range of supply managment (logistics) data services to our customers. The major adp applications at DLSC and some of their interesting background follows.

the world's largest catalog

The bulk of our adp resources are used to support the Federal Supply Catalog System. The system was born out of necessity. The need for a single, uniform, material identification system within our armed forces became apparent to President Roosevelt toward the end of World War II. In January 1945 he told the director of the Bureau of the Budget to proceed without delay to secure the preparation and maintenance of a United States standard commodity catalog. In 1949 the 81st Congress passed Public Law 152, the "Federal Property and Administrative Services Act of 1949." This act made the use of a uniform Federal Supply Catalog System mandatory within the Department of Defense and by all other Federal agencies and saw the end of scores of numbering systems.

It was a big and lusty youngster even in its early stages. First attempts to build a catalog file by manual record keeping methods ended in total inundation and failure. The huge data processing task was then moved onto punched card accounting machines (PCAM). Although an improvement, it took from two to six weeks to complete a catalog update cycle and approximately 100 units of PCAM were utilized in the process. In December 1956, the installation of an IBM Type 705 opened up new vistas for the efficient management of the Federal Catalog.

Today, salient data concerning approximately 30,000 suppliers is maintained in our master files. Among this data are approximately 8 million manufacturers' part, drawing and reference numbers. The system also lists over 4.5 million Federal Stock Numbers (FSNs) assigned to government items of supply. Some 688,000 of these items are also used by 11 friendly foreign governments under the auspices of the NATO codification system.

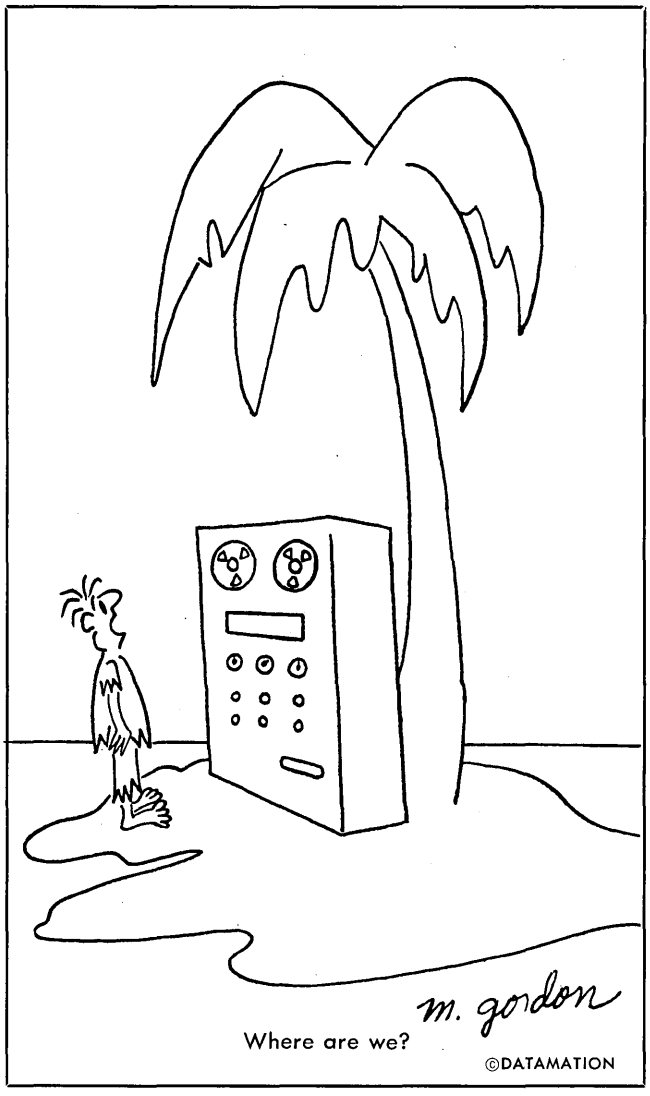
provisioning screening

A major benefit of the Federal Catalog Program, provisioning screening is producing significant dividends. This involves a review of items selected or recommended for procurement in support of a new weapons system or end-item.

The purpose of mechanized centralized provisioning screening is to determine if any of these items are already in the supply system, and properly identified by a Federal Stock Number. It is an essential part of the Government's program to minimize the entry of new items into the supply system.

To accomplish this, the contractor of the military services item manager of the proposed item submits information consisting of his part numbers or stock numbers to DLSC for screening. DLSC screens the part numbers to determine if the item is catalogued and identified by an FSN. Over 40% of the part numbers or stock numbers screened were matched to FSNs. In all, over six million queries were processed.

Today, provisioning screening handles an average of 650,000 data interrogations from manufacturer's part number and/or Federal Stock Number per month. It is the incubator for future logistics support requirements and it effectively separates the common items already catalogued from the unique material which was designed or created to meet the specific needs of new military end-items. In the



*7,4731

(Hello. Is this the computer?)

11111

(Yes it is. Go ahead.)

#8,3000,77,73842

(Sold 3,000 units item #77 to Allu Corp.)

*1,1,0

(Availability confirmed. Account current.)

#4,12,965

(What quantity of item #12 is available for shipment to the Duluth area?)

*9,22000,12,965

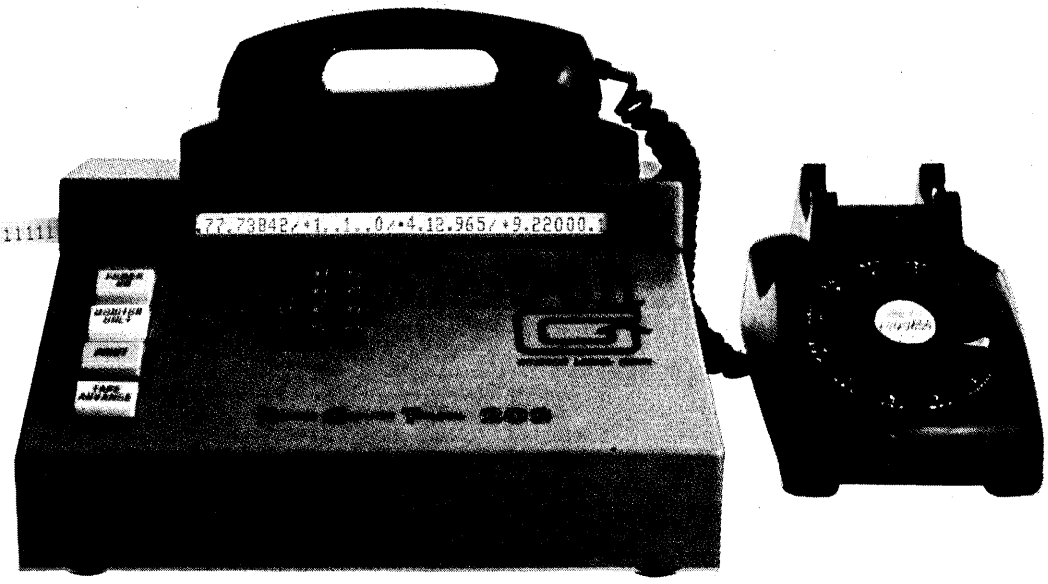
(You can have 22,000 pieces in Duluth on Friday.)

11,8

(Thank you.)

10,8

(Don't mention it.)



A new concept in data transmission systems. Now you can put your computer or data bank to work anywhere there's a phone. And Hi-G's remote computer terminal system gives you so many advantages at such a low cost, you'll find it hard to believe.

Like hard copy readout, for example. At once a verification of the message you're sending or receiving, and a permanent printed record of every transmission, both ways.

Like input and output—the simple ability to feed accurate, verified information into your computer and take needed information out. (Keeps a computer honest and up-to-the-minute.)

Like compatability with any computer and information system. Which means you can plug in at no additional cost — get immediate maximum usefulness out of whatever system you're using.

And at under 15 pounds, this unit is as mobile and flexible as you are.

For about $20 a month, Hi-G's RCT 203 computer terminal opens up a smart new variety of uses for companies large and small. Salesmen can expedite availabilities and orders from the field. Service users can instantly verify and update accounts, charge cards, plates. Plant managers can check — or order — supplies, at a moment's notice. If you've got a central payroll you can feed it data with a phone call. *The only limit to how you can use this unique instrument for data transmission is imagination.*

Let our experienced system specialists supply some of that imagination. Just fill in the coupon or give us a call.

Hi G Incorporated, D2
Spring St. & Route 75
Windsor Locks, Conn. 06096
Gentlemen:

I like the idea of getting maximum computer usefulness with your new low-cost remote computer terminal phone system.

☐ Please send me complete data by mail.

☐ I can't wait for the mails. Please have your representative contact me for an appointment.

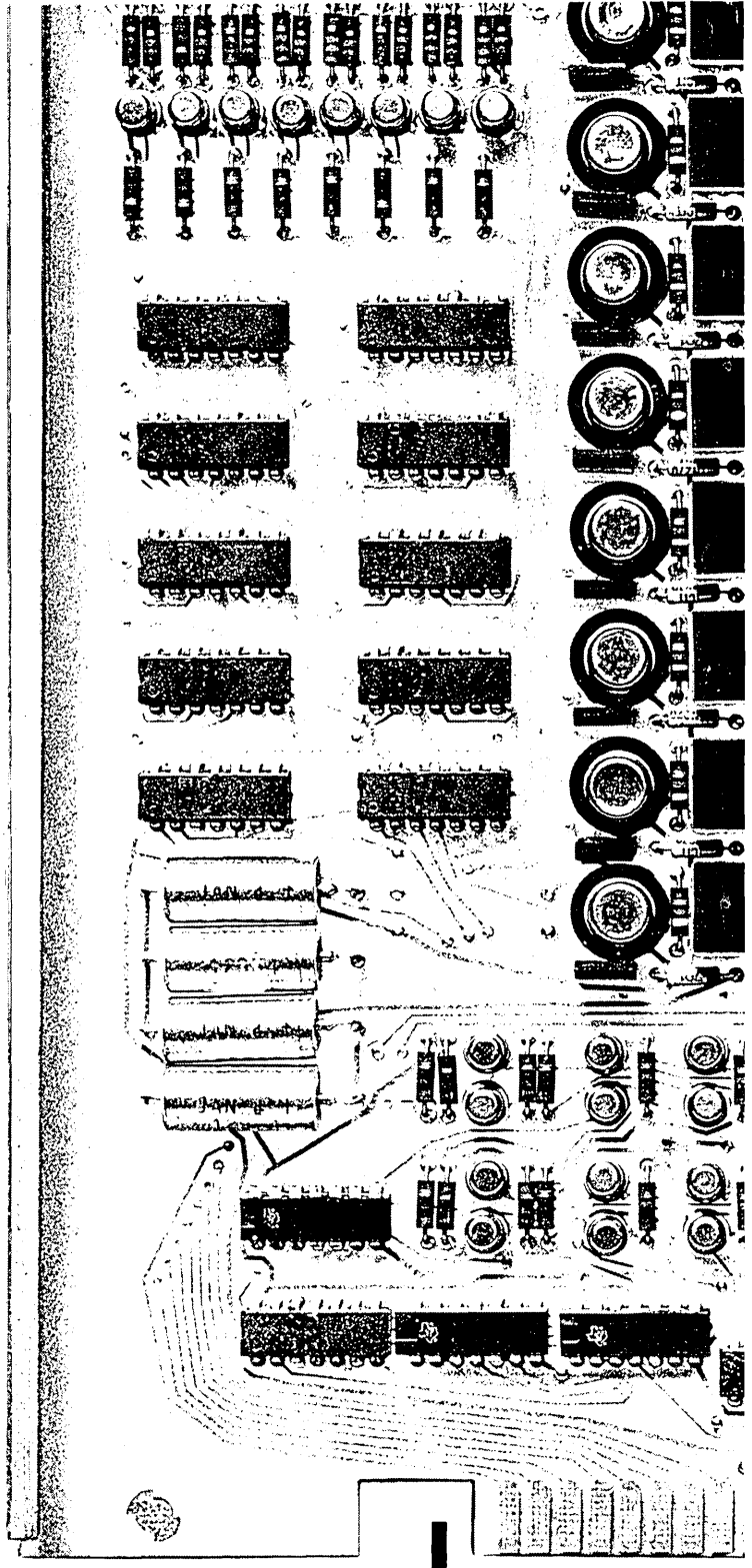
NAME_____TITLE_____

COMPANY_____

ADDRESS_____

CITY_____STATE_____ZIP_____

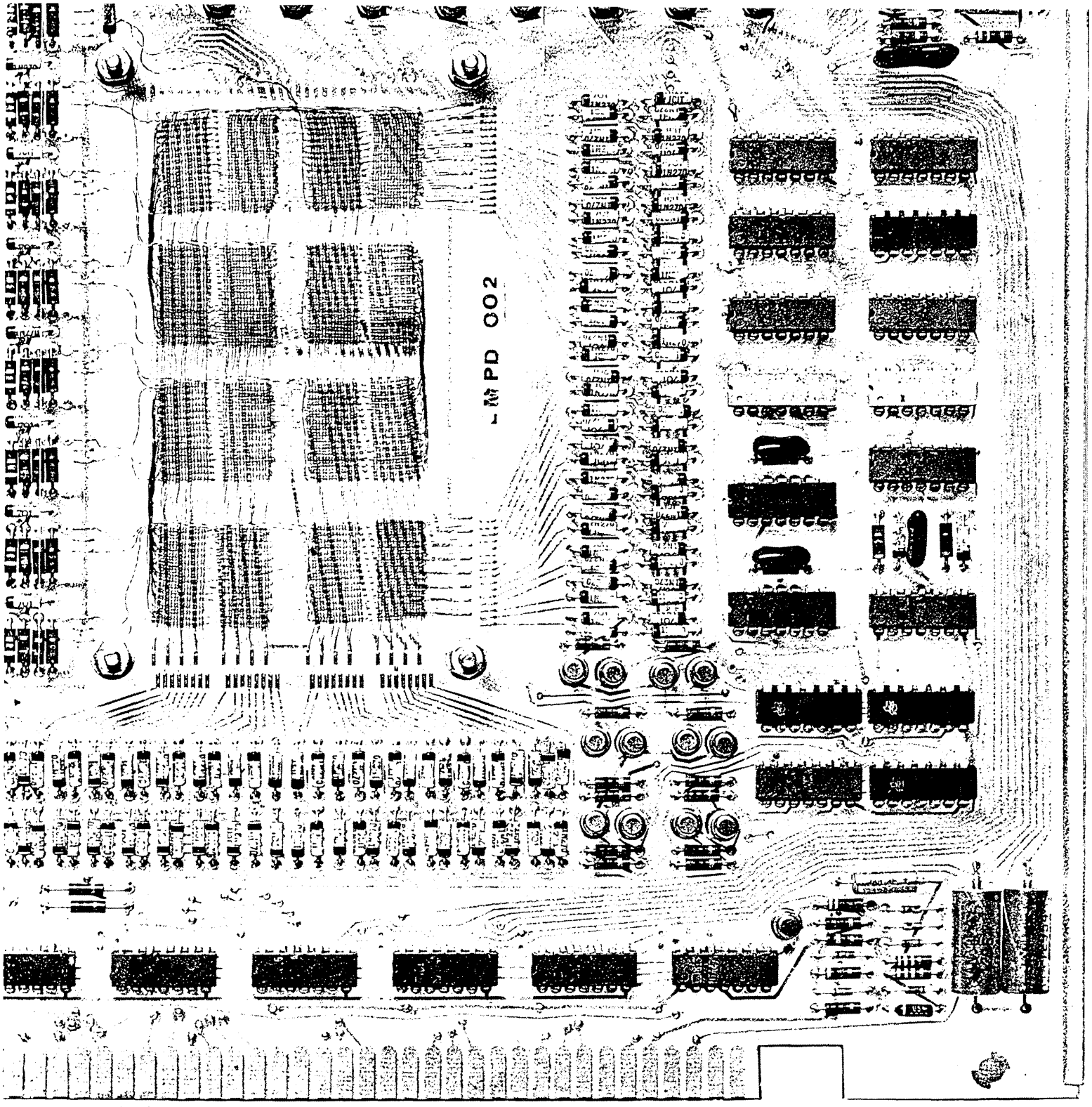
Shown actual size.
Dimensions are
11½" x 12" x ½".



For $650. in lots of 100.

The Sanders Memcard System.

(A complete, expandable, 1K x 8 memory system on a single card.)



Sanders announces the MEMCARD* System...a complete core-memory system on a single, plug-in card. Capacity is an expandable 1,024 words x 8-bits.

The MEMCARD System has read/write circuitry, address and data registers, 0-50°C temperature compensation and POP (Power On/Off Protection). The cycle time is 1.5 microseconds.

MEMCARD units fit your design requirements, reduce wiring and assembly, and drastically cut MTTR.

At a "bargain-bit" price of only $650 per card in lots of 100, the MEMCARD System is more than a bit of a bargain. Sanders provides fast delivery. Even on large quantity orders.

For information and prices on other quantities and capacities, write Memory Products Department, Sanders Associates, Inc., Nashua, N.H. 03060. Or call (603) 885-4412.

SA SANDERS ASSOCIATES, INC.

*TM Sanders Associates Inc.

CIRCLE 37 ON READER CARD

future the volume of provisioning screening input to DLSC is expected to exceed 24 million transactions annually.

DLSC registers material needs of the Army, Navy, Air Force, U.S. Marine Corps and sundry other defense agencies, plus various civil agencies such as National Aeronautics and Space Administration and Federal Aviation Agency, as well as NATO and other friendly foreign governments. The purpose of this program is to satisfy needs with excess material. This list is stored on eight reels of magnetic tape containing 1.3 million requirements records.

The acquisition cost of material DLSC was asked to locate last year was $134 billion. This doesn't mean that there is $134 billion worth of excess available. These are *requirements* of the DLSC's DoD customers not only for this year, but also for future years.

DLSC tries to fill this need to the maximum extent through its management of the Department of Defense Material Utilization Program. This program serves as a clearing house by bringing together the customers who need material with those having excess.

Since July 1965, we have offered nearly $3.5 billion worth of excess items to military customers who needed supplies that were determined to be excess to other military establishments.

We use three different techniques to identify and advertise items needed by the military customers. Two involve a combination of manual and mechanized screening and one is a fully mechanized system called PLUS, which is the DoD central mechanized screening of assets and requirements.

A second master file is the excess material assets file. This contains, in similar supply management detail, approximately $4.5 billion worth of items expected to become excess. This is material determined to be unnecessary to accomplish the responsibilities of the Department of Defense after completion of utilization screening among DoD activities.

There are two important auxiliary mechanized files used in the PLUS system, an Interchangeability and Substitutability File (I&S) and a transaction history file. The I&S file is used in an attempt to find an acceptable interchangeable or substitutable item of supply in the event the exact item requested is not excess.

The acquisition value of the personal property offered to U.S. agencies through the PLUS system was $1.5 billion for the last four years.

In the event the Government's excess material cannot be interserviced and utilized within this country, it is then offered for sale to friendly foreign countries through their embassies in Washington, D.C. Currently there are 72 foreign countries eligible to purchase our country's excess supplies.

from excess to surplus

When all efforts to dispose of excess property—including possible sale to foreign countries—have been exhausted, the property is declared surplus and made available for donation to certain designated activities authorized by law. The remaining property is sold to the general public through our marketing directorate. This outlet to the industrial market place annually sells usable property with an original acquisition value of over $500 million. Only a small percentage of property sold is in unused condition.

This final phase of the life cycle of items of supply and equipment has been likened to the Federal government's logistics graveyard. To add some credence to this rather

somber thought is the mute evidence of yesteryear taken from the pages of surplus sales catalogs such as surplus marlin spikes, caisson boxes and aircraft strut wire!

A national bidders list of individual and industry customers interested in purchasing surplus Government property is maintained by adp equipment. Each bidder advises DLSC of the type of material he is interested in buying contingent upon its availability within any of the 52 different geographical areas which the bidder designates.

DLSC offers over 100,000 line items for sale annually in 1,300 separate sales. Most sales are conducted by 10 geographically dispersed Defense Surplus Sales Offices. If the geographical location and the mix of surplus items included in a particular sales effort match against the stipulated interest of a recorded bidder, the computer will identify these potential bidders. A mailing label is then produced and each selected bidder receives a copy of only those sales catalogs which contain items that meet his predetermined commodity interests and location for participation in a sale. The bidder's account is subject to normal security and financial controls similar to an accounts receivable system and all past bids and records of sales information is recorded by adp processes.

All operating expenses chargeable to the Defense Surplus Property Disposal program are paid out of the proceeds from the sale of surplus property. Worldwide proceeds from sales average $113 million annually. About $46 million came from the sale of usable property, $52 million from the sale of scrap and $15 million from the sale of such items as timber, precious metals, etc.

In addition, over the past three years, $266 million of surplus material has been donated each year to eligible recipients, such as public health and educational institutions, public airports, civil defense organizations and state and local governments.

long range plans

The Department of Defense planners have peered over the horizon and developed long range concepts based upon their "look-ahead" judgment. The first important planning document which dealt with the future of military logistics management and the integrated use of adp, called RAMMS (Responsive Automated Material Management System) was released in 1962. A second Department of Defense (DoD) sponsored plan which greatly influenced the future of logistics management control and the DLSC mission, called PRISM (Progressive Refinement Integrated Supply Management) was published in 1965. One recommendation of PRISM was that DSA undertake a system redesign effort at DLSC to provide for total file integration and processing. As a result the same year a task group began the development of a DLSC Long Range Systems Design which became known as DIDS (DLSC Integrated Data System).

The DIDS system requirements are complete. Its general design specifications have been formulated in a three-inch document entitled, "Administrative and Contractual Information for the DLSC Integrated Data Systems of Defense Supply Agency." These requirements were issued to adp manufacturers as an invitation to bid on September 6. They had until November 8 to respond.

The plan calls for the separate adp applications presently supporting DLSC's logistics services mission to be integrated into one homogeneous system, capable of expansion and highly responsive to the future needs of U.S. Federal, NATO and other foreign country's logistics managers. Included in the system under development is the concept of DIDS as the cornerstone upon which future logistics management information systems can be built without entailing a major redesign effort. As the hub of the future logistics management "wheel," the DIDS data bank is expected to evolve into one of the largest adp-installations in the world. ■

In times of rising cost, Lockheed proudly announces a drastic price reduction.

Bulk-core memories down to less than 1½¢ a bit.

Because so many people were amazed by our very, very low 1968 price of 1½¢ a bit, we feel compelled to reaffirm the above:

Yes, it's true—our CM-300 bulk core memory now comes at less than 1½¢ a bit and as low as a penny a bit for OEM users.

And if need be, you can get up to a million 40-bit words of capacity.

Add to that a full cycle time that runs 2 to 4 microseconds—with access time at 1.8 microseconds or faster—and you've got bulk capacity at the speed of some of the smaller systems.

What's more it's the kind of speed you can count on. A 2½D, 2-wire organization produces inherently high operating margins. And with Lockheed's worst-case design criteria you have to have the most reliable random access, peripheral storage system—on the market or working in the field.

So if you happen to be short on storage capacity, send for our CM-300 brochure. Then just sit back and read—about all the good bits your pennies can buy.

You can reach us at: Memory Products, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022. Telephone: (213) 722-6810.

CIRCLE 94 ON READER CARD

LOCKHEED ELECTRONICS COMPANY

A Division of Lockheed Aircraft Corporation.

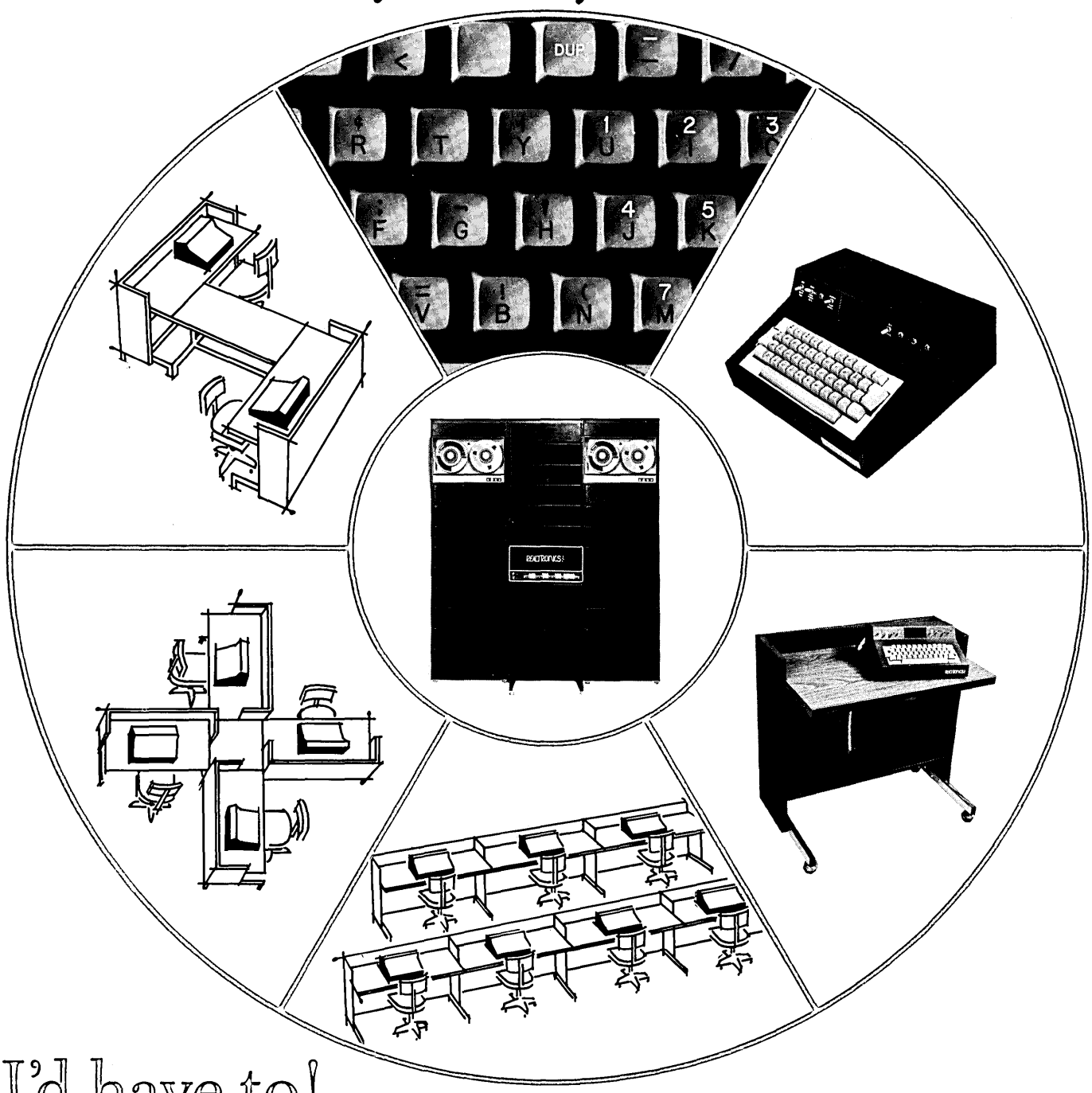
This man is
a Vice President
and the Director
of Data Processing
of a major corporation.

He is knowledgeable, efficient and aggressively cost-conscious. He is respected within his company and throughout his industry as an excellent executive and as an effective computer user. He is famous among data processing suppliers as being "from Missouri" about new products and services. In short, he was considered a prime prospect for our new product line.

When we described the capabilities of our **R1 Systems** and what they would cost him, his response was, "I don't believe a word of it." So we asked him, "If we demonstrate that an **R1 System** can actually do what we say it can—within the operating costs we claim—would you buy a system?"

Without hesitation, he answered. I'd have to!

The R1 Systems by REALTRONICS INC



I'd have to!

When our prospect said that, he validated the **R1 Systems** design goal.

Our goal was:

The achievement of a *compter-controlled* reactive keyboard system to replace all current keystroke devices at a superior productivity/cost ratio.

The system would have to be so capable, so reliable, so modular and so economical that you and every other prospective user must say,

"I can't afford not to have it!"

We are sure you will agree that **R1 Systems** are a giant step ahead of the host of products being announced to share in the data entry business.

The *inevitable* switch from punched cards to compact reusable magnetic tape is happening *now*. **R1 Systems** use magnetic tape as their basic output medium for further processing. **R1 Systems** also provide for other output needs up to direct output into your primary computer sytem.

R1 Systems can also be in remote installations transmitting data to central sites; between **R1 Systems** or directly into your central computers.

But the **R1 Systems** are *not* revolutionary; they are *not* made up of untried "breakthrough" components; it is *not* necessary for users to be "pioneers" and "trailblazers." The **R1 Systems** philosophy implies capitalizing upon the old, well-developed skills of keypunch operators and upon the familiar supervisory and managerial methods of successful data preparation operations.

Today's data preparation schedules do not allow time for experimentation with major changes of procedure or for the operation of radically new and unfamiliar machinery.

The **R1 Systems** make no such demands upon their users. The **R1 Systems** employ proven, reliable hardware components adapted for incorporation into an integrated system; adapted to cause the minimum change in methods to attain *major* cost/productivity benefits.

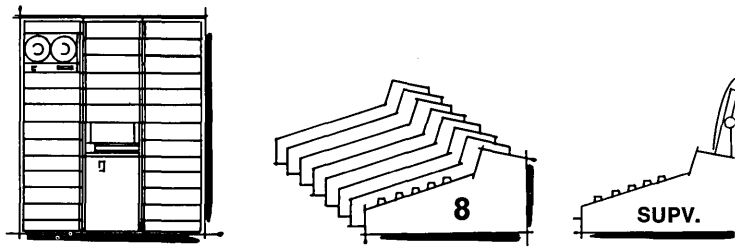
The **R1 Systems** actually *simplify* the work of keystroke operators. They *minimize* the transition from keypunch equipment. They *reduce* training time dramatically—to *hours*.

The **R1 Systems** are evolutionary in concept. They permit cost saving utilization *today* without procedural changes; yet allow evolutionary extension of usage, *tomorrow,* to attain their fullest advantages.

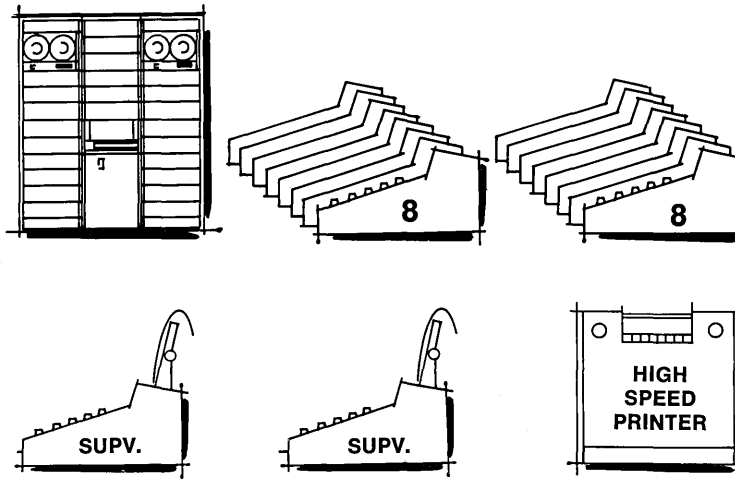
The seven basic **R1 Systems** and the greater capabilities of the expanded **R1 Systems** enable orderly, modular growth *without exchanging equipment.*

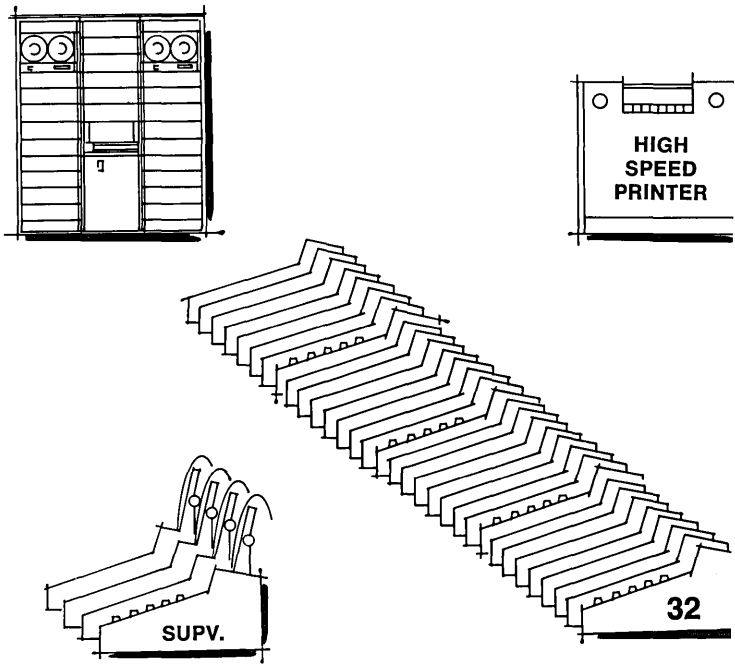
And Realtronics Systems Designers can help you expand the uses of your **R1 Systems** to relieve your primary computers of editing, sorting and merging, reasonability range testing, and other post-entry data preparation tasks. We call this *customerizing* your **R1 Systems**, and you'll call it, "wonderful!"

Basic **R1/1**



Extended Systems





THE R1 SYSTEMS BY REALTRONICS INC

Major components include:

Model	Description
R1/1	Central Controller
R1/2-R1/7	Expanded Central Controllers
R1/101	Data Keyboard
R1/102	Supervisor's Control Console

Model	Description
R1/301	Tape Drive—9-track, 800 bpi
R1/302	Tape Drive—7-track, 800 bpi
R1/303	Tape Drive—7-track, 556 bpi
R1/304	Tape Drive—7-track, 200 bpi

For more information about an **R1 System**—and how it can help you increase productivity at lower costs—contact us at:

REALTRONICS INC
A subsidiary of the Struthers Wells Corporation

Telephone:
212 581-1170

Six Thirty Fifth Avenue
New York, N.Y. 10020

TWX:
710-581-6536

SECOND CONFERENCE ON APPLICATIONS OF SIMULATION

At the Second Conference on Applications of Simulation, held in New York, there were 60 papers presented at 22 sessions covering the areas of facility planning, transportation, communication, computers, urban design, ecology, management, finance, marketing, man-machine interaction, individual behavior, and gaming—plus tutorials in simulation languages and statistical applications.

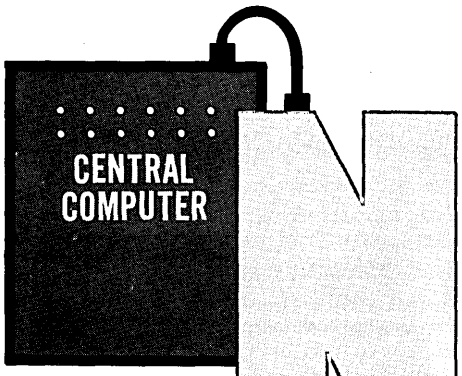
The two and one-half day structure of the conference, Dec. 2-4, forced as many as five parallel sessions. Simulation topics overlap; and fewer parallel sessions would have reduced the attendees' conflict as to which topics to choose. In terms of popularity, the sessions on the modeling of computer systems were the best attended, with corporate and financial models and manufacturing applications following. Some of the sessions encouraged quite active discussions, particularly those on simulation of human behavior, marketing, ecology, and gaming. Obviously there was plenty to choose from, probably too much. The challenge to actively participate in both the sessions and the seven workshops on the last afternoon was well accepted.

Judging from the discussion heard during the breaks, there was one significant factor—simulation is being used for an increasing number of applications with useful results, and there is no single approach as to how to do it or what language to use. There were advocates of simulation languages: GPSS, numerous; SIMSCRIPT, somewhat less numerous; SIMULA, only a handful, primarily from Europe; FORTRAN, numerous and vociferous. There were also a few participants who felt only special purpose simulation techniques would work for their application. The degree of sophistication on the part of the adherents of the different approaches indicates the rapid advance in applying simulation techniques to numerous problems and topics. The

ANNOUNCING!

The NETWORK CONTROL PROCESSOR
By: UNIVERSAL SYSTEMS INC.

a front-end computer communication system



NCP

GOT THE VERY BEST IN LARGE SCALE COMPUTERS?
HERE'S THE VERY BEST IN COMMUNICATIONS FRONT-ENDS.

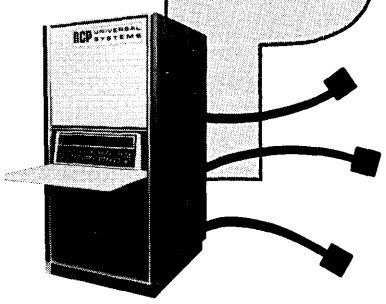
Relieve your main computer system of costly communication interrupts. The NETWORK CONTROL PROCESSOR directs an efficient interchange of data between remote stations and your central computer. The entire system, complete with equipment and the software required to control your network, delivered and operational 90-120 days after your order.

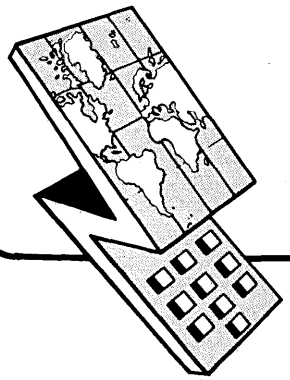
THE NETWORK CONTROL PROCESSOR SYSTEM OFFERS . . .

- **Lower cost per line connection**
- **System expandability and flexibility**
- **Main memory economies for your central computer**
- **Sale or lease arrangements**

NCP SYSTEM PACKAGE CONTAINS:

• High Speed Communications Computer • Communications Line Interfaces • Remote Line Concentrators • Software for 1107/1108 360/65/75 linking. More to come. • High Speed Disc Unit • Intercomputer Coupler • Complete Communications Software





UNIVERSAL SYSTEMS INC.

4733 BETHESDA AVENUE
WASHINGTON, D.C. 20014
301-652-2136

application orientation of the practitioners of the simulation art conditioned their set of desired goals for man-machine interaction toward building and debugging models and using structural simulation languages rather than FORTRAN.

Eventually, man-machine interaction via display consoles should aid in problem definition, speed up model debugging, open a window into how a problem is being run, and provide answers quickly. Unfortunately, there was general agreement that at this time simulation language evolution still leaves much room for man-machine improvement. Norden announced their partially conversational revision of GPSS/360.

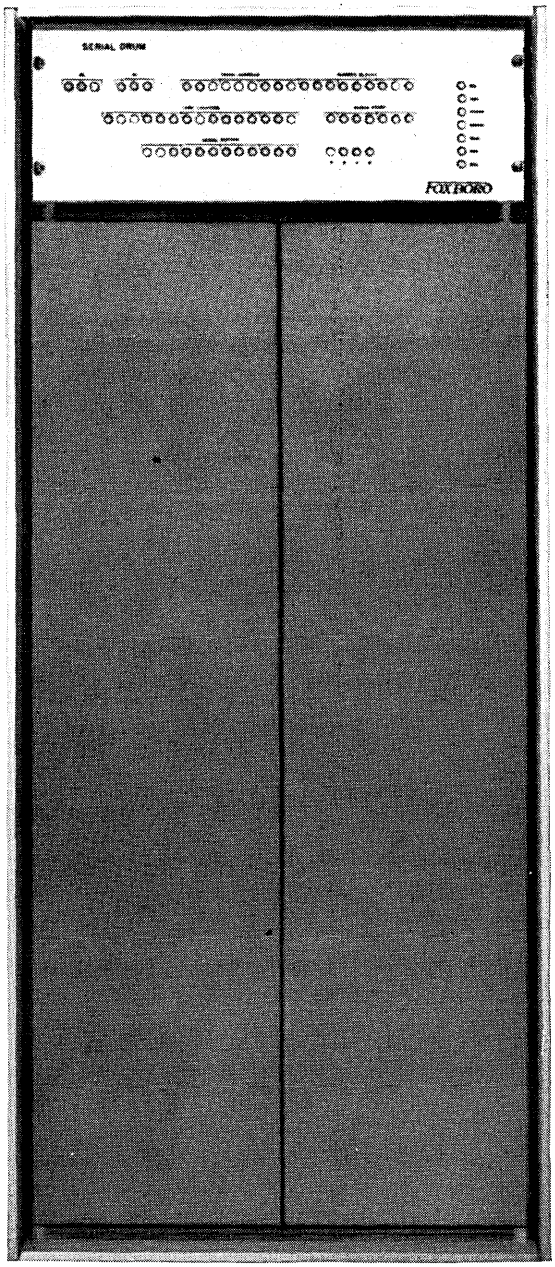
The conference was geared to those whose interest was in the use of simulation—specifically, discrete event simulation. A more precise definition is the use of the computer to represent the real world in terms of sequence of events. These events may occur in actuality in parallel, but in the computer they are processed serially, according to some logical structure. While these events are being processed the simulation clock does not change. The next value for the simulation clock depends on when the next event is scheduled to occur. This is in direct contrast with continuous simulation languages—MIDAS, PACTOLUS, DSL-90, CSMP, where there is no slipping of the clock since the problems are represented by differential equations. Discrete event simulation languages are structured to represent logical interactions as well as probabilistic relationships.

The 1968 conference was the second devoted to application. The first was held in New York in 1967. These conferences were the outgrowth of simulation language workshops held at Stanford University in 1964 and at the University of Pennsylvania in 1966. The broad range of topics being simulated made it necessary to seek conference sponsorship from several groups. In fact, only half the attendees indicated membership in one of the sponsoring societies, ACM, IEEE, SCI, and SHARE. This year there were 856 registrants compared to 401 last year. A 368-page Conference Digest was provided. A limited number of these digests are available from the ACM, 211 East 43rd Street, New York, N.Y. 10017 for $10. Some of the full papers from the 1967 conference appear in a special issue of the November, 1968, IEEE Transactions of the Systems Science and Cybernetics Group. These may be obtained from IEEE, 345 East 47th St., New York, N.Y. 10017.

A third conference is now being

To current and potential PDP-8 and PDP-8/I users:

Here's a compatible drum file system that has twice the access speed, six times the transfer speed, and up to twice the capacity of drums you can buy at the same price.



Foxboro has it . . . a new drum storage unit designed by us and applied in a number of real time uses. It has features like these:

- Capacity — 102,400 or 204,800 or 409,600 words standard. That's up to twice the capacity of units selling at comparable prices. Model with 819,200 words also available.
- Access time — 8.3 milliseconds average, twice as fast as comparable units.
- Transfer speed — 92,000 words per second, up to six times faster than comparable units.
- Cost is as low as four-fifths of a cent per bit.
- Delivery can be as fast as two weeks; 90 days standard.
- Compatible with all PDP-8 and PDP-8/I central processor configurations.
- Uses DEC logic, assuring logic compatibility.
- Applications — scientific, time sharing, real time, complex business data processing, process control.
- Utility and diagnostic software provided; training and service available.
- High reliability; 10-year design life.

For more information on the new Foxboro Drum File System, call Larry DeLong at 617-543-8750. Or write to him, The Foxboro Company, 802 Norfolk Street, Foxboro, Massacnusetts 02035. Offices in principal cities • Plants in U.S.A. • Canada • Mexico • England • France • Netherlands • Japan • Australia

FOXBORO

CIRCLE 46 ON READER CARD

planned for December, 1969, in Los Angeles. Preliminary plans for this conference call for full papers in a Conference Record and an emphasis on how the simulation languages were actually used to obtain the results. This is the time to offer suggestions to Arnold Ockene, the conference chairman, IBM, 112 East Post Road, White Plains, N.Y. 10601, or Phil Kivat, program chairman, RAND Corp., 1700 Main Street, Santa Monica, Calif.

In one respect, this conference was like many others: material was good, but the presentation and visual aids were poor. Providing full papers in the conference record and use of discussants to explore the material should improve the information transfer during the sessions. However, how to improve visual aids is a problem which seems bound to plague conferences forever. One conceivable solution is to prepare all slides on a Stromberg Carlson 4020 programmed to limit the number of words on each slide to 25 or less or no more than 20 letters per line.

One of the workshops held at the end of the conference was on feedback to simulation language designers. Those attending this workshop indicated a need to improve the language beyond where they are, although they had not yet had a chance to use the newest, SIMSCRIPT II, which was described earlier in the conference. General-purpose languages such as FORTRAN were considered inadequate since they required unreasonable efforts to obtain the desired results. In addition, a strong point was made for the use of the structural language to aid in defining the problem—no small factor in complex system analysis and synthesis. The specific requirements above and beyond what can be done now:

Improve the debugging capabilities.
Provide graphical monitoring during running.
Provide comment report generation.
Access large existing data bases.
Handle large scale systems and their data.
Accommodate discrete and continuous in one model.

These goals must be part of any program to improve the existing languages and provide a basic foundation for specifications for any new languages. The workshop will establish a committee to issue a set of general requirements for simulation languages.

By any standard, this conference was a success. Now is the time for all good simulators to volunteer to aid next year's conference committee.

—JULIAN REITMAN

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We've taken the curl out of microfilm enlargements.

Because the new Xerox Microprinter uses xerography, not wet chemicals, it gives you flat, dry prints on ordinary bond paper. Dry prints you can write on with pencil or pen the instant they leave the machine.

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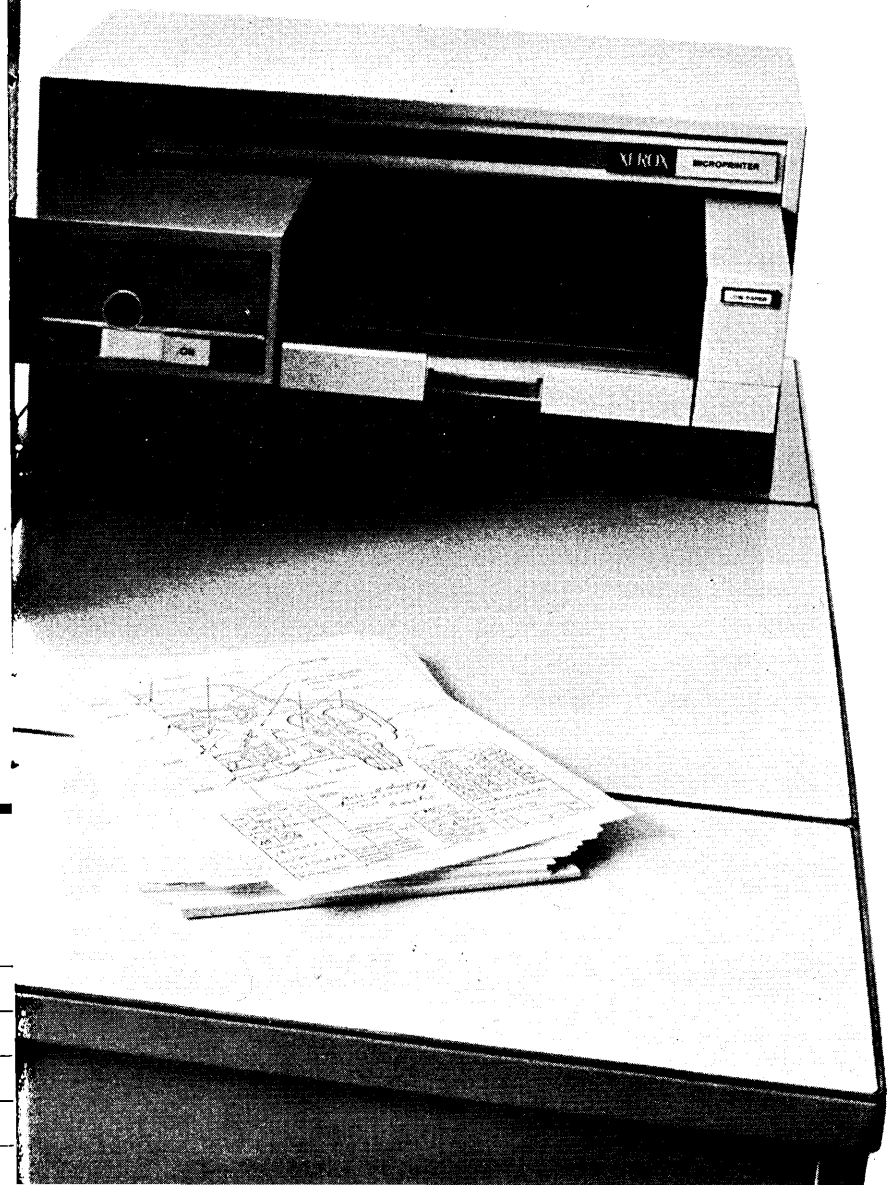
No matter what kind of film you use (16mm or 35mm roll microfilm, aperture cards, microfiche or jacketed film) a Microprinter enlarges and reproduces it automatically. In magnification ratios of 16X, 20X, or 24X.

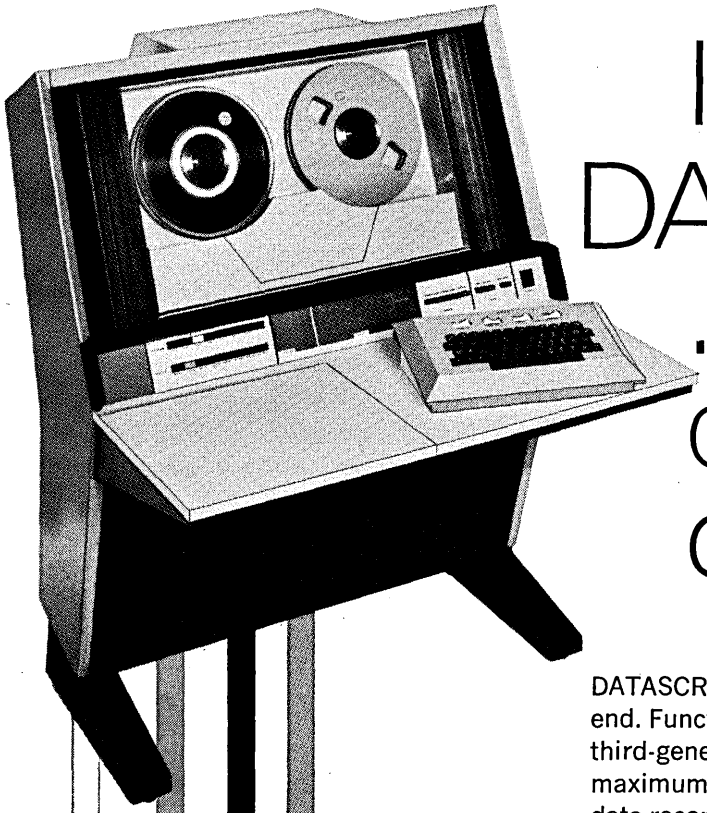
When we took the curl out of your microfilm prints, we added a few new twists.

For complete details on the Microprinter, please write Xerox, Dept. O, Xerox Square, Rochester, New York 14603.

XEROX

CIRCLE 48 ON READER CARD





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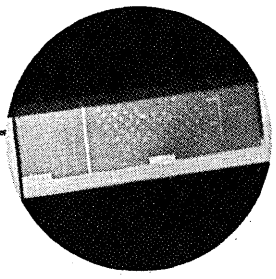

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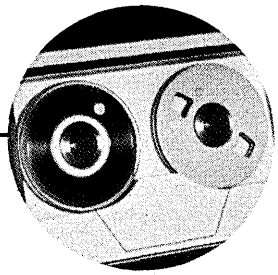

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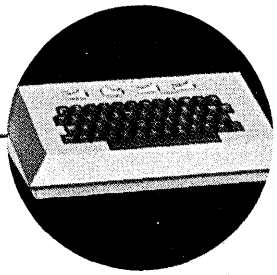

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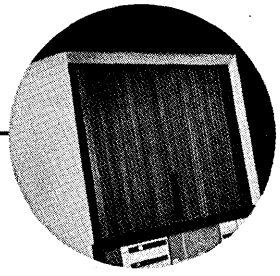

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THE EVOLUTION OF NUMBER SYSTEMS

by DONALD E. KNUTH

This is a portion of Volume 2 of a seven-volume series titled *The Art of Computer Programming*, to be published by Addison-Wesley. The author's intent is to explain and illustrate in the series most of what is known about basic computer programming techniques exclusive of numerical analysis. Several thousand exercises (with answers) will be included. The project was begun in 1962. Volume 3 is expected to be published next year.

The historical development of number representations is a fascinating story, since it parallels the development of civilization itself. The advent of computers has focussed considerable attention on number systems whose radix (or base) is different from ten, and the purpose of this article is to examine the origins of these systems, together with a discussion of significant milestones in their development. The earliest forms of number representations, still found in primitive cultures, are generally based on groups of fingers, or piles of stones, etc., usually with special conventions about replacing a larger pile or group of, say, five or ten objects by one object of a special kind or in a special place. Such systems lead naturally to the earliest ways of representing numbers in written form, such as the systems of Babylonian, Egyptian, Greek, Chinese, and Roman numerals, but these notations are quite inconvenient for performing arithmetic operations except in the simplest cases.

During the twentieth century, historians of mathematics have made extensive studies of early cuneiform tablets found by archeologists in the Middle East. These studies show that the Babylonian people actually had two distinct systems of number representation: Numbers used in everyday business transactions were written in a notation based on grouping by tens, hundreds, etc.; this notation was inherited from earlier Mesopotamian civilizations, and large numbers were seldom required. When more difficult mathematical problems were considered, however, Babylonian mathematicians made extensive use of a sexagesimal (radix 60) positional notation which was highly developed at least as early as 1750 B.C. This notation was unique in that it was actually a *floating-point* form of representation with exponents omitted; the proper scale factor or power of 60 was to be supplied by the context, so that, for example, the numbers 2, 120, 7200, 1/30, etc., were all written in an identical manner. This notation was especially convenient for multiplication and division, using auxiliary tables, since radix-point alignment had no effect on the answer; the same idea is applied today in the use of slide rules. As examples of this Babylonian notation, consider the following excerpts from early tables: The square of 30 is 15 (which may also be read, "the square of ½ is ¼"); the reciprocal of $81 = (1\ 21)_{60}$ is $(44\ 26\ 40)_{60}$; and the square of the latter is $(32\ 55\ 18\ 31\ 6\ 40)_{60}$. The Babylonians had a symbol for zero, but because of their "floating-point" philosophy, it was used only within numbers, not at the right end to denote a scale factor.

decimal notation

Fixed-point positional notation was apparently developed first by the Maya Indians in Central America about 2000 years ago, but their number system had no important influence on the rest of the world. Furthermore, they used a mixed radix system, alternating between radix 20 and radix 18, and so it was not very suitable for operations like multiplication of large numbers, nor is there any known evidence that Mayans were skilled at arithmetic.

Several centuries before Christ, the Greek people employed an early form of the abacus to do their arithmetical calculations, using sand and/or pebbles on a board which had rows or columns corresponding in a natural way to our

Dr. Knuth is a professor of computer science at Stanford Univ., spending the current academic year serving as a staff mathematician at the Institute for Defense Analyses and as a visiting lecturer at Princeton Univ. Since his undergraduate days at Case Institute of Technology, he has written on computer science and mathematics for publications ranging from the Indian Journal of Statistics to Mad Magazine.

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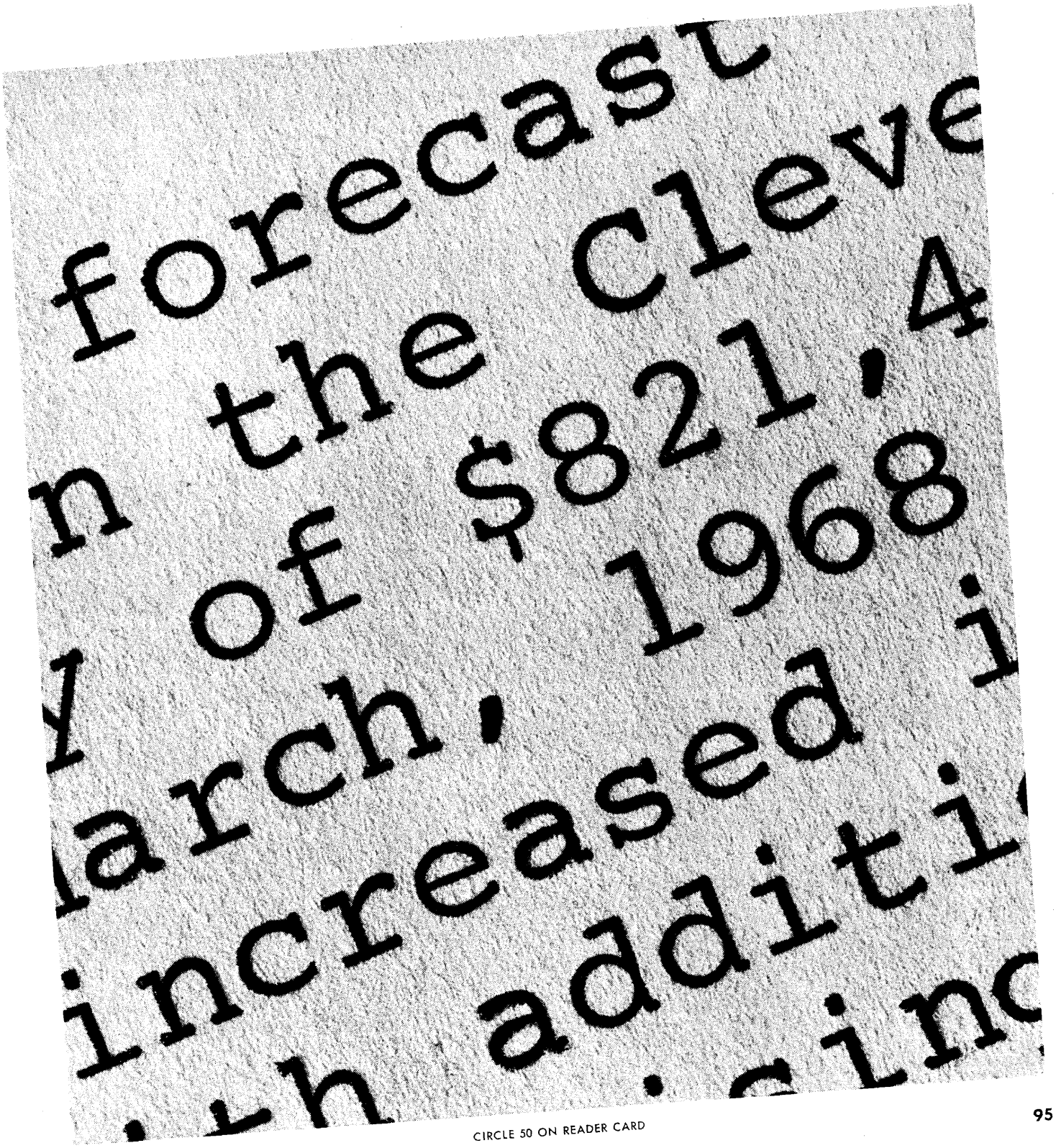

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decimal system. It is perhaps surprising to us that the same positional notation was never adapted to written forms of numbers, since we are so accustomed to reckoning with the decimal system using pencil and paper; but the greater ease of calculating by abacus (since handwriting was not a common skill, and since abacus calculation makes it unnecessary to memorize addition and multiplication tables) probably made the Greeks feel it would be silly even to suggest that reckoning could be done better on "scratch paper." At the same time Greek astronomers did make use of a sexagesimal positional notation for fractions, which they learned from the Babylonians.

Our decimal notation, which differs from the more ancient forms primarily because of its fixed radix point, together with its symbol for zero to mark an empty position, was developed first in India among the Hindu people. The exact date when this notation first appeared is quite uncertain; about 600 A.D. seems to be a good guess. Hindu science was rather highly developed at that time, particularly in astronomy. The earliest known Hindu manuscripts which show this notation have numbers written backwards (with the most significant digit at the right), but soon it became standard to put the most significant digit at the left.

About 750 A.D., the Hindu principles of decimal arithmetic were brought to Persia, as several important works were translated into Arabic. Not long after this, al-Khowârizmî wrote his Arabic textbook on the subject. This text was so popular, our word "algorithm" has been derived from al-Khowârizmî's name. His book was translated into Latin and was a strong influence on Leonardo Pisano (Fibonacci), whose book on arithmetic (1202 A.D.) played a major role in the spreading of Hindu-Arabic numerals into Europe. It is interesting to note that the left-to-right order of writing numbers was unchanged during these two transitions from Hindu to Arabic and from Arabic to Latin, although Arabic is written from right to left while Hindu and Latin are written from left to right. A detailed account of the subsequent propagation of decimal numeration and arithmetic into all parts of Europe during the period from 1200 to 1600 A.D. is given by David Eugene Smith in his *History of Mathematics* 1 (Boston: Ginn and Co., 1923), Chapters 6 and 8.

Decimal notation was applied at first only to integer numbers, not to fractions. Arabic astronomers, who required fractions in their star charts and other tables, continued to use the notation of Ptolemy (the famous Greek astronomer) which was based on sexagesimal fractions. This system still survives today, in our trigonometric units of "degrees, minutes, and seconds," and also in our units of time, as a remnant of the original Babylonian sexagesimal notation. Early European mathematicians also used sexagesimal fractions when dealing with noninteger numbers; for example, Fibonacci gave the value

$$1^\circ\ 22'\ 7''\ 42'''\ 33^{IV}\ 4^{V}\ 40^{VI}$$

as an approximation to the root of the equation $x^3 + 2x^2 + 10x = 20$.

The use of decimal notation also for tenths, hundredths, etc., in a similar way seems to be a comparatively minor change; but, of course, it is hard to break with tradition, and sexagesimal fractions have an advantage over decimal fractions in that numbers such as ⅓ can be expressed exactly in a simple way. The first known occurrence of decimal fractions dates from the 15th century, over 600 years after decimal notation for integers had been in use by the Arabs. It appeared without fanfare in a short treatise on arithmetic and geometry by Jemshîd ibn Mes'ûd al-Kashî, who died c. 1436. His remarkable work (written in Persian) gives the value of π as

integer
3 1415926535898732

which is correct to 16 decimal places. Neither the concept of decimal fractions nor such an accurate approximation to π were known in Europe until over a century later. A little-known arithmetic text by Francesco Pellos (1492) made use of a "decimal point" in a completely modern manner, but only for intermediate results during a calculation when dividing by a power of ten; the final answer was rewritten as a fraction. This idea had previously appeared in the writings of Regiomontanus, about 30 years earlier, who used a vertical bar instead of a decimal point. In 1525, Christoff Rudolf of Germany discovered decimal fractions for himself, but his work did not become well known. Simon Stevin of Belgium independently thought of decimal fractions in 1585, and he wrote an arithmetic text which explicitly set forth the associated theory for the first time. His work, and Napier's discovery of logarithms soon afterwards, made decimal fractions very common in Europe during the 17th century.

binary system

The binary system of notation has its own interesting history. Many primitive tribes in existence today are known to use a binary or "pair" system of counting (making groups of two instead of five or ten), but they do not count in a true radix 2 system, since they do not treat powers of 2 in a special manner. Another "primitive" example of an essentially binary system is the conventional musical notation for expressing rhythms and durations of time.

The Rhind papyrus, which is one of the first nontrivial mathematical documents known (Egypt, c. 1650 B.C.), uses a decimally oriented scheme of notation for numbers, but it shows how to perform multiplication operations by successive doubling and adding. This device is inherently based on the binary representation of the multiplier, although the binary system was not specifically pointed out.

Nondecimal number systems were discussed in Europe during the seventeenth century. For many years astronomers had occasionally used sexagesimal arithmetic both for the integer and the fractional parts of numbers, primarily when performing multiplication. The fact that *any* positive number could serve as radix was apparently first stated in print by Blaise Pascal in *De numeris multiplicibus,* which was written about 1658. Pascal wrote, "Denaria enum ex institute hominum, non ex necessitate naturae ut vulgus arbitratur, et sane satis inepte, posita est"; i.e., "The decimal system has been established, somewhat foolishly to be sure, according to man's custom, not from the natural necessity as most people would think." He stated that the duodecimal (radix 12) system would be a welcome change, and he gave a rule for testing a duodecimal number for divisibility by 9. Erhard Wiegel proposed the quaternary (radix 4) system in a number of publications beginning in 1673. A detailed discussion of radix 12 arithmetic was given by Joshua Jordaine, in his book *Duodecimal Arithmetick* (London, 1687).

Although decimal notation was almost exclusively used for arithmetic during that era, other systems of weights and measures were rarely if ever based on multiples of 10, and many business transactions required a good deal of skill in adding quantities such as pounds, shillings, and pence. For centuries, merchants had therefore learned to compute sums and differences of quantities expressed in peculiar units of currency, weights, and measures; and this was actually arithmetic in a nondecimal number system. The common units of liquid measure in England, dating from the 13th century or earlier, are particularly noteworthy:

2 gills	=1	chopin
2 chopins	=1	pint
2 pints	=1	quart
2 quarts	=1	pottle
2 pottles	=1	gallon
2 gallons	=1	peck
2 pecks	=1	demibushel
2 demibushels	=1	bushel or firkin
2 firkins	=1	kilderkin
2 kilderkins	=1	barrel
2 barrels	=1	hogshead
2 hogsheads	=1	pipe
2 pipes	=1	tun

Quantities of liquid expressed in gallons, pottles, quarts, pints, etc., were essentially written in binary notation. Perhaps the true inventors of binary arithmetic were English wine merchants!

The first known appearance of binary notation was about 1600 in some unpublished manuscripts of Thomas Harriot (1560-1621). Harriot was a creative man, who came to America with Sir Walter Raleigh; he invented (among other things) the notation now used for "less than" and "greater than" relations; but ill health kept him from publishing many of his discoveries. The first published discussion of the binary system was given in a comparatively little-known work by a Spanish bishop, Juan Caramuel Lobkowitz, who in 1670 discussed the representation of numbers in radices 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, and 60 at some length, but gave no examples of arithmetic operations in nondecimal systems (except for the trivial operation of adding unity).

Ultimately, G. W. Leibnitz wrote an article in 1703 which illustrated binary addition, subtraction, multiplication, and division; this article really brought binary notation into the limelight, and it is usually referred to as the birth of radix 2 arithmetic. Leibnitz later referred to the binary system quite frequently. He did not recommend it for practical calculations, but he stressed its importance in number-theoretical investigations, since patterns in number sequences are often more apparent in binary notation than they are in decimal; he also saw a mystical significance in the fact that everything is expressible in terms of zero and 1.

It is interesting to note that the important concept of negative powers to the right of the radix point was not yet well understood at that time. Leibnitz asked James Bernoulli to calculate π in the binary system, and Bernoulli "solved" the problem by taking a 35-digit approximation to π, multiplying it by 10^{35}, and then expressing this integer in the binary system as his answer. On a smaller scale this would be like saying that $\pi = 3.14$, and $(314)_{10} = (100111010)_2$; hence π in binary is 100111010! The motive for Bernoulli's calculation was apparently to see whether any simple pattern could be observed in this representation of π.

octal

Charles XII of Sweden, whose talent for mathematics perhaps exceeded that of all other kings in the history of the world, hit on the idea of radix 8 arithmetic about 1717. This was probably his own invention, although he had met Leibnitz briefly in 1707. Charles felt radix 8 or 64 would be more convenient for calculation than the decimal system, and he considered introducing octal arithmetic into Sweden; but he died in battle before carrying out such a change.

About 140 years later, a prominent Swedish-American civil engineer named John W. Nystrom decided to carry Charles XII's plans a step further, and he devised a complete system of numeration, weights, and measures based on hexadecimal (radix 16) arithmetic. He wrote, "I am not afraid, or do not hesitate, to advocate a binary system of arithmetic and metrology. I know I have nature on my side; if I do not succeed to impress upon you its utility and great importance to mankind, it will reflect that much less credit upon our generation, upon our scientific men and philosophers." Nystrom devised special means for pronouncing hexadecimal numbers; e.g., $(B0160)_{16}$ was to be read "vybong, bysanton." A similar system, but using radix 8, was proposed about the same time by Alfred B. Taylor. Increased use of the French (metric) system of weights and measures led to extensive debate about the merits of decimal arithmetic during that era.

The binary system was well known as a curiosity ever since Leibnitz's time. It was applied chiefly to the calculation of powers and to the analysis of certain games and puzzles. In 1898, the celebrated Italian mathematician G. Peano showed how to use binary notation as the basis of a "logical" character set of 256 symbols.

Increased interest in mechanical devices for doing arithmetic, especially for multiplication, led several people to consider the binary system for this purpose. A particularly delightful account of this activity is given in the article "Binary Calculation" by E. William Phillips [*Journal of the Institute of Actuaries* 67 (1936), 187-221] together with a record of the discussion which followed a lecture he gave on the subject. Phillips begins by saying, "The ultimate aim of this paper is to persuade the whole civilized world to abandon decimal numeration and to use octonal numeration in its place."

Modern readers of Phillips' article will perhaps be surprised to discover that a radix 8 number system was properly referred to as "octonary" or "octonal," according to all dictionaries of the English language at that time, just as the radix 10 number system is properly called either "denary" or "decimal." The word "octal" did not appear in English language dictionaries until 1961, and it apparently originated as a term for the "base" of a certain class of vacuum tubes. The word "hexadecimal," which has crept into our language even more recently, is a mixture of Greek and Latin stems; more proper terms would be "senidenary" or "sedecimal," or even "sexadecimal," but the latter is perhaps too risqué for computer programmers. One man who attended Mr. Phillips' lecture pointed out a disadvantage of the octal system for business purposes: "5% becomes 3.1463 per 64, which sounds rather horrible."

The first vacuum-tube computer circuits were designed in 1937 by John V. Atanasoff, and the first relay computer circuits were designed independently in the same year by George R. Stibitz. Both men used the binary system for arithmetic in these planned computers, although Stibitz developed excess-3 binary-coded-decimal notation soon afterwards.

The first high-speed computing devices actually built, in the 1940's, used decimal arithmetic. But in 1946, an important memorandum by A. W. Burks, H. H. Goldstine, and J. von Neumann, in connection with the design of the first stored-program computer, gave detailed reasons for their decision to make a radical departure from tradition and to use base-two notation. Since then binary computers have become commonplace. After a dozen years of experience with binary machines, a discussion of the relative advantages and disadvantages of binary notation was given by W. Buchholz in his paper "Fingers or Fists?" [*CACM* 2 (December, 1959), 3-11].

Many interesting variations of positional number systems are possible besides those we have discussed so far. We can, for example, use negative or complex numbers for the radix; or we can use both positive and negative numbers as digits. For the theory and history of these number systems, see *The Art of Computer Programming*, Vol. 2: Seminumerical Algorithms, by D. E. Knuth (Addison-Wesley, 1969). References to the original source material from which the historical information in this article has been gathered may also be found in that book. ■

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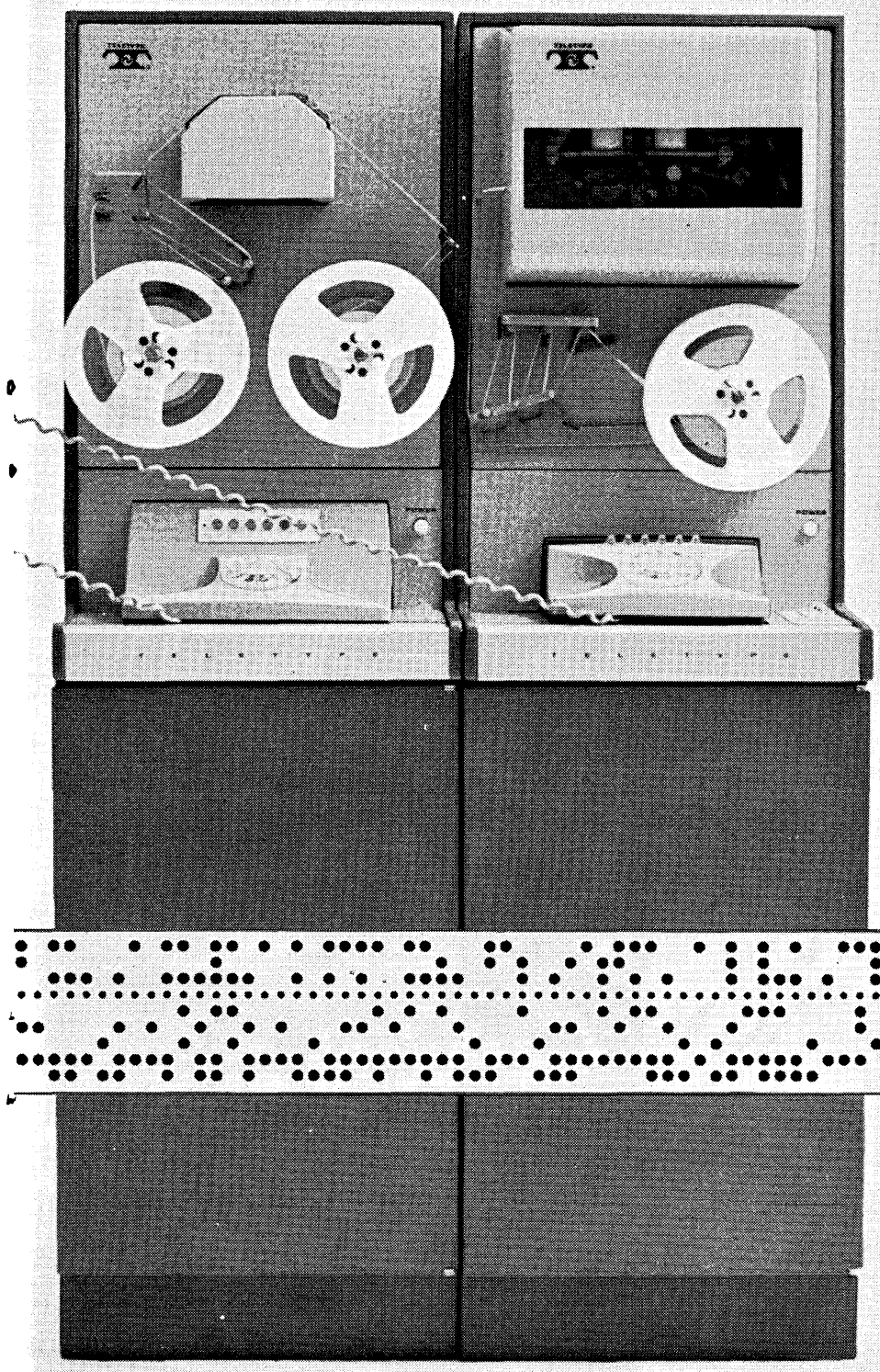

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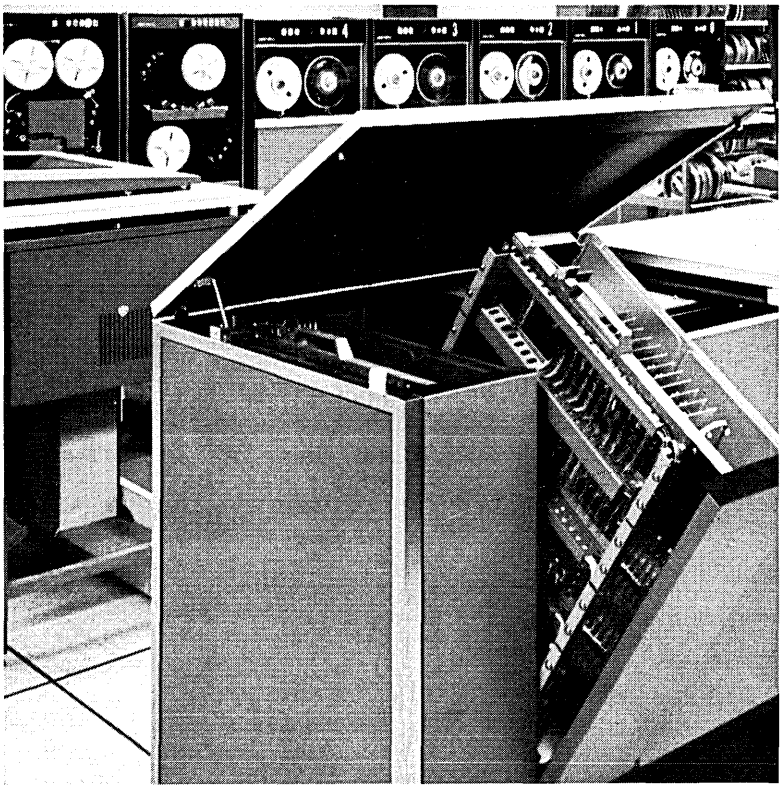

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news scene

an interpretive review of recent important developments in information processing

SWEET SUE: ANOTHER FIRM TAKES A SWING AT IBM AND JUSTICE MAY LEAVE NEUTRAL CORNER

While much of the rest of the computer industry provides moral, if not substantive, support, Control Data Corp. and Data Processing Financial & General prepare—through antitrust suits—to attack all ramparts of IBM's Grey Fortress in hopes of changing the entire complexion of the computer business and the distribution of the shares of the market. And at writing, rumors spread that the Justice Department would follow with its own antitrust suit against IBM. (By now the reader should know if the department followed its many precedents of announcing such suits in the interregnum between administrations, such as the filing against IBM in 1952, resulting in the Consent Decree of 1956.)

On Jan. 3, DPF&G filed its 39-page complaint in the federal district court of the Southern District of New York alleging violations of antitrust laws, the Consent Decree of '56, and the state unfair competition laws. In a move as bold as the rise of the leasing industry iself, DPF&G, which now owns well over $170 million in IBM systems, asked treble damages of $1,054,500,000 and a separation from IBM manufacturing activity of its software (including education and systems engineering services), maintenance, and leasing. These three services would go under three separate companies that would be enjoined from use of the IBM name and any cooperative marketing effort with other IBM subsidiaries, and would be required to buy services or equipment from such IBM entities at the same price as the rest of the industry.

DPF&G is concentrating first on the bundling issue—the provision, in varying combinations for purchase and rental, of software, maintenance, education and engineering services under a single unseparable price for equipment. The claim is that bundling, along with alleged practices like discriminatory policies in maintenance and "intimidating users planning to acquire competitive peripheral equipment by threatening to withdraw general technical support," has restrained free competition and denied the customer a free choice in selecting services and equipment. The suit also calls IBM down for policies that have discouraged purchase in favor of rental, including some practices above; an unfavorable purchase lease ratio; and "subsequent user" label and practices for used purchased systems.

new markets

What DPF&G is fighting for is the opening up of new markets for itself and consequently for others. Maintenance is a case in which there has been very little activity by independent firms since IBM includes maintenance in rental, accounting for 80% of its installations; it is almost the sole supplier of maintenance for purchased equipment because there are so few competitors. DPF&G also claims IBM has discriminatory parts pricing and makes it difficult to obtain them. Thus, it feels a separate IBM company for this function, forced to buy parts from IBM at the same price as everyone else, would be the equalizer. The firm also wants to broaden the non-IBM peripheral market, which it has entered by becoming distributor of Ampex tape drives; IBM marketing practices and the lack of maintenance firms, it says, have obstructed this market. (Most users do not like having to deal with more than one maintenance contract and, reasons DPF&G, they wouldn't have to if there was a big enough market for maintenance companies that can service both IBM and non-IBM equipment—a boon to the mixed-equipment installation.)

DPF&G also wants a better software market to attack. This business is generally thought of as being a poor business for substantial profits, a condition which will not improve as long as software, including basic operating systems, are included in the IBM equipment price. The suit claims that software, including education and engineering support, accounts for as much as 70% of system cost, and the plaintiff intends to introduce evidence to that effect.

But as important to them as the new markets, DPF&G and other leasing firms are fighting for the continued existence of their leasing activity as it is practiced today. Acquisitions of new 360's are coming to an end, and if the trend developing at IBM is an indication—an enlarging gap between the purchase and rental price and higher maintenance prices on purchased systems—future systems may be too costly for third-party lessors. This situation, says DPF&G, violates the Consent Decree, which demanded sale as well as rental of IBM equipment and a "commercially reasonable relationship" between the two. A separate IBM leasing company, even though it could compete with lessors, would have to buy its equipment at the market price—another equalizer.

Harvey Goodman, president of DPF&G, foresaw IBM's initial response to its complaint. IBM said that the "conditions to which DPF&G apparently now objects were in effect at the time it went into business in 1961. Furthermore, they have been the basis of the relationship between IBM and all of its customers for many years and have been well known." The firm enumerated the changes it has made "advantageous to the growing number of leasing companies," which Goodman has "publicly applauded." These include "subsequent user" services (classroom education, programming systems maintenance, and installation planning assistance), withdrawal of maintenance price increases "because of fixed price contractual agreements" of lessors with their customers, and lifting of limitation on the dollar amount of debt for an individual customer.

"Most recently," said IBM, it announced that "by no later than July 1, 1969, it expects to make changes in the way it charges for and supports its data processing equipment." But in a new twist of words not existent in the original announcement, IBM said, "The changes are aimed at determining what support services should be separately offered and priced to better meet the future requirements of all users of IBM equipment." The previous implication was that the changes would entail some separate pricing, rather than serve as a determinant, an interim measure, for what might be an ultimate policy in separation. IBM, however, says its response to DPF&G on separate pricing has the same intent as the original announcement.

goodman statement

Goodman, in his statement announcing the suit, said, "This lawsuit

has been in preparation for nearly a year. During that time, we have on numerous occasions discussed our grievances with IBM in an attempt to resolve them without litigation. Our principal aim has been and still is to establish free and open competition in all areas of the computer industry. We believe that IBM recognizes that major changes in its methods of doing business are necessary to achieve this aim, but we are no longer willing to accept the vague promises and foot-dragging which have characterized IBM's past responses to our complaints. We have also participated in numerous discussions on this matter with other members of the Computer Lessors Association, and they welcome the present action as not only timely, but necessary." Should DPF&G win its case, sources expect other lessors to file for damages as well. Goodman's organization, by the way, says it "is prepared to justify" the damages of $351,500,000 (trebled in antitrust settlements) on a complaint-by-complaint basis. (A spokesman, reached after the IBM rejoinder, was amused by the IBM defense of its practices. Sitting on what DPF&G considers a powderkeg of evidence, he said, "They think just because their illegal practices have existed for so long, nobody has the right to complain about them.")

An examination, if only cursory, of the implications of the suits, including the possibility of government suit, and of voluntary actions by IBM, would seem to be necessary here.

One antitrust expert guessed that the Justice Department would file suit. He noted it is not unusual for such actions to be started between administrations, but if the department did not act before Jan. 20, he said that except for the Truman administration, it has been the Republican administrations that have traditionally and paradoxically (being the big business party) generated the most antitrust actions. Certainly, it has been widely printed that the department was investigating the computer industry and IBM in particular.

Given the filing of such a suit, this expert opined that CDC (which filed suit in December) and DPF&G would wait for its outcome (the Consent Decree of '56 took four years to evolve). Should the government actually go on to win its case, proving antitrust violations, CDC and DPF&G would use this as evidence, not having to prove violations but only the fact that they were damaged in the amounts claimed. However, should Justice and IBM "strike a bargain," he said, meaning agree on a Consent Decree without actual prosecution of the case, the private firms would then have to prove all allegations. (Private suits also cannot be used as evidence by another.)

Another lawyer interviewed did not think the Justice Department would "try to win the case for CDC and DPF&G," since that would open up IBM to treble damage suits from everyone running "into billions of dollars," which "could only be harmful to users and competitors alike." Should the government remain silent, CDC and DPF&G both reportedly intend to take their suits to conclusion in the courts, which will, of course, take years. (DPF&G is reported to already have invested $150,000 in the suit, and is quite prepared to finance the litigation.) DPF&G, for one, claims powerful evidence to prove its charges on both the stated policies of IBM and on improper conduct. While many in the industry think CDC has merely bought time to market its 7600 supercomputer, expecting the suit to keep IBM from announcing a competitive system, sources close to CDC say the company is serious about the *entire* suit, which runs a gamut of complaints far exceeding DPF&G's in scope, and has gathered supporting evidence for them. Sources also say that more "help" is pouring into both firms from around the industry.

open the vaults

With any of these suits comes the right to discovery, which means that the tightly sealed vaults of information on IBM will have to be opened to the plaintiffs. It's likely that the IBM documents will go into a "national depository" to which all plaintiffs will have the same access, eliminating the need for the IBM to reopen its books for each one.

And what if the cases all do go to trial? It is not within the purview of this article to discuss all the issues and precedents. Both private firms (if the government does not try) will have to prove that IBM has committed violations in the past and continues to do so. Even if present policies are found to be in violation if continued, they may not be found to have been so in the past. A case in point, although not a true parallel, is U.S. v. Jerrold Electronics Corp., 1960.

Jerrold was accused of tying-in practices in violation of antitrust laws in the sale of its CATV systems, which inseparably included a service contract. Improper conduct in marketing policy was also charged. Jerrold, it should be pointed out, had begun its CATV marketing in 1951 and had sold 250 systems garnering $870,000 in deferred payments over five years. Thus, in stating the following court judgment, the fact that this was a minute, shorter-lived market in comparison to the computer industry should be taken into account:

"The trial judge finds that Jerrold's policy of selling its equipment exlusively on a full-system basis and in conjunction with a service contract, while not shown to be reasonable at all times in which it was in effect, was never intended by the defendants to drive competitors from the business of supplying equipment for community television antenna systems and to achieve a monopoly in this field for Jerrold. Among other things, it must be kept in mind that this policy was evolved and put into effect when Jerrold first marketed community antenna equipment. At that time, both RCA and Philco were entering the business. Furthermore, the future of this brand new field was quite uncertain. It is highly unlikely that the most ambitious businessman would enter this business from the beginning with a policy intended to force such formidable competitors as these from the field and acquire the power to control prices or foreclose access to this market . . . letters and memoranda of the defendants . . . indicate their purposes were to promote the interests of their customers and to protect their investment in both the individual systems and the industry as a whole. The fact that this policy may have been continued beyond the time it was in fact actually necessary does not mean that the defendants were not acting in good faith in maintaining it as long as they did.

The company was enjoined from continuing these policies.

thorough examination

Now the plaintiffs against IBM are hoping to show that IBM in 1954 or at some point in time since then should not have been bundling its services because it was no longer necessary and did lead to monopoly. That, of course, is only one issue, but it will lead to a thorough examination of the industry and the growth and competition in every submarket.

Should DPF&G win its case, what are chances of the court granting the relief asked relative to the division of IBM's services? The antitrust expert says that it is rare in private cases to be successful in this regard. The federal government, which can force separation or divestiture, may take that matter into consideration in deciding whether or not to sue—meaning it will have to determine if there are violations and these can best or only be solved by such separation.

Should IBM announce a comprehensive separate pricing policy, it re-

mains to be seen if it will satisfy the federal government (depending on whether past violations are adjudged). DPF&G says that it will not be satisfied until the case is prosecuted and the company separation asked is achieved.

It becomes apparent that the "Pandora's box" has been opened and the "era of bland acceptance of IBM domination of almost every computer market is at an end," said one philosophical observer. "The idea that there are more riches to be had if IBM's hold on them could be loosened is catching fire and it is not likely to die until the current situation is significantly changed. First the revolt in the universities, now IBM." —AP

REDCOR ACQUIRES DECADE COMPUTER; BORGERS NOW HEADS COMBINATION

"The Wall Street Journal didn't misquote me," Emil Borgers says. "They just put my answer to one question together with a different question." The way it came out in the Journal, reporting on Redcor Corp.'s acquisition of Decade Computer Corp., Borgers seemed to be saying that the Redcor board of directors made him chairman, president, and chief executive officer "in recognition . . . of what the company needed for growth." The question he was really answering: "Why did Redcor acquire Decade?" Maybe a reasonable answer to the *other* question would be: he did all right as part of the founding group at SDS and as executive vp at Systems Engineering Laboratories.

The acquisition was put together in outline form at a meeting the night before the presidential election and became a reality, with the financial help of Loeb, Rhoades & Co., just before the end of the year. Borgers, who had been president of Decade for a brief period, brought along Dallas Talley as head of marketing—a job he had also held at SEL.

Indications are that Borgers will follow the general outline that has meant success for SEL—emphasis on the engineering/scientific market with the added attraction of offering a system package with a computer built into it. This is what he has to work with:

Redcor, Canoga Park, Calif., was founded in 1956, with three people, and soon earned a good reputation for its amplifiers. For example, Packard-Bell used Redcor's designs. The company added other related products, grew steadily, and went public in 1965. Now it's into i.c. testers (an area that interests Borgers because of the possibility of computer control), analog/digital converters, data acquisition systems, and some software for fitting these components into computer-based systems. Redcor also owns Zeltex, Concord, Calif., a maker of analog computer elements and (still more) amplifiers; 49.8% of Digital Data Systems in Houston (involved in legal quarrels with the ill-fated Westec); and, of all things, the Acme Electric Welder Co. in Vernon, Calif.

"I went down there," Borgers said, "and they were building a machine to weld this thing that looked like it might be able to fly. So I asked them what it was and they said they didn't know but they sure knew how to make a welder that would turn out lots of them."

money problems

Redcor hasn't been much of a swinger financially in the last three years. Sales have stayed in the $6-7 million range and net income was negative for 1966 and '67. Last year, the company came up with $65K net but Redcor was doing all the money-earning with Zeltex in the red again while DDS, referred to irritably in the yearly report as "Associated Company," contributed a $76K loss. Another yardstick: Redcor had over 300 employees in 1968 but is down to about 140 people now—not necessarily a bad thing for profits.

"We could turn out the lights here (in the executive offices)," Borgers said, "and just keep the production people if we wanted to show immediate profits. There's a steady market for some of these products without much selling to do."

What Redcor is getting in Decade Computer is a small (60 people), new company—founded about a year and a half ago. Observers have said that Decade had a good machine but not very strong marketing.

"They were all right," Dallas Talley said, "until they sold something." And, since they had sold about 25, they were operating at a loss when the acquisition took place.

The main problem, as Borgers sees it, was Decade's determination to sell their computer for business applications. The basic Decade machine is a 16-bit unit with 1 usec memory; it comes in several models, but the simplest 4K core version can be had for $12,800. Thus it competes with models from the well-established mainframe producers—plus the horde of newcomers being announced as fast as the news releases and sales brochures can be printed. But attacking the business market, to avoid much of the competition, doesn't work because, Borgers thinks, the prospects just don't understand computers. So every sales job is a major project.

But how is Redcor going to deal with the competition?

"I wouldn't give a nickel for the chances of most of them surviving," Borgers said. "Engineering isn't the critical factor anymore. Now it's marketing and costs. You've got to have a gimmick."

marketing approach

Borgers has *two* gimmicks: one is the combination with Redcor and the other is going all out to get the best salesmen.

The Redcor contribution means that the combined companies can "align computers with front-end instrumentation that has a good reputation and offer good systems work . . . selling computers to yourself is very profitable." Redcor's standard products should get a boost, too, from the enlarged organization. They're now sold by reps—and many of them will continue to be—but the revamped organization will offer service from district offices, instead of sending the man from the factory.

As for the second part of the formula, Borgers and Talley have spent much of the first three weeks of operation since the acquisition rushing around the country courting good salesmen. Some results: Chuck Gallagher is leaving Varian to head the Los Angeles office; Homer Thornton, former southwest district manager for SEL, will set up a Dallas office; Tom Allison, with Decade a few months but before that a Honeywell branch manager, will open a Chicago office. A New York office is next, but the proposed manager has not yet surrendered.

In between lunches with prospective salesmen, the new management has concluded a contract with Colorado State Univ. for a Redcor 685 system using an 18K Decade 70 (this was a conversion from an order for the system with a now-competitive computer); bagged a four-computer system order from Lockheed-Georgia worth a quarter of a million; and expects to close a deal for a bulk order of processors within 10 days.

As for the business marketing approach, Borgers is considering some alternatives—such as letting some other company well-established in the business market make the Decade com-

(Continued on page 105)

The makers of world-famous Ithaca precision shotguns rely on Caelus disk packs to have the right part at the right place at the right time. This will not improve a marksman's score or a hunter's luck, but it does remove one alibi for a poor showing.

Cælus Memories, Inc., 967 Mabury Road, San Jose, California 95133. Regional Sales Representatives: Atlanta (404) 233-2244; Chicago (312) 234-9050; Los Angeles (714) 525-5317; New York (201) 461-6313; San Francisco (415) 347-7077; Washington, D.C. (301) 654-0883.

mercial model under license or handle the marketing while Decade does the manufacturing.

How about more computers in the product line?

"You can say," Talley told us, "that we're considering additional computers that could be either up or down in cost from the 70."

You can't decide everything in the first three weeks. —WR

USERS RALLY FOR SECOND-HALF EFFORT TO KEEP MA BELL OFF THE SCOREBOARD

"The commission has pushed us back to the midfield stripe after we carried the ball to Ma Bell's one-yard line. It will be harder to march up the field a second time."

This is how one knowledgeable user interprets FCC's acceptance, last Dec. 24th, of Ma Bell's foreign attachment tariff proposals. The decision permits independently made modems, acoustic-inductive terminals, and communication systems to be linked with the public telephone network, provided the user in each case also acquires a "connecting arrangement" supplied exclusively by Bell. The connecting arrangement includes a "network control signalling device." In petitions addressed to the commission before Dec. 24th, users had vigorously denied that Bell must be the exclusive supplier of network signal control equipment. FCC told its common carrier bureau to try settling this argument, and several subsidiary ones, through informal discussions with representatives of AT&T, users and equipment makers.

It was the call for informal discussions in place of a formal investigation, rather than the commission's acceptance of the tariff, that seemed to bother users most. FCC commissioner Nicholas Johnson was also bothered. In a dissent appended to the Dec. 24th decision, he wrote: "It seems highly unlikely that (informal) negotiations can lead to any substantial changes in the telephone company's position on (network control signalling) . . . The question must be explored in a full hearing . . . since Commission action to remedy an unreasonable tariff must be after hearing. There is no point in not instituting such a hearing at the outset, and the failure to do so can only result in unnecessary delay. Informal procedures have no advantage over the formal hearing process in this situation."

Informal discussions, adds an attorney for one of the users involved in the dispute, will also enable AT&T to meet privately with individual customers in an atmosphere where parochial interests can be discussed frankly and deals can be made easily. The disunity among Bell customers and independent telecommunications equipment manufacturers should make it particularly easy for AT&T to divide and conquer, he adds.

continued control

The new tariff provides users with a substantial opportunity to cut costs, and gives independent equipment makers a substantial new market, at least potentially. But communications experts believe Bell's continued control over the connecting arrangement could substantially limit both of these benefits—basically because the design of the connecting arrangement constrains the frequency range, amplitude, and other operating characteristics of customer-supplied terminal devices. One such operating characteristic is automatic calling and answering capability. If a time-shared computer, say, is linked to the public telephone network through an independently made modem, somebody must be stationed at the Bell-supplied network control signalling device to dial outbound calls and route inbound calls. Bell has promised to provide a device or devices to automate these functions, but when the equipment will be available is uncertain and the charges are even less defined. FCC will almost certainly be asked to reconsider its Dec. 24th ruling. If the Justice Department is among the petitioners, there's a better than even chance, according to lawyers for various users, that the commission will scratch informal discussions and launch a formal investigation.

The Justice Department's latest pronouncement on network control came just before Dec. 24th, when it commented on the revised AT&T tariff proposal that was subsequently accepted by the Commission. "We believe it is of critical importance that the (telephone company) monopoly be confined to the minimum area necessary" the Justice Department commented. ". . . Generally . . . the (common carriers') appropriate role is to supply facilities for the transmission of information, for this is the field in which duplication of facilities may be prohibitively expensive. . . Production and sale of equipment which perform network control signalling are not fields in which duplication of facilities may be prohibitively expensive . . . For these reasons, we believe that the general prohibition (in the tariff on customer-supplied network control signalling equipment) cannot be justified on the theory that providing (this equipment) is an indispensable part of the carrier's service."

AT&T has insisted that providing network control signalling equipment *is* an indispensable part of its service responsibility, for reasons so obvious that no investigation is required.

The FCC majority, in their Dec. 24th ruling, apparently subscribed to AT&T's argument, in effect, when they said the Carterfone decision was concerned with "what could be connected or attached to" the public telephone system. The Carterfone decision "does not hold that a customer may substitute his own equipment or facilities (whether it be telephone instruments, loops, poles, or central office equipment) for that furnished by the telephone company in providing message toll telephone service as that service is defined in the tariff."

"Why not?" asks one user's attorney. "If a customer can save money, without harming telephone service, by attaching an independently made terminal or modem to the telephone line, why shouldn't he also be able to supply a network control signalling device that is equally harmless and beneficial? Essentially, this is the position the Justice Department advocated."

certain inconsistency

The commission majority implied that its position on network control contained a certain inconsistency when it said: "Although the tariff bar (against customer-provided network control signalling equipment) is not in conflict with our Carterfone ruling, the question remains as to whether" the telephone companies should allow use of such customer-supplied devices. "We believe that we will be in a better position to make these determinations . . . after we have had a reasonable opportunity to closely observe the effects of the substantial changes now being effectuated . . . in the interconnection tariffs." So, AT&T was told to implement its tariff, and was also told to meet informally with the common carrier bureau and with other involved parties "to ascertain what further changes are necessary."

The Justice Department, after looking at the same evidence, arrived at a somewhat different conclusion. It recommended acceptance of Ma Bell's tariff proposal temporarily, adding that "the Carterfone decision places

the burden on the carrier to show the likelihood" of adverse effects being imposed on the telephone network by customers who supply their own network control signalling equipment. Justice then repeated earlier recommendations for a formal investigation. Because of this statement, the government is likely to file a petition for reconsideration, say users' lawyers.

Meanwhile, Bell operating companies have begun filing changes in intrastate tariffs to permit use of customer-supplied terminals and communication systems. These filings will also contain the charges for the connecting arrangements that link customer-supplied equipment to both interstate and intrastate phone lines.

New York Bell's tariff proposal was filed Dec. 23rd and was suspended by the state public service commission so it could hear from users. Under this proposal, the user would pay $25 for installation of a data terminal connecting arrangement, plus $2/month for service. The voice terminal charges would be $20 and 50 cents, respectively. Both would be "in addition to the standard charge for telephone service." Also, where a maintenance visit was made to a subscriber's premises and the trouble resulted "from subscriber-provided equipment," New York Bell would charge him $15/service call.

In some states, the "standard" part of the line charge levied against operators of on-line computer systems has been increased 50% (see Jan., p. 75). There are rumors that other operating companies plan to follow suit. Users' spokesmen see this development as a rallying point for the often-quarrelsome forces that have been fighting to remove AT&T's foreign attachment ban. If the opposing camp does become unified, FCC may be asked to exercise greater control over charges for telephone facilities used in interstate service. The commission's authority is indirect at present, and largely ineffective, say users. They believe that despite legal restraints in the Federal Communications Act, the commission has the authority to do much more. —PH

SECOND ANNUAL MANAGEMENT MEET EXAMINES THE MILIEU OF MIS

American society is engaged in an historic experiment, submitted George Weinwurm of System Development Corp.; namely, "Whether a modern, technologically oriented and technologically driven society is capable of being managed in a democratic way." This is the larger issue at stake that ought to be considered when discussing the management of data processing applications. Speaking at the Second Annual Management Conference sponsored by Brandon Applied Systems, Inc., in January, Weinwurm said, "I am convinced that the way in which we manage computers, and the way in which we must manage the way we learn about managing them, will in the decades to come have a very great deal to do with whether that experiment will yield . . . a successful outcome."

With this, Weinwurm launched into a discussion of management information systems, the reasons for the failure of many formal information systems today, and some of the remedies that must be applied. "It is ironic and tragic," he said, that "despite the enormous effort and attention that has been lavished upon the development of computer-centered management information systems in recent years, it is indeed rare that a management substantively uses—still less primarily relies upon—the output of a formal information system in making policy decisions of any consequence."

He noted that "the process by which such systems are developed and applied is not understood sufficiently well to enable that process to be managed effectively and reliably." Managers understand only imprecisely how they really make decisions; and management scientists have not helped that much.

following tradition

One of the problems is that MIS systems are often treated as highly automated extensions of traditional accounting and financial reporting systems, which has "brought no end of difficulties" to those who must translate the concept of the MIS into actuality.

Most companies, Weinwurm said, conceive of MIS as an "objective and neutral mechanism" for gathering and relating data, which it cannot be because managers who input data are not objective and neutral. "People almost always succeed in using information systems to achieve *their* ends, however much the systems' designers may have intended otherwise," and the introduction of the computer won't alter this.

Too, the unit cost of gathering, manipulating, and outputting data has gone down because of the computer, but many systems are being designed as though this cost were as high as it was with the traditional accounting and reporting systems. Thus, the MIS is being constrained from achieving its real potential.

Another cause of MIS failure is that it is looked upon as a problem in technical implementation, being staffed largely with specialists in finance and data processing. It must be people-oriented, taking into account the "psychological, political and, above all, motivational dimensions that are the locus of effective management decision making and action."

The user must: accept the application of the computer to MIS as a developmental task, not a production task; realize the fact that MIS development is a long-term process requiring much fundamental education; manage the system requirements, which are bound to change in response to the organization's dynamic needs; manage the systems configuration by setting standard approval procedures for creating and modifying computer programs and/or data bases and for documenting and disseminating information about the system; and manage the collection of system experience, so that it can be analyzed to yield some useful information about relevant aspects of an organization.

some seem to know

The speech that preceded Mr. Weinwurm's discussion, but actually appeared to be a good example of management awareness of the problems faced in developing an effective management information system, was that of Robert W. Lear, president of Indian Head, Inc. Indian Head is a 16-year-old corporation with over $450 million /year in sales, 20 operating divisions, and about 60 plants. It has acquired 41 diverse companies since 1953. And three years ago its data processing activity was insignificant.

The firm has embarked on the requisite procedures of corporate and divisional managing: short-term and long-range planning, the responsibility of every manager in the company. Indian Head has the problem that all computer firms that aspire to become conglomerates have: record-development and records-keeping at the corporate level of data from acquired firms that each came with different documents, terminology, inventory control, etc.; accomplishing planning at the corporate level without destroy-

ing the individual and entrepreneurial character of each manager and company; and the need to react quickly and flexibly to business changes and new acquisitions.

"We are not doing our planning at Indian Head nearly as well as we know how to," said Lear, and "one of the biggest factors influencing our progress is equivalent progress in developing and refining our management information systems," defined as a "network of related systems designed to provide information necessary to plan, direct, and control major business activities." The computer is not applicable to all areas, he said, and he made it plain that he does not see himself with an on-line crt on his desk—that will go to those who need it on lower management levels.

Indian Head, he said, is "taking time to indoctrinate our management group into the mysteries of MIS." For the near future, the firm is putting the "best and simplest" MIS at each plant and office, working to standardize procedures and adopt a common language and compatible equipment. This is a "big order," since the firm now has computers in eight divisions and is using outside computer services in 11 of the 12 divisions; of IH's top 20 information specialists, 15 have been there less than two years. Lear noted that in addition to the need to educate management on data processing, the data processing personnel must also be educated on the structure and problems of the company.

Recognizing the difficulties of a long-range MIS plan, Indian Head does not intend to have its divisional long-range plan ready until late 1969, and an overall plan until early 1970. While the firm wants a system that will help it improve all operations and methods of planning, it does not want to produce a "mechanical fishbowl to show visitors," or simply to replace $5,000 clerks with $15,000 programmers.

packaged training needed

Joseph W. Lowell Jr., director, ADP Management Training Center, U.S. Civil Service Commission, tore into data processing people for "contributing little to the solution of their real training needs," and for being "a major part of the problem. . . . By overemphasizing their legitimate need for technical updating, they have neglected their even more pressing need for training in management skills." This problem has had a "dreadful impact on the kind of data processing training" offered to the non-dp manager, who has been forced to ask for defensive training—"how to cope, how to avoid being snowed, how to ask seemingly meaningful questions without giving away one's real ignorance."

Lowell said the industry has provided "appreciation" training for managers and "updating" training for system analysts, but such courses should be packaged via programmed texts, CAI instruction, and audio-visual aids. The classroom should be used, he thought, to provide sharing of experience among professionals, and to educate the non-edp user in what the professional computer man does, via hands-on programming and systems training, so that he will not fear "things electronic" through ignorance. A curriculum for systems analysts is not the impossible task some maintain, he said, and recommended the one outlined by the participants at the conference funded by the Office of Education in May 1967. Most interesting about it, he said, was that the most important requirements for the systems man were considered to be his abilities to think like a manager in designing systems and to communicate.

The conference as a whole was treated most to eloquent generalities, which provided the attendee more with fortificaton that his MIS, training, and other problems were what he thought them to be than with any tangible practical solutions that he might try to apply.

class

In this atmosphere of eloquence, political commentator William F. Buckley, Jr., as the luncheon speaker, was second to none. After admitting no knowledge of science and the fact that in conversation with Dick Brandon he had heard three English words he did not know (COBOL, FORTRAN, and IBM), Buckley proceeded with an impassioned exploration of the causes of current disorders. In the question period, Buckley was asked what might be done about the alienation of youth from business. He responded that businessmen seem to take "vows of banality," promising themselves to be perpetually dull when they walk through the doors of IBM or any other company. Businessmen, he noted, have "failed to intellectualize the meaning" of business and the validity of what they do. "America has produced many more brilliant businessmen than brilliant professors, which makes it more saddening that they've failed to do this," but, he conceded, businessmen cannot accomplish this alone, since the philosophy of business must be integrated into the political and economic philosophy of which it is a part.

Asked about his feelings on a national data bank, Buckley saw many benefits from such a depository of information—among them obviating the necessity of parallel research and helping the forces of law and order. He thought such a data bank inevitable, and the encroachment on privacy would come from the "use to which data are put and not the mere collection of them." A tribunal over such a data bank would be necessary to protect against violation. —AP

"I don't have the heart to tell him that figure's for monthly rental, not purchase."

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news briefs

PL/I UNSTANDARD AGAIN

The USASI Programming Languages Subcommittee has voted to abolish its five-month-old PL/I subcommittee, X3.4.9. The action was not surprising, since the movement in favor of PL/I standards and a PL/I standards committee was never overwhelming. Conceived in a six-to-six tie vote on Sept. 27, 1968, X3.4.9 was already the victim of attempted infanticide as early as Nov. 8.

Most of the same arguments were used in bringing about the end of the committee: the small number of prospective users, the uniqueness of the IBM implementation, the economic advantages to IBM and the disadvantages to other manufacturers, the lack of balance on the standardization decision-making body, and the impact on existing standard languages.

In the standardization case, however, the deicsion of the judges is not final. The motion passed by X3.4 must go to its parent committee X3, the Information Processing Committee, for final action, and that group had not acted on the motion by press time.

ACT EXPANDS INTO EDUCATION, PUBLISHING

Advanced Computer Techniques Corp., New York software and consulting firm, is rapidly expanding its operations, having recently formed an education and publishing subsidiary in New York, Inter-ACT, Inc., and an education and software firm in Italy, Inter-ACT Italia S.p.A., (a joint venture with Gennaro Boston Associates in Milan). It has also acquired Rhode Island Lithograph Corp., a printing firm in Pawtucket, R.I., and Informatab, Inc., N.Y., a data processing service for market research activities.

Inter-ACT, Inc., will provide advanced training for the user's programming and management personnel. Communications, operating systems, project management techniques, and simulation and modeling for new product development will be among the courses aimed at programmers and analysts. "Participatory" courses will also bring both groups together for discussion of interaction problems. At a later date, ACT will offer teaching and consulting to small classes of users with similar edp problems, and ultimately hopes to offer club membership to corporations, entitling them to training and free access to the school for informal discussions of problems. About 20 senior management personnel from ACT will teach the courses. Anthony Capato is technical director; Francis O'Reilly, administrative director.

Inter-ACT, Inc., will also publish materials in the computer field, the first due out this month: *The Guide to the Perplexed: A Directory of Information Sources for System 360 DOS.* This is the first in a series telling the user how, where, and in which order to look at software system documentation. The 130-page DOS guide abstracts and references 450 DOS documents. The second volume will be on OS/360, and others will be done on IBM and other manufacturers' systems. R. I. Lithograph Corp., $500K/year firm, will publish these volumes, as well as the manufacturer documentation ACT is doing under contract.

Inter-ACT Italia, S.p.A., will initially offer educational services in Italy, Spain, and Switzerland, and eventually will provide software and consulting. Co-owner Gennaro Boston Associates is said to be the largest (45 professionals) management consulting firm in Italy.

Informatab, Inc., is an eight-man firm which is grossing $250K/year with its service for data manipulation of raw data from market research questionnaires. ACT intends to develop other proprietary packages to provide diverse services on Informatab's IBM 1130, which will later be upgraded.

NAVY PREPROCESSOR MAY BECOME STANDARD

A preprocessor will be added shortly to the Navy's COBOL compiler audit package. DOD is likely to follow suit; it has already told the other services to use the audit package. If DOD decides that all the military services should also use the preprocessor, it could have much wider ramifications. The National Bureau of Standards is now working on a government-wide directive to implement the USASI COBOL standard. DOD acceptance of the preprocessing idea would encourage NBS to do likewise.

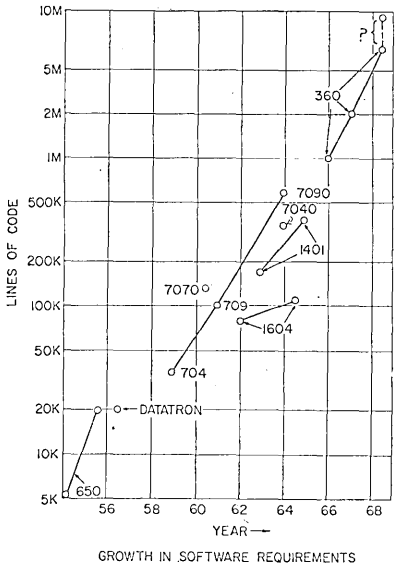
Implementation of the Navy's preprocessor, within the Navy, is likely next month or the month after. DOD action is possible shortly after that.

The Navy's preprocessor operates on source programs that encompass Level B of the DOD COBOL standard adopted late last year. A Level D preprocessor is under development, but no release date is available.

A Level B preprocessor contains a

IF YOU HAD SAID "SEND ME ALL YOUR SOFTWARE..."

. . . and the manufacturers did, this is the quantity you might have received at times over the past decade. The graph was prepared by Robert M. McClure of Southern Methodist University's Institute of Technology from data he has been gathering since 1963 and is based on a "variety of estimating techniques." The estimates are for the body of software that IBM calls Type 1 support and it appears that the volume of such programs increases about tenfold every three to four years. The last figure for the 360 indicates both the highest and lowest estimate in different ways.



GROWTH IN SOFTWARE REQUIREMENTS

This will give you a rough idea

. . . of where to start building a modular data terminal that is truly mated to the application. First, combine the utility of a customized keyboard and powerful function keys to fit the skill of the operator. Next, add an eye-level video display of data, program format, and operator instructions. Now, select an intermediate storage medium that offers the application spectrum of paper tape, but with the performance advantages and convenience of "snap-in" magnetic tape cassettes. Then provide cassette recorders for the off-line capture, verification, edit, and storage of information, plus a converter for transcribing to computer compatible tape. Let them all work under the control of a powerful, integral microprocessor whose read-only memory has been programmed for the job at hand. Be sure to include communications capability, but handle the interface cleanly and economically through "firmware", not hardware. Lastly, package all this capability in a handsome, self-contained desktop console, and you have the end result of the idea started at SYCOR, inc (formerly Systronics). For more about the idea . . . and the product . . . write us.

SYCOR inc

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total of six options; three will be available initially, the others should be ready in June or July. The initial options permit syntax and error checking, standards enforcement, use of shorthand for data descriptions and commonly used reserved words.

The other three options: permit each COBOL source paragraph name to be stored in a file, for later display, as that paragraph is sequentially processed during test of a COBOL program; write, to a single file, in chronological order, an image of each input and output transaction process, and each record from the files processed, providing a single source for all processed transactions and records, and eliminating the need to dump several files to examine their status before and after a test; provide a comprehensive cross-reference listing to assist in the location of related or identical data names.

CONGRESS TO HOLD HEARINGS ON COMPUTERS

Hearings probably will be held this month or next on a bill to computerize Congress. The legislation was introduced last month by Rep. Jack Brooks of Texas; its merits will almost certainly be evaluated by Brooks' GovOps subcommittee, so the chances of favorable action are excellent.

Basically, Brooks wants the General Accounting Office empowered to set up a computerized management information system that could be used by Congress to evaluate Executive Branch programs. The system would also report the status of bills wending their way through the legislative pipeline, supply references to material in the Congressional Record, store selected federal laws, and perform a variety of related information retrieval functions.

Reportedly, GAO is not particularly eager to take on this mission, feeling that its objectivity would become tarnished in the process.

The system proposed by Brooks would utilize the same data definitions, and have logical capabilities similar to those of a management information system now gestating within the Bureau of the Budget. Hopefully, this compatibility would enable agency heads and legislators to start from a common base in their arguments about how much to spend for what.

McKinsey & Co. is now defining BOB's system requirements, and should be finished next month. Sometime this summer, we were told, design of a system to perform the desired mission is scheduled to be completed.

In a speech to Congress last month, Rep. Brooks explained that his MIS proposal would help Congress make better decisions, and possibly save billions of tax dollars. "Higher quality information on government activities and operations would make deficiencies more apparent and susceptible to prompt correction. Duplication and waste, which now might get past the watchful eyes of the Budget Bureau, the President, and Congress, could more easily be avoided."

Outside observers, while admitting that such benefits are conceivable, suspect that computerization may make agency bureaucrats even less innovative than they have been in the past. These sources agree with Brooks when he said, in his speech, that ". . . cost effectiveness studies remain an art rather than a science. They cannot provide the answers to complex and difficult problems with mathematical certainty. They must be considered in the light of sound judgment and common sense." But the skeptics question Brooks' conclusion that, despite the shortcomings of cost-effectiveness studies and planning-programming-budgeting, Congress "needs the benefit of this capability."

The climate for passage of Brooks' bill, HR404, is favorable. When Congress convened last month, Speaker John McCormack alluded to the need for the Hill to exploit edp technology. A whole raft of bills attempting to carry out this thought were introduced in the last Congress; although none of them was enacted, they laid the groundwork for a stronger push this session. Another encouraging factor is the growing use of computerized management techniques elsewhere. As Brooks put it in his speech, ". . . to properly evaluate the work of the cost analysis experts of the Executive Branch and particularly the Department of Defense, we need our own experts."

Besides authorizing GAO to design "data processing and information systems," under the guidance of Congress, HR404 also empowers the agency to "enter into contracts with organizations or individuals, or employ individual experts and consultants . . . to assist in the development of such systems." GAO would also have a permanent cadre qualified to conduct and analyze cost effectiveness studies at the request of House and Senate committees. The bill authorizes establishment of a Division of Budget Information and Analysis in GAO to discharge these responsibilities. If the division is established, Ed Mahoney—now GAO's associate director of policy and special studies—is likely to be chosen as its director.

Rep. William Moorhead of Pennsylvania tried but failed to get a bill somewhat similar to HR404 enacted in the last session. He wanted the operation lodged in the Library of Congress, and was more concerned with retrieval of bill status information and similar data than with computerized management. Moorhead is reportedly redrafting his measure and may submit it soon.

GROUP FORMS TO SUPPORT CAI FOR MENTALLY RETARDED

Friends of the late Rhode Island Congressman, John E. Fogarty, have formed a nonprofit organization in his memory to study the use of computers in the field of mental health and to take action where feasible. The group's first effort will be to establish a program of CAI for retarded children at the J. Arthur Trudeau Memorial Center for Retarded Children in Warwick, Rhode Island, which has offered its facilities for the project.

Manager of the undertaking will be Rev. George C. McGregor, currently director of the Clinton Job Corps Center in Clinton, Iowa, and members of the committee are Eugene LaCasio, a member of the board of the Trudeau Center; Robert Sherman, executive director of the Center; Congressman Robert O. Tiernan, D-R.I.; and John Tierney, assistant to the director, Rhode Island Dept. of Health.

The first phase of the committee's research project on mental health programs involving the use of a computer is estimated to take three to six months and will cost $10K. A fund raising effort is under way and proposals will be submitted to government agencies, foundations and private organizations.

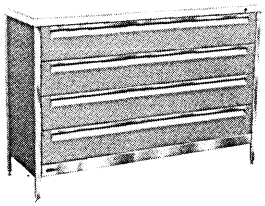
MAINFRAMERS DELAY ASCII IMPLEMENTATION

Uncle Sam's long-delayed ASCII implementation directive is likely to be delayed further. CDC wants numerous changes made and seems determined to fight for them. Honeywell is also reported to be unhappy.

Last December, both companies sent written protests to the National Bureau of Standards, which developed the proposed directive with the help of the Budget Bureau and General Services Administration. Concurrently, either or both computer makers protested to the Secretary of Commerce (NBS is a part of Commerce), and inspired Senator Walter Mondale of Minnesota to address a letter of in-

WRIGHT LINE . . . everything for data processing . . . except the computer

DISK PACKS and DISK PACK STORAGE



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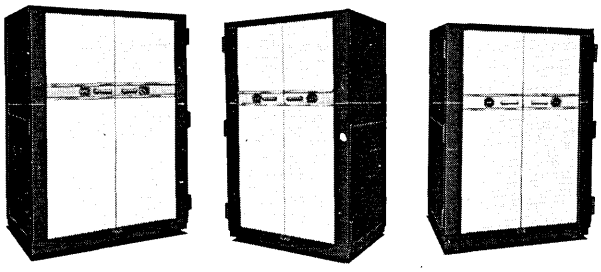

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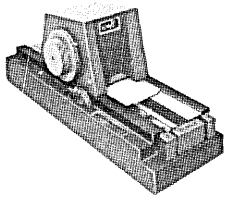

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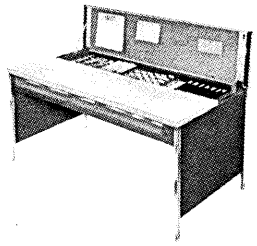
DATA STATIONS



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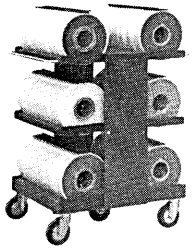

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quiry to NBS. Flack from the latter moves has caused "some delay" in the ASCII implementation timetable, one government official admits. As a matter of fact, it is anyone's guess when the directive will be issued. The document must be signed by the Secretary of Commerce before it can become effective. Current Secretary Stans is against federal interference in private business.

Basically, Norris and Company argued last December that the proposed directive discriminates unfairly against 6-bit cpu makers by requiring use of the 8-bit ASCII format for applications where it can't be justified. The result, for users, will be unnecessary recoding and reprogramming costs, said CDC, and 6-bit cpu makers will find themselves behind a competitive 8-ball.

Specifically, CDC wanted coverage of the proposed directive reduced, the implementation schedule stretched out, and further consultation between government and industry technicians before any directive became effective.

Under this scheme, only those files used for information interchange between installations would have to be formatted in ASCII; also, a user who wanted to exempt his system from the directive would be able to do it automatically, provided the application met criteria to be specified in the directive.

As currently written, the directive permits exemption only if the agency head specifically allows it and "coordinates" this action with NBS. The bureau is entitled to question the justification, and can try to get the agency head's decision overruled by an appeal to the Budget Bureau.

CDC also wanted ASCII subset standards developed before the directive was applied to installations requiring less than the full cast of characters. The company was particularly concerned about a user who, in the language of the proposed directive, "has no existing tape files or program libraries which prevent use of the federal standard." Such users would have to implement ASCII as soon as they acquired a system (others, who already had operational systems, would be given time). CDC felt this language would prevent its equipment from being considered by a new user.

Since December, there have been informal discussions between CDC and NBS. Both sides have given in somewhat, but there is still a wide gap between their positions. Notably, CDC is apparently willing to accept the ASCII collating sequence in place of the one it is now using. Also, the company appears willing to reformat its present 6-bit coding scheme, over a period of time, so that the bit configurations for each character are compatible with those for the same characters in the ASCII standard. NBS has assured CDC that present users of 6-bit CDC machines like the 6600 and 7600 will not have to recode their files or rewrite their sorting routines until these systems are ready for retirement.

The latest statement of what CDC would like to see in the proposed standard goes like this:

"The intent of Federal adp standards is to encourage the use of a compatible code and collating sequence wherever data is reported in character-oriented formats and to discourage the use and proliferation of character codes other than ASCII within the Federal Government. There is no intent to discourage the use of condensed numeric formats, such as packed decimal, binary or floating point, where the formats are technically or economically advantageous. These may be used for numeric information contained in internal files or, by prior agreement between sender and recipient, in files interchanged between installations. Furthermore, the use of compatible ASCII subsets, where these are adequate to the needs of an installation, should be viewed as being in full compliance with these standards."

An NBS official says: "We don't intend to limit federal adp standards to systems where 'data is reported in character-oriented formats.' Furthermore, we *do*, over the long run, want to discourage the use of condensed numeric formats in information interchange, and we don't want to have separate rules for internal files because you can never tell when these files may have to be interchanged. The use of compatible ASCII subsets is acceptable for the present and immediate future, but we don't regard them as 'full compliance' with the standard. Nor would we want to say that systems capable of handling only a subset, and not the full set, would be tolerated indefinitely, although they might be all right for several years."

GILL ADDRESSES HIMSELF TO COMPUTER PHILOSOPHY

Stanley Gill, now professor of Computing Science at Imperial College, London, has long been a combination of devil's advocate on matters of professional ethics and the spur goading government and industry out of moods of indolence on topics technical. Recently, he gave his address as retiring president of the British Computer Society to the handful (80) of the 18,000 members who made the midweek annual general meeting. His theme was that in comparison with other advances in technology such as mass communication through television, or nuclear development, the computer thus far has been a relatively harmless invention. Its essential function is the concentrated application of crystalized logic. But, Gill asked, from what witch's brew of software did the computer's logic crystalize, and whether the emotion might not still be there—secondhand and soulless—to be propagated from context to context through generations of software.

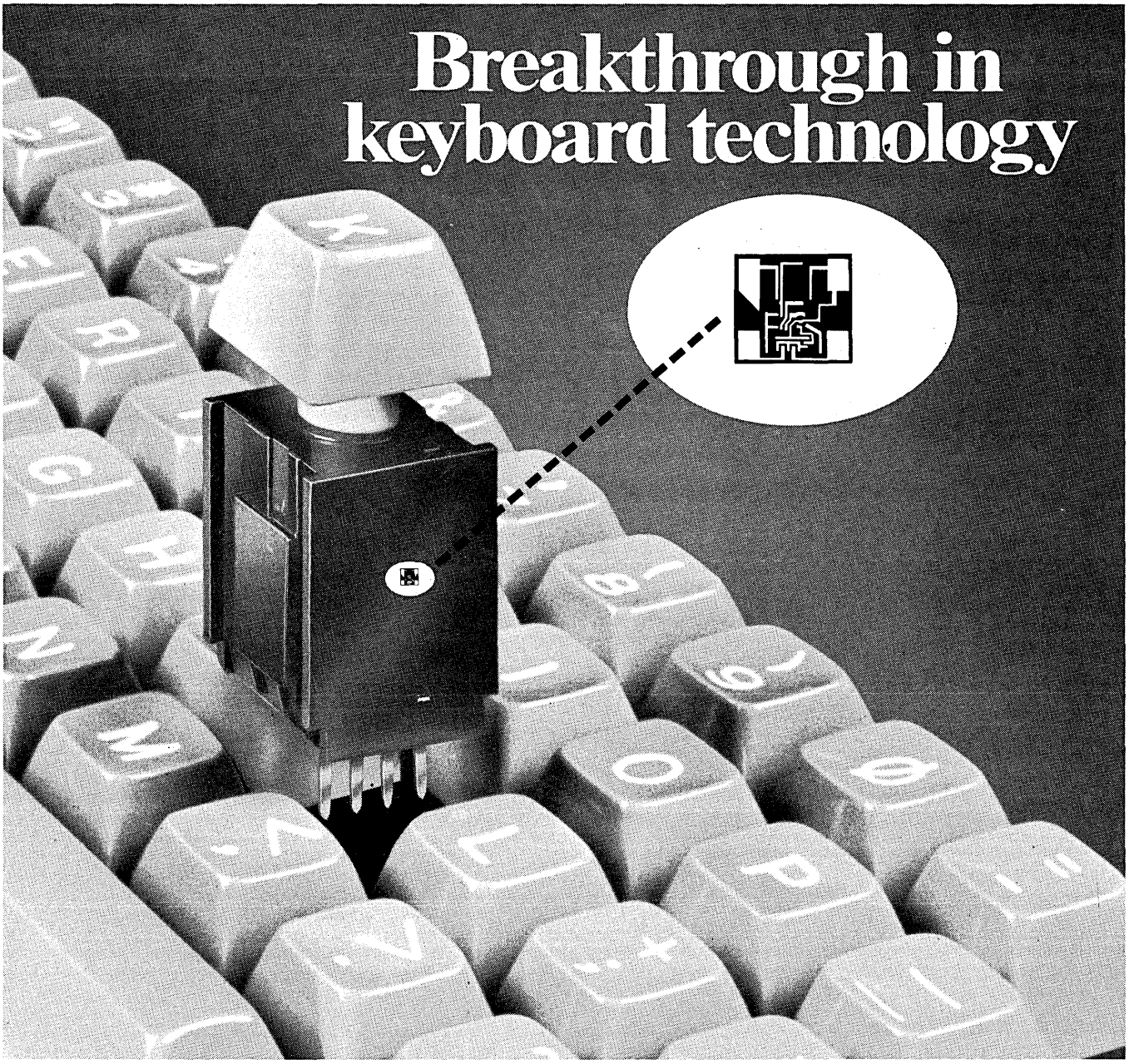
Professor Gill chose an intriguing illustration to extend his thesis in the light of present American and Russian programs of space exploration. He said, "Imagine that you are in charge of the complete set of software for all computer operations supporting a manned flight to the moon. Let's not spend time arguing about how all the trivial bugs can be cleared, but when they have been, how are you to be sure that what remains is pure logic, untinged by subjective and therefore controversial thoughts about how the mission should be conducted? Perhaps this is a meaningless question; perhaps we should ask: how can you be sure the programs faithfully reflect the subjective views of the management? Is this in fact the right criterion? What should you do if you suspect the judgment or the integrity of the authorities? On your answers will depend the lives of men, the prestige of the nation, and the climax of a colossal enterprise. And this is not science fiction; someone is wrestling with the task right now.

"To what extent should all of us who specialize in computing concern ourselves with what computers are doing to society? This is not a new question. It faced the engineers in the nineteenth century; it faced the nuclear physicists in the forties, and now also faces the biologists. Why should the technical expert bear any special responsibility for watching social issues? Is he not too close to his work to make impartial judgment of its effects? Should this not be left to the social scientists and politicians, whose responsibility it clearly is?"

Gill said the modest may draw comfort from such argument—there were those whose modesty would be justified—but let there be no false modesty on this issue. "Surely," he went on, "we are better equipped than the average citizen—or the average politician—to foresee the consequences of our technology and to judge how it ought to be applied."

Later, Professor Gill suggested that the computer professional should be as

(Continued on page 115)



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frank about the negative aspects of the technology as he is about its great potential. There should be awareness of dangers. He concluded: "Computers process information and information is power: power that can reduce waste and maintain justice, or dominate and victimize. What laws are required to encourage one and avoid the other? The question is a tortuous one, but if we find it hard to answer, how much harder must it be for legislators and politicians to whom a computer is a thing as mysterious as the human brain?"

RED CROSS SETS UP BLOOD CONTROL PROGRAM

In January, the Southeast Michigan Red Cross Blood Bank initiated a blood bank inventory program in the hope of finding and eliminating hepatitis carriers as donors, with a byproduct goal of salvaging up to 10K pints of blood that annually become outdated (whole blood is not used after 21 days). About one case of hepatitis will develop in every thousand transfusions, and because there is no test for the disease, tracing the suspected carrier and stopping a particular pint of blood before it is used is an almost impossible manual task.

Although anyone admitting to ever having been jaundiced is not accepted as a donor, there are persons who have never had this or any other symptom of the disease but are carriers. It is this sector that the program is trying to pinpoint among prospective donors.

Southeast Michigan Red Cross is using Mohawk data recorders (in remote batch during late afternoon) to transmit information of daily inventory—including the day's donations of blood—to the national Red Cross 360 in Alexandria, Va. Processed information is in printout form the following morning for the day's activities. This will include donor names to be checked against lists of suspected carriers already accumulated by the Red Cross and the 104 hospitals in the program. It will also be a reading of inventory of blood (type, date, etc.) in each hospital's blood storage banks to assure that the oldest is used before expiration.

The inventory program can also rapidly find certain types of blood for better interchange between hospitals when necessary. Each unit will be identified by group and rh type, hospital shipped to, and days remaining before expiration. Another byproduct of the program will be a donor list and ultimately a rare-type donor list.

"The optimum use of blood is necessary because of increased demand for surgery," said Dr. Frank Ellis, director of the SMRC Blood Bank program. "Shortages always develop over holidays, and this year's siege of Hong Kong flu made the situation acute by sharply curtailing donations to the point where all but absolutely necessary surgery was postponed."

The sleuthing job in carrier identification is apt to be a large one: about 100 suspect donors of the approximately 120,000 people resulting in 90K pints per year, with transfusions requiring up to 30 units (automobile and industrial accidents) in some instances with each unit from a different donor. An accumulated suspect list of 1200 names will be checked against for possible hepatitis carriers. The Red Cross collects about half the blood used in the five-county area of Southeast Michigan; a nonaffiliated agency collects a like amount, and it is hoped that agency will eventually come into the program.

This program is unique with SMRC and serves as a pilot that may later be joined by other Red Cross units.

TRACOR SPINS OFF TRACOR COMPUTING

Tracor Computing Company is what you might call a 100-to-1 shot. This new entry in the great computer derby, which is slated to begin independent corporate existence as soon as the SEC says OK, is a spin-off of Tracor, Inc., an Austin, Texas, firm that has hitherto been confined largely to scientific instrumentation and components.

In disclosing plans for the spin-off before a Dallas investment group, Tracor president Richard N. Lane candidly noted that one major reason for the move is to give present shareholders of Tracor a "bargain" in a new stock. "While Tracor, Inc., might never reach a price-earnings ratio of 100-to-1, this new computing firm could reach that point easily," he said. He also observed that an independent TCC would be better able to attract top computer people through attractive stock options.

The new company will begin life with about $5 million in capital, partly derived from its doting parent, partly from the public sale of stock at $2 per share. (Tracor shareholders will have the right to purchase shares in the new company based on their holdings in the old.) The money will finance the development and production of computing devices for specialized and primarily scientific applications such as pathology testing for hospitals, quality checks for little old wine makers, and other "applications environment" uses. Costs for these new systems would range upwards from $70K. The new venture would also encompass computer service centers, to open in as many as eight cities the first year, which would provide specialized hardware/software services.

President of TCC is Dr. A. F. Wittenborn, formerly a group vp with the parent firm. Dr. Paul Wrotenbery, formerly with IBM's Data Processing Division, is vp and general manager. Prexy Lane anticipated that TCC revenues would hit $10 million in its first year. He also voiced an intent to confine the new firm to areas in which it has a good handle on the technology. "We will do a better job than anyone else in certain technological areas," he claimed.

FCC WILL TAKE A LOOK AT CATV

The FCC's newest foray into the electronic wonderland is concerned with CATV; it may cover more ground, have even greater relevance to the dp industry, and generate an even higher stack of comments than last year's computer inquiry.

Cable television is rapidly evolving into a means of carrying all sorts of communications into the home and office, not just TV programs, the commission explained in its announcement of the new inquiry. Venture capital is "ready and able" to finance these expanded systems. Hopefully, the inquiry will clarify how the capital should be invested to maximize the return to the public. The commission wants to determine, among other things, who should operate multipurpose CATV systems, under what regulatory restraints, with what sort of facilities, and under what interconnection arrangements.

These are some of the expanded services future CATV systems will be capable of offering, says the commission's announcement: facsimile reproduction of newspapers; electronic mail delivery; merchandising; links between a company's headquarters, its branch offices, primary customers and/or suppliers; access to computerized credit checking, airline reservation, and banking systems; library information retrieval; computer-computer communications; and on-line academic and vocational education.

"It has been suggested further that there might be interconnection of local cable systems and the terminal facilities of high-capacity terrestrial and/or satellite intercity systems, to provide

numerous communications services to the home, business, and educational or other centers on a regional or national basis," added the commission. It felt that such networks are likely to be stimulated by recent and potential improvements in high-capacity coaxial cable, millimeter wave guides, laser communications, computers, and communication satellites. "Another matter to be explored is the question of whether it is technically and economically feasible for CATV to develop capability for two-way and switched services."

Although the technology glitters with promise, it is loaded with problems. The commissioners listed several of these and asked interested parties to suggest solutions. Most of the problems pertaining directly to the dp industry are in Part V of the announcement, although some are in Part III. Written comments on Part III must be filed by March 3rd, and on Part V by June 16th.

Part V contains 10 questions, most of which have subsidiary parts. Basically, the commission wants views on "the proper relationship" between CATV operators, communication common carriers, and "other entities"—specifically including the computer industry—who are likely to offer nonbroadcast communication services via CATV. Related questions are: how much restriction should be placed on competition; how should competitors be selected; whether all communication services into the home—e.g. radio, TV, telephone—should be provided by cable; how should CATV interconnect with intercity and satellite communications systems; what should be the division of regulatory functions between federal and state-local authorities. The commission also wants to know what kinds of services are likely to be offered to home and office through the new technology; whether service should be provided to rural areas; and the desirability of subsidizing this service with federal funds.

GSA WILL TEST SEPARATE PRICING

GSA will soon test Dick Caveney's thesis that the federal government can save money by buying independently manufactured peripherals directly from the source. It also intends to hurry along IBM and other manufacturers who are thinking of separating their software and hardware prices.

The means of accomplishing each goal is a test procurement. In one case, peripheral and mainframe makers will be invited to bid separately on a business-oriented system; in the other, software houses and mainframe makers will be invited to participate in a second, similar procurement. Computer makers will be allowed to offer peripherals and software, as well as cpu's, but the cpu will have to be priced separate from peripherals in one case and from software in the other.

Each system that is acquired will be designed for an application already computerized somewhere within the federal establishment. GSA hopes that by comparing the performance of the new system against a like configuration in operation, it can accurately gauge the performance of the former. This data would then be used to evaluate the cost-benefit of specifying separate prices for hardware and software, and of involving independent peripheral makers directly.

Specs for the "peripheral" test procurement are expected to be ready sometime in March. The software-separation exercise will be launched "later." GSA hopes to have each system in place, ready for evaluation, 6-9 months after the related RFP hits the street.

Details of both experiments are still fluid, but it seems likely that: the using agency selected for each test will come from the following list: DOD, NASA, Agriculture, AEC (all of them are reportedly eager to participate); the peripherals procurement will encompass tape drives, disc drives, printers, card reader-punches and possibly paper tape reader-punches—i.e., units that can be interfaced easily with different mainframe makes, as well as units that require complex hardware and software engineering; the separate software-hardware procurement may assign the operating system, as well as application programs, to the software vendor; the using agency may act as system manager, or contract out this function separately; the separately-priced peripherals needed for one system, and the separately-priced software needed for the other, may each be supplied by more than one vendor; application programs needed for the latter procurement will have to be written in a higher-level language. Almost certainly, it will be COBOL, which means the compiler probably will be specified in terms of recently-approved USASI standard modules.

Independent peripheral makers will have to certify the cpu's that their equipment interfaces with. GSA plans to benchmark all the components offered, but to save time, the test will be less rigorous than usual. The system manager will be saddled with much of the responsibility for seeing that a particular configuration, after being selected, actually does the jobs specified.

COMPUTER-ASSISTED VOCATIONAL GUIDANCE

Willowbrook High School, Villa Park, Ill., in cooperation with the College of DuPage, Glen Ellyn, Ill., has established a Computerized Vocational Information System. The college's IBM 360/30 provides data on over 400 vocations, with specifics on the training and academic requirements for each. It also stores information on grades and test results for each of the 1700 students in the upper three academic years. The cpu is connected by phone lines to two IBM 2260 crt's and two IBM 1053 printers in guidance offices at the high school.

Although the primary aim is to provide students with information to aid in vocational decision-making, the system also makes information about both students and occupations more readily available to the counseling staff. Plans call for including information about colleges, technical schools, apprenticeships, and local job opportunities.

A student using the system identifies himself by typing his student id number on the crt keyboard. The computer is programmed to ask the student questions concerning his grades and performance on aptitude tests, and his post-high school plans, giving him choices ranging from none to an advanced college degree. If the student's answers are not consistent with records, the crt gives a message to this effect and suggests he talk to his counselor, but does permit him to continue.

The computer then lists all jobs available at the training level the student has specified. These occupations are divided into eight interest categories and six levels of training. The system describes each area and asks the student to select the one area of greatest interest to him. Next, a list of all jobs in that category is printed out on the 1053 located next to the crt. The student selects a job of special interest from this list and a 50-word description appears on the screen. If he wants more information, he can request a 300-word message which is printed on the 1053.

CANCO TO EXPLOIT ATTACHMENT TARIFF

Continental Can Co. is apparently the first telecommunications user to exploit AT&T's new foreign attachment tariff.

(Continued on page 121)

Starting today, a new breed of computer tape:

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Quantum is the first computer tape that not only starts clean, but stays clean, too.

And in this age of the disc pack, that's very important.

You're putting more and more dynamic data on disc packs, letting magnetic tape handle system backup and record retention.

You expect tape to be a reliable backup medium. Only until now, that hasn't always been true.

All computer tapes generate errors, particularly when they're not in use. These self-generated errors result from mechanical and thermal stresses, which gradually cause your tape coating to decompose. Loose particles then become permanently imbedded in the surface.

The Quantum formulation practically eliminates tape breakdown. It's stress-resistant: more so than any other on the market.

In accelerated aging tests, for example, Quantum proved 15 times more resistant to temporary errors—and 3 times more resistant to permanent errors—than the two leading competitors.

Quantum is casualty insurance.

It means real confidence in taped retention files.

It means fewer checkpoint re-starts, less time lost reconstructing data.

And it means lower cost per reel per year.

Take advantage of the free offer on the next page and see for yourself.

rom Memorex.

MEMOREX

Memorex Corporation
Memorex Park, Santa Clara, California 95050

I would like to test Memorex Quantum. Send me a sample.

Name_____

Company_____

Address_____

City_____ State_____ Zip_____

My tape drives are manufactured by_____. I have (number of)____ tape drives. And (number of)____disc drives. I am presently using_____ brand of computer tape. And have (number of)____reels in my library.

The company has hired Comtel Communications Corp., a Bell Television Company subsidiary, to engineer, acquire, install, and maintain a voice and data network linking Canco offices in Chicago, St. Louis, and New York City. The first stage of the project, scheduled to begin within the next few months, calls for installations in about 24 locations and involves approximately 20K terminals. The bulk of these will be ITT Touchtone telephones. Some on-line facsimile machines are also to be attached, as well as computers in Chicago and New York. Ultimately, Continental Can offices throughout the country—about 300 altogether—will be linked to the system.

Canco is leasing the new facilities from Comtel for an undisclosed figure. The terminals will work through switchboards supplied by Nippon Electric Company. This equipment will access both the public telephone system and leased private lines between a number of Continental's offices. According to a Comtel official, the first stage of the system represents an investment of about $5 million. He estimates that use of non-Bell terminal attachments will reduce costs to Continental Can by 20-25%.

FCC ASKED TO AUTHORIZE COMMON CARRIER SYSTEM

FCC has been asked to authorize another common carrier microwave system, this one running between Washington, D.C., and New York City. It would be operated by Interdata Communications, Inc., and offer 60 4KHz. voice-grade channels, expandable to 600. Besides voice communications, the system could also be used for slow-speed and high-speed data transmission—i.e., a user could combine or subdivide individual channels.

Proposed monthly rates: between New York and Washington, $308 for 4KHz, $538 for a 8 KHz., $769 for 12 KHz., and $3075 for 48 KHz. New York-Philadelphia and Philadelphia-Washington service would also be offered, at rates approximately 20% higher per mile than end-end charges.

The user would be responsible for supplying and maintaining his own terminal equipment, and would also have to find a way of linking it to the nearest ICI microwave tower. The company said it planned to negotiate an interconnection agreement with Mother Bell and other common carriers, but made no promises regarding the outcome.

FCC isn't likely to rule on ICI's proposal until it disposes of a petition submitted several years ago by Microwave Communications, Inc., for a similar system between Chicago and St. Louis. The MCI case is now awaiting a final decision, but no one knows when that will occur. ICI owns "a small amount" of stock in MCI, said an ICI spokesman. He admitted that it was "possible, if each company receives FCC's blessing, for their facilities to be connected." The spokesman said it was also possible ICI might add switching capability to its projected system, thereby appealing to a wider market.

Interdata's principals include General Manager Carlos O. Fox, a Washington consulting engineer since 1964 who formerly worked for the Radcom Division of Litton Industries. Others are Walter Beinecke, Jr., New York, and Walter C. Cottrell, Richmond, Va. ICI's equipment would be supplied by Collins Radio for $878,727. Manufacturers Hanover Trust Co. has agreed to loan ICI $500K to cover first-year expenses, provided FCC grants the company's license application.

GOODMAN GETS INTO THE ACTS

Applied Computer Time Share, Inc., Detroit time-sharing service, has just expanded into New York by moving into the office of Data Processing Financial & General, a major bankroller of ACTS. Harvey Goodman, president of DPF&G, is on the board of ACTS, among his other activities, which include trying to buy up a big hunk of A&P and suing IBM.

Founded last summer, the young company had a GE 420 operating by last Halloween, a week later an SDS 920, and in December purchased two GE 265's from Ford Engineering, which had been part of the first company time-sharing system. The 920 is used for Univ. of Detroit engineering education and other U-D graduate student needs and CAI for parochial and public elementary and secondary schools in the metropolitan area. The 420 is for customers of commercial and complex civil engineering. The 920 will also be used for on-line hospital administration.

ACTS has also opened a branch office in Cincinnati, from which it will serve Ohio and Indiana customers, and is affiliated with the Berkeley Computer Co., Berkeley, Cal. Chairman of ACTS is Dr. Joe Hitt, chairman of the EE dept. at Univ. of Detroit; president is Harold L. Van Arnem, formerly of GE's marketing group; Dr. Jesse Quatse is vp for R&D.

THIRTEEN NATIONS FORM ADP COUNCIL

The Intergovernmental Council for Automatic Data Processing (ICA) was set up at a conference of adp representatives in Edinburgh. The thirteen countries that participated and are represented on the Council are: Belgium, Czechoslovakia, Denmark, Federal Republic of Germany, Finland, France, Israel, Netherlands, Norway, Sweden, Switzerland, United Kingdom, and the U.S.A.

The Council elected Dr. H. R. J. Grosch, NBS, U.S.A., as chairman; John A. Tiffin, Civil Service Dept., United Kingdom, as vice-chairman; and A. Gertz, the Ministry of Finance, Israel, as secretary general.

The purpose of the Council is to serve as a cooperative for the interchange of ideas and information related to governmental adp and its effect on public administration. The Council intends to provide assistance to less experienced nations, to seek cooperation with other organizations concerned with adp, and to form research groups to study specific problem areas. Membership in the Council is available to any interested country.

PERIPHERAL MAKERS MEET ON PERIPHERY OF FJCC

Some 70-80 peripheral manufacturers and interested parties held a meeting at the FJCC to discuss the feasibility of establishing a trade association, a move long espoused by Dick Caveney, of Bryant Computer Products, as a means of getting a fairer share of government contracts. He was named as one of four regional representatives forming a steering committee to work out organizational structure and develop a draft charter for discussion at the SJCC. The others are Warren Pugh of Hewlett-Packard, Henry Sacks, of Modern Data, and Roy Bower, of Houston Instruments.

Among the purposes of the association agreed upon at the meeting is to foster the development of standardization of peripherals for interfacing with major company mainframes, which would stimulate competitive bidding on government subcontracts. Another goal settled on is the establishment of an information center that would provide information on computer equipment currently available from association members. It was also decided to initiate a study on the practicability of setting up a tionwide service-maintenance organ. ion.

After some e, it was generally agreed that the ns houses could join the associa it that dues would be based o fee, rather

news briefs

than revenues, to prevent the big boys from taking over.

Nearly all who attended had a wait-'n'-see attitude.

THIS MIGHT BE CALLED PERT/PROFIT

Project managers who have been familiar with PERT and CPM programs might soon begin considering TOPS, a project scheduling program that is significantly different from its predecessors in at least two respects. First, PERT and CPM programs are attempts at minimizing the cost or time allocated to a project; TOPS is dedicated to maximizing the profit directly rather than indirectly. That is, in some cases where it is necessary to trade-off alternative procedures, the manager using TOPS might spend more money, and take more time, but make more profits. The second major difference between the earlier programs and TOPS is in the computer output produced. Critical path method studies or PERT evaluations yield line drawings and listings of scheduled subactivities, their time, and their costs. TOPS produces a report that tells the status of the project, develops the best schedule for each activity, and also provides for each manager a set of guidelines for alternative actions in case the conditions in his activity change.

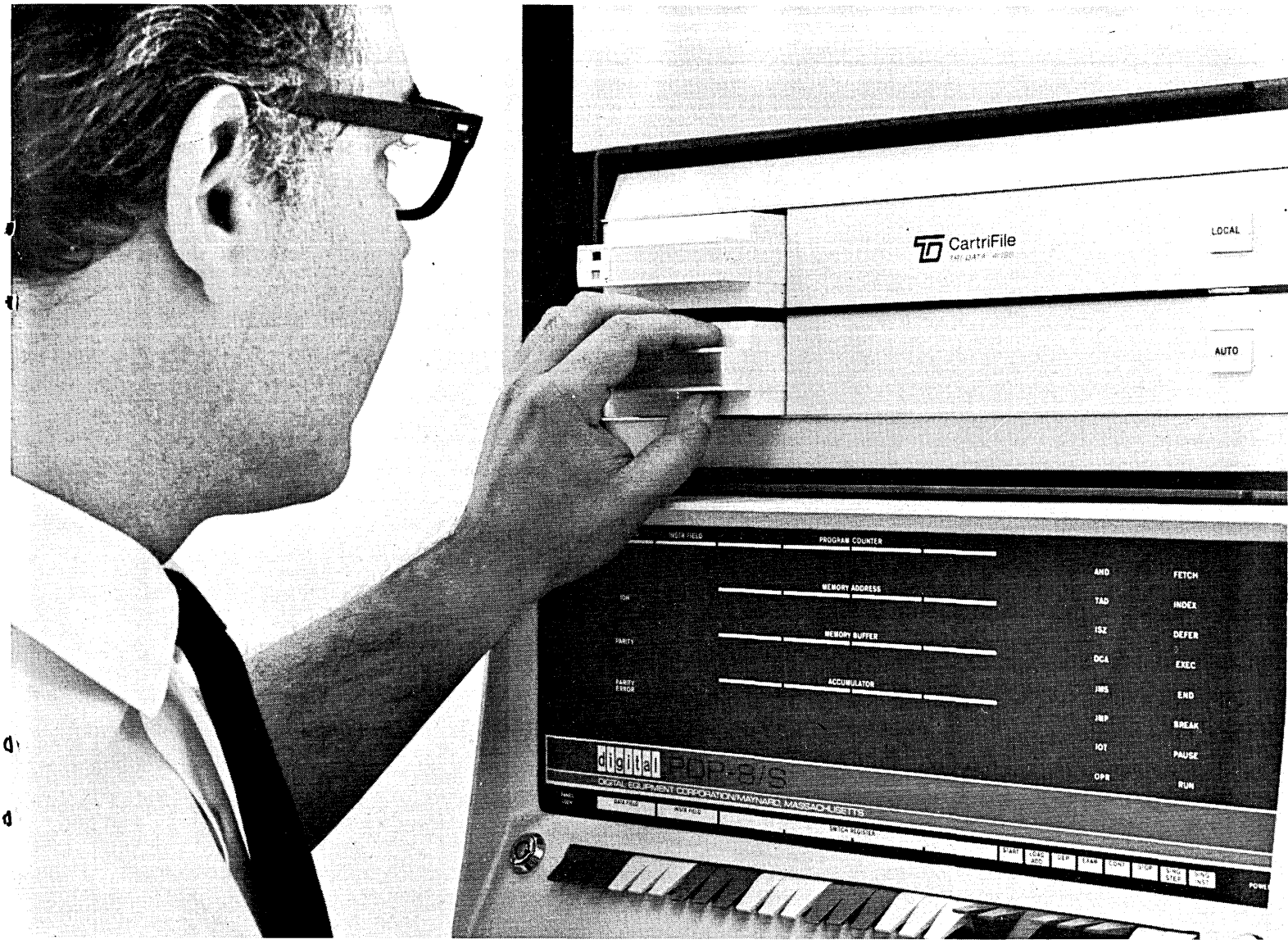
The developers of the new program, Hollander Assoc., claim that it will require no more computer time than the conventional scheduling systems. They also claim the program's design was strongly influenced by the fact that management seldom is given the information it needs to take optimum recourses at times when conditions change during the course of a project. The system they offer puts the onus of a time/cost/profit decision on the activity manager, who alone has the information required to make that decision.

The developers are currently accepting a small number of clients for "experimental" installation of the system. The cost to the "experimental" user will be in the neighborhood of $10K-$20K, depending upon the amount of training in the use of the higher-level algorithms the user requires. For information:

CIRCLE 240 ON READER CARD

COMPUTER-CONTROLLED DATA CONVERSION SERVICE

Compuscan, Inc., Leonia, N.J., was established early last year with the in-



Add magnetic tape to your small computer

Tri-Data now offers the CartriFile with an interface for the PDP8 computer

SPECIFICATIONS

- 4 magnetic-tape transports
- Cartridge-loaded
- Desk-top or rack mount
- Capacity 320,000 12-bit words (80,000 per tape)
- Plug-compatible interface with PDP8, PDP8/S, PDP8/I, PDP8/L
- Simultaneous read and write from different tapes
- Error-correction system assures data reliablity
- Variable-length records
- Start time 15ms, stop time 10 ms
- Price $5,700, CartriFile 4096 with PDP8 interface

MICROINSTRUCTIONS

6305	LTSA	Check tape unit status
6303	LTSB	Check tape error status
6312	WSPC	Write stop command
6314	ACMD	Tape action command Read/write/search tape 1, 2, 3, or 4
6321	SWWC	Skip on write word call flag
6324	LTB	Load tape buffer
6332	SRWC	Skip on read word call flag
6335	RTB	Read tape buffer
6311	SLPA	Skip on load point flag
6322	RSFF	Set or clear flag F/F

CIRCLE 60 ON READER CARD

TRI-DATA Corporation, 800 Maude Avenue, Mountain View, California 94040 (415) 969-3700

news briefs

tention of providing a conversion service for graphic, printed, typewritten, or hand-prepared data to be recorded on magnetic tape, using data conversion equipment designed by the firm. By the end of this year, Compuscan plans to manufacture and market the equipment, although it is presently only providing its own data conversion service, using a single machine. The company claims a major breakthrough in its technique for digitizing data, in that the system is computer-controlled, using a Sigma 2 cpu in conjunction with a flying spot scanner of 5,000 lines resolution, built by the firm. The system provides output through two SDS tape drives.

Pres. Marvin Weiss said the Compuscan device, which has been in operation since October, results in service at a reduction in price "on the order of one-tenth" the cost of manual methods, such as the use of a plotter that must be manipulated by an operator. He noted that the service is not economical for "small" jobs, however, because of high set-up costs: a minimum fee is "a few hundred dollars." Its primary use is for such large jobs as converting the "hundreds of thousands of infra-red spectra charts accumulated by large, chemical, pharmaceutical, and oil companies . . . at a cost of a few cents per chart," and other material including EKG's, engineering drawings, X rays, mathematical curves, etc.

Compuscan presently has eight full-time and ten part-time employees. Principals of the firm, in addition to Mr. Weiss, are Norbert Steinberger, exec vp, and Robert Scheinmann, sec'y.

HAVING TROUBLE WITH YOUR OIL WELL?

Many of us find it difficult to sympathize with people who are having problems with their oil wells, but the problems facing drillers and petroleum engineers are very real and usually demand immediate, intensive attention.

Oilmen in Texas, Oklahoma, Louisiana, and California are getting help with their problems from a subsidiary of Com-Share Southern called The Analysts, Inc. This group of highly specialized consultants compiled a data bank of drilling data, papers, and mechanical and technical discoveries relating to drilling and well maintenance, made that bank resident in Com-Share Southern's computer centers, and placed tty's in the field—even

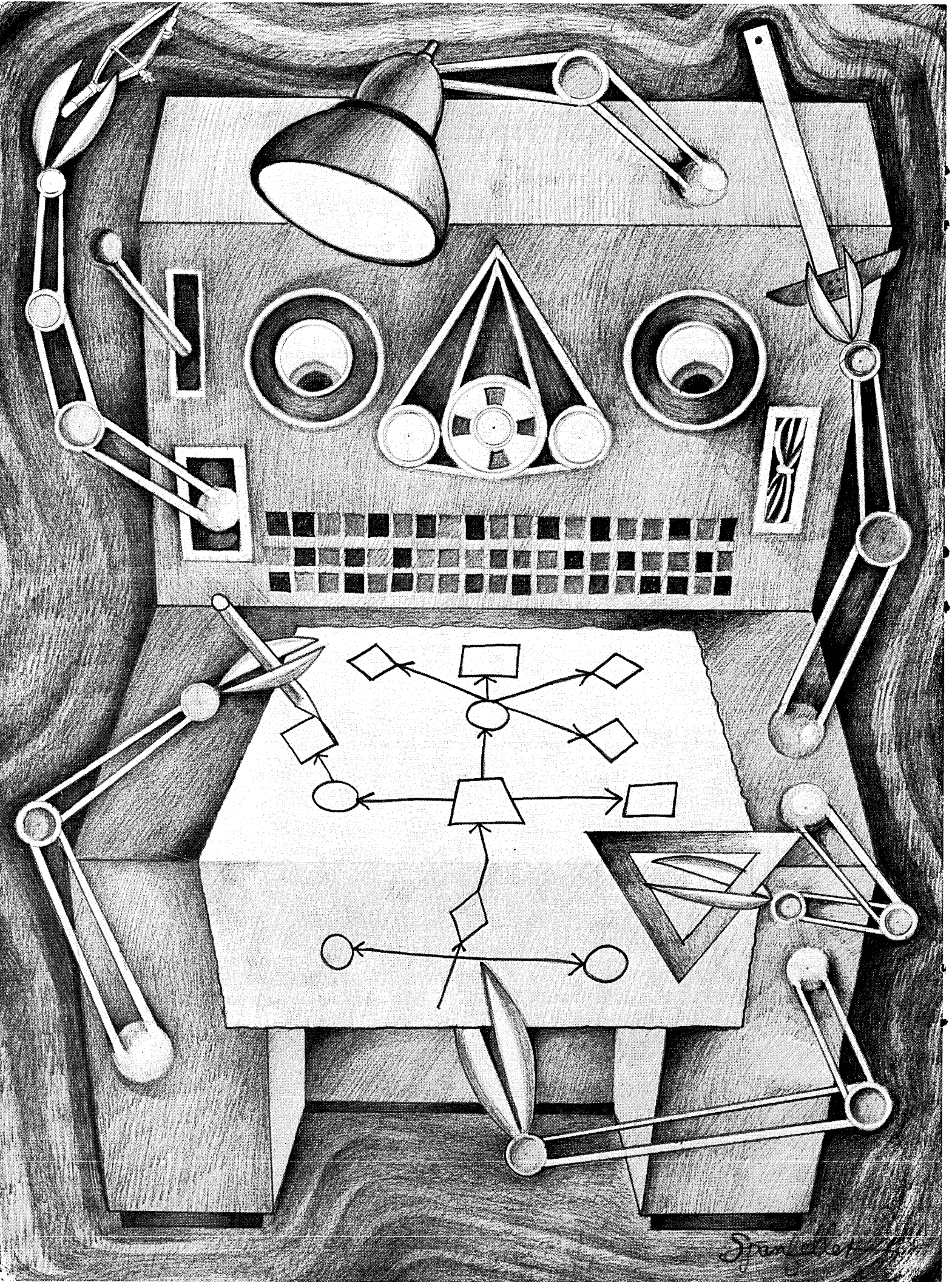
(Continued on page 129)

THE ONLY TOTALLY COMPATIBLE DISC DRIVE AVAILABLE

Here is the Linnell Model 1100. It is designed specifically for System 360 users who want a disc drive which performs, looks and behaves exactly like the IBM 2311. Not faster. Not trickier. Not differently. But exactly like the 2311 in everything—concept, program, interface, styling, maintenance and reliability. This is more than just plug-to-plug compatibility; it is a completely parallel design from the floor up. This means identical contour, colors and dimensions. It means part-for-part interchangeability in essential mechanical components. And it means identical procedure-for-procedure maintenance. More than that, it means assured performance reliability because only thoroughly proven techniques have been used. And since there has been no expensive experimenting with engineering novelty, it also means that it is the lowest priced disc drive in the industry—slightly more than half the cost of its IBM prototype.

Linnell Electronics, Inc., Cooper Parkway Building West, Pennsauken, New Jersey 08109
A member of the Comstock-Keystone Computer Group LINNELL

CIRCLE 53 ON READER CARD



Why not send your computer to our advanced systems design school?

With a little training, you'd be surprised how much help your computer can give you in systems design.

With a little training, you'd be surprised at its ability to save you months of your time and save your firm hundreds of thousands of dollars.

What kind of training? The kind of "training" it gets when you use a sophisticated simulation technique we call SCERT—a technique now being used by more than 200 major EDP users.

But before going into specifics on how these firms are using SCERT not only in systems design, but also in EDP department management and in hardware selection—a word about how SCERT works.

What it is

SCERT is a sophisticated modeling technique that allows its user to take his existing or planned EDP system and simulate that system on any state-of-the-art EDP equipment. The result is precise cost/performance information on the systems hardware and software—information that clearly guides the user in optimizing his decisions.

How it works

There are five functional phases to SCERT—

1. First, SCERT builds a model of your present or planned system. And this step is easier for the user than it might at first sound. You describe your system to SCERT in a common systems-oriented definition language . . . "Sort, Merge, Update, Validate, Table Look-Up" for example. And with the aid of special SCERT input forms, you include such pertinent environmental considerations as size of staff, their years of experience, salary levels, and equipment on which their experience was gained. SCERT explodes all this information into a full mathematical model of your system.

2. Then, separately, SCERT models any hardware configuration you select. In its constantly updated hardware factor library, SCERT maintains full performance files on virtually every computer and every piece of peripheral gear manufactured in the Free World. Thousands of electro-mechanical characteristics are recorded on hardware performance, as well as hundreds on compilers and operating systems.

3. Then, on instruction, SCERT merges the systems model and the hardware model in pre-simulation—a linear representation of what happens in performing the tasks requested of the functioning system.

4. Full simulation then takes place. Here the multiprocessing, multiprogramming, time sharing, and real-time characteristics of the total system are taken into account. In this phase, the entire system functions as it would in an actual working environment with all the hardware and software in place and debugged.

5. The fifth and last phase of SCERT is its output management reports—reports that detail cost/performance data on the overall system and on every facet of the system—the software, the input format, each piece of hardware. Reports that identify every possible bottleneck clearly and quantitatively. Reports that guide the user to change any element of his system and resimulate with SCERT until he's confirmed the optimum system for his needs.

How it's used

With an understanding of how SCERT works, its many uses and advantages are clear to see. Three main categories cover most of the key ones—

In Optimizing Systems Design—This is SCERT's most important use, because it is at the systems design stage that the vital, basic decisions that most significantly affect cost are made. And with SCERT you get much better facts on the alternatives to guide you.

With SCERT, the systems designer can fully compare every approach he wishes to consider. With SCERT, he can decide whether or not performance justifies the cost of making the system on-line or even automated. If 30 second turn around or 60 second turn around is worth its cost. If communication control should be handled primarily in the hardware, or by special new software.

He can accurately estimate the cost of each system and predetermine the time to complete. With SCERT, he can answer the multitude of questions that add up to optimizing the multi-million dollar decision his firm is about to make.

Because of this, Bell Labs is using SCERT to help them design the industry's largest automated, nationwide information system. The Canadian Government is using SCERT to help them design the best logistics system possible for a fixed dollar appropriation. The Singer Company is using SCERT to design an advanced information system linking their 1900 retail outlets, 25 local distribution centers, seven regional warehouses, and five factories. The Air Force Logistics Command is using SCERT to design its 21st Century logistics system. And dozens of smaller organizations are using SCERT to help them optimize their systems decisions.

As a Management Review and Planning Tool—Because SCERT can give you a precise, detailed mathematical model of your present EDP system, it gives you a working tool to measure the efficiency of your present systems versus all other likely systems. A tool to measure efficiency under today's workloads versus possible future workloads. A tool to predict the programming time it will take to complete new tasks. A tool to uncover alternate ways to achieve your desired goal.

In detail, SCERT will identify all bottlenecks to permit sound planning and action. With SCERT as a management review and planning tool, Joseph E. Seagram & Sons uncovered a more efficient way to approach four recurring jobs. Literally overnight they cut their monthly running time for these four programs from 250 hours down to 150 hours.

With SCERT, Pittsburgh Plate Glass found a way to handle present workloads with a machine time saving of 30 per cent. Equitable Life reports a 30 per cent savings.

For Hardware Selection—Because SCERT lets you simulate hardware in your system before you buy it, the advantages here are obvious. You can simulate all likely systems to pre-select the hardware and configuration best for your needs—both today and in a range of future needs. You can pre-select such things as the best programming language, the most efficient operating system, optimal core and on-line storage requirements, I/O speeds, and any variable needed to optimize your system.

The New York Income Tax Department used SCERT in planning their on-line data entry system and uncovered a way to effect a $90,000 annual savings over their best previous hardware purchase plan—a plan that was the best of the recommendations received from the six major hardware manufacturers.

How reliable is it?

A simulation system is only as good as its ability to portray real performances under real conditions. And throughout the past six years, the 200 major SCERT users have proven its ability to do just that. They have made SCERT the "accepted standard".

The SCERT system is available both on a study basis or on a continuing basis. Comress will train your personnel in its use or, if you prefer, provide experienced SCERT analysts.

But the place to start is to schedule a meeting. If you think computer planning and control through simulation could be productive for you, write to Comress, 2120 Bladensburg Road, N.E., Washington, D.C.

COMRESS

CIRCLE 62 ON READER CARD

weren't they great!

The forerunners of modern data preparation

Remember keypunching? Fine first-generation invention. Its monument is its mountains of bulky, hard-to-handle cards.

And key-to-tape devices. Big improvement—no cards! Just dozens of reels of magnetic tape to buy and load and unload and reload and pool and store and such.

Now comes KeyProcessing™.

This is the modern computer-controlled keyboard input system—**simpler, more efficient** and **less expensive** than its forerunners.

And its output is one single tape.

KeyProcessing works like this:

One CMC KeyProcessing System may have up to 32 individual keystations, all independently entering or verifying data simultaneously on different job formats.

Keystations are controlled by a special computer containing proprietary programs provided by CMC as part of each system. As data is entered through each keystation, it is processed by the computer and stored on a magnetic disk in a location unique to the keystation of original entry.

After data has been recorded, it may be verified either by re-keying it and comparing it within the computer or—**without the need for re-keying**—by automatically balancing control totals to the totals derived from the original keying operation.

Verified data is transferred, batch by batch, from the disk onto one reel of magnetic tape. From time to time this single reel is taken to your data processing system for high-speed input.

KeyProcessing will make your data preparation as modern as your data processing. For more information, please call or write:

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2000 Stoner Ave., Los Angeles, California 90025
(213) Granite 7-1585

KeyProcessing™

CIRCLE 63 ON READER CARD

at the drilling rigs—to access the compiled data.

The Analysts' services to an oilman begin before the drilling rig is set up. Working from historical drilling data on surrounding well sites, The Analysts plan the drilling procedures for their customer, including such information as which drill bits to use, what pressures to expect, and how to resolve problems to be encountered. This kind of pre-planning, the consultants contend, can save 10-20% of the cost-per-foot to sink a well, a considerable savings considering that the drilling time can stretch from two weeks to three months.

Once drilling has begun, the on-site engineers can refer to their tty rather than to their slide rules to counter problems which occur. Some 30 programs are accessible from the regional offices in Lafayette, La., New Orleans, Midland, or Houston, Texas. It costs the user $2 per minute of connect time, and $84 per month per terminal. Costs for pre-planning a well run 20 cents per foot. On the other hand, for real tough problems, an oilman can rent the entire Analysts team for $300 per day.

Now, if you have trouble with *your* oil wells we still will not have much sympathy, . . . but The Analysts will.

TELECREDIT FILES SUIT ALLEGING SECRETS PIRACY

A $4,500K damage suit has been filed by Telecredit, Inc., Los Angeles, against Comp-U-Check, Inc., and Comex Corp., both of Detroit, for allegedly pirating trade secrets prior to Comp-U-Check's setting up in business as a check-verification system that Telecredit claims is too similar to its own. Comp-U-Check has denied the charge and has said it will file countersuits alleging malicious prosecution and slander, but Lee Ault, new president of Telecredit, stated at presstime he had received nothing in this regard.

Ault, formerly with Laird, Inc., New York investment banking firm, replaced David Fry, who remains with the company as consultant. Ronald Katz continues as chairman of the board. Laird, Inc., purchased 25K shares (out of 832K outstanding) of Telecredit for $200K in April '68 and placed two men on the board of directors, Ault being one of them. There is now one Laird man on the board and Ault is president, but he stated that there is no connection between his previous Laird affiliation and his present position, that he has been closely involved with Telecredit's operations for more than a year.

REMOTE COMPUTING ACQUIRES TWO FIRMS, ADAPTS B5500

Remote Computing Corp., Los Angeles, a computer utility company formed in June '68 by Joe Hootman, formerly of Burroughs, has reached agreement in principle to acquire Time-Sharing Systems, Inc., of Milwaukee, and has obtained an option to purchase Computer Controls Corp., of Detroit. The latter company is a software and service center and is expected to extend RCC's operations in commercial applications programs.

RCC recently replaced the Burroughs 487 with a new front-end for its B5500's that includes a Rixon multiplexor, an Interdata 4 computer, and RCC software, including systems software within the 5500 and programming for the Interdata 4. In favor of the Interdata machine, according to RCC, is its price/communications line, its ability to take much of the load off of the 5500 (line control functions, etc.), plus its firmware and adaptability to various types of terminals.

The company has offered this new front-end package to Burroughs, which is considering a new unit to replace the 487 (helped by criticism from 5500 users), but will offer it to 5500 users whether Burroughs accepts it or not.

SOFTWARE HOUSE ADOPTS NEW NAME

Information General Corp. is the new name of Programming Services, Inc., Woodland Hills, Calif., software firm, which has embarked on an expansion program and established an office in Washington, D.C. The company has set up two new divisions under the expansion plan announced by Donald R. Ford, founder (in May '65) and president of the company. Art Pozner will head up a time-sharing division for business applications, and Malcolm Sherman, formerly with Hughes Aircraft, will be vp in charge of the Center for Applied Education, which will offer courses to industry and government ranging from introductions to computers, to systems, and contract management.

IGC's Palo Alto group will now be called the Advanced Information Systems Division and will continue to be headed by Charles P. Bourne. This group will provide analysis, design, and implementation services and evaluations of information handling systems. IGC's Control System Division, which developed the firm's process control packages, will continue to provide these services under the direction of Dave Pistole.

NEW GRAPHICS FIRM FORMED IN UTAH

Two well-known young computing figures have formed a new company with the help of a famous old financial name. The company, Evans and Sutherland Computer Corporation, has been set up by Dr. David C. Evans and Dr. Ivan E. Sutherland with the help of the Rockefeller family "and associates of New York City."

Evans is a 30-year-old whiz kid who developed the important and famous "Sketchpad" on-line graphics system at MIT before he spent a couple of years directing the placement of research dollars at the Advanced Research Projects Agency of the Office of Naval Research. He was then on the faculty of Harvard Univ. before joining Evans recently in teaching computing and in graphics research sponsored by ARPA.

Evans, 44, was the key design man at Bendix, where he was primarily responsible for the development of the G-20 before joining the faculty at the University of California at Berkeley and, subsequently Utah, where he is director of computer science and professor of electrical engineering.

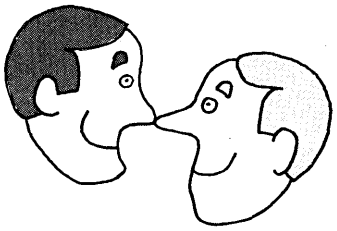
Dr. Evans is president of the new firm, and Sutherland is vp, general manager. Malcom S. Low is secretary-treasurer. Two other widely known computer people—Dr. Alan Perlis, chairman of the computer science department at Carnegie-Mellon Univ.; and Maurice W. Horrell, president of Rixon Electronics, Inc.—have been appointed to the Evans-Sutherland board. Horrell was the top exec at Bendix Computer when Evans headed up engineering there.

The company, which will manufacture computer graphics processing equipment, will be located in Salt Lake City, in the University of Utah's planned Research Park. Much of the research park will be located on land recently acquired by the University from the federal government.

FJCC STEERING COMMITTEE POINTS TOWARD LAS VEGAS

The 1969 Fall Joint Computer Conference will be held in Las Vegas, November 18, 19 and 20, and the gamble might pay off, because there will be an estimated 475 booth spaces, a 20% increase over the number allotted at the

Come.



Let us compute together.

How to partition your System/360 computer to provide time-sharing capabilities almost as good as ours.

RTS Progress Report #3.*

THE problem with meeting your organization's data processing needs, you may have found, is that many different types of problems want solutions at the same time. Obviously, that's not possible in a batch processing mode. That's why time-sharing systems were developed. Ours is called Reactive Terminal Service*, and we believe it is the most advanced, versatile, economical and efficient time-sharing service available—at all the locations listed at the right.

However, we realize that many companies with large in-house computer systems would also like to have in-house time-sharing capabilities.

That's why we're making FORCE-III available. FORCE-III (Fortran Conversational Environment) lets you convert your System 360/50 or 65 into an in-house time-sharing system with up to 15 terminals. It operates in a partition of OS/360 where you can talk freely. Response time can be as fast as three seconds. You can execute FORTRAN IV programs and at the same time maintain a steady OS/360 batch workload. And, you can ship files back and forth between FORCE-III and OS, and file compiled programs for later use under either.

In fact, it's like having your own private RTS in your plant. What you get is a command language interpreter, a file maintenance system, a line editor for file creation and correction, a FORTRAN IV (G-level) compiler and a subroutine library. Plus maintenance support and system updating, as well as complete training in the use of the system.

Of course, when you find that 15 terminals are not enough, you can tie in to our RTS. And while you're having FORCE-III installed, you can also use RTS to get your people accustomed to writing and debugging FORTRAN programs online, and solving problems in a third generation time-sharing environment.

As you know, RTS also offers G-level FORTRAN, and unlimited on and off line program storage, line-by-line debugging, 2.4 million bytes of work file capability for every user program, a new up-date text editor that lets you change single or multiple characters in both data and programs. Plus our recent addition of BASIC.

All in all, it's the world's most advanced time-sharing service. If your requirements are for an in-house time-sharing system with the full range of RTS features, we would be happy to talk about that with you too.

For more information on FORCE-III and RTS check with the ITT Data Services Center nearest you.

**Service marks of ITT Data Services, a division of International Telephone and Telegraph Corporation.*

ITT
DATA SERVICES

news briefs

rainy, crowded San Francisco conference in '68. "Threshold of the 70's" is the theme of the FJCC and 1969 seems the right year for that.

Jerry L. Koory of Programmatics has been named general chairman; Ted Braun, Applied Computer Technology Corp., is vice chairman; Michael Baran, SDC, treasurer; Nancy M. Stringer, Programmatics, secretary.

Koory announced the following committee chairmen: Eugene M. Grabbe, TRW Systems Group, technical program; Frank F. Jurkovich, Applied Computer Technology Corp., registration; Al Deutsch, Associated Aero Sciences, local arrangements; Robert B. Forest, DATAMATION, public relations; Robert L. Koppel, Autonetics, printing and mailing; Samuel F. Needham, TRW Systems Group, exhibits; Fred Gruenberger, San Fernando Valley State College, education; W. S. Dorsey, Autonetics, special activities; and Ann Rataichak, IBM, ladies' activities.

The conference is sponsored by AFIPS, whose representatives are H. G. Asmus, Bruce Gilchrist, and Donald R. Cruzen. Southern California representatives of sponsoring societies working with the steering committee are Richard B. Blue, Sr., TRW Systems Group, ACM; Jerry Baker, Hughes Aircraft Co., SCI; and Sei Shohara, SDS, IEEE Computer Group.

DO YOU HEAR ME?

Audio response units such as the IBM 7770 have made it possible for computers to talk to people, but so far only a few minor successes have been realized in talking back. IBM and Bell Labs have gotten to the point where their devices will understand a few words when spoken by the right person, but the secrets of man-machine communications have remained locked till now.

The problem has been in converting audio signals into unique digital streams, and Dwin R. Craig, of Ingenuics, Inc., Gaithersburg, Md., thinks he has solved it. Mr. Craig has reported that his approach will make it possible for a computer to recognize a vocabulary of 1,000 words, although there appears to be no fixed upper limit to the number of recognizable words. Currently, he is spending his time trying to find the right words for the patent office officials, but he expects to have a patent in eight or nine months and a prototype system shortly thereafter. He listed some of the important applications for voice coding in the following order: (1) direct data input to computers, (2) real-time language translation by machines, (3) dramatic bandwidth compression of audio information, (4) voice operated typewriters, and (5) voice control of machines linked with visual inspection devices.

CASH VENDING INVASION BEGINS

A new use for credit cards may soon spread to the U.S. from Japan and Europe: the cash vending machine. The first machine, made in Japan by Tateisi Electronics Co., arrived at the Capital National Bank of Miami last September. The device, known as the Omron Credit Loan Machine, is said to be a common sight in Japan, where it has already been in use for a few years. The Omron machines will be distributed in this country by National Electronics, Inc., Miami. A second cash vending machine appeared in the U.S. in October, promoted by American District Telegraph Co., a New York-based protection agency. The ADT machine, known as the Bankomat, is made by Metior AB, Sweden. Although no Bankomats have been sold in the U.S., more than a hundred have been installed by European banks in the past two years.

Capital National's Credit Loan Machine stands ready to dispense cash 24 hours a day, seven days a week, bolted to the walk in the bank's exterior lobby. It is free-standing, seven feet tall, and resembles an ordinary soda machine, but instead of accepting small change, it honors special credit cards which are used as tokens, each causing the machine to dispense $50 when inserted—and retained—by the device. An applicant for a credit card loan receives up to six of the cards, but begins paying interest at the rate of two % per month only when he uses the card in the machine; there are no other charges. The machine can dispense money in any denomination, but has a capacity of only 50 envelopes of bills.

The cards are flat plastic, 2½ x 3⅜ inches, with a serial number but no name or raised printing; instead, there are 13 translucent circles which are read by the machine. The machine uses a small magnetic tape recorder to record which cards have been inserted. The recorder is separately located, and also includes a remote locking control. Up to 99,999 different cards are distinguished by the Credit Loan Machine, which is preset at the factory to recognize this number. Up to 100 cards which have been reported lost, stolen, or are cancelled, can be

blocked using a cancel board with manually-set blocking pins. Cancelled or foreign cards which are inserted are also retained by the machine, although no money is issued. The cards are sold to the user at a cost of $18 per hundred; since they are reusable, only a small number is necessary. Price of the machine itself is $8800.

The ADT Bankomat sells for $21,800, but is more elaborate. It also uses a plastic credit card, but with punched holes. The borrower inserts the card, selects the number of bills desired, and enters his personal secret code, using a 15-character keyboard. If the card and code are valid, the money comes out, and the credit card is returned. The machine may be adjusted to dispense one to five bills, each of which must be of the same denomination.

Unlike the Omran machine, the Bankomat is not free-standing, nor is it a single unit. It is operated remotely by a control unit which activates as many as four separate "heads," or cash dispensing units. In Europe, the heads are often mounted in a window or through a wall of a bank. The control unit is an input/output device with a keyboard and a memory. It accepts commands, produces hardcopy printout, and performs real-time magnetic tape recording of transactions. Up to 10^{16} different credit cards per control unit are accommodated. The Bankomat can also block up to 4,000 invalid cards. Should such a card be inserted, the machine will confiscate it.

It only remains for National Electronics and ADT to sell their machines.

THE GOLDEN GATE IS COMPUTERIZED

Computerization has reached the Golden Gate in San Francisco. It seems that up until the end of last year, receipts taken in on the Golden Gate Bridge were tabulated on EAM equipment that was installed when the bridge was built, back in 1937. Although that equipment had been paid off over its 31-year history, it turned out that using it was more expensive than replacing it. Robert E. Shields, engineer of the Golden Gate Bridge and Highway District, supplied the following approximate figures. The annual cost of operating and maintaining the old tab equipment was running the bridge district something like $30,000, exclusive of manpower charges. For a little over $3,200 monthly, the district was able to replace the unit record gear with an IBM 1800.

If that figure sounds like a lot to pay for counting the number of cars that pass over a bridge, it is because most people do not realize what big business bridge-running is. According to Shields, an average of 85,000 vehicles cross the bridge per day. Taking in and counting 10 different types of tolls, and accepting "Commute Books," tickets, and coupons from that many drivers is a big job, not counting waiting for some woman to fish two dimes, a quarter, and five pennies out of the depths of her purse.

Running the bridge is a big money business, too. An average day's receipts are in the neighborhood of $16,000, and the bridge has taken in enough money to have paid off its original bond holders long ago, if those bonds (due in 1971) had been callable. Oddly enough for a government-regulated venture, the bridge district has actually reduced fares continually over the years. But collecting the money has been so much of a problem that the toll system now in effect hits the driver for his pocket change for twice the "regular" tab, but is collected in only one direction. District officials apparently feel that "what goes in must go out," because going into the city (southbound) costs 50 cents, and coming out is free.

With all the tabulating problems involved, the accounting job, for an 1800, is not a large one, and the machine is loafing. Within months, the 1800 is expected to be handling payroll and accounts payable/accounts receivable for the district in addition to its money-counting function.

And Shields is still optimistic. "We hope one day to set up an advance-warning system with sensing devices at selected intersections tied into the 1800," he said. "Such a system could tell us, for instance, when to expect a heavy crush of football traffic, and we could have our optional lane ready for the extra load." (That optional lane is a switchable one that is assigned to the side with the heaviest traffic.) Officials are also looking at a sensing device to be attached to a regular commuter's vehicle. That way, the driver would not even slow down to go through the toll gate, and his account would be docked for one passage. It follows that computerization will lead to faster speeds over the bridge, which will probably lead to increased traffic and increased revenues.

LIMB GONE OUT ON BY HONEYWELL VP

T. Paul Bothwell, vp and general manager of Honeywell's Computer Control Division in Framingham, Mass., recently predicted that more than 20% of the three million multiple-access computer terminals projected for 1980 will be used exclusively for problem solving. He said that problem-solving time-sharing systems "will experience a very dynamic growth rate through the 1970's," averaging about 33% a year. He expects these systems to account for about 10% of the value of all computer shipments in 1971, when their value will reach almost $2 billion. He said that service bureaus will continue to be among the biggest users, and that manufacturers, engineering consulting firms and research laboratories are expected to account for more than half the dedicated installations, which also will be a large factor in colleges and universities.

THE BRITISH ARE COMING

In a reversal of the current trend, Hoskyns Systems Research Ltd., London, has established Hoskyns Systems Research, Inc., New York, as an American marketing arm of the British software firm. HSR, Inc. was incorporated in November, but is still primarily in a formative stage. As of last month, there were only two personnel, both imported from the U.K. Plans call for marketing software packages and for expansion of the staff by hiring Americans. And when HSR says "packages," they mean it in the narrowest sense of the term: literally, a bundle of punched cards which can be mailed to the purchaser with instructions and documentation, requiring no additional support or maintenance. All packages will be of general use to computer installations, rather than specific applications packages. First product is called Formatter, a package designed to handle line printing on DOS/360 systems by separating print logic from program logic, enabling programmers to create layouts more easily, and to be able to change them without reprogramming. Price is $850.

BROKERAGE "CAGE" OPERATIONS AUTOMATED

Reportedly, the first application of computers to the problem-filled "cage" operations of the brokerage industry is being implemented by Paine, Webber, Jackson & Curtis, New York.

Cage operations involve the cash-

(Continued on page 136)

"If there's a better computer than the IBM 1800, I haven't seen it."

Of course he hasn't. Like a lot of executives, he shies away from any computer that doesn't have IBM on the front of it.

The name gives him a nice warm glow of security. Which is fine for him, but rather costly for his company. Since we, Systems Engineering Laboratories, can deliver a better computer than the IBM 1800 for roughly half the price.

Our SEL 810B is faster than the IBM 1800—750 nanoseconds versus 2 or 4 microseconds.

At Systems Engineering Laboratories, we design and deliver custom front-end equipment with the SEL 810B. IBM doesn't with the 1800.

We deliver an SEL 810B in 60 days. It'll probably take you another ten months to get an IBM 1800.

The price difference is rather amazing. You can actually buy two SEL 810B's for the price of a typical 1800.

IBM's answer to all this may be a sermon on service. We swear by our service staff, too. But we say a computer exists to work, not to be worked on.

Now then, we'll be very happy to demonstrate the differences between the SEL 810B and the IBM 1800. After which you may ask your executive decision-makers to take the blinders off long enough for a repeat performance.

Once they get over their skittishness they'll learn something: There are people in this computer business who can make a horse race of it.

For a demonstration, 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 65 ON READER CARD

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ier's area, where securities and money are received, processed, and delivered. Traditional manual methods of handling cage operations have resulted in a multitude of clerical errors, contributing to the problem of "fails," which is plaguing Wall Street, having sent several firms into bankruptcy or merger and necessitated several restrictions in trading and broker expansion. (A fail occurs when a brokerage is unable to deliver a certificate for a stock which has been sold by the fifth business day following the transaction.) Through automation, PW will "increase clerical accuracy in this phase of processing by 90%," according to Samuel A. Gay, partner in charge of operations.

The fully implemented PW edp system will perform the following tasks: process stock certificates; prepare a daily record of stock movements; locate and determine the status of a stock certificate in any phase of processing; obtain an instant inventory of securities; and determine what stock is available for delivery.

In its initial phase, the PW system processes stock certificates sent to the cage from its 63 branch offices. The system makes use of idle time on a CDC 8090 switching computer (a back-up for a second 8090 which controls messages and securities orders between PW's branches and the floors of the New York and American stock exchanges). The cage is linked to the cpu's by CDC 210 Entry/Display crt's and receive-only Teletypes. In April, implementation will begin of two CDC 3300's, replacing the 8090's for communications, and two IBM 360/50's for data processing.

Manual operations presently being automated include the following steps: Each certificate arrives in the cage with a ticket attached, carrying the name of the stock, number of shares, and customer's account number. To enter this transaction into the computerized bookkeeping system, a clerk searches by hand for the stock's computer code number in a tub-like device containing some 35,000 alphabetized stock issues. Once located, the code number is written on the ticket, and this data is keypunched on cards. Errors often occur in selecting the wrong stock from the tub, writing down the wrong code number, or in keypunching. Once errors are introduced into the bookkeeping system, they sometimes take as long as two days to show up in stock record keeping. The new system spots them "in minutes."

The basic concept of the automated

system is to treat stock certificates as pieces of inventory, utilizing edp to record and keep track of their locations. Under the initial phase of automation, an operator at a crt calls up the specific stock by name from the file. This provides her with the stock's computer code number. She then types in the customer's account number, number of shares, and disposition of the stock. With the data displayed on the crt screen, she verifies it against the stock and the ticket, then enters it into the computer. A confirming reply is printed on a Teletype, repeating details of the transaction. The print-out, ticket, and certificate are then microfilmed, providing a permanent record.

If PW solves its cage problems, however, it still remains for the rest of the brokers to follow suit, since one broker's automation does not solve another's problems, and all are dependent on each other to deliver stock certificates. PW will also face the conversion necessary when the new standardized stock certificate is approved; it is expected to be machine-readable, probably in the form of a punched card.

BUNKER RAMO SIGNS FOR OTC SYSTEM

The National Association of Securities Dealers has signed a seven-year contract with Bunker Ramo Corp. to build and operate an automated quotation system for the Over-The-Counter market. The system, to begin operation in 1970, is intended to solve many of the information problems of this market and provide stronger stock-watching ability—making it much more than a "weak sister" to the New York and American Stock Exchange securities markets.

In the past, traders have been relegated to searching yesterday's "pink sheets" of OTC quotes or making delaying calls to market-makers in an issue for bid-ask data. Very little volume data has ever been available. Under the new system, the market-maker will input, via crt console, the quotations, which will be available through the more than 30,000 desk-top interrogation devices now in the offices of brokers, retail traders and market-makers nationwide. Bunker Ramo, Scantlin Electronics, and Ultronics currently provide the devices and NYSE and Amex quotes. The NASDAQ system will initially provide quotes on about 1500 OTC issues and ultimately will handle up to 20,000 issues.

In addition to this service, said NASD president Richard Walbert, "the NASDAQ system will furnish the NASD itself with summary reports of OTC activity and will also supply end-of-day reports to newspapers and wire services for publication in the daily stock tables. These reports will include volume and net change as well as more reliable bid and ask quotations than have ever been available to the public."

The NASD, an organization of 3800 broker/dealer securities firms, is responsible for regulating the unlisted securities markets and its members and salesmen in the business. It will own the data in the system, control selection of market makers and qualified securities, set the charges for the service, and set and enforce rules for use of NASDAQ.

There will be three levels of subscribers. Level III subscribers are the market-makers who will enter bid and ask quotes on issues they deal in through crt consoles with special keyboards or key-sets. The key-set user will also be able to obtain on a 12-inch crt the list of all market-makers in an issue and quotes from each one. Basic charge for this terminal will be $400/month, $380 for the second terminal, $350 for additional terminals. Level III users can enter and change any number of quotes, make up to 100 quote requests per day, and make five "stock listings" without additional charge. Requests in excess of 100 will be 10¢ each, $5/month for each stock over five on which the market-maker enters quotes.

Level II subscribers will be retail trading firms executing orders for the public, who will be able to request the names and quotes of market-makers in an issue. The terminal cost will be $350, $330, and $300/month for first, second, and additional terminals, plus 10¢ for requests over 100.

Level I subscribers will receive "representative" or median quotes on an issue over the desk-top terminals currently installed (30,000). This service (not the terminal) is $20/month, $10 for service on additional terminals at the same site.

Sources estimate Bunker Ramo revenues from the system will exceed $15 million a year.

The system will include two Univac 1108 computers, one for back-up, three banks of 432 and 1782 drum storage systems, high-speed printer, and card readers. Concentrators will be located in New York (three), Chicago, the west coast, the south, and southwest. The concentrators are designed by Bunker Ramo; the New York systems will transmit at 19.2 KC, while the others will handle 4800 baud lines.

AUSSIE BANKS FEAR FOREIGN COMPETITION

Australian banks, fearful of competi-

tion from overseas or foreign controlled banks in Japan and the U.S., have the urge to merge. In one proposed merger, the Australian and New Zealand Bank (ANZ) and the English, Scottish and Australian Bank (ES&A) will pool their resources, and it's also been announced that the Bank of South Wales and the Commercial Bank of Australia are talking about a merger. The reasons given for these mergers, which would reduce the number of competitive banks in Australia, is that combining banking systems would bring down the cost of edp. However, it has been government policy in Australia that foreign banks are not welcome, and the mergers will lessen the number of private banks that foreign banks can buy into, thus staving off somewhat the growing trade imbalance between Australia and Japan.

The economic reasons for merger advanced by the Australian banks would seem to be unsound, especially in the case of the Bank of New South Wales and the Commercial Bank of Australia. They would be faced straightaway with a computer incompatibility problem. The Bank of New South Wales has based its edp program since its beginning in 1964 on the use of systems supplied by Australian GE and manufactured by U.S. GE. However, the Commercial Bank has placed its first order with Burroughs. The Wales Bank operates in Sydney, the Commercial plans an operation in Melbourne. The two systems could not automatically be adapted to each other, and a tremendous amount of reprogramming would be in order. It is not an integration of the kind that brings economies.

The other merger would present fewer problems. The ES&A has been using service bureaus facilities and has not ordered equipment. The ANZ, always one of the bank leaders in edp, operates GE machines in Melbourne and recently expanded into Sydney. They could merge without too many edp difficulties.

MOORE SCHOOL ESTABLISHES GRADUATE COMPUTER DEGREE

After a decade of Topsy-like growth in computer and information science curriculum at the Univ. of Pennsylvania, a graduate program in Computer and Information Science has been formally established at the Moore School. Because of the rapid growth in the number of MA and doctoral candidates, now numbering 235 graduate students, the curriculum has been struc-

tured with integrated curriculum and corresponding research program.

The group will be chaired by Dr. John W. Carr III, and five full professors are included in the faculty. About 30 advanced CIS courses will be offered with an additional 40 related courses available outside Moore School. A recently acquired RCA Spectra 70/46 will be used primarily for research. The detailed program will allow students in advanced CIS to emphasize software aspects of their research. This includes synthesis and analysis of artificial languages and their processors, theory and application of problem-solving mechanisms, and the study of artificial intelligence. Information theory, logic design, mathematics and switching theory also will be basic study areas.

NEW COMPANIES, MERGERS, ACQUISITIONS

Agreement in principle has been reached for **Electronic Memories,** Hawthorne, Calif., to acquire **Dickson Electronics, Corp.,** Arizona manufacturer of tantalum capacitors and semiconductor devices. . . . **Consolidated Analysis Centers Inc.,** Los Angeles, has entered into a preliminary agreement with **Associated Computing Services, Inc.,** to purchase all outstanding ACS stock for an undisclosed amount of C.A.C.I. stock. . . . **Brandon Applied Systems** has agreed in principle to acquire **Business Intelligence Services Ltd.,** London. BIS is a market research, consulting and training firm similar to Brandon. In 1965 the two companies established a joint subsidiary, **Brandon Computer Services Ltd.,** in London. . . . **Intertech Research Services,** Huntsville, will exercise its option to purchase **Data Processing Services, Inc.,** of Chattanooga. . . . Assets of **Gulf Insurance Co.** have been sold to **Gulf Group, Inc.,** a wholly owned subsidiary of **University Computing Co.,** in a transaction involving $240 million based on current UCC common stock market price. And two other UCC subsidiaries—**Computer Industries, Inc.,** and **Computer Leasing**—have agreed to CII's acquisition of the leasing and financing firm. . . . **Advanced Memory Systems,** Sunnyvale, Calif., a new firm intending to design and manufacture products related to data processing and storage, has just completed private financing. . . . **Granite Equipment Leasing** has expanded into international operations with the establishment of **Granite Leaservices International Limited,** London. Other European offices are in the advanced planning stages. Granite has also reached an agreement in principle for the acquisition of **Management Dynamics Holdings Limited,** London, a dp services organization operating throughout the U.K., for approximately $7 million. . . . A new company, **Comserv Corp.,** has been formed in Minneapolis to offer consulting services, contract programming and proprietary software. Cofounders Leo J. Higgins, Jerry Kellenbenz, and James C. Borgstrom, come from Univac in the Twin Cities area. . . . A new computer terminal and peripheral systems manufacturer, **Cybercom Corp.,** has been launched by Eugene Kleiner, a cofounder of Fairchild Semiconductor Corp. Theodore W. Helweg is president of the firm, which plans product introduction this quarter. . . . **Computer Communications Consultants** (C3), specialists in software for message switching, has made a profit every month since its inception last May. The 16-man firm has offices in Falls Church, Va., Silver Spring, Md., and will be in Detroit soon. They're also thinking about going into hardware interfaces. . . . John R. Hillegass and J. Burt Totaro have formed **Computer Conversions, Inc.,** in Jenkintown, believed to be the first firm in the nation

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to specialize in computer conversions. . . . Private financing has been completed for **Iomec Inc.**, Santa Clara, Calif., firm founded last May to design and manufacture computer storage products, all now in the prototype stage. The largest single investor is **EDP Resources,** marking that company's entrance into the manufacturing field. The other major investors are Laurance S. Rockefeller and members of the family and Hornblower & Weeks-Hamphill, Noyes. The four Iomec cofounders—Harold E. Eden, president; Raymond Herrera, vp in charge of engineering; Donald D. Johnson, vp of research; and Robert J. Domenico, operations vp—are all former IBM-San Jose execs. Fifth principal is Paul A. Holland, vp in charge of finance. . . . **Computer Time-Sharing Corp.** of Palo Alto has announced an agreement in principle for its acquisition of **Systems Analysis Inc.,** Los Altos. . . . **Computer Research, Inc.,** Pittsburgh software house dealing in applications packages, acquired seven more nursing homes last month, bringing its collection to a total of 13. The firm, 49%-owned by conglomerate **National Industries, Inc.,** intends to acquire still more nursing homes. A special stockholders' meeting approved an increase in authorized common stock from 1.2 to 5 million shares, with the additional stock to be used for the acquisition program. . . . **Computer Age Industries, Inc.,** Fairfax, Va., has acquired **Bell Educational Services, Inc.,** Washington, D.C. Bell provides "professional assistance in program planning and development" for educational institutions and for educational subsidiaries of business and industry. Although terms of the acquisition were not disclosed, it was revealed that Bell will operate as a wholly-owned subsidiary under present management. CAI Pres. Swen A. Larsen stated that Bell's "professionalism in the field of education will enable Computer Age Industries to expand its capability of providing the finest in training in all areas where computer skills are needed." . . . **Computer Counseling, Inc.,** Baltimore, has acquired **Trionics Engineering Corp.,** Reisterstown, Md., for an undisclosed amount of cash and stock. Trionics, a missile-oriented research design and technical publishing company, will continue to be administered by present management, and will operate as a subsidiary. . . . **Randolph Computer Corp.** has established a wholly owned subsidiary, **Randolph Computer of Canada, Ltd.,** Toronto, as the firm's first corporate subsidiary outside the U.S.; like its parent, RCC Ltd. will specialize in leasing IBM equipment.

● EDP Technology's plan to buy Cornell Aeronautical Laboratory for $25 million has been stopped, at least temporarily. State Supreme Court Justice Frederick Marshall issued an injunction last month that bans completion of the sale until its legality has been determined. Earlier, State Attorney General Louis J. Lefkowitz, acting at the request of the state atomic and space development authority, had insisted the lab couldn't be sold because it was given to the university as a gift by Curtis-Wright and other aircraft manufacturers, who wanted the facilities used to benefit their industry.

● PL/I, currently available for 360 series machines 25 through 85, will be put out in a model 20 sized version in the second quarter of 1970, IBM announced. The model 20 language processor will be disc resident, and will require a minimum of 16K bytes of core storage.

● Pillsbury Corp.'s, Call-a Computer division, which bills itself as the world's second largest time-sharing service organization, has signed an agreement with National Payroll, Inc., to market NPI's payroll services and income tax accounting packages. The programs will be offered to the public accounting professionals in 23 cities in the midwest, south, eastern seaboard, and Los Angeles areas.

● Astrocom Corporation is a new St. Paul-based company making data communications systems and offering services relating to installation and maintenance of such systems. By April, the first system is expected to be ready and will consist of on-site (such as a factory, campus, or other small area) land lines (non-common carrier), transmitter, receiver, and modems for computer data movement. Transmission may be between computers or between remote terminals and computers. Later systems are being developed that could use land lines for up to 20-mile distances, and still later systems will use transmission other than land lines or coaxial cable. Astrocom's officers are: Lawrence Kuller, president, who came from Computer Communications Inc., Huntington Beach, Calif.; Earl J. Hansen, vp of manufacturing and treasurer, who had been project manager at CDC; Sidney N. Jerson, vp

of development and secretary; and Robert E. Rife, vp of marketing.

● De La Rue Bull announced installation of the third and fourth GE 235 time-sharing systems in Great Britain, at Acton and Manchester. The firm, which is a part of GE's Information Systems Group and supplies a complete line of hardware ranging from keypunches to computers, also announced its name is changed to G.E.I.S. Ltd. It is 50% owned by Bull-GE, 25% by De La Rue Corp., and 25% by GE.

● Time-Sharing Enterprises, Inc., Philadelphia, publishers of the *Time-Sharing Industry Directory,* has entered the time-sharing applications area. The firm will assist clients in designing and implementing time-sharing applications. Pres. Alan G. Hammersmith stated that "the many time-sharing systems available today offer a variety of capabilities and costs. Since we do *not* operate such a system, we are in an excellent position to select the best system for a given application."

● University Computing Company (Great Britain) Ltd., a subsidiary of the Dallas, Texas, firm, has opened a $3 million Univac 1108 installation in London to provide on-line services to customers in Switzerland, Holland, Germany, France, and Belgium. The installation is claimed to be the first service bureau linking overseas customers on-line to a cpu. UCC Great Britain also operates a Univac 1107-based center in Birmingham.

● Honeywell has introduced a "simple CAI system" that provides student-teacher interaction and helps reduce the cost of computer-assisted instruction. Basic configuration includes a model 1200 cpu with 32,768 characters of main memory, three mag tape drives, one disc drive that stores and retrieves 9.2 million characters, and six Visual Information Projection (VIP) terminals. Since this hardware is capable of processing administrative data, schools can do R&D work on CAI without incurring the sometimes prohibitive high cost associated with equipment dedicated to CAI. The application package uses Honeywell's Author Language (HAL), which incorporates routines that "liberate" instructional programs written in COURSEWRITER and COURSEWRITER I and requires no previous computer or programming experience by the teacher. The computer keeps records on each student's progress and prints out reports on request, enabling the teacher to monitor student progress.

● Factsystem, Inc., Chicago software house, has changed the marketing policy of its Factsystem—a management information system—so that it is available in modules on one-year leases. Previously, the firm had offered the system only as a complete package or for use at its own service center. The change is from $150K license fee or $5K monthly rental long term for the whole system to a $1K minimum rental per month for a portion of it. Other sections may be added as completed and a major portion of the term lease payments may be applied to permanent licensing of the system. It operates on an IBM 360, under DOS, requiring 65K core; 10 modules will eventually be available.

● The Association of Data Processing Service Organizations, Inc., has established a Time Sharing Section which will be composed exclusively of time-sharing companies, with a chairman, vice chairman, and secretary elected from its membership. Each member firm will also be a member of ADAPSO. The section began in December with five members, three of which were already ADAPSO members; expansion to about 30 firms is expected, according to ADAPSO exec vp J. L. Dreyer. He stated that the t-s companies had considered forming an independent t-s association, but had accepted ADAPSO's offer of a t-s division instead. Dreyer noted that any statements originating in the t-s section would be designated as such, in an effort to avoid problems of conflicts of interest between the t-s firms and other ADAPSO members. However, he felt both groups would be in substantial agreement on most issues.

● Standard Memories, Inc., Sherman Oaks, Calif., is how offering its ECOM 2.5 line of core memory systems at a 30% reduction in price, with a unit sales tag of $2,469, compared to the former price of $3,579. According to Bill Barnes, vp marketing, the cost will be around 2¢ per bit in moderate production quantities, which is less, he contends, than many users are now paying for core stack alone. The move was made possible, said Barnes, by recent volume purchases of ECOM 2.5,

which, in turn, enabled the firm to make volume buys of components.

● ITT Data Services has opened a center in Chicago that offers time-sharing, batch processing, and programming services, and is equipped with an IBM 360/50. ITT Data Services also announced consummation of an agreement with Scientific Resources Corp., Philadelphia, for exclusive rights to market FORCE-III (FORTRAN Conversational Environment), a time-sharing software package developed by SRC subsidiary Honig Time Sharing Associates, Inc., Hartsdale, N.Y.

● The Sumitomo Bank of California claims to be the first in the state to fully computerize savings deposit passbook processing. Using two NCR 315 systems, one in the Los Angeles area and one in San Francisco, the bank processes its eight branches passbook accounting on-line. A teller keys in the account number of the passbook, along with the deposit or withdrawal information. Central files are updated with the new totals, and the customer's passbook is imprinted with the new balance. Should a non-passbook entry have been made at some other time, or should the customer have an interest payment coming, the passbook is automatically updated by the system. A typical transaction time is as little as half a second for a verification only.

● There's cheery news for clients of the Federal Bankruptcy Court in Birmingham, Ala., who might otherwise be discouraged: the court has installed a 360/20 and it is "guiding 6000 debtors along a computerized path toward financial stability." The court claims a reduction in administration costs to 5% from 8% of the debtors' payments and an increase in successful debt retirement from 60% to 80% of the payers. The machine handles accounting and determines priority of payments, thus giving the creditors a feeling of security.

● IBM has announced new software for the 360/25, designed to make it easier for 1400-series users to move up to a 360/25. The new package will allow 1401, 1440, 1460, and System/360 programs to run in a single job stream under the multiprogramming facilities of DOS/360. The feature, scheduled to be available in the second quarter of '69, is used in conjunction with Compatibility Support/30, a program that permits emulation of 1400-series programs on the /25 as well as the /30. An increased selector channel speed will permit attachment of 2401 mag tape units with a rate of 60K bps, double the present maximum rate for the 360/25. This feature will be available by next month. At that time, an adapter that permits direct attachment of an 1100-lpm printer will also be available, at a rental of $60/mo., or a selling price of $3,048. At present, only a 600-lpm printer may be attached directly to the 360/25 without the use of a separate control unit.

● Logic Corp., Haddonfield, N.J., has concluded an agreement with Manufacturers' Lease Plans, Inc., Phoenix, to undertake exclusive leasing of LC-720 multiple-terminal key-to-tape and key-to-disc systems. A long term lease/purchase agreement for a 50-keyboard key-to-disc system valued at $235K would cost $5,475/mo., while a short term lease would be $6,800/mo.

● Burroughs 5500 users opened up their latest Mark IX (operating system) package around Christmas time

and—much to their surprise—found mod 6500 COBOL and ALGOL compilers. Funny thing is users aren't expecting their 6500's until at least spring. Nevertheless, they can work with the compilers since filters are provided which permit compiling on the 5500, though not execution.

● Leasing firm Greyhound Computer Corp. has entered the time-sharing services field through the newly established Greyhound Time-Sharing Corp., Chicago, headed by Ryal R. Poppa. The new firm is actually 88% owned by GCC and 12%-owned by Data Architects, Inc., Waltham, Mass.

shortlines . . .

The Norwegian ship classification company Det norske Veritas has ordered a Univac 1108 system to be installed August/September. The company's recently formed subsidiary, Computas, will run it as a service bureau using remote terminals throughout Scandinavia, and time-sharing services are expected to be offered. The Norwegian Computing Center's 1107 and service bureau operations will be completely taken over by Computas. . . . First purchaser of Scientific Control Corp.'s new 6700 time-share computer is Information Industries, Inc., Los Angeles, who plans to use seven more of the systems over a two-year period. The $2+ million system will be installed late this year. . . . The National Institute of Law Enforcement and Criminal Justice has announced a grants program, Exercise Acorn, for research in the areas of crime prevention and control, corrections and the administration of justice. Proposals must be submitted by April 15 to Institute director Ralph G. H. Siu, U.S. Dept. of Justice, Washington, D.C. 20530. . . . First delivery of an NCR Century 100 system to an educational institution has been made to San Jose City College (Calif.). . . . Com-Share Inc., Ann Arbor t-s firm, has a new affiliate in Computer Sharing of Canada, Toronto. . . . Diebold Computer Leasing, Inc., announced it had more than $130 million of computer equipment under lease at the close of 1968. . . . Time Share Corp., Hanover, N.H., received the first Hewlett-Packard Model 2000A to be delivered to any customer, the first of five ordered by the firm; each will accommodate up to 16 simultaneous users. . . . Computer Investors Group, Inc., Larchmont, N.Y., leasing firm, has established offices in Canada, England, Germany, and Italy after raising $12 million in Euro-dollar bonds. The firm expects a volume in excess of $50 million in European business this year. ■

radio

astronomy

radio telescope controller-processor

Air Force Cambridge Research Laboratories
Waltham, Massachusetts

system spotlight

This is one of a series of descriptions of new computer-based systems of general interest. The equipment discussed is already installed and operational.

Information for this series is invited. Applications submitted should involve a computer as a controller.

Apollo astronauts may be subjected to dangerous solar radiation while working beyond the protection of the earth's atmosphere and magnetic field. This will be a year of unusual solar activity, including predicted "proton showers" which present some of the same radiation hazards associated with large-scale nuclear explosions.

computer and peripherals

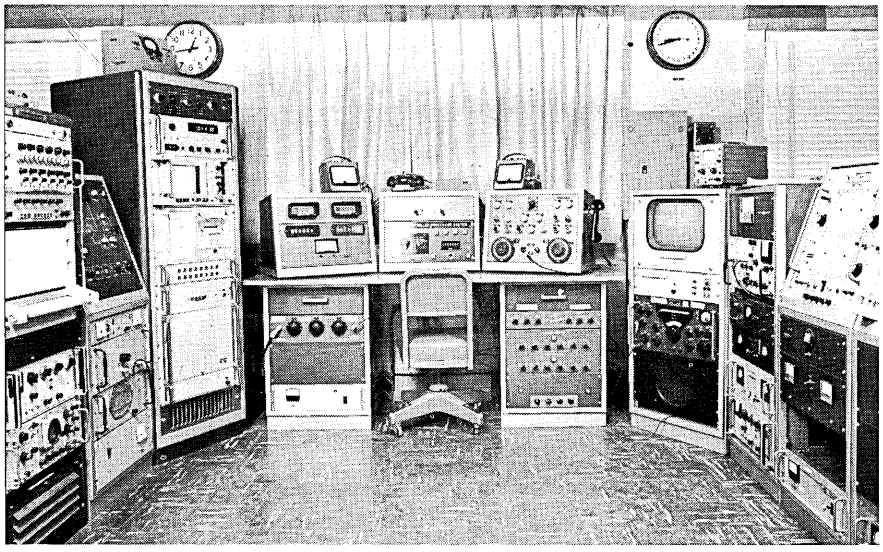
IBM 1800 processor
16K words of core memory,
2 usec cycle time
12 levels of external interrupts
4 data channels
digital and digital-analog
channel adaptors
card reader/punch, mag tape
Astrodata time code generator
Logicon operator's panel

application

One of the instruments at the Prospect Hill Radio Observatory in Waltham, Mass., is a 29-foot parabolic radio telescope used for studying the sun, moon, planets, and celestial radio sources, and for experiments in millimeter wave radio transmissions. The 35 GHz, 8 millimeter wave bandwidth to which the antenna is sensitive is being examined for high data rate transmissions, for high resolution and precision radar, for examining and mapping atmospheric conditions including clear air turbulence, and for experimentation leading to the prediction of solar flares.

This latter application, the examination and prediction of solar flares, is of immediate importance to the Apollo program. After some – but not all – solar flares, streams of protons are

The control and receiving equipment for the radio telescope includes a specially-filtered tv monitor and a Logicon-designed operator's control panel.



emitted from the surface of the sun. These extremely hazardous "proton showers" are absorbed and deflected by the earth's atmosphere and magnetic field, but astronauts will not be thus naturally protected. To reduce the chances of their exposure to such showers, the Air Force Cambridge Research Laboratories (AFCRL) are attempting to develop a technique to predict these occurrences. Given advance warning of a shower, astronauts could either be returned to earth or could face their spacecraft's engines to the sun to shield them from the radiation stream.

Prior to the installation of the IBM 1800-based Antenna Controller-Processor System, the 29-foot antenna was positioned through punched tape-controlled servos. Normally, several days were required for the generation of the punched tape, which was created from ephemeris data (geocentric celestial coordinate position data) on an IBM 7044-7094 system. However, since solar flares and their corresponding high temperature areas often last only a few minutes, a faster antenna-positioning system is now required. The positioning system's accuracy is also very critical. Although the areas of interest on the solar surface are roughly the diameter of the earth, they are small and elusive viewed from a distance of 93 million miles.

Logicon, a San Pedro, Calif., systems engineering and computer sciences firm, contracted to design and supply a computer-driven antenna positioning system and its requisite software at a cost of about a quarter of a million dollars. The system they installed is capable of monitoring 250 programmed points on the sun, and provides for "jump mode" positioning to any other point, homing in on the 2 arc-degree target in increments of 4.95 arc-seconds. This resolution is roughly equivalent to pointing within 1½ inches of an object from a distance of a mile.

hardware

In operation, inputs are supplied on punched cards for the atmospheric pressure, humidity, temperature, and dew point—all critical factors in the refraction of 8mm radio waves — and on the object to be tracked and the tracking mode to be employed. Ephemeris data from the Nautical Almanac Office of the U. S. Naval Observatory is supplied on mag tape. Further positioning inputs are manually entered through the Logicon-designed operator's panel. The Astrodata time clock serves as a fourth input source, providing 40 millisecond pulses for updating the ephemeris data.

Output commands are transmitted to the servo-controller through two parallel 18-bit registers. Shaft encoders on the drive mechanism relay the actual positioning results to the operator. In the future these shaft-encoder signals may be returned to the 1800 for closed- loop corrections.

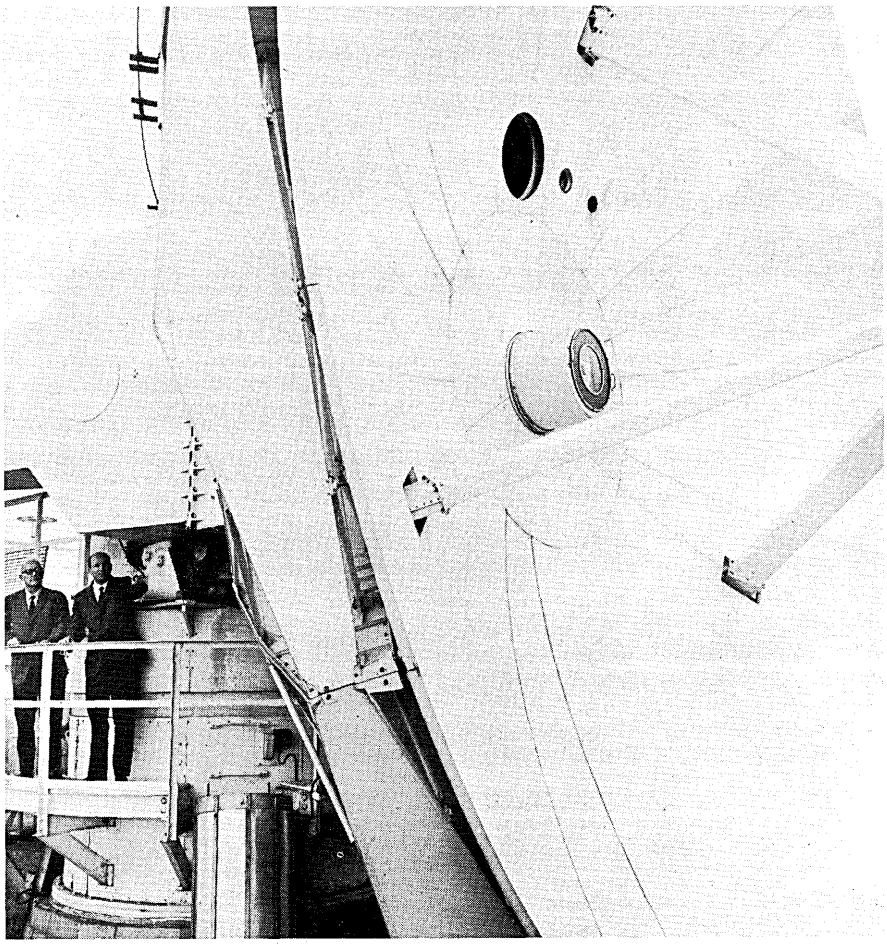
The radio signals received are translated by radiometer gear into temperatures, are printed and strip-chart recorded, and are sent to the Air Force Solar Forecasting Center in Colorado Springs, Colo.

software

Thirty resident subroutines, 10 in assembly language and 20 in FORTRAN IV, perform transformations of the geocentric ephemeris data to topocentric (earth surface) coordinates, and calculate the servo-controller commands after compensating for atmospheric conditions, antenna tilt, and the earth's rotation. The software provides for nine modes of scanning, including raster scanning and rim scanning of the sun or moon, multiple star tracking of up to 100 stars, and drift scanning (waiting for the desired object to cross the path of the telescope beam). Continual interpolations are performed to break down the 24-hour mag tape information to the 10-30 second intervals at which the geometry is recomputed.

Basic to the operation of the software is the interrogation of the rotary switches and buttons on the operator's control panel, from where the tracking mode selection, manual controlling, and position command correction can be done. ■

The surface segments of the 29-foot AFCRL dish have been individually adjusted to be within 0.012 inch of a true parabola.



Surprise package

FORMATTER — a new *kind* of software package. 5 packs like this, 200 cards in each. Supporting manuals.

That's all there is. But look what it does! **It effectively converts your line printer into a document printer.**

FORMATTER prints blocks of data, handling page numbering, heading and page overflow. It will print your data in any format you want. The programmer doesn't have to worry about the layout. FORMATTER looks after all this for him. If he wants to change the format, he doesn't have to modify his program. He's free to concentrate on the logic. He can consider the document *as a whole* — not as a succession of lines. **It's easy to learn.**

FORMATTER allows you to change your order of printing at run-time. Means faster printing, more time for new work, fewer programs to write. FORMATTER is a stand-alone program for use in COBOL and Assembler Language installations, and is also suitable for multi-programming. There are only 9 operating instructions. **It's easy to use.**

FORMATTER, in short, is incredibly time and effort saving.

Hoskyns Systems Research is the software subsidiary of one of the largest consulting groups in Britain.

FORMATTER costs $850 — a small price for a very big programming advantage. If you are a DOS installation, you can use FORMATTER now.

hoskyns systems research

Hoskyns Systems Research Inc., 61 Broadway, New York, N.Y. 10015. Telephone: 212 9434771

CIRCLE 75 ON READER CARD

To: Hoskyns Systems Research Inc.,
61 Broadway, New York, N.Y. 10006.
I am interested in Formatter

Name _____

Company _____

Position in Company _____

Address _____

new products

multiple disc drive

Polishing up its one-upsmanship, CDC has rolled out a multiple disc drive which appears to be an IBM 2314 in a new cabinet. But there is an added twist. The 2314 drive operates nine spindles simultaneously, eight for on-line use and one as a back-up. The CDC 841 can run the eight-plus-one configuration, too, or a seven-plus-one or six-plus-one or even a three-plus-

one, for a small user who plans to become big. In other particulars, the CDC seems to read the same as the IBM unit: 11-disc packs, 35 million characters per disc, recording densities which vary from 1530 bpi for outer tracks to 2200 bpi for inner tracks, access times of 75 msec, transfer rates of about 400 Kc, total capacity over 1.7 gigabits.

Purchase price for the smallest version of the system, the four-spindle model, is around $87,000; a nine-spindle version sells for about $192,000 (compared to $244,440 for IBM's). The specs are comparable to IBM's, but that modularity factor and price difference look like unfair competition. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 160 ON READER CARD

disc drive

"Compatible" is not a strong enough word, apparently, for the relationship of the Model 1100 disc drive to the IBM 2311. The 1100 is meant to be an exact copy of the IBM unit, offering not only compatible specs, but also an identical cabinet on which "only the name has been changed." Using the same IBM 1316-type pack, the unit is rated at 156 Kbps transfer rate, 75 msec average positioning time, and 12.5 msec average latency time. Leases are available. LINNELL ELECTRONICS, Pennsauken, N.J. For information:

CIRCLE 161 ON READER CARD

audio response unit

Talking to computers is becoming an increasingly popular national pastime. Recognizing this, and also recognizing that many users do not require the voice answer-back capabilities of large audio response units such as IBM's 7770, this firm is offering a modularized audio system which performs the answer-back function for as few as eight lines. Digitalk hears inputs in binary from a computer and composes answers from its 31-word or phrase vocabulary.

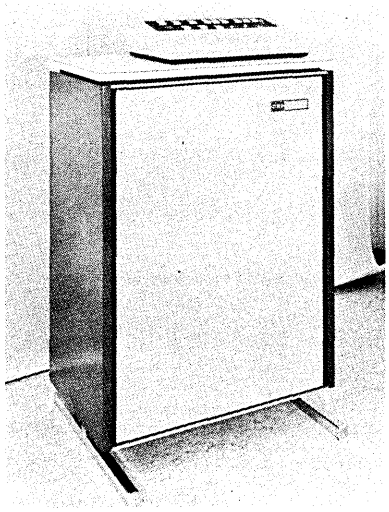
The Digitalk drum, which contains the recorded voice messages, uses fixed heads over 31 tracks; each track may contain one word recorded three times, or a phrase. The resulting sys-

At one time data processing operations were small and close to their primary users. The introduction of second generation machines saw a move toward decentralization, a pooling of resources that took the computer further from the end user. The present trend is to bring the data processing equipment back—call it a return to the suburbs—in the form of a remote terminal or local satellite computer. One such local terminal and peripheral controller is the DCT-132, a stored-program 2K or 4K byte machine with a 21-instruction repertoire.

As a terminal, the DCT-132 can transmit or receive at 2,000 to 4,800 bps and control an ASR-33 tty, a 100 cpm card punch, a 300 lpm line printer, and a 200 cpm card reader, or any smaller configuration. The card reader and punch are Data Products devices; the printer is Analex's. As a "satellite," it can perform off-line services such as card-to-printer or card-to-paper tape or keyboard-to-card punch.

In addition, the DCT can be configured as a message concentrator, in which case it is called a DCT-32. In this capacity it is capable of concentrating up to 32 low speed lines (110 bps or less) into one 4800 bps communication line, or of packing medium speed (up to 1200 bps) asynchronous or high speed (up to 2,400 bps) synchronous lines.

The 2K or 4K bytes of 2 usec core are augmented by 32 bytes of read-only memory. In addition, the first 1K block of memory is treated as read-only unless otherwise desired by the operator. The operating system provides for indirect addressing, nesting of indirect addresses, and automatically updated memory pointers. The cpu uses four registers (address, location, memory data, and accumulator) and two half registers of four bits each ("save" and "operation"). A single I/O channel is provided, but the



first five bits of the 8-bit operand are a device code which is recognized by the device controllers.

The DCT-132 is priced at $16,300 for the base configuration including the line printer. The card reader runs $4,500; the punch $7,500. Base price on the DCT-32 configuration is $7,000. SCIENTIFIC CONTROL CORP., Dallas, Texas. For information:

CIRCLE 162 ON READER CARD

Just what, exactly, is Segmented-Level Programming?

Come to our Seminar and let us explain. But briefly, Segmented-Level Programming is a *new* and coherent technology for program design, programming, testing and documentation. It is designed to solve the insistent problems facing anyone developing complex software or applications systems, namely:
how to avoid enormous penalties in machine time and elapsed time during testing • how to ensure that testing really *is* thorough—that the bugs *are* out when you go live • how to ensure that program modifications do not generate new errors • how to re-allocate programming staff to meet urgent deadlines • how to increase both productivity and job satisfaction for your programmers • how to measure, day to day, the exact progress your teams have made towards their goals • how to pass on to each new programmer a completely thought-through methodology which will immediately raise his performance level.

In 1965 we formed the view that available programming techniques had hardly advanced in the previous six to eight years. We therefore set up an experienced team to develop a value engineering approach to programming, concentrating on Assembler Language under DOS on the 360. Segmented-Level Programming is the result: for over two years we have used it exclusively when building both software and applications program suites. Our continuing research into new approaches to programming has convinced us that today SLP is the only rational way to write programs.

Michael Jackson, who majored in classics at Oxford and mathematics at Cambridge, England, heads up the team of computer scientists who will speak at the Hoskyns seminar. His publications include contributions to Datamation in April, 1967 and February and May, 1968.

Segmented-Level Programming is:
a concept; an approach to segmentation in which the problem, the program, and the data have the most effective relationships one with another • a methodology for implementing the concept: a comprehensive set of standards • a family of macro-instructions to provide the facilities for linkage and for dynamic storage allocation • a special testing package.

We shall be describing SLP in detail, examining how it can be introduced into a busy installation, and discussing a case history, at a seminar **in the Americana Hotel, New York City, on Thursday, March 27th.** The principal speaker will be Michael Jackson, Technical Director of Hoskyns Systems Research Limited, the software company in the Hoskyns management consulting group.

For full particulars of the Seminar, and more information about SLP, mail us the coupon below.

To Hoskyns Systems Research Inc., 61 Broadway, New York, N.Y. 10006

Please send me full information concerning your Seminar on Segmented-Level Programming

NAME

COMPANY

POSITION IN COMPANY

ADDRESS

hoskyns systems research

tem conforms to EIA specifications RS-232-B.

An 8-line, 31-word or phrase base system sells for under $9,000. This price includes decoder electronics. If the base system is not large enough, its vocabulary may be expanded in 31-word increments, and its line-handling capabilities may be increased in any amount. A 256-word memory, for instance, without decoder electronics, would sell for about $14,000. Additional bins, for attaching up to 16 communications lines each, run $3,200. METROLAB, San Diego, Calif. For information:

CIRCLE 163 ON READER CARD

mos/lsi terminal

Up to 15 I/O devices, including card readers and punches, discs, tapes, printers, and crt displays, may be on-line to one "fourth generation" CP-4 remote communication terminal. The sending computer can route its transmission to any one of the devices, obviating the need for a computer-based controller on the receiving end, and therefore reducing the equipment cost, the manufacturer claims. The CP-4's standard code is EBCDIC, but it also speaks ASCII and ASCII-8, if desired, and automatically converts IBM 360 card code to any of these. Its language features were designed to make it compatible with the IBM 2780 terminal.

The standard 400-character MOS/LSI memory of the CP-4 is expandable to 1200 characters. Other standard features are: automatic answering, switchable code conversion, and automatic data compression through a format card.

A 16-bit cyclic check code is used for error detection in EBCDIC transmissions; vertical and longitudinal parities are used for the optional ASCII codes. Various control characters are added to transmissions to further assure data validity. Transmissions in error are automatically resent, and transmission speeds are determined only by line speeds.

The CP-4 is offered with a 315 lpm printer (the Potter HSP-3502), which prints 120 or 132 columns in the standard configuration, but may go to 160 columns optionally. The standard card reader (Burroughs A594) is rated at 300 cpm. The Teletype Inktronic TelePrinter is also available.

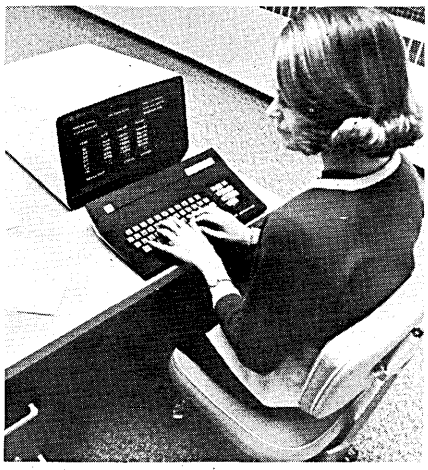
With the line printer and reader, the CP-4 is priced at about $40K. DATA COMPUTER SYSTEMS, Santa Ana, Calif. For information:

CIRCLE 164 ON READER CARD

key-to-four tapes

In many key-to-tape systems, input data from a key station is recorded onto ¼-inch mag tape and must be converted to full-size tape reels before it can be input to a computer. In most key-to-tape applications, including those using the ½-inch as well as the ¼-inch tapes, input data from several key stations must be "pooled" onto one reel to efficiently use the computer time. This system, the series 6000 Data Display Recorder System, records input data from several key stations directly onto one ½-inch tape without an intermediate pooling step. Up to 12 of the recorders can be linked to a rack of four tapes through a single controller, allowing any of the 12 operators to add data to any of the four tapes simultaneously.

The input system is built around a module of four stations. Given this configuration, the crt display screens at each station can work with up to the full complement of 1,024 characters—



including a keyed-in or tape-loaded facsimile of the source document—which the crt is capable of displaying. In a six-station system, the maximum character display is reduced to 512 characters; in a twelve-station system, the display falls to 256 characters . . . still plenty for most data input needs. On pushing a "record" button, the full display of input data is transferred to any of the four tape recorders chosen.

A ¼-inch tape cassette is used to store the key station's programs; up to 30,000 characters of input formats may be stored on a single tape, in any number of "programs." Once the program to be used is loaded into the station's memory, the cassette can be removed.

A basic series 6000 system, including a tape rack with one tape, a controller, and a 256-character display capability, leases for about $190/mo., or sells for about $6,850. SANDERS ASSOC., INC.; Nashua, New Hamp. For information:

CIRCLE 165 ON READER CARD

key-to-tape cartridge

The MAI 100 Data Transcriber is another in the plethora of new source-data-to-magnetic-tape conversion units. The device consists of a 64-character keyboard similar to an 029 keypunch; an 80-character core memory; and a dual vacuum capstan tape drive. MAI claims a significant advantage of the Transcriber is the use of a "unique"

self-threading tape cartridge which holds standard 8½-inch tape reels or 6-inch minireels. Model I, for 7-track tape, is available in 556 or 800 bpi versions, with 200 bpi capability an optional feature on the 556 bpi unit. Model II, for 9-track tape, is available at 800 bpi only.

The Transcriber operates in five modes, selectable via a five-position switch: program entry, program verify, search, data entry, and data verify. Key functions remain constant in all modes. To verify, the operator re-enters source data into memory; when the Transcriber detects an error, a warning light informs the operator, who then presses the "correct" key, enabling her to rewrite, adding one character to memory.

The basic unit uses an array of 35 light-emitting diodes which display the column desired and the data contained in the column in alphanumeric form (like the similar units of Sangamo, Sycor, Vanguard and Viatron, but unlike Honeywell, Mohawk, and Potter, which display digital readout). An optional crt displays 80 or 160 characters.

The unit is designed in a sufficiently modular form so that the crt may be field installed on the basic unit, should the user desire to add the crt later. A printer which will attach to the Transcriber is also planned. The 100 could, it is claimed, be used as an input terminal without the tape deck.

Model I will sell for $5800, and rent for $145/month; Model II will sell for $6400, rent for $160/month. Most competitive units are in the $7000 range, with the exception of Viatron's cut-rate System 21, which will only be rented. Like Viatron, MAI has designed and will market its key-to-tape unit, while another firm does the manufacturing: the Data Transcribers will

We can prove Keytape is more productive than keypunch. And you're still punching cards?

Tell it to me.

You say a Keytape unit can increase my productivity by 30% on the average. Fine. And that my computer can read input up to ten times faster. Because Keytape records data directly on magnetic tape. Instead of punch cards. O.K. You talk about how easy a Keytape unit is to learn and run. All right. You tell me the details. Send me your 40 page description manual right away.

Name_____

Company_____

Street_____

City_____ State_____ Zip_____

Send to Honeywell Communications and Data Products Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:
Honeywell

Sell it to me.

Sure, You've sold me on what a great idea Keytape is. Now's your chance to sell me a Keytape unit.

Send me your 40 page description manual and tell me where I can see a demonstration.

Name_____

Company_____

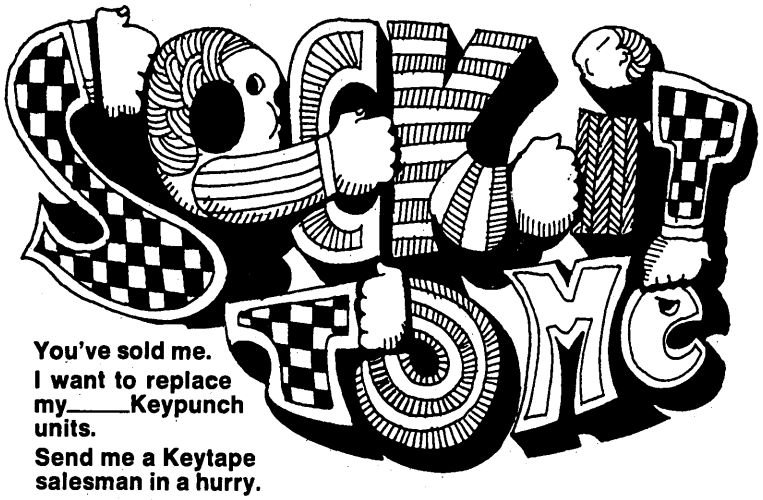
Street_____

City_____

State_____ Zip_____

Send to Honeywell Communications and Data Products Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:
Honeywell



You've sold me.
I want to replace my_____Keypunch units.
Send me a Keytape salesman in a hurry.
Sock it to me. Sock it to me. Sock it to me.

Name_____

Company_____

Street_____

City_____ **State**_____ **Zip**_____

Send to Honeywell Communications and Data Products Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:
Honeywell

be built by Digital Information Devices, Inc., Norristown, Pa. First deliveries will be in mid-year. MAI EQUIPMENT CORP., New York, N.Y. For information:

CIRCLE 166 ON READER CARD

key-to-tape

Since maintenance is included in the $150/month lease contract for the KB-600 Datascribe, the full-size key-to-tape unit will not be offered outside of Southern California for a few months. The 800 bpi key recorder unit will handle 10½-inch reels and provides standard key-to-tape features such as record and verify modes, error search and correction and at a base price of $7,500. Optional features to be announced this quarter include data "pooling" from several units to one tape and additional stored-program capacities (four programs will be stored internally rather than two).

The Datascribe displays column and character last keyed for visual verification; data seen to be in error can then be re-keyed. An error search can be made at speeds up to 32 ips if the visual verification is missed; and, finally, the verify mode serves to correct those errors which pass the originating operator. Record sizes for the 7- or 9-track tapes may extend to 200 characters; longitudinal, lateral, and bit-by-bit validity checks are made on the characters in those records. VANGUARD DATA SYSTEMS, Newport Beach, Calif. For information:

CIRCLE 167 ON READER CARD

key-to-tape

Professing that there is no reason for a key-to-tape station operator to see the record she is inputting, the makers of the Series 7500 (7-track) and Series 9500 (9-track) key recorders do not show even one character of the input record to the originating operator, only the column position. Should the operator suspect that she has keyed in an error, she may backspace and key over the incorrect character, at which time the original input or correction is visible to her in a ¾-inch format. Such error correction is made more easy for her through the incorporation of fast forward scan and fast reverse scan keys. In many key-to-tape systems the operator is forced to skip character by character through the record in error, once she has located that record; with the Series 7500 or 9500, the skip is performed at 5 cps automatically.

The Data Tape Systems contain a

cassette of computer grade certified .150-inch tape for intermediate input collection. When it is desired to transfer that input to a full-size tape, the transfer is initiated from controls at the Data Accumulator, which acts as a pooler. Data can be transferred by manually controlling the Accumulator, or by presetting its controls to access the key stations in a predetermined order. The intermediate cassette tapes need not be removed from the key station for the transfer, and up to 20 key stations can be handled by one Accumulator.

The key stations' 8,000 characters of delay line memory are sufficient for the storage of two programs, various control function information, and 160 characters of input. Should more program storage be desired, an "around $700" option added to the Accumulator makes up to 1,000 programs available in 15 seconds to any of the stations.

An end-of-record key allows any size of record to be input, up to the 160-character storage maximum. A "conditional skip" feature makes it easy for an operator to handle various lengths of data in a fixed-length field without having to manually skip to the programmed auto skip location for short entries.

The Series 7500 and 9500 Data Tape Systems sell for $4,995, or rent for $99/mo. The Accumulator sells for $8,900 in the 7-track version (or rents for $180/mo.), and for $10,200 in the 9-track version ($200/mo.). The supplier is a brand new vendor. TYCORE, INC., Chelmsford, Mass. For information:

CIRCLE 168 ON READER CARD

key-to-disc system

In the data entry field, coming up to compete with the computer-based versions (such as Logic Corp. and Com-

puter Machinery Corp.) are the R1 Systems, providing for key-to-disc input with mag tape or direct computer output. Seven models are offered, R1/1 through R1/7, whose major features are components with military- or industrial control-rated reliability and data entry software with 27 optional extensions to permit the user to go "far beyond keypunch functions."

The hardware: The basic $100K system includes eight keyboards, each with two Nixie tubes for display, a central processor or controller with 16K characters of core, a 450K-character disc drive, one incremental tape drive, and a supervisory station (ASR-33). The maximum system, at over $400K, includes 32 keyboards, 65K-core cpu, two tapes, disc unit with 7.5 million characters (5 million for user data), 300 lpm printer, data set interface, and interfaces to hook the R1 controller with an IBM 360 computer locally or remotely.

The cpu is Digital Equipment Corp.'s PDP-8/I. DEC is providing a three-rack system which includes the cpu and Realtronics-designed, field-installable control circuitry for the keyboards, buffer, and peripherals, which are all at the central site. Only the keyboard, Nixies, and cable are at the operator station, which can be 250 feet away from the system. DEC is also building Realtronics-designed dataset and PDP-8/I-to-360 interfaces. The

dataset interface, R1/43, permits 4800 bps transmission; the R1/41 computer interface provides 133K bytes/second transmission over a 2,000-foot line; the R1/42 remote computer interface permits 50K bytes/second transmission over any distance.

The 64-character shock-proof keyboards are made to order by INVAC, and the photoelectric keys are said to have an expected life of 26 years. The two Nixie tubes, which display any of the 64 alphanumeric characters, are made by Burroughs and are rated at 50,000 hours of continuous life. The incremental tapes, also special order, are made by Kennedy Co. and are military specification rated. They come in four 360-compatible models: 7-track at 200, 556, and 800 bpi, and 9-track at 800 bpi, with speeds of 500 cps for write and 1000 cps for read. DEC makes the smaller discs for the systems (DECDisc) and Data Disc makes the larger models.

Software: The software includes a "comprehensive supervisory control system," which acts as the executive and permits the human supervisor, through the ASR-33 console, to issue commands (such as assigning a keyboard to a job), inquiries, and to call up reports on operator production, jobs completed, time, etc.—all allowing "close production control." An internal job library contains up to 64 jobs and 192 program cards, or record programs, assigned to those jobs. Record size can be from 1-192 characters long. A keyboard operator can use two record programs during any input or verification period. The keyboard operates in three modes: alpha, numeric, and alphanumeric. Among capabilities provided the operator are searching the file, backspacing, overwriting, and display. The Nixies display the columns being written and the character. The keyboard locks if there is a record error.

Among the extensions of the software optionally available are sort, merge, and list (for manipulation of the file off-line), and sequence, expand, shift and selective shift expand, tag verify, add check, multiply check, autoswap, autobit, and autosign. With some of these extensions, for example, the data inputted can automatically be checked against a fixed file on the disc in such applications as parts list inventories; price calculations in invoices can also be checked against the file. In such cases the Nixies would indicate "GO" or "NO" for errors, indicating reentry.

The DEC PDP-8 software library will also be available to the user.

Price and maintenance: The R1 Systems, available 120 days after order, are available on purchase ($100K-400K), rental (about $2K-8K), or 4- and 5-year lease bases. A purchase option permits application of 90% of the first year, and 75% of the second year rental toward purchase. Realtronics, which already claims six sales, says the first 12 systems will be offered in the New York area only.

Maintenance will be under separate contract and will run about 10% of the system rental (it varies component to component, however). The firm intends to replace all faulty elements not easily repairable on site and says that any part of the system will fit into a case the size of a two-suiter so that the repairman can carry it with him. Realtronics expects to market nationally and may contract for maintenance of the system with an R1 supplier in areas where it does not establish offices. REALTRONICS, INC., New York, N.Y. For information:

CIRCLE 169 ON READER CARD

1600 bpi drive

The SC 1091 tape drive handles cartridges of ½-inch tape, and is compatible in read/write formats with the IBM 2420. Directed by its manufacturer at the oem marketplace, the drive is not plug-for-plug interchangeable with the 2420, as it might be if di-

rected to the end user market. The manufacturer says that this interchangeability feature may be added in the very near future.

Tape movement speed is 200 ips bidirectionally; tape loading and threading operations are fully automatic. A single capstan drive with vacuum column buffering is used. In operation the oxide side of the moving tape touches no stationary surfaces except for the cleaner and head, which are moved out of the tape path completely for rewind.

The price has not been announced, but will probably be competitive with the IBM 2420, which rents for $1050/mo. POTTER INSTRUMENT CO., INC., Plainview, L.I., N.Y. For information:

CIRCLE 170 ON READER CARD

performance monitor

Sixteen counters in the Computer Performance Monitor measure either the duration of a signal or count the number of times a signal occurs. When connected to channels or devices on an IBM 1130, 1800, or 360 series computer, the information gained can be used to evaluate the performance of the operating system and hardware configuration under existing job mix

conditions. A removable control panel containing Boolean logic elements makes it possible to measure quantities such as cpu and I/O overlap as well as simpler items such as "number of seeks" on disc or amount of core busy time. A mag tape unit with 1,200-foot reels is built in to collect the data gathered from the system's 20 measurement probes. The manufacturer of the CPM claims that the hardware/software system can be evaluated while in normal operation without interrupting or degrading performance. A Nixie decimal display is included for manually checking any of the 16 counters. Price of the Performance Monitor is $35,000. HEURISTIC SYSTEMS DIV., ALLIED COMPUTER TECHNOLOGY, Santa Monica, Calif. For information:

CIRCLE 171 ON READER CARD

portable acoustic coupler

Metroprocessing Corp. of America, the offspring of Metroprocessing Assoc. (both are headed and staffed by Dr. Leon Davidson), has announced its first product, the Fone-Tone 1200 Spartan Terminal, a battery-powered acoustic coupler which uses a standard twelve-button Touch-Tone pad. The 1200 consists of a sound unit which fastens to any telephone mouthpiece, using an elastic band; an input unit, containing the standard Touch-Tone pad assembly; and an answer unit utilizing a transistorized amplifier inductively coupled to the receiver element of the handset. The unit is manufactured by Roamwell Corp., New York, a manufacturer of telephone equipment. The 1200 comes in a carrying case measuring 13.5 x 9.5 x 5.5 inches, weighs 5 lbs., and sells for $235. Components are available separately, at prices of $25 for the sound unit, $135 for the input unit, and $90 for the answer unit with the case. Deliveries require 90 days. METROPROCESSING CORP. OF AMERICA, White Plains, N.Y. For information:

CIRCLE 172 ON READER CARD

small printer sans ribbon

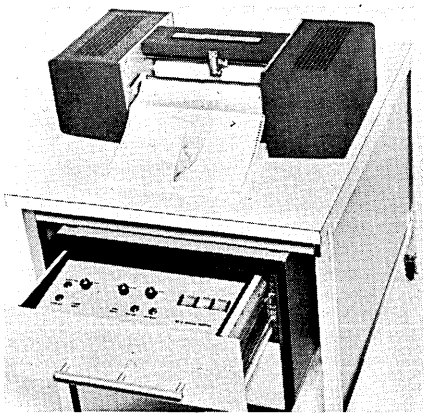
Somewhat like a line printer in the manner in which the paper is pressed against the ink source, the 0769 Incremental Printer is somewhat unlike any other printer. It has no ribbon, and the character font resides on a helical wheel, rather than on individual elements or on a "golf ball." The low-speed asynchronous printer is intended for use as part of a communications terminal or as part of a mag tape recording station, and, as such, is marketed mostly to oem. Rated at up to 25 characters per second, including line spacing, the printer forms its characters by pressing the helical wheel against the paper, which, in turn, presses against a "Porlon" roller ink supply. A full 63-character set is provided; up to 132 columns per line can be accommodated. The manufacturer claims that the small number of moving parts will help increase reliability.

Since the unit is directed to oem sales, it is being offered without controlling electronics, power supply or cabinet. Scheduled to go into production in the second quarter of this year, orders are being taken at $1,000 in large quantities. UNIVAC DIV., SPERRY RAND CORP., Philadelphia, Pa. For information:

CIRCLE 173 ON READER CARD

faster plotter

Conventional plotting programs, those now operating on 300 increment/second plotters, can still be used with the DP-5 plotter, although the speed has been increased to 1,200 increments/second on both axes. Actually, programming for the DP-5 remains the same, since its pen up/pen down speed has been increased along with its plotting speed . . . to 25 ms rather than the "conventional" 100 ms. Z-fold 10-inch paper is used, just as on the DP-1 and DP-3 plotters by the same vendor. The device, which can be used off-line

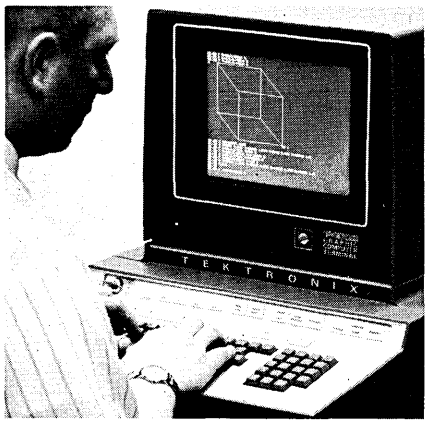


with an optional drive, sells for $11,000. HOUSTON INSTRUMENT, Bellaire, Texas. For information:

CIRCLE 174 ON READER CARD

graphic terminal

Complex graphics with up to 35 lines of 80 characters can be displayed on the 11-inch storage display tube of the T4002 Graphic Computer Terminal. Manually entered characters are shown in either of two keyboard-controlled sizes at resolutions equivalent



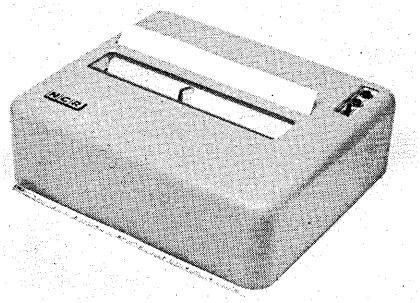
to 400-by-300 line pairs. Additional character sizes may be chosen as options. The terminal package includes the 128-code USASCII keyboard, crt, character generator, and I/O interface for about $8,500. Interfaces to the

DEC PDP-8 and to Bell Type 201 and 202 Data Sets are now available, others are to be included in the product line. The basic terminal sells for $8,000, the Bell interface is priced at $515, including cables, and the PDP-8 interface at $585, including cables. TEKTRONIX, INC., Beaverton, Oregon. For information:

CIRCLE 175 ON READER CARD

thermal printer

Originally manufactured for military applications, the supplier of the Miniature Page Printer claims that the thermal printing device has achieved a



mean time between failure rate in constant use of 43,000 hours. This reliability claim should make the unusual device attractive to oem's. The printer operates by applying heat to a matrix-type print head which is pressed against heat-sensitive paper. The 5 by 7 dot matrix letters can be formed at a rate of 300 wpm. Because of the manner of printing employed, the device is reportedly maintenance free, and should be noiseless. The printer's only moving part is the paper advance mechanism.

Weighing in at 11 pounds, the miniature printer is unit priced at about $1,900. The specially-manufactured paper, which has built-in dyes to form the images, is available for about $2.50/roll. INDUSTRIAL PRODUCTS DIV., NCR CO., Dayton, Ohio. For information:

CIRCLE 176 ON READER CARD

retailing data collection

The Span System collects data from machine-readable tags identifying merchandise or parts at remote store or warehouse locations, and transmits the information by regular phone lines to a firm's data center, where a receiver converts it to computer-compatible paper or mag tape. Based on Digitronics communication equipment, the Span System is intended primarily for use by retail chains which must collect sales data from local stores. Kimball stated that various types of Kimball-designed equipment are presently installed in 18,000 branches of chain stores, and they foresee installation of Span Systems in about 10% of these outlets within the next two years.

The system is said to be the first to transmit punched tag data over ordinary phone lines. According to the firm, all the data required for operation of even a large retail outlet can be transmitted for $1.00 per day, whereas the average cost of mailing the information contained in a single three minute Span message is approximately $2.50, including costs of handling the data, routing it, and conversion to computer tape, but not including postage.

The punched tags used by the system are commonly prepared and attached to merchandise by the manufacturers during the production cycle, using a common tag format standardized by the National Retail Merchants Assn. A typical retail garment tag includes, in addition to the punched area, the price, the size, and a code number reflecting style and color of the item. Kimball notes that punched tags can "be handled, abused, and even partially mutilated," yet still be read by machine.

When an item is sold, the clerk places the tag in a punched tag reader

new products

which is equipped with a 16-key adding machine for entering variable data; this unit records the data from up to 20 tags per minute on a mag tape cassette with a capacity of 14K characters on 300 feet of tape, or, optionally, 26.4K on 550 feet. When recording is complete, the cassette is placed on a 36 cps transmitter which acoustically couples to a telephone handset.

Data is received at the computer center by a Digitronics paper tape receiver or mag tape receiver, the latter available with options including 1020 or 160 characters at 800 bpi on 9-track tape. An optional automatic polling option permits polling of data from remote locations when the Span System is used in conjunction with Data Phones and optional unattended transmitters.

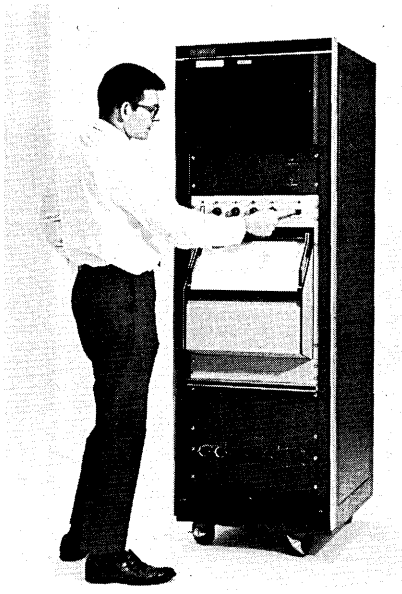
Price of the basic Span System, including tag reader, recorder, adding machine, and acoustic transmitter is $92.50/mo. including maintenance on a minimum two-year rental. Selling price is $3990 plus $25/mo. maintenance. A 7-track, 556 bpi mag tape receiver rents for $1495/mo. or sells for $49,975 plus $200/mo. maintenance in the latter case; installation charge is $300. A 36 cps unattended transmitter adds only $4.50/mo. to the price of the basic system, while the automatic polling option rents for $285/mo. and sells for $12,200 with no maintenance fee. In addition, the Span tag reader will be available to oem's for use as input to point-of-sale or industrial terminals. First deliveries of the Span System are expected this summer. KIMBALL SYSTEMS DIV., LITTON INDUSTRIES, Belleville, N. J. For information:

CIRCLE 177 ON READER CARD

500 kcps plotter

On a 7 by 11 font, 460 lines of 114 characters can be printed per minute by the Statos V printer/plotter. Since any or all of the 1,024 stylii which do the printing can be active at one time, the device is actually capable of 390,000 characters per minute if the full-width line is used. The Statos V can take its inputs from a computer, from paper or mag tape, or from instruments, but each type of input requires its own interface. Input terminals allow the system to accept either BCD and raster scan signals or binary and raster scan signals.

The plotter operates by electrically charging the continuous forms paper so that carbon in a liquid suspension from the toner will bond to it. With this



mechanism, the device's only moving parts are in the paper advance.

The Statos V model 500, with 1,024 stylii, sells for approximately $15,000. A model 514 with 1,400 stylii is also available. ELECTROGRAPHICS DIV., VARIAN ASSOC., Palo Alto, Calif. For information:

CIRCLE 178 ON READER CARD

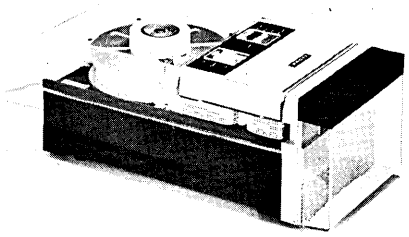
compact paper tape handler

Digitronics claims its Model 6040 Perforated Tape Handler "occupies at least 20% less rack space than other competitive models." The 6040 operates bidirectionally at speeds up to 70 ips using 8-inch NAB reels, or 60 ips using 10½-inch NAB reels. Panel height is 8¾ inches for the 8-inch reels and 12¼ inches for the 10½-inch reels. Standard 5-, 6-, 7-, and 8-level paper tape, ranging in width from 11/16 inch to 1 inch. can be accommodated. Bidirectional rewind speed is over 200 ips. The Tape Handler is compatible with the Digitronics Model 2540 Perforated Tape Reader and most other paper tape readers. Prices are $950 for the 8-inch reel handler, and $1100 for the 10½-inch reel unit. DIGITRONICS CORP., Albertson, N.Y. For information:

CIRCLE 179 ON READER CARD

paper tape punch

This Scandinavian import comes from Facit AB of Sweden, but will be marketed in the U.S. by Potter. The paper tape punch, model 4070, operates at speeds to 75 cps, in standard 5- to 8-track codes or the 6-track code used in typesetting. Incremental tape feeding is done by stepping motors, and is controlled by a sensing monitor which detects jammed or broken tape and detects when the tape reel has come to a



preset low tape level.

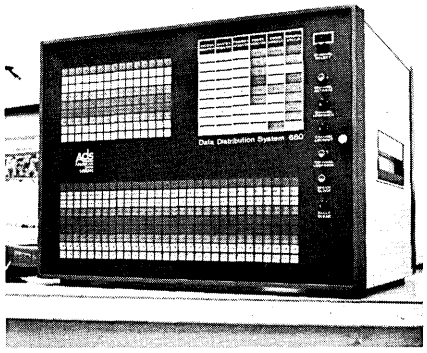
Control electronics are assembled on one board; space is reserved for a similar board to contain interface electronics. The 4070 is unit priced at $1,290, but aimed at the oem discount buyer. POTTER INSTRUMENT CO., INC., Plainview, L.I., N.Y. For information:

CIRCLE 180 ON READER CARD

data concentrator

A single high-speed voice grade telephone line can carry 45 channels of low-speed synchronous data when interfaced through the ADS-660 Data Distribution system. Specifically developed for time-sharing applications, the 660 uses time division techniques to achieve its rated capacity. Two types of interface modules are used to connect an I/O device to the 660, either an EIA (Data Set/computer) or tty (terminal/telegraph line) interface. These two types can be used interchangeably within the 660, without modification.

Intermixing I/O devices of up to three different transmission rates is allowable. For instance, the same 660 could be used to receive inputs from model 33 tty's (rated at 100 baud), model 37 tty's (rated at 150 baud), and from IBM 2741 terminals (148



baud). Since channel capacity is determined by the speeds of the devices, fewer than the maximum of 45 can be handled when the device speeds are mixed . . . the capacity is then determined by the fastest line. For instance, 45 model 33 tty's can be accommodated by one system using a 4,800 bps line, but only 36 of the faster model 37 tty's.

One of the features included in the package is a line error read out which accumulates the number of errors encountered on the vg line. Operator controlled channel lock-outs, terminal status indicators, and built-in test facilities are also a part of the standard system.

The base price of the ADS-660-DDS is $5,000 plus $150 per channel per end (that is, twice the $150 figure when one 660 is needed on the sending end and one on the receiving end). A one-channel, one-end set would run $5,150, while a 45-channel one-end set would sell for $11,700. Decreasing-charge leases are also available, figured at $53/month per $1,000 base price. AMERICAN DATA SYSTEMS, Chatsworth, Calif. For information:

CIRCLE 181 ON READER CARD

network control processor

This communications computer system is designed to link remote Univac 1108 and IBM 360/65 users to their cpu through a disc buffer. Called the Network Control Processor, the system incorporates a 750 nsec cycle, 16-bit word cpu, a 17 msec average access

disc, an intercomputer channel coupler, and a communications multiplexor. The imbedded cpu is a Scientific Controls Corp. 4700; the 174K-word disc is also supplied by SCC.

The hardware is expandable to handle up to 64 low speed (110 baud) lines and 32 high speed (to 2,400 baud) lines. The base NCP system, which is capable of handling 32 low-speed lines and 6 high-speed lines, sells for about $125K. Interface software for the 1108 or 360/65 is included in the offering. UNIVERSAL SYSTEMS INC., Washington, D. C. For information:

CIRCLE 182 ON READER CARD

multiplexor

A bit-interleaving time division multiplexing technique is used with the Timeline 110 to concentrate from 2 - 14, ASCII code, 110 baud full duplex data channels onto a single voice grade line. The 110 scans all its input lines simultaneously and sends one bit from each. This method of transmission, the designer claims, provides better assurance of data validity. Using frequency division multiplexing or character-interleaved time division multiplexing techniques it is possible for a single noise record to alter an even number of bits of a message leaving an erroneous character which will not be detected in parity checking; this is not possible with the bit-interleaved method of multiplexing since single bits in each character will be changed, and this change is detectable.

Up to four control channels (two each way) for each full duplex data channel are optionally available with the 110. The control signals are sent at times when synch bits are not being transmitted along the two standard synch channels. Another standard feature is a built-in test panel. A data set can also be built-in, if desired.

A typical 12-channel full duplex configuration with two control signals will run about $9,880 for both ends. INFOTRON SYSTEMS CORP., Cherry Hill, N. J. For information:

CIRCLE 183 ON READER CARD

data-voice terminal

Data communications to 256 kilobits/sec and simultaneous voice transmissions can be carried over exchange cable pairs through the use of the B313 PCM Wideband Data Terminal. The terminal transmits serial, synchronous or asynchronous signals from digital computers, interfaces, facsimile equipment, or dp peripherals such as printers. Designed for rapid handling of multiple transmissions, the set is intended to reduce the need for intermediate message storage facilities.

One B313 terminal, linked to a Western Electric "T1" PCM system or a Lynch "T1" system, will provide for one 0 - 64 kilobit data transmission and 21 voice lines in a single "Group" modem configuration. Using three or four "Group" modems would increment the number of data lines proportionately, but reduces the number of voice lines to 12. A "Supergroup" modem configuration allows for sending one 0 - 256 kilobit transmission and 12 voice circuits over the cable pair. The B313 is completely compatible with the W.E. TIWB3, its manufacturers claim. LYNCH COMMUNICATIONS SYSTEMS, San Francisco, Calif. For information:

CIRCLE 184 ON READER CARD

mag tape transmission system

The Communitype 850 Magnetic Tape Transmission System is an off-line data receiving and sending station which provides half-duplex communications over ordinary dial-up phone lines, using Series 200 Dataphones or other data sets meeting RS-232-B specs. The 850 incrementally writes, and synchronously reads, data on 9-

new products

track mag tape at 800 bpi; 5-, 8½-, or 10½-inch reels may be used. The 850 is intended primarily for use with Communitype's 100SR Data Communication System.

The 100SR is a source data terminal which uses a standard-keyboard Selectric typewriter for input, and records data on a mag tape cassette; information stored on the cassette is then transmitted via Dataphone at 1200 bps to the 850, which translates it to computer code. Since the 100SR records "about a day's work" of typing input on a tape requiring around four minutes of transmission time, a single 850 can be used to receive input from a large number of 100SR's. The 850 may also provide tape-to-tape transmission, as in a case where a single organization is using two computer codes, one of which would be translated by the receiving 850.

The 850 has two operating modes, set manually by the operator. In the write mode, data is received from a 100SR or another 850 at 100 cps, and is recorded character-by-character in computer-compatible code as it is received. Inter-record gaps and longitudinal and cyclic redundancy checks are generated internally. In the read mode, the unit reads formatted, computer-coded, computer-prepared mag tape block-by-block into a 160-character MOS buffer memory for transmission at 100 cps. Error detection is provided by parity verification for each character received. When an error is detected, the receiving unit stops and transmits a signal back to the sending station, which, in turn, retransmits the entire block in which the transmission error occurred. The retransmit capability works in both send and receive modes.

The unit is housed in a steel cabinet measuring 47x22x25 inches, and comes in a "computer-compatible blue" finish. A Communitype spokesman, noting that some IBM machines have lately been painted other colors than blue, stated that Communitype has no intention of suing IBM over the resultant incompatibility with the latter's off-color equipment, however. The 850 will sell for $24K and rent for as low as $528/month, plus maintenance costs. First deliveries are expected in April. COMMUNITYPE CORP., New York, N.Y. For information:

CIRCLE 185 ON READER CARD

mag tape converters

Magnetic tape conversion systems to interface any computer built within

the last 10 years with any other will be custom tailored to a user's specifications by this U.K. vendor. Called Inter Computer Interfaces, the systems are housed in a cabinet which accommodates two 2,400 foot tape reels and control electronics. The front of the console offers the operator only three control buttons, "Start," "Abandon," and "Mode Selection" (for determining whether the conversion will be from format A to format B or the reverse). In operation, four subprograms are called into play for the conversions, which require about six minutes for full input reels.

Input records which are not readable on the first pass are retried until they are read successfully or until the operator abandons the read attempt. When output tape sections cannot be written, they are blanked over, the tape is forward spaced, and the write is retried. Console lights indicate the error conditions.

I/O can be double buffered by using two memory units. Block sizes are determined by the size of the memory units requested by the customer. A file search feature can also be added upon request. The custom tailored products will sell for about $60K to $112K. DATATECH INDUSTRIES LTD., Feltham, Middx., England. For information:

CIRCLE 186 ON READER CARD

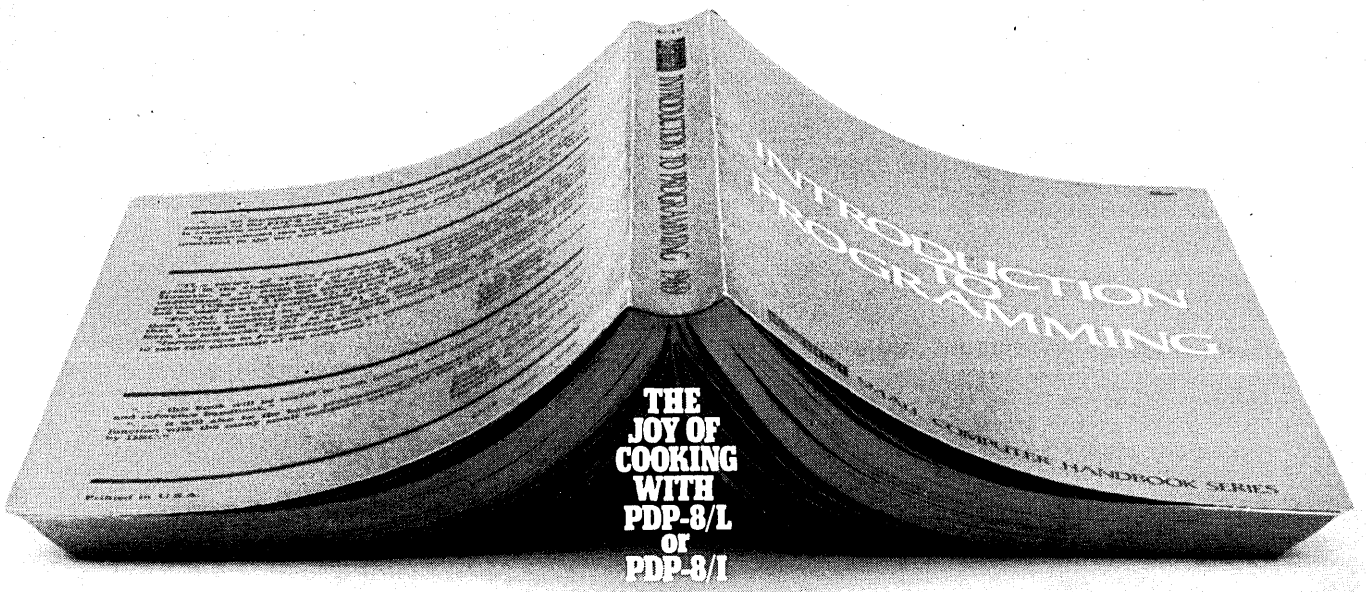
automatic data set

The Modem 4400/48AE data set not only transmits data at 4800 bps over dial-up telephone lines, but, at the push of a button, automatically equalizes the lines for optimum transmission quality, avoiding the pitfalls of depending on human judgment. The manufacturers note that they are "anticipating the implementation of the FCC 'Carterfone' decision" in creating the new data set. Orders are now being taken for delivery in May. Price was not announced. INTERNATIONAL COMMUNICATIONS CORP., Miami, Fla. For information:

CIRCLE 187 ON READER CARD

10-inch drum

The CLC-1 drum memory system stores 37,700 bits per track on 32 tracks for a total of 1.2 megabits of 8.5 msec storage. The 10-inch drum rotates at 3,600 rpm to provide packing densities of 1,200 bpi and transfer rates of 2.2 MHz. The unit is constructed with four pole-piece head assemblies, each containing eight read/write heads. The components used are direct descendants of larger systems made by the same firm, and are therefore claimed to be ultra-reliable. The



A 432 page cookbook. Loaded with recipes for programming with the most extensive software ever developed for small computers. The PDP-8 family software. Free. Digital Equipment Corporation, Maynard, Massachusetts 01754, Telephone: (617) 897-5111.

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new products

CLC-1 is priced at about $3,000 in quantities of 25 or more. A half-power unit, with 16 tracks and a capacity of 600K bits, sells for about $300 less in similar quantities. BRYANT COMPUTER PRODUCTS, Walled Lake, Mich. For information:

CIRCLE 188 ON READER CARD

one-usec memory

An access time of 450 nsec and a full cycle time of 1 usec are advertised for the Model 200 ComRac (Commercial Random Access Core) memory systems. Capacities up to 8K by 36 bits or 4K by 72 bits are offered; all use a four-wire construction. The 200's power supply is packaged as an individual assembly, and all components are packaged as functional plug-ins. A built-in tester, read/modify/write feature, parity generation and checking, and sequential addressing are among the options offered. Price of the 4K by 36-bit configuration is $12,000. INFORMATION CONTROL CORP., El Segundo, Calif. For information:

CIRCLE 189 ON READER CARD

3d memory

Access times as low as 290 nsec are realizable with the three-wire 3D MS3370 memory system. Built around ferrite cores which are 25% faster than those previously used, the 3370 offers full-cycle times of 750 nsec in building-block modules from 4K by 4 bits to 16K by 40 bits. Capacities to 128K can be achieved through paralleling the 16K blocks. The same memory plane design is used over the full line. The memory core stack is a pluggable module; the power supply is also discrete. Prices range from $5K to $35K depending upon size and features. MEMORY PRODUCTS DIV., RCA/ELECTRONIC COMPONENTS, Needham Heights, Mass. For information:

CIRCLE 190 ON READER CARD

i/o system

The Univac 1100 10S is an input/output system designed for use with Univac 1108 systems to service remote terminals and on-site peripherals. The system offers up to 16 bidirectional channels with an aggregate channel rate in excess of two million words per second, relieving the mainframe of such functions as communication line termination, message buffering, translation, formatting and requests for retransmissions. Card reading, punching, and line printing will also be trans-

programmer's dream

COMPUTER AUTOMATION ANNOUNCES NEW COMPUTER

Computer Automation, Inc. has announced (quietly) one of the most powerful 16-bit machines on the market. It is modestly called a Programmed Digital Controller, the Model 816; but it is in fact, a general purpose computer with many features found only on the larger (and more costly) machines. Memory paging is avoided with relative (forward and backward) and indexed addressing. Two accumulators and an index (hardware) register are provided. The I/O capabilities are almost unbelievable in a machine in this class, with some 29 I/O instructions! In total, there are over 140 basic instructions, but with microcoding many more can be created. There are some powerful instructions such as Compare (three-way), Memory Scan, Load/Dump Memory, Read/Write, etc., that drastically reduce memory requirements and make the machine operations extremely fast. (Software multiply is 102 microseconds for example.)

The instruction set includes a full set of 15 Memory Reference instructions, eight Immediate instructions including byte compares, some 62 Conditional Jumps, multi-shift instructions that allow up to 16-place shifts (arithmetical, logical and rotate all either left or right) and over 40 Register Change instructions.

The machine is supported with basic FORTRAN, an assembler that allows ONE PASS assemblies, several loaders, debug, maintenance, math and utility programs, all of which operate in 4K.

Initial deliveries have been made with full-scale production scheduled for February. The price of a 4K system without I/O devices is $11,900 before substantial quantity discounts.

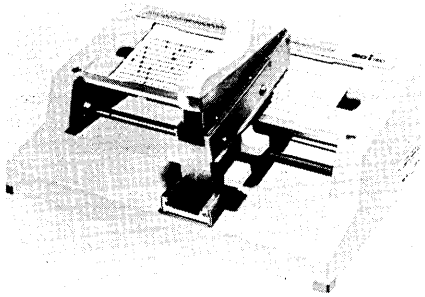
new products

ferred to the 10S. The device has "the same general architecture" as the 1108, including a main memory of 36-bit words, and an instruction subset of the 1108 with a typical add time of under two usec. Deliveries of the I/O system will begin in the fourth quarter of the year, with purchase prices starting at $185K. SPERRY RAND CORP., UNIVAC DIV., Philadelphia, Pa. For information:

CIRCLE 191 ON READER CARD

portable keypunch

If you have ever turned in an almost-compiled deck with three flag cards indicating corrections to be made, and then waited a day for the job to come out of keypunching, you might be in-



terested in the ACI-960 manual keypunch. A small IBM 010-sized unit, the 960 features a carriage lock for repetitive punching of alpha or special characters. The device's size and under-$100 price tag should make it welcome in programming areas and computer rooms. PERIPHERY, INC., Framingham, Mass. For information:

CIRCLE 192 ON READER CARD

nylon-post-binder binder

The vendor that claims the distinction of inventing nylon post binders has invented a metal easel for holding several binders in an open position for easy reference. Called Data-Ref, the easel can accommodate six or more binders, with a total capacity of 5,000 sheets for the unit, in a position so that any of the 5,000 pages can be opened flat. The $39.95 unit works something like a vertical parts catalog file. WILSON JONES CO., Chicago, Ill. For information:

CIRCLE 193 ON READER CARD

improved 360 software

Users linked to a 360/40 or 50 have been given new file I/O capabilities through an improved version of RAX, IBM's remote access computing system. This, the third version of RAX, allows users to read/write files from terminals, and allows multiple users to simultaneously access permanent files. Users with a 30, 40, or 50 can now store object program modules as well as source programs. Up to 63 IBM 1050 terminals can be tied to a 256K system: a minimum of 128K is required. DP DIV., IBM CORP., White Plains, New York. For information:

CIRCLE 194 ON READER CARD

matrix program

MATLAN (for MATrix LANguage) is an IBM program designed to aid scientists and engineers in solving large matrix problems. The program consists of a language processor that accepts and translates statements written in the user-oriented MATLAN, and an execution program which performs the actual computations as specified by the user's statements. The program includes an automatic storage management feature that allows it to handle matrix problems which exceed the size of main storage. Matrix elements may be real or complex numbers, in single or double precision. Subprograms can be written in FORTRAN or MATLAN. The program may be used on 360/40 or larger cpu's, having at least 128K bytes of core storage. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 195 ON READER CARD

$10 dos/tos program

Inflation has not yet hit Virginia, apparently, for this Dixie-based software firm is offering a proprietary program which interfaces programmers and the 360 DOS/TOS supervisor for $10. The program, ANALYZE, is designed to give the user more control in a situation where the supervisor is about to cancel a program for improper data or programmer error. Control is transferred to an operator, who is given the option of correcting the error or aborting the job. The routine is triggered either by a program check or an operator interrupt. ANALYZE comes complete with a load deck, listing, and instructions. COMPUTER RESOURCES CORP., McLean, Va. For information:

CIRCLE 196 ON READER CARD

management software

Three software packages have been released for Honeywell 200 series machines. The programs have been introduced to add math, statistical, and operations research capabilities to the 200. PERT is now offered for use on any of the nine models in the 200 series that has 16K of core, from the small model 110 to the dual-processor model 8200. MPS (Mathematical Pro-

gramming System) is offered for 128K model 1250, 2200, 4200, or 8200 systems. Finally, GPS (General Purpose Simulator) is offered for the 65K versions of the 1200, 1250, 2200, or 4200. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 197 ON READER CARD

critical path plotting

Taking its input from a critical path method program's regular output statements aimed at disc, tape, or card files, the AUTONET (Automatic Network Display) program produces critical path charts complete with labels, headers, a time line, and pertinent comments. The charts provide the following types of information: duration of project, earliest and latest start and finish dates for each activity, identification of critical activities and paths, and "float" times. AUTONET will produce either on-line plots or an off-line plot tape. Coded in FORTRAN, the program requires a machine with at least 16K to operate. The one-time lease price for the package is $3,750. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif. For information:

CIRCLE 198 ON READER CARD

100v analog computer

The Comcor 550 line of medium-scale analog computers was designed with an eye toward hybridization. The 100 v machines offer an integrated patch-panel for both analog and digital patching, modular construction which permits component additions in the field, and compatibility with such digital lines as CDC, IBM, SDS, and Honeywell.

For hybrid configurations, the 550 is backed by the Comcor Intracom interface unit and by systems software originally developed for the manufacturer's C-5000 large-scale line. Both the interface and the software are claimed to be fully compatible with the smaller machine.

The 550's system complement includes over 460 components, and these are rated in the 100 to 200 MHz bandwidth range. Its prices range from a low of about $60K to a high of about $225K, depending upon size and application. ASTRODATA, INC., Anaheim, Calif. For information:

CIRCLE 199 ON READER CARD

production logic tester

The Digital Logic Module Test System, model 2060A, has been designed to expedite quality assurance testing of digital circuits by comparing a production line board against a known-good standard. The computer-controlled system automatically runs through a programmed test making as many as 10,000 individual tests per second. In operation the 2060A applies the same test inputs to the known-good standard and to the circuit being QC'd. A listing of modules which fail is returned.

The system operates in two modes, "run" and "conversational." The "run" mode is used for testing entire circuit boards to find those which fail; the "conversational" mode is used to modify test conditions and to specify additional tests of the failing logic.

The basic capacity of the system is 16 module connector pins, but this can be expanded to 256 pins in 8-pin increments.

The 2060A operates on programs written in Au-Test, a specially-designed language which, the manufacturer claims, allows "thousands" of individual tests to be called out by as few as two statements. The manufacturer also claims that board testing costs fall under $1, including programming. Prices start at $80,000. HEWLETT-PACKARD, Palo Alto, Calif. For information:

CIRCLE 200 ON READER CARD

RANDOM, TIME SERIES, STOCHASTIC OR NOISE DATA. MAC/RAN IS THE SOFTWARE TO ANALYZE IT.

MAC/RAN® is a newly developed computer software package for analyzing random, time series, stochastic, or noise data. Simply, random data refers to any data sample, regardless of its origin, which has no explicit mathematical formula and must therefore be analyzed and interpreted in terms of probability or statistical properties.

MAC/RAN is a practical, powerful and efficient way to analyze random data. The user merely has to fill out a few control cards to automatically obtain comprehensive plotted results on many channels of data with one or two passes through the data. The programs will select parameters to give standard acceptable statistical accuracies in the data, or the user can specify desired accuracies.

Applications

Application areas for random data analysis, hence the MAC/RAN System, are very extensive and well recognized today in many engineering, scientific and commercial fields. Some recent applications by users have been:

1. MAC/RAN has computed the two-dimensional frequency response function between two 40,000 point input time histories and a 40,000 point output to determine the characteristics of flow properties in a turbine engine.
2. MAC/RAN has been utilized to determine important frequency and time correlation characteristics of random processes in nuclear reactors.
3. MAC/RAN has been used to do extensive time series computations on oil well logs.
4. Similar applications for random data analysis occur routinely in areas such as vibration, acoustics, biomedical research, oceanography, seismology, structural dynamics, econometric analysis, communications and many others.

The Package

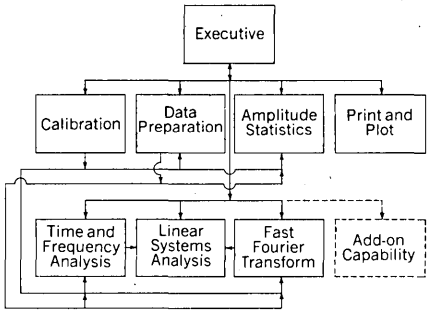
The MAC/RAN System, consisting of some 10,000 FORTRAN statements on cards or tape, is custom installed by MAC personnel on your computer in a period of about one week including one day for training operators to run the system. Seven copies of an extensive 275 page User Reference Manual are left with each system containing detailed instructions along with explanations of the theory which underlies the processing operations. Backup technical services are also available from MAC personnel to assist users in collecting desired data, writing special programs required, and interpreting results for various applications.

Arrangements

MAC/RAN is available now to government and military computer facilities for an installation and training charge plus a modest monthly rental. Industrial and university users may obtain MAC/RAN on a similar monthly rental plan or a one-time payment lease plan.

The MAC/RAN System

Seven completely independent computational modules are employed, all codes in ASA FORTRAN IV and designed around a system executive.



System Executive provides overall control of input/output, transfer of data as necessary from one routine to another, and selection of overall required processing sequence.

Calibration Processor performs the function of calibrating data to engineering units according to calibration information supplied with the data.

Data Preparation Processor performs trend removal, filtering operations, and data decimation operations.

Amplitude Statistics Processor computes probability histograms as well as first through fourth order moments, and performs a chi-square test for normality.

Time and Frequency Analysis Processor computes auto- and cross-correlation functions and power and cross-spectral density functions from a pair of time histories by standard methods.

Linear Systems Analysis Processor operates on spectral density matrices from order 2 up to a maximum of 50. Frequency response functions, coherence functions (ordinary, multiple, and partial) and associated confidence limits can be computed for single input/single output linear systems and multiple input/single output linear systems.

Fast Fourier Transform Processor implements a recently developed fast Fourier transform algorithm. Calculations include power spectra, single input/single output frequency response functions and ordinary coherence functions.

Printer and Plotter Output Processor provides a control systems capability for hard copy printed output of results, or plots using Cal Comp or other types of plotters. This processor is an essential part of the system in order to obtain results in useful, easy to interpret forms.

Add-On Capability: The modular feature of MAC/RAN allows the user to introduce new modules into the MAC/RAN System very easily. It is only necessary to code the new processor to interface with the Executive card input routines and modify certain Executive instructions to load and enter the new processor.

MAC/RAN at CDC Data Centers

Control Data Corporation is a licensee of Measurement Analysis Corporation to use the MAC/RAN System at their data centers throughout the country.

Computer Requirements

The MAC/RAN System is usable on any medium-to-large scale digital computer having an appropriate FORTRAN compiler and sufficient memory and peripheral units available.

Internal memory and word size requirements will vary with both the FORTRAN compiler and operating system used. General requirements are 32,768 words of memory or more, and at least 20 bits of significance in real variable operations.

The following peripheral units should be available to maintain both the data being processed and the MAC/RAN System itself:

One system overlay unit
One unit for maintaining a data directory
Two or more date input/output units
One plotting output unit (if off-line plotting is used)

Typical computers acceptable for the MAC/RAN System are:

CDC 1604, 3200, 3400, 3600, 6400, 6600
IBM 7040/44, 709/90/94, 360-40 and above
UNIVAC 1107, 1108
SDS 9300, 940, SIGMA 5, SIGMA 7
RCA SPECTRA 70-35, 45, 55
GE 625, 635, 645

MEASUREMENT ANALYSIS CORPORATION

A Digitek Company
4818 Lincoln Boulevard
Marina del Rey, California 90291
Telephone: (213) 823-6367

☐ Please send me complete technical information as well as available contractual arrangements for a MAC/RAN System.

☐ I have specific applications for a MAC/RAN System and would appreciate a call from one of your technical representatives.

Name _____

Position _____ Telephone _____

Company _____

Address _____

Zip Code _____

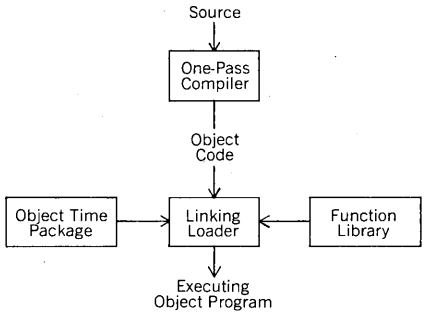
SMALL SINGLE PASS FORTRAN COMPILER SYSTEMS. DIGITEK IS THE COMPANY TO PRODUCE THEM.

Digitek experience in producing compiling systems, particularly FORTRAN compiling systems, is without equal. In the eight years since its incorporation, Digitek has produced thirty-nine (39) compiling systems implementing some version of the FORTRAN language.

Twenty-nine (29) of these FORTRAN compilers are small single pass compiling systems.

Small Compiler System

The Digitek single pass FORTRAN compiling system contains a complete FORTRAN programming system consisting of a one-pass compiler, linking loader, object time package, function library and utility routines. The system can be designed to compile almost any version of FORTRAN, subset or superset. All I/O interfaces are isolated and simple so that the system can operate either standalone or under an operating system. In fact, several compilers are presently operating under time-sharing systems.



One-Pass Compiler

The compiler accepts and interprets the language chosen. Compilation is single pass batch, producing locally optimized object code. Depending on the system environment the object code may be either interpretive or direct machine code. The optional source listing contains complete diagnostics and the object program memory map. The diagnostic messages not only follow the statement to which they are related, but are keyed to the precise character within that statement at which the error was detected by undermarking. The messages themselves are English language descriptions of the errors, not numeric codes.

Core Requirements

The entire compiler is core resident occupying between 3200 words and 7000 words, depending primarily upon word size. For example, an ASA Standard FORTRAN requires 3600 words in a 36 bit machine and 5500 words in a 16 bit machine. About 1000 words additional are required for table space to give a capacity of 500 source cards. Capacity increases rapidly with table areas greater than 1000 words. No backup storage of any kind is required. Compile speed exceeds 1000 cards per minute on most computers.

Linking Loader

The linking loader places object programs in core, performs data initialization, and loads and links required sub-programs from the object time package and function library. It is overlaid by the I/O editor prior to program execution.

Object Time Package

The object time package contains the I/O editor and associated conversions, routines for double precision and complex arithmetic, and miscellaneous FORTRAN routines such as sub-program argument transfer.

Function Library

The function library contains all of the internal and external functions recognized by FORTRAN.

Utility Routines

The utility routines include a system maker, a transliterator and a debug routine. The system maker is used for standalone versions to merge the system components into a single compiler system. The transliterator is used to transform the compiler, written in POP, into a form acceptable to the standard assembler for the particular computer. The debug routine is used to provide trace and dynamic dump services for compiler checkout.

Implementation Technique

The techniques by which Digitek produces compilers and the related programs are highly regarded in the computing industry. Many purchasers of Digitek compilers, including two computer manufacturers, have later used the Digitek methods to produce other software products. From experience in constructing these compilers, Digitek has developed the technique of separating the compiler into:

- The part which is dependent only on the machine on which the compilation is being done.
- The part which is dependent only on the source language and object machine.

The result of this separation is that these parts can be constructed independently. Furthermore, the source language and object machine dependent sections can be written in a language which is machine independent. This machine independent language is called POP and is an exclusive Digitek development.

Digitek POP Code

POP (Programmed Operators and Primitives) is the optimum machine instruction code for a hypothetical computer designed specifically for compilation purposes. The POP language is a single address construction, whose operands are the input language source string, the dynamically allocated last-in first-out tables used as temporary storage by the compiler, and the recursive subroutine structure. Dynamic storage allocation procedures assign storage to individual compiler tables as required, with the result that no single table overflows until all table storage has been used—the limits imposed on the FORTRAN program are therefore much more flexible than is usually the case.

Implementation of the POPs is accomplished by macro-assembly and interpretation. Allocation of storage, saving of backup information, stepping of data position indicators, and general housekeeping is carried on automatically by the programs which underlie the POPs.

Benefits

This approach to compiler construction yields several important benefits for users:

- Since POP language is well-defined, the functions of the compilation-machine-dependent portion of the compiler are also well-defined. This allows Digitek to follow standard yet comprehensive procedures for coding and checking out these portions, materially decreasing the cost of implementation and occurrence of errors.

  The POP language portion of the compiler is constructed as a functionally organized model. The relationship of the source language being compiled and the POP language description of the procedures for parsing the source language are clearly related and simple to understand so that modifications to the compiler, resulting from changes in the source language specifications, are easily made.

Digitek's method of compiler construction is not automatic or dependent upon syntax tables. Each compiler is handcrafted as is required in a production compiler. Nonetheless, the discipline, compactness, and efficiency derived from use of the POP language give the advantages of standardization. Implementation cost, delivery time, program size, and error rate are drastically reduced. By these methods, Digitek was first to produce an efficient FORTRAN IV compiler that operates completely in 4096 (32 bit) words.

DIGITEK

4818 Lincoln Boulevard
Marina del Rey, California 90291
Telephone: (213) 823-6361

☐ I have specific requirements for a small FORTRAN compiler system and would appreciate a call from one of your representatives.

Name_____

Position_____ Telephone_____

Company_____

Address_____

_____ Zip Code_____

WE KNOW WHAT YOU'RE UP TO

You've got a project going — to design a compact mag tape package into a computer input system. Perhaps you are planning to use the familiar cassette or cartridge. More likely it will be adapted to data handling requirements.

Here's a suggestion: Before it's too late, let's work together. You do the system design; we'll evolve the tape package to match. After all, we've been designing, modeling, producing, and improving mag tape packages for years. And lots of times the designs have come out of close cooperation with customers — in the computer industry, in the entertainment industry, or wherever a precisely molded plastic package was considered important.

You people in data processing taught us close tolerances and reliability. Our cassettes and cartridges inherited these standards. But of course your new system may need something even better.

Let's talk.

Data Packaging Corporation, 205 Broadway, Cambridge, Massachusetts, Tel. (617) 868-6200 TWX 710-320-0840.

CIRCLE 98 ON READER CARD

new literature

DATA DISPLAY SURVEY: 74-page report surveys computer-generated displays capable of operating in real-time on a dynamic control system and visual displays that present information to the eye by means of visual cueing. A tabulation of commercially available console displays and display bibliography are included. BNWL-725. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

COMPUTER CAREERS: 24-page booklet provides detailed information on careers in the designing, production, marketing and application of computers, including types of jobs available and personal qualifications for each. BUSINESS EQUIPMENT MANUFACTURERS ASSN., New York, N.Y. For copy:

CIRCLE 214 ON READER CARD

T-S SERVICE EVALUATION: Two-volume proceedings of workshop on time-sharing and remote EDP services (held Nov., 1968) includes printouts from over 80 on-line tests performed on nine working systems and the 10 programs that provided evaluation of time-sharing services by yielding comparative performance data on the following parameters: memory size; arithmetic speed; size of symbol table; testing of round-off errors; file creation, protection, editing and access; program development; execution modes; and transmission error rate. Six tables of comparative detail data describe other t-s parameters of interest to prospective users: hardware features, executive control, edit capabilities, file management capabilities, language capabilities, programming aids, rate structure of services, and cost efficiency figures derived from demonstrated performance of benchmark tests. Cost: $100. NATIONAL INFORMATION RESEARCH INST., P.O. Box 3358, Santa Monica, Calif. 90401.

UNIVERSITY SYSTEM: Four-page brochure describes computer installation at San Fernando Valley State College (Calif.) and the school's student-oriented approach to computers in education. GENERAL ELECTRIC INFORMATION SYSTEMS, Phoenix, Ariz. For copy:

CIRCLE 215 ON READER CARD

TEST DATA GENERATOR: Four-page brochure describes a COBOL-oriented pseudo-compiler which validates preproduction programs, eliminating programmer development of the test files required to adequately debug user programs. This is accomplished by TDG's ability to accept a combination of English language instructions and a COBOL source language program and to deliver single or multiple test files in user specified formats. Other proprietary products are included. INFORMATION MANAGEMENT INC., San Francisco, Calif. For copy:

CIRCLE 216 ON READER CARD

IC LOGIC ASSEMBLIES: Sixteen-page paper written for industrial control equipment designers emphasizes the advantages of the company's logic assemblies in performing relay functions in industrial control situations where increasing size and complexity impose strains on reliability and often result in spiraling costs. CAMBRIDGE THERMIONIC CORP., Cambridge, Mass. For copy:

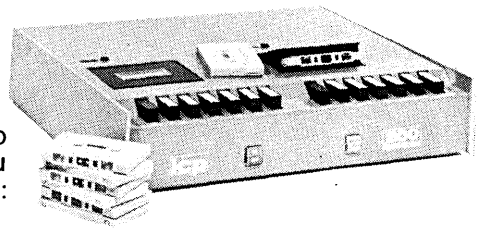
CIRCLE 217 ON READER CARD

COMPUTERS IN MEDICINE: 64-page Defense Documentation Center bibliography covers computers in biomedical systems, biological simulation, biomedical monitoring, computer-aided diagnosis, and data analysis. AD-675 600. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

TYPESETTING PROGRAMS: New periodical is a clearinghouse for programs for computerized typesetting offered and needed by non-competitive users. Purpose of the publication is to avoid duplication of effort, to provide meaningful interface between printing and publishing industry computer practi-

Stack ours against yours!

Speed, cost, capacity and space . . . why you should use the **DigiCorder** instead of a paper tape system. Even for the small and medium business which has never been able to afford the convenience of magnetic tape. *SPEED:* The **DigiCorder** reads and writes at 500 characters a second. What is the capability of your paper tape punch and reader? *COST:* Prices of the high-speed **DigiCorder** begin at $840 (in quantity). What is the price of your paper tape punch, reader and controls? *CAPACITY:* The **DigiCorder** cassette stores up to 500,000 8-bit bytes. How many standard rolls of paper tape would it take to reach this capacity? More than four rolls? *SPACE:* The **DigiCorder** measures 17½ inches x 3½ inches x 14 inches. How much space is consumed by your paper tape punch, reader and controls? The **DigiCorder** cassette measures 4 inches x 2½ inches x ⅜ inch. How much space is required to store 4 standard rolls of paper tape? If you now use paper tape, you need to know more about the **DigiCorder.** For specifications, contact:



icp

INTERNATIONAL COMPUTER PRODUCTS, INC.

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CIRCLE 110 ON READER CARD

tioners and software suppliers, and to assist computerized typesetting users in extending their general-purpose systems into a wide range of business-oriented applications. Sample edition will be sent. COMPOSITION INFORMATION SERVICES, Los Angeles, Calif. For copy:

CIRCLE 218 ON READER CARD

SIMULATION COURSES: Six-page brochure describes seminars to be offered through the end of the year in Los Angeles and Washington, D.C. CONSOLIDATED ANALYSIS CENTERS INC., Santa Monica, Calif. For copy:

CIRCLE 219 ON READER CARD

D/A APPLICATIONS: Six-page brochure describes the company's digital/analog instruments and details applications for a multichannel automatic scanner, jet engine test instrumentation, and automatic programmer. ANADEX INSTRUMENTS; Van Nuys, Calif. For copy:

CIRCLE 220 ON READER CARD

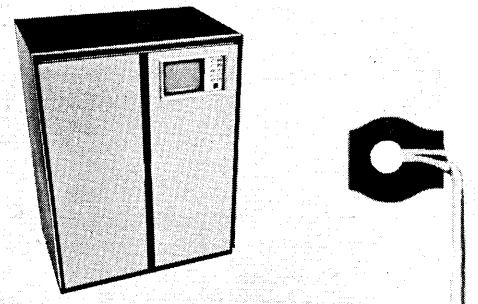
CONFERENCE PROCEEDINGS: 371-page book contains material presented at the 1968 International Data Processing Conference sponsored by DPMA. Subjects include software-problems and development, trends in systems analysis techniques, installation management, personnel management, computer room operations, real-time systems. *Data Processing, Vol. XIII* is available to DPMA members for $10.20 and to all others for $12.20. DATA PROCESSING MANAGEMENT ASSN., 505 Busse Hwy., Park Ridge, Ill. 60068.

TELEPRINTER APPLICATIONS: Two eight-page case histories describe a network of teleprinter terminals at Lighting Products Div. of Lear Siegler used for order processing, inventory control, credit checking, and invoicing and a nationwide network used by Marathon Oil to mail invoices day after sale and to control inventories at distribution outlets across the country. TELETYPE CORP., Skokie, Ill. For copy:

CIRCLE 221 ON READER CARD

TAPE MAINTENANCE: Brochure describes the company's approach to magnetic tape cleaning and maintenance. The system includes cleaning with the MARK II tape cleaner, punching master cards with the

The $100,000 Bargain.



It's the Link APD-5000 Microfilm Plotter.
It's the most plotter for your dollar in high resolution, speed and accuracy.

Not only does the APD-5000 offer today's computer user the sharpest available film recording, its versatile high-performance features and numerous applications capabilities can significantly reduce the overall cost of your entire computer output operation.

Sounds like an impossible bargain? Here's proof it's possible:

- ☐ Proven 4096 x 4096 matrix, fully capable of recording the information contained on a highly-detailed D-size drawing on one 35mm frame.
- ☐ Incremental and whole-value plotting, with variable line thicknesses and density levels.
- ☐ Modular design for "you-buy-only-what-you-need-now" cost efficiencies, without risk of obsolescence.
- ☐ Integrated circuitry to reduce maintenance costs and increase up-time.

What's more, Link has developed a third generation software package especially for the APD-5000. Written in Fortran IV, it's compatible with almost any computer. And, using a Link translator, programs written for other plotters can easily be run on the APD-5000.

One more thing about the APD-5000. Since similar plotters can cost upwards of $250,000, ours would still be a bargain at twice its price.

For full details on Link's APD-5000 Microfilm Plotter, write to Advanced Technology Systems Sales, Department D, 1077 East Arques Avenue, Sunnyvale, California 94086 or phone (408) 732-3800.

LINK GROUP
Singer-General Precision, Inc.

CIRCLE 112 ON READER CARD

new literature

MP461 and utilizing a COBOL-oriented management reporting system. DATA DEVICES INC., Tarzana, Calif. For copy:

CIRCLE 222 ON READER CARD

RESEARCH BUDGETING: 138-page report presents a formulation and digital computer program that can be used by any research organization as a management tool for budget allocation. AD-676 269. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

CORE MEMORY: Six-page brochure describes model RG memory package available in 4, 8, 12, and 16 word capacities, 8-80 bits. Modular design allows expansion to larger word sizes, with practical limit at 65,536 words. Timing chart is included for read-restore, clear-write, and read-modify-write cycles. AMPEX CORP., Redwood City, Calif. For copy:

CIRCLE 223 ON READER CARD

LINEAR IC's: Four-page brochure describes reference workbook on linear integrated circuits, including content, format, utility, application, parameters used. The book includes over 2,000 circuits from 60 manufacturers in seven countries. D.A.T.A., INC., Orange, N.J. For copy:

CIRCLE 224 ON READER CARD

DISC SYSTEMS: Three data sheets list all specifications and discuss features and applications for the company's Television Display System, Fixed-Head Parallel Digital memory system, and Servo Drive System. TDS combines a disc memory and television in a display system capable of storing and simultaneously displaying up to 128 TV pictures. FPD is a self-contained memory system which can write or read up to 72 data channels simultaneously on a 12-inch storage disc. The Servo Drive System can synchronize the speed and phase of a disc memory to within ±50 nsec of an external reference signal. DATA DISC INC., Palo Alto, Calif. For copy:

CIRCLE 225 ON READER CARD

KEYBOARD DISPLAYS: Eight-page brochure describes models 7550 and 7555 combination typewriter keyboard and crt for use in on-line communication with the company's Sigma computers. The units feature a 96-character graphic set with upper- and lower-case letters; an integral buffer memory with 2,048-character capacity; a display area of 2,752 character positions; text-editing functions, including the ability to replace, insert, or delete data at any point in the text. Models differ only in that the 7555 can be equipped with an optional high-speed feature, increasing data transmission rate from 15 to a maximum of 180 cps. SCIENTIFIC DATA SYSTEMS, El Segundo, Calif. For copy:

CIRCLE 226 ON READER CARD

HOLOGRAPHY: 200-page SPIE Holography Seminar Proceedings contains 23 technical presentations. Cost: $20. SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, 216 Avenida Del Norte, Redondo Beach, Calif. 90277.

TRAINING AIDS: Brochure describes educational films and texts that may be rented and purchased for use to gain basic understanding of instrumentation technology. INSTRUMENT SOCIETY OF AMERICA, Pittsburgh, Pa. For copy:

CIRCLE 227 ON READER CARD

COMPUTERIZED TYPOGRAPHY: 16-page brochure describes a computerized typography service which uses a general purpose computer as a tool to produce phototypography directly from a customer's mag tape or punch card master data file. The end product is a complete set of film pages ready for the printer. The new process is compared with conventional manual typographic steps. COMPUTER COMPOSITION, INC., Chicago, Ill. For copy:

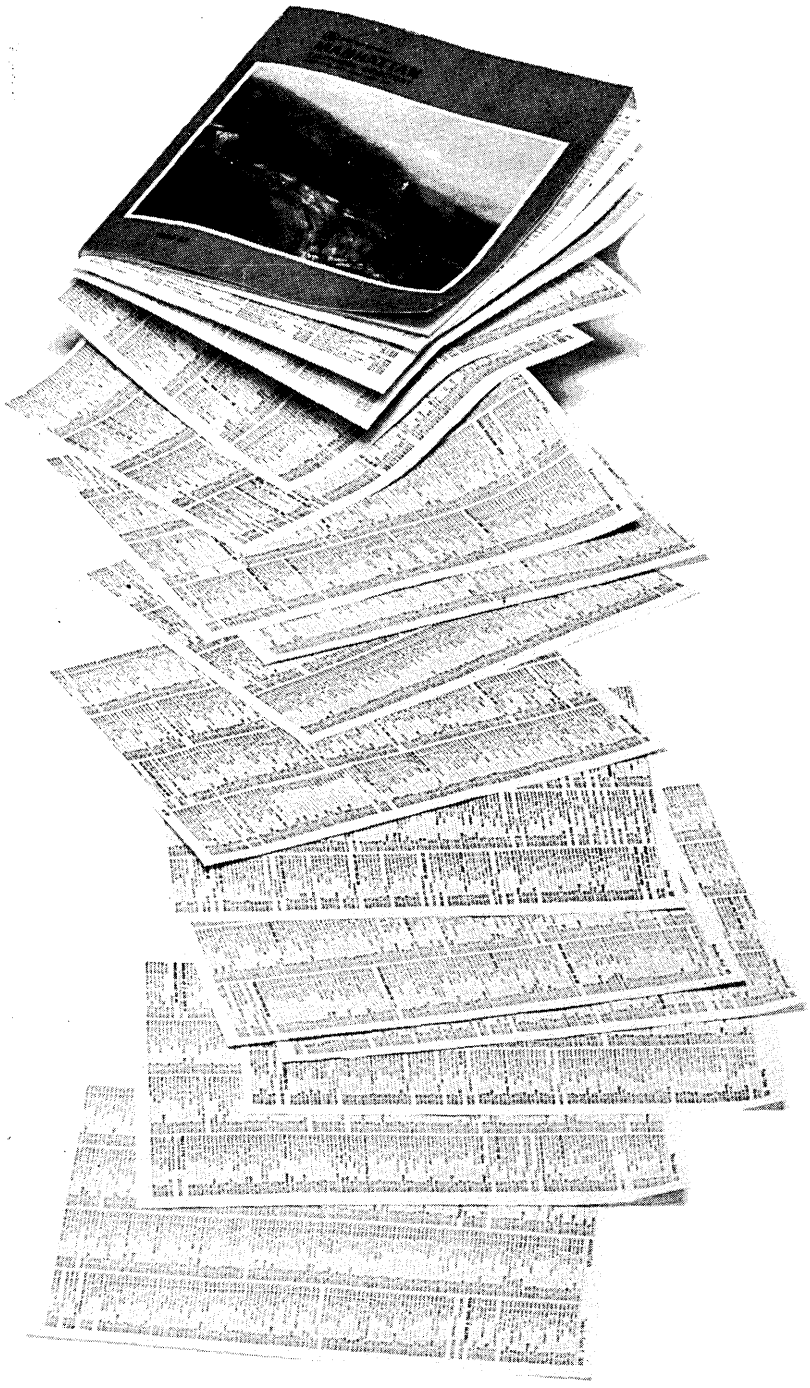
CIRCLE 228 ON READER CARD

INTEGRATED CIRCUITS: 960-page data book contains complete specifications and other applications and test data for all standard integrated circuits (digital and linear) manufactured by the company. Interchangeability guide cross-references direct replacement circuits for those made by other companies. Cost: $3.95. MOTOROLA SEMICONDUCTOR PRODUCTS INC., Dept. TIC, Box 20924, Phoenix, Ariz. 85036.

Overheard in a junior college course on introduction to computers the first day: "I think the difference between analog and digital is you work the digital computers with your fingers."

letting fingers do your punching?

DIAL 215-277-0500



Converting data by key punching? The cost is high, the time is long, the accuracy is questionable. Management is entitled to the most timely and dependable information. More and more OCR offers greater efficiency and lower systems costs.

Case in point: we have delivered an OPTICAL SCANNING SYSTEM that reads your telephone book. If you are key punching a directory or if you have a similar special input problem, we probably have the answer. Are you key punching payroll, billings, purchase orders or other routine applications? We can show you how to enjoy the benefits of OCR with a surprisingly small capital investment.

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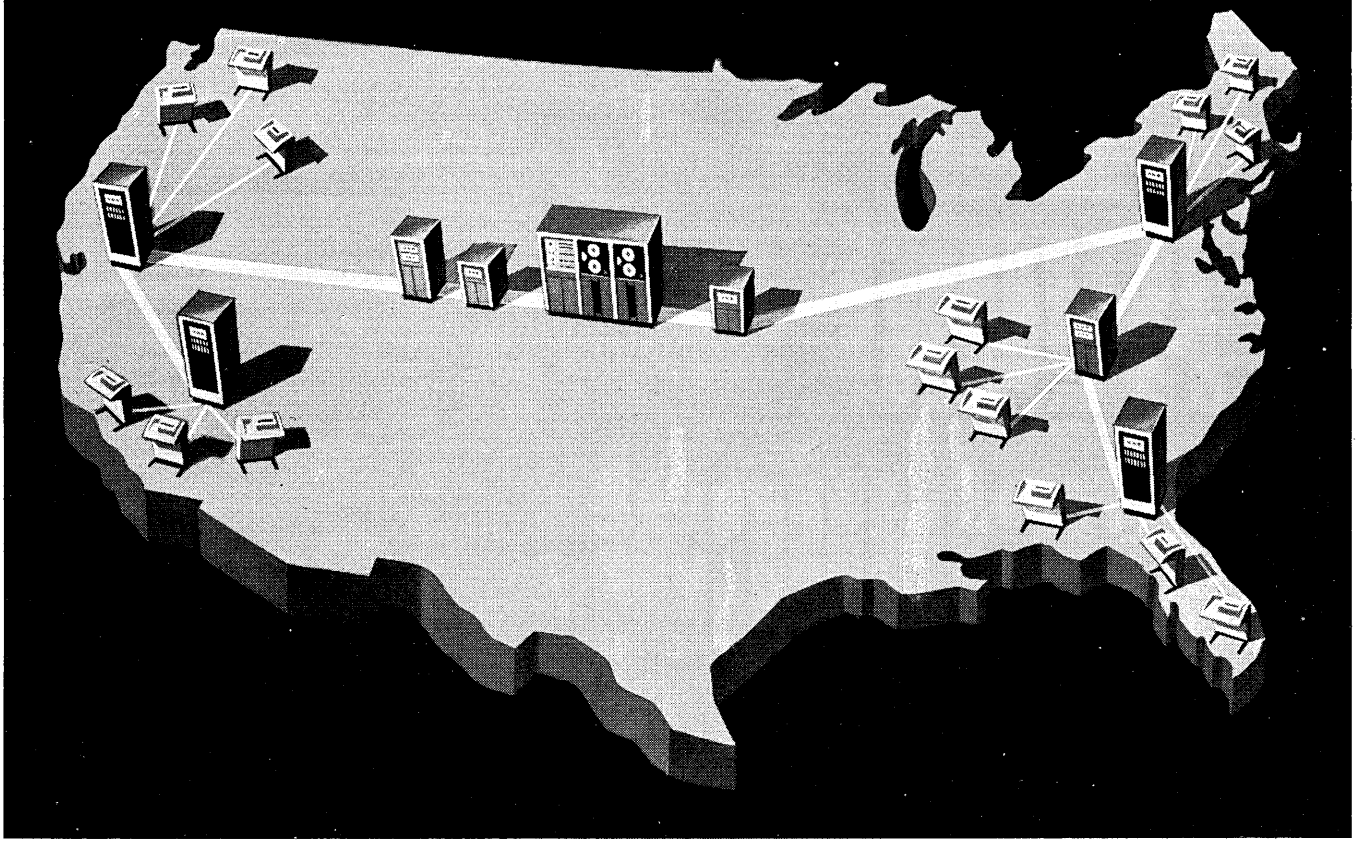
ULTRONIC CUTS LINE COSTS



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We *thought* you'd be interested. Especially since high costs of multiple leased transmission lines are probably strangling growth of your data communications network. That's why we've developed Ultracom™ Multiplexing Systems. They use advanced time division multiplexing techniques, enabling you to transmit and receive data from many terminals simultaneously—through a *single* voice-grade line. This means you can eliminate most telegraph-grade lines in your network . . . and the high charges that accompany them.

Ultracom™ is a family of modular data multiplex units. Each is designed to efficiently solve a *specific* problem in a communications network. The right combination of these units, working together, provides far superior performance than you'd get from any single unit multiplexer system available today.

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CIRCLE 114 ON READER CARD

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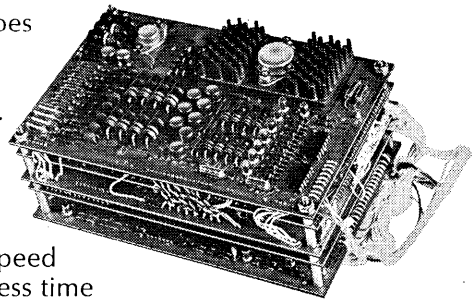

Handsome is as handsome does . . . and our new 420 Buffer Memory does an outstanding job in spite of its appearance. We could have made it prettier, of course. But we wanted to keep the size down. And the price. So we concentrated on things like speed (4.0 usecs full cycle, with access time of 600 n.s.) . . . performance (20,000 hours MTBF) . . . capacity (1024 words x 8 bits per word) . . . and design (TTL integrated-circuit logic).

The really beautiful thing about the 420 is its versatility. It's ideal for just about any buffer operation where data comes in bursts that can't be absorbed by I/O equipment. Like data-conversion jobs in information terminals . . . numerical control devices on automated machine tools . . . unusual applications such as highway toll-collection systems . . . process control . . . medical electronics. *Ad infinitum.* Comes with or without address and data registers, too. (Either way, two 420's will just about fit into a shoebox.) Operating environment? 32 to 140° F., 0% to 90% R.H. without condensation.

For more facts on the 420, or for help with application problems, contact a Fabri-Tek man at one of our national or international offices. Or write or call us direct.

Fabri-Tek is a leader in advanced memory research, development and production. Our experienced Applications Engineers are ready to help you find solutions to problems in the following areas: Main Memories • Buffer Memories • Scratch Pad Memories • CRT Refresher Memories • Peripheral Mass Memories • Mil-Spec Memories • Extension of Main Memory • Numerical Control.

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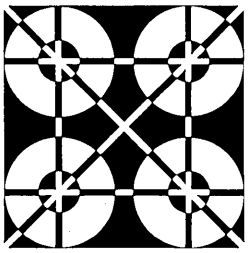

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books

***Design of Real-Time Computer Systems*, by James Martin, Englewood Cliffs, N.J., Prentice-Hall, 1967. $13.00.**

This useful text (called an "essential handbook" in the publisher's blurb—that overstates the case) is the most comprehensive review of on-line systems yet published. If it suffers from anything, it is the time lag between conception and birth in publishing, a circumstance ironically at odds with the central theme of the book.

The book is an adaptation of text materials used in the IBM Systems Research Institute. It creates the impression that students in the course worked hard, and probably came away with a good grasp of what on-line systems are about. Incidentally, Martin calls them "real-time," but in this reviewer's mind that term is reserved for systems in which response time is critical and measured in milliseconds. Reservation systems, time-sharing systems and the like are on-line, but not real-time in this sense.

The book is readable, well-organized, and contains a wealth of practical information. It is not *all* you need to know to design an on-line system, but it points to all the areas that need coverage. It is weakest when it enters the area of implementation, the post-design phase. The author may perhaps be excused on the grounds that he has already written a book on that subject.

The subject matter is oriented primarily towards large, monolithic applications such as airline reservations and message switching. There is a discussion also of the place of special-purpose supervisory systems. These items in themselves date the discussion. It is true, of course, that these considerations have some relevance, but less today than two years ago. Now standard operating systems capably support a wide variety of on-line systems, and on-line applications are conveniently multi-programmed with normal batch-processed data processing. Some discussion of this type of "foreground" processing will, hopefully, find its way into the next revision of this book.

The field needs more books like this one, despite its chronological shortcomings. It is a quality production written by someone who obviously knows what he is about. The casual reader will have to decide for himself whether his interest is $13 deep, but libraries and educators should have no qualms about its quality as a reference or a text. —Richard H. Hill

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Features	Ty-core	Brand A	Brand B	Brand C
Character Display Large ¾" Letters & Numerics	Yes	No	No	No
Easy-to-read ¾" Position Display	Yes	No	No	No
All Tape Handling Eliminated	Yes	No	No	No
Keyboard Mechanical & Electrical Interlock	Yes	No	No	No
Desk Top Convenience	Yes	No	No	No
Direct Computer Interface	Yes	No	No	No
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Price	**$4995**	**$8000** (Plus)	**$8500** (Plus)	**$9500** (Plus)

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DATA ACCUMULATOR — The Data Accumulator accepts data from one to twenty Ty-tape cartridges. The EDP supervisor can make one large reel from the inputs of up to twenty data tape station operators at his own discretion.

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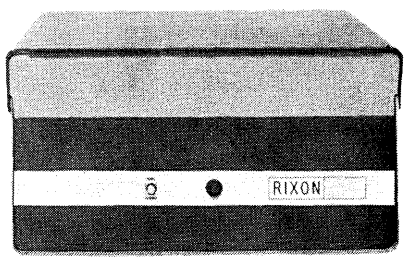
You've been renting a 202 series data set for eleven or twelve months. What do you have? A modem that belongs to someone else. And a pile of rent receipts. / The same expenditure could have *bought* you a Rixon FM-18. And what would you have? An ultra-reliable 1800 bps modem. A modem that you can *own* for less than the cost of a one year's rental of the equivalent 202. / If you are using several data sets (as do most users) think of the savings that can accrue if you buy your modems rather than lease them. / Many forward-thinking people have already started to convert to owned modems. Rixon modems. Rixon makes a variety of data sets that are fully compatible with Western Electric series 103, 202, 201, and 207. And a few that have no equal. / A little time spent talking to one of our Applications Engineers can show you just how to save money by buying rather than leasing.



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RIXON ELECTRONICS, INC.

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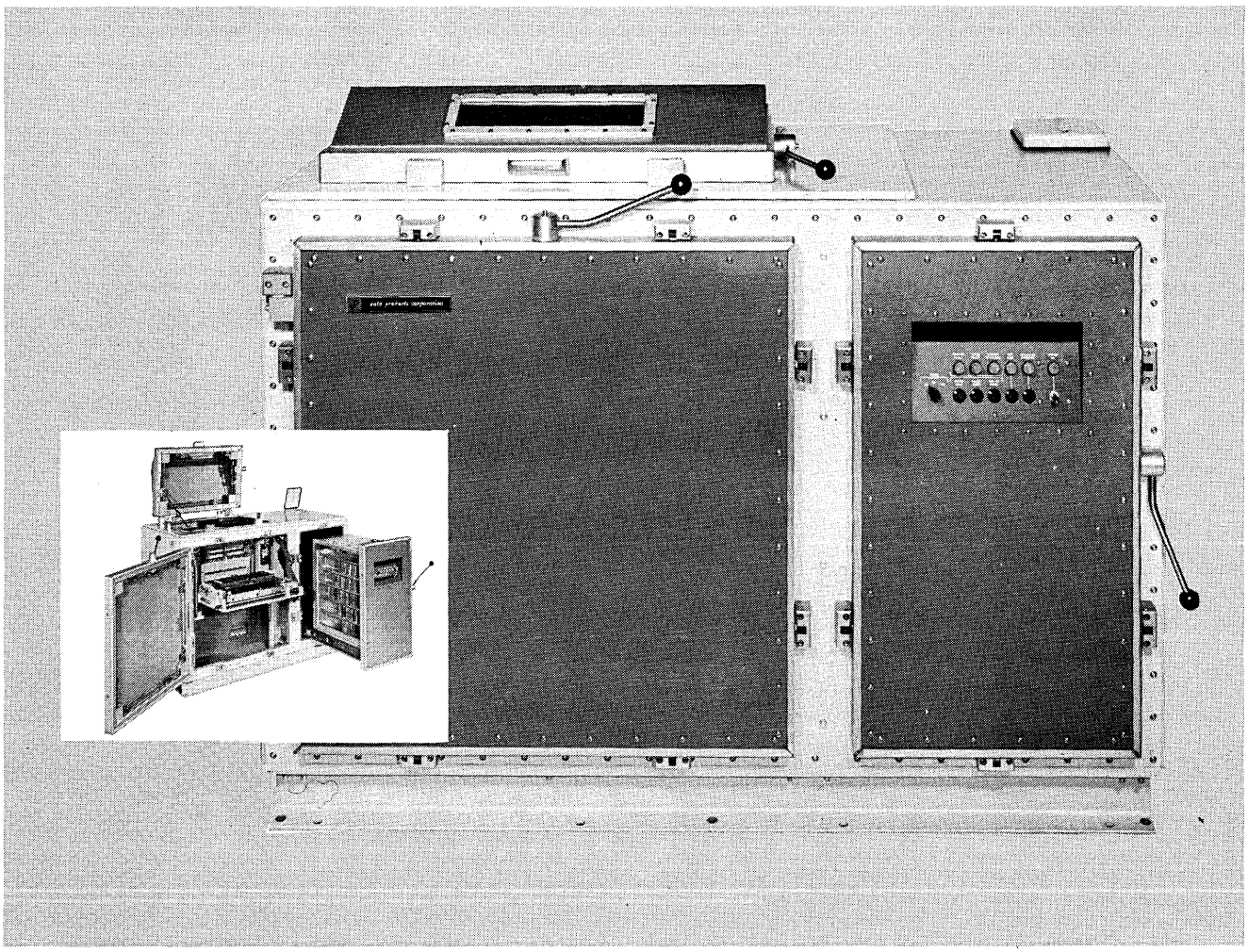
CIRCLE 117 ON READER CARD

tough. (tŭf);

adj. able to endure strain, hardship, or severe labor; robust

...best word for Data Products' RO-280/UYK Military LINE/PRINTER*



■ It's as rugged a printer as they come. Designed specifically for the brutal environments experienced in military use, the RO-280/UYK is built to MIL-E-16400, and is designed to meet all applicable specs for shock, vibration, temperature, humidity, and EMI/RFI. Truly rugged design and construction make the RO-280 ideal for shipboard use, trailer mounting, or any other location where high reliability under adverse conditions is a no-compromise requirement.

Like all Data Products' LINE/PRINTERS, the RO-280 is a high-speed printer for on-line use with digital computers, or off-line with magnetic or paper tape units, or communications terminals. It prints letters, numerals and symbols at speeds to 1000 lines-per-minute, with unparalleled clarity and dependability. The RO-280/UYK is the third generation of Data Products Military LINE/PRINTERS that have been proven in the field.

If you plan to give your computer printers a hard time, write Data Products, 8535 Warner Drive, Culver City, California 90230, for detailed literature on our Military LINE/PRINTERS.

Data Products manufactures LINE/PRINTER™, DISCfILE®, Core Memories, Off-Line Printer Systems, Card Readers & Punches

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"the peripheralists"

...get an EMR 6130

You would like a computer that performs like a Sigma 7. Yet, you want the Sigma 7 features in a Sigma 2 size system. Well, cheer up. The EMR 6130 can give you most of the key Sigma 7 features . . . at a Sigma 2 price tag!

The secret is ASSET, an unusual Real-Time Executive that allows extensive multiprogramming applications. Standard modules handle job and I/O queuing, dynamic core allocation, shadow-time batch processing, and interrupt processing to let you tailor the executive to your applications. Other software includes Real-Time FORTRAN IV and ASIST (a macro-level assembler). This package is available *now*.

The hardware features of the 6130 are unusual, too: Multiple, asynchronous memory busses permit true simultaneous I/O operations. Context switching is performed with just one instruction. Up to 126 external priority interrupts. Hardware multiply, divide, and double precision integer arithmetic are standard.

This brings us to a small surprise. The EMR 6130 is a 16-bit computer. But it happens to be the fastest (775 nanosecond cycle), most versatile 16-bit system on the market.

Let us prove it to you. Call or write our marketing manager in Minneapolis. If we can't convince you the EMR 6130 can do a better job for you, we might even forward your inquiry to the Sigma boys.

After all, it's your money.

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diodes. The novice—for whom this article was written—generally prefers to waste a bit of time and hardware for the sake of more basic and universally applicable instructions.

Let me refer to the last paragraph of my previous article in DATAMATION (May, '68), in which I stated that virtuosity in logical design is not acquired in a day, and hail a virtuoso in your correspondent.

PETER L. LINDLEY
Pasadena, California

promotion

Sir:

The references to Burke Marshall in the item beginning on Page 195 of your December issue are fallacious and unfair.

Mr. Marshall, who had a distinguished public career before joining IBM as vice president and general counsel in 1965, is being promoted to the Management Committee. The Management Committee has been the most successful organizational improvement in IBM in many years. It is composed of our most senior people and is involved with our most important managerial decisions. Your article, therefore, not only is an injustice to Mr. Marshall but also is unfair to the other members of the Committee. Mr. Marshall's performance as IBM's counsel has been so outstanding that he has been *promoted* to the Management Committee in order to avail the IBM Company more fully of his talents which we feel far transcend his obvious competence in the law.

I am astounded that a reputable publication such as yours would deal in such irresponsible gossip resulting in injustice to senior members of our management. The wrong cannot be righted but can be mitigated by an early retraction.

THOMAS J. WATSON, JR.
Armonk, New York

DATAMATION welcomes correspondence about the computer industry and its effects on society, as well as comments on the contents of this publication. Letters should be typed, double-spaced, and brief. Only those reaching the editors by the 5th can be considered for the next month's issue. We reserve the right to edit or select excerpts from letters submitted to us.

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To apply for a position in either area, call Mr. Tom Bryant at (617) 543-8750, collect, or forward your resume to him at the Foxboro Company, Dept. D2, Neponset Avenue, Foxboro, Massachusetts 02035. Look into other career building opportunities with Foxboro, an equal opportunity employer.

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people

Edward F. Kearns, most recently vp for RCA's Information Systems Div., has been named vp of the Computer Sciences Div. of CSC. . . . Computer Disc Mastertape Corp., NYC company recently formed to enter the peripheral systems field with a specialization in disc-oriented system devices, has announced the appointment of **Geoffrey Post** as president. He had been director of digital systems at ITT. . . . **Robert W. Holmes,** formerly vp and controller of SCM Corp., has been elected president and director of Lincoln Institute and vp and director of Lincoln Co. . . . The new computer systems group of Dow Chemical's Computations Laboratory is headed by **R. N. Farris.** New president of the USA standards Institute is **Francis L. LaQue,** vp of The International Nickel Co. . . . **David Packard,** board chairman of Hewlett-Packard, is now Deputy Secretary of Defense for the Nixon Administration. . . . **Thomas D. Truitt,** former exec vp, is Applied Logic Corp.'s new president. . . . **D. H. Warnke** has joined Portland-based EDP Central as director of administration. Formerly corporate staff systems manager for Honeywell in Minneapolis, he is international executive vp of the DPMA. . . . University Computing Co. has promoted **Eugene V. Scott** to president of its domestic Computer Utility Network. He had been vp in charge of the company's Technical Services Div. . . . **Dr. Lawrence M. Kushner** has been named to act as deputy director of the National Bureau of Standards to replace **Dr. Irl Corley Schoonover,** who is retiring. **Dr. Howard E. Sorrows,** former deputy director of the NBS Institute for Materials Research, replaces Kushner as acting director of the Institute for Applied Technology. . . . **H. Myrl Stearns,** a founder and former president of Varian Associates and presently a director and consultant to that company, has joined Ness Industries, Palo Alto, as senior staff consultant and board member. . . . **Robert J. Smallacombe,** formerly production director of the Washington Daily News, has been named president of The Milgo/IDAB Corp., replacing Edward Bleckner, Jr., who has been appointed president of International Communications Corp., a Milgo subsidiary. . . . **Stephen E. Wright,** a founder of Applied Data Research, has rejoined the company as a senior staff analyst to work with accounts on a consulting basis and in the development of new proprietary programs. . . . **James A. Yunker,** president of Astrodata, Inc., has been elected board chairman. . . . **Seymour R. Cray,** who headed the design, development and construction of CDC's first computer and who now directs the company's Chippewa Laboratories where he was in charge of developing the

6600 and 7600 series, has been elected a senior vice president of the firm. . . . **Ralph R. Johnson,** most recently vp of data processing systems marketing for Univac's Federal Systems Div., has been named president of Computer Network (COMNET), Washington, D.C., time-sharing firm. . . . **Arnold D. Palley,** a group vp of Brandon Applied Systems, has been appointed president, chief executive officer and a director of Ennis Brandon Computer Services, Inc., a new company formed by Brandon and Ennis Business Forms to provide edp services to small businesses. . . . **Nelson S. Courtright,** exec vp, has been elected president and chief executive officer of Bailey Meter Australia Pty. Ltd. . . . **Donald G. Ward,** former vp and gm of Transamerica Credit Corp., has been appointed chief executive officer and gm of Consumer Credit Clearance, a subsidiary of Computing and Software. . . . **Talmadge F. Broughton,** cofounder

people

of Satellite Computing (SATCOM) with COMNET, has been named SATCOM president. . . . At General Electric, **Jerome T. Coe** is now in charge of special studies. Replacing him as gm, Information Services Div., is **Paul Sage,** formerly general manager of the Mississippi Test Support dept. of the Missile & Space Div. **Dr. Thomas A. Vanderslice** is deputy division gm of Information System Sales & Service, replacing **Vern Cooper,** now gm of the Portable Appliances Dept. He had been gm of the Information Devices Dept., Oklahoma City, and will be succeeded there by **Frank E. Lenherr. Ralph S. LaMontagne** will be the company's manager of Federal Systems Operations for the Information Systems Field Sales Operation, responsible for marketing all GE dp products to federal agencies. He replaces **E. Hugh Kinney,** who has joined Auerbach Associates as vp and gm. . . . **Nathan Snyder,** secretary of Randolph Computer Corp., and **James O. Powell,** formerly president of the company's United Data Processing Div., has been named corporate vp's. Succeeding Powell is **Wallace L. Preble,** former division exec vp. . . . **Stuart M. Trooskin** has been promoted to director of proprietary systems for Delta Data Systems. . . . **James E. Starnes** has been named to the new position of vp-operations for Computer Usage Co., where he will be responsible for all field operations and marketing. He had been director of defense programs for IBM. CUC's Midwest and Southwest regions have been consolidated and will be headed by vp **Elbert Matthews.** . . . Univac has established a liaison organization between the company and the two major user groups to be headed by **Richard L. Robertson** as manager of user group relations. . . . **Erwin Tomash,** president, and **William N. Mozena,** exec vp, of Data Products Corp. and **Chester I. Lappen** have been elected to the board of directors of Stelma, Inc. Data Products recently

purchased 40% of Stelma stock. . . . **Fred W. O'Green,** Litton Industries exec vp, has been elected to the company's board of directors. . . . **Robert J. Cymbala** has been named manager of Honeywell EDP's advanced systems development dept. **Lawrence J. Hess** will manage advanced computer systems development of the division's hospital and medical information systems. **Dr. Christopher B. Newport** has been appointed engineering director for Series 16 computer systems at the Computer Control Div. . . . **Richard A. Babb,** formerly director of corporate planning for Datel, has been named Digitronics product manager for the DATA-VERTER and Dial-o-verter systems. . . . VIP Systems has added two new executives: **Joseph Arthur Mulloney, Jr.,** vp for corporate development, and **Harry D. Bennett,** vp for technical operations. . . . Burroughs has announced the appointment of **L. O. Browne** as manager of time-sharing and data center planning. . . . **Dr. Leon V. Hirsch** has been appointed senior vp and gm and **Martin S. Klein** as vp and director of research for United Research Co. Both had been with United Research Inc. before its recent merger with URS Systems Corp. . . . **Duey Glaubitz** has been promoted to vp, manufacturing, for Datel Corp. . . . **John V. Miller, Jr.,** has been appointed president of Home Testing Institute/TvQ, Inc., subsidiary of Computer Applications Inc. . . . **George B. Pressly,** formerly with IBM in Cleveland, has joined Computer Response Corp., Washington, D.C., as exec vp and member of the board. . . . **Ulysses G. Carlan** has been elected exec vp of Computer Age Industries. He had been a senior systems analyst with Planning Research Corp. and is a retired U.S. Army Colonel. . . . **Philip B. Crosby** has been elected corporate vp and director-quality of ITT. . . . **Ralph Rodriguez** has joined Electronic Memories as vp and gm of the Government Products Div. He had been with Litton Industries for 12 years, most recently as gm of the company's Memory Products Div. . . . **Olin B. Lane,** with IBM's DP Div. for 10 years, is the new vp-production for Management Systems Corp., Dallas. . . . **Irvin A. Kunzman, Jr.,** former manager of the Operating Systems Development Section at Honeywell, has joined the technical staff of Keystone Computer Associates. . . . Information General Corp. has announced the appointment of **Arthur N. Pozner** to the newly created position of director of the Time Sharing Applications Div. Most recently he was with the TRW Space Vehicles Div. where he was engaged in the development of time-shared applications in technical and administrative areas. ■

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We have key positions open on a number of our programming teams. Opportunities for you to work with our powerful 6000-series systems, and the new super-scale 7600. Computers of this size will be one of the fastest growing segments of the industry for years to come. Right now, you have a rare opportunity to get in on the ground floor. Choose from openings in the Minneapolis area, at Palo Alto, California and a number of other locations.

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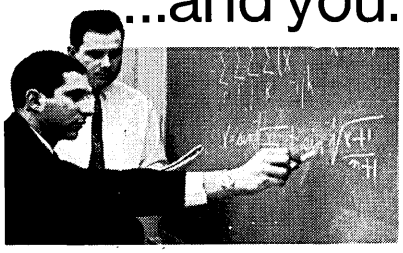

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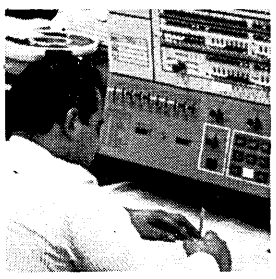

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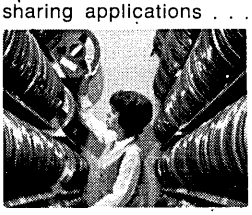

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world report

UK PROGRAMMING SCHOOLS AT STAKE IN MUSHROOM

Action is expected in the United Kingdom that will resolve the controversy over the role of the commercial programming schools. Suffering under a predicted shortfall of systems men and programmers for the seventies, there has been a mushroom growth of the independent schools over the past three years. Not surprisingly, the quality varies. But the topic came to a head last year when substantial numbers of aspiring candidates found that the best job they could expect from industry was as junior coders. As so often happens in such matters, the situation came to the ears of the politicians, who promptly called for some control to protect the gullible. Responsible schools suffered in reputation and many manufacturers from being beseiged by applicants with valueless qualifications. What this served to do was to underline the deficiency of college and university education facilities for producing courses tailored to commercial edp work. One route available for junior staff is to take part-time courses at local technical colleges for an examination set by the City and Guilds Institute, a body that has been a mainstay of examination for technical trades over the years. City and Guilds is to extend its activity in the computer field to examine for a wider range of work, including candidates from commercial schools, and to set language-oriented exams for those taking, say, Cobol courses.

Another development in the education field has been work at Leeds University, where computer aided instruction for medical students has emerged from a successful trial period. More than 30 students have tried the teaching method with keyboard displays and a response display unit. Behaving as a simulated patient with a range of various symptoms for investigation, the computer is subject to examination in such a way as to make the student frame his questions in particular forms. If the patient is supposed to be a child aged seven, then the machine will answer only those questions a child would understand. At the same time, the machine will berate a student for phrasing a vague question or asking irrelevancies, and it will also give advice when asked about the significance of unusual symptoms. The idea is to supplement group teaching at the bedside and in clinic.

FIRST FINANCIAL EFFECTS OF UK COMPUTER MERGER

First indications of the financial effects of merging the two major UK companies, English Electric Computers and ICT, to form ICL (International Computers, Ltd.,) have become apparent with the year's results from ICL. All told, about $21 million has to be written off by ICL to allow for English's trading loss and write-off of research and development. After allowing for such contingencies, the group returned a pre-tax profit of nearly $10 million from ICT's activities, which is 25% up on a turnover that rose from $160 million to $185 million. ICL has been on the go nine months. Forecasts for the end of this first year proper are for a near $13 million profit.

Looking for business that will cover r&d on the inherited English Electric System 4 series, ICL will put in a strong bid for the contract to undertake

(Continued on page 195)

Room at the Top

We're going to fill it with the best information system and programming professionals in the business. It's in our new 60-story building and there's plenty of room for the right men. But we don't have a spare inch for limited ideas. That's why our EDP program has never stopped growing. We hope it never does.

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cargo handling at London's Heathrow airport. This contract has slipped into the background while the airlines agree on specs. It is a cooperative venture with the usual difficulties of reaching decisions on a committee issue. Briefly, it will be funded by the Treasury for a scheme selected by the National Data Processing Service, which was given the job of project management. Income will be derived from the major users, i.e., airlines, shipping agents and customs. Called Lace (London Airport Cargo EDP), it should speed the paperwork handling and cash settlement for goods shipped through the port--30% of which are for forward shipment to the Continent. Ultimately, 1,000 displays are expected to come into use. With major installations for real-time jobs in the airlines now, Univac and IBM are favorite contenders. But with a need to break fresh ground into the real-time field, ICL will push hard for a System 4-70, although the severity of the penalty clauses may cause it to think twice.

GRANITE SEEKS SOLID FOUNDATION

Granite Computer Leasing is the latest of the third party financing-cum-software groups to make a bid for a stake in Europe. Differing in approach from the start of predecessors such as Leasco and Boothe, the Granite management has made a takeover bid for Management Dynamics, a group that wraps up service bureau, data preparation and systems consultancy subsidiaries. An offer of $7 million has been made for the company, which John Brown, a former ICT city manager, started three years ago. Management Dynamics also includes one of the biggest personnel recruitment agencies among its interests, was backed by the Brooke Bond company, which makes its money mainly from tea. Completion of the deal depends on Granite raising $15 million through the Eurodollar market to finance the project.

SOFTWARE HOUSE GOES TO BAT WITH UMPIRE

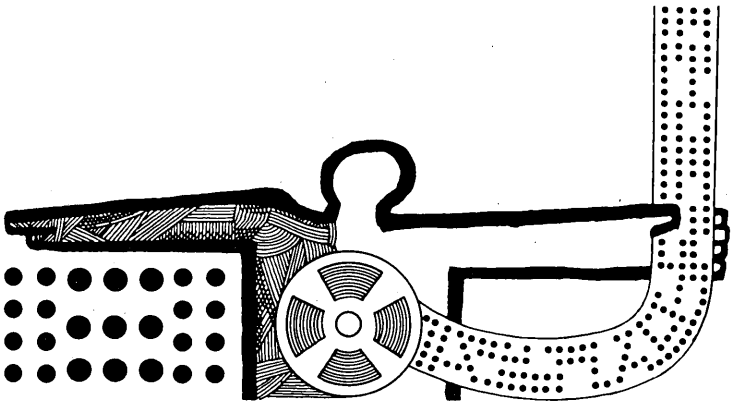
A management science and software house not given to undue exaggeration, Scientific Control Systems, Ltd., has claimed development of probably the world's most advanced mathematical programming system, called UMPIRE. Running on a Univac 1108, it has been designed as a general mathematical programming system, rather than a linear programming system, which hopefully could be extended. But it stems from earlier work in extending LP/90 and for handling integer variables. The first jobs so far dealt with by UMPIRE are a water resources job for planning drinking water supplies, and a capital investment appraisal in land irrigation for a developing country.

CII TO PROVIDE GEAR FOR AIR TRAFFIC CONTROL

The French national manufacturer, CII, has added a useful $10 million plus prospect to its future in getting a letter of intent to supply a clutch of 10070's for an air traffic control scheme. Intended for controlling civil vehicles in airspace, it will consist of three centres at Paris, Aix-en-Provence and Bordeaux to interchange data derived from flight plans, radar, etc.

JAPANESE PERIPHERALS AIM AT U.S. OEM MARKET

The Los Angeles branch of Marubeni-Iida, the Japanese trading company, has established a new department headed by Albert Naito to serve as liaison in representing Japanese computer, communication, and peripheral manufacturers in the sale of peripheral equipment to OEM in the U.S. Naito expects a sizable market because of the continuing lower cost of development and manufacture of new equipment in Japan and has set up working agreements with Fujitsu, Hitachi, and Toshiba, plus other smaller firms.



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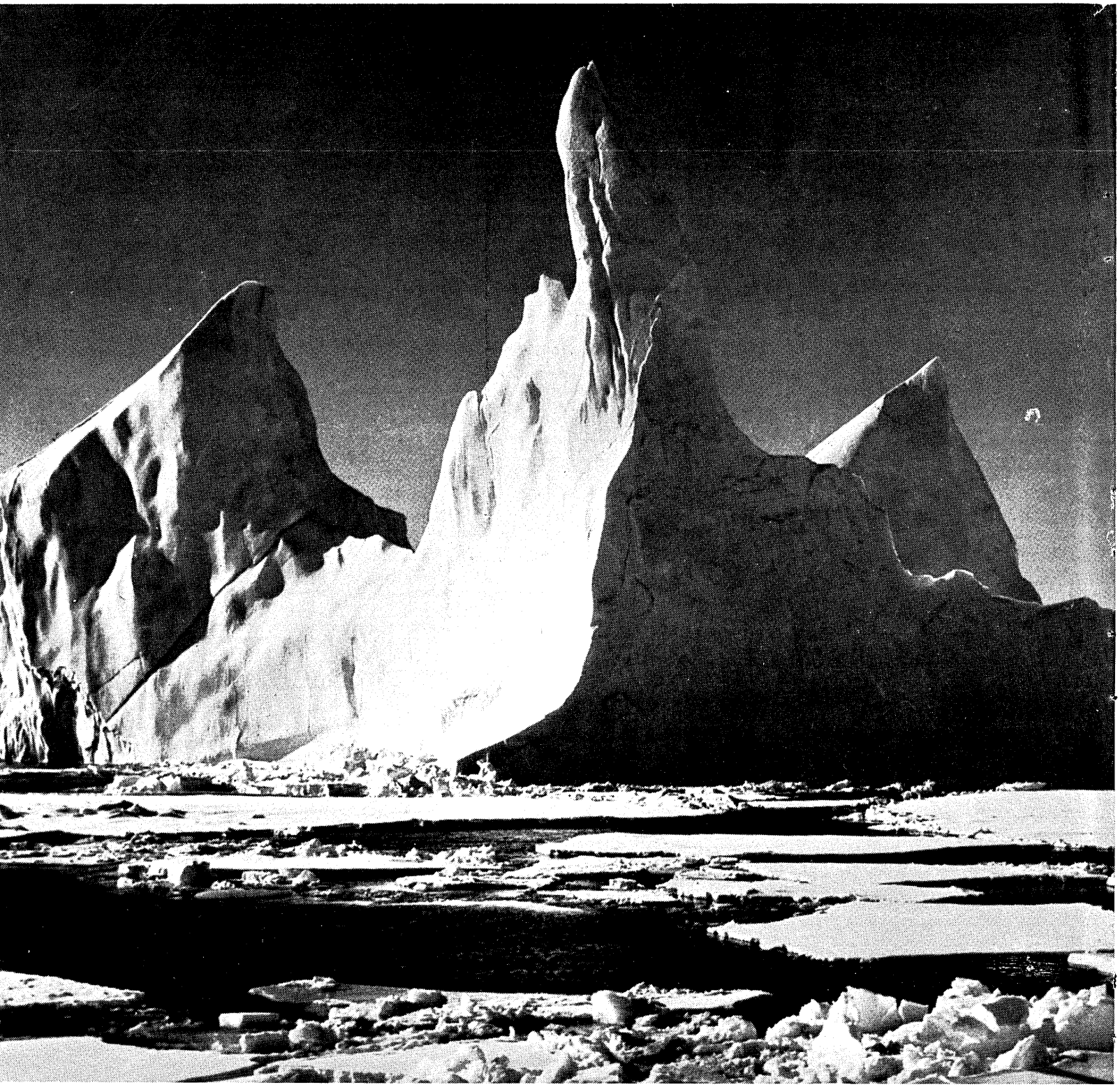

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Speaking of visibility, there may be some things about RCA which are not too obvious. We are in a period of fast expansion; working on large-scale multipurpose computers with special emphasis on Information Systems.

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RCA

washington report

CAPITOL MAKES CAPITAL OF JUSTICE VS. IBM SUIT

Washington is filled with cryptic rumors about IBM's legal problems. One source says, "Watch FTC and ICC. Now that Justice has acted, they are going to." Asked for details, the source clams up. Another knowledgeable observer, asked why the Justice Dept. waited till LBJ's last day to file its complaint, says in a whisper, "It was touch and go up there until the last minute."

One theory is that the CDC and DPF&G suits, filed a short time before the Justice complaint, opened additional sources of information to government lawyers. This evidence had to be correlated with what they already had, and Justice waited till LBJ's final day simply because it needed all the time it could get.

The reason government attorneys didn't wait for the Nixon administration to sue IBM seems fairly clear. When Nixon took office, a new team came aboard at Justice; the old hands, who had been studying IBM's operations for years, wanted credit for any benefits produced by a lawsuit. Also, they knew the suit would be delayed while the new team learned the ropes. Some felt that the Republicans' pro-business sympathy would delay court action against IBM indefinitely. The appointment of Richard McLaren as Nixon's chief of the antitrust division seems to support this latter fear. McLaren is a corporation lawyer who had defended Sealy Mattress and National Dairy against antitrust charges.

A contact familiar with IBM's front-office psychology thinks the suit will encourage Watson and company to go ahead with their proposed plans for separating software and hardware prices. He also looks for an early announcement of a major reorganization, adding that "If IBM plays these cards right, it could take most of the steam out of all three suits before they really get started."

CAPITOL BRIEFS:

A new division of automatic dp services has been established in the Federal Water Pollution Control Administration as part of a major internal shakeup. ...Domestic computer shipments this year will soar 17% to a record of $6.4 billion, says the Commerce Department. Exports will rise 4%, to $660 million, and imports will increase 8%, to $178 million...HEW's new budget includes $2.1 million for the national biomedical communications network, moving it from design to development stage....Inspired by a presidential commission, several bills have been introduced to set up a "Wet NASA," a National Oceanic and Atmospheric Agency, to do underseas research. Direct expenditures of the agency for data services would rise from $3.2 million to $60 million annually during its first 10 years....The Small Business Administration will rate computer programming firms and service bureaus "small" (hence eligible for special SBA loans and preferential treatment on government procurement) if their average annual sales for the previous three years were no more than $3 million....EDP Technology, Inc., Falls Church, has won a $250K contract from HUD to develop an adp system within 10 months to measure the progress of 150 cities under the Model Cities Program.

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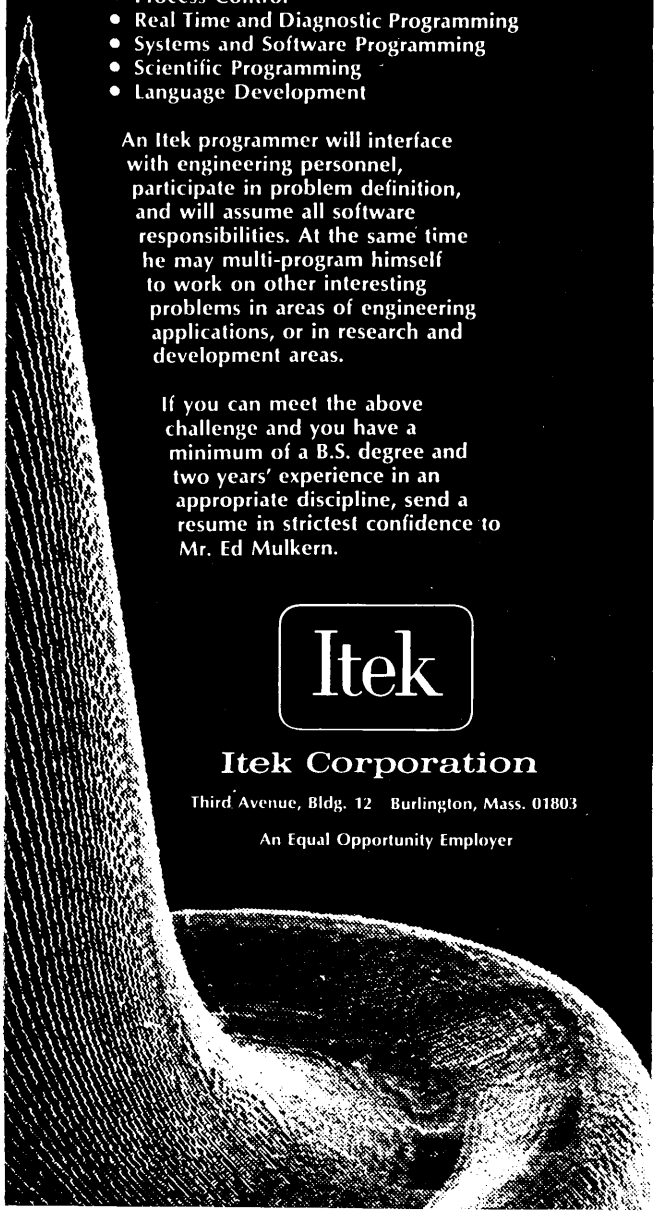

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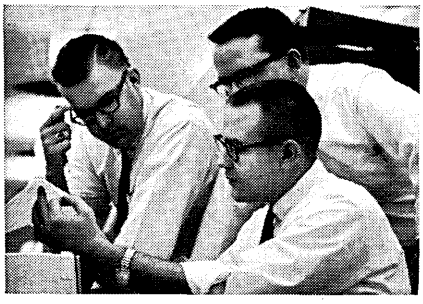
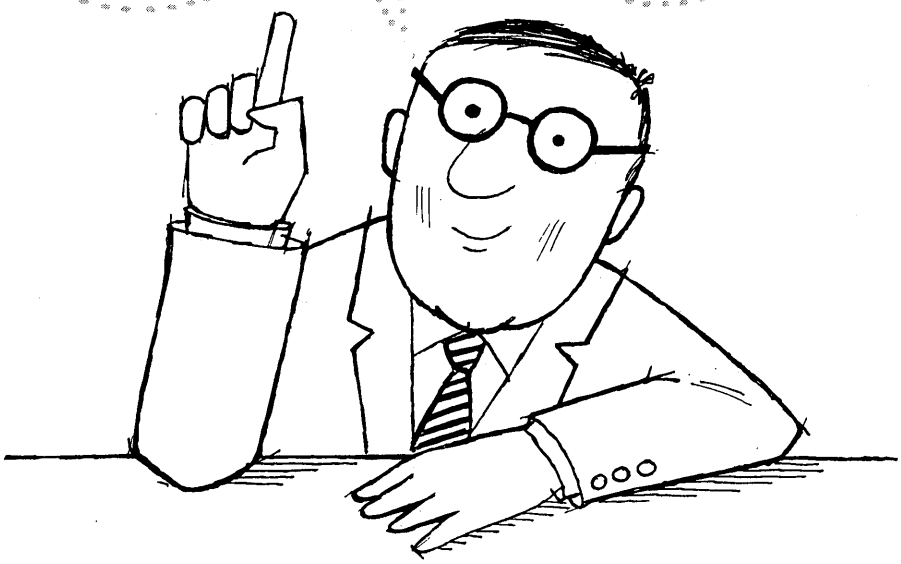


IBM programmers and systems analysts work in small teams on an IBM System/360.

ASSIGNMENT: DESIGN OR PROGRAM A COMPLETE ORDER ENTRY SYSTEM ON LINE TO A 360/65



How does that grab you!?

If that assignment brought a glint to your eye, read on. There are more. *Like designing or programming a data base for over 300,000 parts . . . or mathematical and simulation models of VTOL aircraft . . . or software in support of a real-time data acquisition and reduction system, airborne computers or a major retrieval system for technical data.* We could go on, but that will give you the idea.

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or even operators. Anyone who works where the machine is installed and can read short words will do.

Data Techniques, headed by the redundantly named Allen Allen, leases complete packages—hardware, software, and any other equipment needed; they do all the systems work too. What the customer gets is an installation where the machine gives all the instructions to the user, in plain English. Punched cards are color-coded, for example, and the typewriter prints out: PUT THE GREEN CARDS IN THE READER. Or: FOR A SALES ANALYSIS, PRESS SWITCH B. That's all there is to it and it works, given all the fancy programming that DT has to do in the first place. Of course, this leads to some pretty strange phone calls:

"Mr. Allen? It's not doing anything."

"It just stopped?"

"That's right. We woke it up again like you told us but it seems to want something."

"Take a look at the lights on the front and tell me what the numbers are...the first three at the left of the bottom row...O.K....Now press switch C."

"Wait a minute. It's saying something."

"What did it say?"

"Oh, dear. It says it wants more paper for the printer...I should have known that."

CCI PLANS LEFT JAB FOR MOHAWK, RIGHT CROSS FOR COMPUTER INDUSTRIES

Although president Bob Fagen of Computer Communications, Inc., takes pains to point out that CCI is an all-around systems/software/design operation as well as a hardware manufacturer, some of his new products may further blur the image.

In early '67, CCI announced its first hardware--a crt/keyboard terminal using a standard TV set. Now, after impatiently waiting out the 90-day silent period that goes with registration of a stock issue, it turns out the company has 15 products. They're all related, filling in gaps between a computer and the remote station, but two are of special interest.

One is the first of a family that will parallel the Cope terminals of UCC subsidiary Computer Industries. Called the CC-36 Televideo Conversational/Batch Station, it includes a keyboard, 300 cpm (or faster) card reader, slow printer (300 char/sec, nonimpact), sequencer, and interface for remote communication via dataset at 50K bits/sec... plus a crt. Faster printers can be had and other peripherals can be added. But the sock-it-to-'em part is the price--about one-third the smallest Cope job.

Slipping it to them--such as Mohawk, Honeywell, and the other key-to-tape or key-to-disc makers--is an evolutionary expansion of CCI's basic 301, the original package that drives the crt and handles the keyboard, plus seven other peripherals. While Fagen says no one should go out to buy this combination to prepare input data since it's too expensive, if you happen to need it for all sorts of off-line chores they do happen to have this package they're working on that makes the 301 highly suitable for putting input data on mag tape...or discs...

ALPHABET SOUP BATTLE RAGES: OCR-A VS OCR-B

Another battle between edp manufacturers and the federal government erupted last month.

Dr. Herb Grosch, director of the Center for Computer Technology at NBS, told USASI he opposes extension of its X3.17-1966 OCR (A) standard to include lower case letters and ASCII characters. Instead, the ECMA OCR-B font should be developed as a USASI standard for upper and lower case use. Grosch wants most optically read documents to use OCR-B

(Continued on page 205)

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characters, if they have to be read often by humans as well. USASI's OCR-A would then be limited to documents to be read only infrequently by humans.

Some manufacturers--notably REI and Scan-Data--side with Grosch, possibly because their multifont readers can accommodate OCR-B. The other side is led by CDC's Jack Rabinow and includes Farrington and IBM, firms whose equipment which, as presently configured, can't read OCR-B.

Grosch likes OCR-B for most applications because it is similar to the characters people are used to reading. Also, OCR-B already offers lower case, has been standardized in Europe.

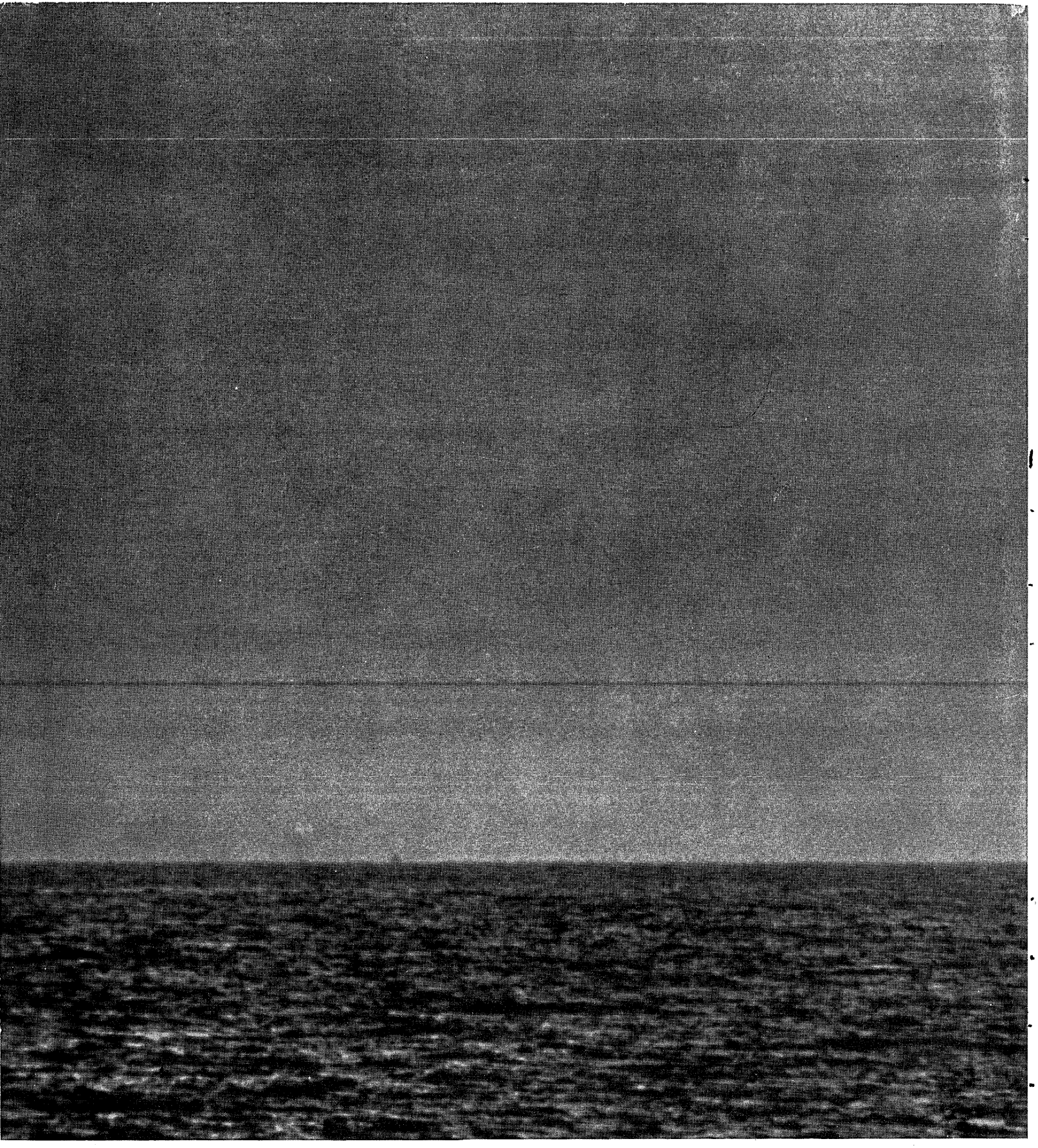
The opposite view: thousands of people are reading OCR-A characters today without trouble. Rabinow says A-type readers "cost five-10 times less than" B-type machines, "and will always be cheaper because they're simpler to build."

CASE AGAINST SCERT

Computer Learning Corp.'s CASE simulator is apparently becoming a major competitor of SCERT, the Comress program that has long been the favorite for measuring computer system performance. Last fall, U.S. Forest Service and the Internal Revenue Service, after subjecting both packages to identical benchmarks, selected CASE. Last month, we hear, Ernst & Ernst, a nationally known CPA firm headquartered in Cleveland, made the same sort of test and also picked CASE over SCERT. Ernst & Ernst will soon be offering CASE simulations to smaller scale dp users on a service center basis. The customer, instead of being billed by the month for use of the program, will pay so much for each machine run. Computer Learning, which recently hired Tom Bianco, former advanced projects manager at IBM/FSD, to head up its CASE promotional program, is reportedly negotiating similar service center deals in other parts of the country.

RUMORS AND RAW RANDOM DATA

General Electric's French-made 55 will soon be joined by soon-to-be-announced GE 60, an upgraded version of the earlier model, with disc and communication controller. Price details not yet available. GE will probably announce a new communication device to be front end to the 600 line this month...Sources say that IBM was shocked when L. E. Donegan, number two exec at SBC heading up the newly transplanted Call/360 time-sharing operation, decided to become RCA's division vice president of marketing operations. Donegan was said to have a majority of the SBC staff under him, was to guide the transformation of SBC into a time-sharing power. No replacement was announced at writing, the time-sharing division reporting directly to president John Williams...The 8500 is evidently a dead duck until a new version, the 8502, comes out in a couple of years. The 8501 may become an in-house T-S system. Two big UK outfits and U.S. Steel have been switched to dual 6500's. Meanwhile, Burroughs may start opening T-S centers; T-S software requirements may delay decision to produce PL/I compiler for the 6500, already budgeted for '69... A plan to reorganize and streamline the USASI X3 standards committee is near a final decision...Look for DEC to announce a low-cost 16-bit system featuring modularity, ease and efficiency of programming, broad-range peripherals...Arista, Winston-Salem, N.C., software house, has a new package called Data Trap for reducing program debugging time 30-50%; it works with PL/I, Cobol, assembly language and RPG on 360/30's and /40's under DOS and TOS. Cost: $950.



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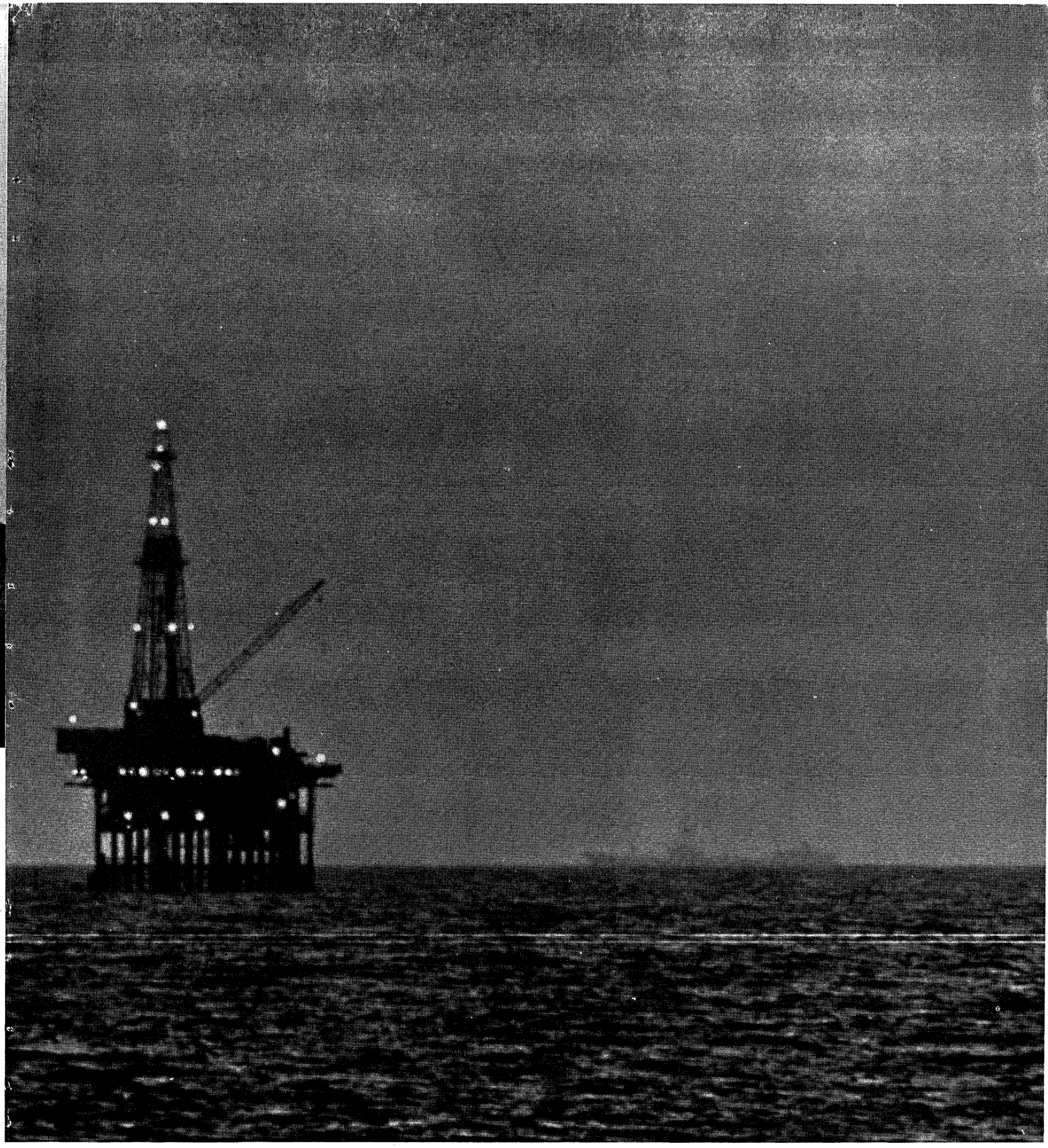

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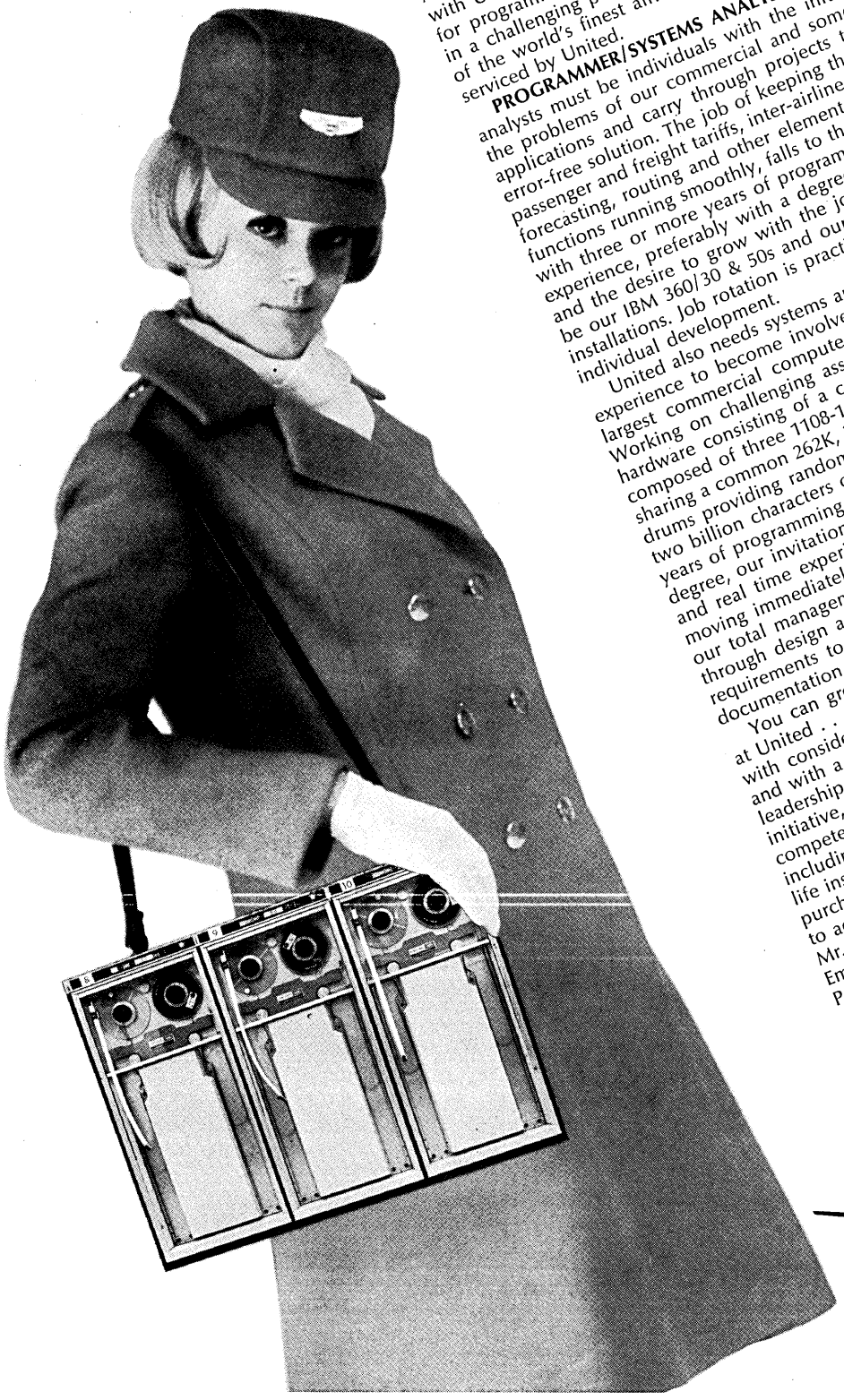

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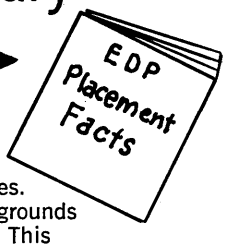

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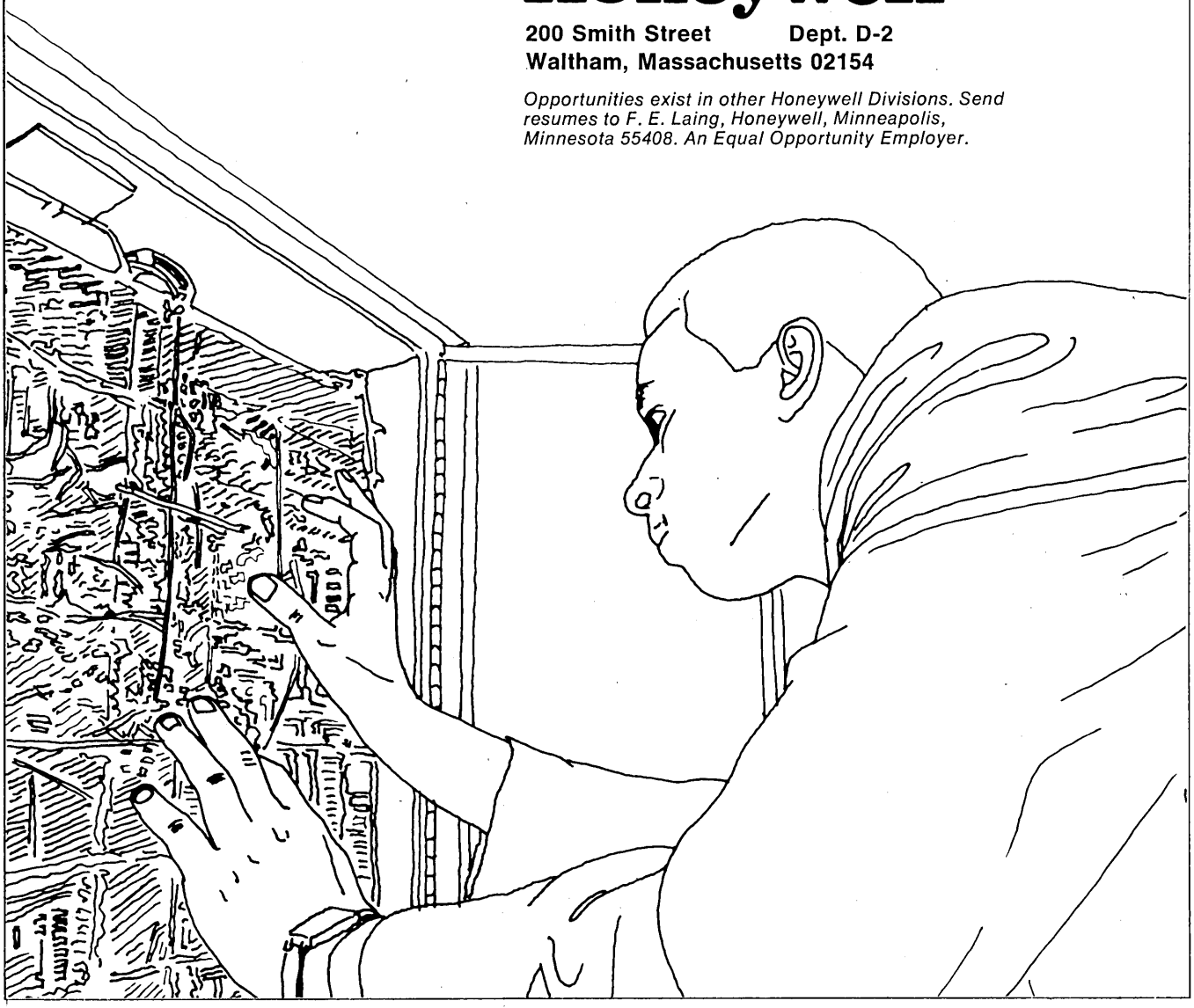

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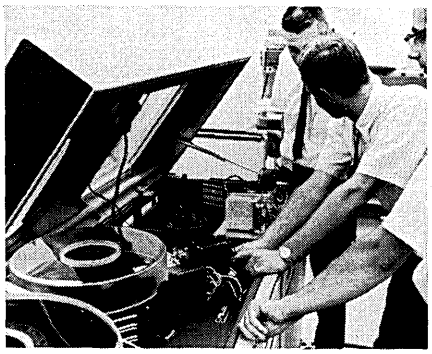

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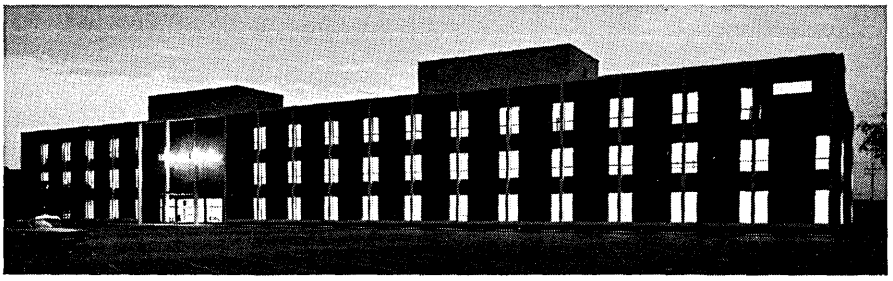

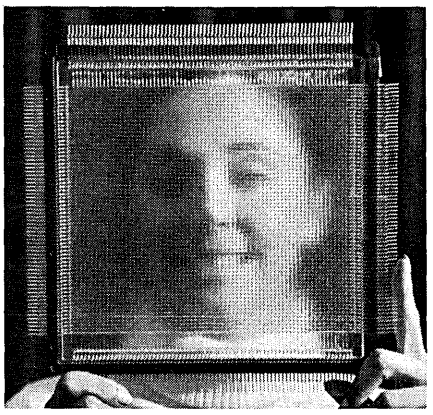

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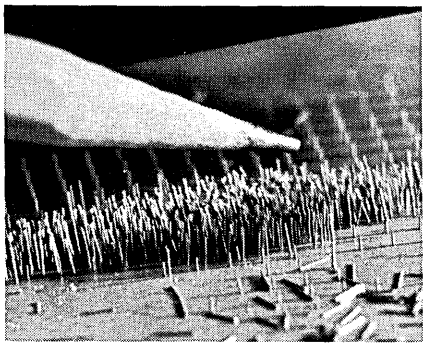

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A REALISTIC LOOK AT THE SYSTEMS APPROACH TO SOCIAL PROBLEMS

An era characterized by bigness—big budgets, big business, big government, big explosions—of population, information, and technology—provides an environment hospitable to the growth and development of the big, total approach. Such is systems analysis, with its components and companions, cost/effectiveness measures and program planning/budgeting. These methods, utilized and refined in military and space missions, have gained favor for the apparent tidiness with which they have achieved management marvels. For this and other reasons to be mentioned later, systems analysis has come to be accepted as a nostrum for all manner of social ailments, and the market for socio-economic systems is booming. At present receiving one dollar out of every five in the U. S. Budget, socio-economic programs, by 1975, will account for one or perhaps two out of every four dollars. With the federal investment in urban renewal for 1968-78 amounting to $250 billion, predictions that the market for urban civil systems will reach somewhere between $210 and $298 billion by 1980 may prove accurate.[1]

The prospect of so bountiful a market is enticing, and prospectors of remarkable diversity as to discipline, background, and competence are converging on it. There are aerospace and aviation firms, computer manufacturers and their multifarious subsidiaries, electronics companies, management consultants, appliance makers, directory publishers, and university-based entrepreneurs. Prominent among the contenders for contracts are the nonprofit but highly profitable "think tanks," with their in-house experts and

on-tap consultants and their proliferating satellites with unpronounceable acronyms. They are all competing energetically to bring what journalists enthusiastically hail as "the powerful tools of technology" to bear on matters concerning the commonweal.

The forensic is familiar: A nation that can send men to the moon should be capable of closer-to-home accomplishments. All we need to do is to apply our scientific know-how to the analysis and solution of social problems with the same creativity we have applied to space problems.[2] This type of argument is persuasive on several counts: first, the prestigious origin and logical, scientific aura of systems analysis, and second, the growing recognition of the need for better planning, organization, and management of social affairs. A brief review of the genealogy and current conception of the systems approach will adequately illustrate the first point. Charles J. Hitch, whose imprint on this methodology is so great that it is sometimes called "Hitchcraft," described systems analysis as a direct lineal descendant of World War II operations research.[3] O.R. was used to solve tactical and strategic problems of a military nature; systems analysis uses the same principles but has wider range and scope. It encompasses (1) a more distant future environment, (2) more interdependent variables, (3) greater uncertainties, (4) less obvious objectives and rules of choice.[4] Impressive as to historical background, systems analysis, with its heavy reliance on models and mathematical computations and manipulations, has special appeal in an era characterized by a universal craving for certainty and orderliness.

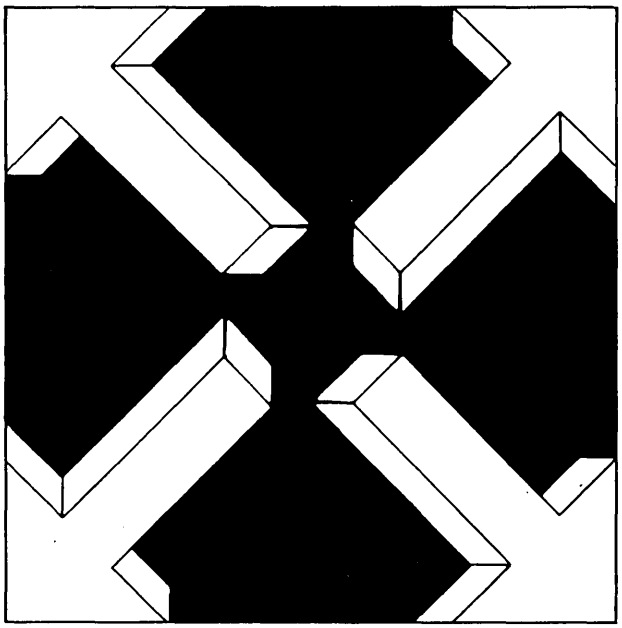
This yearning underlies the present impatience with traditional approaches. Juxtaposing the duplication, confusion, and disarray of current public administration with the rationality and neatness of program management to be realized from application of the "revolutionary concepts," proponents of systems analysis make a strong case for their wares. And there is no gainsaying the fact that social problems beset us: urban blight deepens and spreads; pollution of air, water, and land proceed at an awesome pace; crime rates soar; arteries and facilities for air and ground travel are danger-

[1] *Finance Magazine*, January 1968. Staff, V-P Marketing, North American Aviation, *The Economic Business Spectrum as Related to National Goals—Identification of New Business Opportunities*, 1967.

[2] Statement by Senator Gaylord P. Nelson, *Congressional Record*. Proceedings and Debates of the 89th Congress, First Session, Oct. 18, 1965, No. 194.

[3] Charles J. Hitch, Royal Society Nuffield Lecture, London, Oct. 25, 1966.

[4] This comparison was made by Albert Wohlstetter in "Scientists, Seers, and Strategy," Columbia University, Council for Atomic Age Studies, 1962, pp. 36-7 (unpublished paper).



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ously clogged. In one way or another, these problems ultimately become the business of government, already regarded by many as too big to be potent and too trapped in a bureaucratic maze to respond effectively.

Since 1964, when the state of California pioneered by hiring aerospace engineers to help solve problems of public concern through systems analysis, many public officials, from county to Congress, have chosen the same vehicle on the high road to grants and contracts.

Can we assume from the vast expenditure of public funds and mobilization of motley systems experts that we will now witness a diminution of the inefficiency, ineptness, and uncertainty that plague planners of public programs? The question deserves serious consideration, for there are signs that the incoming administration in Washington will be especially receptive to further involvement of the private sector in public affairs. Its managerial techniques will be given full play. We may find it useful, therefore, to note the factors surrounding the adoption of systems analysis in the social arena. Four are especially important: historical antecedents and scientific attributes, already mentioned briefly, and political and economic circumstances. Because of the admirable escutcheon derived from its association with defense and space achievements, systems analysis has enjoyed almost total immunity from the critical evaluation to which some other methodology might have been subjected. And yet, to judge from recent discussion,[5] the DOD model may not be optimal for military, let alone other kinds of decisions. Government officials struggling with program budgeting as decreed by President Johnson are learning, the hard way, that the circumstances governing and the criteria for judging effectiveness in the DOD resemble not remotely those prevailing in matters for social accounting.

Since, however, the same assumptions, rules, and courses of action that appeared so logical and scientific in their earlier context are being transplanted bodily, they deserve scrutiny. First and foremost, there is the assumption that because the word *system* can be used for everything from atomic weapons delivery to anthropotomy, the same analytic tools can aid in understanding all of them and the same type of remedies can be applied to their malfunctioning. There is the related assumption that since large scale, complex systems have been "managed" by use of certain techniques, then social systems, which are often large and always complex, can be "managed" in like fashion. This presupposes similarity of structure, with social systems reducible to measurable, controllable components, all of whose relationships are fully recognized, appreciated, and amenable to manipulation. To the extent that these are fallacies, they must be attributed to semantic impoverishment. Moreover, the very characteristics which distinguish social from other species of systems render them resistant to treatment that tries to force them into analytically tractable shape:

1. They defy definition as to objective, philosophy, and scope. For example, what kind of definition of a welfare system can be regarded as valid—that which encompasses the shortcomings of *other* systems, such as health, education, employment, or the one which focuses on individual inadequacy? A definition depends on the point of view and the ideological posture. The system looks very different to the administrator, the recipient, the black power monger, the social critic, and the politician.
2. "Solution" of social problems is never achieved. You do not "solve" the problems of health or transportation. Consequently, where you start and where you stop is purely arbitrary, usually a reflection of the amount of money the government has to fund the particular analysis.
3. Despite the semblance of precision, there are no right or wrong, true or false solutions. Consequently, it is presumptuous to label as *wrong* anything being done now and *right* that which looks good on paper. By concentrating on miniscule portions or isolated variables simply because they are quantifiable, the technique may actually lead to results which are irrelevant and inappropriate. Assignment of social costs and social benefits is an arbitrary mat-

[5] James R. Schlesinger, *Systems Analysis and the Political Process*, RAND Paper P-3464, June, 1967, pp. 14 ff. See also Hearings before the Committee on Foreign Relations, U. S. Senate, 90th Congress, Second Session, Part 2, May 28, 1968.

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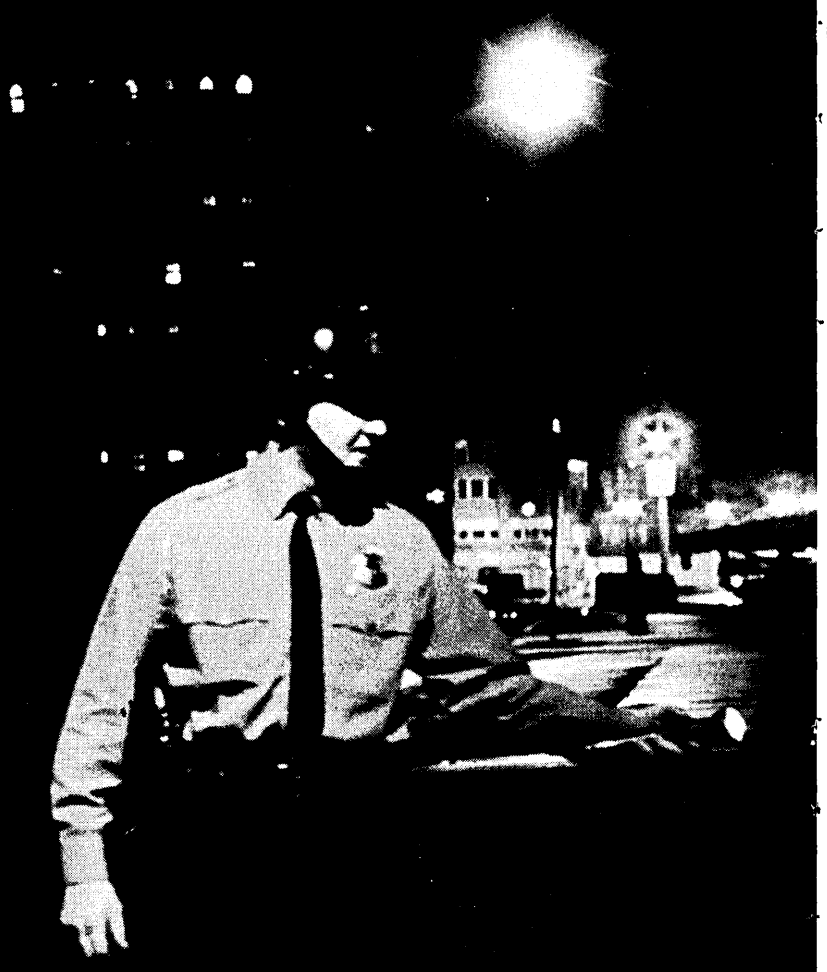

ter, and even dollar cost/benefit comparison is a matter of interpretation. There are no ground rules for identifying the Peter being robbed and the Paul getting paid. It should here be noted that anyone can join the popular sport of knocking bureaucracy; playing utopian games is easy.

Corollary to the assumption that systems analysis can improve the state of the art of public program planning is the notion that the "systems expert" is a past master of advanced concepts on all fronts. He often ascribes to himself a clairvoyance denied specialists in the subject area, for, with the greatest of ease, he hurdles 1984 and designs year 2000 plans. As though by his own original discovery, he brands present practices as fragmentary and duplicatory. This situation he corrects by an unfurling of flip charts, a dubbing of labels in blank boxes, and an affixing of arrows on the flow diagrams. He deplores the lack of information and proposes a data bank to capture every last bit. After an exercise in present-day serendipity now known as "playing around with some models" and a series of optimistically-called "progress reports," time and money will have run out. The air may be no safer to breathe, urban ills no less crucial, but conclusions and recommendations, like campaign speeches, will ring with truisms and promises: (1) Present planning is wasteful and ineffective; (2) the prescribed course of action is more systems studies which will harness huge reservoirs of talent and put to use the "powerful tools of technology" and produce knowledge and understanding. Anyone who has reviewed systems reports cannot fail to recognize the pervasiveness of the "Perils of Pauline" feature, which may be intrinsic to the nature of the technique.

This hard look has fallen on the technicians as much as the technique and necessarily so, for the two are inextricably intertwined. What the analyst conceives as the system is reflected in its definition, its objectives, its interfaces, its significant variables, its relevant data. The methodology of systems analysis supplies the form; the analyst, the content. The inputs which he selects become determinative. That he chooses to omit certain phenomena because of his own bias or because they resist quantitative treatment may be far more crucial to society than his model, but neither the technique nor the technician has use for them. It is precisely because of the centrality of his role that the analyst should possess a deep and sensitive understanding of the social matter with which he is engaged. Unfortunately, this is seldom the case. On the contrary, "expertness" is an *ad hoc* affair, with titles bestowed to suit the contract in hand. The casting of characters reminds one rather uncomfortably of the Puritan who marched around the fort in a succession of hats to fool the Indians. Lacking in orientation and without an appropriate frame of reference, such an analyst substitutes ignorance for objectivity and banal generalization for total system comprehension.

If anyone is surprised at the discovery that the emperor, for all his multimillion-dollar wardrobe, goes naked, that may well be because oversell dominates every stage of the system analysis, from proposal to final report. The "expert" appears in many forms—as undersecretary of a government agency, as think tanker, as advisor to contracting agencies—but always as a salesman in disguise. He testifies at Congressional hearings; he delivers keynote addresses at meetings of all kinds of professional groups. His presence at the latter is strictly that of the fox in the henhouse, for he invariably predicts growing complexity ahead and promulgates the notion that nothing short of the powerful tools of his technology will suffice to handle the problems. He may occasionally offer the modest disclaimer that systems analysis cannot solve every problem, but he earnestly implores his listeners not to throw out the baby with the bathwater, or the egg with the eggshells. The rules of his game are simple: one for the money, two for the show. The name of the game is self-perpetuation, the stakes are high, for systems business is booming, here and abroad.[6]

Economic considerations on the part of all participants keep the game going. The prosperous and growing community of problem solvers is apparently more concerned with obtaining more contracts than with improving the state of the art or of the nation. There is a serious dearth, among practitioners, of critical evaluation. Apparently, no one with sufficient claim to systems expertness to preach or practice the technique would be so rash as to shoot down the goose that lays the eggs, especially

[6] Daniel S. Greenberg, "Consulting: U. S. Firms Thrive on Jobs for European Clients," *Science*, Vol. 162, Nov. 21, 1968, pp. 986-7.

the forum

when they are golden! The moral problem of the profession as expressed by C. West Churchman[7] has been delicately sidestepped in pursuit of the objective not to do better, but to do more. The political arena in which the game is played discourages rigorous review, since large sums of public money are involved. In their expenditure, everyone must look good. No official is so possessed of the death wish as to admit that the venture was anything but successful. Consequently, every aspect of the transaction, quite irrespective of its true color, comes through tinted with a glow of success.

The mixture of salesmanship and politics may, ultimately, undermine the state of the art, for short-run, pervasive zeal for self-perpetuation practically guarantees stagnation. With little benefit of feedback from earlier experience, the same level of sophistication remains, with the same shortcomings, the same deficiencies, the same old excuses. Conceptual and methodological mutations are needed in order to create a tool useful in social planning, but these cannot occur unless there are open channels of inquiry and assessment free from public relations embellishments.

Such evaluations are not the private preserve of any one professor or any particular discipline. Nor need they be considered the bailiwick of any one sector. There is an important role in the process of social accounting and planning to be played by professional persons, whether in the employ of government, industry, universities, or elsewhere. In every system study, the close and constant involvement of individuals expert in the relevant disciplines is absolutely essential. Every major problem facing urban society today is multifaceted in nature. Economic, political, and social rationality must all contribute to developing a viable model, for human and social values are at stake as old problem areas are subjected to new modes of treatment. Understanding calls for knowledge on many fronts. Highly desirable, indeed, would be a creative synthesis achieved through a genuine multidisciplined approach. It is interesting to speculate on the extent to which systems analysis will be the means to an end of such a synthesis.

—IDA R. HOOS

[7] C. West Churchman, "Wicked Problems," *Management Science*, Vol. 14, No. 4, December, 1967, pp. B-141-2.

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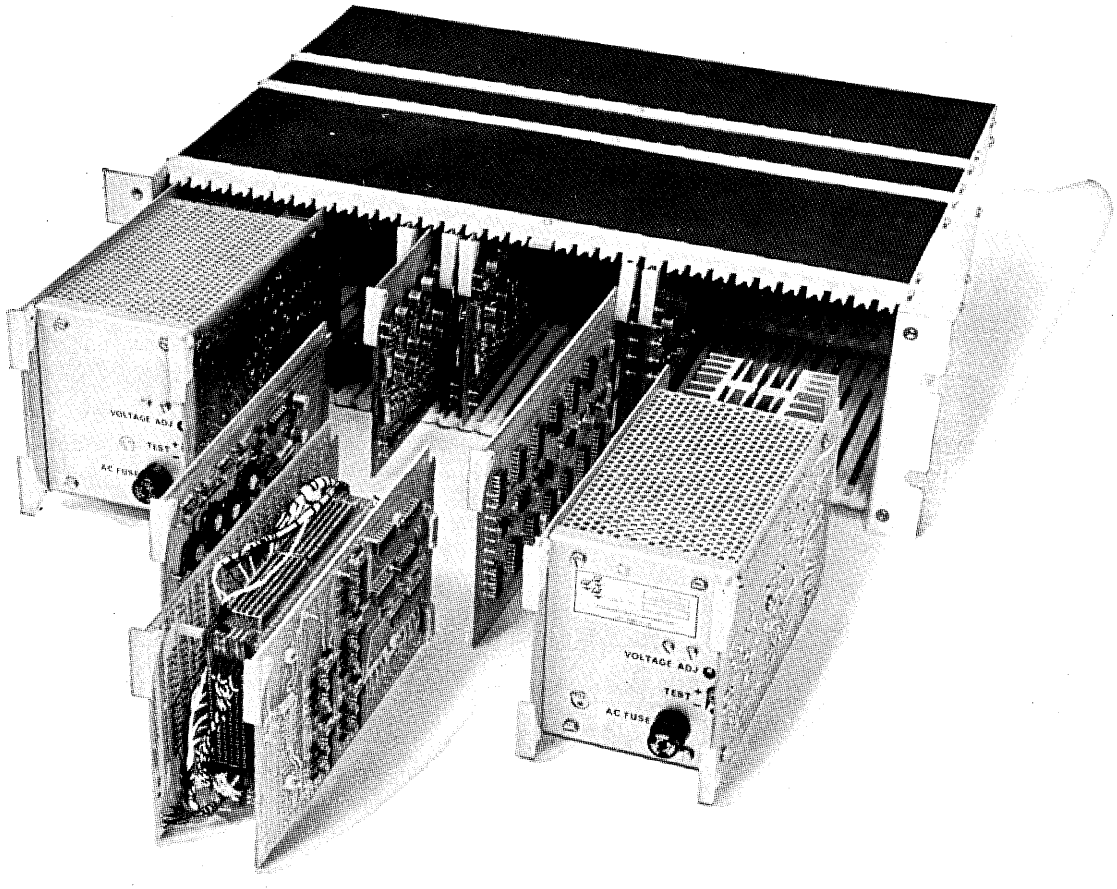

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