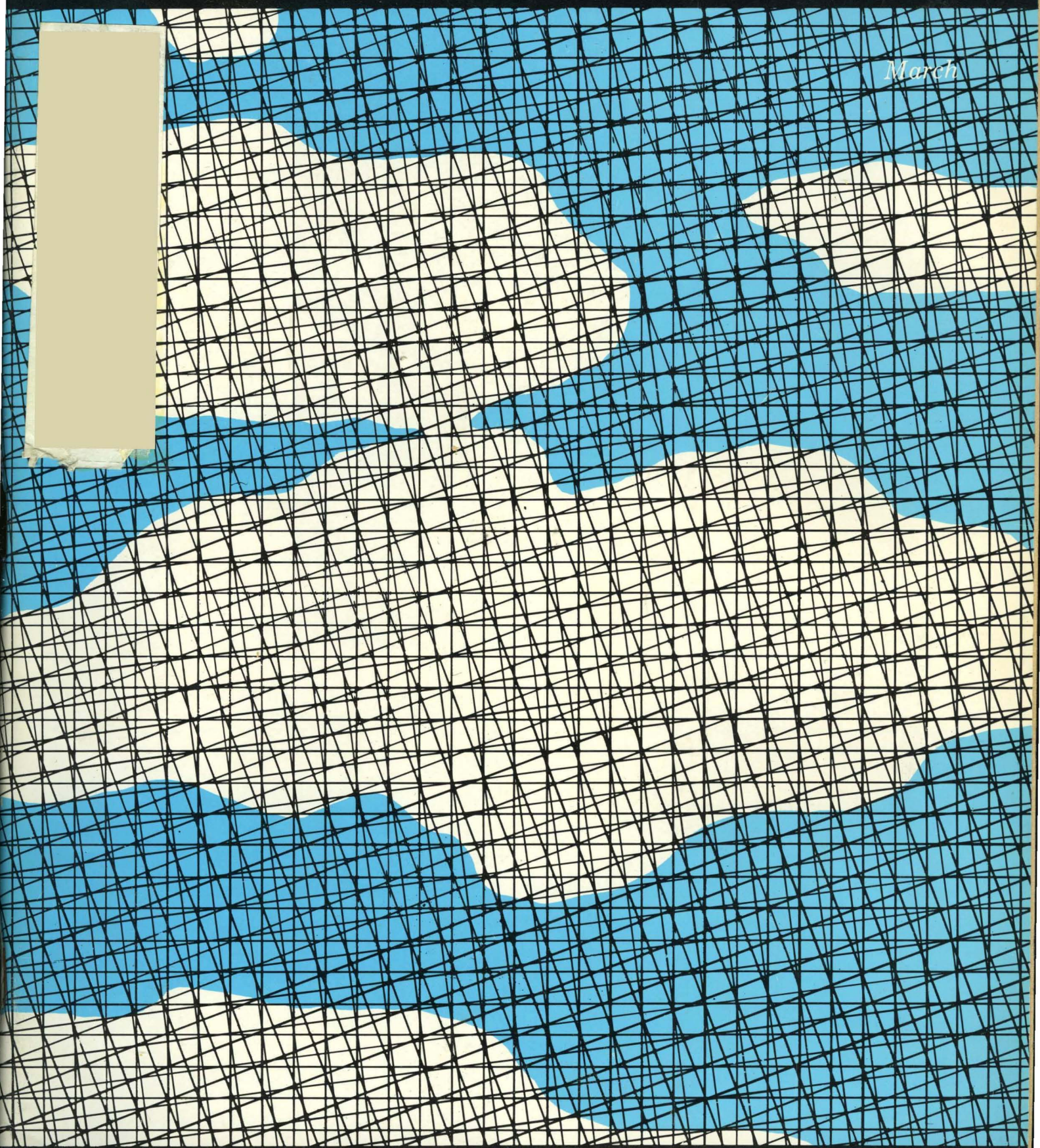
DATAMATION®

69

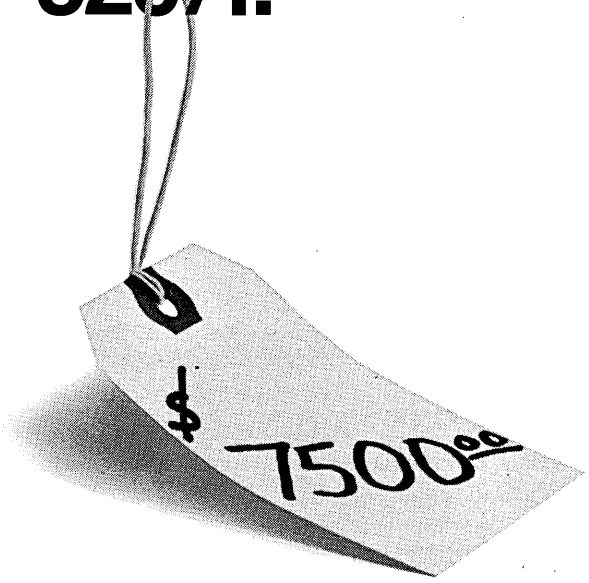
March



THE BUSY, CROWDED WORLD OF AIR TRANSPORTATION

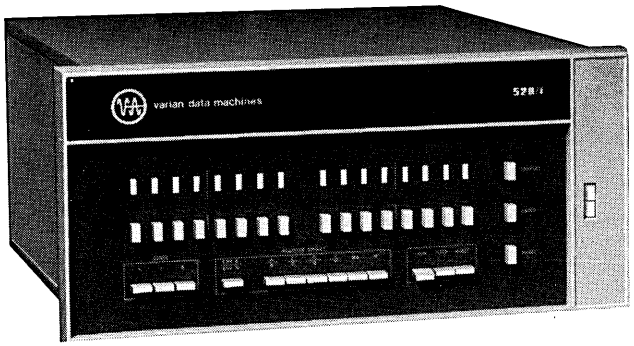
. . . also in this issue: a survey of minicomputers

The new Varian Data dual-environment 520/i.



Tag this one to upset the present balance of power and price.

We've hung some other powerful attractions on this system-oriented computer besides that price tag. Two complete sets of hardware registers, including index registers.



They allow the 520/i to run dual programs. A single 1.5 μs instruction transfers control between programs, or between processing and I/O programs. Data may be manipulated in multiple 8-bit bytes—it'll do arithmetic in 8, 16, 24 or 32-bit lengths within the same program. Program precision is changeable any time.

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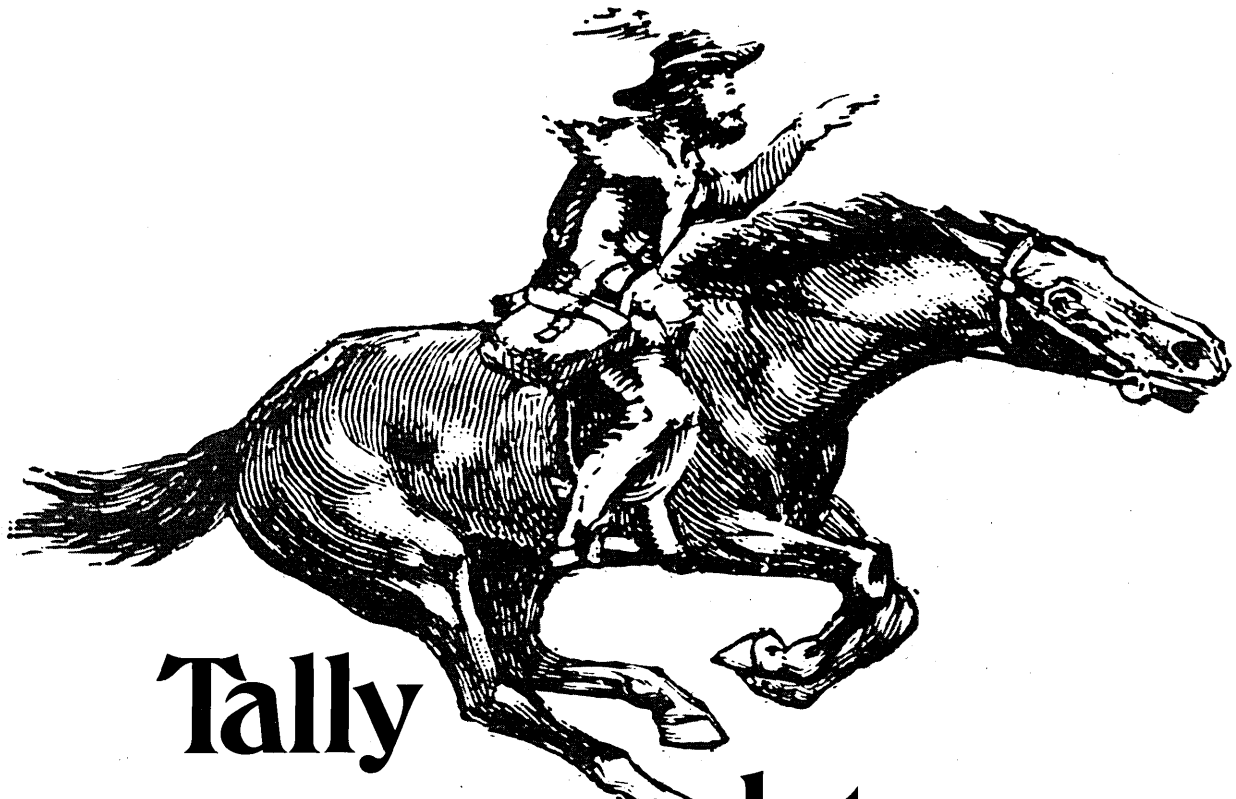
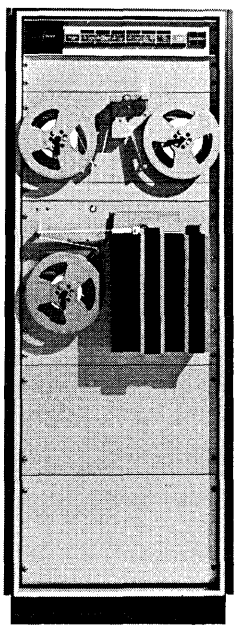
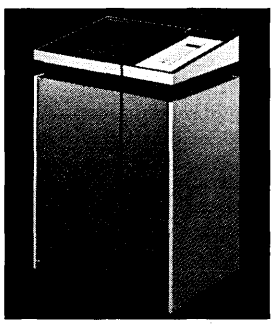
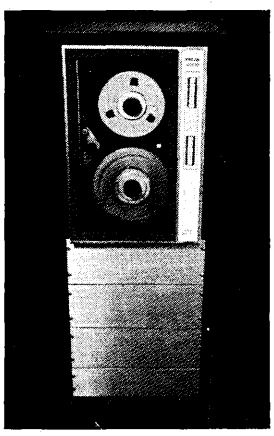
CIRCLE 1 ON READER CARD



Tally moves more data faaaaster for less.







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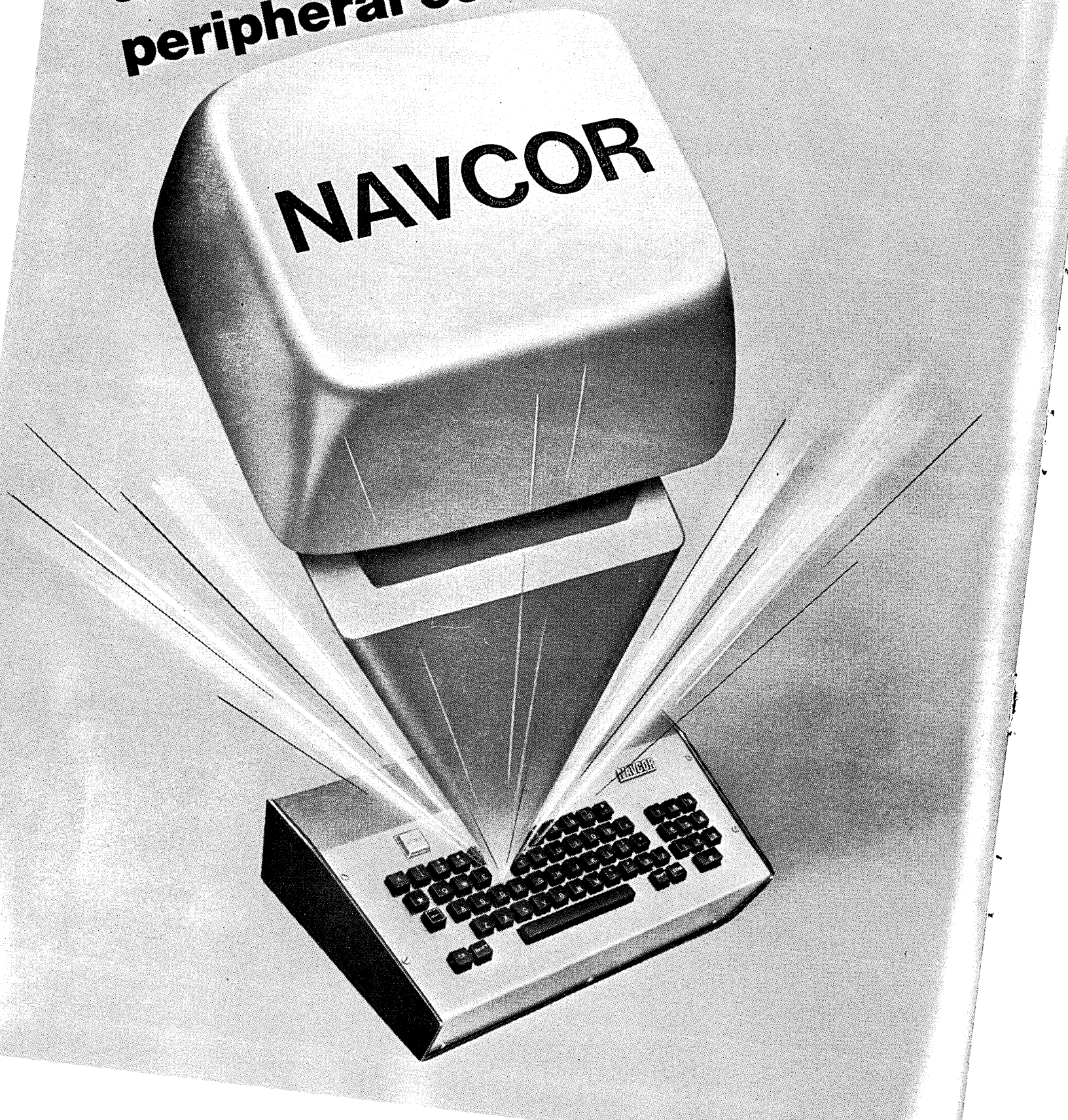

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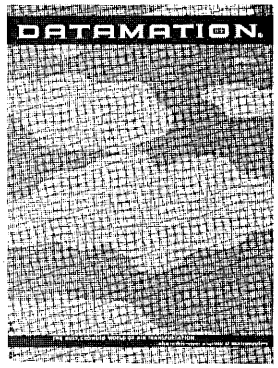

march
1969

volume 15 number 3

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GOOD NEWS!

Badger adds new capabilities to PDP-10 system

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The PDP-10 computer system, time-tested and economical, can now do more jobs than ever before. To the basic system, Badger has added remote batch capability and business-oriented software. COBOL. Sort/merge. And RPG.

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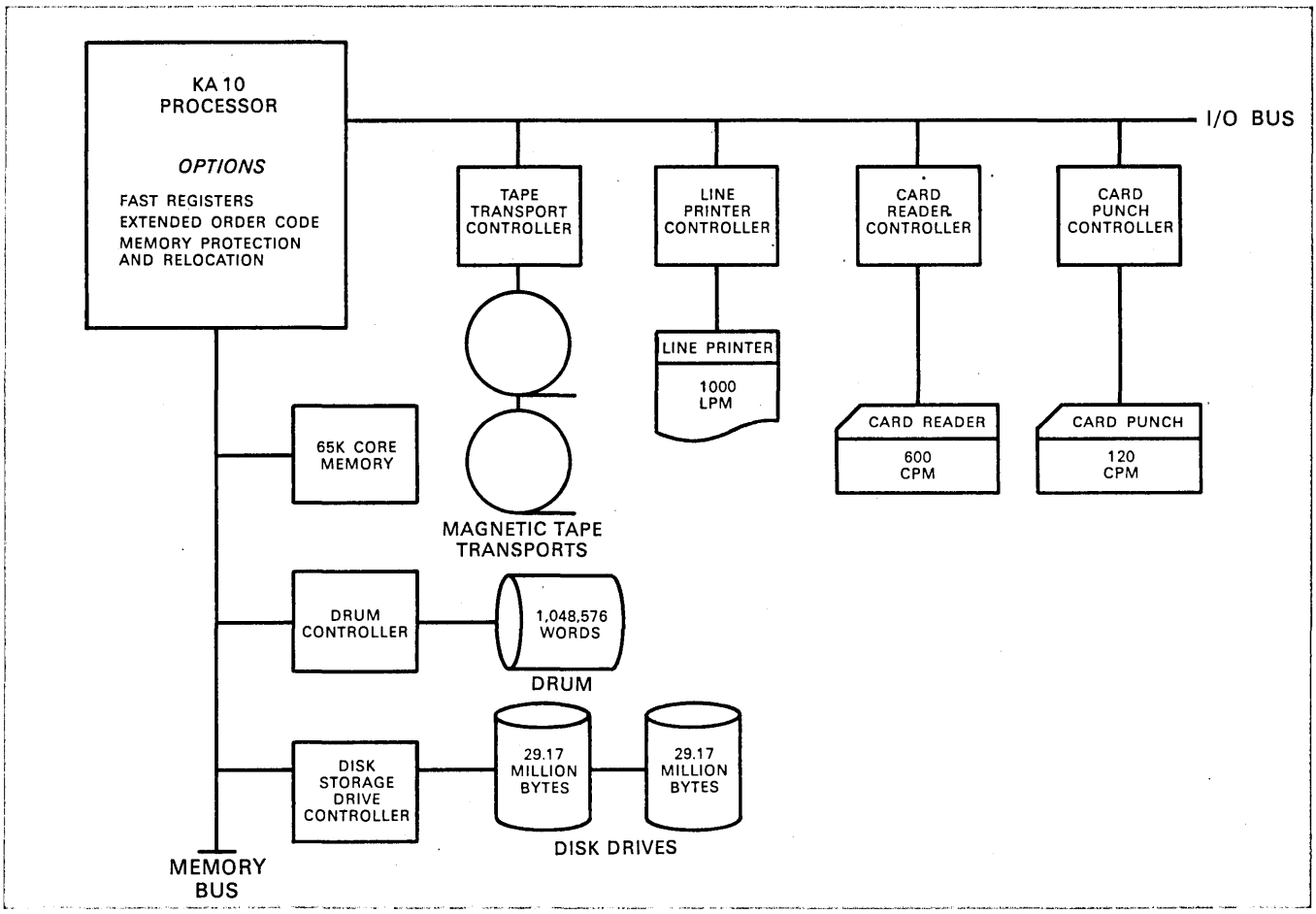
S-4-69



CIRCLE 7 ON READER CARD

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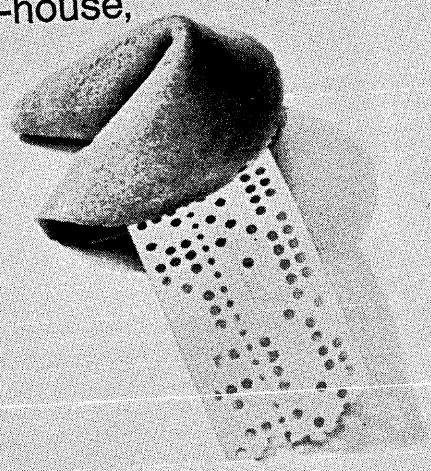

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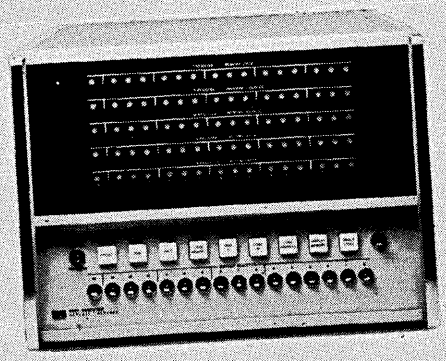

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DATAMATION 69®

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calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
Mar. 24-27	Int'l Convention and Exhibition	New York City	IEEE, 345 E. 47th St., New York, N.Y. 10017
Apr. 8	Symposium: Techniques for Evaluating Data Processing Systems	Philadelphia	ACM, DPMA/ Saul Stimler, RCA-ISD, Bldg. 204-2, Cherry Hill, N.J. 08101
Apr. 8-10	Int'l Symposium on Computer Processing in Communications	New York City	Polytechnic Inst. of Brooklyn, 333 Jay St., Brooklyn, N.Y. 11201
Apr. 28-30	Conference on Statistical Computation	Madison	Univ. of Wisconsin Computing Center 1210 W. Dayton St., Madison, Wis. 53706
Apr. 30-May 2	Electronics Components Conference	Washington, D.C.	EIA, 2001 Eye St. N.W., Washington, D.C. 20006
May 5-8	Design Engineering Conference	New York City	ASME/Clapp & Poliak, 245 Park Ave., New York, N.Y. 10017
May 14-16	Spring Joint Computer Conference	Boston	AFIPS, 210 Summit Ave., Montvale, N.J. 07645
May 19-21	National Aerospace Electronics Conference	Dayton	NAECON, 124 E. Monument Ave., Dayton, Ohio 45402
June 10-12	Int'l Communications Conference	Boulder	IEEE/A. J. Estin, Radio Standards Engrg. Div., NBS, Boulder, Colo. 80302
June 16-19	Int'l DP Conference & Business Exposition	Montreal	DPMA, 505 Busse Hwy., Park Ridge, Ill. 60068
Aug. 19-22	Western Electronic Show and Convention	San Francisco	WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005
Aug. 26-28	National Conference & 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
Sept. 15-17	Joint Conf. on Programming Languages for Numerically Controlled Machine Tools	Rome, Italy	IFIP-IFAC/E. L. Harder, R&D Center, Westinghouse Electric Corp., Beulah Rd., Pittsburgh, Pa. 15235
Oct. 6-10	2nd Int'l Congress on Project Planning by Network Analysis	Amsterdam, Neth.	INTERNET Foundation/ Holland Organizing Centre, 16 Lange Voorhout, The Hague, Netherlands

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PDP-10
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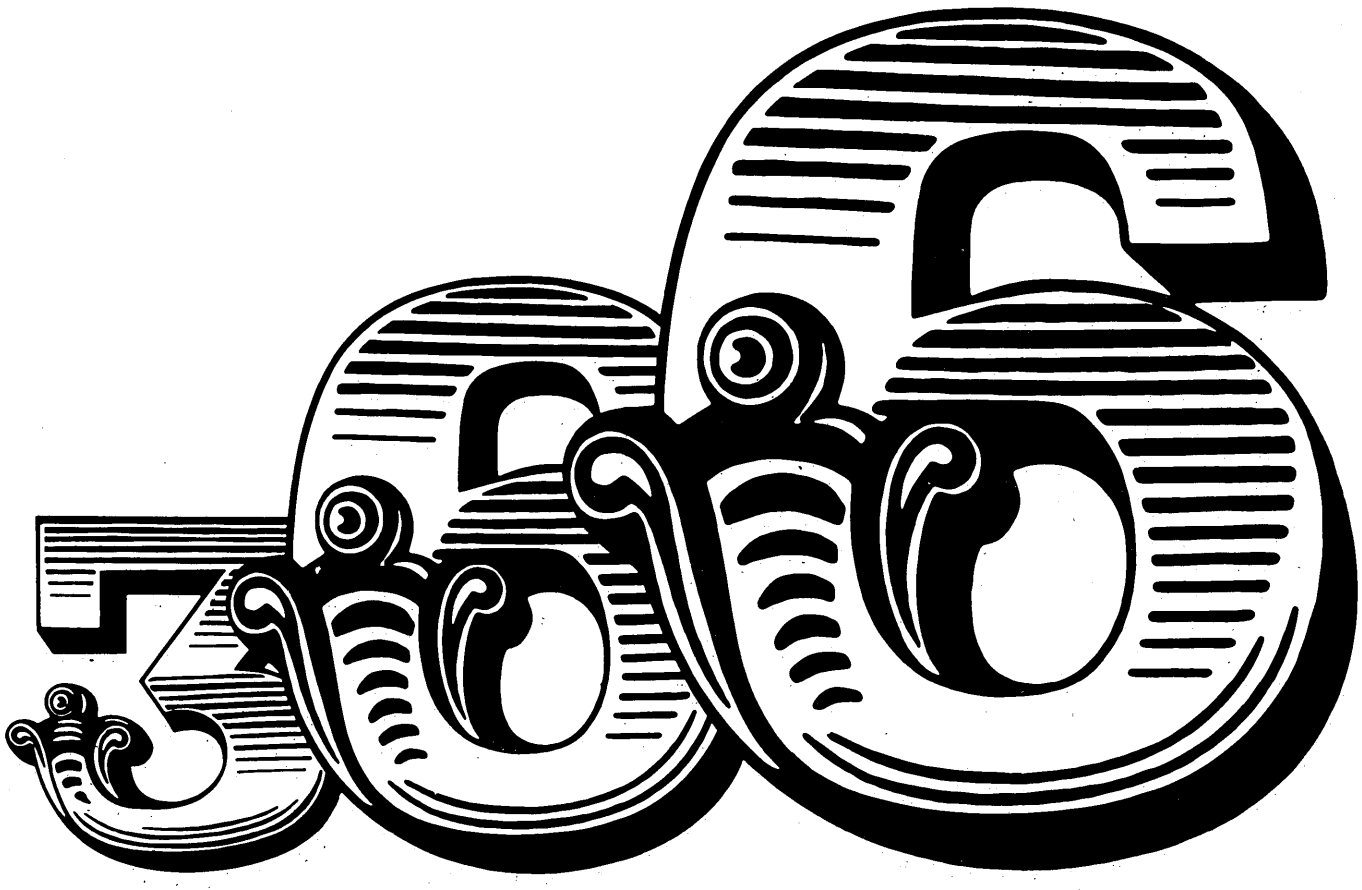
Maynard, Massachusetts



letters

me first

Sir:

Mr. J. O. Duhamel's (Dec. Letters, p. 205) explanation that Spear & Staff, Inc., was not the first to analyze security data from the New York Stock Exchange on-line in real time misses a basic point.

Spear & Staff's on-line, real-time system (Oct. p. 116) is designed for stock *analysis*, not merely as a security monitor system as in the Jesup & Lamont example cited by Mr. Duhamel. It was the fact that an on-line, real-time *analysis* was being achieved before the next trade that Spear & Staff felt they had achieved a first. At this writing, no one else, to our knowledge, has an analysis system functioning in real time.

ROBERT A. SYKES
Spear & Staff, Inc.
Babson Park, Massachusetts

unreal people

Sir:

I would like to congratulate Mr. George Glaser for that excellent article "Computers in the World of Real People" in your December 1968 issue.

This article should be required reading for all edp personnel, but particularly the academic edp community. Unfortunately, there are far too many purely theoretical courses taught under the guise of computer or information science that assume the existence of the "unreal people" that Mr. Glaser describes.

Let's have more articles like this one that "tell it like it really is."

ERWIN M. DANZIGER
Chapel Hill, North Carolina

basically honest people

Sir:

Mr. Nathan Partos' letter (Feb., '69), regarding my article "TACT Will Improve Your Input Data" (Dec. '68) is appreciated. His analysis of TACT reflects expertise.

There has been no evidence of employee resentment to being rated by a machine. As he has already presumed, however, this rating must be impartial and accurate. In fact, my observation has been that many employees prefer leaving their chances for advancement to an unbiased computer, rather than a prejudiced human. The key, of course, is accuracy in rating.

Employment of TACT has been a stimulus to improved morale. He mentioned that personnel might "become very upset if their chances for advancement or possibly their jobs were jeopardized by a grade from a computer." The computer is only a tool for decision making, and such a decision as personnel management would come under the close scrutiny of managers. The computer can be used to pinpoint the areas contributing to the errors but the managers must analyze the reasons and determine the action.

In my relationship with the individuals that create the input data, I have found them to be fair. My philosophy of life—that people are basically honest—has been vindicated by TACT. Admittedly, we have experienced personnel who attempt to place the blame on the program, the computer and/or the system. Each allegation must be researched and explained to the satisfaction of the "alleged offended." I have not had any employee blaming isolated bugs for his poor performance. This is due primarily to the fact that our personnel who initiate the input are somewhat awed by the capability of the computer and hesitate to challenge its accuracy. Also, insofar as unions are concerned, union officials are reluctant to instigate a complaint unless, in their opinion, the evidence is in favor of the employee (which, in our experience, has not been the case).

We have never discovered "an unscrupulous employee resubmitting old data." We have controls to check duplicate data on our systems; however, each system must have special controls designed for its input. For example, in a payroll system, one would not accept duplicate time cards, or time cards in excess of the authorized work hours (usually eight), without printing the data out for management review. In order to be specific on this, I would have to review each system and the input for it to determine how to avoid resubmission of old data. It is possible and it does work.

CORMACK P. HEARN
Midwest City, Oklahoma

you can't pl/I everybody

Sir:

In his article, "PL/I for C & C?", in the December issue, Mr. Christopher Shaw says, "There are presently only two practical alternatives to PL/I for command and control programming: assembly language and JOVIAL." However, the CS-I language (which he mentions in the article) is very well suited to C & C programming. CS-I has outstanding capabilities in all the areas he marks as important: text processing, bit processing, arbitrary data origins, etc. In addition, there are CS-I compilers which generate code with efficiency comparable to that produced by most assembly language programmers.

The language's simple, English-like source format, powerful features, and tight target code have made it many friends.

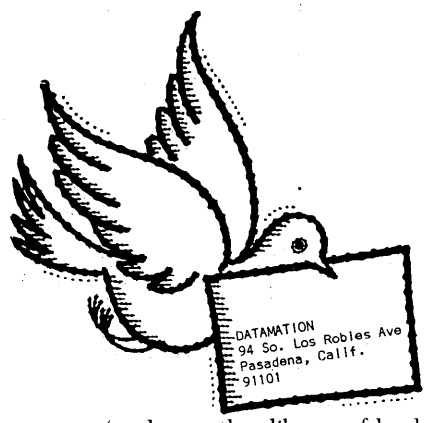
Name withheld by request.

Mr. Shaw replies: Let's face it. In this world, a programming language needs more than anonymous friends; it needs influential advocates. Whatever its technical merits, CS-1 seems to be just one more unsung language.

Sir:

In the News Briefs section (p. 136) of your December issue, there was an article about the "long-awaited" PL/I version of Scientific Subroutine Package for system/360, where you stated that SSP/360 is available only in FORTRAN at the moment. This may be true if we only consider the language in which the routines are programmed.

However, if, under OS, the SSP/360 is arranged as a library of load modules, this library may be regarded as an extension of both PLILIB and



FORTLIB (and any other library of load modules) by a simple concatenation. Passing arguments from a PL/I program to a FORTRAN subroutine is very simple. At our installation, the SSP/360 is used by both PL/I users and FORTRAN users, and if no new routines are available in the PL/I version of SSP/360, this version represents in fact no extension of our user spectra.

SVERRE STORØY
Univ. of Bergen
Bergen, Norway

Sir:

Your series of articles in December on PL/I was quite informative. Of particular interest was Mr. Richard L. Gauthier's article "PL/I Compile Time Facilities." Reference to compile time facilities as " . . . relatively new con-

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letters

cepts . . . " is perhaps a little misleading, however; those familiar with the Univac II GPX "compiler" (by today's standards an assembler with a highly sophisticated library facility) will recognize the compile time facility as a somewhat rudimentary approach to the generative capabilities inherent in GPX "set parts" and "interpolators." The GPX system is about ten years old.

Perhaps each generation of compiler writers is condemned to rediscover the wheel. For those language implementors who wish to build on past achievements, an intensive study of volume 2 of the GPX manual is highly recommended.

PAUL L. LUJANAC
Camp Hill, Pennsylvania

computer sex

Sir:

Mr. McKune's witty article (Jan. '69) on the gender of computers contained an inaccuracy which should be corrected. In the banking industry at least, feminine names have been and are applied to computers.

One example of this is the Electronic Recording Machine Accounting system developed about 15 years ago by the Bank of America, NT&SA with the aid of Stanford University and others. This large scale system was called Erma—a decidedly feminine acronym. At about the same time, the Chase National Bank (now merged with the Bank of the Manhattan Company to form The Chase Manhattan Bank, N.A.) commissioned the design and construction of a special purpose computer to be called "Diana" (goddess of the Chase).

Several banks have installed audio response systems in recent years which invariably have feminine voices in their vocabulary and are consequently given feminine names by their users. This may tell you more about bankers than it does about computers.

I want to wish Mr. McKune much luck in his drive for sexual clarification. Maybe we could make a rule: If in doubt, call it Tiny Tim.

EDISON L. SPECK
Chase Manhattan Bank
New York, New York

paternity

Sir:

I just finished reading the interpretation of the United States Court of Customs and Patent Appeal's decision *In re Prater and Wei* November 20, 1968 by one of your editors, which appears on page 78 of your January issue. Upon completing the first paragraph of this interpretation, I was at first amazed and then somewhat frustrated. To quote this paragraph: "The ban on computer program patents was loosened and possibly broken last November when a federal appeals court ruled that 'mental processes' may be patentable." While the holding in the *Prater* case does break the ban on computer program patents, the case does not, in any way, indicate that "mental processes" are patentable.

It is common knowledge that a raging controversy exists with regard to the patentability of computer programs. The basis of much of this controversy is confusion as to the nature of stored programs and what rights one acquires if he is allowed a patent for a program. Since your periodical is so widely read by those connected with the field of data processing, it can be of great service in eliminating the confusion. However, it is imperative that statements made by your editors which relate to the controversy be factually correct. If they are not correct, they merely increase existing confusion and mislead many individuals who will ultimately be affected by the resolution of the controversy. For this reason, it seemed necessary to write this rather lengthy letter pointing out that your analysis of the *Prater* case is not altogether accurate.

As a patent attorney who is actively engaged in attempting to obtain patent protection for computer programs, I was very pleased with the *Prater* decision and I have read it numerous times. Additionally, I have discussed the decision with a number of my colleagues who are also active in attempting to patent computer programs. I must say that both my views and my colleagues' views of the holding in *Prater* differ substantially from those put forth by your editor.

Even though it is apparent that the late Judge Smith took great pains to make the rationale and holding clear in the *Prater* decision, your interpretation indicates there are still individuals who, for one reason or another, fail to understand the decision. This misunderstanding may be due, at least in part, to both an unfamiliarity with legal writing and the patent law.

If one reads the *Prater* decision carefully, it is abundantly clear that the patentability of "mental processes" was not an issue in the case. The key issue in *Prater* was as follows: Are processes carried out completely on machines, to the exclusion of human intervention, mental processes?

In answering this question in the negative, the Court merely states that a sequence of operations carried out exclusively on a machine are, in that context, not mental. More simply, the Court's holding is, essentially, that a process cannot be mental unless some human activity is required in its performance. This is quite different from saying that mental processes are patentable. In fact, the Court implicitly recognizes the existence of a class of unpatentable mental processes and holds that performance of the *Prater* method or a machine does not fall within this class.

The *Prater* case makes no new law in the area of mental processes. It merely restates and clarifies existing law in the area. Prior to *Prater*, the mental process cases had always involved methods which were performed, at least in part, by human beings. The Court merely distinguishes the *Prater* method from these cases on the basis that no human being is required to carry out *Prater's* method. Since the claims in *Prater* were allowed on the basis of their claiming a process carried out physically on a machine, these claims cannot be used to enjoin a human being from mentally performing the method by means of pencil and paper. In the patent law, a method claim covers performance of the method on all apparatus that is equivalent to the apparatus disclosed by the inventor in his application. However, the human mind is not considered the equivalent of apparatus. Consequently, the allowed claims in *Prater* cannot be used as a basis for monopolizing the manual performance of his method by an individual.

Had the Court held as your editor indicates, the foregoing limitation would not exist and the question becomes much more difficult. In other words, if the Court had held that mental processes were patentable, the Court would obviously have had to consider whether such a holding would be in violation of the First Amendment to the Constitution of the United States as abridging freedom of thought. Surely, no Federal Appellate Court would resolve a question so obviously involving constitutional issues without ever addressing itself to these issues.

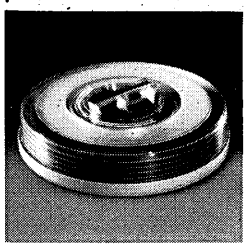
NORMAN MCCLASKEY
Plainfield, New Jersey

stalking the giant

Sir:

On behalf of my own company, and if I may boldly present myself as a spokesman for a few other terminal manufacturers (NCR, Burroughs, Olivetti), I feel I must chide you for your News Brief "IBM Meets Banking

(Continued on p. 187)



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CIRCLE 13 ON READER CARD

look ahead

IBM DENIES GENERATION GAP; COMPATIBILITY NOT GOING TO POT

The report by a computer weekly that IBM's fourth generation systems may be so incompatible with 360's as to require total reprogramming (yaaagh), is an "out of context" interpretation of comments made by vp George Bietzel, says an IBM spokesman.

In an internal IBM publication in December, Bietzel said the following: "When we announced System 360, we asked the data processing community to 'reset to zero.' We did this because of the proliferation of languages, machine architecture, and input/output devices. Incompatibility and proliferation meant customers were paying a premium price to go much further in computing. That was our judgment. It has been more than vindicated by System 360's reception in the marketplace.

"Where do we go from here? We have a great debt to ourselves and to our customers to maintain some consistency between where they are today and where they are going to be in the future. But I don't think we will do this at any price. If something comes along we think is a substantially better way to get price/performance into the market, we would not hesitate to change."

Those last two sentences opened Bietzel to interpretation "at will." But IBM claims they were not intended to imply total reprogramming—"reset to zero"—but rather were meant to assure IBM developers that stiff compatibility requirements would not stifle all advances either.

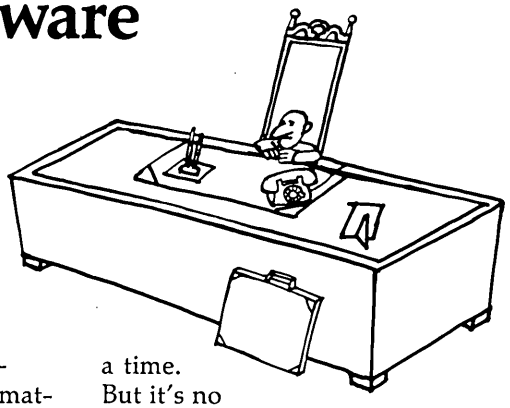
The real impetus for 4th generation compatibility lies in what one source estimates is a $500 million-$1 billion IBM investment in 360 software. Further fortification comes in the report that IBM's unannounced supercomputer work at San Jose originally produced 360-incompatible design, scrapped last summer in favor of a compatible model. The leaders of the project were also changed, and Gene Amdahl, a father of the 360, is now at the helm.

BROOKS WANTS FACTS OF LIFE FROM DEAR OLD DOD

Congressman Jack Brooks has asked DOD to answer several questions regarding the management and design of the Wimmicks buy. Assuming the answers aren't fully responsive, which is probable, award of a Wimmicks contract could be delayed significantly.

Last month, in a letter to Defense Secretary Melvin Laird, Brooks asked: what Pentagon office has responsibility for overall coordination of the Wimmicks procurement; what studies have been made to support "the immediate need for acquisition of new hardware"; why hardware is apparently being selected and acquired before completion of the system design; what evidence supports the expectation that the Wimmicks buy will produce a system "significantly better in capability or versatility" than the present one, and whether the system won't be at least partly obsolete by the time it is fully installed.

Instant software company anyone?



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

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

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

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

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

But it's no longer the same ball game.

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

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

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

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

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

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CIRCLE 15 ON READER CARD

Brooks implied strongly that hardware procurement should be put off until DOD has: a) decided what data management system it needs, and b) found a way of exploiting technological breakthroughs that occur while new Wimmicks hardware is being installed (this will take five years, under present plans).

One Hill source says the letter notifies DOD that "Brooks has doubts about the adequacy of Wimmicks planning, is watching developments closely, and expects DOD to resolve the doubts before making any final commitments, or face the consequences." What consequences? Hearings before the Brooks subcommittee are one possibility, a Phase II-type GAO investigation is another.

FRANCHISING SPREADS TO EDP RECRUITMENT HOUSES

A former software firm executive with extensive personnel agency experience hopes to combine that unusual combination with the hottest marketing gimmick—franchising—to establish a nationwide chain of franchised edp recruitment houses.

He's Dave Greenberg, who left Time Share Services after it was acquired by Coburn's Computer Methods. Seeking experienced computer salesmen, he'll provide three-month training (with a draw), then set them up in business, paying all expenses, including selling and national advertising. Free training is also provided placement counselors hired by the franchise. There's no entrance fee, and Greenberg's company—Federated Agencies of America, in L.A.—gets 50% of the gross. If the guy doesn't gross $30K a year, he loses the franchise.

Greenberg has already signed up six franchises—in NYC, LA, and Boston—and expects to be the IBM of edp personnel placement within 12 months.

NEW OMNITEC GEAR MAY BROADEN T-S HORIZONS

We hear that Omnitec Corp., manufacturer of acoustical couplers and conversational terminals, will demonstrate eight new products at the SJCC in May. The rumble is that the line will be extended to offer standard and portable terminal links to IBM-compatible and ¼-inch tape cassettes...and to couplers as well. A cassette-portable terminal hookup could open up a host of applications built around remote data capturing on cassettes, which could be read over phone lines or delivered to computer centers. Add a coupler and you have on-line, real-time data acquisition.

Refusing to comment on the rumors, Omnitec admits it has a healthy percentage of the acoustical coupler market and a big backlog of conversational terminals ...plus a $1 million order for portable terminals from Realtronics of Denver (not to be confused with the Struthers Wells subsidiary), which will install them for the Cleveland Board of Realtors, for on-line acquisition of multiple listings.

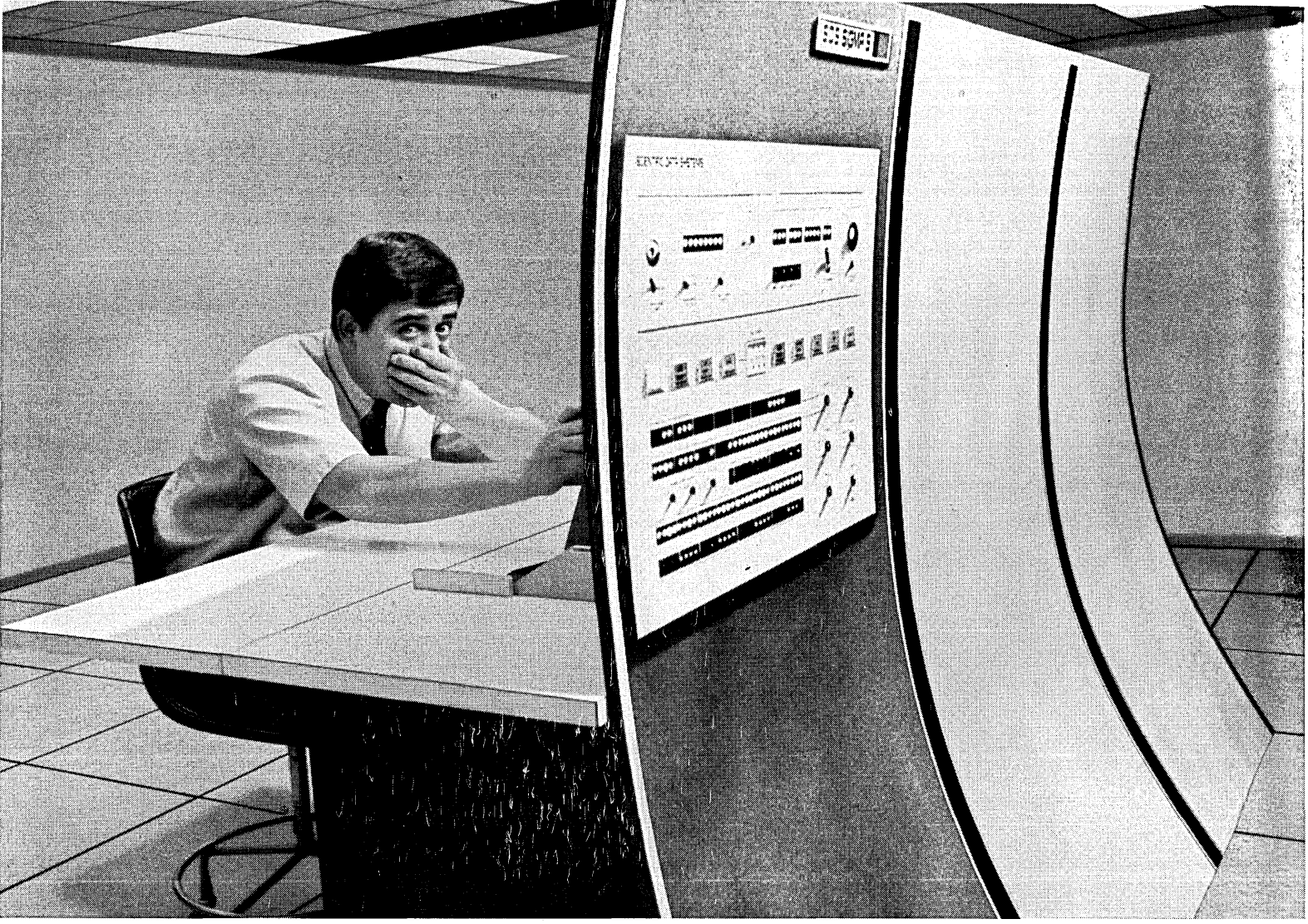
GAO REPORT SPANKS DOD AND GSA ON THEIR PERIPHERALS

A GAO report aimed at changing federal dpe procurement practices is nearly ready to be issued. It will probably generate considerable interest in Congress.

The report offers specific recommendations for increasing federal use of independently made peripheral devices. It chastizes DOD and GSA, at least by implication, for not thinking of similar ideas on their own.

GSA should be regularly telling federal dpe users what independently made peripherals are plug-plug compatible with what cpus, says the GAO report; the agencies could then take advantage of the independents'

(Continued on page 215)



If you can't afford an extra Sigma, fake it.

Get remote batch.

Most companies that need an extra Sigma, but can't afford it, get a Volkswagen.

The VW picks up stacks of punched cards at outstations, runs them back to your computer, then back to the boondocks. It's a big waste of time. A programmer away from headquarters gets only a few passes through your computer each day.

Our remote batch lets the boondocks transmit directly to your computer. Programs get queued immediately, instead of being held up by traffic jams.

The system is unique in the industry: it doesn't cost an arm or a leg. You can have the 7670 card reader/punch/line printer for $810 a month on a four year lease. Communications equipment for your center runs $196 per terminal each month, for the same length of time. But we'll toss in the program for free. Or if your comptroller prefers, buy the system.

The only other item needed to give small stations large computing ability is a telephone line for each station. You'll be able to transmit data as fast as a voice grade line will permit.

It's slightly slower than being there. But an awful lot faster than a Volkswagen.

SDS

Scientific Data Systems, El Segundo, California

CIRCLE 16 ON READER CARD

editor's read*ut

FURLING THE UMBRELLA

For almost 20 years now the information processing industry has writhed and thrived under the umbrella of IBM, a huge and magnificently managed company which undoubtedly represents the greatest success story in the history of free enterprise.

And while that umbrella has shielded from the cold rain of financial disaster most of the companies in the industry, it has also to a large extent blocked off the healthy sunny rays of prosperity.

In effect IBM has more or less dictated the pace of progress: it has established the essentially financial nature of the business through its purchase:rental ratios; it has drawn the "free" services line competitors have found difficult to toe. With at least 75% of the market, IBM has pretty much shaped the announcement cycle, created *de facto* standards for packing densities, collating sequences, programming languages . . . to name only three.

That's the way it has been. Now, within one brief five-week period, we have seen three antitrust suits filed against Number One by Control Data, Data Processing Financial and General and the Justice Department. Each, in essence, seeks to break up the Yankees.

It would be presumptuous of us to discuss the validity of these cases, to set ourselves up as the judge and/or jury in cases which will be pursued, defended and judged by people with far more information and sagacity than we command.

But we hope that the people involved understand the gravity of their individual and organizational responsibilities to the industry. And we'd like to humbly suggest that it is not simply a question of breaking up a monopoly, but of restructuring an industry which has known only the structure of IBM dominance.

In other words, we hope that the final decisions will be based not only upon sound legal and economic principles, but upon the nature of an essentially immature industry. Hasty decisions based on narrow, short-range economics or upon revenge could create chaos. DATAMATION's Angie Pantages suggests in her News Scene story on the Justice suit (p. 99), that the industry may be ready to don its first pair of long pants. We hope so. At stake is a huge industry vital to the nation's progress.

The question of how to restructure the industry is the single most important issue the industry will ever face. For this reason, we urge those of you with information, ideas, a typewriter, and a command of the language to submit to this magazine's *Forum* brief articles discussing this vital topic.

We hope in this way to make available to the industry and the powers who will decide the fate of the industry ideas which might not otherwise be available. As the old motto goes, "Think." Then write.

You owe it to your industry, your nation and yourself.

—R.B.F.

bigger and bigger

AIRLINE CHALLENGES FOR THE FUTURE

by STUART G. TIPTON

In the past 10 years, a whole new era of transportation has evolved—the jet era. During that time the airline industry has experienced extraordinary growth. Passenger traffic has tripled, freight traffic is up five times and mail volume is six times as great as it was a decade ago.

Last year, the airlines carried more than 150 million passengers and about 4.2 billion ton-miles of cargo, while accounting for some $8 billion in operating revenues. In terms of revenues, the airline industry is now larger than all domestic regulated transport carriers combined just prior to World War II, including railroads, trucks, oil pipe lines, water carriers, freight forwarders, REA express and bus companies.

The nation's economy is expected to continue to expand at a rapid pace. The gross national product will reach well over 1 trillion annually by 1975 compared to some $860 billion today. The population of the United States, about 200 million today, will increase to 225 million by 1975. Disposable income will jump from $585 billion to over $800 billion by 1975 and consumer expenditures will be in excess of $700 billion compared to $530 billion today.

All this means an increasing volume of airline traffic. While the number of airline passengers has more than tripled in the past 10 years, it is expected to double again by 1975 and triple by 1980. The airline industry now accounts for about 70% of U.S. intercity common carrier travel. By 1975 it is predicted that the proportion will be more than 90%.

What are the airlines doing to meet the challenges implicit in this growth outlook—to prepare themselves for the second decade of the civil jet age?

the new fleet

First and foremost, they are investing in a new generation of large capacity aircraft. For the years 1968 through 1972 and beyond, they have committed in the neighborhood of $8 billion for 1058 subsonic planes. In addition, they have reserved delivery positions for just under 100 supersonic aircraft—the British/French Concorde and the U.S. SST, the Boeing 2707. These new aircraft will require an investment of another $3 billion.

By late 1969 or early 1970, the first of the so-called jumbo jets, the Boeing 747, will be operating and will be capable of transporting up to 490 passengers or 100 tons of cargo. A few years later the 1400-mile-an-hour Concorde is scheduled to begin operation. The same period will see entering service the Douglas DC-10 and the Lockheed L-1011, capable of carrying 250 to 300 passengers on short and medium runs and designed to penetrate the mass market. Then, in the mid-seventies, the U.S. SST, is expected to be operative, with passenger capacity of some 300 and flying about 1850 mph.

on the ground

The airlines' investment program to meet the demands of the traveling and shipping public does not stop with the aircraft. The airlines must match their improvements in the air with improvements on the ground.

It is common knowledge that the inadequacy of the nation's airports could become a major constraint to the continued growth of air transportation. The current airways/airport congestion problem points up the need to expand the nation's airport system at an accelerated rate. Figures from the federal government indicate that the expansion program between now and 1975 will cost some $6 billion.

A recent survey of 18 major airlines indicated that they will spend $1.5 billion in airport improvements throughout the United States during the period 1968-1971 and another billion dollars from 1972 through 1975, most of which will

Mr. Tipton joined the Air Transport Association in 1944 as general counsel and was elected president in 1955. He was previously assistant general counsel for the Civil Aeronautics Board. He has a BS from Wabash College and a law degree from Northwestern Univ.

go for passenger and cargo terminals and maintenance and overhaul facilities.

While this investment by the airlines will represent a considerable part of the funding required, additional sources must be found. To help provide these funds, the airlines have proposed an Airport Development Trust Fund, similar to the present Highway Trust Fund and based on the same idea that those who use a transportation system help pay for it.

The trust fund would be maintained from the proceeds of a 2% tax on airline passengers within the United States and from a $2 fee on those departing to a foreign point. The funds raised in this way would be used to help amortize local airport bond obligations through payment of annual debt service. It is estimated that this procedure would permit issuance of over $3 billion by the end of the fifth year of the program. Both large and small airports would be eligible for financial assistance under the plan. The smaller airports serve a vital purpose in relieving the major airports of general aviation traffic.

equipment/airport compatibility

Realistic airport planning is directly related to the type of aircraft that will be using it. In this regard, a special airline working group has undertaken the development and publication of a series of documents entitled "Recommended Standard Format of Aircraft Characteristics for Airport Planning." These airport planning documents will include the operational characteristics of each commercial aircraft flown by the airline industry. The data assembled will establish the airport compatibility requirements for each aircraft under review and will provide necessary guidelines for airport planning purposes. The documents will be updated as revisions, new model series and technical advances are developed for aircraft.

Documents on the 747, L-1011, Concorde, and the L-500 have already been completed and distributed to airport management and the Federal Aviation Administration. The L-500, which is being designed to carry a 300,000-pound payload, will be far and away the highest-capacity cargo aircraft in existence when it goes into commercial production in the early 1970's. Similar documents are in process for the DC-10, as well as for all turbojet aircraft presently in airline service.

air traffic control

Just as important as an airport development program is an improved and updated airways system to overcome the air traffic control inadequacies which were the root cause of the congestion crisis during the summer of 1968. The national air traffic control system is the responsibility of the federal government—specifically the FAA.

To enable the airways system to keep pace with the sophistication of airline equipment, for some time the airlines have supported efforts to modernize the airways and have publicly urged the FAA to do more and to do it faster. The airlines themselves continue to offer positive programs to accomplish the necessary modernization. Again last July, the industry went to FAA and the Congress to reemphasize the need for improvement and expansion of air traffic control facilities, including an increase in the number and an improvement in the pay and working conditions of air traffic controllers. To help accomplish this, the airlines have urged that FAA's budget be increased by $150 million a year and sustained at that level for four or five years. The airlines, of course, expect to pay their fair share of the cost of the system. Through a 5% ticket tax recognized by Congress as a user charge, airline traffic generates $250 million annually for the government—just about equal to the 45% of the airways' cost the FAA says is the airlines' share.

As the new generation of expanded-capacity subsonic jets enters airline service—to be followed in the mid-1970's by supersonic aircraft—the airlines must be prepared to handle the greatly increased volume of passengers and baggage these aircraft will generate.

The first steps have been taken to develop a push-button ticketing system that would vastly reduce passenger congestion at ticket counters. To help reduce terminal congestion and speed the flow of baggage, an automatic baggage-handling system is now under development. Recent tests have proved that airports closed by warm fog could be opened to airline operations by seeding chemicals into the fogged areas. Significant progress is being made towards developing an airborne collision avoidance system (CAS). The use of a communications satellite to transmit data on passengers and cargo from one country to government inspectors of another to facilitate customs clearance has been tried experimentally and proved feasible.

A major technological breakthrough of the next 10 years could be development of an airborne maintenance computer that would give advance notice of needed repairs or replacement of aircraft components. This would benefit not only the carrier but the passenger by reducing delays or cancellation of flights because of mechanical problems.

Probably one of the most exciting potential developments on the horizon is the application of computer technology to an entire airline complex. Often referred to as "Data-Link," such a system would make available at one place all information relating to the operations of an airline. For example, the system would be able to pinpoint the location of every plane in an airline's fleet—report on its status and all the factors that affect its utilization.

The implications for management decision-making are tremendous. With this and other information all in a single management information system, an airline president could get up from his desk, walk a few feet and, as an airline electronics expert puts it, "know precisely how everything is ticking."

government support

The airlines are greatly encouraged that their concern for the problems facing the nation's air transport system will be shared by the new administration. President Nixon recently stated: "In the next several years, many of our cities will require additional airports. Several thousand airports are in need of runway lengthening, parallel air carrier runways, a parallel light aircraft runway, a heliport, or a STOL runway, in order that all aviation interests may be accomplished without rationing.

"The Republican platform recognizes that new and additional equipment, modern facilities including the use of computers, and additional personnel must be provided without further delay. It advances the trust fund concept, so successful in promoting our magnificent national highway system in the Eisenhower administration."

Finally, he said, "Free enterprise has given to our citizens the best commercial and military aircraft in the world, and the world's best air carrier transportation system. Our nation's air commerce must not be permitted to stagnate through government neglect and inattention. I pledge my full support to those measures necessary to permit our nation's air commerce to flourish and prosper."

Implicit in these words is recognition of the government's responsibility to keep pace with the multimillion-dollar investment the airlines are making in new equipment and related facilities.

They mean that by helping to provide the necessary airport and air traffic control facilities so vital to the nation's transportation system our government intends that the spectacular achievement made by the air transport industry during the first decade of the jet age will be continued in the second. ■

THE OUTLOOK FOR IMPROVED PASSENGER SYSTEMS

by GEORGE A. BUCHANAN

The U.S. air travel revolution which began with the introduction of jet service rounded out its tenth year on Oct. 26, 1968. During those 10 years of the jet age, the U.S. scheduled airlines invested $7 billion in new planes and ground equipment. Air passenger traffic tripled and cargo traffic increased fivefold.

Elsewhere in this issue, Stuart G. Tipton, president of the Air Transport Association, has described what the airlines are doing to be prepared for the extraordinary growth of air traffic anticipated during the next decade. He discusses in some detail how the airlines are investing heavily in new and improved aircraft and in airport and air traffic control facilities, in addition to urging the government to meet its responsibility to expand the national airways system in consonance with the continued growth of air transportation.

This growing demand for air travel is having its effect not only on the kind of flight equipment the airlines are buying and the kind of airport and air traffic control facilities that must be developed to accommodate this equipment, but on the airline passenger-handling techniques as well. Reservations must be made, tickets must be issued and baggage must be controlled in ever-growing numbers and with jet-age speed and precision.

computerized reservations systems

For some time the airline industry has recognized the potential of the computer as a formidable aid in processing the increasing numbers of passengers generated by the tremendous growth in the demand for airline services. The pressure of these demands became particularly marked following World War II.

At that time, the state of the art of automation prevented its application to many of the areas where the need for improvement in handling airline passengers was becoming increasingly evident. The first breakthrough came in the mid-1950's, when a number of major carriers began to apply the computerized techniques that were being developed to their reservations systems. Initially, these early "put and take" systems enabled the airlines to keep track of the number of seats sold and those remaining for sale. And while this was an important advance over the manual system, the accelerated rate of airline growth meant that more sophisticated systems would have to be developed to keep pace with passenger demands for airline service.

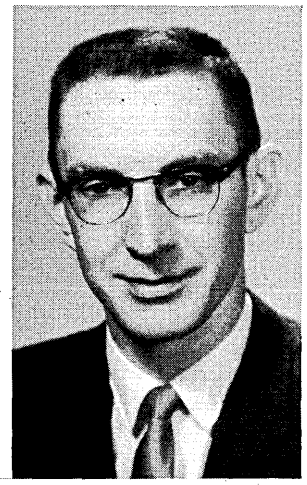
The airlines have been diligent in passing their requirements on to the manufacturers of computerized equipment. As the state of computer technology has progressed, more sophisticated reservation systems have come into being. Also, an increasing number of airlines have installed the systems—thus moving progressively towards the highly sophisticated nationwide network of computerized airline reservation systems we know today.

For example, today's highly developed systems have the capability of handling reservations inventories for a year in advance. In addition, they are capable of holding over a million passenger name records (PNR's) and can locate any one of them in a fraction of a second.

PNR storage and retrieval is becoming more and more a requirement for the airlines' computerized reservation systems. Another refinement which adds notably to airline reservations capability is the cathode ray tube input and output device. When used as an input device, the crt greatly facilitates error detection and correction in the input message before it is transmitted to the computer. On the output side, the crt speeds up the retrieval and display of information from the computer.

The versatility of airline computerized reservations sys-

hurry



Mr. Buchanan joined the Air Transport Association in 1962 as director of passenger services and was elected assistant vice president in 1967. He is responsible for those aspects of marketing, advertising, and customer service where the member airlines want to take joint action. He was previously with United Air Lines as assistant to the director of reservations.

tems makes it possible for any one airline to obtain almost instantaneously information as to seat availability on almost all other carriers. This is most important in view of the fact that about one-third of all airline passengers today use more than one airline to complete their flights.

At the present time, U.S. airlines—both large and small—have some $250 million invested in computerized reservations systems. This network enables airline reservation agents to handle with reasonable swiftness and efficiency the 300 million reservations which were made by the 150 million passengers who flew in 1968.

For some time, the airlines have had under study a program which would expand the use of computer technology in the reservations field to high volume users of air transportation. Their search took a significant step forward last April when the Air Traffic Conference of America (ATC), representing the scheduled airlines, decided to proceed with the implementation of a common automated reservations system which would provide travel agents and commercial accounts with immediate access to the seat availability of all participating airlines. From the number of systems studied, the ATC selected the system known as ATARS (Automated Travel Agents Reservations Systems) as being the most promising. Contractual arrangements are now being developed.

automated passenger processing

One way to visualize the airlines' evolving total automated passenger-processing system is to consider each step as a building block.

First, there are the reservations systems and the crt terminal devices, mentioned above, which, together, utilize computer files containing airline seat availability and PNR's. The system provides its users with reservations information and the capability to create, store or retrieve a reservations record.

Another block in the foundation—still in the development stage—is the common automated reservations system for travel agents and commercial accounts described above.

Succeeding steps in the development of a total automated passenger processing system—and for which the technology is feasible—are in the planning stage.

Member carriers of the Air Transport Association (ATA) and the International Air Transport Association (IATA) are now working on specifications for documents to be used with a computer-controlled system that would permit a single standard document to serve the air passenger from the time of initial issuance to destination. Such a system would provide for fare computation and ticket issuance by computer and automated methods of passenger check-in and boarding, aircraft loading control and baggage handling. As envisioned, they will perform the following functions:

1. Construct and display fares for all worldwide itineraries.
2. Confirm a passenger's reservation and issue the ticket by extracting information from the airline's central reservations computer in a remote location. The ticket number, rather than being preprinted as today, will be assigned by the computer and printed accordingly.
3. Provide quick, self-service ticketing for credit card holders with or without an advance telephone reservation. Within this concept, the passenger could insert his credit card into a ticketing device which checks the validity of the card, verifies or creates the reservations record, and issues the ticket.
4. Permit a passenger with an automated ticket to make a rapid exchange of a flight coupon for a machine-readable boarding pass at his first contact with the airport on day of flight.

In addition, other refinements will be possible. The system will have the capability to:

1. Reject used or invalid tickets and boarding passes.
2. Process instantaneously no-show information and keep track of standby passengers according to priority.
3. Direct passengers to an airline employee for assistance when necessary.
4. Provide continuous information to the airline on the number of passengers boarding an aircraft according to destination, class of service and by type of fare.
5. Provide automatically alternative routings for passengers in the event of flight cancellation, equipment change or other similar circumstances.

automated baggage handling

Baggage handling is also part of the totally automated passenger-processing concept. The sheer size of the activity requires that new methods of processing luggage be developed. Based on the industry's average of 1.3 bags per passenger, during 1968 the airlines loaded and offloaded almost 200 million pieces of baggage. By 1975, the number is expected to more than double.

To keep pace with these demands, the U.S. scheduled airlines are in the process of researching and developing an automated baggage transport system for use within the airport terminal complex. A prototype—the DOCUTEL system (formerly known as TELETRANS)—has been completed and is being tested. It uses shock-proof baggage carts which travel along tracks at 15-20 mph. The system incorporates a linear induction motor which propels the carts through an interaction between the vehicles and the tracks. While being developed initially as an interline baggage-handling system, it has the capability of further development for use by the passenger to move his baggage to and from the aircraft.

The DOCUTEL system continues as the most promising breakthrough in baggage handling to date. However, the automatic issuance of baggage tags and appropriate reading devices are still under development. Studies of other automated baggage-handling systems are also continuing.

In order to take the steps leading to the automated passenger processing system reviewed above, the airlines established five "project teams" about a year and a half ago. These teams, comprised of technical experts of U.S. and foreign flag carriers, are now working towards the development of technical standards and specifications for the various functions. While still in the planning stage, the potential system will be a major step in eliminating the growing problem of airport terminal congestion. The hardware for the proposed system can be built and it is hoped that the transformation from concept to reality will take place by the early 1970's.

A recent statement by an airline spokesman summarizes where the industry stands today:

"Today our industry is not very far from the threshold of automation in the areas of fare construction and ticket issuance—early 1970's is a reasonable target. Not too far behind will follow automation of credit card sales, check-in and boarding procedures. Through such automated capabilities, airlines will in the 1970's increase and improve employees' productivity in the handling of the forecast traffic growth, enhance passenger services through provision of accurate and more uniform information as well as procedures and, most importantly, speed up the passenger's movement through airport terminal facilities."

The same spokesman warns what could happen if the anticipated progress were not made:

"Projecting the number of employees that would be required by major airlines to keep pace with anticipated growth if they continued to accomplish manually the functions of reservations, ticketing and revenue accounting alone, it is not unrealistic to say that most major airlines in the 1980's would need the building and office space for these functions in the magnitude of Rome's Colosseum." ■

move the people

DYNAMIC SYSTEM DESIGN FOR AIRLINES

by WALTER H. BRANDENBURG

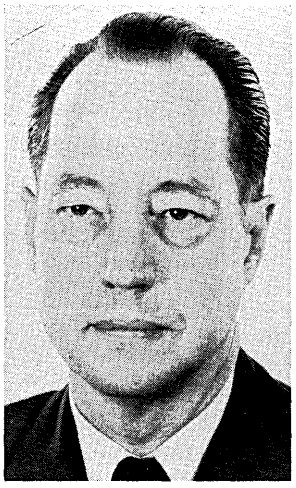
Mr. Tipton's article in this issue graphically describes the "transportation explosion" that will occur within the airline industry during the next decade—500 million passengers and 20 billion ton-miles of cargo, being transported annually in SST's, airbusses, STOLs, and other yet-unnamed flying machines, from entirely new and bigger ground facilities. It will indeed require outstanding systems design to adequately serve Mr. Tipton's dynamic industry.

Likewise, Messrs. Jenkins and Buchanan have ably demonstrated the major contributions which the airline industry has made in pushing the state of the edp art, and in providing an ideal environment for testing computer capabilities to handle high volumes of input with the necessary real-time response. The airlines have truly pioneered many of the present-day computer concepts. But the aforementioned explosion does not leave much lead time for continued research and development of the computer system applications specified by those authors.

Most certainly, there has been a successful marriage of these two dynamic industries; but like most marriages, the honeymoon does not go on forever and some major shortcomings do develop. My objective here is to identify some of the questions and problems in that marriage, and to offer some possible answers.

1. Have the two industries completely grasped the proper direction and scope of the requirements described by Tipton, Buchanan and Jenkins?

With all due respect to the accomplishments outlined by these spokesmen, I believe that we can agree there has been too much concentration on information processing, or on



Mr. Brandenburg is a transportation consultant and president of Brandenburg & Assoc. He was with United Air Lines from 1940 to 1968, with time out for Air Force service including a tour as director of operations for the Air Transport Command base in Naples. His last position at United was manager of reservations systems research.

playing games with large data banks, and too little emphasis on the basic problem of moving people and things efficiently from one place to another. Today's systems do an admirable job of keeping track of passenger records, cargo pallets, etc. But what is needed is a total system design of all facilities for getting to and from the airport, for the simple processing of customers at the airport and, above all, for the airport itself.

More specifically, too many systems are designed piecemeal, whereby the designers conduct a system analysis of the existing data base, develop a program to massage the data, and select a little black box to execute the instructions. Then great claims are advertised about the system's ability to "do-it-all" for the customer. But, in reality, the system does not come to grips with the major payoff area, which is tight control of the dynamic forces of travel on the day of departure: misconnections, delays, no-shows, go-shows, etc. Hopefully, Mr. Buchanan's ATA "project teams" will close the gap.

2. Have the two industries acquired the proper insight into the fundamental problem, which is the dynamic interaction of people and systems?

Here again I believe we can agree that too little consideration has been given to the interaction of the public with the systems, of the employee with the systems, of the systems with each other, both between airlines and between functional areas, and of management with all three.

Today the human interface with most systems is too sophisticated for the average person who must communicate with the system. The design of the interfaces must be simplified so that the burden of procedural decision making rests on the built-in logic of the system components rather than on the operator, and with only a minimum of common-sense controls at the point of input.

On the other side of the coin, the inter-system relationships are too elementary and incomplete. There is no airline system today with significant capability to interact with other systems either laterally from one airline to another, or vertically from one echelon to another.

3. Have the airlines adequately developed the "in-house" skills to cope with the problems outlined by Tipton, Jenkins, et al?

I believe that the "user" departments of many airlines which use edp, e.g., Passenger Service as opposed to Accounting, are simply not ready to participate in this kind of planning and development, because they do not have knowledgeable and qualified systems people in those departments. In some cases, there is an actual disinterest, with a complete willingness to let the "bookkeepers" (edp types) run the show, or with a blind faith in Brand X's ability to handle the problems. Also, there is a significant lack of understanding between the two groups regarding the importance of defining the "user" requirements.

seeking some answers

There is no simple solution to the problems of this tremendously complex marriage, and there will still be many headaches. Consequently, I would like to present certain guidelines for what I call dynamic system design. And immediately I must define "dynamic" as being responsive to the constantly changing requirements and volumes, but still within reasonable limits of standardization.

In order to provide a logical and methodical approach, I submit the following formula: TE + CO +PR + EN = DS. The formula is interpreted as follows: terminal equipment design plus computer design plus program design plus environmental design equals dynamic system design. But keep in mind the dynamic interplay between all the parts of the system design formula. That is, there are no neat compartments; people needs affect terminal design; terminal design affects computer and software design, which also affect terminal design . . . etc. We must avoid the very piecemeal approach that now exists.

So what does the structure of a dynamic system look like?

terminal equipment design

Terminal equipment design refers to those components which provide the human interface with the computer system. There has been a lot of conversation about this subject, but few satisfactory solutions. I recommend five basic requirements.

First, the equipment must be people-oriented, which means easy to operate, in order to minimize the skills and training required by the large number of people who will utilize the system. I believe that a limited number of those people will be able to operate today's sophisticated devices with any degree of speed and accuracy. There are many manual operations involving forms and reports which must be mechanized. However, as stated earlier, the burden of procedural decision making must not be placed on the operator through complicated terminal hardware. Instead there must be an entirely different approach which relieves the operator of all except the most common-sense operations, and which incorporates specific logic in the remote equipment.

Second, the terminal equipment must be flexible and variable to serve many operators from company presidents to baggage handlers, from million-milers to Grannys in wheel chairs, and from pilots to mechanics. As Mr. Tipton points out, the airline president wants to "know precisely how everything is ticking." But none of the presidents has the time (or the inclination) to learn about cursors, function keys, or formatting restraints. The million-miler must be catered to even more, and certainly Granny needs the simplest possible device. At the other end, the functions used by the pilot, ticket agent or baggage handler are very diverse. I believe that these different requirements can be fulfilled only by a range of equipment rather than by a single all-purpose device.

Third, some terminal equipment must be event-oriented, with fast, automatic responsiveness to the facts of life as they occur. Top management "decision making" requires fast, accurate facts, similar to the military defense networks.

Fourth, the terminal equipment must be durable and reliable, so that a minimum amount of maintenance will be necessary at the many remote locations.

Finally, there is a need for terminal equipment which can be shared by two or more operators. Because terminal hardware can be the most expensive part of most systems, the airline can not afford to get into the "razor blade" trap, where the initial purchase requires more and more terminal units. With the annual increase in volume during the life span of any large system, there certainly is a point of no return beyond which the user should not have to add another piece of expensive hardware for each new working position.

computer design

It is apparent that the economic advantages and the all-purpose computer capabilities, which were anticipated from the "third-generation" centralized systems, are not materializing. Therefore, I recommend that a better approach is for the designers of large airline systems to give more consideration to multiple systems which are structured on a regional and functional basis, with obvious interaction capability and compatibility.

In any large organization, the hierarchy of command necessitates different decision points, both vertically and

laterally. I am convinced that there should be separately sized systems for headquarters, regional offices, and local installations such as airports. Likewise, the many functional areas should have separate dedicated systems, e.g., accounting, advanced models for simulation, random-access systems as opposed to static displays, etc. The headquarters system should be a command and control system with lateral interfaces to all other airlines, and vertical interfaces to remote systems and to functionally dedicated systems. At the other end, large airports require localized systems which receive only the significant data from the higher echelon systems, and which function as a local control point with summary data passed back up the line. The remote systems should not necessarily be broad, general-purpose systems, but instead should include only the specific logic and storage to perform specific functions. The thought occurs that the remote systems should be process control-oriented rather than data-oriented.

One major advantage of multiple systems is the opportunity to take advantage of the best available components to meet the unique requirements of each functional or decision level. And I want to intercept the question of how to establish responsibility for system guarantees when different vendors are involved; each vendor is assigned responsibility for a well-defined area rather than for the total system. This will require precise boundary conditions in clearly defined performance specifications.

program design

It is almost trite to say that each computer manufacturer cannot be all things to everybody. Perhaps that statement was one of the underlying themes of the 1968 SJCC panel on the separate pricing of hardware and software. However, my answer is along a different line. I believe that the real challenge for the software companies is to "play in-house," which means that they should concentrate on problem orientation, e.g., transportation, and they should specialize in selected application areas for given computers. And I do not mean packaging! The larger airlines have had some experience with packages which required from major to complete revision.

Consequently, I recommend that designers of large systems call in different software specialists for each of the applications areas, in order to develop the final program package on-site. Here again, each vendor would be assigned responsibility for a well-defined application rather than for the total system.

environmental design

"The environmental enclosure is a physical thing which takes shape as a result of all that is being housed within, and should be a true expression of the human and mechanical functions enclosed."

This quotation from a leading architect defines a new and special skill which must be applied within a dynamic system—environmental design. In other words, we must consider the interaction of external forces on the system; certainly shapes, color and lighting are important, even if psychedelic; the patterns of movement within the system for people, equipment, information, baggage, etc., must be analyzed. For example, automobile parking and traffic flow are major environmental problems. Another example: perhaps airport runways can be built with a completely controlled environment which would provide a constant wind velocity and direction, with positive temperature and humidity control. (I envision a controlled flow of air along the runway without the use of a tunnel.)

dynamic system design

The one common thread throughout this discussion has been the consciousness of dynamic environment: human interface hardware, computers on the firing line, in-house software, and controlled environment. Dynamic system design requires an organization which understands these four areas and which has the ability to put together the interwoven pieces of a dynamic system. But dynamic systems cannot be designed by people in ivory towers, nor by some mysterious force in a fancy machine. It must be done by those "users" who have years of experience and job know-how, plus imagination, creative ability and brainpower. I call it "vision with aptitude." Such a combination may be available "in-house," or through a vendor, or through a third-party project manager.

Dynamic system design also requires time. I recommend a gradual buildup, application by application, with appropriate adjustments along the way, until the final integration is accomplished.

In summary, the airline and computer industries have combined to make significant advances. On the other hand, airlines can no longer tolerate management information systems which play games with data, or an airport design which is primarily aesthetic. Their managements must select people who have "vision with aptitude," and must allow adequate time for those people to design dynamic systems which are oriented to the changing forces of the transportation environment.

I believe that the proposed formula for dynamic system design stands the test of all the requirements specified above. ■

"Ever get one of those days
when everything seems to go wrong?"

AIRLINE RESERVATION SYSTEMS

125,000 seats per day

by WILLIAM E. JENKINS

The development of today's sophisticated computerized reservations system is as significant to the airlines as the development of the jet engine. Reservations has finally caught up with the jet age. In the formative years of the airline industry, the reservations process was about as sophisticated as the Ford Trimotor; however, it was a minor triumph for an airplane to depart fully loaded. As the airplane gained popularity and passenger volumes increased, advance reservations became normal practice for the vast majority of the air traveling public.

Eastern Air Lines' new third-generation computer system, required to handle today's reservations volumes, is one of the largest commercial computer installations in the world. The traveling public has adopted the telephone as the simplest and quickest means, versus a personal visit to an airline office, to make reservations. These telephone calls, in the case of Eastern, average 125,000 daily. The telephone, therefore, has become the major revenue pipeline to the airline.

It is the reservations unit's responsibility to serve the needs of these customers efficiently and effectively. Thus it is extremely important that the reservations unit have the necessary tools to respond promptly and to complete a reservation in minimum time. Reservations calls vary from 90 seconds for an information call to 717 seconds for a round trip booking, with an average of 237 seconds per call on a normal day.

Since Eastern schedules 125,000 seats per day over 27,000 flight segments between 98 airports, access to status records and control of inventory requires high speed edp capabilities with massive storage devices. This requirement is multiplied since customers wish to reserve seats well ahead of time—up to a year in advance—and the records must be maintained for that period.

The control and management of the airlines' seat inventory, as well as selling the product, makes the reservations function a key part of an airline operation. The success of reservations depends largely on the capability and reliability of our computer systems. Fortunately, we have achieved both, which is partially attributable to the experience gained over the past 20 years as the airlines took advantage of technological developments.

A look at the progress airlines have made in reservations

Mr. Jenkins is division vice president, reservations and telephone sales, for Eastern Air Lines. Before joining Eastern, he was director of traffic services for Northeast Airlines. With nearly 25 years of airline experience, he has been responsible for many innovations in services for passengers.

systems will best illustrate how edp has enabled the airlines to keep abreast of phenomenal traffic increases year after year.

The industry has progressed through many phases of reservations and seat inventory control techniques. One of the first of these was to allocate control of seats by city. Exchange of seats between cities was frequently required and handled through the airlines' radio network.

Continuing growth soon made it necessary to seek new communications methods for transmission of reservations data. Private line Teletype (PLT) became the new medium in communications and was quickly adopted as the basic reservations communication device. With improved communications facilities, space allotments by city soon became outmoded. Special control offices were then established to maintain inventory records and to confirm requested seats according to demand from the various cities. This system reduced the average time to process a reservation from approximately 24 hours to eight hours.

The next improvement was a "sell and report" procedure. Under this system, availability of flights was maintained in each office, permitting any city to immediately confirm a seat and report the sale via Teletype to central control for recording. When a flight was sold out, central control Teletyped this fact to all cities to update their availability records. The availability records in each office ranged from massive wall displays to simple clipboard charts—depending on the number of flights and personnel requiring access to the information.

Through this pre World War II period, traffic grew at a rapid rate. In 1935, 874,116 passengers were carried and by 1940, just five years later, the total had increased 264% to 3,185,278 passengers. By 1945, volume had increased 115% to 6,852,401 and there was no sign of let-up in the postwar period. It was evident that manual reservations systems would soon be incapable of handling the volume of reservations requests. Airlines turned their attention to the newly emerging electronics industry as the source of a potential solution.

The first attempt at mechanization was an electromechanical device designed for American Airlines by Teleregister Corp. (now Bunker-Ramo) in 1946. A key component of this system was the agent set or I/O device located at each reservations agent's position. The I/O device solved a major problem by placing the status of each flight at the agent's disposal, thus replacing cumbersome, hard-to-read wall displays. By depressing certain keys, illumination of lamps indicated if a seat could be sold on a flight. The central processing facility was based upon a pinboard technique and availability was changed manually. This initial system, although it had no electronic switching, computation, or magnetic storage devices, can be credited with paving the way for application of electronic techniques to the reservations process.

enter the drum

By the early 50's, significant advances had been made in electronic techniques, control and computational functions. In addition, the magnetic drum had become a reliable and effective storage device. Teleregister, with their previous reservations experience, was quick to apply this new technology in the design of the first seat inventory reservations control system. At the same time, a new I/O device was developed which enabled the reservations agent to adjust inventory on a flight by depressing certain transaction keys, e.g., SELL, CANCEL. This system, installed in 1952, finally eliminated the need to report sales and cancellations by Teletype.

This system, or later models subsequently developed by Teleregister, was used by American, Braniff, National, Northeast, Pan American, United and Western. In fact, several are still in use today.

Univac was next to enter the airline reservations field when they introduced the Model I File Computer encompassing new schedule display features in the I/O device in 1956. Using 35mm slides, mounted in a cartridge, the agent displayed and quoted schedules and, through magnetic coding on these display slides, sold and cancelled specific flights by depressing associated keys on the agent set. This system was installed at Capital (which later merged with United), Eastern and Northwest.

In all of these systems, it was still necessary for the reservations agent to manually complete the passenger's reservations record on either a card or a chart—depending on that airline's procedure. The new systems had eliminated the manual space control and solved the availability display problems. In 1960, airline traffic volume had grown 203% over that of 1945. This volume undoubtedly could not have been handled efficiently and economically without the aid of these electronic devices. Up to this time, however, the exchange of reservations data between airlines, which was handled by both telephone and Teletype, had received little attention except in the area of Teletype message switching centers to expedite traffic between airlines.

Since some of the previously mentioned electronic systems were already processing on-line Teletype messages and plans were underway for a fully automated system, the industry began developing standard machinable Teletype message formats in 1959. One was adopted as the standard format for all U.S. airlines in 1963 and later on a worldwide basis. With common machinable language, uniform programming for the new, more sophisticated computer systems under development could be assured.

sabre starts

The first of this new breed, now referred to as "second-generation" systems, was initiated by IBM. The initial system was installed by American. SABRE, as the system was called, encompassed all the former benefits of inventory and availability, plus the capability of recording the passenger's name record (PNR) and automatically generating any required Teletype messages to other airlines. The system was also designed to perform many other functions formerly handled manually from card records. To name only a few—meal counts, boarding manifests, ticketing time limits, and checks for duplicate reservations. Another feature of significant importance is reconciliation of passenger name records with inventory. Under the former systems, manual name records and machine inventory were extremely difficult to reconcile because of communications lag and records out of file.

Delta and Pan American, however, followed American's lead with the IBM Passenger Name Record concept. Today, most of the airlines are installing or have on order highly sophisticated "third generation" PNR systems introducing the cathode ray tube (crt) and alphanumeric keyboards as the agent set I/O device. The following, while not including all airlines of the world, is representative of what the airlines are doing and the vendors they have selected:

Air Canada	Univac
Air France	Univac
Alitalia	IBM
American	IBM
BEA	Univac
BOAC	IBM
Braniff	IBM
Continental	IBM
Delta	IBM
Eastern	IBM

Frontier	IBM
Lufthansa	Univac
National	IBM
Northeast	IBM
Pan American	IBM
Swissair	IBM
TWA	Burroughs
United	Univac
Western	IBM

The new IBM system, which the industry refers to as a "PNR System," introduced the first alphanumeric agent set installed at each reservations agent's position. The set consisted of a modified typewriter with a functional subset for insertion of prepared schedule display cards. These cards were coded to enable the agent to perform inventory transactions through depression of keys. The alphanumeric keyboard was used to insert all other elements (name, telephone number, etc.) of a passenger's reservation. The pioneering of American and IBM in the PNR system concept paved the way for today's airline reservations systems.

In the interim, increasing traffic volumes forced several carriers to upgrade their first-generation systems by introducing real-time inventory control and availability systems without the associated PNR concept. Examples here include Eastern and Northwest, with Univac 490's and United with Teleregister's Instamatic. Shortly following Eastern's installation in 1962, one of the first approaches to time-sharing was introduced when Eastern made its system available to Allegheny, Lake Central, Mohawk, Ozark, and North Central. All of these carriers except Mohawk are still a part of this system which since has been upgraded to Univac 494's.

the crossover point

Reservations system requirements are primarily related to the volume of traffic that must be handled. An airline handling 10,000 passengers per month can still efficiently and economically maintain a manual system without the aid of a computer. However, an airline with a volume of a million or more passengers a month must take the fullest advantage of today's electronic technology. It appears likely that the smaller airlines, heretofore denied the advantages of computerization for economic reasons, will be able to take advantage of these new systems in the future through joint participation or sharing.

Regardless of the volumes a particular airline handles, the same basic requirements for information and passenger processing exists. To describe the system requirements, one must examine the primary needs of an agent to promptly respond to a customer's telephone inquiry. These inquiries may involve not only the agent's own airline, but any airline in the world. Primary tools are:

1. Readily accessible schedule and fare information.
2. Means for determining availability status of flights.
3. Means for reporting sales or cancellations for inventory adjustment.
4. Ability to quickly record and subsequently access passenger records of itinerary, contacts, ticketing information, special service requirements.
5. Current date operational flight information.
6. Other travel related information such as rental cars, hotels, documents, ground transportation, city information and baggage requirements.

In addition to these needs, many other complex functions occur in the reservations process. These supporting functions formerly represented manpower requirements nearly equaling the number of personnel servicing incoming telephone calls. Once a telephone sales agent has booked a customer's reservations, the computer system must be capable of performing these supporting functions which combine to make today's total computerized reservations system so extremely complex.

Fortunately, today's technology has enabled us to eliminate pencil and paper in the reservations process and those arduous and time-consuming supporting functions of sorting, filing, searching, counting, changing and communicating. Except for certain static forms of information which cannot be economically stored and retrieved, the new PNR systems efficiently and effectively accommodate the reservations requirements for a total system.

To describe the new PNR system in more detail, I will use as an example Eastern's IBM 360/65 system which was initialized when the first reservations office cut over last July. We are at the mid-point of conversion from the Univac 494 system.

Ten regional reservations centers—located in Atlanta, Ga.; Charlotte, N.C.; Chicago, Ill.; Houston, Tex.; Miami, Fla.; Montreal, Can.; Woodbridge, N.J. (New York area); San Juan, P.R.; Seattle, Wash.; and Tampa, Fla.—will be connected by a network of high speed data lines to the central processors in Miami when conversion is completed this summer. (Two foreign offices in Bermuda and Mexico City are connected by Teletype.) To handle the anticipated 1969 traffic volume of 40 million telephone calls, 1700 crt agent sets will be active in these 10 reservations centers. In the same period, we will handle more than 20 million passengers (excluding our no-reservations Air Shuttle). This will require the creation of an estimated 22 million PNR's (a party of two or more traveling together requires only one PNR), allowing for normal cancellations.

the system

The basic hardware components which make up the system are as follows:

Quantity	Unit
3	IBM 360 Model 65 processors (524K core storage each)
3	Large core storage (6 million plus characters each)
3	2703 Transmission Control Units
20	2314 disc file system (200 million plus characters each)
676	Movable disc packs (25 million plus characters each)
24	Tape drives (9 track, 1600 bits per inch)

Here's how the system fulfills the needs of a reservations agent in responding to one of those 40 million telephone calls.

Schedule Information. Depressing a special key plus a simple input of date, city pair (from-to) and time, will obtain 10 current flight schedules, displaying flight number, city pair, departure and arrival, type of equipment, meal service and number of stops.

Availability. Depression of another key and the same input will display schedules of four available flights. The computer spans a 34-hour period in its search for seats available nearest the time requested.

A seat may be sold on one of the displayed flights by entering only the line number, class of service and number of seats, followed by all mandatory elements required in the PNR. If the agent fails to enter an element, the computer politely reminds the agent what has been omitted. Mandatory items are:

Passenger name(s) which must correspond to seats sold
Telephone contact
Ticketing information
Who booked the reservation

The up-to-date schedule and availability display is the most significant advancement over earlier PNR systems. Higher speed processor and crt capability allow storage and retrieval of this information. For example, extra sections may be added immediately after being set up for sale. Only flights scheduled to operate are displayed. No longer does an agent have to watch for fine print denoting exceptions

such as "no operate Sunday," or "Saturday only." Pick up any airline schedule and you will see what I mean.

Space does not permit covering all the functions performed by the system, so I will briefly describe several of the more important ones.

Retrieval of Passenger Records. An agent in any one of the 10 regional centers can instantly retrieve any passenger's record if the customer calls to cancel or change his itinerary, which occurs with some frequency. A complete history (PNR) is maintained until the passenger has flown the last segment of his itinerary. Each subsequent transaction involving a record in the system is time-stamped, "fingerprinted" with the agent's symbol, and notes who (passenger, secretary, etc.) made the change.

Automatic Message Handling. The system automatically generates messages to sell or request seats on other airlines. Eastern maintain availability on 24 other airlines, accommodating more than 90% of the requests we receive. Also, we supply many other airlines with Eastern's flight availability. Messages selling or requesting seats received from the other airlines are automatically processed and replies sent if necessary. Messages are automatically sent to other airlines advising of schedule changes. A reply of seat confirmation or advice from another airline of a schedule change is automatically processed and placed on special queues alerting the agent to notify the passenger. All such messages (an estimated 37 million in 1969) previously were handled manually.

Waitlist. As seats are canceled on flights previously sold out, the system will automatically search the waitlist file; if names are listed, it will select the earliest record, confirm the seat and place the record on a special queue for an agent to call the customer.

Schedule Change Processing. Airlines historically change schedules in the spring and fall concurrent with Daylight Saving Time changes, and at other times of the year to meet seasonal or market requirements or to phase in new aircraft deliveries. A very intricate process takes place when a new schedule is loaded into the computer. Flights are matched and, if a flight changes, the passengers are automatically booked on a flight most similar to their previous reservation. Each PNR record is adjusted and queued for agents to notify the passenger. This seemingly simple process is one of the most complex and difficult operations performed by the system.

Other newly automated internal processing functions of significant importance include cancelling PNR's with expired ticket time limits, duplicate booking checks, alphabetizing PNR's for boarding manifests, and placement of PNR's on queue at appointed time for tickets to be mailed or sent by Teletype.

Another feature of vital importance is flight information. Facts pertaining to non-routine operating conditions and revised arrival and/or departure information can be retrieved through a simple transaction or given automatically with a schedule or availability display.

reliability and response

In addition to performing these feats, the system must meet severe performance standards in response time and reliability in order for the reservations unit to service the 125,000 telephone calls received each day. Reliability takes on its real meaning when you consider a reservations agent in the process of making a reservation for a customer. Suddenly the System Available light goes out. The agent no longer has the ability to access flight schedules, seat availability or flight information. The customer is still on the line. This is just one agent, but when you consider there are 1,700 agents in this same situation, you can visualize the effect of a complete system failure. Imagine, too, that it's not just one customer. In our system, the scene is being repeated at the rate of 262 times each minute. This problem is further compounded when you consider all the support functions and the other departments in the company, dependent upon information from the system. I believe you can quickly understand why we must have a totally redundant system—from incoming power, to processors and storage devices—which duplicate every record stored in the system.

Response time becomes critical, too, when you consider a normal round trip PNR may involve 10 or more separate entries, each requiring a response from the computer before the transaction can be continued. If our response time standard of eight-tenths of a second is not met, you will note pauses in the conversation with the customer. Besides embarrassment and inefficiency, the added seconds can be extremely costly. To add five seconds to work-time-per-call would require 31 additional personnel in our system to handle the same number of calls.

Variable length of PNR's, variable number of PNR's stored a year in advance and variable loads by hour of day, day of week and month of year give the computer sciences department a tough job of design, programming and operating to maintain these critical system performance standards.

Design of such a huge and complex reservations computer system involves the interaction of the professionals in both the reservations and edp functions. Neither can act independently if the system is to be successfully implemented and operated profitably. The user department—particularly in a function as intricate and wholly dependent on the system as reservations—must have a strong voice in establishing design and operating criteria.

Reservations management, based upon operation knowledge and experience, must study, evaluate and analyze the specific needs of the function in order to present to the edp unit a concise, in-depth, comprehensive statement of definition of requirements. Through the application of technical knowledge, the edp specialist can identify and select the system which most nearly meets the needs of the user.

One of the grave problems that the development of the science of edp has generated is an ever-widening communications gap between the management of an operating unit and the technical specialist. As the state of the art in edp progressed and the subject became less intelligible to those outside the function, the responsibility for the identification and definition of requirements and the selection of hardware, programs and peripheral equipment fell more and more to the edp technician. He, while a specialist in his own field, did not possess the depth of knowledge and experience in an alien function to properly identify and define its particular requirements.

The mutual responsibilities of these units, therefore, cannot cease with planning, development or even implementation of the system. Constant communication of ideas and facts is vital. Requirements and capabilities must be reconciled. Refinements and new programs must be defined and developed. All of this can be done effectively only through continued meshing of the background, knowledge and experience of the operating unit and the edp unit.

Reservations management must accept their responsibility for identifying and providing detailed functional specifications in order to close the technological and communications gap between the user and supplier. The user, particularly in an airlines reservations environment, must have edp-oriented personnel on his staff to insure complete continuity and understanding of the task to be performed. The edp unit must recognize and accept the fact that reservations is the telephone selling and service unit of the airline faced with dynamic circumstances which will not permit subordination of their requirements to those of the edp unit. ■

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CONVERSATIONAL COMPUTING FOR HOUSEWIVES

can you get me a bargain?

by GEORGE U. HUBBARD

Regarding the concept of conversational computing, several dialogs of possible man-machine conversation have appeared in the literature of the past few years. Mostly, these dialogs have illustrated the educational use of computer-student conversation and medical diagnosis between computer and patient. Both the possibilities and the potential pitfalls have been emphasized.

Conversational computing certainly lends itself to the concept of the computer utility. And as other utilities have become regular household features, the computer utility proponents predict that theirs, too, will ultimately find its way into the home. Does this mean that the home terminal will largely sit idle during the day while only the wife is at home and then spring into action for the all-knowing, technically minded husband upon his arrival from the office? Not at all. It's time that we examine the possibilities of conversation between computer utilities and their true users —our wives.

The possibilities of dialog between computer and housewife are so vast that they can't possibly be covered in one article. My purpose herein is merely to suggest a few areas in which computer conversation may be helpful and desirable to the housewife in hopes that these ideas will stimulate further ideas from the women themselves. I also want to illustrate that the housewife will be the master of this relationship and not the slave. She will always have the option of overriding any of the computer's decisions or suggestions.

So, reader, take this article home, have your wife read it, and note her reactions to this type of service. After all, if the wives like it, the husbands will buy it.

Housewife: (Signs on)

Mr. Hubbard is a programmer with the Service Bureau Corp. in San Jose, Calif., and has been active in the development of remote terminal systems. He has a BSEE from the Univ. of Texas, an MS in mathematics from North Texas State college, and an MS in statistics from Stanford.

Computer: Good morning. What may I do for you?

H.W.: Compute my menus for next week. I want T-bone steak for dinner on Tuesday and macaroni and cheese for dinner on Friday.

Computer: Your menu is ready. Do you want to see any particular meals?

H.W.: What will we have for breakfast on Monday?

Computer: Monday Breakfast:
Orange juice
Oatmeal
Scrambled eggs & bacon
Toast, buttered
Strawberry jam
Milk, sugar, salt

H.W.: What will we have for supper on Monday?

Computer: Monday Supper:
Liver and onions
Brussels sprouts
Diced carrots
French bread
Ice cream
Butter
Salt

H.W.: Substitute ham for liver

Computer: But you substituted so many items last week your menu was deficient in iron. And remember, Peggy's (daughter) doctor wants her on a special iron-building diet. Besides, you gained 3 pounds last week, and we have to be more restrictive with what you eat.

H.W.: All right. Substitute spinach for Brussels sprouts.

Computer: But Brussels sprouts is John's (son) favorite vegetable, and he hasn't had it for 3 weeks.

H.W.: Substitute it anyway.

Computer: All right. But balancing your dietary needs on $35 a week isn't easy. Shall I order the groceries?

H.W.: Yes. Have them delivered tomorrow afternoon at 3:00.

Computer: All right. What more may I do for you?

H.W.: I saw a Hide-a-Bed at Macy's for $295. Is that a good price?

Computer: Hide-a-Bed prices currently range from $150 to $525. The average price is $312.

H.W.: Can I pay for the Hide-a-Bed at Macy's this year?

Computer: Yes. The final payment for your washer will be made next month. At your present rate of income you can pay $50 a month beginning in July for the Hide-a-Bed without borrowing money. However, this will require your Christmas fund to be reduced from $300 to $263.

H.W.: All right. Is a down payment necessary?

Computer: Madam, our subscribers do not require down payments. Shall I order the Hide-a-Bed at Macy's?

H.W.: Yes. Have it delivered tomorrow afternoon at 3:30.

Computer: All right. What more may I do for you?

H.W.: I would like my plumber tomorrow afternoon at 2:00.

Computer: Your plumber is already scheduled at that time. He can come next Tuesday at 4:00. Shall I schedule him then?

H.W.: All right. I also would like my electrician tomorrow afternoon at 2:00.

Computer: Three months ago you expressed dissatisfaction with your electrician and ordered us to drop his name from your file.

H.W.: Didn't I submit another name?

Computer: No.

H.W.: Can you recommend an electrician for me?

Computer: Thompson & Sons have the most clients and the smallest complaint record, but their prices are in the upper 25% for electricians. Do you want them assigned to your file?

H.W.: All right.

Computer: Thompson & Sons are your new electricians. They are available tomorrow afternoon at 2:00. Shall I schedule them?

H.W.: All right.

Computer: What more may I do for you?

H.W.: I need a new fall coat and the children need new school clothes. What stores are having sales in these items?

Computer: Our files show the following clothing sales:
Fall Coats:
A. Stein & Co.
R. Goldberg & Sons
Neiman – Macy's
Children's Clothes:
A. Stein & Co.
Neiman – Macy's
Sears, Roebuck
Merrill, Lynch, Pierce, Schaffner, & Marx
Would you like more detailed information?

H.W.: No.

Computer: What more may I do for you?

H.W.: We will be on vacation from June 3 through June 18. Please stop our services for that period.

Computer: The following services will be stopped from June 3 through June 18:
Telephone
Gas
Electricity
Newspaper
Water
Is this list satisfactory?

H.W.: No. Do not stop the electricity.

Computer: All right. Do you wish to leave a forwarding address for your mail?

H.W.: Yes: Send our mail in care of:
We Catch 'Em You Ride 'Em Dude Ranch
Cascade, Colorado

Computer: We will forward your mail from June 3 through June 14. Is this all right?

H.W.: Yes.

Computer: Your son, John, has a dental appointment on June 10 that conflicts with your vacation. Can we reschedule him for 10:00 a.m. on July 2?

H.W.: All right:

Computer: What more may I do for you?

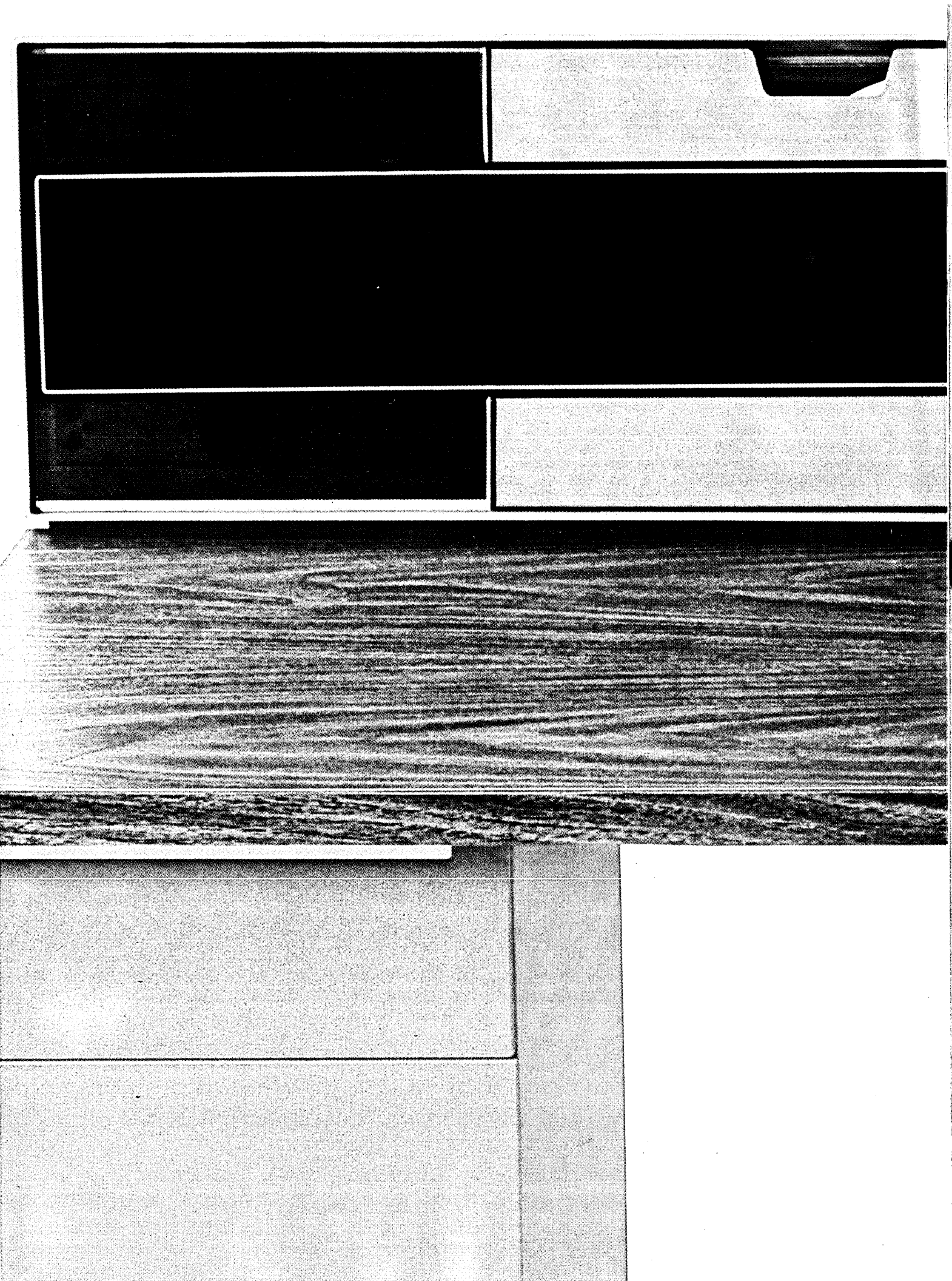
H.W.: Please list all of our appointments through July.

Computer: Appointment Schedule

Date	*Time*	*Description*
May 21	2:00 p.m.	Electrician
May 21	3:00 p.m.	Grocery delivery
May 21	3:30 p.m.	Hide-a-Bed delivery
May 24	4:00 p.m.	Plumber
May 28	8:00 p.m.	PTA
June 3 – June 18	–	Vacation
June 25	8:00 p.m.	PTA
July 2	10:00 a.m.	Dentist (John)
July 15	9:00 a.m.	Dr. McAuley for annual physical checkup (Ruth)
July 27	8:00 p.m.	PTA

What more may I do for you?

H.W.: Print next week's menu sometime within the hour. And thank you. ■



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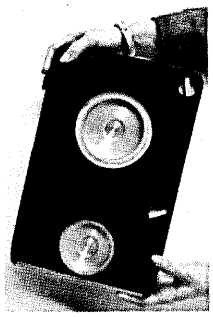

It's easy to set up because it operates in any of 5 different modes. Program entry. Program verify. Search. Write. And verify. All your operator has to do is rotate one switch.

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- ☐ in field
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- ☐ on board ship.

CIRCLE 18 ON READER CARD

MINI-COMPUTERS FOR REAL-TIME APPLICATIONS

by D. J. THEIS and L. C. HOBBS

many, many

Most investment research analysts agree that the small real-time control computer market is one of the more promising segments of the computer industry from the standpoint of growth potential. Interest in this relatively new market became serious about 1965 when close to 1,000 units were sold, valued at approximately $25 million. In 1968 sales were estimated to be in the order of $200 million, including associated peripheral equipment. This market has been created by advances in magnetic and semiconductor technologies which have made small low-cost real-time computers economically feasible. Sales in 1973 are expected to be in the order of $500 million with over 25,000 units being installed. New applications created by the cost and performance of these low-cost computers will eventually lead to unit sales volumes that few people or organizations have foreseen. This segment of the computer market has become important both to manufacturers, because of the sales potential, and to users because of the new solutions that small low-cost computers make possible in applications such as instrumentation, communications, control systems and many others.

This article surveys the characteristics of presently available small-word-length (i.e., 8-, 12-, 16-, and 18-bit) commercial computers. This survey only includes computers which are priced in the order of $50,000 or less for a minimum system and which are offered with a normal complement of input/output equipment. Although many of these computers are used as small stand-alone engineering and scientific computers, most of them are used in real-time applications such as:

Instrumentation systems
Automated test systems
Process control systems
Data acquisition and telemetry systems
Communication concentrators and processors
Peripheral controllers and preprocessors for larger computer systems
Display controllers, buffers, and processors
Transportation and distribution control systems
Bio-medical monitoring systems

Since many of these applications involve real-time control, the computer must be able to process input information sufficiently fast that the results of this processing can control or influence certain input variables from parts of the system that are external to the computer.

Table 1 (pp. 48 thru 53) includes most of the basic characteristics associated with each computer. Since the proliferation of machines in this market necessitates a time consuming evaluation by any potential user, these comparisons of characteristics will aid a user in working back from the requirements of his particular application and analyzing the major features that must be provided. Analyzing the competitive computer characteristics available to meet the requirements of an application aids in understanding which computer features are more important to the specific application. These features are grouped into the following categories:

Memory
Cpu characteristics
Arithmetic operations
I/O capability
Software
Basic mainframe costs
Peripherals

minicomputers

Originally, 12- and 16-bit-word-length machines dominated this market but in 1968 several 8-bit-word-length machines were introduced. Some of the 8-bit computers are designated as controllers, but for all intents and purposes they fully qualify as computers. These mini-computers are priced below $10,000, but it is important to note that these

Mr. Theis is a senior consultant with Hobbs Associates, Inc. He has a BS from UCLA and an MSEE from the Univ. of Southern California; he is also a registered professional engineer in the state of California.

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machines with storage of 4,096 words of 8 bits each have half the number of bits of storage of a 16-bit computer with a 4,096-word memory. The one obvious advantage of a smaller memory module is that it costs less; if it can do the required job, why pay for more memory? However, two 4,096 8-bit memory modules usually cost more than one 4,096 16-bit memory module.

A large market is developing for computers in applications, such as communications and monitoring functions, where very little sophistication in cpu performance is needed and only a limited arithmetic capability is necessary. The requirement for stored program machines to perform control and monitoring functions places heavy emphasis on very low cost computers. This has been a major factor leading to the development of 8-bit computers. Although these 8-bit machines are not as powerful in computing capability as the 12-, 16-, and 18-bit machines, they still represent serious competition in many applications where sophistication and high performance are not the primary requirements.

The trade-off in the 8-bit computers is basically speed for cost. In a sense, a minicomputer is a slave to its peripherals whereas the other machines (12, 16, and 18 bits) are the master of their peripherals. The minicomputers also have a definite advantage in applications requiring 8-bit I/O byte manipulations, although most of the longer word length machines have this capability in some form.

Generally, one word of an 8- or 12-bit machine is not as effective as one word of a 16- or 18-bit machine, particularly from the instruction format standpoint. Despite the claims of salesmen, a given program usually requires more storage locations (words) in an 8-bit machine than in a 16-bit machine. However, there are many places in application programs, such as register-to-register operations, where a single 8-bit instruction accomplishes the same function as a 16-bit instruction would. Therefore, comparing machines of different word lengths is very difficult. It is not accurate to compare the cost of the smaller word length machines by multiplying the price of the larger machine by the ratio of the word sizes. In fact, the only valid ways to compare machines with different word lengths is by running benchmark problems which are typical of the specific application for which the computer is being selected. It is even better to program the machines for the actual problem.

The major cost item in all of these computers is the memory. Memory cycle time is one characteristic of performance, but usually memory cycle time alone is not a true indication of the relative speed of a machine in actual use. In other words, a machine with a faster memory cycle time may not necessarily execute a given program in less time than a machine with a slower cycle time. For example, one analysis of a typical real-time application program showed that one machine with a 2.0 usec memory cycle time executed the required program functions slightly faster than another machine with a 1.0 usec memory cycle time.

Another important point to consider is the amount of core required to handle the desired program. Programs can be written to minimize time or to minimize core requirements, but the user must realize that trade-offs between memory capacity and execution time are involved. Even more importantly, the user must realistically evaluate the memory size that will be necessary to do the job without spending an undue amount of programming time making the program fit this memory size. Quite often users find out too late that much of the manufacturers' software is not designed to operate with their minimum memory configuration. Underestimating program requirements often leads to ordering a memory which is not large enough to handle the particular application. It is important that the program requirements for the application be determined both by adding up the instruction execution times (including addressing, indexing, and other required operations) to perform the job and by itemizing the number of memory locations needed to store this program.

If a parity check system is to be used to facilitate error detection, an additional bit is added to each word. As core memories have become more and more reliable, the need for parity checking has been minimized or eliminated in many applications, but there are some applications, such as process control and communications, where parity checking is still highly desirable. Memory protection is a feature that prevents writing in certain restricted regions of memory, except by special instructions. In more complex computer systems (such as those for time-sharing, multiprogramming, etc.) additional protection requirements are incorporated as part of the memory protect feature. Memory protection can be implemented in hardware, software, or a combination of both. Some machines with 18-bit memory words use one bit of each memory word for parity check and one for memory protect. In these cases, the 18-bit computers function logically and arithmetically as 16-bit processors. However, other 18-bit machines use the full 18 bits for representing numbers and instructions.

Information on the Beckman Model 816 was received too late for inclusion in the chart accompanying this article. The most pertinent points, however, are summarized here: The 816 is a 16-bit-word-length machine with a 4.8 usec memory cycle time. The minimum memory size is 2048 words and maximum is 4096 words. It has two accumulators and one hardware index register. The I/O data path is 16 bits at a maximum word transfer rate of 6KHz. It has an assembler and the basic system price with 2048 words of memory and an ASR-33 is $9750. With the full 4096 words and an ASR-33, the price is $13,550. It is used in real-time data enhancement and/or control applications.

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cpu features

The features of the central processing unit (cpu) significantly affect the speed and efficiency with which any application program can be performed. The small com-

puters discussed here can best be characterized as having a parallel binary internal processor structure utilizing some form of modified single address instruction word format.

The user must carefully consider the variations in instruction word formats and addressing techniques that result from different design trade-offs in competitive machines. Both the instruction format and the data requirements affect the selection of word length in the design of a computer. The precision required in a specific application (or group of applications) determines the data word length while the instruction word length is a function of the number of instructions necessary to fully utilize the capabilities of the cpu, the addressing requirements, and special features (e.g., index register designators). It is usually desirable to have the data word length and the instruction word length the same so that data and instructions can be stored interchangeably in memory. If higher precision is required in portions of an application, double-word-length operations can be used. Double-word-length or multiple-word-length operations are common in many applications where small computers are used. Once the machine word length is fixed, the designer must make several trade-off decisions in allocating the bits used in the three basic fields which make up the typical machine instruction format. These basic fields (subdivisions) are for the operation code (op code), the addressing modes, and the address. This format is shown in Fig. 1.

Fig. 1 Generalized instruction word format

Two major design decisions in small-word-length machines are how to specify the required number of instruction types in an abbreviated operation code and how to address the full memory with an abbreviated address field. If 4, 5, or 6 bits are allocated for the op code, the machine then is limited to a 16-, 32-, or 64-instruction repertoire, unless some exceptions are taken to conventional instruction format concepts. One such exception common in short-word-length machines is to set up two categories of instructions—those that address the memory and those that do not. Then all but one of the available op codes can be assigned to memory reference instructions which use the address field for addressing purposes. The remaining op code can be used to represent the entire category of instructions that do not reference the memory (e.g., register-to-register transfers). This then permits using the address field to specify the operation to be performed—i.e., as an extension of the op code.

For specifying address modification modes, such as direct, indirect, and indexing, these machines usually provide one or more bits in the address mode field to permit two or more address modes. The remaining bits make up the address field, which is obviously insufficient for directly addressing the full memory. Generally 7 or 8 bits of a 16-bit instruction word are used for the op code and address modes, which leaves 8 or 9 bits for addressing. This problem is, of course, even more severe in 8- and 12-bit machines. On small-word-length machines, the address portion of the instruction word is of necessity an abbreviated address, which is used either as an increment or displacement within the fixed page boundary address (i.e., the least significant part of the effective address) or as a displacement relative to the contents of the program counter.

"Page size" is a term used to refer to a fixed number of contiguous memory locations which can be addressed by the address field. The "page" and the addresses in it are relative to some reference (i.e., program counter, fixed memory location, index register, etc.). The page size typically ranges from 256 up to 2,048 words. Schemes for page addressing are implemented in a wide variety of ways which are very interesting but difficult to discuss briefly. Two common techniques are page relative addressing and addressing relative to the program (or location) counter. The former method is a page addressing concept where the page boundaries are fixed and the page used is usually (but not always) determined by the higher-order bits of the program counter. In the latter technique the page extends a half page size before and after the current address in the program counter. As the program counter advances so does the page. These techniques are illustrated in Fig. 2.

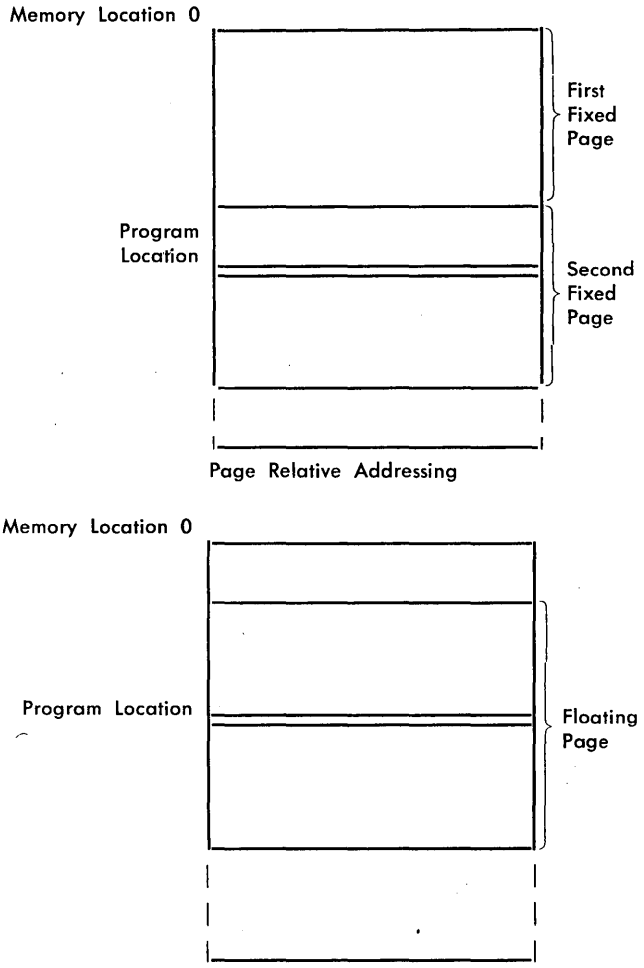

Fig. 2 Two common page addressing techniques

If the address mode field is reduced, the additional bits can be used in the address field to increase the page size, but this is done at the expense of reducing the number of alternative pages that can be specified. In addition to the page containing the current instruction, the address mode bits may specify alternative pages, such as the first page in memory or the pages designated by the contents of one or more index registers, or they may specify indirect addressing. Some form of indirect addressing or indexing is needed to address memory locations outside the page boundaries.

Indirect addressing is an addressing technique in which the memory location specified by the instruction contains the address of the operand rather than the operand itself. An instruction using indirect addressing requires an additional memory cycle to obtain the address of the operand and it requires an additional memory location. Indirect ad-

dressing permits using an entire word for the operand address. Hence, in a 16-bit machine, indirect addressing permits addressing any location in a memory of up to 65,536 words. The indicated address itself may also be indirect, which permits multiple levels of indirect addressing.

Index registers provide another means of addressing memory locations outside the current page. If the programmer specifies an indexed addressing mode, the address field of the instruction is added to the contents of the index register (or in some cases subtracted) to generate the effective operand address. Some of the machines covered in this survey have dedicated hardware index registers, while others use various schemes to provide indexing capability at lower cost but at the expense of time.

One common method for providing indexing capability is by providing an extension to the accumulator which permits extended memory addressing but which is also used for multiply, divide, and double-length operations. This approach requires additional housekeeping by the programmer to assure that the program contents are loaded each time for the desired operation. Another technique used in several machines for providing indexing capability without the cost of dedicated hardware registers is to allocate special memory locations whose contents are used as indices when the indexing mode is specified. This method requires one additional memory cycle, but the programmer can modify these memory locations utilizing normal load and store instructions. The programmer can also use the index registers to keep track of loop operations he might require in a program.

Another alternative in addressing larger memory directly is the use of two-word instructions at the expense of two memory cycles and two words of storage. This is one example of the point made earlier that a machine's memory cycle time is not always a good measure for evaluating program execution time for a given job. Eight-bit machines use double-word instructions for many operations. In the two-word format, one word usually defines the operation and the other specifies the operand address. This format allows more instructions (op codes) and larger address fields providing ease of programming at the expense of storage efficiency and assembler complexity.

One major trend in cpu design is the use of more general-purpose hardware registers and/or accumulators to provide programming versatility and efficiency. This reduces the number of memory references required in any given program but increases equipment costs. General-purpose registers can be used for indexing and other operations which are not normally handled by the accumulator, but a general-purpose register may also be used as an accumulator. In this approach, a full set of inter-register instructions, which are grouped into a special instruction word format, are frequently used to manipulate the contents of these registers arithmetically and logically.

All of the small-word-length computers in this survey are binary, fixed-point, general-purpose machines with negative numbers represented in one's or two's complement notation. All of the machines, except the 8-bit machines, provide fixed-point multiply/divide hardware either as an option at additional cost or as a standard unit in the basic mainframe price. Both the hardware multiply and divide execution times and the software multiply and divide times are included in the survey chart accompanying this article. The hardware unit cost is high for these features but hardware arithmetic operations are executed much faster. They also save memory space since the software subroutines that would otherwise be needed generally take 20 or more words of core memory. This trade-off should be determined by the frequency of these operations and the requirements for speed in the specific application.

Micro-instructions, micro-operations, and machine subcommands are different terms for essentially the same thing. In some machines, each bit in the address field of the register-to-register instruction format refers to a register operation such as complementing, shifting, etc. A few of these machines bring the wires controlling these operations out to the connector so the user can provide logic to generate certain desired micro-operations. This technique, which is frequently referred to as microprogramming, is a means of building various special instructions as needed from the subcommand structure of the computer.

Microprogramming is sometimes associated with read-only memories. Read-only memories are used to store a predetermined program that is used to interpret and execute a given set of micro-instructions which make up a macro-instruction. To effectively use this microprogramming technique, the read-only memory must be much faster than the main random access core memory. In applications where the computer is dedicated to one job where one program is executed repeatedly, a real advantage may be gained by using a read-only memory and tailoring the operations to the specific application.

input/output capability

The input/output capability of computers used in real-time applications is extremely important. The width of the I/O data channel is typically the word length of the computer (which may or may not be most appropriate for the external device). As an example, the 8-bit machines transfer data in byte increments, which is very advantageous in communications systems that operate on 8-bit characters. In this application, 12-, 16-, or 18-bit machines are forced into higher overhead operations because they must pack and unpack data into memory words to minimize storage requirements. When the application requires the input of 10- or 14-bit data words from an analog-to-digital converter, the opposite balance results, favoring the larger-word-length machines.

A wide variety of I/O channel configurations is available on these small machines. The major problem in comparing the capability of various I/O channel configurations offered by different manufacturers is that one computer may have much more hardware capability, thus requiring the use of fewer instructions than another machine. Generally speaking, there are two basic types of I/O channels:

1. I/O transfer is under direct program control of the cpu where the data path is through the registers in the cpu (e.g., programmed data channel, party line I/O, etc.).
2. I/O transfer is directly between the controller of the external device and the memory, independent of program control once the transfer has been initiated (e.g., direct memory access channel, selector channel, direct memory channel, etc.).

Each type of I/O channel can be implemented so that progressively higher system performance can be achieved by providing higher degrees of independent, automatic control of data transfers.

More than one external device or peripheral can be put on either type of channel. The typical programmed data channel has a certain number of wires for input/output data, the appropriate number of wires for outputting the address for the desired device, and a few wires for the necessary control signals to set up and initiate the data transfer. Some machines provide the programmer with one instruction to execute I/O automatically while on other machines more programming is required, such as testing program loops to see if the channel is busy, providing the address of

(Text continues on p. 57; Table 1 next six pages)

Table 1

MANUFACTURER/MODEL NUMBER	Digital Equipment Corp. PDP-9	Digital Equipment Corp. PDP-9/L	Computer Automation PDC-816	Control Data Corporation 1700	Data General Nova	Data Mate Computer Systems, Inc. Data Mate-16	Decade Computer Corp. 70/2	Electronic Assoc. Inc. 640	EMR 6130	Hewlett-Packard 2114A	Hewlett-Packard 2115A	Hewlett-Packard 2116B	Honeywell DDP-416
MEMORY													
Memory cycle time (us)	1.0	1.5	8	1.1	2.6	1.0	.860	1.65	0.775	2.0	2.0	1.6	0.96
Memory word length (bits)	18	18	16	18	16	16	18	16	18	16	16	16	16
Minimum memory size (words)	8K	4K	4K	4K	1K	4K	4K	4K	8K	4K	4K	8K	4K
Memory increment size (words)	8K	4K	4K	4K	1K, 2K, 4K	4K	4K	4K	8K	4K	4K	8K	4K
Maximum memory size (words)	32K	16K	16K	32K	32K	32K	16K	32K	32K	8K	8K	32K	16K
Parity check (std., opt., no)	opt.	opt.	no	std.	no	opt.	std.	no	std.	opt.	opt.	opt.	opt.
Memory protect (std., opt., no)	opt.	opt.	no	std.	no	std.	std.	std.	std.	no	opt.	opt.	opt.
CPU FEATURES													
Instruction word length (s)	18	18	16	16/32	16	16	16/32	16/32	16/32	16	16	16	16/32
Number of accumulators (or general purpose registers that can be used as accumulators)	1 std. 1 opt.	1 std. 1 opt.	1	2	4	2	1	2	2	2	2	2	1
Number of hardware registers (not including index registers)	1 std. 1 opt.	1 std. 1 opt.	6	8	10	6	5	9	4	7	7	7	4
Number of index registers (indicate whether they are hardware, memory or other techniques)	7 (auto. index mem. reg.)	7 (auto. index mem. reg.)	1 hardware	1 hardware 1 memory	2 hardware 16 memory	1 hardware	1 memory	1 hardware	3 hardware	none	none	none	none
How many bits for operation code	4	4	5	4	5	5	6	4	5	4	4	4	6
How many bits for address modes	1	1	3	4	3	3	3	3	3	2	2	2	1
Number of addressing modes	2	2	8	7	8	8	5	3-8	7	4	4	4	2
How many bits for address	13	13	8	8/15	8	8	7/14	9/15	8/15	10	10	10	9/14
In this machine one can directly address_____words in	8,192	4,096	768	256	1,024	256	16,384	512	32,768	2,048	2,048	2,048	1,024
_____us and indirectly	2.0	3.0	16.0	1.1	5.2	2.0	1.9	1.65	1.9	2.0	2.0	1.6	0.96
address_____words in	32K	16K	16K	32K	32K	32K	16K	32K	32K	8K	8K	32K	16K
_____us	3.0	4.5	24.0	3.3	7.8	3.0	1.9	3.3	2.9	4.0	4.0	3.2	1.92
Indirect addressing (multi-level, single-level, no)	Single-level	Single-level	Multi-level	Multi-level	Multi-level	Multi-level	Single-level	Multi-level	Multi-level	Multi-level	Multi-level	Multi-level	Multi-level
ARITHMETIC OPERATIONS													
Store time for full word (us)	2.0	3.0	16.0	2.2	5.5	2.0	1.9	3.3	1.9	4.0	4.0	3.2	1.92
Add time for full word (us)	2.0	3.0	16.0	2.2	5.9	2.0	1.9	3.3	1.9	4.0	4.0	3.2	1.92
Fixed-point hardware mult/divide (std., opt., no)	opt.	opt.	no	std.	no	std.	opt.	std.	std.	no	opt.	opt.	no
Multiply time—hardware (us)	3.0 to 11.0	4.5 to 16.5	—	7	—	6.0	6.5	18.15	4.5 to 8.3	—	24.0	19.2	—
Divide time—hardware (us)	3.0 to 12.0	4.5 to 18.0	—	9	—	7.0	12.5	18.975	7.9 to 11.4	—	26.0	20.8	—
Multiply time—software (us)	281 max.	421 max.	102	—	329.3 to 334.1	N/A	—	—	—	187	187	150	154.6
Divide time—software (us)	352 max.	528 max.	178	—	424.8 to 519.2	N/A	—	—	—	387	387	310	220.8
I/O CAPABILITY													
Data path width (bits)	18	18	8/16	16	16	16	16	16	16	16	16	16	16
Direct memory access (DMA) channel (std., opt., no)	std.	no	std.	opt.	std.	opt.	opt.	opt.	std.	no	opt.	opt.	opt.
Maximum DMA word transfer rate	1 MHZ	—	125 KHZ	900 KHZ	312 KHZ	1 MHZ	1.1 MHZ	600 KHZ	1.26 MHZ	—	500 KHZ	625 KHZ	1 MHZ
Number of external priority interrupt levels provided in basic system	1	1	3	16	16	8	1	7	none	8	8	16	2
Maximum number of external interrupts	256	256	256	16	62	64	32	64	126	56	40	48	48
Response time (us) including time to save registers of interrupted program and initiate new program execution	4.0	6.0	48.0	50.0	38.6	5.0	8.0	5.8	13.2	10.0	10.0	8.0	4.8
OTHER FEATURES													
Power failure protect (std., opt., no)	opt.	opt.	opt.	std.	std.	std.	opt.	std.	std.	opt.	opt.	std.	std.

MANUFACTURER/MODEL NUMBER	Digital Equipment Corp. PDP-9	Digital Equipment Corp. PDP-9/L	Computer Automation PDC-816	Control Data Corporation 1700	Data General Nova	Data Mate Computer Systems, Inc. Data Mate-16	Decade Computer Corp. 70/2	Electronic Assoc. Inc. 640	EMR 6130	Hewlett-Packard 2114A	Hewlett-Packard 2115A	Hewlett-Packard 2116B	Honeywell DDP-416
Automatic restart after power failure (std., opt., no)	opt.	opt.	opt.	opt.	opt.	std.	opt.	no	opt.	opt.	opt.	opt.	opt.
Real-time clock or internal timer (std., opt., no)	std.	opt.	opt.	opt.	opt.	opt.	opt.	opt.	opt.	opt.	opt.	opt.	opt.
SOFTWARE													
Assembler (1 pass, 2 pass, both)	2 pass	2 pass	2 pass	2 pass	2 pass	2 pass	1 pass	2 pass	both	2 pass	2 pass	2 pass	both
Relocatable assembler (yes, no)	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	no
Minimum core size necessary to use this relocatable assembler	8K	4K	4K	4K	—	4K	4K	8K	8K	4K	4K	4K	—
Macro assembler capability	yes	yes	no	yes	no	yes	no	no	yes	no	no	no	no
Compilers available (specify explicitly, e.g., Fortran II, IV, ASA Basic Fortran, etc.)	Fortran IV	Fortran IV	none	ASA Basic Fortran	none	none	Fortran IV	Fortran IV	ASA Basic Fortran Fortran IV	Algol, ASA Basic Fortran	Algol, ASA Basic Fortran	Algol, ASA Basic Fortran	none
Conversational compilers (e.g., FOCAL, BASIC, CAL, etc.)	FOCAL	none	none	none	none	none	CHAT	DOI	none	BASIC	BASIC	BASIC	none
Real-time executive monitor available (yes, no)	yes	yes	no	yes	no	no	no	no	yes	no	no	yes	no
Disc operating system available (yes, no)	yes	yes	no	yes	no	no	no	yes	yes	no	yes	yes	yes
BASIC MAINFRAME COSTS													
Basic system price with 4K words including power supplies	N/A	$19,000	$11,900	$29,000	$ 7,600	$13,900	$12,800	$26,500	N/A	$ 9,950	$14,500	N/A	$15,700
Price of ASR-33 Teletype (if not already included in Basic System Price)	—	$ 900	$ 1,900	$ 6,000 (ASR-35)	$ 1,400	$ 2,000	$ 1,200	$ 1,200	—	$ 2,000	$ 2,000	—	$ 1,200
Total system price, including ASR-33 Teletype and CPU	—	$19,900	$13,800	$35,000 (ASR-35)	$ 9,000	$15,900	$14,000	$27,700	—	$11,950	$16,500	—	$16,900
Basic system price with 8K words including adequate power supplies, enclosure, control panel	$35,000	$25,000	$17,900	$37,000	$10,885	$20,400	$18,600	$35,500	$46,000	$13,950	$19,500	$24,000	$23,700
Price of ASR-33 Teletype (if not already included in Basic System Price)	Included	$ 900	$ 1,900	$ 6,000 (ASR-35)	$ 1,400	$ 2,000	$ 1,200	$ 1,200	$ 3.100	$ 2,000	$ 2,000	$ 2,000	$ 1,200
Total system price including ASR-33 Teletype and CPU	$35,000	$25,900	$19,800	$43,000 (ASR-35)	$12,285	$22,400	$19,800	$36,700	$49,100	$15,950	$21,500	$26,000	$24,900
PERIPHERALS AVAILABLE													
Magnetic tape available (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Approximate price for operational unit (including controller, computer options necessary, etc.)	$22,000 to $23,000	$22,000 to $23,000	$ 5,700 to $10,000	$22,500	$12,000	$19,500	$12,000	$30,000 to $32,000	$35,200 to $67,200	$12,500 to $15,000	$15,500 to $21,500	$15,500 to $21,500	$23,355 to $35,430
Mass storage device available (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes
Approximate price of operational unit (including controller, computer options necessary, etc.)	$ 9,750	$ 9,750	$ 6,500 to $ 9,950	$27,500	$ 6,500 to $ 9,250	$18,000 to $45,000	$15,000	$24,500	$20,200 to $54,700	—	$26,500 to $31,500	$26,500 to $31,500	$22,300 to $36,000
High speed paper tape reader (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Speed (char/sec)	300	300	300	350	300/150	300	300	300	300	300	300	300	300
Approximate price of operational unit	Included	Combination $ 4,800	$ 2,200	$ 4,500	$2,650/$2,150	$ 2,000	$ 2,500	Combination $ 8,400	Combination $10,100	$ 2,100	$ 2,100	$ 2,100	$ 3,800
High speed paper tape punch (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Speed (char/sec)	50	50	60	120	63.3	120	120	120	60	120	120	120	110
Approximate price of operational unit	Included	Combination $ 4,800	$ 3,300	$ 5,100	$ 2,200	$ 4,000	$ 4,000	Combination $ 8,400	Combination $10,100	$ 4,100	$ 4,100	$ 4,100	$ 4,500

NOTE: N/A = Not Announced—or Not Available

MANUFACTURER/MODEL NUMBER	Honeywell DDP-516	Information Technology, Inc. ITI-4900 (Model 20)	Interdata Model 3	Interdata Model 4	IBM 1130	IBM 1800	Lockheed Electronics MAC-16	Raytheon 703	Raytheon 706	Scientific Control Corp. 4700	Scientific Data Systems Sigma 2	Systems Engineering Laboratories 810A	Systems Engineering Laboratories 810B
MEMORY													
Memory cycle time (us)	0.96	0.975/1.75	.980/1.5	.980/1.5	2.2/3.6	2/4	1	1.75	0.9	.920	.9	1.75	.750
Memory word length (bits)	16	16	16	16	16	16	16	16	16	16	16	16	16
Minimum memory size (words)	4K	4K	2K	2K	4K	4K	4K	4K	4K	4K	8K	4K	8K
Memory increment size (words)	4K	4K	2K, 4K	2K, 4K	4K	4K	4K	4K	4K	4K	4K	4K	8K
Maximum memory size (words)	32K	32K	32K	32K	32K	32K	65K	32K	32K	65K	65K	32K	32K
Parity check (std., opt., no)	opt.	opt.	opt.	opt.	std.	std.	opt.	no	opt.	opt.	std.	opt.	std.
Memory protect (std., opt., no)	opt.	opt.	opt.	opt.	no	std.	opt.	no	opt.	opt.	opt.	opt.	opt.
CPU FEATURES													
Instruction word length (s)	16/32	16/32	16/32	16/32	16/32	16/32	16	16	16	16/32	16	16	16
Number of accumulators (or general purpose registers that can be used as accumulators)	2	8	16	16	2	2	1	1	1	3	2	2	2
Number of hardware registers (not including index registers)	5	16	18	33	7	7	6	6	6	10	6	2	2
Number of index registers (indicate whether they are hardware, memory or other techniques)	1 hardware	6 hardware	15	15	3 memory	3 hardware	4 memory	1 hardware	1 hardware	1 hardware	2 hardware	1 hardware	2 hardware
How many bits for operation code	5	8	8	8	5	5	4	4	4	4/9	4	4	4
How many bits for address modes	2	2	2	2	2	2	3	1	1	3	4	2	2
Number of addressing modes	4	4	3	3	3	3	8	2	2	5	16	4	4
How many bits for address	9/14	6/16	6/16	6/16	9/16	9/16	9	11	11	9/16	8	10	10
In this machine one can directly address_____words in _____us and indirectly address_____words in _____us	1,024 0.96 32K 1.92	32,768 .975/1.75 32K 1.95/3.5	32,768 0.98/1.5 — —	32,768 0.98/1.5 — —	32,768 2.2 32K 2.2	32,768 2.0 32K 2.0	512 2.0 65K 3.0	32,768 3.5 — —	32,768 1.8 — —	32,768 .92 65K 1.84	1,024 .9 65K 1.8	1,024 1.75 32K 3.5	1,024 .750 32K 1.5
Indirect addressing (multi-level, single-level, no)	Multi-level	Multi-level	no	no	Single-level	Single-level	Multi-level	no	no	Single-level	Single-level	Multi-level	Multi-level
ARITHMETIC OPERATIONS													
Store time for full word (us)	1.92	1.95/3.5	6.0	6.0	4.64	4.25	2.0	3.5	1.8	1.84	2.2	3.5	1.50
Add time for full word (us)	1.92	1.95/3.5	3.2	3.2	4.88	4.25	2.0	3.5	1.8	1.84	2.2	3.5	1.50
Fixed-point hardware mult/divide (std., opt., no)	opt.	opt.	opt.	opt.	std.	std.	opt.	opt.	opt.	opt.	opt.	std.	std.
Multiply time—hardware (us)	5.28	10	23	23	15.67	15.25	9	12.25-17.5	6.3 to 9.0	6.44	10.3	7	4.5
Divide time—hardware (us)	10.00	25	38	38	46.36	42.75	12	24.0	9.0	6.90	10.8	10.5	8.25
Multiply time—software (us)	154.6	50	900	900	—	—	150	147	75	—	103	—	—
Divide time—software (us)	220.8	100	1,020	1,020	—	—	300	299.25	154	—	297	—	—
I/O CAPABILITY													
Data path width (bits)	16	16	8	8	16	16	16	16	16	8/16	8	16	16
Direct memory access (DMA) channel (std., opt., no)	opt.	opt.	opt.	opt.	std.	std.	opt.	opt.	opt.	opt.	std.	opt.	opt.
Maximum DMA word transfer rate	1 MHZ	1 MHZ	450 KHZ	450 KHZ	460 KHZ	500 KHZ	800 KHZ	571 KHZ	1.1 MHZ	1.1 MHZ	200 KHZ	572 KHZ	1.33 MHZ
Number of external priority interrupt levels provided in basic system	2	8	2	2	6	12	4	1	1	2	2	3	3
Maximum number of external interrupts	48	256	255	255	96	384	64	16	16	256	132	96	96
Response time (us) including time to save registers of interrupted program and initiate new program execution	9.6	5.0	9.0-16.0	9.0-16.0	100.0	100.0	6.0	5.25	2.7	7.36	6.0	10.5	6.75
OTHER FEATURES													
Power failure protect (std., opt., no)	std.	opt.	opt.	opt.	no	opt.	opt.	opt.	opt.	std.	opt.	std.	std.

MANUFACTURER/MODEL NUMBER	Honeywell DDP-516	Information Technology, Inc. ITI-4900 (Model 20)	Interdata Model 3	Interdata Model 4	IBM 1130	IBM 1800	Lockheed Electronics MAC-16	Raytheon 703	Raytheon 706	Scientific Control Corp. 4700	Scientific Data Systems Sigma 2	Systems Engineering Laboratories 810A	Systems Engineering Laboratories 810B
Automatic restart after power failure (std., opt., no)	opt.	opt.	opt.	opt.	no	opt.	opt.	std.	std.	opt.	opt.	opt.	opt.
Real-time clock or internal timer (std., opt., no)	opt.	opt.	opt.	opt.	no	std.	opt.	opt.	opt.	opt.	opt.	opt.	opt.
SOFTWARE													
Assembler (1 pass, 2 pass, both)	both	1 pass	both	both	2 pass	2 pass	2 pass	both	both	2 pass	2 pass	2 pass	2 pass
Relocatable assembler (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Minimum core size necessary to use this relocatable assembler	N/A	4K	4K	4K	4K	4K	4K	8K	8K	4K	8K	8K	8K
Macro assembler capability	no	yes	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes
Compilers available (specify explicitly e.g., Fortran II, IV, ASA Basic Fortran, etc.)	Fortran IV	Fortran IV	none	none	ASA Basic Extended Fortran	ASA Basic Extended Fortran	ASA Standard Fortran IV	Fortran IV Fortran ASA Basic	Fortran IV ASA Basic Fortran	ASA Basic Fortran Fortran IV	Fortran IV ASA Basic Fortran	Fortran IV	Fortran IV
Conversational compilers (e.g., FOCAL, BASIC, CAL, etc.)	Fortran IV BASIC	none	Fortran	Fortran	APL	none	none	none	none	none	none	none	none
Real-time executive monitor available (yes, no)	yes	yes	no	no	no	yes	no	yes	yes	yes	yes	no	yes
Disc operating system available (yes, no)	yes	no	no	no	yes	yes	no	yes	yes	yes	yes	yes	yes
BASIC MAINFRAME COSTS													
Basic system price with 4K words including power supplies	$23,800	$ 9,950	$10,800	$13,800	$25,880	$47,300	$11,950	$15,000	$19,000	$14,800	N/A	$18,000	N/A
Price of ASR-33 Teletype (if not already included in Basic System Price)	$ 1,200	$ 2,500	$ 1,900	$ 1,900	Included	$ 2,930	Included	Included	Included	$ 1,700	—	Included	—
Total system price, including ASR-33 Teletype and CPU	$25,000	$12,450	$12,700	$15,700	$25,880	$50,230	$11,950	$15,000	$19,000	$16,500	—	$18,000	—
Basic system price with 8K words including adequate power supplies, enclosure, control panel	$31,800	$15,950	$17,700	$20,700	$34,030	$55,700	$15,900	$23,000	$24,600	$22,300	$34,000	$23,000	$30,000
Price of ASR-33 Teletype (if not already included in Basic System Price)	$ 1,200	$ 2,500	$ 1,900	$ 1,900	Included	$ 2,930	Included	Included	Included	$ 1,700	$ 7,000 (ASR-35)	Included	Included
Total system price including ASR-33 Teletype and CPU	$33,000	$18,450	$19,600	$22,600	$34,030	$58,630	$15,900	$23,000	$24,600	$24,000	$41,000 (ASR-35)	$23,000	$30,000
PERIPHERALS AVAILABLE													
Magnetic tape available (yes, no)	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
Approximate price for operational unit (including controller, computer options necessary, etc.)	$23,355 to $35,430	$18,000	$ 9,900	$ 9,900	—	$15,620	N/A	$10,500 to $28,000	$10,500 to $28,000	$24,000	$25,000	$24,000	$24,000
Mass storage device available (yes, no)	yes	N/A	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes
Approximate price of operational unit (including controller, computer options necessary, etc.)	$22,300 to $36,000	—	$17,400	$17,400	Included	$13,500	—	$21,500	$21,500	$19,500	$26,000	$30,000	$30,000
High speed paper tape reader (yes, no)	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	yes
Speed (char/sec)	300	300	300	300	60	—	300	300	300	300	300	300	300
Approximate price of operational unit	$ 3,800	$ 2,500	$ 2,500	$ 2,500	$ 1,720	—	N/A	$ 3,300	$ 3,000	$ 3,000	Combination $12,000	$ 4,000	$ 4,000
High speed paper tape punch (yes, no)	yes	yes	yes	yes	no	no	yes	yes	yes	yes	yes	yes	yes
Speed (char/sec)	110	50	60	60	—	—	60	110	110	120	120	100	100
Approximate price of operational unit	$ 4,500	$ 3,000	$ 3,800	$ 3,800	—	—	N/A	$ 4,200	$ 4,000	$ 4,000	Combination $12,000	$ 4,000	$4,000

NOTE: N/A = Not Announced—or Not Available

MANUFACTURER/MODEL NUMBER	Tempo Computers, Inc. Tempo 1	Varian 620 i	Digital Equipment Corp. LINC-8	Digital Equipment Corp. PDP 8/1	Digital Equipment Corp. PDP 8/L	General Automation SPC-12	Motorola MDP-1000	Spear Computers, Inc. Micro Linc	Business Information Technology 480/482	Computer Automation PDC-808	Data Technology DT-1600	General Automation SPC-8	Varian 520 i
MEMORY													
Memory cycle time (us)	0.9	1.8	1.5	1.5	1.6	2.0	2.16	1	3.0	8.0	8.0	2.0	1.5
Memory word length (bits)	16	16/18	12	12	12	8	8	12	8	8	8	8	8
Minimum memory size (words)	4K	4K	4K	4K	4K	4K	4K	4K	1K	4K	4K	4K	4K
Memory increment size (words)	4K	4K	4K	4K	4K	4K	4K	4K	1K, 2K, 4K	4K	4K	4K	4K
Maximum memory size (words)	65K	32K	32K	32K	8K	16K	16K	32K	65K	16K	16K	8K	32K
Parity check (std., opt., no)	opt.	opt.	opt.	opt.	opt.	opt.	no	opt.	opt.	no	no	opt.	opt.
Memory protect (std., opt., no)	opt.	opt.	no	std.	std.	no	no	no	no	no	opt.	no	std.
CPU FEATURES													
Instruction word length (s)	16/32	16/32	12	12/24	12/24	8, 12, 16	12	12	8/16	8/16	8/16	8, 12, 16	8/16
Number of accumulators (or general purpose registers that can be used as accumulators)	2	2	2	1	1	4	6	1	1	1	1	2	7
Number of hardware registers (not including index registers)	7	6	10	4	4	8	9	12	8	8	8	6	7
Number of index registers (indicate whether they are hardware, memory or other techniques)	1 hardware	2 hardware	8 memory	8 memory	8 memory	3 hardware	3 hardware	16 memory	none	none	none	1 hardware	1 hardware
How many bits for operation code	4	4	2, 3, 7	3	3	8	8	7	8	6	4	8, 12	3
How many bits for address modes	3	3	3	1	1	3	3	5	none	2	2	3	3
Number of addressing modes	8	4	6	2	2	5	6	4	1	4	2	4	5
How many bits for address	9/16	9/11	12, 10, 8, 4	8/15	8/13	12	12	12	8/16	8	8	12	15
In this machine one can directly address_____words in	512	2,048	1,024	256	256	4,096	4,096	1,024	256	512	512	4,096	4,096
_____us and indirectly address_____words in	0.9 65K	3.6 32K	3.0 4K	1.9 32K	1.6 8K	4.2 4K	4.32 4K	2.0 1K	3.0 65K	24.0 16K	16.0 16K	4.2 4K	2.5 32K
_____us	1.8	5.4	4.5	3.0	3.2	6.3	10.8	3.0	23.25	40.0	32.0	6.3	5.25
Indirect addressing (multi-level, single-level, no)	Multi-level	Multi-level	Single-level	Single-level	Single-level	Single-level	Single-level	Single-level	Single-level	Multi-level	Multi-level	Single-level	Multi-level
ARITHMETIC OPERATIONS													
Store time for full word (us)	1.8	3.6	3.0	3.0	3.2	4.2	4.32	2.0	14.25	24.0	24.0	4.2	4.5
Add time for full word (us)	1.8	3.6	3.0	3.0	3.2	4.2	4.32	2.0	14.25	24.0	24.0	4.2	4.5
Fixed-point hardware mult/divide (std., opt., no)	opt.	opt.	mult.-std. div.-opt.	opt.	no	no	no	mult.-std. div.-no	opt.	no	no	no	no
Multiply time—hardware (us)	7	10	34	N/A	—	—	—	14	N/A	—	—	—	—
Divide time—hardware (us)	9	10-14	37	N/A	—	—	—	—	N/A	—	—	—	—
Multiply time—software (us)	—	200	—	360	360	N/A	N/A	300	N/A	1,100	1,200	400	N/A
Divide time—software (us)	—	200	460	460	460	N/A	N/A	1700	N/A	1,880	1,500	500	N/A
I/O CAPABILITY													
Data path width (bits)	8/16	16/18	12	12	12	8/12	12	12	8	8	8	8/12	8/16
Direct memory access (DMA) channel (std., opt., no)	opt.	opt.	std.	opt.	opt.	opt.	opt.	std.	std.	no	no	opt.	opt.
Maximum DMA word transfer rate	800 KHZ	200 KHZ	666 KHZ	666 KHZ	625 KHZ	430 KHZ	430 KHZ	1 MHZ	250 KHZ	—	—	430 KHZ	660 KHZ
Number of external priority interrupt levels provided in basic system	4	none	1	1	1	2	1	1	1	3	3	2	3
Maximum number of external interrupts	256	64	1	64	64	256	64	1	1	64	32	256	11
Response time (us) including time to save registers of interrupted program and initiate new program execution	3.6	N/A	14.0	14.0	18.6	20.0	N/A	8.0	50.0	88.0	32.0	20.0	1.5
OTHER FEATURES													
Power failure protect (std., opt., no)	std.	opt.	opt.	opt.	opt.	opt.	opt.	std.	opt.	opt.	opt.	opt.	opt.

MANUFACTURER/MODEL NUMBER	Tempo Computers, Inc. Tempo 1	Varian 620 i	Digital Equipment Corp. LINC-8	Digital Equipment Corp. PDP 8/1	Digital Equipment Corp. PDP 8/L	General Automation SPC-12	Motorola MDP-1000	Spear Computers, Inc. Micro Linc	Business Information Technology 480/482	Computer Automation PDC-808	Data Technology DT-1600	General Automation SPC-8	Varian 520 i
Automatic restart after power failure (std., opt., no)	opt.	opt.	opt.	opt.	opt.	opt.	opt.	no	opt.	opt.	opt.	opt.	opt.
Real-time clock or internal timer (std., opt., no)	opt.	opt.	opt.	opt.	opt.	std.	std.	opt.	opt.	opt.	opt.	std.	opt.
SOFTWARE													
Assembler (1 pass, 2 pass, both)	both	2 pass	both	both	both	1 pass	2 pass	2 pass	3 pass	2 pass	2 pass	1 pass	2 pass
Relocatable assembler (yes, no)	yes	no	yes	yes	yes	yes	yes	no	no	no	yes	yes	yes
Minimum core size necessary to use this relocatable assembler	4K	—	8K	8K	8K	4K	4K	—	—	—	4K	4K	4K
Macro assembler capability	yes	no	yes	yes	yes	no	yes	no	no	no	no	no	no
Compilers available (specify explicitly, e.g., Fortran II, IV, ASA Basic Fortran, etc.)	ASA Basic Fortran	Fortran II	Fortran II Algol	Fortran II Algol	Fortran II Algol	none	none	none	ASA Basic Fortran	none	none	none	none
Conversational compilers (e.g., FOCAL, BASIC, CAL, etc.)	none	none	BASIC FOCAL LAP-6	FOCAL BASIC	FOCAL BASIC	no	no	no	no	no	no	no	no
Real-time executive monitor available (yes, no)	no	no	no	no	no	yes	yes	yes	yes	no	no	yes	no
Disc operating system available (yes, no)	no	no	yes	yes	yes	no	no	no	no	no	yes	no	no
BASIC MAINFRAME COSTS													
Basic system price with 4K words including power supplies	$15,000	$12,100	$38,500	$12,800	$ 8,500	$ 6,400	$ 8,500	$46,500*	$ 9,310	$ 6,600	$ 6,600	$ 6,400	$ 7,500
Price of ASR-33 Teletype (if not already included in Basic System Price)	Included	$ 1,800	Included	Included	Included	$ 1,100	$ 1,200	Included	Included	$ 1,500	$ 1,900	$ 1,100	$ 1,400
Total system price, including ASR-33 Teletype and CPU	$15,000	$13,900	$38,500	$12,800	$ 8,500	$ 7,500	$ 9,700	$46,500*	$ 9,310	$ 8,100	$ 8,500	$ 7,500	$ 8,900
Basic system price with 8K words including adequate power supplies, enclosure, control panel	$19,000	$18,500	$47,500	$16,30	$13,200	$ 9,600	$11,500	$56,500*	$11,250	$ 8,800	$ 8,800	$ 9,600	$10,000
Price of ASR-33 Teletype (if not already included in Basic System Price)	Included	$ 1,800	Included	Included	Included	$ 1,100	$ 1,200	Included	Included	$ 1,500	$ 1,900	$ 1,100	$ 1,400
Total system price including ASR-33 Teletype and CPU	$19,000	$20,300	$47,500	$16,300	$13,200	$10,700	$12,700	$56,500*	$11,250	$10,300	$10,700	$10,700	$11,400
PERIPHERALS AVAILABLE													
Magnetic tape available (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Approximate price for operational unit (including controller, computer options necessary, etc.)	$12,000	N/A	$24,700	$24,700	$24,700	$11,000	N/A	N/A	$18,700 to $22,500	$ 5,700 to $10,000	$ 9,950	$ 9,800	$ 9,000
Mass storage device available (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Approximate price of operational unit (including controller, computer options necessary, etc.)	N/A	N/A	$ 6,000	$ 8,700 to $15,700	$ 8,700 to $15,700	$ 6,000 to $15,000	N/A	N/A	$ 7,390	$16,500 to $ 9,950	$10,000	$ 6,000 to $15,000	N/A
High speed paper tape reader (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Speed (char/sec)	300	300	300	300	300	300	300	300	300	300	300	300	300
Approximate price of operational unit	N/A	N/A	$ 2,500	$ 2,000	$ 2,000	$ 3,000	N/A	N/A	$ 2,300	$ 2,200	$ 3,300	$ 3,000	$ 2,900
High speed paper tape punch (yes, no)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Speed (char/sec)	60/120	60/120	50	50	50	120	120	120	60	60	60	60/120	60
Approximate price of operational unit	N/A	N/A	$ 2,000	$ 2,000	$ 2,000	$ 4,000	N/A	N/A	$ 3,000	$ 3,300	$ 2,900	$3,600-$4,000	$ 3,300

NOTE: N/A = Not Announced—or Not Available

*Price includes 2 mag tapes and crt with keyboard

The two-f

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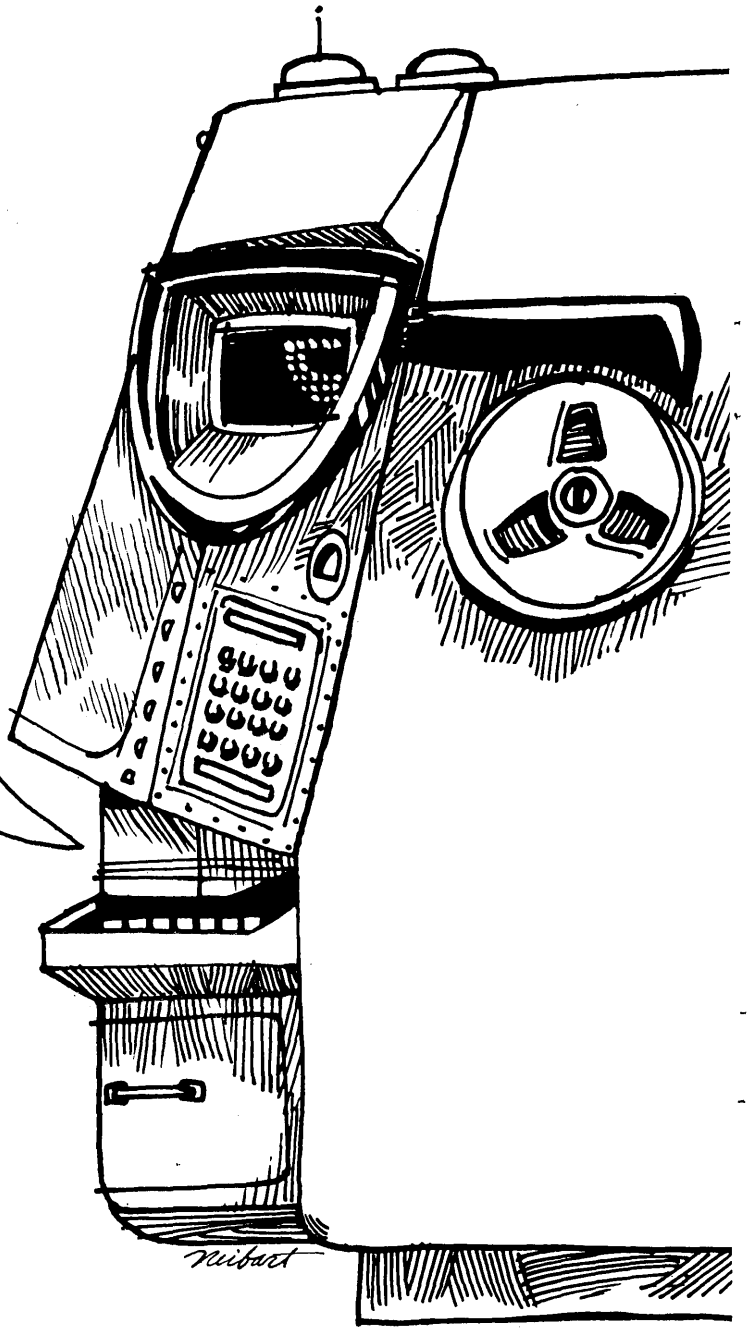
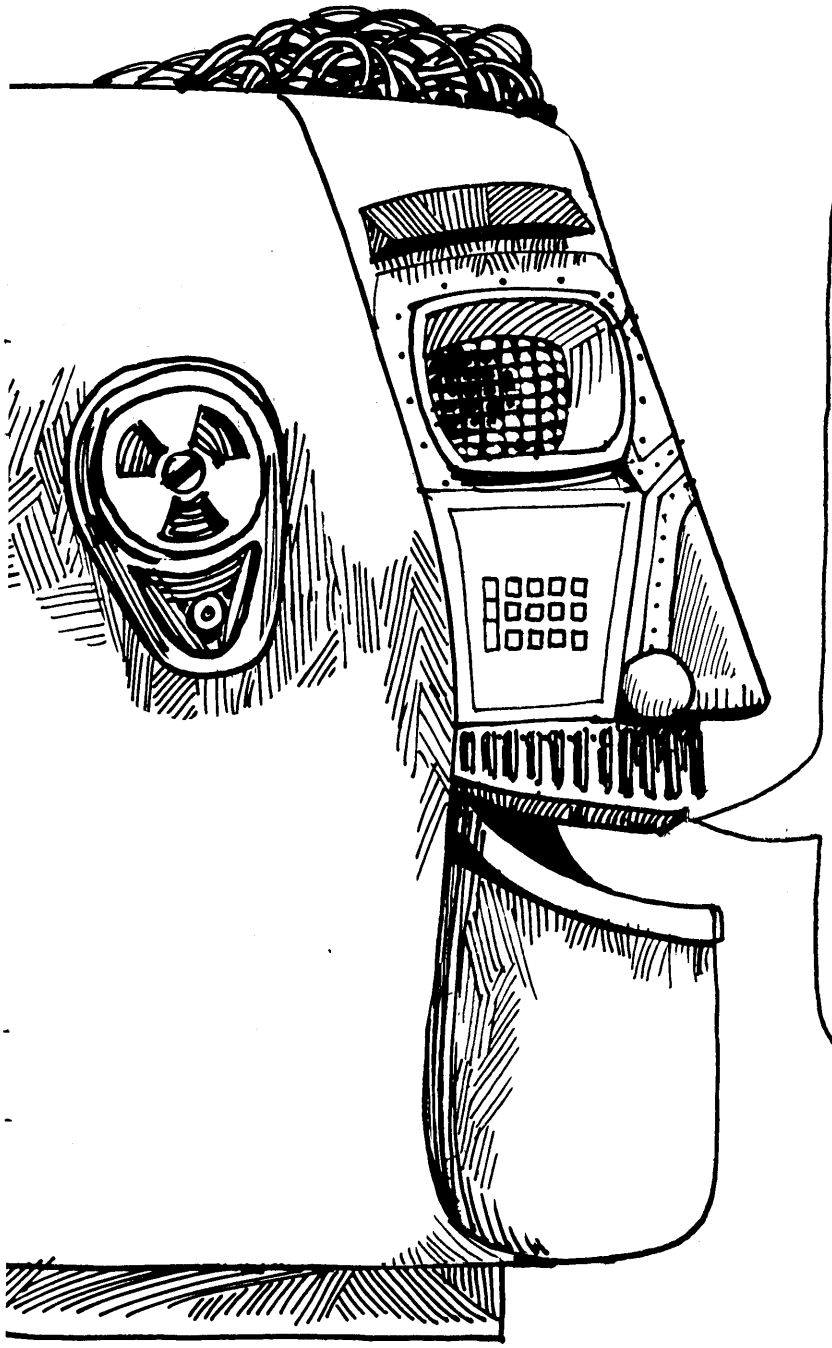


aced 200



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the external device, etc. A channel with minimum programming overhead is sometimes referred to as an automatic channel. It is fully buffered, meaning each channel has two registers associated with it which hold the necessary data and control information so that the cpu is not tied up waiting for the data transfer. Buffering permits several I/O channels to operate concurrently.

As an option, most of these machines offer some type of I/O channel that permits very high speed data transfers. The basic approach used to achieve these high speeds is to bypass the cpu and directly access the memory bus. This type of channel is most commonly called a direct memory access (DMA) channel. Here again, gaining the speed advantage costs hardware to provide the necessary start address and word count needed to perform the data transfer independently of the cpu. This type of channel provides word transfer rates approaching the maximum data transfer rate of the computer's main memory.

A program interrupt feature of one kind or another is necessary to initiate data transfers between external devices and the computer. External interrupts are used in almost every real-time application. Internal interrupts are usually provided for power fail, memory parity fail, and other alarm signals generated internal to the computer. The typical interrupt system consists of a single interrupt line on which multiple interrupt sources can be connected. The interrupt initiates the transfer of the contents of the program counter and prescribed registers to memory and transfers control to a software routine that initiates the new program to be executed. Most real-time systems require a multilevel priority interrupt to handle several devices. These priorities can be evaluated in software or hardware. The hardware approach costs more but results in much shorter response times and reduced storage requirements. Some of the more sophisticated interrupt systems permit each interrupt level to be individually disarmed (to not allow that interrupt) and/or to be disabled (to defer a response for the time being). These features are under program control and implemented in hardware.

A real-time clock provides immediate access to current timing information used to control and synchronize operations in a real-time environment. It facilitates keeping track of the time since a given event was initiated and can provide the time of day. The clock is basically a number of counter stages; the number required varies with the degree of resolution desired. Power failure protection and automatic restart provide for a safe nondestructive shut-down, in case of power failure, and automatic restart when conditions have returned to normal.

software

There is speculation that the small computer (8-, 12-, 16- and 18-bit machines) market may well be the first major segment of the computer industry in which most of the software is sold separately from the hardware. Since the overriding trend in the small computer market is to minimize basic mainframe costs, with many features optional, separate pricing of software becomes a real temptation to the manufacturer. Assembly programs might normally be included in the mainframe price, but higher level languages (e.g., FORTRAN) and special-purpose applications software might easily be priced separately. This is a potential advantage to the user who may not need many of the software packages.

The most important software for these machines is the assembler. The state of the art in assemblers has advanced significantly over the last few years. Three or four years ago

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How does Keytape do it?
Send me your 40 page description manual and tell me where I can see a demonstration.

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Send me a Keytape salesman, NOW.

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implementing a macro-assembler in 3,000 bytes of memory seemed impossible, but this has now been accomplished. For a small computer it is very important to have an assembler that allows the programmer:
Ease of coding in the assembly language
Minimum time and effort to debug programs
Efficient I/O and program linkage operations
Minimum housekeeping tasks
In evaluating assemblers, one should consider the core size required for the assembler, how many symbols can be handled in the symbol table (because this places an upper limit on the programs and program size is usually more important than speed), and whether the assembler generates relocatable code in the memory size provided.

The binary machine code produced by an assembler can be absolute or relocatable. Absolute code refers to specific memory locations, whereas relocatable code allows a program to be loaded into any convenient set of available memory locations. A relocatable assembler is one that can generate relocatable code. A routine, commonly called a relocatable loader, assigns the available absolute memory addresses to the program prior to execution. The loader provides certain basic functions:

1. It loads the program into memory.
2. It allocates memory space for all necessary subroutines associated with this program.
3. It links these subroutines together so they can be properly executed in the main program.

Some of the small computers have relocatable assemblers that can operate within a 4,096-word memory, but most relocatable assemblers require 8,192 words. In small memory configurations where only one dedicated program is to be continually run, a relocatable feature is not really necessary, but in larger systems where many programs are run this feature is particularly attractive.

Both one-pass and two-pass assemblers are used. A pass refers to the assembler scanning the source program. A one-pass assembler does not require the source program to be reloaded, thus saving time, but it has the limitation of allocating storage (symbol tables, etc.) at the beginning of the program and has no means of providing forward references. A two-pass assembler allocates storage and sets up proper address reference label tables on the first pass. On the second pass it generates the basic machine code. One minor point of confusion might arise on the number of passes in a computer system that has a disc memory since when using a two-pass assembler the program need only be loaded once from paper tape or punched card and is then reloaded from the disc. The number of passes refers to the number of times the assembler scans the source program, which is not necessarily the same as the number of times the program is read in from the peripheral input device. When the ASR-33 Teletype is used for program tape input and listing output, three passes are required because the ASR-33 does not punch binary and print out ASCII concurrently. The ASR-35 Teletype does not have this limitation.

One convenient feature in many assemblers is the provision for pseudo-operation codes. This makes it easier for the programmer to reserve memory locations for constants. The pseudo op code is not a machine instruction but an instruction to the assembler itself. Another popular assembler feature, not always found in these small-word-length computers at present, is the provision for macro-operations. Macro capability allows the programmer to define a set of instruc-

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tions by name along with specifying desired variables as arguments. This facilitates the inclusion of often-used code sequences with a minimum of effort. A macro differs from a subroutine in that it is assembled every time it is called, but there is less linkage overhead involved. Although the subroutine is only assembled once, it requires the loader to supply the proper addresses and linkage. Macros are primarily used with higher-level languages, and they permit the user to execute these higher-level-language programs on other machines with a minimum of reprogramming. In the future, it seems likely that more of the assemblers for small computers will have simulator programs written for them so that programmers can debug their programs on a larger computer that might be more readily available.

Compiler languages are used infrequently in real-time applications of small-word-length computers because the input/output subroutine must be closely tailored to the specific characteristics of the external device when interfacing to external hardware. Tight timing requirements and higher machine efficiency also frequently dictate the use of assembly language. Presently, no 8-bit machine has a compiler, but there is one under development. There are too many versions of FORTRAN available to itemize, but a user should note the differences if he plans to use FORTRAN on one of these small computers. Some compilers are implemented in a conversational (i.e., interactive) mode, where the user types in source statements on-line to the compiler, which immediately executes the program; but most compilers are designed for operation in the batch mode. One should be careful to note the amount of memory required to use any compiler. Compiler languages with the same name (i.e., FORTRAN) can vary greatly in memory requirements and other features. There are standard specifications for some of these languages but not all. The United States of America Standards Institute (formerly American Standards Association) has standards for FORTRAN, derived from FORTRAN IV, and for Basic FORTRAN, which is a compatible subset. Many other variations of FORTRAN have been developed by manufacturers but there is no real industry standard for these. Other languages (e.g., ALGOL, COBOL, etc.) are available for some small machines, and some of them meet specified standards while others do not.

A real-time executive monitor is a control program specifically designed to efficiently operate a real-time equipment configuration. The major functions of a real-time executive monitor are:
Input/output data transfers
Process interrupts
Memory allocation/protection
This type of monitor typically handles one dedicated real-time program. Most, but not all, of these small-word-length computers require optional hardware (such as DMA channel, additional interrupts, real-time clock, etc.) to implement a real-time monitor. Recently, real-time monitors have been designed to handle more than one program in a multiprogramming (often called foreground/background) environment. The foreground program has higher priority and may be a real-time program whereas the background programs are usually batch jobs (e.g., assemblies, compilations, etc.). Multiprogramming real-time monitors are being developed for longer word length (24, 32, 36 bits per word) computers. A few of the machines in this survey have (or manufacturers are developing) real-time monitors with some of this capability, but so far the real-time executive monitors written for this class of machines have been limited to handling one dedicated real-time application.

Real-time systems often require a disc memory for high speed data storage and retrieval. A resident executive program, sometimes called a disc operating system, enables efficient use of the disc.

Any operating system or executive monitor must be provided with a number of debugging and diagnostic routines. Diagnostic routines are necessary for the cpu, the memory, and the peripherals. This capability, which is most easily evaluated from experience, is very important for the user striving to maintain the highest possible machine utilization.

basic mainframe costs

Mainframe costs are shown in the table for 4,096-word and 8,192-word memory configurations, including an ASR-33 Teletype. In addition, prices for some of the standard peripherals are included along with the basic characteristics of each peripheral device. These prices supplied by the manufacturers are intended to include all the necessary equipment to make each peripheral device a fully operational unit, but these have not been verified in detail for each computer included.

One predominant trend lately in the small-word-length-computer market is to offer the lowest sales price possible for the minimum basic configuration and to price options separately. However, a few manufacturers include some of the options as a part of the basic minimum configuration price. The example shown in Table 2 of the variations in cost for a typical hardware configuration for machines X, Y, and Z dramatically illustrates that the computer with the lowest minimum system price is not necessarily the lowest in an expanded configuration.

	X	Y	Z
Basic mainframe with 4K memory/ASR-33	$14,000	$16,500	$19,800
4K memory expansion	$ 7,000	$ 6,000	$ 5,000
Power failure protect and automatic restart	$ 1,000	$ 500	Standard
Hardware multiply/divide	$ 4,000	$ 2,500	Standard
DMA channel	$ 3,000	$ 1,000	Standard
Real-time clock	$ 1,000	$ 500	Standard
Total	$30,000	$27,000	$24,800

Table 2.

A different application would require a different set of options, and thus the results would vary as a function of the system requirements. Hence, a user must base his selection of a computer on the exact hardware and software configuration needed for his specific application based on a careful analysis of his requirements.

In closing, a qualification and a disclaimer are required. First, it is impossible within the scope of an article of this type to cover all of the possible design considerations and alternatives in machine organization, optional features, and software techniques. For example, a complete discussion of the addressing techniques and the associated trade-offs in short-word-length computers could by itself require an article longer than this one. The same is certainly true for software considerations and optional features. Second, the information on the characteristics and prices of the different computers presented in the survey table are based on information supplied by the manufacturers in response to a detailed questionnaire. Considerable time has been spent in validating this information and trying to achieve consistency of interpretation, but the authors cannot vouch personally for the accuracy of every figure.

If this is the era of the minicomputer, is the bikini-computer next? With further advances in LSI semiconductor technology, the "computer on a chip" will eventually become a commercial reality. Unfortunately, there are no prospects for "peripheral equipment on a chip." ■

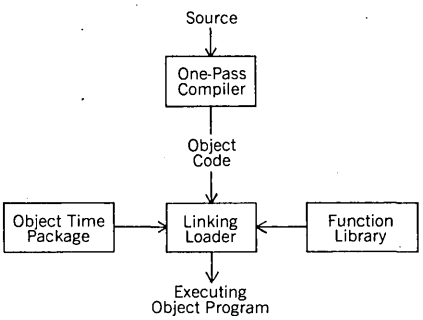
SMALL SINGLE PASS FORTRAN COMPILER SYSTEMS. DIGITEK IS THE COMPANY TO PRODUCE THEM.

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.

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COMPUTER GRAPHICS IN ELECTRONIC DESIGN

by FRANKLIN F. KUO, WALDO G. MAGNUSON, JR., and WILLIAM J. WALSH

In recent years, computer-aided analysis of electronic circuits has become a reality. Today, the computer is being used to considerable advantage in the following phases of electronic circuit design: (1) semiconductor device model investigations, (2) analysis and simulation of electronic circuits, (3) mask generation for integrated circuits, (4) circuit layout for printed circuits, and (5) determination and maintenance of manufacturing information such as parts lists and wiring schematics.[1] In this article, we shall concentrate only on those aspects which deal with on-line design. Our particular concern is that of using computer graphics as an input-output medium on the design process.

circuit analysis programs

Analysis, coupled with experimental investigation, is an important step in designing electronic circuits. In recent years, huge strides have been made in the field of circuit analysis by computer. Programs such as CIRCUS[1] and SCEPTRE[2] now exist which are capable of analyzing quite extensive circuits—say with 15 transistors and 20 diodes. These programs are, in essence, *circuit simulators*. An important part of these programs is the *mathematical models* of semiconductor devices. Since most of these devices are *nonlinear* in nature, the fidelity to which the computed results corroborate with physical measurements reflects the ability of these analysis programs to accurately model the devices and solve the associated nonlinear algebraic and differential equations. All of the programs contain *equation compilers* so that the network equations are automatically generated from a description of the circuit's topology, element kind, element values, and type of analysis desired (transient, frequency, dc, worst-case, etc.).

The way in which these programs are used in design is simple and straightforward. A trial design is formulated by the engineer. He then uses an analysis program to test his hypothetical design. If the response curve meets his original specifications, the design is completed. Otherwise, he changes certain parameters and repeats the process until the response does meet specifications. It is clear that if turnaround times are on the order of 24 hours or more then the computer's usefulness in iterative design is minimized if several trials are needed.

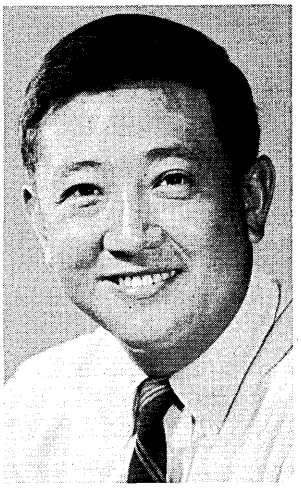
Time-sharing with its inherently short turnaround times has made circuit design by computer practical. The interaction between man and machine in a real-time dialogue makes possible the iterative design of circuits. The only drawback to on-line design is that great strain is placed upon input-output processes. Most of the analysis programs heretofore developed have been intended for batch processing. Consequently, their I/O formats are somewhat clumsy and inappropriate for on-line work.

In circuit design the natural "language" of the engineer is the schematic. Thus the communications medium between the engineer and the computer should be *graphic*. Ideally the engineer should present the computer with a circuit schematic and the computer, in turn, should return a set of response curves. This is what we have accomplished with the GINA (Graphical Input for Network Analysis) system.[2]

The GINA system uses a computer-controlled crt display, the dd80 (now identified as the CDC280) for on-line graphics communications. The display is tied to an IBM 7094 whose memory unit is shared with the display. All

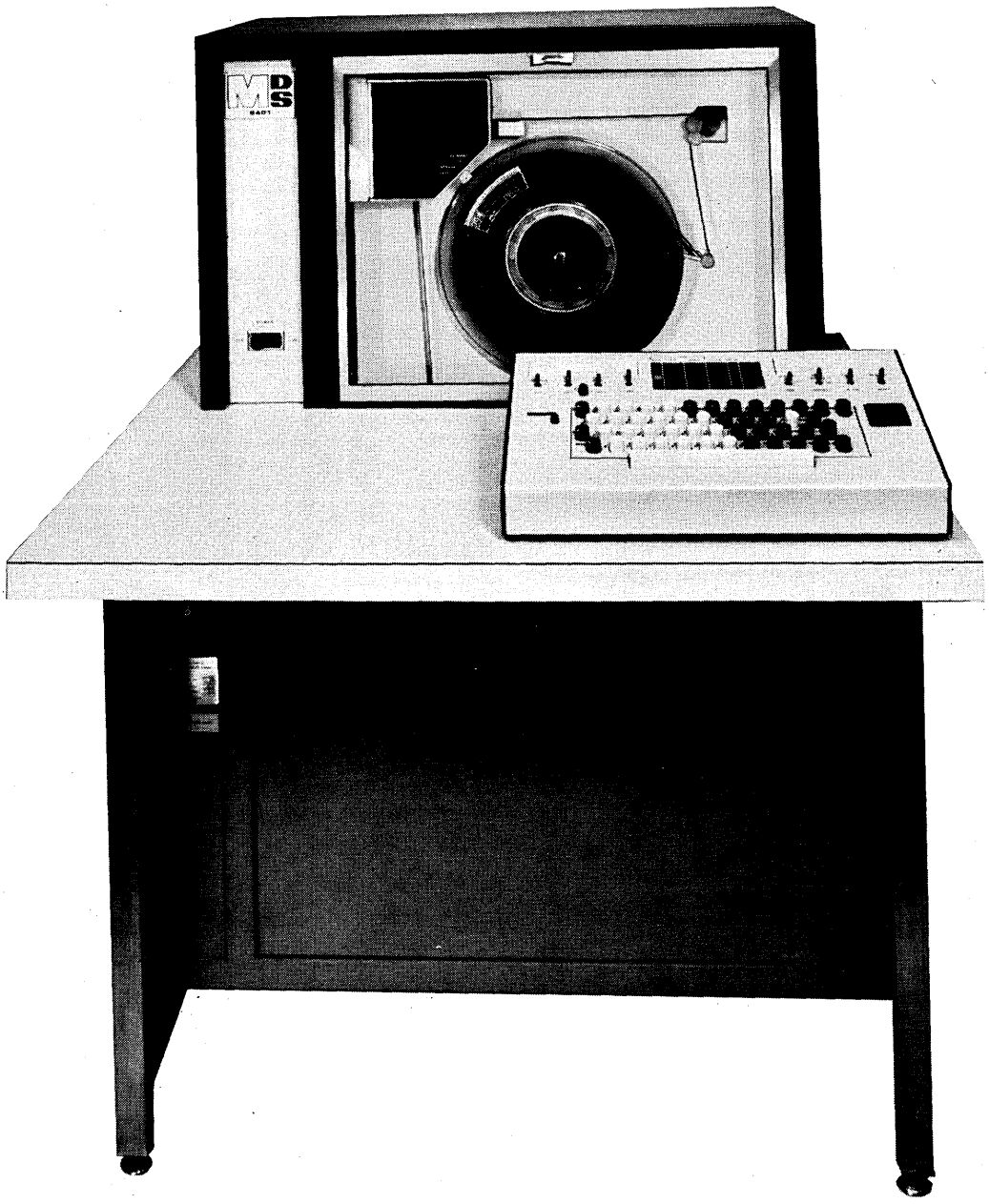
(Work performed under the auspices of the U.S. Atomic Energy Commission.)

1. A special issue of the IEEE Proceedings (November 1967) is devoted to articles on computer-aided design.
2. W. G. Magnuson, Jr., F. F. Kuo, and W. J. Walsh, "Graphic Input for Network Analysis," Chapter 11 of *Computer Oriented Circuit Design*, F. F. Kuo and W. G. Magnuson, Jr., (eds), Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968.

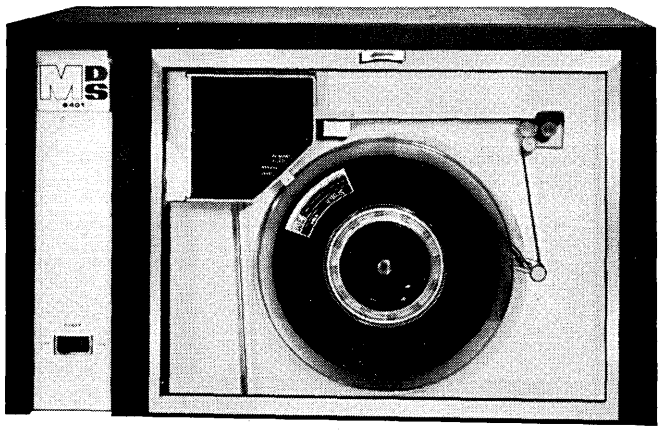


Dr. Kuo is professor of electrical engineering at the Univ. of Hawaii and a consultant to the electronics engineering department of the Lawrence Radiation Laboratory. He has also taught at the Polytechnic Institute of Brooklyn and the Univ. of Colorado and was a member of the systems research department of Bell Telephone Laboratories for six years.

If you have 25 of these...



you have 24 too many of these.



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graphic entities, "glyphs," are software-generated. In Fig. 1 we see a circuit being composed on the crt, using GINA. Sitting at the graphics console, the engineer enters his schematic using a light pen and a set of special-purpose graphic entities called *light buttons*. The crt face is divided into two areas: a *display area* at the center and a *control area* at the bottom. On the control area are displayed the light buttons, which may be sets of characters that allow the user to initiate certain actions such as ROTATE, COPY or CONNECT, or may be problem-oriented glyphs—in our case, the circuit elements—resistor, capacitor, inductor, diode, etc. The user initiates an action by pointing the light pen at the button, a move known as *picking*. Once a circuit element is picked, the designer can move this element to the display surface by means of a tracking cross and the light button, POSITION. The action buttons allow the designer to

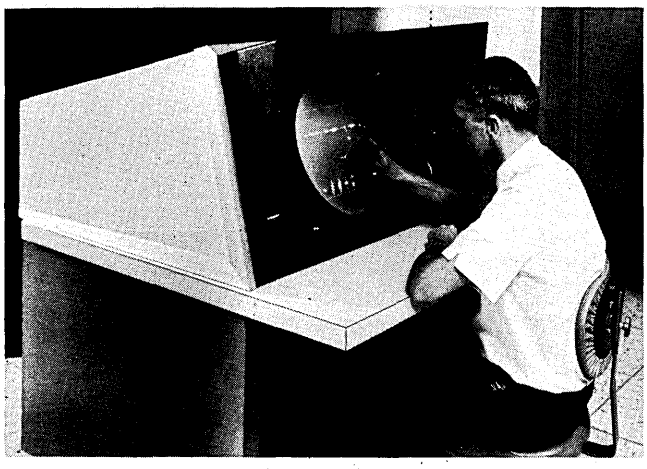


Fig. 1 Circuit designer at dd80 graphics console.

compose his circuit in a step-by-step manner. In a later section of this article, we will have more to say about the structure of GINA and about the way the light buttons are programmed. First let us examine some features of the software base under which GINA was programmed.

levels of graphic dp languages

An ideal graphical language should be flexible to the user, require a minimal amount of computer memory, and be adaptable to any computer system. The language should be *multilevel*. The low-level part of the language should have as its basis a set of subprograms to perform the most basic graphical functions (i.e., put a dot at the point (x,y), display a character on the crt, draw a vector from one point to another, etc.). The high-level part of the language should be FORTRAN compatible so that communication with the basic set would be by FORTRAN subroutine call.

The low-level graphics language must perform such functions as:

1. Given a picture or an object, display this on the crt.
2. Given an (x,y) coordinate pair, place the beam at the point.
3. Given a picture being displayed, destroy this picture or remove it from the crt, but retain the picture information.
4. Draw a line, create a letter, create strings of letters, etc.
5. Give names to and allocate storage for picture parts.
6. Enable and disable the beam.
7. Track the light pen.
8. Uniquely determine a picture part, when using the light pen.
9. Be able to recover coordinate positions of any given picture part.

The lowest or most primitive level of graphics language is the most hardware-dependent part of the language structure, but a surprising amount can be accomplished when it is used together with FORTRAN. If we assign Level 0 to this lowest level language, then a possible ordering of higher levels of structure are:

Level 0 Build display commands, control graphic I-O devices.
Level 1 Rotate, translate, chain lists, etc.
Level 2 Mathematics, computation.
Level 3 Specialized process languages (i.e., circuit design).

CALLIGRAPH is a level 0 graphics language developed at Lawrence Radiation Laboratory and implemented with an IBM 7094 and a dd80 display device.[3]

The principal concern of the graphic language is one of beam (light pen) and picture part control. The beam is controlled by the following set of subroutines:

RUN—The electron beam is controlled by this command. The beam can be ON, OFF, or ON for a specific time (i.e., number of display cycles) and then OFF.

LPEN—The light pen is enabled or disabled by this command.

TRACK, NTRACK—The tracking feature (i.e., the electron beam following the light pen) is enabled and disabled with these commands. The picture parts are controlled by another set of subroutines.

Dr. Magnuson is head of the special development group in the electronics engineering department at Lawrence Radiation Laboratory. He was previously an instructor in electrical engineering at Oregon State Univ. and with GE's Hanford Research Laboratory. He is now concerned with development of graphic input/output techniques for network design.

Mr. Walsh is now completing the requirements for a PhD in electrical engineering at the Univ. of California, Berkeley. He was an associate engineer for IBM at Poughkeepsie and worked on circuit development for the System/360. At Berkeley, he has established a computer-aided design facility used for research and classroom instruction.

3. K. R. Bertran and G. A. Michael, "Graphic Languages for Data Processing," Chapter 10 of *Computer Oriented Circuit Design*, ibid.

IGRAPH—Allocates the amount of storage to be set aside for the picture parts. It also determines where these parts are to be stored in memory.

NAME—Gives a unique name (for identification purposes) to a picture part.

IN-OUT-CLEAR—By these commands a picture is: (1) Added to the display list, (2) removed from the display list but still "remembered," (3) removed from the display list and all record of it destroyed.

STORE—A portion of a picture part is created by this command. To create an entire picture part would possibly require a series of these commands.

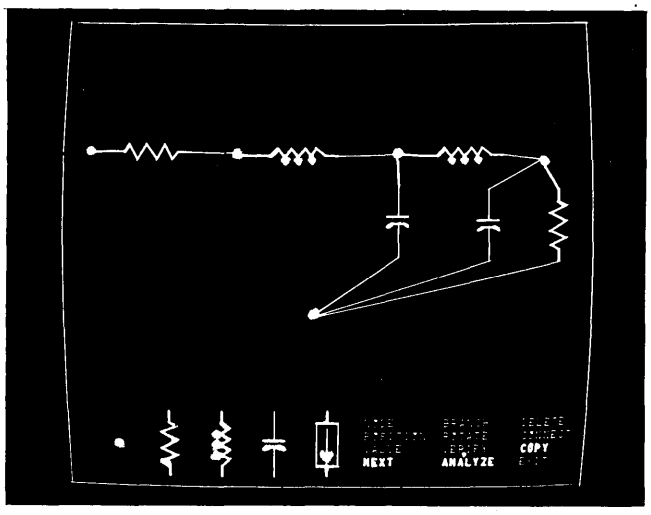


Fig. 2 Console close-up of GINA display.

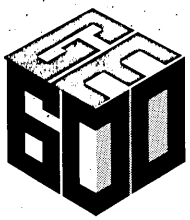
Regardless of the level of graphic language an applications program is written in, the result must be accommodated to the user and not the language. In a similar manner, in the case of electronic circuit design, the generation of the on-line network schematic must be convenient to the user and not to the program that performs the analysis.

The GINA system utilizes the low-level graphic language CALLIGRAPH outlined in the previous section. A console close-up of the graphic display is shown in Fig. 2. In the control area the set of light buttons is displayed that is used in constructing the circuit shown in the display area. The remainder of this section describes the operation and some of the reasoning behind the graphic portion of the program. Fig. 3 (see p. 78) shows the logical flow for the GINA program, and will be used to describe the program.

At the start, the control area of the crt display has two options active: NODE and EXIT. The process of creating the network in the display area is as follows: initially, NODE and EXIT are displayed at high intensity while all other light buttons are at normal intensity. The light pen will cause a program response only when it detects a "hit" of NODE or EXIT. When the light pen is placed anywhere on the word NODE, the intensities of all options become normal, and the node at the left of the control area becomes bright (high intensity). The change of intensities is an effective method of informing the user that something has occurred. The selective brightening of different options directs the user to the next step.

Next we pick the bright node which causes both a tracking cross to appear in the center of the display area and the option POSITION to become bright in the control area. Next, with the light pen, the tracking cross is moved to the appropriate position on the working area of the crt. Then the light pen is used to pick POSITION and a node is positioned

But it has other things on its mind.



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at the tracking cross and the cross disappears.

The next available options are NODE, DELETE, and EXIT, all displayed at high intensity. After two nodes are displayed, a BRANCH may be selected.

Once the BRANCH option is active and is picked, the flow goes as follows:

1. Select an element type (RLC or Source).
2. POSITION it on the crt by means of the tracking cross.
3. ROTATE the element (if desired).
4. CONNECT the element to two different nodes.
5. Assign a VALUE to the element.

The user is then given the option of making a hard copy, adding or deleting the next node or element, or performing the analysis.

The DELETE option becomes active only after a node has been displayed. The BRANCH option is activated only after two nodes are displayed. These conditions prevent the user from selecting DELETE when there is nothing to delete, or selecting BRANCH when there are no nodes to which to connect it. When the DELETE option is chosen the user picks a particular node or branch on the working surface. The selected item disappears from the screen, its memory space is released for use, and the data arrays are adjusted.

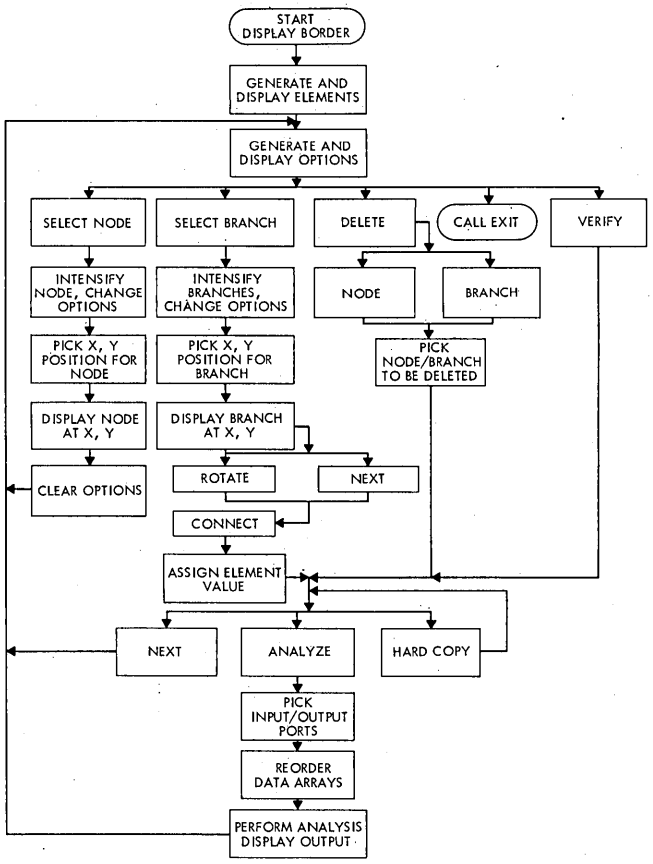

Fig. 3 Flow chart for GINA system.

At each point in the development of a schematic, a number of methods are used in directing the user. One very effective method is intensity control. The options available are displayed at high intensity, thus directing the user not only to the proper choice, but also indicating what will follow. Each option displayed is actually a light button with a unique value associated with it. Through programming, the value of the light button is repeatedly checked until the correct one is selected. This prevents the user from selecting an option from which a recovery cannot be achieved.

The display and nondisplay data can be changed, both adding to it or subtracting from it, by using the DELETE option. The DELETE option simply sets the proper member of the data arrays equal to zero and removes the element or node from the display list.

When the VALUE option is picked we are ready to assign a numerical value to the element, and the control display is replaced by the display

VALUE =
0 1 2 3 4 5 6 7 8 9
+ − BACKSPACE
DEC NEXT

The user then sequentially picks the numbers which are displayed to the right of the equal sign. Multiple light-pen hits are prevented by the requirement that the light pen must detect a light-pen value of zero (moved off a light button) before the succeeding digit can be picked. The use of the light pen and programmed light-pen buttons to assign values to elements has proven to be very convenient; we believe it is better for entering element values than the use of an adjacent keyboard because it is faster and the user's attention does not leave the display console at any time.

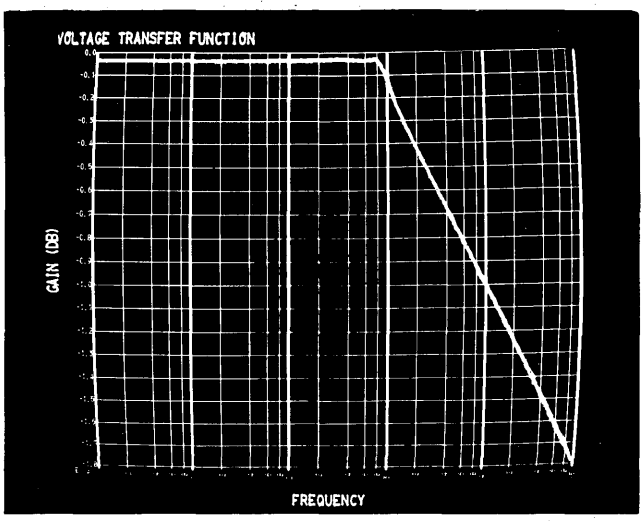

Fig. 4 Response displayed via GINA.

When the network is complete and the ANALYSIS option is selected, the user then picks the input and output ports, and a frequency domain analysis is performed. During this time and until the response appears, the options portion of the crt displays RUNNING. After the analysis is completed, the gain-versus-frequency response is displayed on the crt (Fig. 4). At the user's choice successive displays of phase and delay versus frequency are displayed, and then finally a return to the network topology display is made. At this time the user can add, delete, or change the network topology and element values (or exit if finished).

The entire programming is done in FORTRAN II. That portion of the program dealing with the generation of the graphic display and creation of both the display and analysis files requires 7144 words of memory. The CALAHAN analysis program requires 12,876 words (frequency analysis only), and CALLIGRAPH requires only 524 words of memory. Finally, the use of comments during the graphical construction are both specific and implied. They are implied, as mentioned earlier, through intensity control. They are specific in the case of assigning element values, picking the port nodes, and during the actual execution phase by displaying RUNNING. The provisions for additional comments are in the program and can be easily implemented.

Thus far we have discussed the role of graphics as an input/output medium. Once the circuit is designed in final form, graphics comes in again in layout of the circuit on a printed circuit board. If the circuit is to be realized in integrated form, programs exist for automatically producing the precise artwork which is necessary in master mask generation.

The computer's function in most of these programs is to obtain a *layout* for the components and to determine an optimum *routing* for interconnections. Typical outputs are: (1) an assembly drawing, (2) a hole drilling list and (3) a mask of the printed circuit. Usually, the drafting of the final

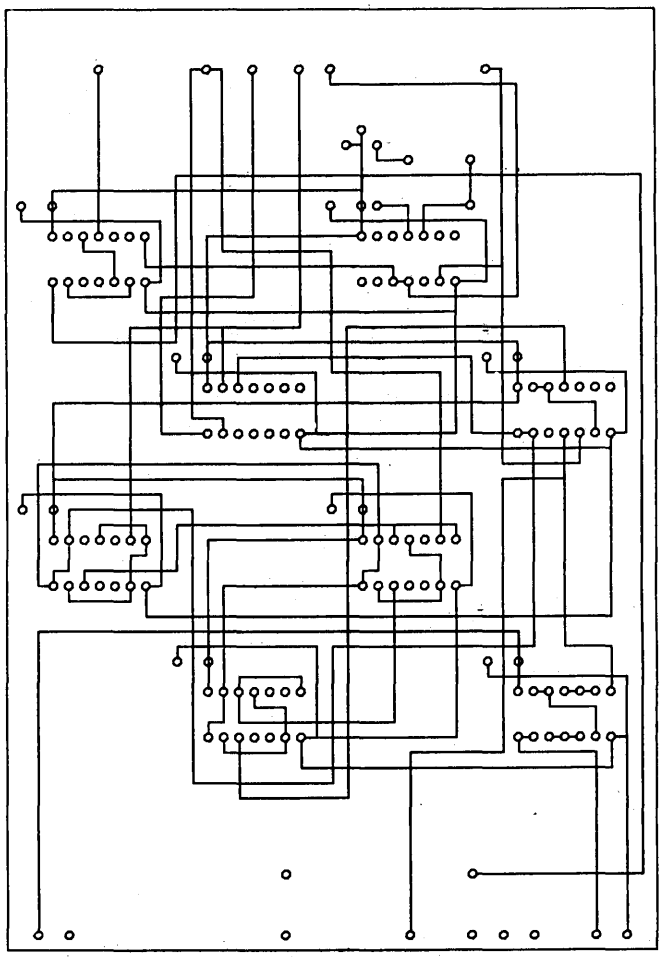

Fig. 5 Printed circuit designed by PUZZLE program.

printed circuit is performed on a precise plotter such as a CalComp or Gerber.

A printed circuit designed by the PUZZLE program developed at Lawrence Radiation Laboratory is shown in Fig. 5.[4]

conclusions

In this brief report, we have attempted to point out the role of computer graphics in the design and analysis of electronic circuits. Although feasibility has been shown by GINA and other systems, on-line design is still not widely practiced. However, since the advent of LSI (Large-Scale Integration) design automation is becoming a necessity rather than a luxury. Computer graphics will play a major role in preparation of diffusion masks, interconnection patterns, etc. Computer-aided design, and in particular on-line operation, has far-reaching implications and will undoubtedly occupy an increasingly important place in design and in engineering education. ■

4. R. Zane and D. Wilber, "Computer-Aided Design of Printed Circuit Artwork," Chapter 12 of *Computer Oriented Circuit Design*, ibid.

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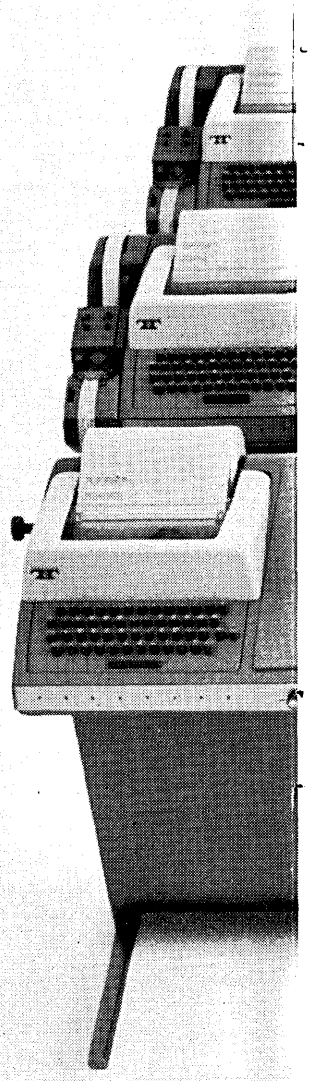

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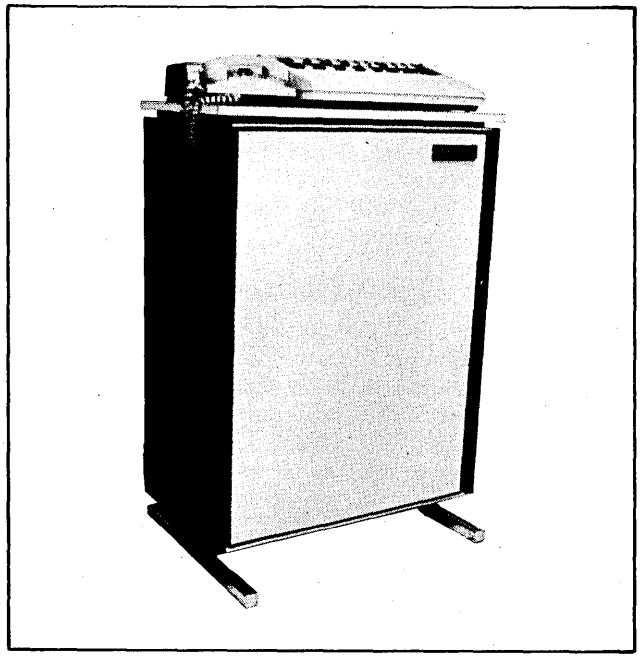
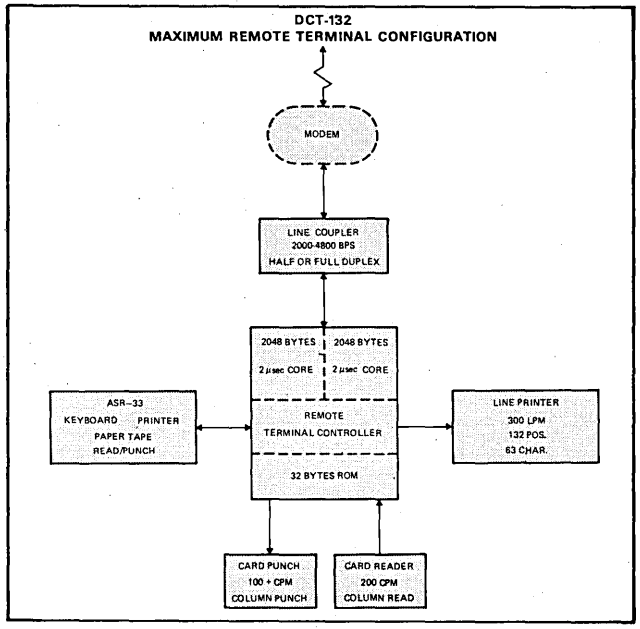
Your central site computer was a wise choice. Now let's look at your remote terminal needs.



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



Although the DCT-132 is 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.

For less than $25,000, Scientific Control offers the DCT-132 with 2000, 2400 or 4800 Baud interface, 300 LPM printer, 200 CPM card reader.

DELIVERIES TO START IN MARCH 1969 — PLEASE GIVE US A CALL.

Scientific Control Corporation

P.O. Box 34529 • Dallas, Texas 75234 • 242-6555 • TWX 910-860-5956

EASTERN REGION: College Park, Md.
Orlando, Fla.
Parsippany, N. J.
West Springfield, Mass.

CENTRAL REGION: Dallas, Tex.
Denver, Col.
Des Plaines, Ill.
Hazelwood, Mo.
Houston, Tex.

WESTERN REGION: Palo Alto, Calif.
El Monte, Calif.

CIRCLE 39 ON READER CARD

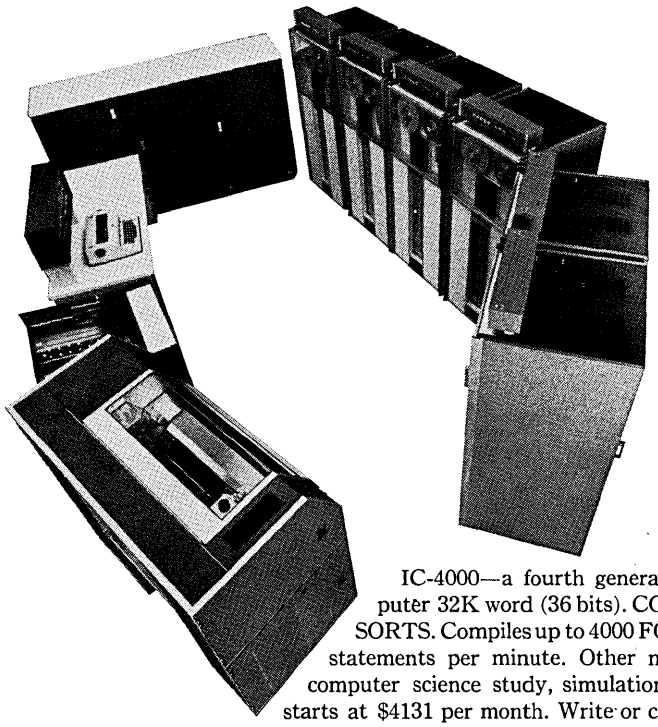
The generation gap

Soon after the first announcements of integrated circuit computers, it was apparent that the new generation had a major split down the middle. The third generation had brought a fourth right along with it. Both represented far more power than earlier machines of equivalent size; both scored major new achievements in cost, performance and reliability. But the similarities stopped right there. The third generation switched from transistors to integrated circuits. The fourth generation did that and more. It switched to a whole new concept in computer design: a computer controlled by its own inner computer. The operating characteristics of the overall system are controlled by micro-programming the inner computer. Accordingly, the user can adapt the logic design of the computer to optimize the system for different types of problems. The tremendous flexibility of fourth generation computers derives from their machine language independence and their high degree of problem adaptability. In practical terms, the computer-within-a-computer delivers significant performance advantages at a much, much lower cost.

We were the first company to announce and ship a fourth generation computer. So far, we have shipped more of them than anyone else.

We didn't bridge the gap; we created it.

Standard Computer



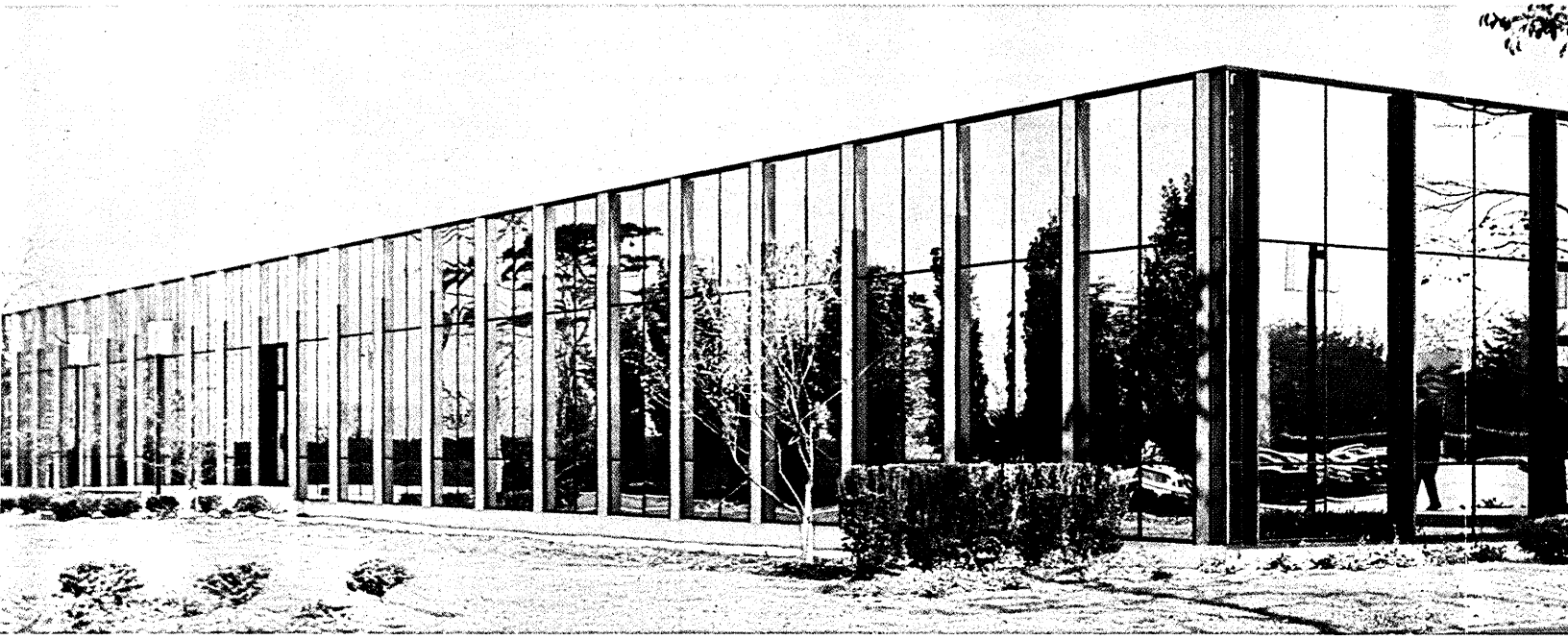
IC-4000—a fourth generation computer 32K word (36 bits). COBOL and SORTS. Compiles up to 4000 FORTRAN statements per minute. Other models for computer science study, simulation. Leasing starts at $4131 per month. Write or call for full information and documentation.

STANDARD COMPUTER CORPORATION 1411 West Olympic Boulevard, Los Angeles, California 90015 (213) 387-5267

CIRCLE 40 ON READER CARD

FOR 3M CO. CIRCLE 41 ON READER CARD →

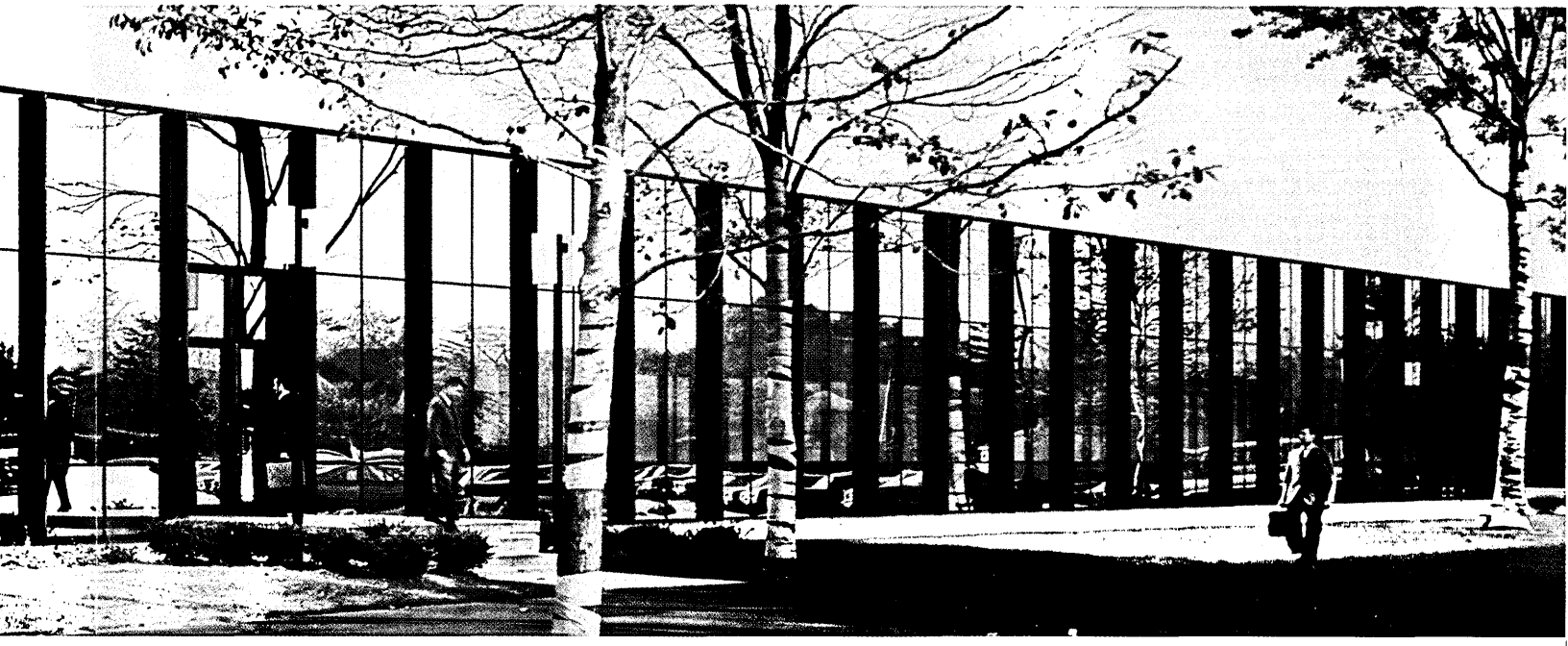
Firestone spent millions for a new computer and data processing center.



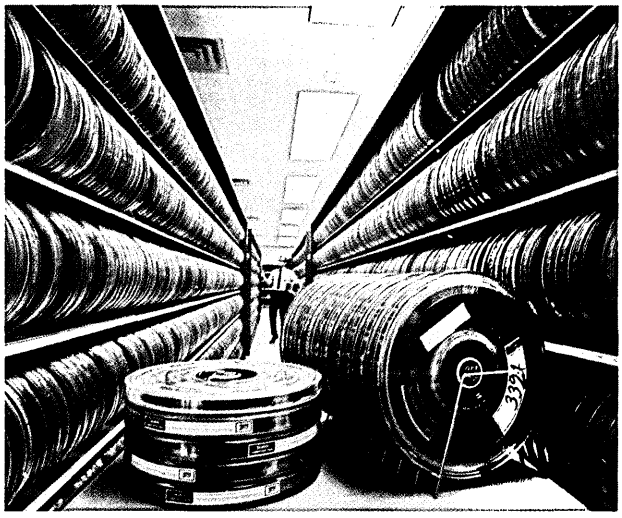
But not an extra nickel for certified computer tape.

No need to. In-process electronic testing of "Scotch" Brand 777GP eliminates the extra certification step.

r.



Firestone's computer room, and fireproof library with over 18,000 reels of computer tape, indicate the scope of the facility.



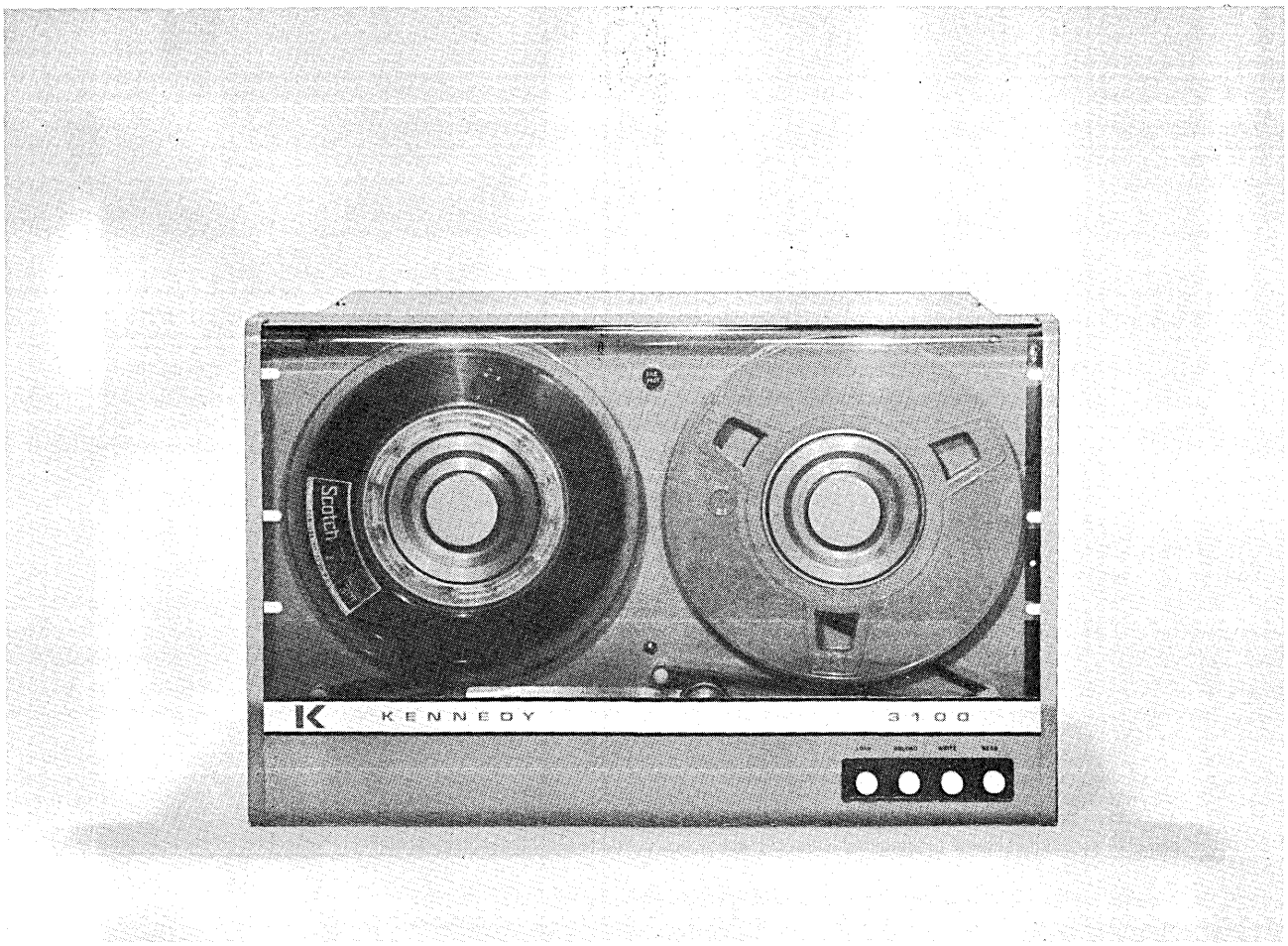
777GP

To serve all areas in a world-wide organization, Firestone built a new computer center in Akron, Ohio. And then equipped it with the most modern computers in the industry. Their choice in computer tape was the most modern, too: "Scotch" Brand 777GP.

"Scotch" Brand 777GP is 3M's Guaranteed Performance* Computer Tape that makes the extra certification step obsolete. Firestone test reports show 777GP performance unsurpassed at all bit densities. With 777GP, oxide rub-off and redeposits are virtually nonexistent, thus assuring unexcelled dependability in long-term use.

*Find out how 777GP can save money in your computer center. Ask your 3M Representative for detailed specification sheet M-CL155, or write to: Magnetic Products Division, 3M Company, 3M Center, St. Paul, Minn. 55101.

3M COMPANY



now-Kennedy goes synchronous

Not content with being first in incremental recording, we've gone synchronous at Kennedy.

Our Model 3100 Continuous Magnetic Recorder offers the small computer user all the features of big, expensive transports, but at sensible low prices. Now it is possible to have full magnetic tape capability without spending several times the cost of your computer.

Operating at synchronous speeds up to 25 ips, the Model 3100 has a high performance single capstan drive matched to the reel servos for fast, accurate start/stop.

Read/write rates up to 20 Hz can be accommodated at 800 BPI. Tape motion is bidirectional with no program restrictions.

Forward and reverse high-speed search operations can be accommodated at 120 ips. Tape motion is under capstan control at all times.

Exceptionally easy to interface, the Model 3100 with write electronics provides write clock signals appropriate for the speed and density ratings as well as time delays for gap generation.

Model 3100 is available as transport only, or with any combination of Read and Write electronics. Seven track and nine track models are all fully IBM-compatible.

Reel size of the 3100 is 8½" (1200 feet) and 10½" (2400 feet) reels are available on Model 3110, which is essentially identical except for size.

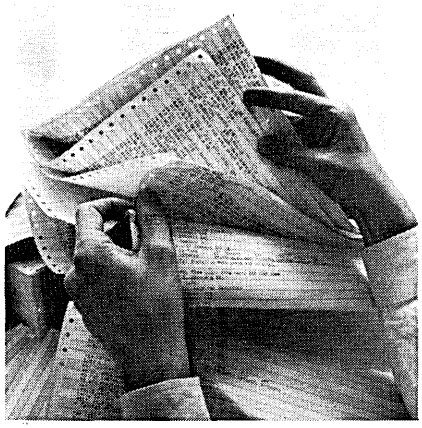
Model 3100/3110 specifications:

Normal tape speed—up to 25 ips.
High tape speed—120 ips.
Drive direction-bidirectional.
Start/stop time—10 msec.
Record mode—NRZI-IBM compatible seven or nine track.
Density—200, 556, 800 BPI.
Program restrictions—none.
Write clock—internally generated.
Gap time—internally generated.

Prices for the Model 3100 begin at $2600 for deck only. Electronics prices are correspondingly low. Write or phone for complete information and for the 36-page catalog of Kennedy products.

KENNEDY CO.

540 WEST WOODBURY ROAD, ALTADENA, CALIFORNIA



It's the computer age. Time to give up the paper route.

Kodak has an easier way.

The new KODAK KOM-90 Microfilmer. It converts tape data *directly* into plain language on microfilm for the many jobs where you really don't want paper.

And it does so at speeds compatible with third-generation computers—up to 90,000 characters a second. That's 20,000 lines a minute and twenty times faster than conventional line printers.

Setup couldn't be easier. A Job Setup Control Card automatically handles several operator functions, thereby reducing need for operator decisions. Registration of characters is sharp and clear. You can even integrate business forms—such as report forms—with the translated data in precise registration.

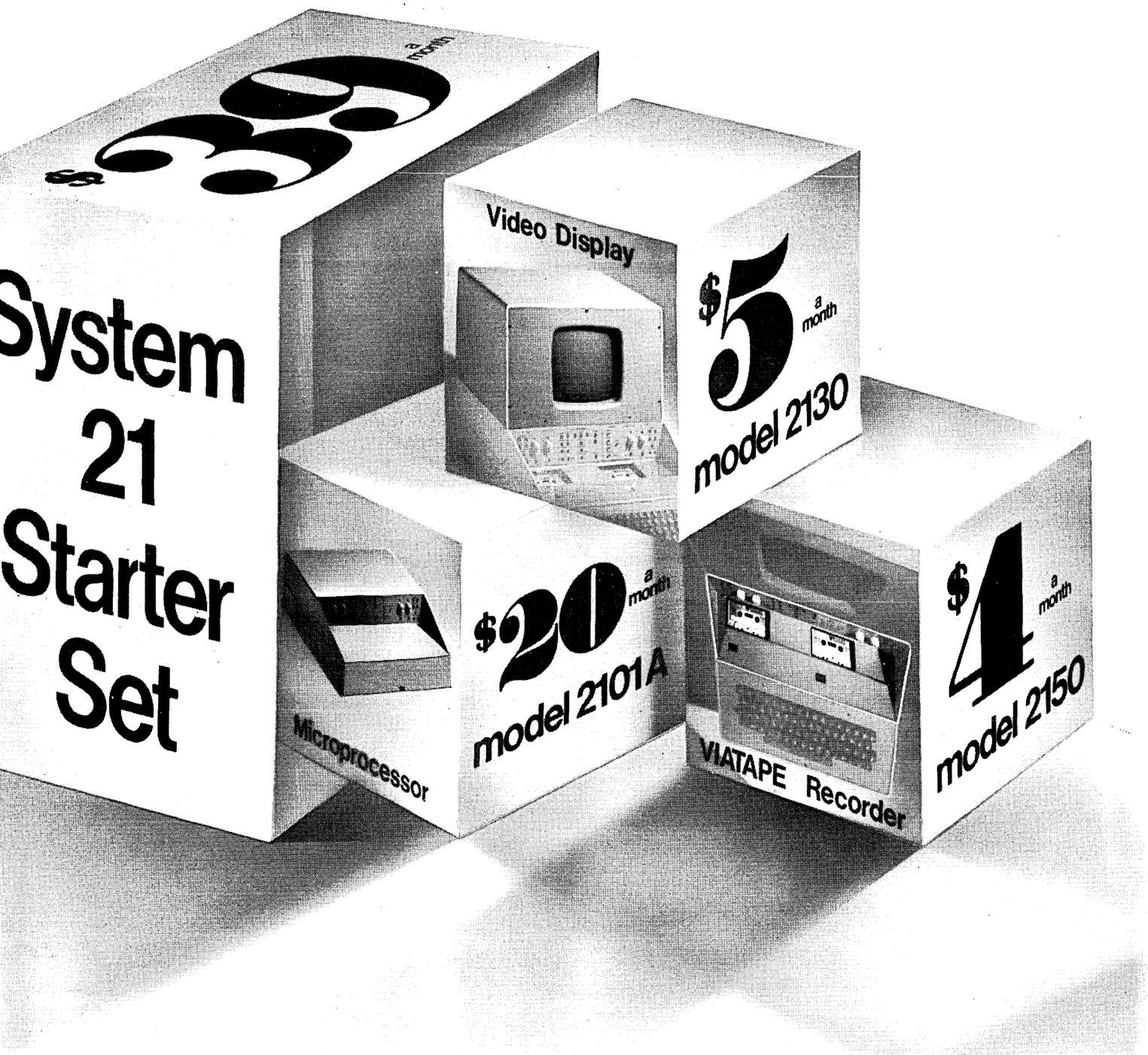
Related RECORDAK Microfilm equipment and coding techniques enable you to retrieve microfilmed source documents and EDP data in seconds... by merely pushing a button or two.

Kodak will help take you from your present paper route to microfilm. It has software programs and professional people to make this transition with ease. Get in touch with them... today. And ask about the new KOM-90 Microfilmer. Eastman Kodak Company, Business Systems Markets Division, Department ZZ-12, Rochester, New York 14650.

"The easier way."

KODAK KOM-90 Microfilmer.

For $39 a month you will be able to have this starter set of VIATRON System 21 building blocks— it's all you will need to cut data input costs in half.



With these five System 21 building blocks you can eliminate keypunch/verifier and key/tape operations. $39 a month will be all that it costs you to record, verify, edit, format and display data at your desk.

Other System 21 building blocks will let you build low-cost, on-line input/output, visual intercom and print-out systems.

You pick the components you need to do a job. Plug them together. They will do the job. Anywhere. There's no need to create the computer environment required for key/tape operations. No software is needed, either. No modifications have to be made to your existing computer system. You don't even have to switch from cards to tape — System 21 will prepare data for automatic translation to either.

Take the "blindfolds" off computer input

You will even avoid the lengthy training and change-over programs required with most new equipment. System 21 will be simple enough for any clerk to operate. It will show her how to do the job and let her correct errors as they're made.

She will be able to see just what she's doing. No "blindfolds." Data entry formats are shown on a video display. All she has to do is fill in the blanks. As data is entered from a standard keyboard it is automatically displayed and positioned within the format shown on the video screen.

When each entry is completed, it can be visually verified.

Then, the next format is displayed. There's no limit to the number of formats that can be used. Over 500 different formats can be stored on a VIATAPE cartridge placed in one of the two recorders built into a System 21 microprocessor.

Data entries covering as many as 80,000 characters can be recorded on one VIATAPE cartridge by calling up and filling in sequential formats.

No long-term leases required

All VIATRON rental agreements include a 30-day cancellation clause. These rental agreements also provide two back-up units for every 50 rented. Should any operating unit fail, it can be replaced immediately. There's no time loss. No waiting for a serviceman.

System 21 deliveries are scheduled to start this year. For more information write VIATRON Computer Systems Corporation, Dept. D-4, 105 Terrace Hall Avenue, Burlington, Massachusetts 01803.

VIATRON

SYSTEM 21

VIATRON System 21 puts the logic where the problem is

CIRCLE 44 ON READER CARD

top of the line

THE RCA SPECTRA 70/60

by R. A. McLAUGHLIN

RCA designs their machines to fit in the slots that IBM leaves open. For instance, where IBM introduced the 360 series model numbers 30, 40, 44, 50, 65, etc., RCA offered models 35, 45, 46, and 55. Now, because the IBM elves left such a big slot between the 50 and the 65, RCA has decided to double-team them by adding the 70/60.

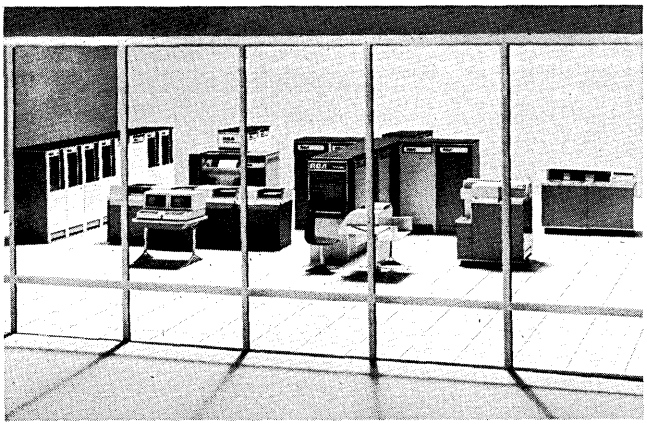
The new top of the RCA line, the 70/60, is aimed squarely at those commercial dp users who need to process large volumes of data rapidly—users with applications such as credit reporting, communications networks, and utility billing. To handle their massive character shuffling (as opposed to number crunching) needs, the 70/60 provides main core in sizes to more than a million bytes, and a data transfer rate of 4 megabytes/sec.

comparisons

The 60 offers the same compatibility with the 360 series as do other units in the Spectra series, including all instructions, character codes, and other facilities available to non-privileged 360 programs. Provided identical inputs, both series of machines grind out identical results.

Pricing considerations, like compatibility, are an important part of RCA's philosophy of "filling the slots." Each Spectra computer is priced competitively with the next-lower numbered 360. In the case of the 70/60, which leases from $17K/mo. up, the price competitor will be the 360/50, which leases from $14K to $55K/mo. (For those interested, the $17K price quoted is for the cpu, 128K bytes of main core, a card reader, printer, disc, four tape drives, plus the required controllers. The multiplexor channel and two selector channels are standard.)

In performance, the 60 will not be competing with the 50; its specs place it in another league. The 360/50 has a 64-



512K core with a cycle time of 2 usec—compared to the larger and faster (1 usec/4 bytes) core of the 60. The 360/50 is rated at 4 usec/cpu cycle (adder time)—compared to the 1 usec adder speed advertised for the 60. A Gibson job mix was used to contrast the 360/50 and the 70/60. The results of that test, RCA claims, showed an over-all through-put rate 1.5 times greater for the 60 (corresponding to a cpu rate of 280,000 instructions/sec). This they attribute partially to the 4 MBs transfer rate, which results in less channel interference. Attempting to compare the new machine with a 360/65 (750 nsec/8 byte core, 1.3 usec adder, $39-$100K/mo. lease price) is equally frustrating. RCA, again, has found a middle ground.

special features

The 70/60 is a late third-generation machine. RCA spokesmen claim that the time delay allowed them to judge what extra features were most wanted in third-generation systems, and to implement those features in the hardware. Three such features are the "shaded" memory, built-in error detection and correction facilities, and a type of core modularity. The main core is designed in 256K modules (two banks of 128K each), which have their own power supply; the modules can be taken off-line and tested through their own built-in test panels without impeding operation of the rest of the system. This kind of modularity is probably a first for a single-processor machine. Each 256K module also has a 1K "shaded" core memory to which the user is denied access. This area is used to store the multiplexor channel device addresses and program error indicators.

Data, memory protect, and control errors are detected by the hardware, and the pertinent instructions or functions are automatically retried. If the retry attempt also encounters an error, then the hardware takes a snapshot of the relevant registers. On a branching error, the operator is informed and is given the option of entering an "audit" mode, which is equivalent to requesting an error trace of the previous 63 branches.

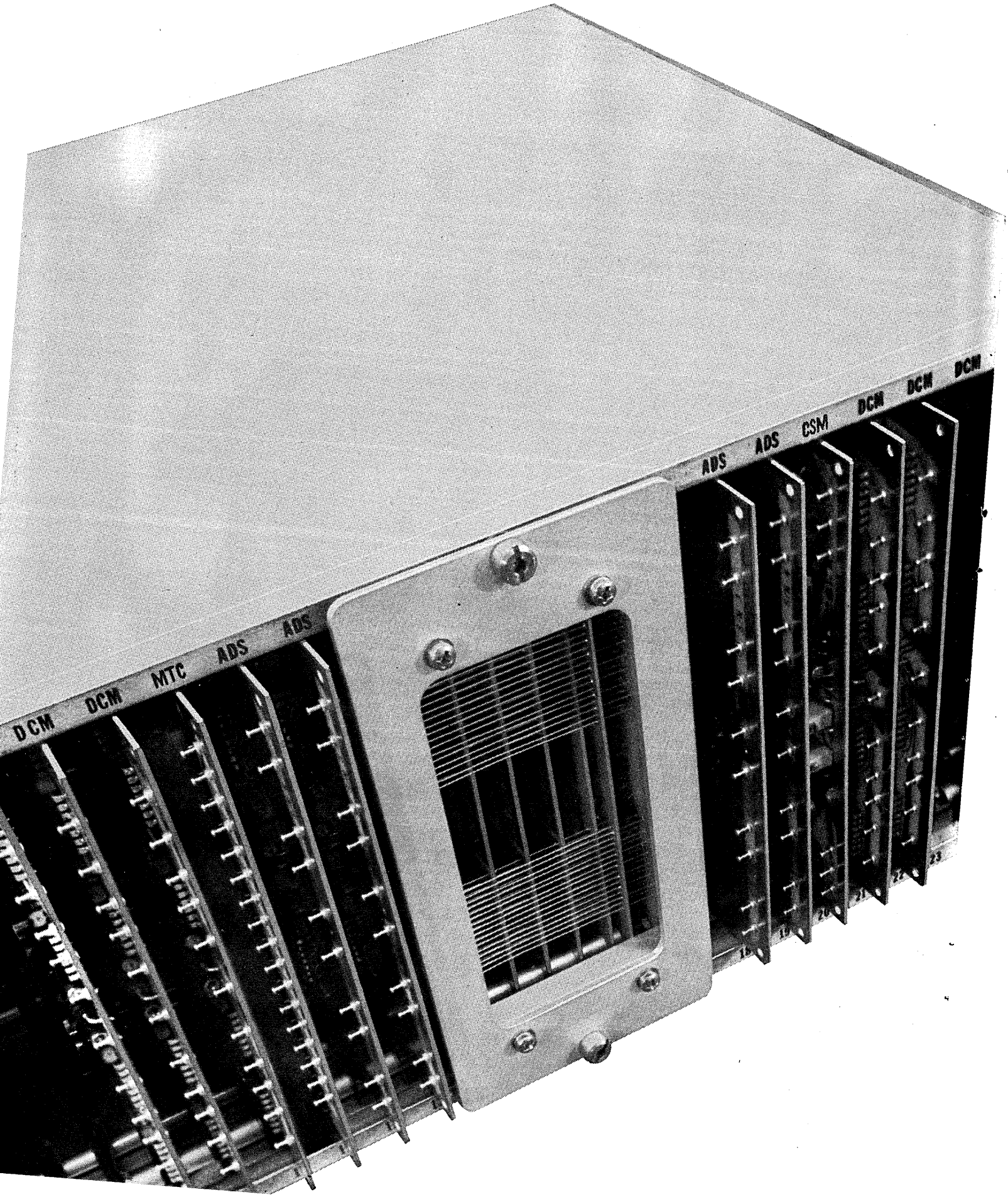
Several other of Spectra's built-in features are unique to its line. For instance, a scratchpad memory, consisting of 128 32-bit words of 100 nsec cycle time, provides a limited amount of general-purpose storage. It is used primarily to contain the system's registers. The 60 has 16 general-purpose registers, but the contents of many of these, including double-word floating point registers used for interrupt status and interrupt mask, and others for program and utility information storage are duplicated as many as four times. The redundancy exists to provide already-loaded registers for the processor in each of its four processor states (processing, interrupt response, interrupt control, and machine condition). In this way, valuable cpu cycles are not used in loading and unloading registers before and after switching program states, such as in processing interrupts.

Obviously there is more to a system than its hardware specs. It may be reassuring to note that the monitor software (Tape/Disc Operating System) has already been operating on 70/35, 70/45 and 70/55 systems for a period of three years, and that its manner of implementation—logical operations effected through micro-instructions programmed in read-only store—has been checked out for a similar period of time.

The step between the 360/50 and the 360/65 is a long one, and an expensive one, but many users who are outgrowing a 360/50 will find the Spectra 70/60 more than just a healthy step up. It takes a big application to outgrow a four-megabyte transfer rate and a megabyte of main core, and getting the latter system at the price of the former might make a lot of sense to a lot of users. ■

RCA SPECTRA 70/60 SPECIFICATIONS

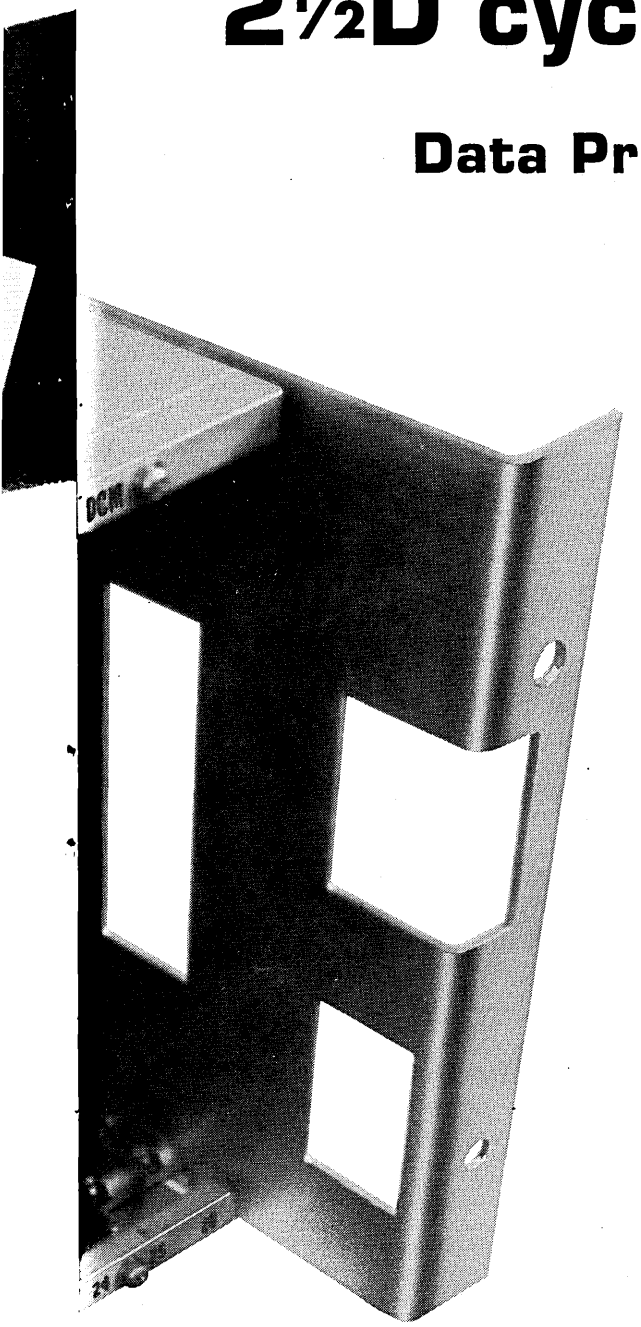
CPU	cycle time	1 usec (280K operations/sec)
	word size	32 bits (4 bytes)
	arithmetic	binary (fixed or floating)
	index registers	16 (plus duplicates)
MEMORY	Main core:	
	cycle time	1 usec
	size	128-1024K
	access	4 bytes
	Scratchpad:	
	cycle time	100 nsec
	size	128 words (32 bits/word)
	Shaded core:	
	cycle time	1 usec
	size	1K (approx)
	Read-only:	
	cycle time	330 nsec
	size	3K words (72 bits/word)
I/O	Selector channels:	
	rate/channel	900 KBs
	rate/system	4,000 KBs
	trunks/channel	3
	channels (max.)	6
	Multiplexor channel:	
	transfer rate	167 KBs
	trunks	16
	addressable devices	248


DCM
DCM
MTC
ADS
ADS
ADS
ADS
CSM
DCM
DCM
DCM

2½D cycle time at 3D cost!

Data Products' new 3-wire, 3D memory

...the STORE/33™



STORE/33 is in full production at Core Memories, Inc.* . . . now you can have 2½D speed at coincident-current prices! For example, the 4K x 16 version of STORE/33 uses 18 mil cores to give a full-cycle time of 650 nsec. The price? Under $4500** in production quantities.

What makes this price breakthrough possible without a tradeoff in speed? The key, of course, is 3-wire 3D organization in which the fourth winding normally associated with coincident-current organization is eliminated. By utilizing the same winding for both sensing during reading and inhibiting during writing, assembly costs of the magnetic planes are reduced . . . But 3D organization is only part of the story.

STORE/33 employs IC electronics throughout to increase reliability, reduce power consumption and achieve more compact packaging. The basic memory uses only four types of plug-in cards. The memory stack also plugs in. This standardization of circuit card types and modular construction reduces your inventory costs and simplifies maintenance. Word capacities to 16K, interface flexibility, plus a wide range of options . . . for the full story, write Data Products Corporation, 6219 De Soto Ave., Woodland Hills, Calif. 91364.

Los Angeles, Calif. 213/887-8000 **Melbourne,** Fla. 305/262-4773
Bethesda, Md. 301/652-8120 **Acton,** Mass. 617/263-3961
Minneapolis, Minn. 612/338-4717 **Dallas,** Tex. 214/239-9641
Amsterdam, 020/156-297 **London,** 1-579-3116

*Core Memories, Inc. is a subsidiary of Data Products Corporation.
**Price does not include optional power supply.

dp data products

"the peripheralists"

Data Products manufactures LINE/PRINTERS™, DISCfILES®, Core Memories, Off-Line Printer Systems, Card Readers & Punches.

CIRCLE 45 ON READER CARD

Moore New Ideas for Data Processing

Cash payroll prepared by ADP

Moore has a system that completely automates cash payroll preparation. System input starts at time clock. From there on everything is done by computer. Bank or armored-car personnel insert cash in envelopes and deliver to paymaster. No paperwork, no drudgery, no mistakes. Greatly reduces cost and risk of paying in cash. Ask about "cash payroll" system.

Labeling made easy

Inventory, production items—anything you keep in stock and need to keep track of—can now be labeled. Moore can provide you with continuous labels that can be prepared on automated data processing equipment and will stick to just about any surface. Modern adhesive requires no heat or moisture. Saves time. Keeps records straight. Ask about "automated data processing labeling."

Payroll privacy without envelopes to stuff and seal

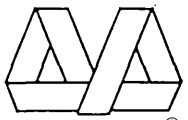
Payroll checks, monthly statements, scores of other documents can be prepared on automated data processing equipment. Moore has a system that not only prepares all basic documents but also prepares and seals an envelope around the documents to be mailed. No stuffing, no sealing, no bother. Ask about "privacy."

Mechanize random sorting

Moore can show you how to mechanize random sorting without using valuable computer time. A Moore Detacher-Sorter uses optical scanning for off-line sorting of random input. It reads computer coding. Machine removes margins and detaches and sorts, all in same pass. Great timesaver and good way to cut computer costs. Ask about "Detacher-Sorter."

Where to go for more ideas

Look for the Moore number in your phone book. When you call this number, you plug into an idea exchange that reaches into every kind of business in North America. Moore has more than 2400 men keeping track of ways to cut costs, improve control, and reduce paperwork. Every idea presented here is now in use. One Moore idea may be what you need.



MOORE® BUSINESS FORMS, INC.

Over 675 offices and plants, 2407 salesmen in North America

OS
IS NOT
TO REASON
WHY . . .

(To the tune of "Everglades" and "The MTA", and with apologies to the Kingston Trio, which does not necessarily include IBM.)*

(sparkling guitar intro)

I. I was born and raised around Poughkeepsie,
A programmer is what I had to be;
But IBM and its programming team
Have turned me into a debugging machine.

Running all my jobs under MVT.

CHORUS Where a job can run and never be found,
And all you see are the discs goin' 'round;
And when you get your output the results are nil:
If the JCL don't get you then the systems will.

II. I put my job in the input queue,
And watched in awe as the system blew.
When I reran the job, I felt really crushed:
I saw on my listing INPUT STREAM DATA FLUSHED.

Running all my jobs under MVT.

CHORUS

III. I reran the job and ran out of space;
I reran the job with a step out of place;
I reran the job with priority 10 . . . (pause)
*{"Will it ever return, no, it'll never return,
And its fate is still unlearned,
It may hide forever in SYS1.LINKLIB . . ."
(pause)

Running all my jobs under MVT.

CHORUS

IV. Well, I couldn't get a job past the JCL hump,
So I never got a chance to read an ABEND dump,
If I could get one through, I'd have debugging fun,
'Cause the job was in the language known as PL/I.

Running all my jobs under MVT.

CHORUS

Getting lots of grief from this MVT.
Running like a thief 'way from MVT.
Getting 'round this mess via DOS!

(rousing guitar finale)

— JACK P. GELB

Your typing pool.

Our typing pool.

Our one girl can do more work than your four girls combined. Faster, cleaner, error-free work.

She's no super typist, either. But she has a super machine: the new 2340 by Friden.

The 2340 is a powerful automatic writing machine that brings an end to many of the things you've put up with all your working life: messy originals, smudged copies, nagging little errors, and endless re-typing.

Now a typist never types the same thing twice. Because the 2340 puts everything she types on paper tape. From then on, the 2340 does the typing automatically, error-free.

And when those inevitable corrections come along, the 2340 takes care of them too. Because the 2340 not only types automatically: it also *rearranges* words on a page automatically. It hyphenates or drops hyphens, and changes margins when you change a word, sentence, paragraph.

If you think all this officework automation is going to cost you a bundle, you're wrong: the 2340 leases for *less than $95 a month.* No other machine can do so much for so little.

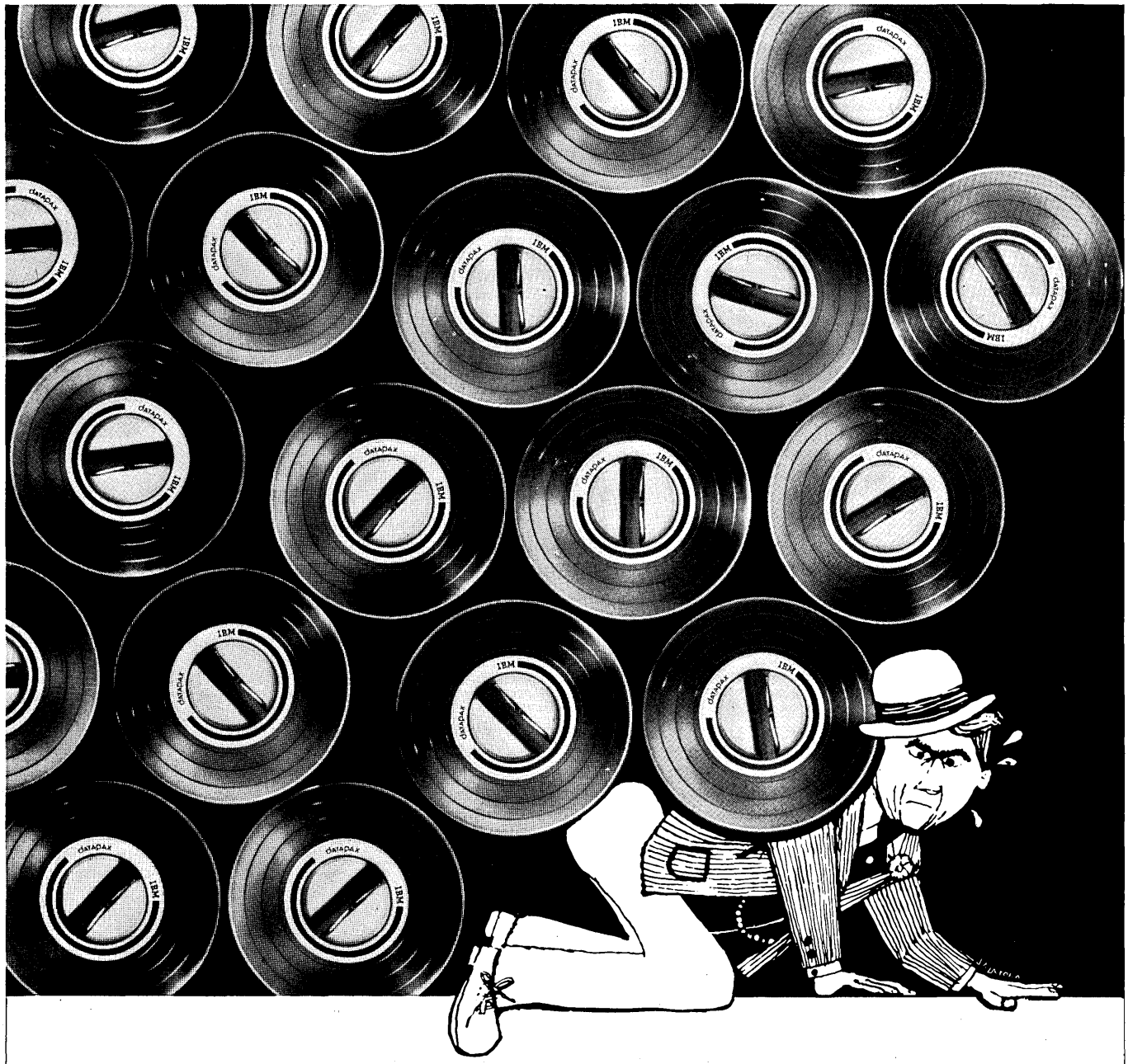
It takes only one day to train a girl on a 2340. So you're one day away from error-free letters, documents, stencils, contracts, lists, orders, summaries. One day away from a one-girl typing pool.

For a demonstration of the 2340 doing *your* paperwork, call your local Friden office. Or write: Friden, Inc., San Leandro, California 94577.

It's the beginning of the end of the typewriter.

Friden
DIVISION OF SINGER
DIVERSIFIED · WORLDWIDE

CIRCLE 48 ON READER CARD



"Maybe Datapax can lend a hand."

Maybe Datapax can lend a hand. Better still, Datapax can lend you either IBM or Datapax 2316 or 1316 type disk packs to ease the load. Waiting time? At Datapax we don't know what delay is. Our units are ready for immediate delivery. Replacement if necessary, by air freight at our expense within 24 hours. Flexible lease terms and lower rentals that continue to decrease the longer you use them. Purchase/Leaseback plans are also available to provide you with additional savings. So, if you're in a bind, give us a buzz. **Datapax. We're your relief.**

datapax

DATAPAX COMPUTER SYSTEMS CORPORATION • 415 Madison Avenue, New York, N. Y. 10017 (212) 986-7756

news scene

an interpretive review of recent important developments in information processing

JUSTICE VS. IBM: STRIKE THREE AND YOU'RE AHEAD OF THE GAME?

"The users and leasing firms certainly made IBM back off on its maintenance price increases. They were discriminatory; IBM just wanted to see how far they could go."

"IBM is being forced to separately price its services because it fears government action; this will be good for everyone."

"Control Data is using an antitrust suit against IBM just to buy time to market its 7600.'"

"Data Processing Financial & General's suit? What have those ruddy leasing companies got to complain about? They owe their existence to IBM . . . But I'm glad they did it."

Those snide, critical comments on the events of the last six months and the chuckles of delight at the thought of IBM coming to its knees seem to have subsided now that the government has filed its civil antitrust suit against the giant. The Justice Department charged IBM with monopolization of the industry in violation of Section 2 of the Sherman Act. It is a "structural" suit, which signifies that whatever is accomplished—consent judgment or full trial—is bound to change the structure of the industry. How well this is done will not only determine IBM's future share in it (not guaranteed to go down), but also which submarkets and competitors will grow or fade.

The serious, sometimes bewildered, comments from industry professionals and the press evoke the thought that the industry may now be putting on its first pair of long pants. It is now beginning to examine, as a professional businessman, economist, philosopher, and technician, precisely what it is that has made IBM one of the richest (after taxes) companies in the world; what, besides IBM policies, has kept others in the red; what IBM has done that has been good/bad for competition; and what would happen to everyone if the 241,000-man firm were altered. It's not only competition, it's the customer. It's not only business and profits, it's the growth of technology. And it's not just the business of this peculiar industry, it's the laws that have been set down with certain precedents and attitudes that in themselves know nothing of mainframes, software, and SHARE/GUIDE user groups.

government's complaints

The Justice Department had done its computer homework for a few years, however, and filed a 12-page suit on January 17, an 11th-hour act of the Johnson administration. While brief, especially compared to the tomes filed by CDC and DPF&G, it covered the major complaints of these plaintiffs, although it limited itself to monopoly charges, with no claims of improper conduct. The action was brought in the U.S. District Court of the Southern District of New York.

It is the general purpose digital computer market, accounting for 95% of the total computer market, that IBM is said to have monopolized. The Justice Department sets the beginning date of the offense at "in or about 1961," unlike the private suits that claim violations starting in the '50's when the industry was just beginning. This seems to point out the government's recognition of the history of the industry and the factors, such as bundling of services, that were acceptable in order to compete and to expedite development and usage.

Like the private suits, the government complained of the single price policy for hardware, software, and related support—which inhibited or thwarted competition in the manufacturing and independent software and computer support industries. For this alleged violation, the government asks that IBM price and sell or lease separately general purpose digital computers, peripherals, software and other customer support.

As CDC claimed, the government says IBM introduced computers with unusually low profit expectations in those segments of the market where competitors had or were likely to have "unusual competitive success" and also announced future production of new models for such markets when it knew it would not be able to complete production within the announced time. The relief asked is that IBM refrain from both practices, and in particular, that IBM announce software and hardware only after they have been subjected to "normal testing."

As both CDC and DPF&G claimed, the government also took IBM to task for discounts to the educational market —"which was of unusual importance to the growth of competitors both by reason of this market's substantiality and by reason of its ultimate impact on the purchasing decisions in the commercial market." Toward correcting this, the government wants IBM to refrain from use of special allowances, buybacks of computer time or research grants in all products and services "where the effect of such practices may be unreasonably to inhibit the entry or growth of competitors."

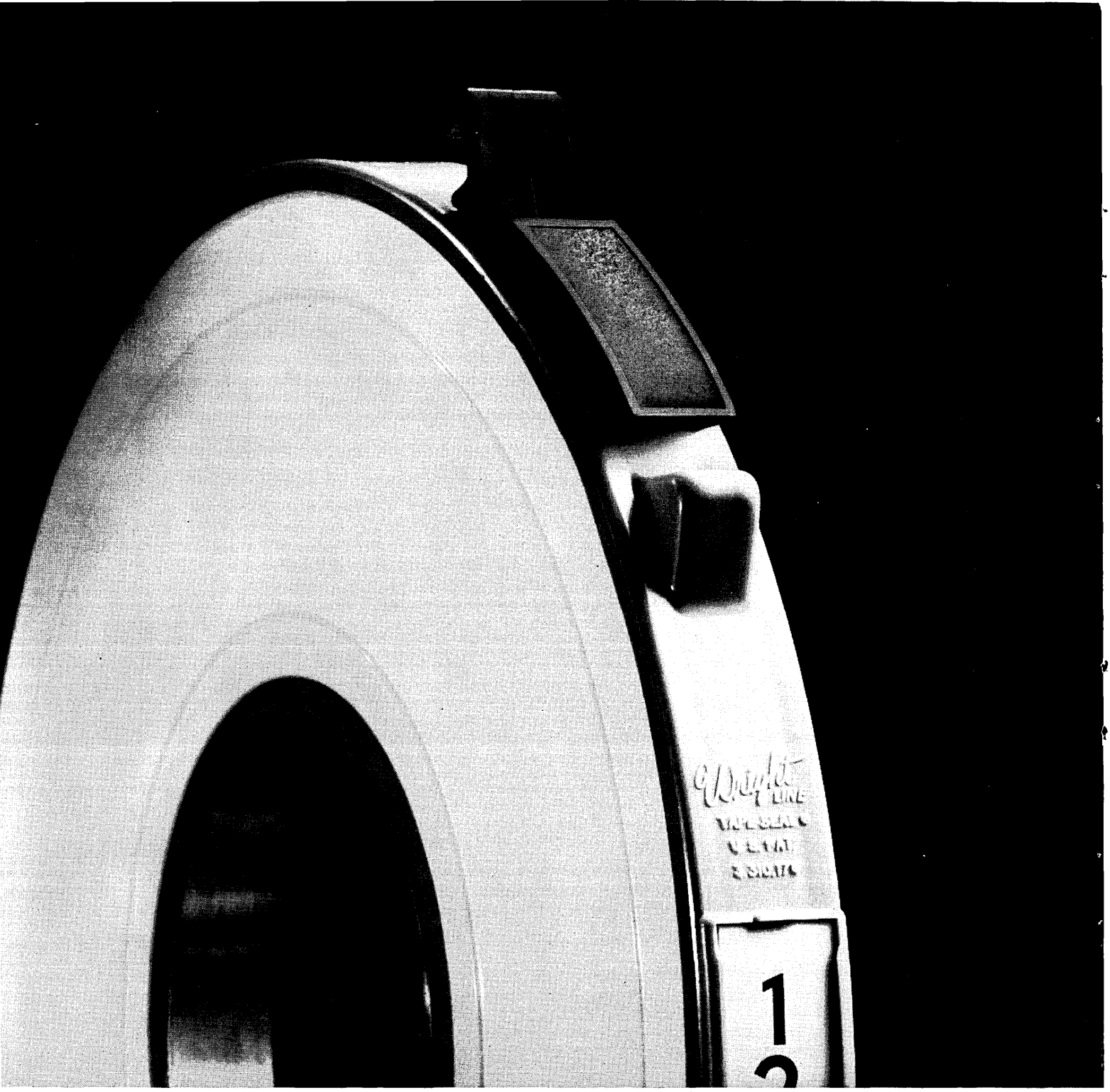
And last but not least, it asks relief by way of "divorcement, divestiture and reorganization of the business and properties of the defendant."

As stated before, (see Feb. News Scene, p. 101, and Look Ahead, p. 17) antitrust lawyers say that generally the federal government is the only plaintiff that can achieve such structural changes in an organization in an antitrust suit. The courts have not been known to grant such relief in private suits. Also, as said, the government's case, if brought to trial and won, can be used as evidence in private suits, but not if the government and IBM agree on a consent judgment.

bewildering implications

The issues that the Justice Department has raised have brought varied comments from the industry. Separate pricing seems inevitable with or without court action, since IBM has stated that by July 1 it will change its policies and will undoubtedly be testing those and perhaps other later policies on the market for many months after that. But it will remain for the courts or a decree to put the permanent seal on separate pricing, enjoining IBM from ever returning to any single pricing structure.

IBM's actions on separate pricing, however, will provide information on what might happen if the firm were to be cut up into separate independently operating pieces. If one IBM makes up 75-80% of the industry, do you get synergism with four, more efficient IBM's—90 or 95%? If you do, do you make IBM divest itself of all of one activity (which one) or a percentage of each (how do you break them down)? What if you get a manufacturing company that makes only hardware (with a little firmware thrown



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CIRCLE 101 ON READER CARD

in), and is able to market the cheapest mass-produced equipment? You can't set their prices for them, and certainly not a lower limit. What happens to competition—must they merge to compete in mass production? That "umbrella" comes into play; IBM's prices have not been based on cost but on what the user will pay and the competitor can afford to charge and still survive.

The educational market to which IBM has given discounts and numerous grants is one that rises to IBM's defense—at least for past practices. Dr. Bernie Galler of the University of Michigan and president of the Association for Computing Machinery feels that without IBM's allowances and support, many universities would not have been able to afford equipment and the research and development that have helped advance the technology. Hence, the industry would not have grown as quickly.

As to the demand that IBM announce systems only after "normal testing," the industry has varied reactions. Most feel the firm should not announce equipment so far in advance just to thwart current or growing competition; but on the other hand, if IBM waited until a few months before delivery, this too would hurt competition. For example, the industry has had to follow on IBM's heels in developing disc packs and drives, since most of the market for these is on IBM equipment. If IBM were to announce and deliver quickly, the industry might not be able to respond in time. Competitive computers, especially those like RCA's, which strive to be IBM-compatible, would also be at a disadvantage. RCA was able to come up with a line that included some improvements in price/performance over the IBM 360's because there was a long lead time between announcement and delivery.

There was no mention in the Justice suit of IBM's time-sharing services activity under Information Marketing Department, which has now been given over to Service Bureau Corp. Some sectors were hoping that if the government filed, it would also charge IBM with being in violation of the Consent Decree of 1956 by developing these services under the corporate name and resources rather than under SBC (which the decree forced IBM to separate). Indeed, the suit distinguished the main IBM computer activity about which it is complaining from that of its three subsidiaries, IBM World Trade, Science Research Associates, Inc., and SBC.

ibm profit spiral

IBM's earning statement for 1968 came out just before the suit, showing over 30% in earnings increase, adding fuel to what the government already thinks. Consolidated gross income from worldwide operations amounted to $6,888,549,209, and increase of $1,543,258,216 over 1967. Earnings were $871,497,991, an increase of $219,998,433 over '67. World Trade accounted for over $2 billion of that (an increase of over $415 million over '67), with earnings at over $270.5 million.

Said Watson in a letter to shareholders, much the same as in 1967, "During the year 1968, IBM's gross income and earnings showed abnormally high rates of growth, primarily because of a major increase in the level of outright sales of data processing equipment. Independent computer leasing companies' purchases of IBM System/360 accounted for most of this unusually high level of outright sales. Although total gross income increased by 28.9%, gross income from rentals and service increased only 15.4%. We believe the latter figure is the better measure of the basic progress of the business for the year." IBM does not believe the high level of outright sales will continue because of the volume of purchases already made and the fact that the 360's have been on the market for over four years. IBM foresees that if there is a "marked decline in purchase activity during a future reporting period, income comparisons would then appear unfavorable, perhaps even to the extent of showing a decline in income for that period."

In that same letter, Watson also noted that there were a number of new or enlarged facilities that became operational or were started in the U.S. and 10 other countries, and that employment increased by 20,000 to over 241,000 worldwide.

Watson's letter further stated that "we intend to make a vigorous defense against the allegations of the complaint," meaning the Justice suit, and about all suits, noted that "these suits were filed despite the fact that the data processing industry is one of the healthiest and most competitive in the nation . . . The computer business, which virtually did not exist 20 years ago, has grown into a multibillion dollar industry that has attracted more than 60 systems manufacturers and some 4,000 companies dealing in related equipment, support and services."

IBM also took out two-page advertisements all over the U.S. after the government filed that did not mention the suits, but simply detailed the competitive nature of the industry as outlined above by Mr. Watson. It was a well-written documentary of how IBM sees the business, and the advertising media have estimated in the press that the cost was between $500,000 and $700,000—about half what DPF&G expects to spend in prosecuting its suit against the firm.

The next annual meeting for IBM stockholders is in Santa Monica, Calif. on April 28. It should be an interesting one. —ANGELINE PANTAGES

MISCO STARTS TRANSITION TO T-S IN PURSUIT OF $1.3 BILLION MARKET

Batch processing service bureaus will see a decline in revenues from $700 million a year to $300 million a year by 1973, while time-sharing and remote batch services will capture $1.3 billion of the $1.6 billion market forecasted by a study done for McCall Information Services Co. by International Development Corp.

For this reason, MISCO is planning massive changes that it hopes will turn it from a $12 million/year batch bureau into a $100 million/year time-sharing network by 1973. Up to now the two-year-old firm has concentrated on facilities management and subscription fulfillment, with much of its business and staff inherited from McCall Corp. and the sister companies owned by parent Norton Simon, Inc. (Hunt Foods, Canada Dry, etc.). James Gallagher, president of MISCO, says he wants the ratio of Norton Simon:outside customer business to reverse to about 70:30, and the only way to do this and capture a significant place in the future service bureau market is to go the time-sharing route. "The time when you could build a company on one program and three devoted friends has just about ended," he said. The industry will merge and bankrupt itself into a relative handful of giants and the only firms that will thrive will be those with: sound financial support, time-sharing services, emphasis on both the business market and special industries, special applications programs, proprietary packages to sell, and a stable of experienced personnel. At least that's what MISCO plans for itself. MISCO will have the dollar support if Norton Simon approves the plan that will be formulated

by late summer, but currently it does not have most of the rest of the prerequisites or at least more than a base in any one.

MISCO has two west coast centers in Fullerton and Hayward, Calif., which together have a mod 50 (one more due soon) and four 30's; in a center in Dayton, where dp and educational services for a group of Ohio colleges and McCall's subscription fulfillment are done, are two 50's, a 40 and three 30's. One more mod 30 is in Washington, D.C.

reshuffle

The first hint that a MISCO reorganization was in the wind came with the news that 10 personnel in the large Fullerton office had been axed, including the vice president and general manager of the Computer Management Division, Max Muller, and the manager of western operations, Philip Cramer, who had been charged with software development. The reasons are said to be disagreement between Muller and Gallagher over the direction of the firm and some problems with the financial operation. Cramer and others were unknowingly caught up in the management battle and were swept out as part of the Muller-built organization.

Now MISCO has been split off from McCall Corp., becoming a firm directly under big parent Norton Simon. Because of this, MISCO has moved its headquarters from New York to Fullerton to be nearer the parent and its guidance in developing the new venture. The result is that Gallagher will fill the void left by Muller until the new organization is approved and a vice president with batch and time-sharing experience can be found for the division. Tom Sheehan has taken on many of Cramer's responsibilities in the west as general manager, and George Gautney will be Sheehan's eastern counterpart.

One major decision Gallagher must make with the help of an outside consultant in the next few months is whether MISCO will create or buy its time-sharing ability. The data processing management veteran has identified the current leaders in the industry, ranging from GE (his survey shows 41% of the market for them), IBM (Quiktran, 16%, Call 360, 4%), Call-A-Computer (7%), Com-Share, Tym-Share, and CEIR (all 5%). These and many other growing firms in the field are either owned by a larger firm and/or publicly held. The problem with the latter is that their value on paper puts a prohibitively high price on them.

Other decisions to make are the special industries that MISCO will service (in addition to general time-sharing), what packages it will develop, and, of course, what computers it will use. Much of this will be affected by what IBM comes up with in the way of separate pricing policies in July. This does not mean MISCO will buy IBM, Gallagher emphasizes, even though it has a stable full of IBM systems (all on third-party lease). Gallagher must also decide whether to change the MISCO corporate name, since it is no longer a McCall company, and put current activities under a MISCO division.

(A sidelight: It is unclear whether McCall's application for a channel in the COMSAT experimental domestic satellite, contingent on uses by all its former entities, will be affected by the McCall-MISCO separation.)

And while Gallagher and outside consultants mull MISCO plans, the deposed Philip Cramer, along with ex-MISCOites Peter Nordyke and Larry Chuba, has formed CNC Data Systems Inc. to continue what they had been doing at MISCO. That is, they will develop a data base service concentrating on the industrial relations field. One major application will be wage and salary analysis. (Chuba developed the Salary Information Retrieval program at System Development Corp.) Cramer's offices will be in Long Beach, Calif. CNC won't have a computer and, with no ill feelings, will rent time from MISCO. —AP

ASCII FINAL (MAYBE) VERSION SPEEDS SLOWLY TO FINAL (MAYBE) APPROVAL

A "super final" version of the ASCII implementation letter was reportedly awaiting final clearance by the Director of the Budget Bureau as we went to press. His blessing is expected to be given quickly. ASCII will then be implemented as an interchange code, paper and mag tape file code next July 1st, provided Commerce Secretary Maurice Stans gives *his* blessing before that date. There is some question whether he will.

One source, with close ties to the Commerce Department's front office, believes the ASCII letter "will not be signed over there as fast as Grosch (Dr. H. R. Grosch, one of the letter's chief architects) thinks."

Another source, who works for one of the equipment manufacturers involved, says "we can't live with the letter as it's presently written."

Conversations with the opposition camp indicate that a delay in the letter's effective date might lessen the conflict considerably (but not end it). Honeywell, one of the most vocal protesters, has an 8-bit-oriented computer family on the drawing boards that will be announced this year or early in '70, we were told. The company needs "a year to 18 months" after July 1st '69 to accommodate the proposed federal ASCII standard.

Misunderstandings about the scope of the directive continue to get in the way, despite numerous meetings between government and industry officials. For example, some industry participants believe the proposed rules would require files stored in core or on disc to be formatted in ASCII. This is not true, according to NBS officials. They say the only storage media encompassed by the directive, as presently written, are magnetic and perforated paper tape.

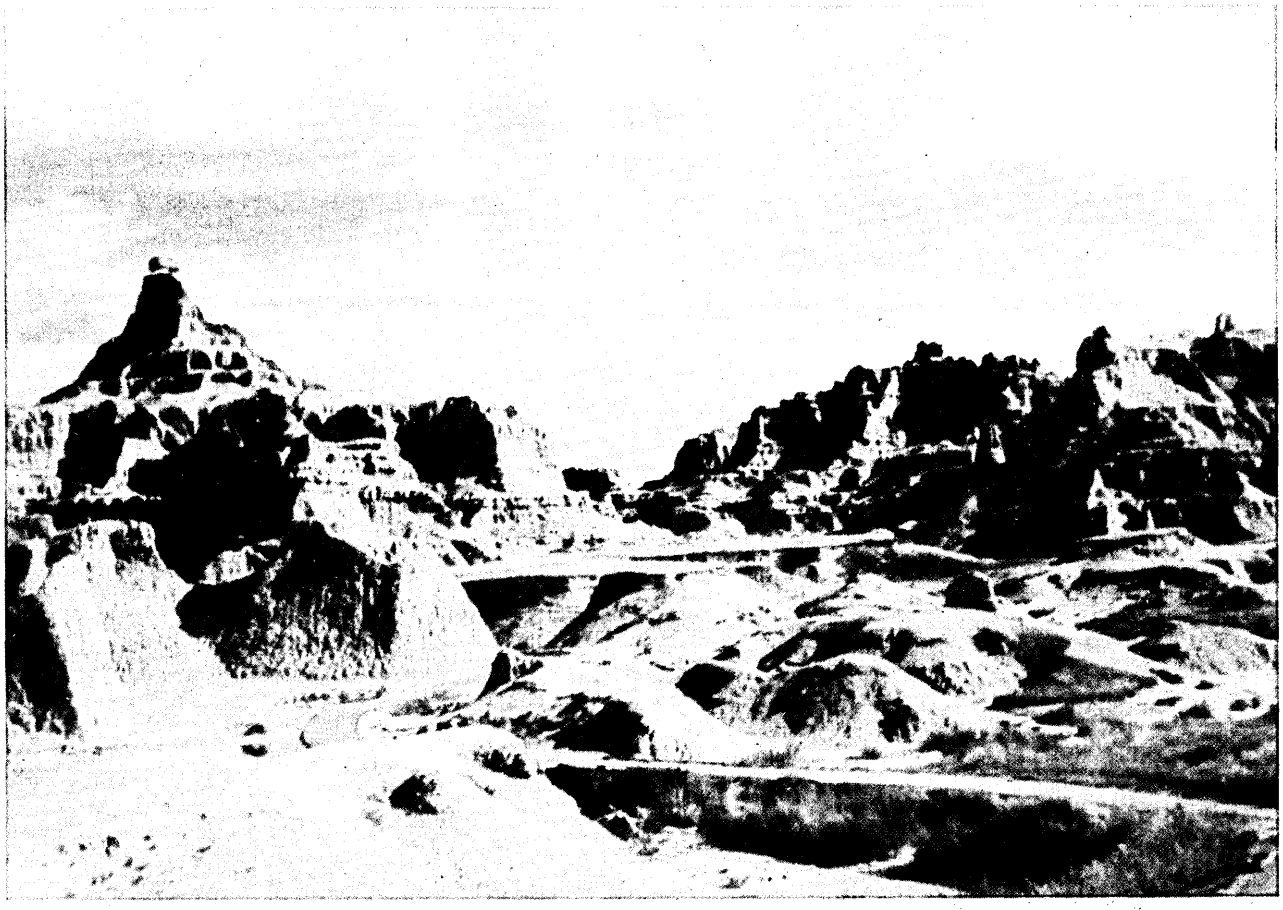
notable change

The latest version of the letter is quite similar to the one we described last December (p. 103). One notable change involves nonconforming codes. This section, as now written, reads as follows:

"More efficient utilization of magnetic tape and other media for interchange and for installation files is sometimes realized by the use of nonstandard techniques (packed numerics, floating point, pure binary). Where such techniques have already been adopted, local use may be continued until federal standards applicable to these techniques are promulgated. To facilitate USASI and federal standards development, agencies making heavy use of such techniques should advise the National Bureau of Standards of the form, degree and length of use, application, and technical or cost advantages of the representation used. If the use of these techniques established prior to issuance of the applicable federal standards is to carry past a replacement or augmentation procurement, the waiver procedure must be followed."

As translated by one official who participated in the drafting of the letter, this means, in effect, that users of 6-bit and other nonstandard codes will have to secure waivers if they want to

It Took Time...



Some 25 to 40 million years after the sedimentary rocks of the Badlands were initially deposited, the first computer was introduced to the public. High-speed information began to quicken the pace of life. Yet, for all of its usefulness, one major flaw soon became apparent. Computer tapes, holding vital, oftentimes personal information, were—for the most part—easily accessible. Privacy and Security became increasingly important.

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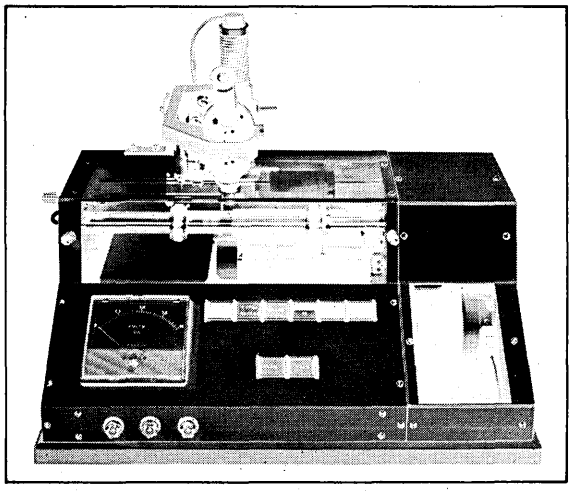

SAAB Automatic Film Scanner Mk II gives the computer an eye of its own

A photographic film can store large quantitites of information in a very small area. And a digital computer can process large quantities of information in a very short time. It's the gap in between that's the trouble: studying the film by eye and converting the information by hand into a form that the computer can digest.
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Wide range of applications

The Mk II Scanner is capable of extracting information from film records of many kinds. A few examples of its fields of use are:

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- NUCLEAR PHYSICS. Bubble-chamber particle tracks
- GENETICS. Chromosome analysis
- MEDICINE. X-ray plates, EEG and ECG traces

as well as numerous applications in scientific, industrial and military research, statistical analysis, etc.

For further information

write or call SAAB AKTIEBOLAG, Electronics Laboratory, GOTHENBURG, Sweden. The Mk II Automatic Film Scanner was described by professor S. Abrahamsson in the Journal of Scientific Instruments Vol. 43 (1966) No. 12, p. 931. Additional particulars on request.

SAAB

Electronics Laboratory
Box 5042, S-402 21 GOTHENBURG 5, Sweden.
Phone 031/40 00 80, Telex Gbg 2263

CIRCLE 51 ON READER CARD

continue operating with such schemes after replacing or augmenting present dp systems, but the waivers will be granted more-or-less automatically. Earlier drafts of the directive implied, at least to some industry representatives, that getting such waivers would be difficult. Both CDC and Honeywell are understood to have felt that way. "We changed the language to reassure them," says our NBS source.

The definition of nonconforming codes has also been altered in the latest draft. Now, the 128 lowest-order bit configurations of an ASCII compatible binary code can be assigned to alternate symbols. The latter will comprise an "extended" character set. On 9-track mag tape, which contains 8 information bits for each character, the directive allows the use of a zero in the eighth position for either ASCII or extended characters. Shift characters will permit transfer from one set to the other. An "expanded" character set is defined as one containing the ASCII characters *plus* special ones. The former must be assigned to the lowest-order bit configurations.

Both extended and expanded sets will have to be approved by NBS and recorded in the agency's recently established Federal Information Processing System Register before they can be used.

also drafted

These are the other key points of the latest draft:

Implementation—Essentially, ASCII standards must be implemented when software conversion is completed. In a new system, "where there are no significant tape files or program libraries," or in the case of replacement equipment "which does not require significant reprogramming effort," this means that ASCII code, collating, and media standards must be put in use immediately unless the user can qualify for a waiver. In the case of augmented systems, the present draft says "deferral" will be permitted "until segments, subsystems, or the entire system can be converted to the standards." Added equipment should, if possible, have ASCII capability; if not, the waiver procedure must be invoked. New capabilities added to an existing system, such as remote terminals or a source data acquisition system, should use approved standards "wherever technically possible and economically feasible." If the full character set of ASCII cannot be applied, the largest possible character subset should be used, and the ASCII collating sequence observed.

Coverage—The directive applies to "computers and related configurations brought into the federal inventory, or acquired or leased with federal funds as set forth in Paragraph 3, BOB Circular A-54, as revised June 27, '67." It also applies: to "data systems developed for implementation by or for government agencies; to data developed outside the federal government at government expense if such data is to be a part of the data base of a federal agency;" to "related equipment" including "all character-oriented equipment in which magnetic tape or perforated paper tape is produced for input to a computer-based data system or received as output from a computer-based data system;" to new or used equipment brought into the federal inventory from outside; and to "transmission terminal equipment and facilities procured primarily in support of a computer-based data system."

If dp hardware declared excess by one agency is transferred to another, "equipment which conforms to, or can be adapted, to the standards . . . will be given preference over equipment which does not conform and cannot be adapted." Cpu's and peripheral gear used "substantially fulltime" as part of a larger system "not . . . primarily concerned with information activities" is not covered by the directive.

Waivers—An agency head can grant them provided he "coordinates" with NBS "sufficiently in advance of" the final decision, so that NBS "may consider the impact on the federal standards program, and the significance of the action with respect to future national standards participation." The directive indicates that NBS will go along with the agency if it can be demonstrated that use of the ASCII standards would impose a "significant, continuing cost or efficiency disadvantage," and if "the interchange of information with other systems is minimal and is expected to remain minimal." If NBS and the using agency disagree about the need for a waiver, and can't resolve their differences, the dispute will be kicked upstairs to the Budget Bureau.

Waivers will not be required for equipment delivered before July 1 '69, nor for equipment ordered before March 11 '68 even if delivered after next July 1. The March date was when LBJ issued a presidential order launching the present implementation effort. The directive specifies that nonconforming equipment ordered after March 11 '68 but before July 1 '69 "shall be described in memorandum form to NBS within 60 days after issuance of this letter."

stocked with provisions

Miscellaneous provisions:

—There is a specific disclaimer of any intention to dictate cpu internal codes.

—"Techniques for interchange shall be given priority" but introduction of the standards for character-coded data and program storage within installations, and conversion to "appropriate" files, "shall also proceed as rapidly as possible."

—"When interchange and internal file techniques are updated from Hollerith, bcd, pure binary and 6-bit oriented codes and media, the ASCII character, code, media and sequence standards shall be applied. In no case may a nonstandard alternative be introduced." —PHIL HIRSCH

JUSTICE DEPARTMENT DISAGREES WITH FCC ON FOREIGN ATTACHMENTS

FCC "erred" last December when it allowed AT&T's foreign attachment tariff to go into effect without ordering a formal investigation. This was the gist of a petition for reconsideration filed by the Justice Department recently. Justice said several issues remain to be resolved—notably "the need . . . for a general tariff prohibition against all customer-provided network control signalling equipment." The commission, in its December decision, told the common carrier bureau to work out this and other conflicts through informal discussions; but, according to the Justice Department, discussions will be inadequate. Most users feel the same way.

related developments

A second petition for reconsideration was filed by a users' group. Also, AT&T offered a few concessions, and described—at least partly—the terms and conditions under which it proposes to link its private lines to customer-provided terminals and communication systems.

The users' group, which includes Bethlehem Steel, Ford Motor Co., and eight other big companies, echoed the Justice Department's contention that the network control signalling issue hasn't been resolved. But this petition called for slightly different relief. The users said the December order should be amended so that no one gets the idea that it represents the commission's

0 to $6,400 in 90 seconds.

Sometimes circumstances can change a man's mood very fast. One minute he can be driving along enjoying things. In the next he can be standing alongside a few thousand dollars' worth of scrap metal that used to be his fine, new car.

To say the very least, it's frustrating.

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SPERRY RAND

CIRCLE 52 ON READER CARD

final judgment on foreign attachments. The commission should also make it clear, said the Bethlehem Steel-Ford Motor Co. group, that no final ruling will be forthcoming "in advance of the commission's further investigation . . . as to what portions of an interconnected communications system may be provided by customers."

Ma Bell, in a Jan. 24 letter to the commission, said "we expect to have available, by the end of the current quarter, some automatic data access arrangements for the answering and origination of calls by customer-provided data equipment connected to the Bell system network." Similar facilities for voice systems are planned to be available "by mid-1969."

The letter also offered an olive branch to independent manufacturers of acoustic-inductive terminals. Earlier, these manufacturers had complained about the signal levels specified in the foreign attachment tariff that went into effect last Jan. 1. The basic beef was that, because of the specification language, the user of an acoustic-inductive terminal device would receive poorer service from an independently-made device than from Bell-supplied equipment. AT&T, in its Jan. 24 letter, proposed new language that would eliminate the discrimination "where acoustic or inductive connections of permanently-located, customer-provided equipment are made." But the concession isn't likely to end the dispute because the biggest problem involves customer-provided equipment that is not permanently located.

Provisions in the Jan. 1 tariff banning linkage of customer-provided facilities with Bell's Picturephone and 50 kilobit services will remain, the AT&T letter reported, because both "are currently offered on an experimental basis and are undergoing technical shakedown . . . It would seem premature to determine changes in the present tariff regulations at this time."

private-line users

AT&T wants its private-line customers who supply their own terminals or system to abide by basically the same interconnection regulations as its public telephone system customers. This means that a connecting arrangement, "furnished, installed, and maintained by the telephone company," would be required. The customer-provided equipment and communication system would have to meet "certain (unspecified) minimum protection criteria." Private-line users of acoustic-inductive terminals would not have to acquire the connecting arrangement, or abide by the protection criteria, until one year after these requirements were imposed on other users.

Other key proposals in the AT&T letter:

"Where customer-provided facilities are to be connected to private-line service and there is to be connection to the exchange network, the customer facilities will be required to comply with the minimum network protection criteria as set forth in the Jan. 1st Foreign Attachment Tariff."

Each private-line customer will be liable for a $10 service charge if he reports trouble, the phone company sends a repairman, and the trouble is found to "result" from the use of customer-provided equipment."

A customer-provided communication system will be connected to Bell's private line "at a point on the customer's premises where the customer has a regular and continuing requirement for the origination or termination of communications over the customer-provided communications system." These systems will be connected "only to private-line channels of voice grade or less (i.e., not Telpak)."

The AT&T letter was distributed to interested users and equipment manufacturers for their comments. After these are received, AT&T must draft a proposed tariff, which has to be considered by the FCC before customer-supplied terminals or communication systems can be interconnected with Bell private lines. —PH

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news briefs

USSR TO INTRODUCE ITS THIRD GENERATION

Word that the USSR would soon announce a line of IBM-compatible third generation computers leaked out of Europe late in January. While such a development has been rumored, even IBM World Trade in New York was surprised by the story and at writing was wiring its London office.

The only details offered were that the line, the United System of Electronic Computers (USEC), would be IBM-compatible down to the instruction level and that FORTRAN, COBOL, and PL/I would be implemented. The West is said to be five years ahead of the Soviets in computing technology. Indications are that the Russians are anxious to graft as much Western technology as possible onto their own developments. For example, they may develop interfaces that will allow Soviet and Western peripherals to be hooked onto systems. Peripherals will be a problem area, since the Soviets are not known for their manufacturing ability in electro-mechanical devices. It was also rumored that the USSR would try to obtain IBM interfaces, but at the moment IBM has a strict policy against selling any computer equipment to Russia, although it does trade with the satellite countries (except Albania).

Re languages for USEC, the Russians have never made any secret of their reluctance to develop their own language.

The intention with the new line is to utilize metalanguage ideas—with a machine-independent language to translate ALGOL 68, FORTRAN, COBOL, and PL/I. Development of software systems along this line is said to have been tackled with ALGOL 68, FORTRAN and PL/I on a BESM 6, a 32K system rated as comparable to a CDC 3200.

A Soviet third generation line, which a New York source says will be announced in detail by June, raises some questions with U.S. export laws. The U.S. firms can export computers to the USSR and satellites, except Albania, but generally each application must go through a horrendous process that involves the Department of Commerce, Defense, the CIA and other agencies. Often NATO has a say in what will be shipped. Each application is considered on a case-by-case basis, with considerations being the recipient, the application, the power of the equipment, etc. An arbitrary limit is that the computer must be slower than 2 usec, although that is not a firm rule.

There are some small third generation machines in the East now, but the supply is not as large as the demand. Should the Soviets mount a full-scale attack on world markets, the U.S. will probably more seriously consider easing its restrictions. The current laws have been under review for some time.

On the other hand, one reaction to the Soviet plan: "Well, that should keep them five-ten years behind the U.S."

XEROX AND SDS ANNOUNCE A TENTATIVE ENGAGEMENT

A four-sentence news release from Scientific Data Systems was issued to notify the world that a "tentative agreement has been reached to combine the businesses of Xerox and SDS." This mild statement was followed by the usual disclaimers that the boards of directors would have to agree, the shareholders of both companies would have to vote, and the feds would have to come through with a "satisfactory" tax ruling. Nevertheless, the betting at the time of the first announcement was that this was a deal that would probably really come off—unlike the batch of other proposed mergers in the last year, typified by the CSC/Western Union temporary liaison.

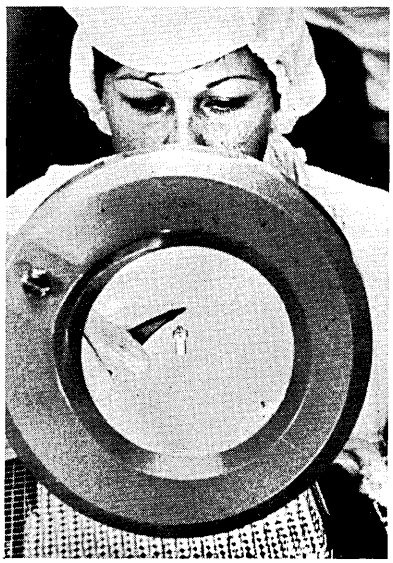
Terms of the proposed transaction call for the exchange of one share of Xerox for two shares of SDS. SDS stock has been a bit sluggish lately, appearing from time to time on the new-lows-for-the-year list. But during the four days prior to the late Friday announcement, it moved from about 85 to slightly over 100. (The market was snowed in Monday so no quotes could be had immediately following the news.) Xerox was about 268 that Friday—near the middle of its 229/328 range for 1968-69. So at this price SDS stock would be worth some $134.

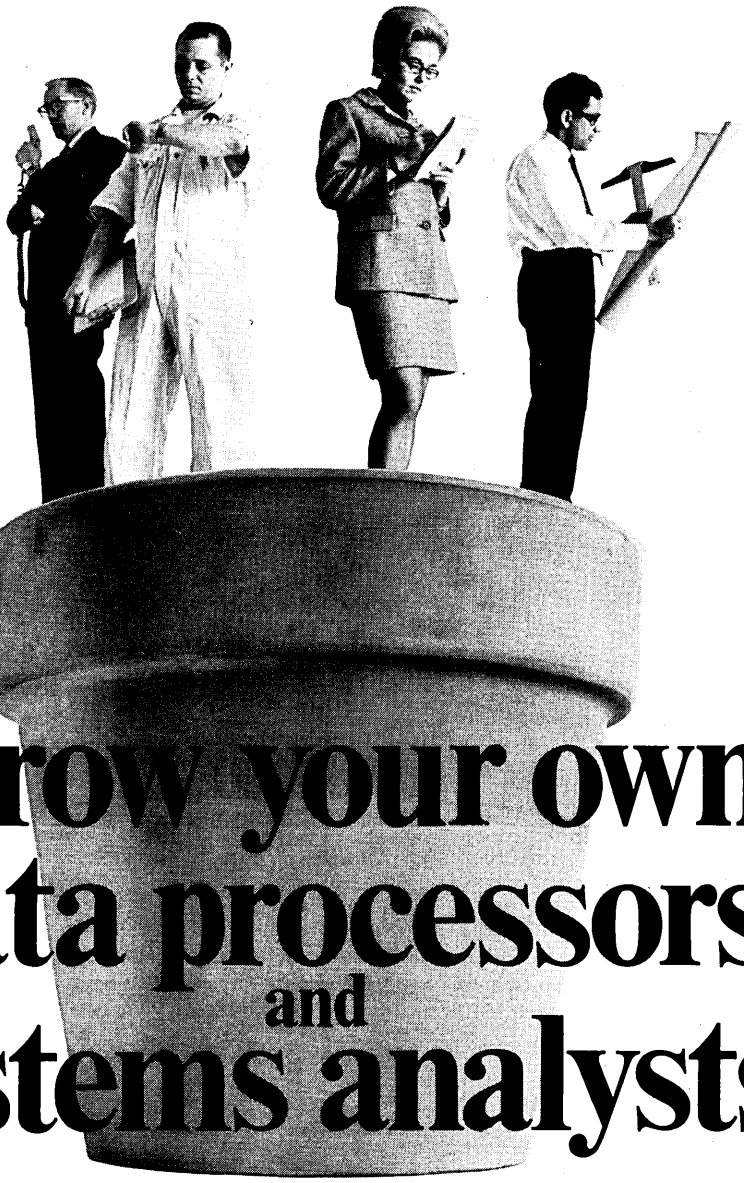
Why should SDS want to be acquired? They just reported sales up 40% to over $100 million, with net up 45% to over $10 million. At the same time president Max Palevsky noted that SDS is presently in the strongest financial position in its history with no

FOUR PATENTS DEFINE COULOMETRY

The US Patent Office has officially recognized a new technology called applied coulometry, which is already making itself known as a competitive technique in analog data acquisition and in the production of sub-computer devices. The four patents issued cover the components and manufacture of E-cells, small electrolytic devices that have the ability to integrate, remember, or subtract information. E-cells are about the size of a navy bean, are constructed of an electrode, a sheath that serves as a second electrode, and plating materials that travel in an electrolyte between the two.

Present uses for the devices center around their ability to be stationed in small or inaccessible spots for measuring the time, temperature peaks, or hours of operation of the equipment they monitor. For instance, they can be used to measure telephone line usage, to indicate the service needed in jet engines, or in control systems monitoring machine operation. The $2-$10 register-like units are presently accurate to about 1%, but the manufacturer, Bissett-Berman Corp., of Santa Monica, Calif., feels that the limits of their accuracy are not even being approached.





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bank debt and a net worth of over $78 million. He also said, perhaps prophetically, that "no equity financing will be required to accommodate the company's future growth plans." And Leasco has announced plans to buy up to $40 million worth of Sigmas.

Still, money seems the main attraction. SDS has 4000 people on the payroll, around 1000 installations to worry about, and 25 or 30 sales offices. And no one in the business, except IBM, ever seems to have enough money to do everything they would like to.

What's in the deal for Xerox? Here it's easier to find the advantages. Xerox needs to maintain its glittering image as a super growth company. This has been getting harder to do, with increased competition in the office copier field. Their acquisition of Basic Systems, presumably a start in the education market, didn't work out. They have a product on the fringes of the dp market—the Computer Forms Printer, which reproduces and reduces computer print-out to standard page size. They are also said to be busy in Rochester with prototypes for a device to create hard copy from crt displays.

During the last few years they have hired a number of computer people, including Sullivan Campbell from IBM (who has since left) and some from Univac. There haven't been any reports of their trying to develop a computer; presumably, these edp types were wanted for advice on such peripheral activities as automatic typesetting.

In some ways this proposed move is reminiscent of the scene 10 or 12 years ago, when the office machine makers decided they had better move into computers. Examples are Burroughs and NCR. And perhaps this one is at least as sensible as those—since Xerox shares the same problems of replacing high technology products, commission structure to motivate salesmen of fast-replaced products, and the necessity for skilled maintenance.

One reason a merger could benefit both: SDS has not made many inroads in the business applications area—and that's where Xerox stars.

In any case, we shouldn't have too long to wait. The Xerox shareholders' meeting is scheduled for May 16 and SDS holders should have a chance to vote in April.

PL/I SENT ON NEW ROUTE TOWARD STANDARDIZATION

The USA Standards Committee X3, Computers and Information Processing, at its January meeting in Phoenix attempted once more to move toward resolving the continuing wrangle over the standardization of PL/I as a composite business and scientific data processing language by adopting the following:

"X3 authorizes the organization of its component of a composite language development group to perform developmental work on the composite language PL/I in cooperation with ECM TC 10 (European Computer Manufacturers Association Technical Committee 10) and IFIP TC 2 (International Federation for Information Processing Technical Committee 2). The group is charged with:

1. Producing a language specification for input to X3 for standardization.
2. Assuring that the development is in consonance with existing and draft U.S.A. and international standards.
3. Reporting to X3 on the activities and level of development."

The resolution authorizing the group was passed unanimously and, although no timetable was established for the completion of the group's work, pro-PL/I forces consider its establishment another step, however tortuous, toward standardization.

NEW STANDARDS APPROACH IN X3 REORGANIZATION

A plan to reorganize USASI's X3 standards committee is nearing a final decision. Here's how the proposed reorganization—already approved in principle by X3 and BEMA's data processing group standards committee—would look.

Serving as staff to the 43-member X3 information processing committee is SPARC—Standards Planning and Requirements Committee. SPARC will evaluate the recommended subjects for standardization, and—once they have been selected—will set forth the programs for their development . . . including goals, benchmarks, reporting techniques and schedules. And SPARC is supposed to develop the criteria by which standards activities are selected.

The avowed goal is to make SPARC user-oriented, although it will represent manufacturers, users and "general interests." Selected to be the first SPARC chairman is Tom Steel of SDC. A veteran U.S. and international standards worker, Steel is an executive of SHARE and is currently serving as chairman of the X3 common programming languages subcommittee, X3.4, which will cease to exist, although its task groups will continue under an as yet unnamed "software disciplinarian."

Other members will include the chairman of the Standards Steering Committee and the heads of the three steering groups for hardware, software and systems technology (none of whom, at press time, had been selected).

The SPARC programs will be assigned to technical committees which will be formed to develop a specific standard, and dissolved when their work has been completed and blessed. Monitoring the performance of the technical committees will be steering groups under the direction of the Standards Steering Committee.

It all sounds somewhat complicated, but BEMA DPG spokesmen claim that the new organization will remove one level of balloting, thus hopefully speeding standardization work. Presently, balloting on proposed standards starts at the task group level and slowly works its way through subcommittee to X3 level before the Information Processing Systems Standards Board gets *its* hands on it.

Under the new lashup, there will be no subcommittees and subcommitteers will ballot on a proposed standard and submit it simultaneously to X3 and to SPARC. But SPARC will be free to comment only upon the degree to which the committee has met the preassigned goals and *not* upon the standard itself, according to dp standards officials.

After X3 approval, a standard would then go to a Standards Review Board, proposed as a substitute for the current IPSSB, which now consists of edp specialists who evaluate three things: whether or not there is a consensus concerning a proposed standard, the competency of X3 . . . and whether there are any negative ballots which have not been responded to adequately.

Reorganization pushers feel that it doesn't take technical experience to decide these essentially nontechnical matters, which should be referred to a board that reviews these questions concerning all sorts of standards . . . not just for edp.

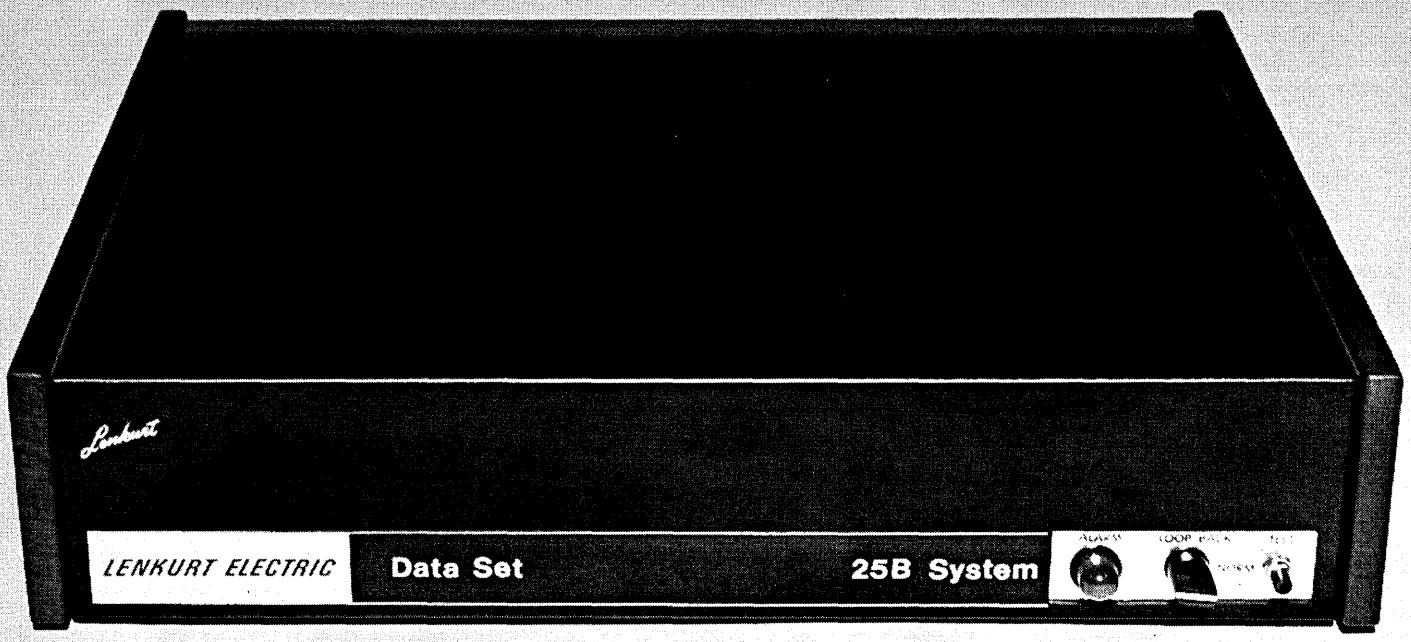
The new organization and its procedures are now being reviewed in detail by the DPG standards committee, which must decide what changes in financial and manpower requirements the new org chart would require. And then BEMA's plans and policy committee (currently chaired by RCA's Bill Lonergan) must approve it.

If all goes well, the revised organization could be a reality within a couple of months.

ENGAGEMENT BROKEN OFF BY DEMOCRATIC PROCESS

The members of IBM user groups SHARE and GUIDE have voted down the proposition to merge their operations,

Announcing the little black box to end all little black boxes.



The Lenkurt 25B may be the only data modem that really deserves to be called a little black box.

For a modest-sized piece of equipment, it does an amazing job.

It handles computer, telegraph, and telemeter data . . . individually or in combination.

You can transmit up to 25 channels over a single voice circuit. Plug-in filters give you a choice of five data speeds from 75 b/s to 600 b/s.

And you get 20% more speed for a given channel spacing than you've ever had before.

You can use it for single-channel or multi-channel operation. Or as terminal equipment to work into other modems.

People who know our other video, voice, and data equipment won't be surprised to learn that the 25B is fully compatible with Western Electric's 43A/43B. (We've always been very easy to get along with.)

The 25B is a great little black box, designed by a company that really knows data transmission. (And microwave, multiplex, cable carrier, and coaxial cable systems, too.)

Even though to us, it will always be a computer-telegraph-telemeter data modem to end all computer-telegraph-telemeter data modems.

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Lenkurt Electric Co., Inc., San Carlos, California.

Data Transmission Systems from Lenkurt

CIRCLE 55 ON READER CARD

but according to spokesmen will continue to cooperate on various mutual projects, guiding and sharing with each other while they go their duplicate paths. Price Waterhouse & Co. audited the returns and in its best Academy Award tradition did not reveal the actual results, nor any percentile breakdowns concerning commercial or university user reactions. This information is likely to remain unknown.

AT&T SALE OF TWX TO WU KEY TO NATIONWIDE NETWORK

AT&T's agreement last month in principle to sell TWX to Western Union for a reported $80 million is regarded by one knowledgeable source as a "key move in a 3-way chess game; WU wants to establish a nationwide network of on-line, commercial dp service centers, while the FCC and the dp industry want, at the very least, to fend off unfair competition. I'd say WU, by working at the TWX deal with Ma Bell, has captured a knight, possibly a queen, and put itself in a position to gain a competitive edge in a large sector of the commercial dp market."

Last year, the telegraph company established a subsidiary, Western Union Computer Utilities, which is now erecting a network of franchised service centers across the country. Our source expects the majority of TWX-Telex users who need outside data processing to employ WUCU, "even assuming WUCU charges no less than its competitors and offers identical services. For, if a TWT-Telex customer is satisfied with Western Union's communications service, chances are he'll go to the same basic source for dp capability; it's easier than looking for a new supplier, and has at least the appearance of being less risky. You can be sure WU will exploit these benefits in every way possible—for example, by offering to send the customer a single bill each month, covering his communications and dp purchases, and by having the salesman who handles the customer's communications needs participate actively in any negotiations with WUCU for machine time."

FCC OK'S NEW AT&T PRIVATE LINE TARIFF

FCC allowed a new AT&T private line tariff to go into effect last month; it permits shared use of voice grade and narrower band width channels. Western Union had objected that the new service would enable private line customers to become unregulated common carriers.

The new tariff may cut costs for some customers of stock quotation services and on-line service bureaus, as well as for some other private line data communicators. If one of these users isn't fully loading his present channel, he can under the new tariff, share the channel with similar users. The new tariff, however, does not allow sharers to communicate with each other.

Western Union, in opposing AT&T's new service, was espceically concerned with private line customers who, under preexisting tariffs, are allowed to multiplex voice grade channels for data transmission. WU insisted that sharing would permit these customers to sell the multiplex channels to others on a dedicated basis. The multiplexor would be outside the FCC's regulatory power, and so he should charge whatever the user was willing to pay. Western Union thought this situation would create unfair competition with its own offerings.

"Western Union's apprehensions appear to be highly speculative," said the commission. "They are confined to only one possible feature of the potential use of the shared private line service—i.e., the sharing of a multiplex channel. There is no way of knowing at this point the extent to which the sharing privilege afforded by the revised tariff schedules will be utilized in this manner . . . We cannot assume at this point that the prospective customers will use the sharing privilege in violation of the law. In addition, the AT&T tariff prohibits the 'resale' of communication service."

The charge for the new service is the existing private line tariff charges, plus 10%. Sharing is allowed among a name user—who is designated as the customer, remains responsible for the bill, and makes all arrangements for service—and others whom he designates. The telephone company bills each party for a pro-rata share of the service, as specified by the customer.

Each joint user must have a station and a service terminal, or a local channel on his own premises, linked to the customer's private line. Also, the communications that are transmitted must relate directly to the joint user's business.

Joint use arrangements are offered 24 hours per day, seven days per week. The following private line channels can be shared: Series 1,000, 2,000, 3,000 and 4,000. The following cannot be shared: Foreign exchange channels; voice channels used alternately for foreign exchange; "Those services . . . furnished in connection with a common control switching arrangement or a switched circuit automatic network;" wide band services; program transmission; video transmission; Telpac, and certain other services with band widths wider than voice grade.

THE OTHER COMPANY ENTERS S-B FIELD

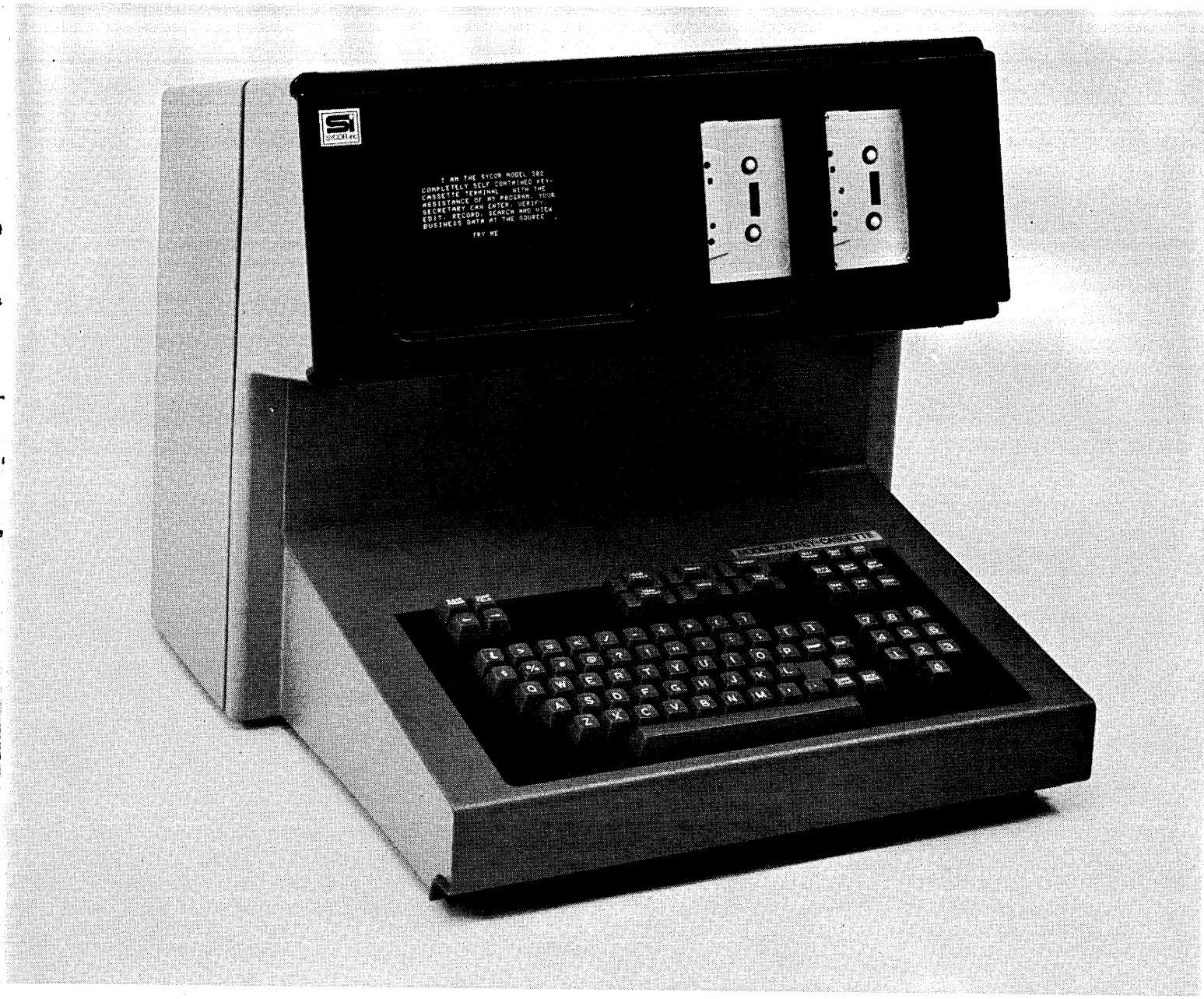
A week after its announcement of a new time-sharing system, H-1648 (see New Products, p.), Honeywell revealed plans to blanket the country with a string of 11 service bureaus under the direction of its new Information Services Division. Seven of the sb's will offer time-sharing on the 1648 system, capable of serving 48 users simultaneously, for a total of 960 terminals per system. The 1648 may also be used as a general purpose batch processing system when not occupied in time-sharing.

The first time-sharing center is now operating at corporate headquarters in Minneapolis, and the six additional t-s centers are scheduled to be opened by the end of the year. Each of the nine EDP Division customer education centers will be expanded to offer sb capabilities through additional hardware and personnel. These centers will include t-s services in Los Angeles, San Francisco, Chicago, New York, and Cleveland. Time-sharing will not be available at centers in Washington, Philadelphia, Detroit, and St. Louis, while a separate center providing only t-s will be opened in Boston, and an additional center without t-s established in Atlanta next year.

The present education center hardware includes 14 computers, with plans for expansion to 21 by next year. Expanded sb capabilities at these centers will include batch processing, keypunching, keytape data transcription, programming, and systems analysis and design. Each center will be able to act "as a customer's full data processing facility," and will sell machine time by the hour or by the shift, as well as provide software libraries, including such commercial packages as payroll, accounts receivable/payable, inventory, and estate planning. Remote batch processing service is currently "under study," and may be offered in the future.

PROGRAMMATICS AWARDED SOFTWARE PATENT EVEN SO

Even while the patent commissioner's request for a rehearing on the Prater and Wei patent case is being considered, Dave Ferguson, president of Programmatics, Inc., a Los Angeles software firm, has been awarded Patent



The tractable terminal

. . . that talks the language of business, when and where it takes place, and records it on the industry's most promising information storage and exchange medium—the magnetic tape cassette.

The obliging terminal whose video display presents the entire record content along with field labels and format control characters for location or verification at a glance.

The precocious terminal whose program vocabulary minimizes operator training, reduces chance for error, and increases speed and ease of data or text preparation and manipulation.

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CIRCLE 56 ON READER CARD

No. 3422404 for an "Apparatus and Method for Decoding Operation Codes in Digital Computers." The patent covers both software and hardware embodiments of the package, but the company considers it basically a software patent. Application was made over two years ago, and final approval was received the later part of Jan. '69.

The invention is based on the fact that, although many command codes are necessary to the operation of a computer or a language, most of them are not used in conjunction with each other. For instance, a math function would not be implemented just after a file open command, and therefore the same operator that would normally signal the beginning of a specific math function could be used right after a file open to signal something else.

This method was used by Programmatics in developing a proprietary assembler, called MACROBIT, for the SDS 92 computer. The resultant macro assembler, including relocation, literals, and symbolic linkage, requires only 4K bytes of storage. MACROBIT uses only three bits to represent 26 distinct commands; consequently each interpretive command fits into one 12-bit word. The technique can therefore be used to cut program space in any machine and to allow the use of larger address fields in small-word machines to solve their inherent address ability problems.

In such a program, the interpretation of the command code depends upon the state of the computer. The state may be set or changed through status indicators or base registers and may be controlled implicitly or explicitly by the program.

ONE TRILLION BIT LASER MASS MEMORY SYSTEM ORDERED

By early 1968, Precision Instrument Co. had developed a massive-scale laser recorder/reader storage system, but the first order for the device was not received until this year. Ed Gray, the chief engineer on the UNICON (Unidensity Coherent Light Recorder/Reproducer) Laser Mass Memory System, said that convincing the first potential customers that they should acquire a $500K to $1 million memory system was not easy, especially when you had to "tell someone that you were not going to store data with magnetics like God intended." Now that the first order has been placed, by Pan American Petroleum Corp. of Tulsa, Oklahoma, Mr. Gray feels that the systems will move a little faster in the marketplace.

The $740K system placed with Pan American is to be installed with all requisite software about March of 1970. Four other potential customers, including some government agencies and a private credit-reporting firm, are also expected to place orders.

Data for the system is permanently recorded on mylar-based tape with a metallized coating. The 5 x 30 inch tape strips are subjected to a laser that burns the metal coating off the tape base in selected spots, leaving 1-micron holes that are packed 1,000 times more closely than bits on magnetic tape. Each strip can contain 5 billion bits of data. The recording code is proprietary, but it is known that a "longer than average" word size is being used (something over 36-bits), and that liberties have been taken with the code since compatibility is not considered a problem when you are working at the state of the art level and beyond. Errors that may occur in recording are flagged by an indicator that follows the recorded word. Since the fixed contract accepted by Precision Instrument Co. requires that the data retrieval error rate be less than one bit in one million, apparently data validity is not seen as a significant problem.

The strips are mounted on two revolving drums, one strip per drum. The information is recorded and accessed from longitudinal tracks, just as in a magnetic drum environment. There are approximately 1200 tracks per strip, and the transfer rates realized from the 22 cps drum and 13 megabits/square inch packing are in the neighborhood of 4.5Mbits/sec. The trillion-bit storage figure is achieved by storing and mechanically accessing a total of 250 strips in the system. The worst case access time for a single strip is reported to be about five seconds. Once the drum has been stopped, the strip has been mounted, and the drum has been brought up to speed, access times run something under 200 msec, a speed comparable to most disc storage systems. (The disc comparison can be carried somewhat further: each strip holds about the same amount of information as does an IBM 2314 8-spindle disc system. The Laser Mass Memory System therefore provides storage roughly equivalent to that of 250 2314 systems. In addition, however, a low-cost library of the strips could be held as archival storage. Each has about the same storage capacity as 10-15 2400-foot reels of mag tape, and costs roughly the same as one reel, $30-$40.)

PI had announced that it could produce a laser system to record data as early as 1966. However, developing the method for reading the vaporized-metal holes on the tape wasn't developed until 1968. The reading procedure turned out to be roughly equivalent to reversing the path of the laser and reading the reflected light. The hard part came in positioning the "read" laser. This reading scheme offers immediate verification of the recording as the reflected light can be constantly monitored while the "write" beam is vaporizing its holes. Once a hole is cut through to the tape, the reflectance falls off at that point.

The system will have two built-in cpu's. One, a high speed word processor, will read the data to be recorded, format it, add a check sum, and direct the laser burning operation (or do approximately the reverse in a read). It will probably be based on read only memory. The second, which will operate as a system controller and scheduler, will be chosen from among a wide variety of commercially-available systems. The choice is not extremely critical, as the memory system is not time-dependent—the drums can be run at almost any speed slower than the 22 cps nominal. Right now, PI is looking at systems about the size of the SDS Sigma 2 or the Hewlett-Packard 2116, which will be used to interface Pan Am's 360/75.

Whatever the choice of the second cpu, certainly it will not make up much of the $750,000 bill to be presented to Pan American. Impressive as that price tag is, though, it is a far cry (about half) of the price of the IBM Digital Photo Store, the only working storage system to approach the PI device in data compaction, and far less than the Ampex in-development video recording system, which is slated to go for between $1 and $2 million. The laser Mass Memory System looks exciting for those user applications where archival storage is desired, such as for Pan Am's oil well and seismic data. But don't ask to be able to change even a record or two; they haven't come up with the answer to that one yet.

PALO ALTO FIRM OFFERS TIME-SHARING ON CDC 3800

With the characteristic modesty that marks most PR operations, InterAccess Corp., a Palo Alto-based firm, has claimed for itself the distinction of being the first to offer time-sharing of large scale-computers. The claim is too strong, but the operation is nonetheless significant. Basing their service on a CDC 3800 (which easily qualifies as large-scale with its 900 nsec adder and 262K core but does not qualify as the

"first" large-scale t-s system), InterAccess offers each customer his own virtual memory of nearly 100K 48-bit words. To do this, the initial system configuration includes 30 million words of on-line mass storage.

The time-sharing configuration uses a Varian 620/i and a CDC 1700 as preprocessors. These satellites translate, compact, and buffer transmissions between the cpu and terminals. Because of the dexterity of the satellites, almost any kind of user terminal can be accommodated.

InterAccess is using the Control Data operating system SUMMIT (Supervisor of Multiprogramming, Multiprocessing, Interactive Time-Sharing) with a communications package of its own design. The present 3800 system, using SUMMIT, offers remote batch processing; the time-sharing service will not be available before May. Once in full operation, the remote batch jobs will be run simultaneously with the conversational processing. The multilevel priority structure employed even allows for entering and debugging programs in the conversational mode and then running them in the less expensive batch mode. Source languages will include ALGOL, FORTRAN, COBOL, SUPERBASIC, and 3800 assembly language (COMPASS). Special application programs are also available in the software library supplied. These include SORT, SIMSCRIPT, PERT/TIME, and linear programming codes.

IRS COMPUTERS DEDUCE THOSE DEDUCTIONS

The Internal Revenue Service is using dp techniques to pick out those tax returns most likely to contain errors. The new system, known as DIF (Discriminant Function), amounts to a preaudit audit; it decides which returns should receive the very special attention of 20,000 IRS agents and greatly expands the efficiency of the whole IRS auditing operation.

Few people really understand how the IRS audit works until they actually undergo one: To say the least, it is thorough. Nevertheless, of the 3.1 million tax returns audited in fiscal 1967 (the latest figures available), 60% were found to have errors. Officials feel DIF can quickly increase the efficiency and productivity of the IRS auditors because it will eliminate many of those returns that do not contain errors. DIF will mean that of those returns receiving the full IRS-audit, probably 70% will be found to contain errors. DIF should also enable IRS to raise the number of complete audits it can conduct.

The 20,000 agents available for the work produced additional revenues for the Treasury of $3.3 billion in 1967 while returning $363 million to taxpayers who had overpaid.

DIF began a couple of years ago with the "Taxpayer Compliance Measurement Program"—an extra intensive audit—that taught IRS agents which line items on the tax form were most likely to yield errors. From TCMP, IRS developed mathematical formulae assigning various weights to each line item. IRS technical sources explain "discriminant function" this way: "The word 'function' refers to a quantitative relationship determinable between the values of one group of characteristics and the values of other groups of characteristics, so that the former can be deduced or computed from the latter. The adjective 'discriminant' refers to the power of such a function to separate the objects into significant groups by discerning the differences of their measured characteristics."

The line items are the "values" that are combined into relative scores. Those returns with higher scores are expected to yield more errors. The IRS won't tell what the formulae are. Computers at the National Computer Center have been programmed to make the calculations using the formulae to score the returns. Those with the high scores are sent to the District Audit Divisions. The auditing process then consists of one or all of three steps: Audit by correspondence, by the taxpayer visiting the local IRS office, or by the IRS man visiting the taxpayer in his office or home.

Singleton B. Wolfe, director of the audit division, calls DIF "the most important breakthrough" in years at IRS. In the past, IRS agents have used the hop, skip and jump technique—"eyeballing" returns "—on perhaps 15 million returns a year." So far, only returns reflecting incomes of less than $10K are being checked but IRS will be DIF-ing all of the nation's 80 million-plus individual returns by 1970.

All computer operations by the IRS in 1968 added an extra $134 million to federal tax collections bringing the total to $300 million since 1962. Last year was only the second full year in which IRS electronically processed all business and individual tax returns.

IRS also reports its new system for taking data from returns and preparing it for computer processing will be used on 1968 returns. Called "direct data entry," it eliminates punch cards. Data moves directly from the return to magnetic tape. The system checks the data as it is transcribed and signals the operator when an arithmetical error is discovered; the operator views the transcribing process on a crt. When the system is completed, some 400 million punch cards will be eliminated.

Magnetic tape reporting by the taxpayer is increasing. Over 1,000 businesses used magnetic tape last year to report wage, interest, dividend and other payments, while some 37 million information reports of all kinds came to the IRS on tape.

A final example of expanded dp at IRS this year is its SCRIP system (System for Controlling Returns in Inventory and Production). As the tax payer's return travels through the maze of the IRS machine-people structure, an up-to-the-month progress report will be made so that at any time theoretically the return can be located by a gimlet-eyed agent. SCRIP helps the audit division meet the legal deadline for auditing returns within the 36 months after they are filed.

FCC DOESN'T WANT TO LET CATV OUT OF THE BAG

Two days of hearings by the FCC (Feb. 3-4) on proposed CATV regulations produced some reference to the possibilities of data transmission. The commission announced no further hearings and asked for comments on its proposals in March with replies in April.

Warren E. Baker, a lawyer for United Telephone System, noted his firm has tariffs in effect that would include data transmission and that some experimental services are being provided. He also reported a major technical breakthrough using coaxial cable to send tv and any data transmission the FCC proposes to regulate.

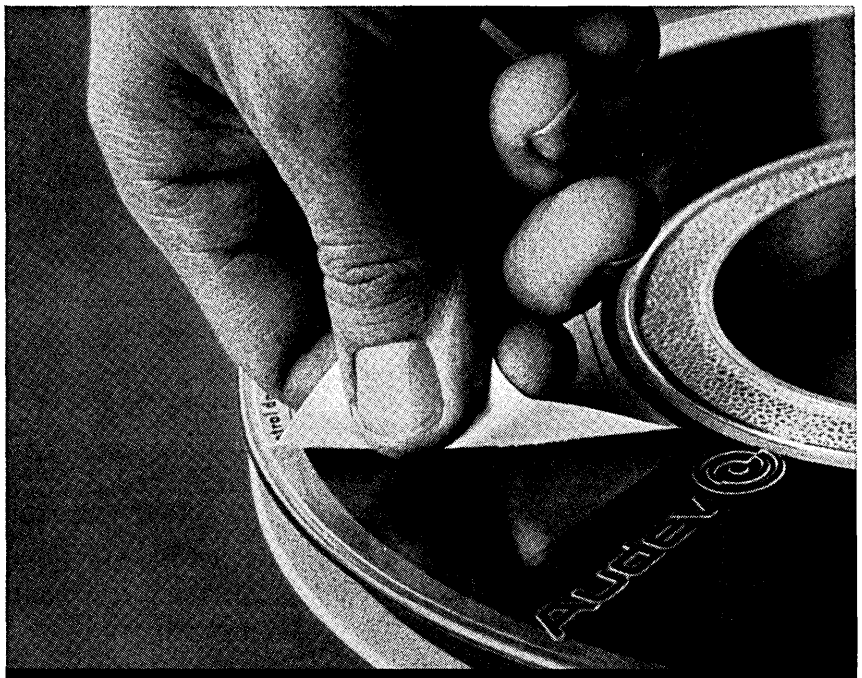
Lewis H. Ullman of AT&T did not touch directly on data transmission but suggested the FCC was in uncharted territory, since it asked to have CATV meet state and local regulations. The problem of checking each operator against each state and local regulation would be fantastic, thought Mr. Ullman. He warned that an attempt by FCC to give CATV operators common carrier status if they used spare capacity for common carrier services wouldn't hold up because the signal deteriorates after 10-12 miles and such systems are usually confined to single states.

AT&T interest in CATV is significant: Of 2,300 CATV systems, 1,500 have cables attached to poles belonging to one or another of the Bell Telephone companies.

ARMY TO REQUIRE USASI STANDARD COBOL COMPILERS

Army dp policymakers, following the Navy and Air Force, have issued a di-

The lethal label.



With proper handling, computer tapes can be "scratched" and reused almost indefinitely. However, careless removal of previous labels can crush reel flanges against tape edge, and kill a good tape.

Moral: Hold flanges away from tape when removing labels.

Antidote for tape problems: Audev. Whether you use our series 61 or premium K-68, you're in good company. These are the tapes used by the top U.S. companies.

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rective requiring all COBOL compilers delivered after Jan. 1 '70 to be specified in terms of the new USASI standard. Compilers encompassing either the full standard, or specified modules (levels), can be acquired under the new directive. But nothing is said about nonstandard extensions.

Meanwhile, Air Force officials report that recent tests of a new COBOL compiler validation system, developed by Information Management, Inc., "went very well indeed." Some changes and corrections are necessary, but these are regarded as routine. The tests were performed on a Univac 1108, IBM 360/40, GE 635, and B3500.

The IMI package, developed for approximately $100K, is reportedly more automated than similar programs worked up by Dr. Grace Hopper of the Navy and by USASI. The IMI validator is expected to be operational by next Jan. 1, when all three services must begin accepting only USASI-standardized COBOL compilers. It may be adopted for use throughout DOD; however, the Navy and USASI validation programs are also being considered. An amalgam of all three is another possibility.

Heart of the IMI package is a set of test routines, each related to an element of the USASI standard, and a set of test results that show the object code that should be produced by a compiler if it conforms to the standard. The program automatically compares this standard code against that produced by a compiler being validated, and flags discrepancies. The program doesn't measure compiler efficiency—e.g., run time, core requirements, register usage—but AF officials say this data can be acquired without much more effort. The IMI program includes test routines related to only a small proportion of all the elements in the USASI standard. More routines probably will be cranked in before next January. Tests for nonstandard elements "are a possibility."

Sometime this month (March), the IMI program should be ready for release to interested users, equipment makers, and software houses. All three groups are being encouraged to test the package on their own compilers and report bugs to the Air Force.

MINI-SCERT WILL HAVE A LEG UP THIS SUMMER

"MINI-SCERT," an abbreviated version of the well-known Comress system simulator, will be introduced this summer "at a lease price up to 50% less than" SCERT 50, the current version of the full package. MINI-SCERT is aimed at the smaller-scale computer user, who has remained largely indifferent to the virtues of simulation until now.

MINI-SCERT will permit user-specified systems or system families to be simulated. SCERT, by comparison, is a single package designed to simulate the operation of all the well-known U.S. and foreign systems.

The measurements made by MINI-SCERT for a particular computer or family, applied to a given job, are identical with those produced by SCERT, given the same environment. Both packages will also be marketed in the same way—via an annual lease contract requiring monthly payments from the user, and on a "study basis," involving a one-time charge based on the complexity of the application and run time. MINI-SCERT will operate on an 1108, 360/40 or larger, and Spectra 70/45 or larger.

Comress reported that SCERT 50, which has been commercially available since the first of this year, will shortly be programmed to run on the 1108. At the moment, it requires a 360/40 or a Spectra 70/45. SCERT 50's ability to simulate time-shared applications will be enhanced substantially this year, says a company spokesman. Definition procedures are also being restructured to make the package easier for customers to use. Comress plans to open new branch offices this year in San Francisco, Detroit, Houston, and possibly Atlanta. Negotiations for overseas franchises are under way in Japan, Venezuela, and Australia.

Comress insists that it did not compete with Software Products Corp. for a simulator contract at Ernst & Ernst, Cleveland cpa firm, as we reported last month (Feb. '69, p. 205). We have rechecked our source, who sticks with his original story: that Ernst & Ernst used SCERT to simulate a 360/40 DOS application, then did likewise with CASE, the SPC simulator, and afterward picked the latter package.

Our story also said the U.S. Forest Service and Internal Revenue Service had leased CASE after performing similar benchmarks. According to Comress, there has been no test performed at the former agency and no contract signed at the latter. We stand corrected on the first point. The Forest Service has leased CASE apparently on the basis of price alone ($9.7K vs. $10.9K). At IRS, a test was performed and a contract with SPC has been signed. It covers simulation of systems being considered for installation at the agency's Detroit data center. The test of CASE and SCERT was brief and incomplete, says an IRS official, and had no bearing on the final choice. "We found no really strong qualitative difference in the two proposals and picked CASE essentially on the basis of a better price."

MIT LAB OFFERS POSSIBLE SOLUTIONS TO URBAN ILLS

Local government's lack of understanding of the major urban problems—from racial conflict to pollution—is the stumbling block to their solution. It needs an urban information system (UIS) to gather, disseminate, and analyze meaningful data. But nobody understands urban information systems either. This was the simple conclusion presented by the summary report of the Urban Systems Laboratory held at Massachusetts Institute of Technology last summer.

Lest that sound urbane, the summer study examined past efforts with urban systems and while concluding these had generally failed, it also affirmed faith in their potential and urged the Department of Housing and Urban Development to support the use of computers in urban planning, design and management.

"Proposed priority areas" for this support were identified:

1. One problem in current systems is ignoring the needs of the ultimate user, using ill-suited procedures and software, compounded by the user's faulty specifications. HUD, says the report, should initiate an Urban Information Systems Demonstration program—a research and development project—to "foster close cooperation between designers and users" of these systems.

2. HUD should undertake an intensive educational effort in the uses of urban systems. Specifically, it should organize task forces of experts for on-the-spot consultation about local problems, extend urban training grants to specialists in the design and use of UIS, and schedule regional short courses on its use in planning, design and management.

3. Since conventional manual files cannot and should not be transposed into computer data banks, guidelines on what makes useful data must be developed. And HUD should give parts of its major grants for UIS development.

4. Simple-to-use analytic tools are needed for the noncomputer-oriented urban leaders and for the rapid manipulation of data for any arbitrarily defined area (transportation corridors, Model Cities Neighborhoods, etc.). Thus, HUD should assign high priority to the research in: geographic coding schemes, use of associated address-

matching programs (to tie-in any kind of data), problem-oriented languages such as MIT ADMINS for data management tasks and analysis, use of bulk memory effectively to save costs, graphic capabilities to produce easily understood output, management control programs like PERT, CPM, and file manipulation and data-screening programs.

5. For systematic analysis needs, HUD should support developmental mission-oriented problem-solving procedures for urban programs; research in production functions, "the economic description of how resources can combine to achieve objectives" for the UIS; and define indicators to measure urban environment periodically to measure progress and do analyses.

6. HUD should also consider strategies to develop UIS, the privacy issues involved, and the commonality of UIS subsystems.

The summary notes that the full report contains more specific recommendations, developed with the Boston Model Cities Agency and the Infill Housing program. This can be obtained from the MIT Urban Systems Laboratory, Room 9-519, 77 Massachusetts Ave., Cambridge, Mass. 02139.

PL/I CONVERSION PROGRAMS NOT QUITE WORTH TROUBLE

The response of a programming expert to IBM's announcements of language conversion programs (LCP) for COBOL, FORTRAN, and ALGOL to PL/I: "Who would be dumb enough to use them?"

Well, for those who have that seldom used program that is too expensive to rewrite or not worth it—and for those who are dumb, here are some IBM statistics, including timings for conversion and comparative timings and core storage requirements for the converted PL/I program vs. the original.

According to a January IBM programming announcement to users, the LCP's will do one-for-one statement translation, flagging statements with no PL/I equivalent or that cannot be meaningfully translated. Once the user has at least a 360/40 with 128K bytes of core and the minimum OS-required peripherals, he can slap on the LCP module of his choice. IBM says that a mod 50 with 128K, using the minimum partition size (80K), will convert COBOL to PL/I at 55-75 cards a minute (varies with peripherals and other conditions); FORTRAN is converted at an estimated maximum 100 cards a minute (add 37 seconds for each subprogram); and ALGOL on a mod 40 is about 100 cards a minute.

The deterrent to any significant reliance on the conversion aids is obviously execution time (slower) and core storage needs (more) of the converted PL/I program.

Using sample programs to test the LCP's produced these results when translated and compiled by the PL/I F compilers: compared to the original COBOL programs, the PL/I programs took 1⅓ to 1⅔ times longer to execute and required three times the core storage; compared to the FORTRAN, PL/I took 1¼ times longer and needed up to twice the core; compared to ALGOL, PL/I took an average .85 times as long, but needed 1½ times the core.

RAILROAD CUTS NETWORK COSTS WITH WATS LINES

What's claimed to be the first use of WATS lines (dial-up network) in a computer/communications network in the railroad industry is reportedly saving Chicago & North Western Railway over $350K a year in communications costs. The Fastfax system, which had been phased into operation by September 1968, is designed to handle message switching, freight car tracing and shipper inquiries on an average 58,000 cars daily rolling on the road's 11,500 miles of track. The railroad says it collects, monitors and transmits about 200,000 messages a day from its 90 freight yards in 11 Midwestern states and 40 nationwide sales offices.

Hourly, an RCA Spectra 70/45 system in Chicago dials IBM 1050 terminals in the freight yards to collect punched-card data compiled on each car that has arrived at or left the yard. Previously, data was transmitted from 1050's in the field to 1050's in the Chicago center over leased lines, costing $25K more a month than the WATS service. Sales offices now use 48 RCA 70/750 video terminals, as opposed to the previous Teletype system, in making inquiries to the system. Savings of $60K a year ($100K vs. $40K) are achieved by the line cost differences and by the fact that with the crt messages are written on the terminal off-line first, saving actual transmission time. Fastfax responds in a few seconds, versus the hours it took to find a car previously.

Other, hidden savings to the railroad have accrued. C&NW merged with Chicago Great Western last year and is now planning a merger with Milwaukee Railroad. The road says that the instant and all-points availability of WATS service has helped it avoid the time and dollars lost in arranging for and configuring additional leased lines to handle the added operations.

Car-tracing systems have become a "must" for the railroads, whose revenues depend on the constant movement and full utilization of freight cars. C&NW is not the first to institute such a system, but it does claim to have the "most extensive" management reporting system utilizing the data it collects. Three more 45's and a 35 are used in the report preparation, as well as all other data processing functions of the road. (Another 45 is used as back-up for Fastfax.) Currently, daily reports are produced on such information as new business loads on the line, financial estimates, and car movement summaries. Accounting, sales reports, and forecasts are produced monthly. C&NW says its daily management reporting is now primarily for upper levels of management, including the president, but will later be extended to include detailed reports for the sales and operating levels.

Car tracing is expected to be done in "real" real-time when car identification terminals are placed along the nation's tracks to automatically read and transmit the car's number as it passes. C&NW and others are now putting the machine-readable numbers on their cars, a project due to be completed by next January (but reportedly behind schedule). When the new tracing units go in, C&NW and the other railroads with similar systems will be changing equipment and reprogramming.

LAW ENFORCEMENT SYSTEM EVALUATED

A 360/40-based computer system went into operation last May in the Kansas City, Mo., Police Dept. A tabulation has been made of its usage from July 1, '68 to Jan. 1, '69 for the evaluation of the system, and the results show that the computer is there to stay. The Kansas City network hooks the patrol car officer to an IBM 2260 operator through a radio link. The crt terminal operator keys in the data radioed to him by the on-duty officer and retrieves information regarding such items of interest as whether or not a car is stolen or whether a street address about to be entered has a history of housing dangerous suspects. With half-electronic and half-verbal system, response times of ten seconds are generally realized. This means that an officer radioing a "rolling make" to headquarters is apprised of the status of a vehicle being followed before it has traveled more than a block.

About 970 officers using the system to the extent of 110,000 calls during the period resulted in arrests of wanted suspects or recoveries of stolen vehicles in over 2,000 cases. A spokesman for the department said that fully half of these might not have been realized without the computerized information network, and that an immeasurable amount of good is realized for the officers' safety by apprising them of potentially dangerous persons or situations.

Present plans call for expanding the network to include a 360/50 operated by the FBI in Washington. With the upgraded configuration, the patrolman would be given local and national file information on a suspect. In addition to expanding the scope of the information accessed, the Kansas City network will extend its services to counties nearby through the installation of 20 additional terminals (these will be IBM 2740 mod II's) in May of '69. The hookup to Washington will be made by micro-wave.

CALIFORNIA ADOPTS SHORT-RANGE EDP PLAN

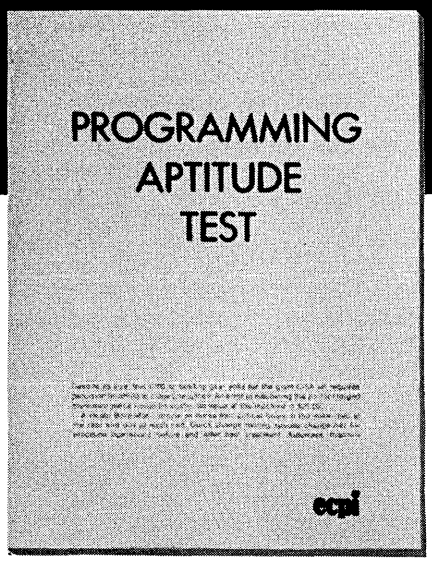
As a parting shot, former Lt. Governor Robert H. Finch of Calif., now Secty. of HEW, announced the adoption of a short-range master plan for the effective utilization and consolidation of edp facilities in the state. The plan will be in effect until June '69, when a 5-year long-range plan is expected to be implemented. There are 73 computers in operation in the state, excluding the Univ. of Calif., and the primary consideration has been "socio-political," with the various heads of departments loathe to surrender possession or use of their computers, which include machines from all the major mainframe makers, but mainly from RCA and IBM. However, consolidation has been effected between the Public Retirement System and the State Veteran's Administration; the Board of Equalization and the Board of Professional and Vocational Standards; and the Resources Agency. Over $40 million dollars is spent annually on government data processing in California, an expenditure overseen by the state's EDP Policy Committee, formerly chaired by Finch, who now will be replaced by the newly appointed Lt. Governor, Edward Reinecke.

UNIVERSITY CONTINUES COMPUTER COSTS SURVEY

Dr. V. W. Ruskin of the Univ. of British Columbia has completed certain elements of his North American com-

(Continued on page 127)

If you think getting into ECPI is easy, you could have another think coming.



At ECPI, we run what is probably the toughest obstacle course in the business. But not every would-be programmer gets a chance to run it.

First, he has to get by our aptitude test. Because desire is one thing, and ability another. Then, if he's got the ability, we give him an in-depth interview just to make sure he's got the proper attitude. In fact, our screening is so intense that 7 out of 10 high school graduates who apply don't meet the requirements.

But that's only the beginning. In his course of study, each student has to sweat through hundreds of hours of class work, plus several hundred more of homework. He has to write 21 programs. What's more he gets practical work on third-generation equipment and plenty of time to de-bug what he's written.

Then, just to make sure he's got it all filed away in its proper form, each ECPI student has to pass five tough mid-term exams and a three-hour final that's the final crusher.

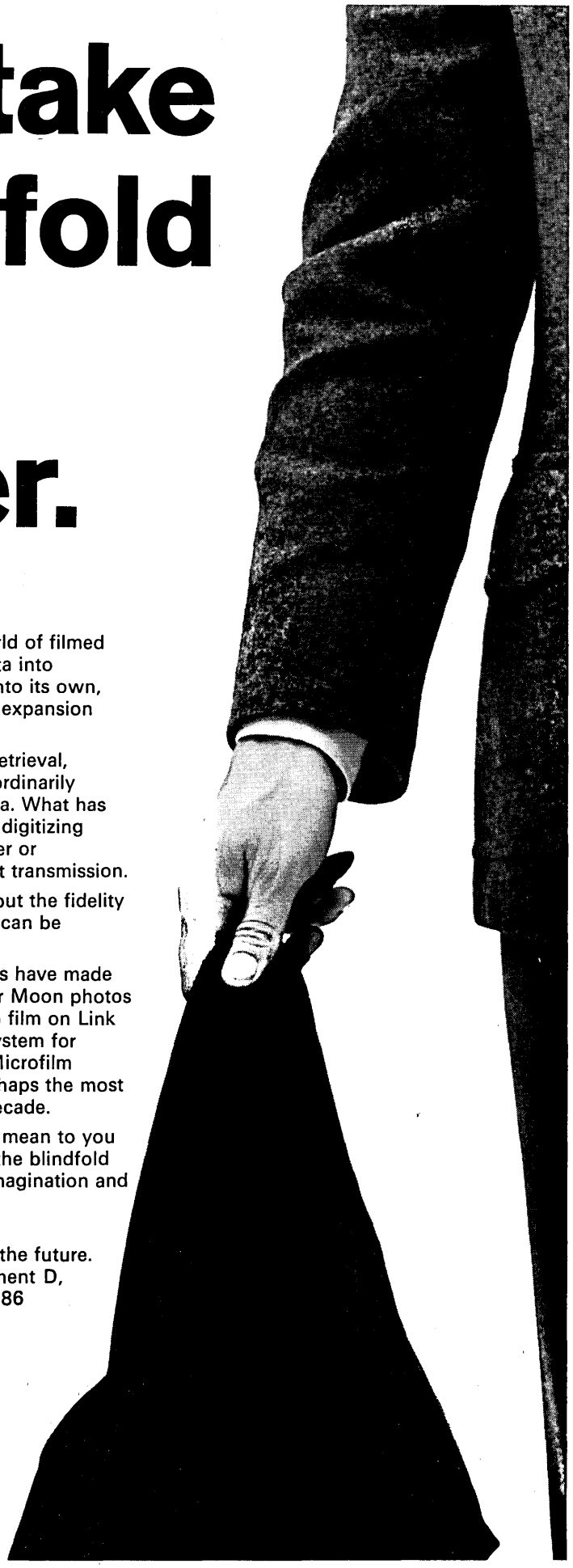
Our course isn't easy. In fact it's pretty tough. More than 20% of our students don't even make it through. But, we figure the harder we make it for them, the quicker they'll make it with you.

ecpi **ELECTRONIC COMPUTER PROGRAMMING INSTITUTE**

CIRCLE 59 ON READER CARD

The toughest obstacle course in the business.

Let Link take the blindfold off your computer.



Until recently, no computer could "see" the vast world of filmed data. Graphic data conversion—translating filmed data into computer language and vice versa—has now come into its own, however. And Link is in the forefront of this exciting expansion of computer input/output capabilities.

It's no secret to anyone involved with data storage, retrieval, transmission and other handling that film is an extraordinarily economical medium for storing and manipulating data. What has been a secret has been a feasible, reliable method of digitizing filmed data so that it could be ingested by a computer or "conditioned" for other applications, such as efficient transmission.

Not only has Link found an answer to this problem, but the fidelity of the converted data is astounding. And conversion can be performed on-line, too.

Some of Link's graphic data conversion achievements have made headlines, because the Mariner, Ranger and Surveyor Moon photos were obtained by converting digital or analog data to film on Link film converters. A recent Link accomplishment is a system for electronically revising microfilm. Called Automated Microfilm Aperture Card Updating System (AMACUS), it's perhaps the most notable advance in the use of microfilm in the last decade.

What can Link's graphic data conversion capabilities mean to you and your computer operation? It's more than taking the blindfold off your computer. It's taking the shackles off your imagination and opening up a whole new range of opportunity.

As a first step, let us send you literature on our past accomplishments. Then, let's get together to discuss the future. Write: Advanced Technology Systems Sales, Department D, 1077 East Arques Avenue, Sunnyvale, California 94086 or phone (408) 732-3800.

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Why we add $725 to Farrington page readers.

This Model 3030 page reader was just an empty shell on the factory floor when Don Morris first saw it six months ago. He's been seeing a lot of it since then. And he'll be seeing a lot more of it from now on. Because he'll service it. Maintain it. And mother it, if necessary. Like other customer engineers assigned to Farrington page readers, Don watched the circuits and electronic components and wires being put into his machine. He helped run the quality control and performance tests. He even followed the truck that delivered it to his customer in Raleigh. And for six weeks, he took an intensive classroom and hands-on OCR course to add to his two years of technical schooling and more than six years of field service experience. So he's ready to stake his new job in Raleigh on the page reader he grew up with. And he's ready to cut downtime and save his customers thousands of dollars. All for just $725.
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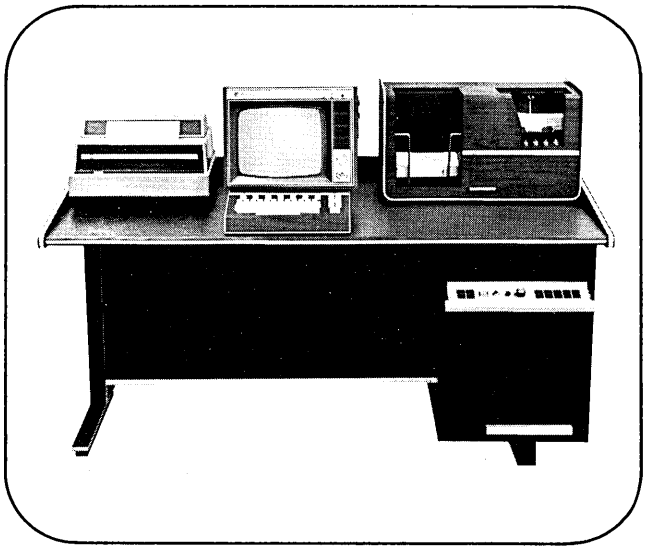
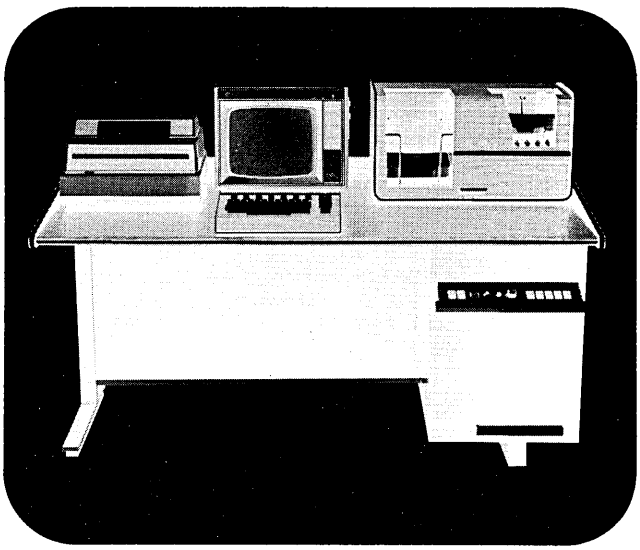
FARRINGTON


328

DAY or NIGHT





CONVERSATION or BATCH

The CC-36 TeleVideo Conversational/Batch Station is ready whenever you are, wherever you are, for whatever you have to do...at prices starting as low as $23,900.

The CC-36 can communicate with your computer — any computer — whether it's across the room at computer speeds or across the continent at speeds up to 50,000 bits per second. And it can be used with any standard data set or modem.

Integrated within the CC-36 console are a keyboard for operator control and data entry, a television screen for visual display of alphanumeric or graphic data, a 300 CPM card reader, a 300 character/second non-impact printer, a sequencer for automatic control of specified batch operations, and an interface to a data set for remote communications. (Higher price versions of the CC-36 provide impact printers where format control and multiple copy is needed.)

In Conversational Applications

The CC-36 allows you to create formats, input formats and data to files, create and submit executive programs, access files for visual examination or editing at the station, and request file data printout at other remote terminals.

In Batch Applications

The CC-36 allows you to enter a program from any remote location via the card reader into the central computer, monitor and control its execution via the CRT/keyboard, and receive the output on the line printer.

So if you want a dual-purpose station at less than single station cost, consider the CC-36.

Feature for feature the CC-36 is another reason why ability in computer communications means Computer Communications.

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CIRCLE 62 ON READER CARD

puter costs survey (see "Computer Costs in Canada," Oct. '68) but is continuing his efforts to find out where the money goes and needs assistance from edp personnel in the U.S. He has received several hundred requests for the detailed results of his Canadian survey, indicating extensive interest in the subject, but is experiencing difficulty in obtaining sufficient information in the U.S. to provide statistical reliability. Anyone who wishes to contribute to the project in the form of data may obtain a questionnaire by writing to Ruskin at the Dept. of Mechanical Engineering, Univ. of British Columbia, Vancouver, B.C., Canada.

SPACE MAPPING PROJECT AT OSU

A comprehensive new map of space is being developed by Ohio State Univ. astronomers with the help of computers and one of the world's largest radio telescopes. Radio signals (broadband noise, not radio communication signals), some of which have wandered in space for more time than the earth has existed, are picked up by the radio telescope. Beneath the observatory at Delaware, O., ultra-sensitive devices receive and convert the signals to numerical values which are conveyed to an IBM 1130 to be organized and recorded on mag tape. The 1130 also commands the receivers to note signal characteristics such as angle of approach, strength, and other factors. Correlation of this data allows astronomers to gauge the location and relative size of objects or group of objects. In recent years the number of known space objects has grown from 200 to about 10,000, and this project is expected to record many more.

The data types are taken to the university's computer center in Columbus where they are analyzed by the 7094 (programs are being converted for the new 360/75). The analysis output is then used on a 1620 and a plotter to plot another map segment. Space garbage from our recent ventures is not included, as the signals can be identified and ignored. The radio telescope is not used as a tracker, but is put into one position for several days before being moved again. When necessary, astronomers use a visual telescope for verification.

SYSTEM SIMULATOR ABANDONED BY ARMY

S$_3$, the event-oriented computer system simulator developed for the Army by Leo Cohen Associates, has been abandoned. According to an Army news release, the cost of preparing the S$_3$ data base makes benchmarking more cost-effective. The news release was based on a technical evaluation that wasn't made public. The evaluation gave these other reasons for dropping the Cohen package: lack of procedures for data base preparation, lack of applicability to scientific/engineering workloads, lack of user documentation, and excessive running time.

The news release said the Army will "therefore . . . use the benchmark technique as its primary tool for analyzing throughput capability." Simulator suppliers think this will be a temporary decision. The new policy, they point out, closes the door but doesn't lock it, since use of simulators for system design studies is not ended. Two new simulators—CASE and SCERT 50—are available, and both are said to represent quantum jumps in the state of the simulation art. One or both packages could be used as system design tools and turn in such dazzling performances that the army would be persuaded to change its mind.

This development, if it materializes, will be interesting to watch because Comress, Inc., which developed SCERT 50, and Software Products, Inc., the inventor of CASE, have been throwing stones at each other for several months (for the latest news on that struggle, see p. 119). Both firms are making a big pitch for the small computer user, so their success in wooing the Army could have wider significance.

BLACK DP SEMINAR ON SELF-EMPLOYMENT

The Interracial Council for Business Opportunity of New York joins with the Association of Data Processing Service Organizations in sponsoring a seminar for minority group members on the twelfth of this month. The theme is "How to Start and Operate a Data Processing Business." Minority group members with experience in data processing have been invited to attend the three and a half hour session, at no charge to participants. Objective of the meeting is "to permit the black business community with experience in the edp industry to learn directly from industry leaders about the opportunities for self-employment in such areas as software, time-sharing, data centers," etc. Topics to be discussed include ways to finance a dp business, how to market services, and operating problems.

Industry panelists are: Richard Guilbert, vp, Statistics for Management, Inc.; Sal Parisi, pres., Tabulating & Data Processing Corp.; Bernard Goldstein, pres., United Data Processing, Inc.; Robert Feuerzeig, Director, corporate development, Programming Sciences, Inc.; Andrew Thrash, pres., and Robert Johnson, vp, Data Transformation, Inc.; and Charles Bartlett, account exec., Datatab, Inc. Joel Dorfman, vp, Integrated Computer Services, Inc., is the seminar coordinator.

ICBO, founded in 1963, assists minority group members in starting and operating their own businesses through business counseling and business education. In addition to New York, the organization maintains councils in Newark, Washington, Los Angeles, and New Orleans. This is the first ICBO seminar on the dp industry, however.

UTAH EMPLOYMENT DEPT MAKES COMPUTER MATCHES

In 1966, the Federal Bureau of Employment Security began funding test operations in three states, Florida, Michigan and Utah, to computerize State Employment Department operations. Michigan drew an assignment of computerizing unemployment relief benefits, and is testing a system to print checks on-line at employment department offices. Florida drew a project relating to the administration and management of employment services. Utah, smallest of the three states, seemed to get the toughest job, that of developing a job-matching file system.

The degree of Utah's success with the project can be measured by the job placement ability of the Utah Department of Employment Security. The state presently has records on some 80,000 job seekers, along with some 50,000 nonfarming openings. (The farm laborers are not left out; some 20,000 farming positions are also listed, but only seasonally.)

Using a 262K SPECTRA 70/45, a multiplicity of RCA 70/752 video terminals, four IBM 2311 disc drives, and two RCA 70/568 RACE storage systems, the department is capable of responding in minutes to a job-seeker's request for placement openings. An applicant's request and identification is fed into the system from a terminal and is checked against job characteristic indexes stored on the 2311's. If one of the coded entries on the 2311's seems to fit the job applicant's qualifications, then a more complete match is made from a more complete record stored on the RACE units. The final match is returned to either the video terminal operator or to a line printer.

The RACE units, based on 4 × 14 inch mylar "cards" which are mechan-

What with everybody, including maybe even your brother, rushing to get into the software consulting field, you might wonder why we've been so reluctant to admit we're in it too.

The answer is, quite frankly, that we were initially forced into the field. And that until late last year we were emphatically limiting our services to those twenty-two organizations who believed we alone could help them.

That's not so strange, once you consider how Comress started.

We were formed six years ago to develop and market a dynamic simulation program called SCERT—a program that models any real or planned computer installation and predicts both its performance and costs. And before long, more than 200 major EDP users were using it to optimize their systems.

In fact, it saved them so much time that it accelerated their need for software development.

And that's when they asked our help. Because of the software development expertise that SCERT and our other proprietary programs had given us, Comress was best qualified to help them plan and implement their complex data collection and advanced communications system installations most quickly and most economically.

And we did, to the point where we now have a staff of nearly two hundred engaged exclusively in software—a significant enough effort to convince us that we have a lot more to offer than most software consulting firms do. We even give fixed estimates of time and cost in our proposals, which we're told is pretty uncommon.

So now, we're in it for real—and we'd like to meet you.

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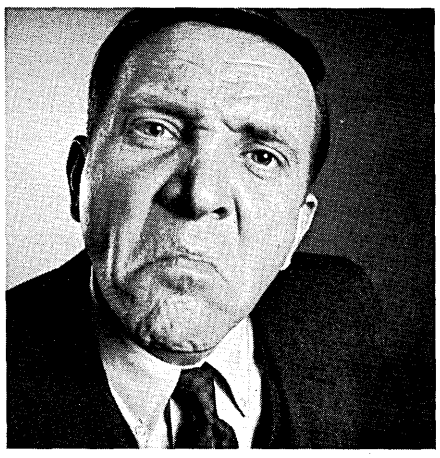


ically retrieved for reading, are each capable of storing approximately 531 megabytes of data. This amount of storage is sufficient to enable a small state like Utah to file openings and applicant records for the full employment spectrum of the state's work force, from illiterate farm laborers to highly paid professionals. Mr. Lee G. Burns, dir. of dp for the department, stated that large states may have to wait for a breakthrough in mass storage technology before they are able to implement a system similar to Utah's. Larger states will benefit, however, from the logical testing and economic trade-off data generated by Utah and the two other test states. Data and instruction will be freely given to all interested state governments, and, in fact, much of the bulk of the task of each test state has been to document and generalize the findings of their projects so that the resultant logical and physical systems would not be provincial.

N.C. COMPUTERIZES LEGISLATURE AND BILLS

Legislation itself isn't computerized yet, but the North Carolina legislature is storing it on an IBM 360/40 that all but creates new bills. The system, said to be the most advanced of its kind, performs three basic functions: It provides access to information on pending legislation through six IBM 2260 crt terminals located in the State Legislative Building; it uses a text editing package that justifies right-hand margins and permits correction or modification of bills, providing clean, final printout; and it maintains a continuously updated index of all newly introduced legislation. Data stored in the system includes original drafts of bills, names of authors, related statutes, amendements, and other pertinent information.

The system has been in operation since the start of the current legislative session in mid-January, and has been "heavily used" and "very successful" thus far, according to John C. Brooks, administrative officer of the general assembly. More than 2,500 bills are anticipated during the session, of which more than half are expected to become law; use of the computer to prepare final copies of enacted legislation should speed up the process of ratification.

All legislators were given orientation sessions and demonstrations of the operation of the crt's, and are provided with one-page instruction sheets with code numbers for retrieval of various information. Using the crt's, they may obtain lists of all legislation introduced by a particular House or Senate member, a list of all the proposed legislation relating to any specified general statute, the latest action on any bill, or the current status of any legislation. The last task might previously have required two days of red tape. Legislators cannot access the text of a bill, however.

Clerical personnel were trained in the operation of the text editing system, which is particularly useful for adding amendments to pending bills, since only the amended sections need be altered. In addition, all bills must be changed to a slightly different format when finally passed by both houses of the legislature.

Less sophisticated legislative edp systems are presently in operation in Pennsylvania and Florida, and several other states are said to be considering use of computers. Future plans for the North Carolina system include providing complete statutory retrieval capability by recording the entire North Carolina code on tape.

3i, DATA BANKS, AND HOSPITALS

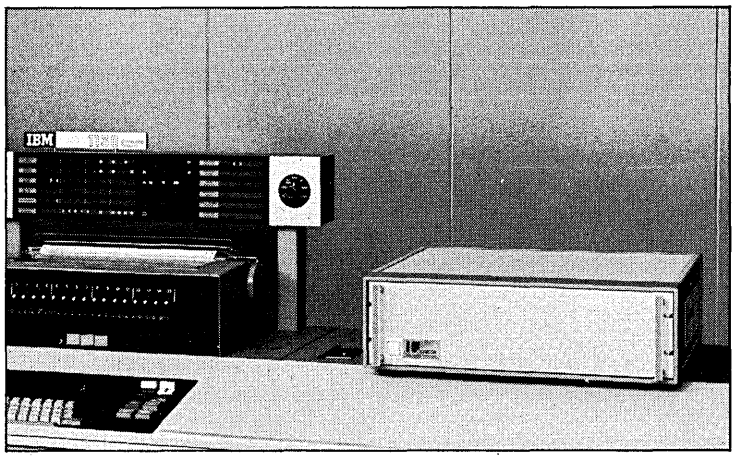
Information Interscience, Inc., known as 3i Company, processes and classifies English- and foreign-language scientific and technical periodicals for storage and retrieval, using an IBM 360/40 system, and is now entering the field of hospital edp. The firm has offices in Los Angeles, Philadelphia, and Arlington, Va. A full-time staff of 65 is supplemented by 120 professional consultants and includes 38 scientists with degrees of at least M.S. or equivalent, most of whom are multilingual.

Some 30 proprietary software packages are used for retrieval of information based on about 130,000 reference concept terms or descriptors. Classifications include such general categories as air pollution, birth control, health aspects of alcohol, chemical, food, pharmaceutical, waste disposal, water pollution, etc. An average of 4,000 periodicals in 52 languages are reviewed each month.

In fiscal 1968 (3i's second full year of business, ended January 30, 1968), the firm had sales of $1.2 million and, after tax, earnings of $115K.

Early this year, 3i reached agreements to acquire seven firms in the medical field, in connection with a plan to design a "totally integrated Data Bank information storage and retrieval system" for hospitals, according to 3i president Gerald L. Brodsky. The organizations involved are North Dade

New way to make your IBM 1130 roar like a lion.



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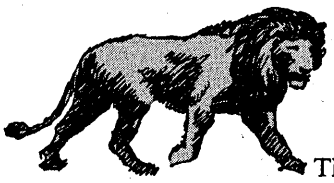
These are just a few of the many potential applications of the Logicon LI/ON. Using modularized construction, it combines off-the-shelf availability and economy with flexibility for adaptation to individual customer requirements. In addition, the purchase price of the LI/ON includes free software with foreground/background capabilities. To obtain full details just call us collect. Our Los Angeles telephone is 213-831-0611. Ask for Jack Duston. Or, write him.... Logicon, Los Angeles Division, 255 West Fifth Street, San Pedro, California 90731.

LOGICON



The Logicon LI/ON adds a new dimension to your IBM 1130.

Medical Group, Inc., and its wholly owned subsidiary, Parkway General Hospital, North Miami Beach, Fla.; Park Associates, Inc., doing business as Lincoln Community Hospital, Buena Park, Calif.; Management and Planning Associates, Miami; Computer Aided Medical Diagnosis Inc., New Jersey; Computer Predictions Co., Minneapolis; and Object Recognition Systems and Medical Diagnostic Laboratories, both in New Jersey.

North Dade Medical Group and Park Associates and its hospitals will be acquired for establishing test sites for the hospital data bank storage and retrieval systems, utilizing time-sharing systems installed by 3i. Once operational, these services will be available to other hospital groups. According to Brodsky, "The entire hospital institution and all of its departments, rather than any single segment, which is now the approach of other groups, have to be put under the information storage and retrieval system to really demonstrate the effectiveness of the total data bank concept. Everything from a patient's history, X-ray information, laboratory examinations and drug information to the hospital's inventory control and billing will be stored in a data bank ready for instantaneous use."

Computer Aided Medical Diagnosis, Inc., offers computerized diagnostic techniques particularly useful in prescreening in the insurance industry. Approximately 3,000 diseases with associated symptoms are stored in a CAMD data bank that will be tied into 3i's present information storage and retrieval system. CAMD is headed by Dr. Sidney Auerbach.

Management and Planning Associates, headed by Dr. David Babnew, offers consulting services in hospital planning and administration, as well as design and development of hospital facilities. The company will specialize in the installation of hospital-related information systems.

Object Recognition Systems, Inc., has developed a patented device that automatically perceives object forms, makes comparisons and identifies with data previously stored in a data bank. Medical Diagnostic Laboratories, Inc., operates several automated clinical medical laboratories. These will be integrated with the other medical facilities within the 3i complex and will utilize its storage and retrieval systems.

Brodsky promised that "Additional 3i related acquisitions are presently under consideration that will add additional capabilities for services in information storage and retrieval utilizing 3i's proven data bank concepts."

CDC LINKS CENTERS TO FORM "CYBERNET"

Claiming the "first national computer network—serving all major metropolitan areas throughout the United States," Control Data Corp. has announced CYBERNET.

The network includes six 6600's—one just installed in New York and the others at existing data centers in Boston, Washington, D.C., Minneapolis, Houston, and Los Angeles. Another will be added soon in Palo Alto, Calif.

The next level down consists of 3300's and these are supplemented by Marc II terminals, made up of crt entry/display stations, card readers, and line printers.

Altogether, the service covers 25 cities and wide-band switching allows load transfer between elements of the network. Customers can also install terminals on their own premises. Charges are for cpu time only, with rates ranging from $800 to $1200 per hour.

JOCKEY CLUB HORSES AROUND WITH COMPUTER BREEDING

The program at Santa Anita might one

news briefs

day list a horse as: Seacracker out of No Regret by IBM 360/30. The Jockey Club in Lexington, Ky., which is responsible for the registration of thoroughbred race horses in the U.S., is using a 360/30 to establish a data bank on horses foaled in the U.S. and Canada since 1927. With this information and ongoing input on performance and pedigree, the Club hopes to be able to assist in the selective breeding of race horses to produce winners instead of also-rans, to provide analyses and information useful in decision-making throughout the industry, and to predict the potential for success of untried horses. Regrettably, the latter two processes at the two-dollar window will continue to be performed by the traditional pinstab/hunch methods. With over 40,000 different racehorses charging around various U,S. tracks each year, a terminal at each patron's seat would seem to be a future must.

GE EXPANDS ITS ON-LINE BUSINESS ARM

GE's Information Systems Group has pushed out some walls to make more room at the top for executive offices in a move to expand its on-line computer sales and services. J. Stanford Smith, vp and group exec, announced the appointment of Paul W. Sage as gen. mgr. for the Information Services Div., the organization in charge of GE's time-sharing and specialized computer services in this country and abroad. Sage is a 15-year computer man with previous experience at the U.S. Army's Redstone Arsenal, at IBM, and in several GE operations. He succeeds vp Jerome T. Coe, who will work directly with Smith on advanced studies in GE's information services business.

Mr. Sage was also given a new department for his division, called Information Networks Dept., and the requisite dept. head, gen. mgr. George J. Feeney. Feeney's previous experience has been in GE's corporate planning staff where he was in charge of computer-based business and economic models. Sage and Feeney will run their operations from Bethesda, Md., the site of the three related departments in their domain: Information Networks, now headed by Feeney; Information Service, with national responsibilities for marketing, customer applications, and development of on-line services; and International Information Service. Also reporting to Mr. Sage will be the medical information service called MEDINET, which is located in Watertown, Mass.

INDIA COMPUTER SOCIETY HOLDS ANNUAL MEETING

The Computer Society of India held its fourth annual meeting in January and elected Col. A. Balasubramanian president and Bijoy G. Chatterjee secretary for the coming year. Key item on the agenda was a panel discussion on the effects of automation on labor and management, and, as with every discussion in every country on that subject, there was substantial disagreement. One reliable U.S. source, who has established an installation in India, has stated that India is resisting computerization because of the vast human resources it might displace, and, indeed, is resisting updating of facilities it already has, which now operate nearly one hundred computers. To increase the knowledge and understanding of computers in India, the Computer Society will organize seminars for members of various industries and will soon begin publication of a journal.

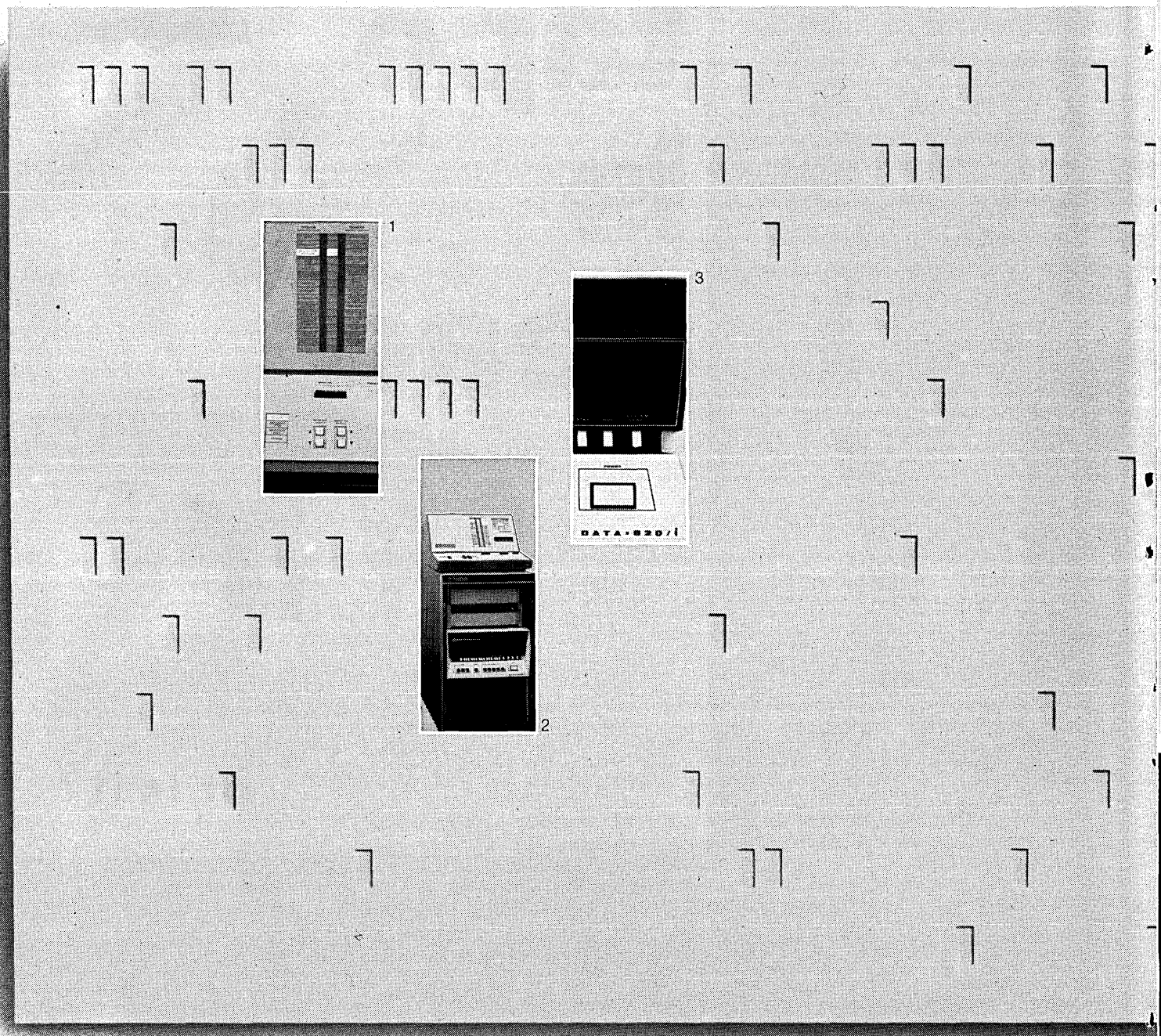
PROGRAMMING SCHOOL OFFERS FRANCHISES

Computer Environments Corp., Hanover, N.H., has begun a franchising program for its computer education centers, which are presently owned by the firm. Franchises will be for schools that will duplicate CEC's wholly-owned education centers, which offer programming instruction for beginners plus management seminars and special programs for edp firms. The franchises will also permit access to time-sharing, provided by CEC's parent, Time Share Corp., which recently installed a Hewlett-Packard 2000A t-s system. CEC is seeking "edp professionals" to become franchisees.

Three-year old CEC owns nine schools in New England and New York, which it claims makes the chain the largest completely-owned computer education organization in the area. Each of these schools has either an IBM 360/20 or a Univac 9200 on premises dedicated to student use. One of the nine, Concord Commercial College, Hanover, has recently acquired the programer education assets of H&G Technical Services, which formerly held the Electronic Computer Programming Institute franchise for Vermont and New Hampshire. CCC offers a two-year program in business and computer science, which began last September with some thirty students. Most CEC schools offer programs of instruction of about 640 hours in length. CEC has a total of over 700 students enrolled. The com-

(Continued on page 136)

Varian computer systems can completely Auto-Mate



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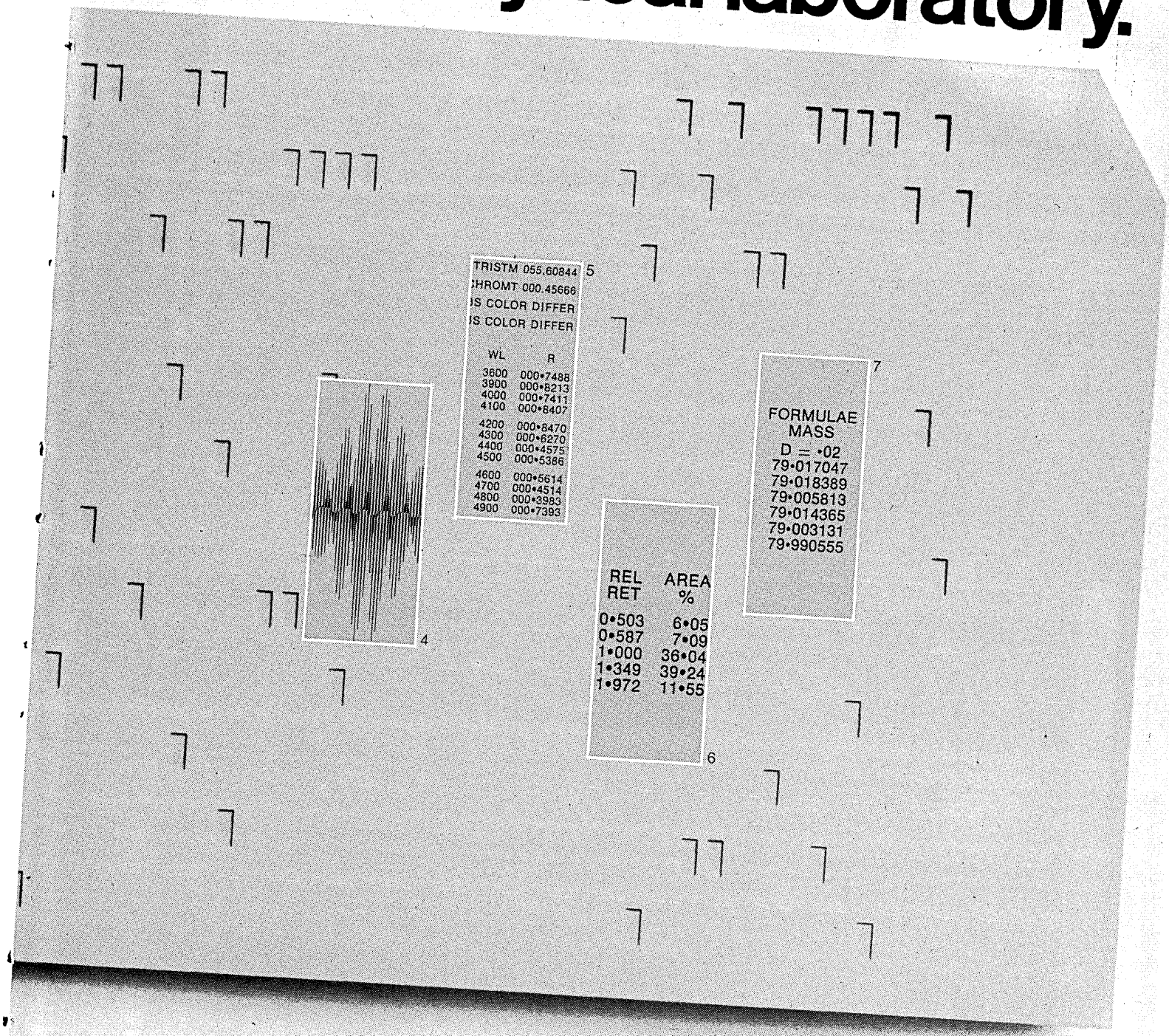

mulus colorimetry analysis, printout (6) of a gas chromatography analysis, printout (7) of formula calculation from mass spectroscopy measurements.

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CIRCLE 69 ON READER CARD

news briefs

pany is profitable, having earned about $75K net income in fiscal 1968, on over $1 million in sales.

PEROT TO FORM INDUSTRY INFORMATION CENTER

That Dallas wunderkinder, Ross Perot, president of Electronic Data Systems and celebrated by Fortune Magazine as the "fastest, richest Texan ever," has revealed a new direction in growth for his highly successful firm. Talking before Dallas investment analysts, Perot disclosed a new contract with Southwestern Life Insurance Co. that will be the cornerstone for EDS's first "industry information center." EDS proposes to invest as much as $5 million to develop an information system that would handle Southwestern's needs and would be adaptable to any other life insurance company. Accorrding to Perot, this approach would enable smaller companies to enjoy the advantages of advanced software in the same manner as a service center providing advanced hardware to all. Once life insurance is squared away, Perot said, similar systems will be created for other industries. "Our objective is for EDS to be one of the great companies in the country in the next few years," he said.

DON'T CALL CONDATA A SERVICE BUREAU

The first question that comes to mind when a company calls itself a "computer utility" is how is it different from a service bureau. Gene Kyle, pres. of Condata, Van Nuys, Calif. firm, listed several differences. First, the "utility" does not offer services to the world at large, only to a discrete segment of it. Condata has defined, and is attacking, three market "apertures," manufacturing distribution, retail store chains and auto dealerships, and light manufacturing. A fourth "aperture," on-line financial services, will be added this fall.

The second difference Mr. Kyle listed was in charging for software. Condata does not charge the user for the programming undertaken to perform the tasks designed for that aperture. In fact, if one of the programs developed by Condata, with its multiple options, does not satisfy a particular user, that user is aimed toward a service bureau; Condata will not do his programming for him. A third difference lies in the method of charging for cpu time. Basing its charges on the

philosophy that the location of the computer center is not the choice—nor the fault—of the user, Condata does not charge for communications facilities used in getting data into the cpu; the user is charged only *after* the data is in core. Also, there is no minimum charge, and no set-up charge.

Four levels of service, ranging from overnight batch processing to conversational debugging or data retrieval, are offered. Depending upon the service and location, a variety of hardware is used. At the "mother" facility in Los Angeles, a Burroughs 5500 with a CDC 1700 front end is used. The company has set up satellite corporations to run its satellite centers in various states. The remote centers use either CDC 1700's or Honeywell 200's for store and forward devices, although some on-site processing is performed in the larger satellite centers. (Note the Honeywell 200 use, an application that even Honeywell did not think of, reportedly.) A total of 14 satellite corporations in the 12 western states will be in operation by the end of May; each is locally financed, but Condata will hold controlling interest in all of them.

Condata became a corporate entity on Dec. 1, '67, and made a profit in '68. About 35 people are involved in the operation at present, and these expect to see a stock offering in August of '69 to establish a holding company for the firm.

The resultant "utility" looks like a mini-GM—offering standard lines with multiple options at acceptable prices (quoted at about 2½ cents per line for invoice processing and file updating).

EIGHT MEN, $1 MILLION ABOVE A PIZZA PARLOR

Modern Data Techniques, Inc., is the name of a Madison, N.J., firm that has a one-room office above a pizza parlor, big ambitions, eight personnel, and a million dollars from the sale of stock when it went public last November. Prior to August 1, 1968, the two-year old company had no full-time employees. The grand plan is to become a big name in the edp industry, not just another little independent software house. MDT intends to sell franchises to businessmen, not necessarily edp people. The holder of such a franchise might pay from $7500 to $1 million for the privilege, depending on size of territory (say, the latter sum for all of New York state), and would receive the full rights to MDT's software, sales methods, computer time, and technical personnel, as well as complete instructions on how to use this raw material.

At present, the firm has no franchisees. But it does have a couple of acquisitions: Central Jersey Data Processing, Inc., Jamesburg, N.J., a 360/20 equipped 22-man service bureau; and Computer Consultants Corp., a Denville, N.J., software house with six personnel. Expanding in another direction, MDT has obtained an option to buy the Morris County Diagnostic and Safety Center, Inc., a Whippany, N.J., automotive diagnostic center that uses an Allen/UTI 1280 automotive diagnostic computer. Presumably, there are applications for computers in this sort of business. And the Diagnostic Center is already profitable.

Central Jersey Data Processing will be operated as a subsidiary, serving as a model of an MDT franchise office. A time-sharing capability will also be established at CJDP. The acquired firm will function as MDT's computer service center for its accounts and franchisees throughout New Jersey. Previously, MDT used an IBM 360/30 at the Westinghouse computer center.

Cofounders of MDT are William H. Griffin, president, and Robert DeBiasse, vp. Griffin was formerly worldwide systems and dp manager for the Chemical Coatings Div. of Mobile Chemical Co. DeBiasse was president and general manager of Arrasol, Inc.,

an automotive parts distribution, rebuilding, and auto repair center. They're planning to move to larger quarters shortly.

COMPUTICKET ENTERS INTERNATIONAL OPERATION

Computicket Corp., CSC's computerized ticket reservation system subsidiary, has sold European rights to the operation to International Publication Corporation, Ltd., which has annual revenues of $360 million, and whose subsidiary, International Data Highways, will operate the system in the UK and Europe. Travelers will be able to purchase tickets to entertainment and sporting events prior to departure at the various Computicket outlets on either side of the Atlantic. The U.S. terminals are linked to CSC's 360/40, and a spokesman stated that International Data Highways also utilize the System 360. Computicket's newest clients, are the Ice Capades, which opens April 30 in the L.A. Sports Arena, and the San Diego Chargers of the AFL.

SOFTWARE FIRM OFFERS COMPUTER MENU PLANNING

TransTech is a new Kansas City proprietary software firm (specializing in linear programming) whose initial offering is computer-aided menu planning. Beginning operations last November, the company is in the process of installing the second hospital to lease the system, which had been developed at Midwest Research Institution (a non-profit research facility in Kansas City) from whom TransTech purchased exclusive rights. TransTech's president is Dr. Sheldon Levy, formerly director of mathematics and physics for Midwest; vice president is Dean Lawrence, previously manager of computer sciences for Midwest Research.

The package on menu planning for institutions varies by size of hospital and installation costs (runs on 65k 360) with TT figuring that a medium-sized hospital cost would be about $30K. The program is available on a lease basis for about $10K a year.

The package is designed to produce optimally priced menus of at least as high quality as the hospital is accustomed to serving. The menus are for the 80-90% of hospital patients who are on normal diets. A four month experience with the first installation has produced a $10 per bed a month savings on raw food costs.

The menu planning is concerned with three parts: the price of all food items included in all recipes to be used, the nutritional values of each food (which can vary depending on how it is prepared), and the recipe file.

NEW COMPANIES, MERGERS, ACQUISITIONS

First product of **Tempo Computers, Inc.**, Orange, Calif., will be a small integrated circuit general purpose computer system of modular design. Tempo president J. Edward McAteer is the former director of development for Varian Data Machines. . . . A second new Orange County mainframe maker, **Micro Systems, Inc.**, Santa Ana, is producing a series of "high-speed general purpose computers in the $5-10K range that can be easily adapted to dedicated applications." Shipments of their first computer, the Micro 800, are already in process to the company's European licensee, according to Micro president Fred Cox. . . . John C. Young has resigned as president of Consultec, Inc., to head **Time-Sharing Terminals, Inc.**, Washington, D.C., a new firm owned by Datel Corp., Qatron Corp., U.S. Time-Sharing, and a limited number of associates. The company markets and leases a line of on-line terminals and intends to develop, manufacture and maintain proprietary computer communications equipment and software systems. . . . **Control Data** plans to acquire control of **Computing Devices of Canada Limited**, Bendix subsidiary which manufactures electronic aviation and oceanic systems and instruments, through an exchange of stock. . . . **EDP Technology** has acquired **International Development Service, Inc.**, Washington, D.C. There has been no announcement of plans to consolidate IDS with EDP Technology International, Inc., headed by former Agriculture Secretary Orville L. Freeman, which is engaged in similar work with developing nations. EDP Technology has also announced agreement in principle to acquire the assets and business of **Educational Computer Corp.** in an exchange of shares. . . . **Frederic R. Harris, Inc.**, New York City engineering/design organization currently listed among the five largest professional design firms in the U.S., will become a wholly owned subsidiary of **Planning Research Corp.**, subject to approval by appropriate regulatory agencies and by Harris board of directors and shareholders. . . . **Carterfone Communications Corp.**, Dallas, and **Data Communications Systems, Inc.**, Minneapolis, have agreed in principle to merge through an exchange of stock. . . . **National Liberty Corp.**, Valley Forge, Pa., has entered the computer field with the formation of **National Information Systems Corp.**, which will offer facility management, software development, turnkey systems contracting and product development services to business and government. . . . New entry in the packaged software field is **National Systems Planning, Inc.**, Atlanta, which plans to serve a national market emphasizing documentation and installation support. . . . **Electronic Memories**, core memory manufacturer, has acquired **Caelus Memories**, producer of removable disc packs, in a transaction under which Caelus will become an Electronic Memories subsidiary. . . . Agreement in principle has been reach for **Unionamerica Computer Corp.** to acquire controlling interest in **Computer Input Corp.**, a Los Angeles service bureau. . . . **Scientific Control Corp.**, Dallas, has agreed to acquire all the capital stock of **Summit Industries, Inc.**, Garland, Tex., metal fabricating firm that has been a supplier of computer cabinets and other parts for SCC for a number of years. . . . **Computer Applications Inc.** has agreed to purchase all of the outstanding stock of Professional Automation Group, Denver service bureau, bringing to seven the number of service centers operated by CAI. . . . **Scientific Data Systems, Elbit Computers of Israel**, and The Discount Bank Investment Corp. of Israel have created **SDS Israel Limited** in Haifa to develop, manufacture and sell computer peripheral systems and components, with initial emphasis on rotating memories. . . . Raytheon subsidiary **Seismograph Service Corp.**, Tulsa, has announced agreement to acquire **P.E.D., Inc.**, Dallas, a planning, evaluation and development firm whose supervisory and control communications products will be manufactured by SSC's Seiscor Div. . . . **Computing and Software**, as part of the program of planned expansion of its information data bases, has acquired the assets and business of the **Retail Merchants Credit Assn.** of Los Angeles for an undisclosed amount of cash. . . . **Canoga Electronics Corp.**, Los Angeles, has announced the completion of three acquisitions: **Stellar Hydraulics Co.**, Sun Valley, designer and manufacturer of hydraulic and pneumatic devices; **Aqualite Corp.**, North Hollywood, designer and producer of specialized hydraulic and pneumatic valves and filters; and **Calhar Corp.**, San Diego, developer of special design and production techniques in the fields of laminated plastics and plastics forming. . . . **Computing Corp. of America**, Denver-based software and consulting firm, has acquired **Styran Corp.** to

handle special hardware or interfacing for customer systems. . . . **Computer and Applied Sciences, Inc.,** has been formed in Philadelphia by Dr. Arthur Sherman to carry out software development for computer systems in both business and scientific applications and to pursue theoretical research in various areas of engineering sciences. . . . **Data Techniques Corp.** of Northridge, Calif., which sells and leases hardware and software and specializes in facility management, has agreed to acquire the assets and personnel of **LaBianco & Assoc.,** Chicago, an application programming and consulting firm. . . . **Sterling Electronics Corp.,** Houston, has acquired **Industrial Machine Tools, Inc.,** also of Houston, Sterling's 27th acquisition within the last two years. . . . **Consolidated Analysis Centers, Inc.,** Santa Monica, has signed a preliminary agreement with **Associated Computing Services, Inc.,** Canoga Park, Calif., software services firm, to purchase all outstanding ACS stock. . . . **Data Memory, Inc.,** new Mountain View, Calif., firm, has acquired **MVR Corp.,** developer of stop action and slow motion instant replay for TV sports broadcasting, to provide a technological base on which to expand magnetic disc recording into numerous visual and data information retrieval systems. . . . Agreement in principle has been reached whereby **Central Data Systems,** Cleveland, would acquire all outstanding stock of **National Data Processing Corp.** of Cincinnati. . . . **Datapax Computer Systems Corp.** of New York City has formed a wholly owned Canadian subsidiary, **Datapax Canada Limited,** which will purchase and lease new and used disc packs. . . . **Computer Leasing Co.,** Washington D.C., equipment leasing and financing subsidiary of University Computing Co., has purchased **Alcorn Combustion Co.,** a privately owned engineering and process control firm headquartered in New York City. . . . **Ad/Mar Research Co., Inc.,** NYC marketing organization, announced its entry into educational services through the acquisition of **American Computer Institute, Inc.,** and its affiliate, **Harvey Products Corp., Inc.,** both of Mt. Vernon, N.Y. . . . INTEGON **Corp.,** Winston-Salem, N.C., has formed a new subsidiary, INTEGON **Computer Corp.,** to market the company's on-line service for savings and loan associations, as well as other computer services programs and systems. . . . **Clary Corp.** has reached a preliminary agreement to acquire **Roof Structures, Inc.,** Tacoma, Wash., and agreement in principle to acquire **Rushmore Homes, Inc.,** Rapid City, S.D. . . . **Gordon & Breach, Science Publishers, Inc.,** has reached an agreement in principle to acquire, through a stock transfer, **Howard Institute of Technology,** which trains operators of computers and related equipment at its New York City HQ and 11 franchised training schools in the New York metropolitan area. . . . **Management Data Corp.,** Philadelphia leasing, financing and management services firm, has merged with **Systems Technology Corp.,** Warminster, Pa., system analysis and design company, which will operate as a subsidiary. . . . There's cooperation out in Deer Park, L.I. (N.Y.), where two new firms—**BCD Computing Corp.,** a hardware company, and **Computyne, Inc.,** a software house and service bureau—are sharing some directors, including each other's presidents, Dan M. Bowers and Donald E. Lees, respectively. BCD plans to offer dedicated systems for dp, computer control, and information retrieval applications. Computyne is developing specialized software packages for the medical profession, as well as government and general industry, and will also offer time-sharing services. . . . **Cybermark Systems,** New York City marketer of retail and inventory control systems, has agreed in principle to acquire **Portal Publications Ltd.,** California-based print and poster manufacturers and distributors. . . . **Cullinane Corp.,** new Boston-based software house, hopes to "eliminate the 'reinvention of the software wheel' by locating, writing, and distributing the highest quality computer software, and providing the proper support through a nationwide network of technical/marketing offices." . . . Bill Witzel, former exec vp of Computer Concepts, Inc., has formed his own consulting firm, **Pharos Systems, Inc.,** in Bethesda, and is specializing in design and development of law enforcement, medical technology, PPBS, commercial and educational t-s systems. . . . **McManis Assoc.,** Washington-based management and research consulting firm, has formed an affiliated software company, **Continental Software Services, Inc.,** whose emphasis will be on designing special purpose proprietary packages for time-sharing systems. . . . **Analog Devices, Inc.,** Cambridge, Mass., has acquired **Pastoriza Electronics,** manufacturers of modular A/D and D/A converters and related computer interface equipment, which will be operated under present management as an Analog subsidiary.

● In its first venture off the transportation track, the Louisville & Nashville Railroad has formed Cybernetics & Systems, Inc., as a controlled subsidiary that will provide consulting, systems design, and programming services, specializing in management information systems. The Louisville-based software house was incorporated in January and expects to have nearly 50 people by next month, including some transferred from L&N in-house edp operations. The L&N itself is expected to be C&SI's first customer. Head of the new firm is Samuel A. Alward, presently director of management information services for the L&N, who came to the railroad from IBM two years ago. Vice presidents are Joseph A. Carothers, formerly director of fee education marketing at IBM in White Plains, N.Y., and Joseph A. Mungovan, formerly manager of IBM's headquarters field systems center in Raleigh, N.C.

● Project ACCESS (Area Cooperative Computer Educational Systems Services), headquartered in Des Moines, is making dp facilities available to 58 elementary and secondary school districts in nine Iowa counties on an as-needed basis at a price they can afford. The 360/30 is presently serving an enrollment of 125,000 in both public and private schools. Each participating school compiles basic information and delivers it to the computer center, where it is processed and returned to the school within a few hours. Services offered include class scheduling, grade and attendance reporting, test scoring, payroll accounting and student census. It is estimated that each teacher has gained an extra week's instruction time per year since the computer began handling the class scheduling function. In addition to administrative work, one county uses /30 as an educational tool, and students enrolled in computer clubs can have scheduled time on Saturdays for hands-on training.

● Honeywell claims "one billion dollars' worth of Honeywell-designed third-generation computer systems are now installed worldwide." The firm also stated that during 1968: its growth in computer shipments "exceeded the over-all industry growth rate by a considerable margin;" its employment in computer activities increased from 13,500 to more than 17,000 worldwide; it spent more than $30 million on research and development in the computer and communications areas; it added more than 200 new products to its computer products line; and the company's overseas computer opera-

(Continued on page 141)

If you've been looking for all-solid-state keyboards to arrive, why wait?

Call "the other keyboard company." They're talking about a $100-$200 unit and showing some enticing pictures.

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Being solid state, its reliability is inherent. The keys are electronically interlocked to prevent errors caused by striking more than one key at a time. Each key generates its own code so it's easy to get exactly the keyboard arrangement you want without wiring changes. Diode matrices, mechanical switching or photo-electric devices are eliminated.
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_____

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tions moved into the black, while overall computer business became "substantially profitable."

● Conrac Corp., New York, has announced receipt of an order valued at $750,000 from Digital Equipment Corp., for private label on-line crt terminals. Delivery will begin next summer and continue through 1970. The terminals are Conrac crt's displaying 960 characters, modified so that the I/O section is compatible with DEC equipment. They will be marketed in DEC colors and symbols.

● IBM, in a bold look into the future, has announced that PL/I will be available for disc versions of the 360/20 in the second quarter of next year. PL/I is currently provided only for Models 25 through 85. The Model 20 PL/I will be disc resident and require a minimum of 16,148 bytes of core storage. The compiler will operate under control of the Model 20 Disc Programming System monitor.

● National Computer Services, Inc., a Dallas-based computer services outfit formed last April, has attracted a wealthy and mature suitor despite its tender months. Lomas & Nettleton Financial Corp., which according to its president Joseph Hay is the largest mortgage servicing company in the nation, has revealed agreement to acquire approximately 60% of NCS stock for $350K and 40,000 shares of L&N common as the main prop in a complex financial arrangement. Some 20% of NCS stock will be distributed to L&N shareholders as a dividend if all necessary consents can be obtained. Also, NCS will take over the data processing aspect of L&N's business, which is expected to add about a megabuck to NCS annual revenues.

● The American Bankers Association is compiling a list of data communications consultants specializing in system engineering design and cost effectiveness who are interested in providing consulting services to banking. The listing will be included in a forthcoming data communications guide to be published by the ABA's Automation Planning and Technology program. Organizations wishing to be included should contact Alan L. Price at the ABA, 90 Park Ave., New York, N.Y. 10016. Deadline is March 31.

● Committee chairmen for the 1969 ACM National Conference and Exposition have been announced by general chairman Solomon L. Pollack. They include Dr. Ward Sangren, technical program; Dr. N. R. Nielsen, education; William G. Gerkin, exhibits; and Pasteur S. T. Yuen, public relations. Thomas R. Dines has been named vice chairman and David Katch administrative coordinator. The conference will be held at the San Francisco Civic Center, Aug. 26-28.

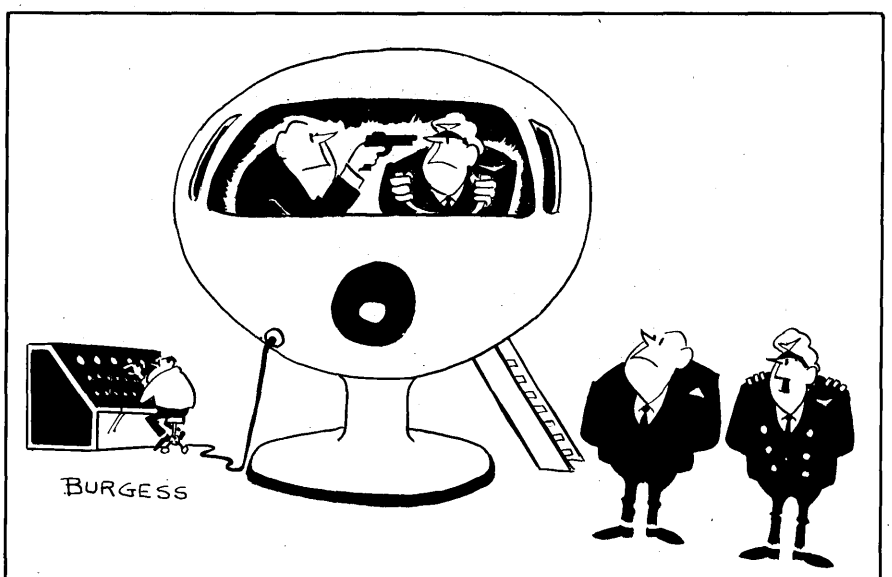
● The Society for Savings has ordered a $1.5 million Honeywell system that will include 61 on-line teller terminals (manufactured by Bunker-Ramo) and a Model 1250 computer. The system will be used for loan and savings accounting in the bank's 16 offices in the Hartford, Conn., area. Forty-five terminals will be installed by midyear, and the remaining 16 implemented by mid-1970. The cpu will have 65K memory, five tape drives with a transfer rate of 45K cps, and four disc drives with total storage of 36.8 million characters. This equipment will replace a Teleregister system installed in 1961.

● The Bureau of the Census notes that the first sample summary tape for the 1970 census is now ready for public use. It covers Madison, Wis., and is available in IBM format, 7- or 9-channel BCD, 556 cpi. The bureau points out that this test reel is "very nearly an image of the expected 1970 census first count but there will undoubtedly be a few minor changes." Final documentation will be provided in the fall of this year, after users have had a chance to react to the test reel. Readers who want an order blank should address: Data Access and Use Laboratory, Bureau of the Census, Washington, D.C. 20233.

● Atar Computer Systems, Inc., recently added Western Airlines to the list of carriers that have signed up for its common airlines reservation system and now has five, half the number it needs for CAB approval. Previously signed were TWA, United, Delta and Northwestern. The firm already has met the other requirement for CAB approval: signing carriers of at least 50% of U.S. passenger revenue miles.

● The great Dallas punched-card controversy (Dec. '68, p. 98) was seemingly laid to rest with the payment of $60K to Datamedia, Inc., by Dallas County by order of a district judge. The action means that punched-card balloting and computerized tabulation will be the mode of future Dallas elections despite a determined and oft raucous effort by anticomputer forces to hold back progress or maintain honest electoral processes, depending on your point of view.

● The manufacturing and engineering activities of Honeywell's EDP Division have been reorganized into two new operating units. They are the Computer Systems Operations, which will be responsible for the design, manufacture, and testing of cpu's, control units and communications systems, and have overall EDP Division re-



"We try to simulate actual flight conditions as closely as possible."

sponsibility for systems design and shipping; and the Peripheral Device Operations, which will be responsible for the design, manufacture, and testing of peripheral equipment and certain remote terminals supplied by the division, and will also handle factory reconditioned equipment.

● Vermont Research Corp., Springfield, Vt., has announced selected price increases on drum memories, memory systems, and components. The increases approximate 15%, and are the first price changes in over three years. They are said to reflect technological improvements in drums and interface electronics that have occurred during the past three years, causing a "completely different product" to have been developed, while prices remained constant.

● The International Real Estate Referral System, introduced over a year ago by IBM as a system to match buying and selling listings for real estate brokers, has been purchased by Incom, Inc., Stamford, Conn., a firm specializing in providing computer services to the life insurance industry. Incom has already activitated IREFS through brokers in Fairfield County, Conn.

● The National Registry, an affiliate of Computer Applications, Inc., has developed a computerized job-matching system for use in placing executive, professional, and technical personnel. Jobseekers pay $15 a year, fill out a precoded resume form, and are periodically matched against the Registry's job opportunity data bank, stored on an IBM 1401. Listed firms pay $250 a year and submit an 8½x11-inch "ad," which is distributed to "matched" personnel, using address labels produced as printout. Frequency of matching runs is determined by the number of jobs in a given field. About 40,000 resumes are now on file.

● Greyhound has ordered 45 CARD (Compact Automatic Retrieval Display) systems for installation in the New York bus terminal and offices of its Eastern Greyhound Lines Div. The equipment, which stores up to 73,500 microfilmed documents, any one of which, it is said, can be displayed on a console screen for reference in less than four seconds, is manufactured by HF Image Systems of Culver City, Calif. Documents stored will include complete national bus schedules, fare tables, tour information, and general information relating to travel along Greyhound lines. Installation of a total system of mre than 1,000 CARD units throughout Greyhound's nationwide network will be contingent upon the success of the operation in New York.

● Sangamo Electric Co., Springfield, Ill., and Transamerica Computer Co., South Pasadena, Calif., have announced an agreement under which Transamerica will purchase computer input equipment manufactured by Sangamo and leased to Sangamo customers. The arrangement could involve up to $25 million in equipment value.

● Com-Share will extend its time-sharing services into Canada under a technical service agreement with Computer Sharing of Canada, Toronto, in which CSC will be considered the sole distributor of Com-Share's standard commercial services in Canada. CSC customers will access the Com-Share system through equipment and lines maintained by Com-Share; will install, operate and maintain remote-terminal equipment and computing systems compatible with the existing Com-Share network; and will use Com-Share software. Under terms of the agreement, Com-Share holds an equity position in CSC and receives appropriate reimbursement for its services to the firm.

● NASA has awarded a one-year contract extension of $22,576,000 to the Western Development Laboratories Div. of Philco-Ford for continued support of the Mission Control Center of the Manned Spacecraft Center in Houston. Under its contract, Philco-Ford provides systems engineering to NASA for the continuing improvements that are made in the Mission Control Center's systems as new procedures and equipment become available. In addition, Philco Houston prepares the control center for each flight and is responsible for its operational performance. The contract extension also contains two one-year negotiated options totaling an additional $49,910,000 which if exercised will continue the contract through the end of June, 1971.

● USASI Task Group X3.2.5 (Data Formats, Related Sets and Applica-

tions) is in the process of proposing a standard label and record format for magnetic disc storage. To develop a proposal incorporating the requirements of the computing community, they have prepared a questionnaire to be distributed to computer users. Those wishing to respond to the questionnaire should write to BEMA/DPG, 235 E. 42nd St., New York, N.Y. 10017, to secure a copy.

● Travelers on the newest section of the London "tube" (subway) now have their tickets issued by NCR machines that print the amount and type of fare on one side of the tickets and record this information on the reverse side in magnetic code on an oxide coating. When placed in an electronic station gate, the data on the back of the ticket is "read" and passengers holding valid tickets are allowed to pass. For accounting purposes, the machines also provide printed totals of the various types of tickets issued.

● How pollutants travel in water will be studied in an AEC-conducted project at Battelle Northwest, division of Battelle Memorial Institute, to gain insight into the relationship of water pollution to natural environments. Upon completion of the development phase of a DEC PDP-9-driven graphics display system, visual demonstration of the way pollution elements are carried and distributed in ground and surface waters will be produced.

shortlines . . .

BEMA plans to open a branch office in Washington later this year and may move its HQ there within the next two years. . . . Stanford Research Institute reportedly did such a poor job of pulling together comments collected last year in FCC's computer services inquiry that the commission has been forced to give the institute another six months in which to prepare a final report. . . . Detroit-based Vickers, a division of Sperry Rand, expects its recently installed Univac 1108 to be ready by mid-1969 to be message switching for a worldwide network—Tokyo, London, Australia, and across the U.S.—for all parent company sites. Software, being written by Computer Usage Co. (Detroit-Chicago offices), is also due mid-year. . . . When Norm Ream left the Navy last September, he received a plaque and scroll memorializing his "meritorious service" as the secretary's special assistant for ddp management. On the Johnson Administration's final day in office, the Navy took back these meritorious memorabilia and gave Ream a gold medal for "distinguished service." . . . Geographers at Hebrew Univ. have recently completed a detailed survey of East and West Jerusalem, using a computer mapping technique developed in the U.S. and adapted to an urban geographical survey, utilizing the university's CDC 6400 computer. . . . This year's Spring Joint Computer Conference will offer preregistration by mail for the first time. Deadline for receipt of checks is April 18. For application forms and information, write: 1969 SJCC, P.O. Box 662, Brookline, Mass. 02147. . . . Applied Data Research, Inc., has installed an IBM 360/50 in its new Princeton, N.J., headquarters and computer center. . . . Burroughs Corp. has consolidated all of its federal government activities into its Defense, Space and Special Systems Group, which employs over 6,000 persons in its Paoli, Pa., HQ. . . . First Federal Savings of Detroit, largest federal savings association in Michigan, has ordered an $800K system of 63 Bunker-Ramo electronic teller machines for its 25 offices. Installation is scheduled for late this year. . . . The U.S. Office of Education has awarded Education and Training Consultants Co., Los Angeles, a grant to develop mathematical models for occupations. The study is to produce quantitative models which describe and measure the utilization of government-published occupational data by vocational and technical teachers in high schools. . . . Computer Sciences Corp. has been awarded a three-year $4.8 million contract to operate a large-scale centralized computer facility serving the U.S. Navy's Naval Undersea Warfare Center at Pasadena, Calif. . . . Kongsberg Vaapenfabrik, producer of Kingmatic drawing equipment, has reportedly taken over drawings and production rights free from the Norwegian Defence Research Establishment for production of a military version of Norsk Data Elktronik's Nord-1. The ordered quantity is rumored to be 50-100, mainly for field artillery purposes. . . . Allen-Babcock Computing, Inc., has opened a time-sharing center in Union, N.J., the third in a series for a planned nationwide network. . . . Information Science's PICsystem, said to be the largest computer-based man-job matching system in existence, is guaranteeing employer savings in hiring personnel. Three-year average cost per hire from the NYC firm has been $400. . . . The Connecticut State Welfare Dept. has begun using a 360/50 to store and update individual case data, reducing the time social workers will need to spend on paper-work. . . . Advanced Computer Techniques Corp.,

meet the new PDP-12

Talk to a computer? How?

JUST GIVE ME ENGLISH THROUGH THE KEYBOARD, I'LL TALK BACK THROUGH MY 7" x 9" SCOPE.

O.K. Now, tell me about yourself.

I'M A COMPLETE LABORATORY SYSTEM WITH A BIG NEW DISPLAY, 16-CHANNEL A/D CONVERTER, 2 TAPE UNITS, AND A 1.6 μSEC COMPUTER WITH 43 BASIC INSTRUCTIONS.

What can you do?

CONTROL EXPERIMENTS. ACQUIRE, ANALYZE, STORE, AND DISPLAY DATA IN ANY FORMAT YOU WANT.

Haven't I met you somewhere before?

I'M BRAND NEW. YOU MUST BE THINKING OF MY PREDECESSOR, LINC-8.

What makes you different from the LINC-8?

I'M FASTER AND MORE POWERFUL, YET $10,600 LESS. I HAVE COMPLETELY BUFFERED I/O, INCLUDING AN ALL-NEW MAG-TAPE PROCESSOR. AND MY NEW DISPLAY-BASED PROGRAMMING SYSTEM IS A CINCH TO USE. FOR YOUR OWN PROGRAMS, FOR LINC-8 PROGRAMS, FOR PDP-8 PROGRAMS, AND THEN SOME.

You're too much, PDP-12.

NO. JUST $27,900.

digital

Maynard, Mass.

news briefs

New York City, has been retained by the Dominion Bureau of Statistics, Canada, to provide an edp training program for its staff members. . . . ITT World Communications and Empresa Barsileira del Telecomunicacoes, the Brazilian communications administration, have announced an agreement to provide a broad range of international communication services between the U.S. and Brazil via satellite. . . . The National Institute of Law Enforcement and Criminal Justice, Washington, D.C. 20530, has announced the availability of funds in support of manuscript preparation in an effort to speed publication of research articles and books which contribute substantially to crime prevention and control and to the improvement of the administration of justice. . . . Salt Lake City's Academy of Computer Technology has ordered a Univac 9200 system as a terminal unit to the 1108 at the Univ. of Utah. The 9200 will be used as the communicator system for students to learn entry level programming at the Academy. . . . Leasco president Saul Steinberg's bedroom is featured on the cover of a recent issue of House & Garden. . . . a note for tea-leaf readers, stock market prophets, and other omen-watchers: Burroughs' recent stock split is the first they've had in a very long time—since August, 1929.

call for papers . . .

32nd Annual Meeting of the American Society for Information Science, San Francisco, Calif. Papers are solicited in the general areas of the design, operation, and evaluation of information systems; classification and indexing; coding and notation; search and retrieval techniques; user studies; information handling equipment and technique development; national issues, patterns, trends, and systems related to information handling; basic research in the information sciences; library automation and other application areas. Statement of intent should be sent immediately. Camera-ready manuscript must be submitted by May 1 to Charles P. Bourne, Technical Sessions Chairman, Information General Corp., 999 Commercial St., Palo Alto, Calif. 94303

Joint Conference on Mathematical and Computer Aids to Design, Anaheim, Calif., Oct. 26-30. Original papers are invited on relevant mathematics and numerical analysis, computer science (graphics, man-machine interaction, formula manipulation), large scale systems (urban, utility), continuous valued networks (electrical circuits, mechanical structures, networks), digital signal processing; logic circuits, special topics in design (holography, lens design, high energy physics, airplane design). Those planning to present a paper should submit a working title by May 1 to SIAM-1969 Joint MCAD Conference, 33 So. 17 St., Philadelphia, Pa. 19103.

Symposium on Parallel Processor Systems, Technologies and Applications, Monterey, Calif., June 25-27. Systems, hardware, and applications papers are requested. Three copies of complete papers and 500-word abstracts should be submitted by March 16 to L.C. Hobbs Assoc., Inc., P.O. Box 686, Corona Del Mar, Calif. 92625. The symposium is sponsored by the Office of Naval Research, Naval Weapons Center, Navy Postgraduate School and Hobbs Assoc.

Reliability and Maintainability of Computing Systems Workshop, Lake of the Ozarks, Mo., Oct. Areas of discussion will include system reliability (redundancy techniques, error-detecting and error-correcting codes, self-repair), system maintainability (system architecture, design principles, error recovery techniques, fault-detecting and diagnostic methods), and machine aids (fault simulation, logic analyzers, diagnostic languages). Those interested in presenting informal talks are requested to send three copies of abstracts by July 10 to the program chairman, Dr. H. Y. Chang, Bell Telephone Laboratories, Naperville, Ill. 60540. The workshop is sponsored by the IEEE Computer Group Midwest Area Committee.

SICCOM Symposium on Data Communications, Pine Mountain, Ga., Oct. 13-16. Tentative subjects for inclusion in the program are the organization and optimization of on-line computer systems and communications networks, modeling techniques, data transmission techniques, languages and standards, terminal design characteristics. Those having suggestions about the session or who would like to present a paper should send details to Edward Fuchs, Room 2C-518, Bell Telephone Laboratories, Holmdel, N.J. 07735, or to Walter J. Kosinski, Interactive Computing Corp., P.O. Box 447, Santa Ana, Calif. 92702.

Electronic Components Conference, Washington, D.C., April 30-May 2. Short "recent news" papers are invited on recent developments in the fields of electronic materials, components and associated processing technologies, Four copies of a 100-300 word abstract must be presented to the technical program chairman, Dr. J. O'Connell, by April 1. Electronic Industries Assn., 2001 Eye St., N.W., Washington, D.C.

Northeast Electronics Research and Engineering Meeting, Boston, Mass., Nov. 5-7. Two types of papers will be considered: 1) advanced technical papers in engineering, research, or development, focusing on new and original work; and 2) technical application papers covering the use of components, circuits, instruments and hardware in military, industrial, or commercial equipment. Three copies of a 35-40 word abstract and three copies of a 600-1000 word condensed version of the paper, accompanied by all pertinent drawings, photographs and artwork, must be submitted by July 1 to the program chairman, IEEE NEREM-69, 31 Channing St., Newton, Mass. 02158.

10th Annual Symposium on Switching and Automata Theory, Waterloo, Ontario, Canada, Oct. 15-17. Papers describing original research results in the general areas of switching theory, automata theory, formal languages, theory of computation, theory of programming, and theoretical aspects of logical design are being sought. Authors are requested to send six copies of detailed abstracts by May 16 to Prof. J. E. Hopcroft, Dept. of Computer Science, Cornell Univ., Upson Hall, Ithaca, N.Y. 14850. Symposium is sponsored jointly by the Switching and Automata Theory Committee of the IEEE Computer Group and the Dept. of Applied Analysis and Computer Science of the Univ. of Waterloo.

Fall Joint Computer Conference, Las Vegas, Nev., Nov. 18-20. Original papers on new work, state of the art, future projections, evaluations, experiences, surveys, tutorial treatments, and critical issues are invited. Six copies of the complete draft manuscript, not to exceed 6000 words, must be submitted by April 11. Authors should include a 100-150 word abstract and original drawings and photographs keyed to the text. (Those planning to submit a paper should send a statement of intent immediately to E. M. Grabbe, Technical Program Chairman, 1969 FJCC, P.O. Box 3708, Santa Monica, Calif. 90403.

At $11,950, MAC makes every little bit count.

Why is MAC great, though small? Price, surely. But look at what else makes MAC the best Multi-Application Computer in its class:

Its standard 4K memory of 16-bit words is expandable to 65K. Fast? The fastest. Memory cycle time is 1 μsec. Add, 2 μsec. Full-word shift, 5 μsec. Interrupt response, 6 μsec. That's a big head-start: capacity and speed.

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For more information, write to MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.

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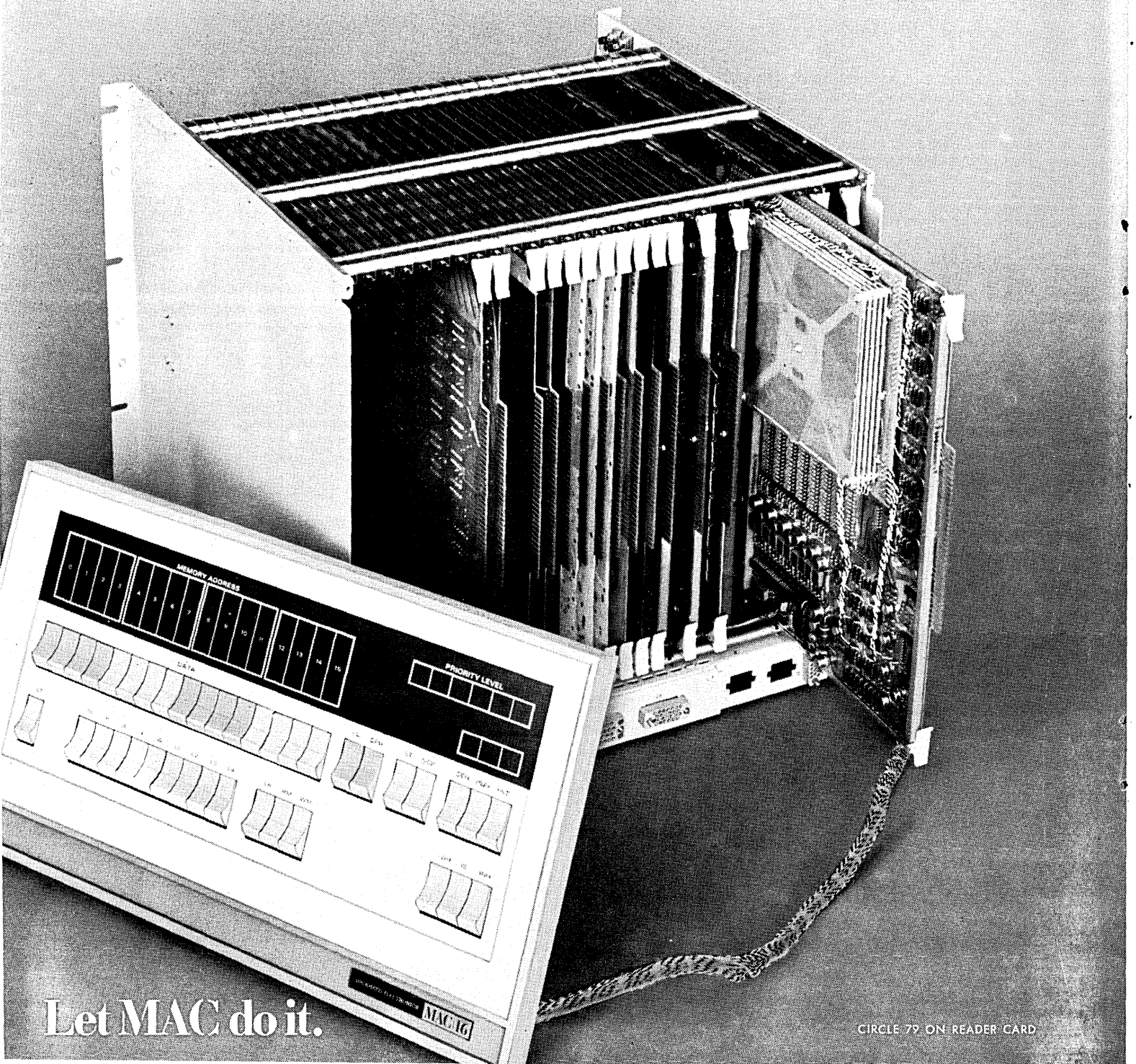
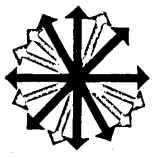


Let MAC do it.

CIRCLE 79 ON READER CARD



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.

information retrieval

CREDIT REPORTING SYSTEM

Credit Data Corp., Anaheim, California

computer and peripherals

Two IBM 360/50's with 512K bytes each of core storage; 500 nsec cycle time

Six IBM 2314 disc units with 233.4 megabytes each of random access storage; 75 msec average access time

200 IBM 2260 crt display stations plus printers, card readers, mtu's

application

The computer complex of the Los Angeles area office of Credit Data Corp. maintains files on 11 million persons in the western states, supplying charge authorization information and credit histories to the thousands of credit grantors who subscribe to its services. More than 100,000 credit information requests are fielded each day by Credit Data's staff. Servicing these inquiries is a massive task, requiring an equally massive computer complex and a large staff of operators. Credit Data has both the staff and the hardware. Over 250 persons are employed in the operation of its 200 IBM 2260 crt display stations and the two 360/50's which support them.

Inquiries of two basic types are handled. Approximately one-fourth of the crt terminals are dedicated to charge authorization requests. Operators at these terminals wear telephone headsets and converse with clerks in retail chain stores, keying in such information as subscriber (store) ID, name and address of credit applicant, and station (operator) number. Within seconds the 360/50 pulls the applicant's credit record from the 2314 files and displays it for the operator, who gives a "go" or "no go" reply to the store clerk.

Credit reporting for purposes of opening new accounts, with a retail store or auto dealership for example, may be handled verbally, as are charge authorizations. However, since most long-term credit grantors do not require the "immediate" response necessary to a clerk ringing a sale, the credit reporting may take the form of a more extensive printout. Overnight service is provided for listings of this type.

The printed report, like the crt display is coded for more efficient storage and retrieval. Contrary to the fears of much of the general public, very little data of a very personal nature is included. Data entries do include such things as name and Social Security number of applicant, present and previous addresses, previous charge account and loan applications, and employment records. The "personal" in-

SAMPLE OF PRESENT WRITTEN REPORT FROM LOS ANGELES CENTRAL FILE

cdc CREDIT DATA CORPORATION 680 WILSHIRE PLACE — LOS ANGELES

30-200 ROBERTSON WILLIAM J MARY 3-30-66
01212 WILSHIRE LA DOUGLAS 386-32-1362

PREVIOUS ADDRESS. CHECKS
CURRENT ADDRESS CHECKS
FILE EMPLOYMENT - DOUGLAS
SOCIAL SECURITY NUMBER CHECKS

INDUSTRY	CODE	FILE DATE	TYPE	AMOUNT	MO'S	RATING OR COMMENT	DATE RATED
BANK	15-310	02-62	AUTO	$1500 TO $2000	24	EARLY PAY	03-63
RETAIL	41-053	06-64	CHG ACCT	$250 TO $500	10	OPEN ACCT	06-64
RETAIL	43-011	04-65	SECURED	UNDER $250	06	PD UNSAT	12-65
FINANCE	22-910	09-65	PERSONAL	$250 TO $500	18	DELINQ 60	01-66
OIL	30-900	01-66	CHG ACCT		01	INQUIRY	01-66

formation usually regards only the amount of loans or purchases and the manner in which they were paid. No information on income, or house payments, or personalities is involved. For those 98% plus of individuals who are "good risks," the files contain no additional notations. For the other 1% or 2% of the populace—those who abuse their credit privileges and make credit reporting necessary in the first place—the record may contain notations on bankruptcies or defaulted payments.

The file information is supplied by Credit Data's customers, the credit grantors, not the credit applicants. Customer files are entered into the files on punched cards. For purposes of updating files, some large subscribers supply data on mag tape. Due to the variety of users, several forms of input must be accommodated. These records are usually quite accurate. A spokesman estimated that only one of every 1500 records is questioned, and that less than one in 150,000 might be in error. Once detected, errors can be corrected in minutes.

software

For those who are afraid that the computer never forgets—and therefore credit reporting agencies never forgive—there are comforting words from Dr. Harry C. Jordan, chairman of the board of Credit Data: "Unlike old-fashioned paper files, where storage is very cheap but selective removal of data is very expensive, in the case of the computer file storage is very expensive and selective removal is very cheap. Storage can run as much as half of the total computer cost. . . . Consequently, Credit Data builds a case of amnesia into its computer programs." The "software with amnesia" is largely proprietary. CD reports that the 360/50 operating system is based on a version originally implemented on an IBM 1410 and upgraded to a 360/40 which supported a keypunch-based reporting service until September, 1968.

The software is responsible for checking variant spellings of a given surname, and for searching for possible solutions where the identification does not match file information. If none of the present or previous addresses match, for instance, the program searches for other characteristics that meet minimum standards so that possible matches can be detected. An indicator of the level of search at which a match attempt is successful is displayed or printed with the file record retrieved. So far, the mismatch rate experienced is in the neighborhood of one in 10,000 attempts.

In addition to the file manipulation package, CD has developed a program called MAGIC (Method for Asynchronous Graphics Integral Control) which they claim enables the company to achieve far greater performance from the 50's than is normally realized. Finally, some small routines have been written for pulling credit records from more general subscriber files.

hardware

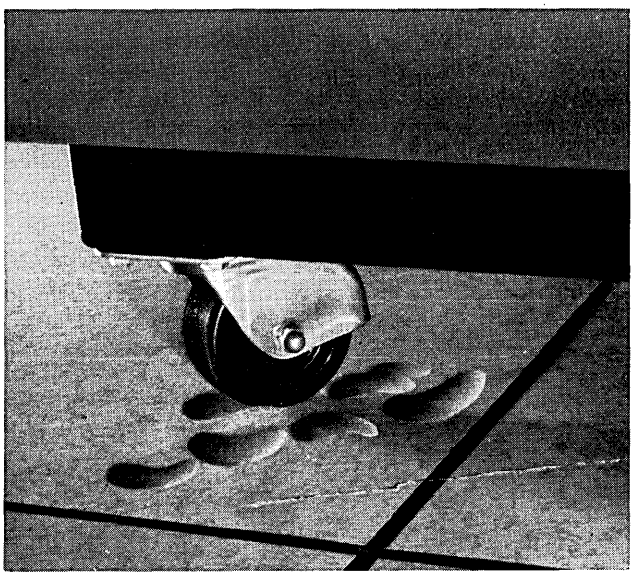
Only one of the 360/50's is required to support the information retrieval and file updating functions. The back-up cpu is either used for testing system improvements or for rental income. The on-line 50 has access to six IBM 2314 disc files, and is accessed, in turn, by all 200 2260's in Anaheim, and also by charge authorization terminals in cities as far away as New York. In addition, Credit Data is studying the possibility of placing tty's in the offices of heavy system users, and an IBM 2780 is being installed in San Francisco to relay messages from Northern California.

Since the subscribers may be quite distant, WATS lines to every service area are provided, toll free. Two 200-line Automatic Call Distributors have been installed to field incoming calls and match them with free operators.

The subscribers demand prompt service in those cases where a customer is waiting. And this hardware/software/operator system provides answers in less than three minutes to over five million requests per month for charge authorization alone. ■

The Anaheim Credit Data Corp. office houses approximately 200 IBM 2260 Display Stations for accessing credit files, but additional terminals as far away as New York also access the charge authorization file.

there are dimples... and dimples



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Almost any raised floor looks great new, but how will it stand up under use?

Good question. A question to answer *before* you buy.

We build WacoFloors with extra strength. That saves you problems such as deflection, or costly changes to meet new requirements later.

Result is, we guarantee your WacoFloor against dimpling. An exclusive guarantee.

Another WacoFloor exclusive is the patented Snap-Lok Rigid Grid System. You get total accessibility without giving up strength or rigidity.

If there's a reason other floors aren't guaranteed against dimpling . . . a reason why they can't match WacoFloor's combination of strength with accessibility, it can't be the price.

WacoFloors are priced competitively.

WacoFloors are installed with panels of steel or wood core.
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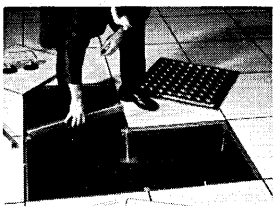
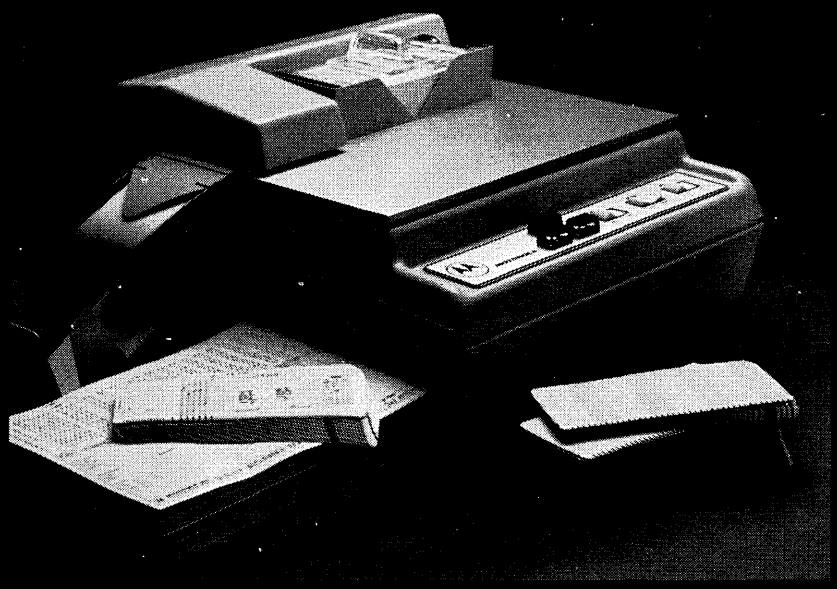
There is no equal to a WacoFloor



Stringers are easily removed from the exclusive Snap-Lok Rigid Grid System.

The Indiscriminate Reader.



It reads practically everything.
Ordinary pencil-marked data.
Keypunched data.
Preprinted data.
In any combination.
In any column-spacing format.
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On snap-out forms.
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But what does it do for an encore?

Operates unattended. With automatic feed. And automatic end-of-data card injection.

But even without these options, the basic manual-feed machine can buy you extraordinary efficiency. Consider, for a moment, just a few possibilities.

Source documents designed to fit the task, not machine requirements. Data can be marked with ordinary pencils, and you can include instructions right on the form itself.

A strategically dispersed source-data collection system with a 'built-in' audit trail. The input documents serve as their own hard copy.

Direct data entry without conversion and verifying. The MDR reader provides an output in standard USASCII language or, optionally, other binary decimal codes. It interfaces with various standard modems.

Et cetera.

Now, what about cost? Remarkably modest for an optical reader of such versatility: $3600 to $5000. Lease rates are attractive too. Our MDR literature kit describes the various Indiscriminate Readers and their application. Write us for a copy. Motorola Instrumentation and Control Inc., P.O. Box 5409, Phoenix, Arizona 85010. 4327

MOTOROLA Information Systems

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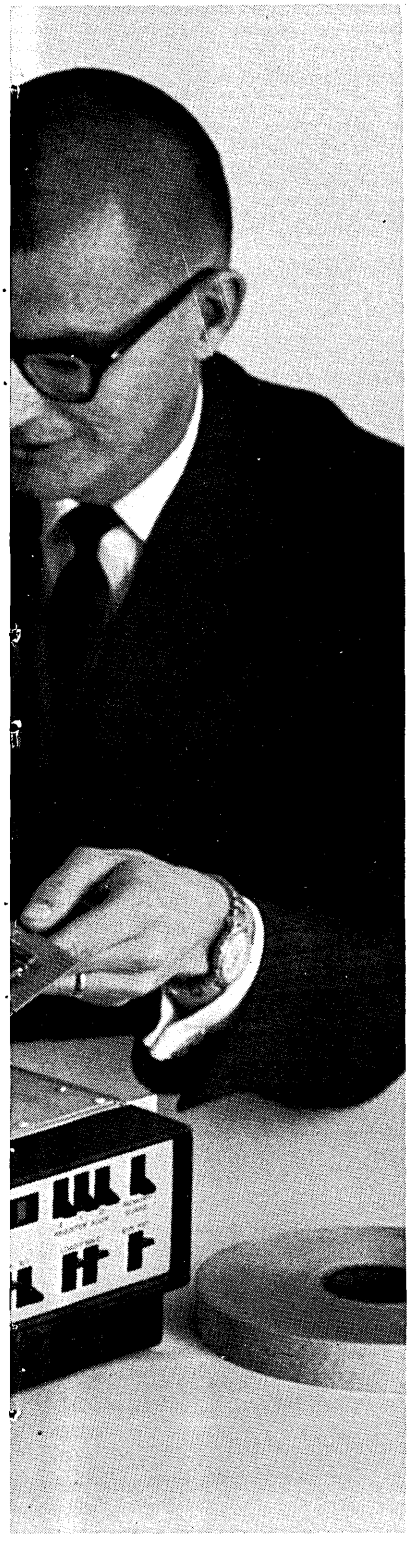

At General Automation we know what it takes to apply computers to automation projects. So, we've gathered the best brain power in engineering, hardware and software to do a complete and effective job.

Directed by William Beyer (Left), our engineering service covers feasibility studies, process analyses, installation and "turn key" projects. Mr. Beyer is well known for his work in the utility, petrochemical and steel process fields.

Dr. Robert Jackson (Center) is responsible for the development of our computers, including the SPC-12 and SPC-8 and our unique economical system interface units. Dr. Jackson has gained wide recognition for his inventive contributions to the development of numerous computers and controllers.

Under Dr. 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 departments is available to you separately or together to meet your individual requirements. If you are contemplating adding a computer to your product, or would like engineering, hardware, or software assistance, or all three, call on General Automation, your automation partner.

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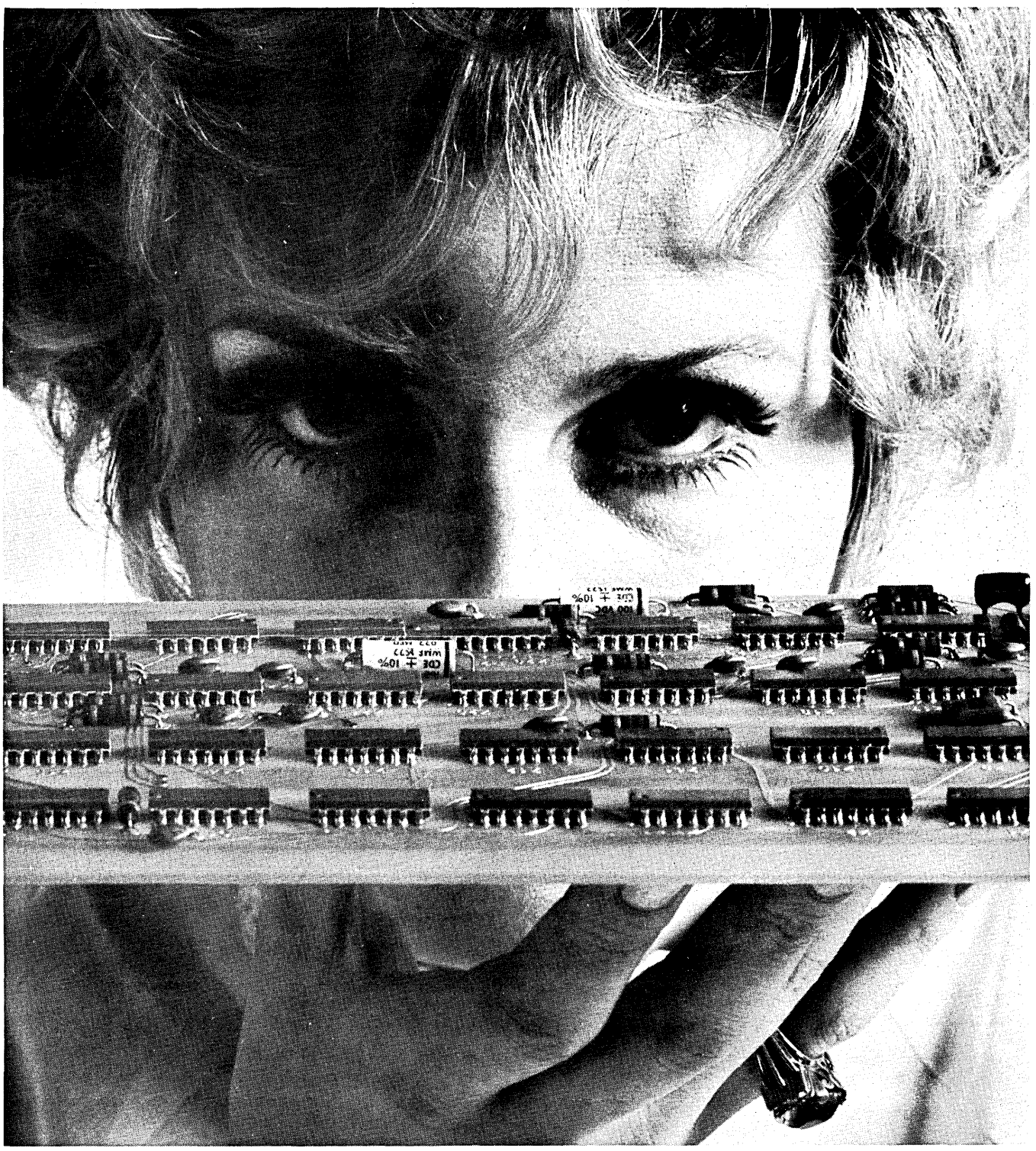

introducing the tt-103 data set, a modem compatible with the bell 103 that costs less than $200*

Now that the FCC interconnection rulings are in effect, a modem should be as much a part of your terminal as its keyboard, power supply or even its housing. The TT-103 Data Set is ideal for this application in terminals operating up to 300 bps. Physically, it's a single flat 50 square inch PC board that will fit in just about anywhere. Your terminal power supply will power the TT-103 too. *The cost in small lot quantities is about $200 and a lot less in OEM lots. That kind of economy makes your terminal worth more with the TT-103. For information call or write: Tel-Tech Corp., 9170 Brookville Road, Silver Spring, Md. 20910. Telephone: (301) 589-6035.

TELECOMMUNICATIONS TECHNOLOGY
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CIRCLE 82 ON READER CARD

WHEN IS YOUR COMPUTER NOT A COMPUTER?

when it stops . . . for communication line handling

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**
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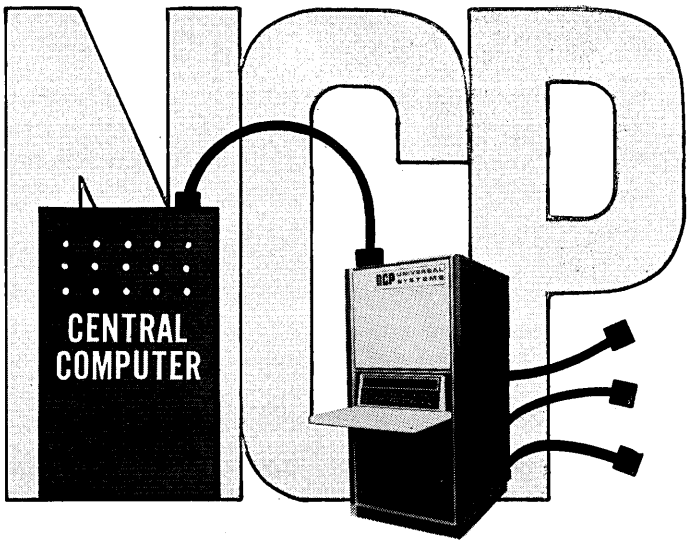
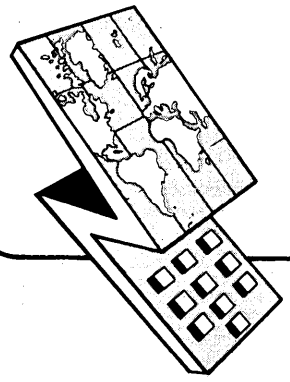


put your computer back to work!

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.

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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

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CIRCLE 84 ON READER CARD

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I am interested in Formatter

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Company _____

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new products

small-scale computer

Thinking small, GE built the 105 as a little brother to their 115 and 130 systems. Both based on a 7.5 usec memory, the two models available differ in the size of the core provided and in the speed of peripherals. Model A, which rents for $1,250/mo. and sells for $57,370, plus $261/mo. maintenance, can be obtained with 4 or 8K (8-bit word) memories, a 350 cpm card reader, a 250 lpm printer, and a 60-200 cpm card punch. The additional 4K memory module adds $180 to rental, $8,520 to the selling price, and $13 to maintenance. Model B comes equipped with the 8K memory as standard, and replaces the printer with a 300 lpm unit, and the punch with a 300 cpm unit: its price is $1,450/mo. or $66,410, plus $285/mo. maintenance.

Additional peripherals can be added only by upgrading to a 115. The instruction set of the 105 cpu is identical to that of the 115, therefore software for the 105 is exactly the same as that provided with the equivalent 115 configuration. This permits upward compatibility of both hardware and software within the GE-100 line. Software for the 105 includes an assembler, an extended report generating program called LOGEL, and EAM-replacement routines for listing, summarizing, reproducing, and gang-punching in a SIMTAB package. Applications available for the system include a 4K payroll program, PROCON-115 for production control, and a critical path method program (CPM).

The 115 is expected to be in competition with the IBM 360/20, Univac 9200, and Honeywell 110. Notably, the 360/20 Model 3 offers memory expandable to 16K, cycle time of 3.6 usec, hardware multiply and divide, and "more elaborate capabilities" for only several dollars more per month than the 105A. Average instruction execution time and actual processing power of the 105 are claimed to be "significantly better," however, and the 105 user can grow to a 115 without incurring reprogramming, which is not possible in stepping up from a 360/20 to a /25 or /30.

The Univac 9200 also offers memory expandable to 16K, has a cycle time of 1.2 usec, and more extensive overlap capabilities, for only $40/mo. more in rental than the 105A. GE hopes to provide faster delivery of the 105, however, and points to its "extensive system software and applications packages, and the outstanding support GE provides to all of its customers" as competitive advantages over the 9200. The Honeywell 110 offers memory expandable to 16K, has a 4 usec cycle, but costs $580/mo. more than the 105A, so GE believes it "cannot be considered a serious competitor in the card system market."

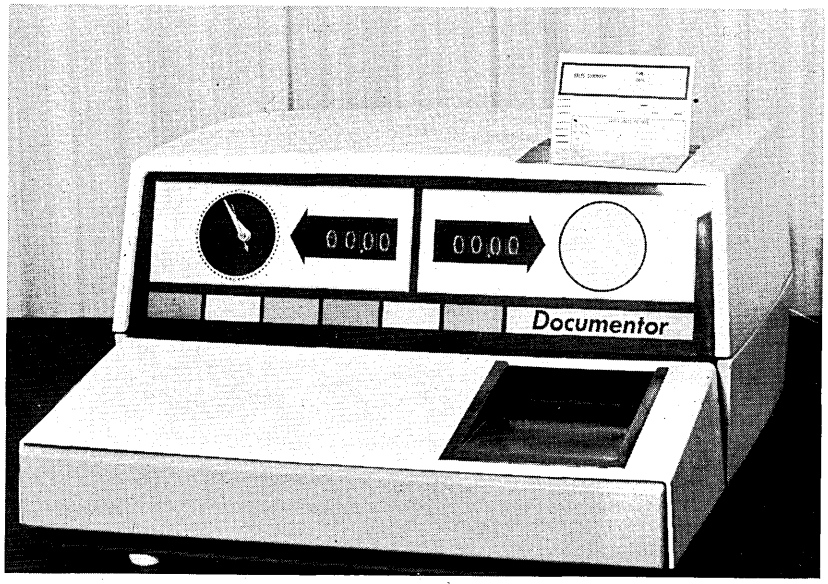
First deliveries of the 105 are scheduled for July. GENERAL ELECTRIC CO., Schenectady, N.Y. For information:

CIRCLE 160 ON READER CARD

economy time-sharing

Honeywell has entered the time-sharing market with a dedicated time-sharing system, H1648, which uses three Series 16 cpu's—a DDP-416 and two -561's—to handle up to 48 simultaneous users, at a cost of about $12 per terminal per day. The firm claims that the system, priced at $394K or $12K/mo., will "solve business, scientific and engineering problems at one-eighth the cost of comparable subscription services." Early last month, orders had been received for 16 systems, valued at more than $6 million. Two in-house systems, developed over the past two years as a service for Honeywell engineers, have logged more than 30,000

PRODUCT OF THE MONTH



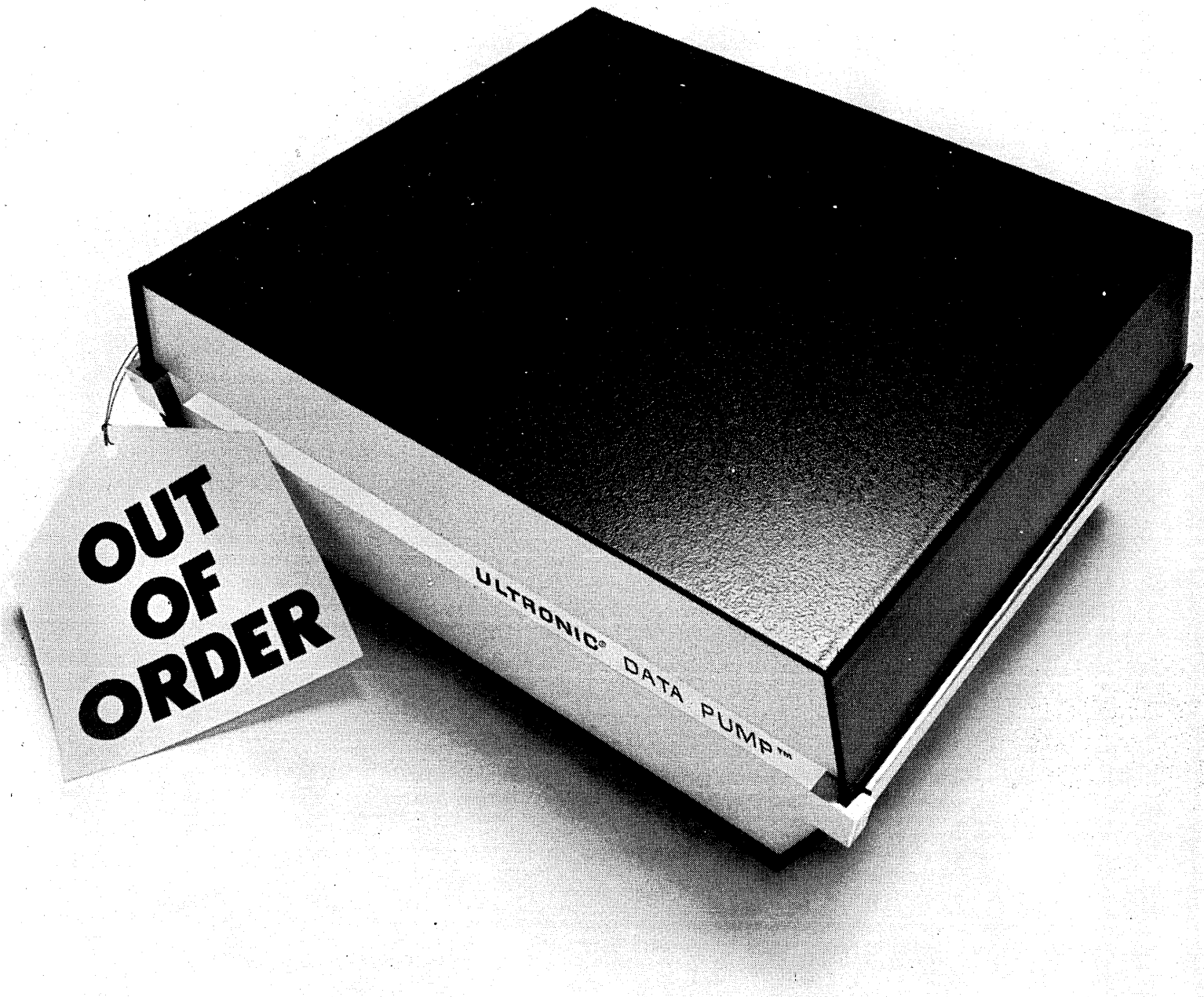
data collector/processor

Generally, a data collection unit of this size is a terminal which is linked to a larger-scale cpu for performing data manipulation, file updating, and even calculating the payroll of the staff that uses it. The Documentor, however, is a stand-alone source data collector/processor which does not require another cpu to do its data manipulation, file updating, or payroll calculating. It is a 4-16K byte, 5 usec machine with six registers, a serial arithmetic unit, and a parallel programmed word I/O channel. It performs two's-complement arithmetic, addresses by 4-bit bytes, and uses a repertoire of 16 basic and 40-50 generic instructions. It has its own reader (mark sense), 12-character printer, visual displays, and, if desired, slave terminals.

The Documentor has no buttons or switches; it receives its inputs through the mark sense reader. That input may be sales information, a parts order, a time card, or a new program. The machine differentiates between the types of cards read. A stored program acts on the data read, and performs the calculations, file updating or formatting. Program output is visually displayed on the front and the back of the unit, and is printed on the input form. Function lights in front may be programmed as needed.

Should another application pro-

(Continued on page 159)



The hell it is.

Nine times out of ten if a modem is out of action it isn't out of order.

The trouble is somewhere else in the system.

And finding the trouble takes a lot longer than fixing it.

That's why Ultronic Data Pump™ modems have something extra. A built-in troubleshooter.

This is a panel of buttons, each of which isolates a part of your data transmission system. In two or three minutes, you can pinpoint your problem, and get a serviceman aimed in the right direction.

Of course, Ultronic Data Pumps aren't immortal. Even though their solid state design keeps breakdowns to a minimum.

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Our family of Data Pumps has capabilities from 300 to 2400 bits per second. And you can buy one outright for as little as $450—which is about what it costs to lease a competitive one for a year.

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CIRCLE 85 ON READER CARD

terminal hours, resulting in "reliable hardware performance, complete documentation and proven software." Honeywell expects the H1648 to capture 10% of what it estimates to be a $175 million market for small- and medium-scale time-sharing systems in 1969.

A spokesman for GE, acknowledged leader in the time-sharing field, ex-

pressed little fear of the Honeywell invasion, however; indeed, he had been unaware of the threat until queried. He noted that GE time-sharing systems are more expensive—for example, the GE-420 costs $555K and handles up to 30 simultaneous users, and the GE-265 costs $740K and handles 40 simultaneous users—but he expressed the view that such simple comparisons are invalid: "The whole key is the level of service; whether the Honeywell system can really satisfy users demands remains to be demonstrated. Sure, it will handle input from 48 terminals at once, but how well?"

Software available for the H1648 includes applications packages for lease vs. purchase analysis, Fourier analysis, and AC/DC circuit analysis. Languages available are FORTRAN IV, BASIC, SOLVE (a Honeywell-developed language intended for users with no programming experience, which provides numerical problem-solving capabilities ranging from simple arithmetic to some problems normally performed with FORTRAN) and TEACH (an interpretive language designed for interactive processing of strings of data, in applications such as information retrieval and CAI).

The three computers perform the following functions: The DDP-416 has a 4K memory and .95 usec cycle, and acts as communications processor, formatting information received from the terminals for input to the other two processors. Conversely, it transmits responses from these processors to the terminals. One DDP-516 with 32.7K memory acts as control processor, monitoring all activity within the system. It controls the sequence in which requests are serviced, monitors the flow of input and output data, and logs information on services provided for each user. The second -516, also with 32.7K memory, acts as job processor, performing job requests. It compiles programs and executes jobs under the direction of the control processor.

The three processors provide a total main memory of 136K 8-bit bytes. Memory is allocated to users in a maximum unit of 16K words or 32K bytes. Source programs can be up to 600 statements long, assuming an average statement length of 50 characters. Average response time at a user's terminal is 3-5 seconds. Two disc units are standard with the minimum configuration. One is used for system storage, the other for up to 7.2 million bytes of user storage. Up to three additional disc units can be added to bring user storage capacity to a maximum of 28.8 million bytes. Two magnetic tape units are provided with the minimum system for user file back-up.

The operating system is structured around the control processor software. It directs all systems activity in both the control and job processors and does all scheduling, dispatching, and disc file allocation. Honeywell claims that this distribution of control processing and time-sharing functions between two processors results in an optimum use of both, providing a multiprocessing balance that improves terminal response time.

The system accepts Teletype units with paper tape reader/punch. The H1648 may also be used as a general-purpose batch processing system when not occupied in time-sharing. The off-line system is contained on a single disc pack.

Rental price of $12K/mo. for the minimum system includes three shifts of maintenance. Delivery requires five months ARO. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 162 ON READER CARD

hybrid expansion system

A hybrid expansion system from Honeywell is aimed at users of the Electronics Associates, Inc. TR-48 analog computer. Designated DDP-516/TR-48, the system provides a DDP-516 computer, analog linkage, and a hybrid software package. Claimed to be the only "standard product of its type" for TR-48 users, the system sells for $51,900, said to be less than half the cost of alternate methods of providing hybrid capability for the TR-48.

The DDP-516 is a general purpose computer designed for real time system applications. The 16-bit machine has a cycle of 960 nsec and a basic repertoire of 72 instructions. Memory is expandable from 4 to 32K. The interface with the TR-48 includes analog-to-digital and digital-to-analog converters, an interface patch panel, interrupt lines, servo set potentiometer, sense and enable lines, and all necessary connecting cables. The A/D conversion system contains a four-channel multiplexer and a 12-bit A/D converter. Four channel-dedicated D/A converters are provided with the basic system.

Software includes arbitrary function generation, function storage, and playback and transport delay routines. A complete set of analog control functions is also included. For TR-48 users

PRODUCT OF THE MONTH (Con't)

gram require more core space than the normal operating program mix, or be less frequently used, it could be read into core when needed on the mark sense forms. Up to 800 characters of input may be encoded onto one 4.2 X 11 inch bond paper form, and any number of forms may be used. The Documentor uses data word sizes of 8 or 12 bits, and instructions of 8 or 16 bits. The device requires 3-4 seconds to read and process a single card, but the cpu is loafing at this rate.

The system allows for tying in up to 12 slave units. Slaves look like the master unit, but do not have the logic boards or memory. In operation, they share cpu cycles with the master and with each other, appearing to be stand-alone units, too. One large chain of food-to-go houses is experimenting with the Documentor system and attached cash drawers, aiming to use the units as adding cash registers and inventory controllers (and payroll calculators, and time clocks, and . . .).

A single master unit in production quantities will sell for less than $5K; a slave may go for half of that. The very small California builder says that service centers will be established in large business areas in about 12-18 months. Service will consist of replacing faulty modules. DOCUMENTOR SCIENCES CORP., Santa Ana, Calif. For information:

CIRCLE 161 ON READER CARD

without digital programming experience, step by step operating instructions are included. A hybrid monitor controls the analog control functions, A/D and D/A data transfers, and random or sequential addressing. In addition to hybrid software, standard DDP-516 software is provided, including FORTRAN IV, an assembler, I/O, utility, test and verification routines, and a math library.

The standard DDP-516 training course will be provided to DDP-516/TR-48 customers together with a special hybrid course. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 163 ON READER CARD

10 volt analog/hybrid

The AD/FIVE was constructed with an eye toward hybridization, so that a minimum of circuitry and interfacing is necessary to mate it with a digital machine. The FIVE's bandwidth is 500 KHz, as might be expected for 10v reference hardware. It sports a universal analog and logic plugboard for giving program parameters, specifying logical operators, and providing counters and shift registers on the same panel. The basic system will feature a 12-bit control/data word. Deliveries are slated for June or July. The price range runs from $20K to $100K, depending upon the number of components. APPLIED DYNAMICS, Ann Arbor, Mich. For information:

CIRCLE 164 ON READER CARD

keyboard terminal

This Model 33 keyboard is called a secretarial terminal since the keyboard is built with the general layout and "feel" of an electric typewriter. It does have features, however, that no typewriter ever considered. It transmits in 8-bit ASCII code using a one-character buffer, at up to 75 char/sec through a 402C Bell System Data Set. (This happens to be the top transmission speed for the 402C.) The ASCII code is good for upper and lower case alpha, numerics and some control functions, but in addition to these data sending capabilities, the Model 33 is equipped with a key to convert the keyboard into a keypunch numeric format. While the terminal is being used to send the keypunch numerics, a tiny light in the "NUM" key glows, indicating the transmission mode. Lights on the top of the unit can be used in conjunction with the 402C's three error detection signals to signify whatever the user chooses. Eleven additional

function keys are available. Unit price for the product is $700; oem discounts are also offered. DATANETICS CORP., Redondo Beach, Calif. For information:

CIRCLE 165 ON READER CARD

crt terminal

The VT03 crt terminal is for use in an interactive time-sharing environment with the PDP-10 computer. It accepts data at the rate of 1200 baud and displays up to 12 rows of 80 characters each. A full-duplex console features a local memory for display refreshing, eliminating the use of cpu time to perform this function. The terminal uses an alphanumeric keyboard, provides editing capability from either keyboard or computer, produces audible end-of-line and incoming message tones, and has plug-in boards for easy maintenance. An interface option, priced at $400, generates hard copy remotely via standard Teletypes. Price of the VT03 is $7900. First deliveries are scheduled for this summer. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 166 ON READER CARD

student response system

The Student Response System 1000 is designed to enable an instructor to monitor the performance of students working in large classrooms or in independent study booths. Each student has a response panel for inputting answers to multiple-choice questions. All answers are then analyzed by computer, which displays percentage responses and produces printout for later use by the instructor in determining individual student performance. The system requires that the user have access to a computer or a time-sharing service.

The student response panel is a solid state unit with six push-buttons, five of which are for answering multiple-choice questions, and the sixth for "erasing" a choice. Five lights confirm that an answer has been entered into the system. Two thumb wheels are used for recording student i.d. number, question number, lesson number, etc.

Each student response panel has a printed circuit board installed in a single central electronic scanner interfaced with a Model 33 or 35 tty or Teletype DRPE paper tape punch, providing a capability of working either off-line or on-line with any computer that accepts ASCII code by means of a paper tape reader, or in an on-line time-sharing mode. Additional student response panels may be added later by installing additional printed circuit boards in the scanner.

Two present-day SRS 1000 systems are currently being installed at the Univ. of California (San Diego) Medical School and the State Univ. of New York at Albany. Price of the SRS 1000 starts at $20,000, but varies widely depending on the number of student response panels and type of installation required. Delivery requires five months ARO. GENERAL ELECTRIC CO., Schenectady, N.Y. For information:

CIRCLE 167 ON READER CARD

source data collection

The Message ComposeR system is designed for capturing, transmitting, and recording source data. It consists of a keyboard (with sliding keys), a junction box which contains the logic for encoding the keyboard inputs, a master unit which scans the junction boxes and converts the data to tones for transmission over phone lines, a tone receiving and decoding unit, and, finally, a solenoid pack used to drive the keys of a typewriter, keypunch, or similar keyboard unit. With the basic configuration just described, a user has the capability of taking reservation, stock brokerage, or inventory information at remote sites and having it recorded on hard copy or punched cards. An overlay on the keyboard above the keys is designed to tailor the general system to any application, so that the data originator will have a better feel for what he is doing.

To increase the potential market for the system, several accessories are offered, including an acoustic coupler, an audio tape recorder, a card reader, and a badge reader. Since the levers on the keyboard can be used to encode 20 variable characters (the digits from 0 through 9), and up to 28 internal characters can be added to messages in the junction box, a total of 48 characters per message can be sent with the basic system. If desired, custom junction boxes may be incorporated to add up to 100 characters to the message stream, and serial dual-keyboard configurations are offered. The device is aimed at applications with a high proportion of numeric data to be transmitted, but an alphanumeric sys-

tem is planned.

The manufacturer, North Electric, spends most of its time building telephone equipment, so it is not surprising that the Message ComposeR is itself composed of off-the-shelf telephone components and delivery of the devices is "immediate".

The following are the lease/purchase figures for the components: input station (keyboard, junction box, cable) $33+/$671; master (transmission unit) $30/$600; tone receiver and solenoid pack $32+/$650; acoustic coupler $6+/$125; card reader $100/$2,000; badge reader $10+/$210; acoustic mtu $25/$500. ELECTRONETICS DIV., NORTH ELECTRIC, Galion, Ohio. For information:

CIRCLE 168 ON READER CARD

credit card authorizer

Buying a larger purchase with a credit card often means waiting while a clerk calls into a central credit-checking office in some other part of the city. Even under the best conditions, that is, assuming that the phones are not busy and that the clerks on both ends of the line know what they are doing, the process takes time. With the Creditmaster system, the response time for checking a credit card is cut to a few seconds.

The Creditmaster system is composed of three parts, the point-of-sale terminal, a central cpu and memory,

and a credit office "authorizer" terminal. Various versions of the point-of-sale unit are offered, but typically this device is a shoe box-size unit with touch-tone buttons, a throat for the credit card and one for the sales slip. The credit card is read, the clerk keys in the sale data, and the central cpu responds with a "go" or "no go" signal, printing the sales data on the sales slip if the transaction is accepted.

The cpu controls a central file of "no go" account numbers, a negative file, which may range in size from 12K 8-digit (4 bits/digit) accounts to 180K 10-digit accounts and up. Either a 16 msec access drum or a slower disc is used. Up to 32 inquiries/sec can be fielded by the cpu and drum configu-

ration, and the number of terminals the system can support is almost unlimited since it is unlikely that more than 32 transactions will be keyed within the same 1-second interval.

The "authorizer" only comes into the loop on a questionable account. From this keyboard and Nixie display terminal a central office clerk can authorize a one-time buy on a negative account, depending upon the circumstances of the sale (which must be phoned in). The authorizer can also be used to interrogate the cpu for the reason that a sale was not approved.

The Creditmaster network is leased to a store chain at a fee of about $10 per clerk terminal, and from $750 to $2,500 per month for the cpu and memory. (A $2,500 system would be capable of handling a million negative accounts.) Training in the use of the system is included in the lease price. DIGITAL DATA SYSTEMS CORP., Pennsauken, N.J. For information:

CIRCLE 169 ON READER CARD

analog remote terminal

This device may be the first of a whole new breed. Although specifically designed for instructional purposes, the Dynamics Terminal provides a generally applicable kind of time-sharing access to an analog/hybrid computer. The terminal was developed for replacing large numbers of small analog machines with an equally large number of even smaller terminals and one large analog machine. The need for this kind of replacement exists where the same problems are being examined by a group of people, as in an educational environment or in some scientific applications.

The Dynamics Terminal/hybrid network is not capable of time-sharing in the strictest sense; one problem is solved before the cpu is allocated to the next user. However, since the execution speed of a large analog computer is measured in terms over 1,000 solutions per second, up to 64 individual users should receive "immediate" responses. The terminal can be used with 100v or 10v reference hybrids, and with either kind of system is capable of accessing one to three programs patched on the large system's plugboard. Although each user's terminal is protected from interference from other terminals, for instructional purposes a master terminal is provided which can access the solutions being returned to any user. The terminal is offered with its oscilloscope for $6,200; a second version, with a more sophisticated scope, sells for $7,500. APPLIED DYNAMICS, Ann Arbor, Mich. For information:

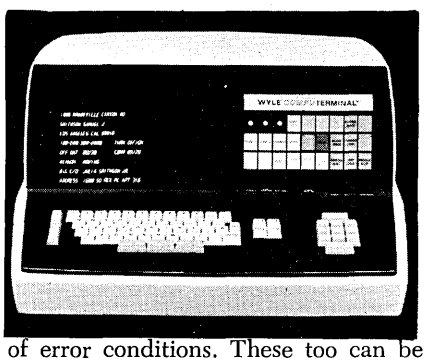
CIRCLE 170 ON READER CARD

crt-based inquiry station

Eight lines of 32 characters are displayed on the crt face of the Model 600 Computerminal. This display represents one-fourth of the information stored in the terminal's 1K by 8 bit memory. The remaining information can be "rolled on" or "rolled off" the screen as if it were on a sheet of paper in a typewriter. If desired, several of the lines can remain fixed on the screen while the remainder is rolled on or off, or a field of the displayed lines can be held constant while the remainder of each line is rolled on or off. The operator can be allowed to add information to the record displayed, or that information can be protected from her inadvertent change or erasure. Console controls allow her to skip from one line to another or from one character in a line to another to make allowed changes. If desired, characters or whole lines can be erased, or an entire entry can be "ignored."

The console is equipped with a typewriter-styled keyboard, several function keys, and a numeric keyboard which, although its inputs exactly correspond with the numerics on the typewriter keyboard, can be more convenient since its layout is that of an adding machine. If required, additional function keys can be added for specific applications.

The 600 also features indicator lights which describe the functions being performed or notify the operator



of error conditions. These too can be augmented by customer-specified displays.

Hard-wired functions can be added to the stand-alone to accommodate special requirements. For instance, one labeled "credit" might pull only credit information from a larger, more general, file record.

The device interfaces to phone lines and transmits or receives at either 600 or 1200 baud, depending upon the interface equipment and line condition. Vertical and longitudinal redundancy checks are made on the transmissions. Another interface, to a Selectric typewriter, is available for hard copy.

If the multi-optioned device seems too complicated for the average operator, the terminal can be hard-wired for

semi-instructional operation, supplying the operator the first half of each line and leaving her to fill in the blanks.

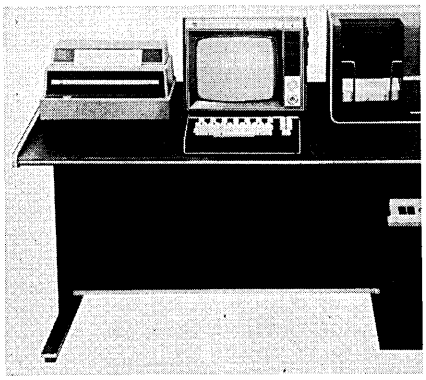
Price ranges are from $5,000 to $7,000, depending upon quantities and features. WYLE LABORATORIES, El Segundo, Calif. For information:

CIRCLE 171 ON READER CARD

remote batch terminal

Most remote terminal builders begin with a card reader/punch, printer, and console, and then later consider adding more sophistication with a crt. CCI, on the other hand, who already had the crt terminal with interfaces to all kinds of computer hardware, decided to add card reading and line printing capabilities to make a remote batch terminal. Their product, the CC-36, comprises a keyboard, a 300 cpm card reader, a 300 char/sec 80-column electrostatic printer, a full size tv screen, a "sequencer," and an interface to a data set for remote communication at rates up to 50 kilobaud.

Based on the CC-301 controller, which has a 1K by 9 bit 920 nsec memory, the CC-36 is actually the first



in what may be a long line of on-line conversational/off-line peripheral/remote batch stations. Basic to the terminal's operation is the "sequencer" which is a buffer for storing up to eight commands from the operator or central site cpu. Interfaces have been built for CDC, IBM (1130 or 360), PDP-8 (and Linc-8), SDS (Sigma), Varian, GE, and Univac cpu's. Any kind of modem or transmission line is acceptable to the system, even hard-wiring to a distance of one mile.

At $23,900, the CC-36 costs approximately the same amount as 16 months rental on a COPE .32 terminal, which does not have a crt (but does have a card punch). The tv, which can be used for watching ball games when the central site computer is down, can be ordered with a light pen for conversational graphics work if desired. COMPUTER COMMUNICATIONS,

*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, D3
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_____

new products

INC., Inglewood, Calif. For information:

CIRCLE 172 ON READER CARD

updated multi-disc drive

Last month, CDC tried to steal some of IBM's thunder by introducing a multi-spindle disc drive which was more flexible, they claimed, and less costly, they proved, than a similar IBM 2314. This month, IBM has announced two new versions of the 2314; both provide access times 20% faster than the previous model. Like the original 2314, one of the new units has nine spindles (eight operating discs and one back-up drive). The second unit, however, has only five disc packs. The CDC 841 still enjoys a claim of more flexibility—it can be configured with 3-8 active and one back-up drive.

Average access time for the new model 2314's is 60 msec; minimum access time is 25 msec. (This compares with 75 msec for the old 2314 and for the CDC system.) Existing programming and formatting will remain acceptable. The five-disc pack model will sell for $175,075 and lease for $3,875; the nine-spindle model will sell for $256,400 and lease for $5,675 (compared to CDC's sale figure of $192,000). IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 173 ON READER CARD

tape transport

A new magnetic tape transport features switch-selectable, electronically-controlled variable speeds through use of a frequency oscillator which permits speed reductions from a predetermined maximum in two-to-one increments. This method of varying speeds is claimed to be more reliable and faster than methods using pulleys of different diameters. Typically, a speed change from 7½ to 15 ips requires .1 second. The unit has a single capstan, and uses three printed circuit DC motors in a completely servo-controlled drive system, said to provide constant speed and constant tension tape handling in all modes. Integrated circuits are used for logic and low level amplifiers, with power transistors for motor control. Fast wind speed is variable from a panel control up to 500 ips, or less than one minute for a 2400-foot reel. The tape transport may be variously equipped, for use with 7-inch or NAB reels, ½- or 1-inch, 7- or 9-track tape, and 200/556/800 bpi. It can be powered by either 110-volts AC or two 12-volt batteries for portable use.

Prices start at $3500 for one, with reductions to $2200 in quantity. The unit will be marketed by Brogan Associates. MAGNETIC RECORDING SYSTEMS, INC., Westbury, N.Y. For information:

CIRCLE 174 ON READER CARD

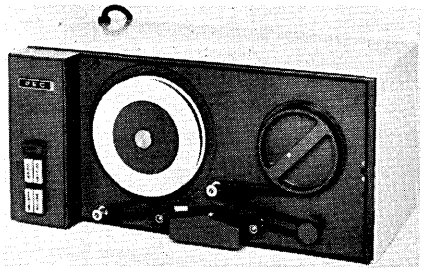
mag tape terminal

Point-to-point serial data transmissions at speeds to 1200 words/min and parallel transmission speeds of 600 or 720 words/min are advertised for the 4031 magnetic tape terminal. The stand-alone unit features automatic answering capabilities, automatic error detection, and error correction. Hardware translation of BCD paper tape, BCD mag tape, or 9-track EBCDIC code can be chosen as standard. Other hardware translation capacities can be specially ordered. Higher transmission rates can be achieved when 4031's are used on both ends of the line, but this is also available only on special orders. Recording densities of 200, 556, and 800 are offered in 7- and 9-track versions (800 only for the 9-track, of course). The unit uses ordinary phone lines, and is compatible with other Tally equipment. Prices start at $23,500 without code conversion, and at $25,000 with the conversion feature. TALLY CORP., Seattle, Wash. For information:

CIRCLE 175 ON READER CARD

rack-sized mtu

Advertised at $2,750, the Model 7820 9-track mag tape drive is aimed at the paper tape drive market. The manufacturer claims that a user can buy himself 100 times the transfer rate of a paper tape device with very little more investment. Recording or reading at 800 bpi and 12.5 ips, the IBM-compat-



ible unit yields a transfer rate of about 10 KHz. The 7820 uses 7-inch reels which contain 600 feet of tape. Driven by a single capstan velocity servo, the tape path wraps around two tension arms to a reel-less take-up hub. The lack of a take-up reel does not help them much to cut the price to the $2,750 figure, but the fact that an erase head is listed as an option might. Another option listed is 7-track operation. The complete unit is 8¾ × 19 inches. PERIPHERAL EQUIPMENT CORP., Chatsworth, Calif. For information:

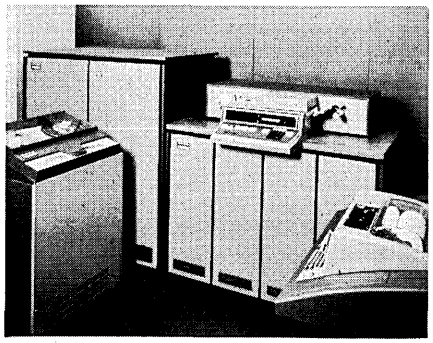
CIRCLE 176 ON READER CARD

journal tape reader

The Farrington 4040 Optical Character Multifont Journal Tape Reader has a string of capabilities almost as long as its name. The 4040 reads data printed on rolls by adding machines, cash registers, and accounting machines, recognizing Farrington, IBM, NCR, and ASA standard fonts. It utilizes flying spot scanning and has throughput speeds of up to 6,000 lpm with a rated speed of 2,000 cps. At these speeds, Farrington claims the 4040 is the fastest journal tape reader on the market. It is also said to be the only such device which performs formatting, editing, and other dp tasks which would otherwise require mainframe time. Seven- or nine-channel magnetic tape is standard output; the unit may be interfaced directly with a computer, however.

Additional features include automatic threading, on-line character in-

new products



sertion, re-scan capability, and the ability to read tapes either forward or backwards, making the rewinding of journal tapes unnecessary, and permitting the 4040 to read tapes created from various manufacturers' equipment. Prices start at $105,000. Delivery requires four to six months ARO. FARRINGTON MANUFACTURING CO., New York, N.Y. For information:

CIRCLE 177 ON READER CARD

11-high disc pack

The Audev 11-high disc pack is compatible with IBM 2314 disc drives. It consists of eleven 14.72-inch diameter discs, weighs 14 lbs., and utilizes 20 recording surfaces with 200 tracks per disc surface, for a total of 4,000 tracks. Storage capacity is 29.17 million eight-bit bytes. Price is $650. AUDIO DEVICES, INC., New York, N.Y. For information:

CIRCLE 178 ON READER CARD

text editing program

EDIT/360 is the latest addition to the System/360 Text Processor software. The new program extends the line justification and formatting capabilities of the two previously announced COMPOSITION/360 and HYPHENATION/360 programs, both of which will continue to be available as independent programs. EDIT/360 is designed to speed the editing process by permitting an editor or compositor to enter a text change through any of a number of available input devices, such as punched tape or a terminal keyboard. The computer scans the original copy, stored on disc files, and inserts the changes. The revised text may then be converted into the medium required for final composition and printing.

The Text Processor programs perform under DOS, enabling the computer to process copy while simultaneously handling other jobs. EDIT/360 requires a Model 30 or larger cpu with a minimum 64K main storage. The program is scheduled to be available in the fourth quarter of this year. IBM

DP DIV., White Plains, N.Y. For information:

CIRCLE 179 ON READER CARD

third-generation scert

SCERT 50 is an updated version of the Systems and Computers Evaluation and Review Technique proprietary simulation program. Previous SCERT's were primarily run on second-generation equipment, but the new SCERT 50 is written for 360/40's and up, Spectra 70 Model 45's and up, and Univac 1108's, and requires 131K core memory. SCERT 50 is claimed to be faster and have greater capacity than that realized on second-generation systems, "by a factor of ten to one." At the same time, "it reduces simulation costs by as much as 70%." SCERT is provided as a service, or may be installed at user locations, complete with personnel support, which is mandatory and included in the basic cost. COMRESS INC., Washington, D.C. For information:

CIRCLE 180 ON READER CARD

1401-360 translator

IBM 1401 source decks or well-documented object decks can be translated to 360 COBOL for about 60¢ per 1401 card. The translated deck is returned to the customer along with a clean compilation listing; evaluation and production checkout are then the responsibility of the customer. Object decks will be accepted if they are accompanied by a fairly recent source listing for use in determining the basic intent of the program and the locations of I/O and work files, but an additional 20¢ per card is charged. The minimum translation charge using a source deck is $300; the minimum for working with an object deck is $400. INFORMATION MANAGEMENT INC., San Francisco, Calif. For information:

CIRCLE 181 ON READER CARD

market reporting system

A position reporting system for use by over-the-counter dealers, funds, brokerages, and sophisticated traders is the first product of seven-man Futuristic Applications Corp. The system uses a Varian 620/i computer, which is included in the basic price of $39,000, perhaps portending a future end to separate pricing by software houses. The basic system has 8K memory, and is expandable in 4K increments to 32K, with each 4K capable of handling about 80 stocks. Software is designed for real time operation, using a Model 35 TTY for input. FAC claims

that a Teletype operator can input about 125 transactions per hour, providing "instant" responses during trading. Retrieval functions include capabilities to list buys, sells, shorts, covers, co-totals, securities totals, etc. Delivery time for the system is four to six weeks ARO. The firm intends to develop additional financial packages for use on small computers, with a back office system anticipated shortly. FUTURISTIC APPLICATIONS CORP., Wayne, N.J. For information:

CIRCLE 182 ON READER CARD

plotter controller

The TSP-12 Plotter Controller hangs onto a time-sharing terminal to accept, decode, and plot transmitted data. It operates by converting the digital information stream into absolute plot coordinates, a method which is claimed to be significantly faster than incremental plotting. (For instance, a corner-to-corner pen-up movement of the attached X-Y recorder can be effected with one command.) Inputs to the TSP-12 must be formatted by specially designed subroutines. Written in FORTRAN or BASIC, these routines are supplied to the user with the controller. The device is compatible with a large number of X-Y plotters, but the recorder is not included in the $2,500 sales price. TIME SHARE PERIPHERALS CORP., Wilton Conn. For information:

CIRCLE 183 ON READER CARD

investment program

Having trouble with the bookkeeping for your stock portfolio? This proprietary software package might help. Designed for use by investment advisors, Managed Investments performs the calculations for updating accounts, including figuring margin accounts at the broker end, stock splits, capital gains and losses, and complete audit trails. Written in COBOL, the system requires a 32-40K character machine to run efficiently. Installation, manuals, flow charts, training and maintenance sell for $2,000 plus expenses. PROCESS CONSULTING, INC., San Diego, Calif. For information:

CIRCLE 184 ON READER CARD

file management software

FILE-EXEC is a file management software package, written in COBOL and requiring 16K memory. It performs file creation, file maintenance, and information retrieval on either tape or disc files. The package provides for the creation of files from basic card input, addition of complete records, adding data to existing records, altering portions of records, deleting entire records, and generating unique record ID numbers. The information retrieval capability allows the user to select complete records, or parts of records, based on up to fifty sets of "and/or" conditions. Conditions of selection can be "greater than," "less than," "equal to," or "not equal." FILE-EXEC allows re-formatting of complete output records or selected data to either tape or disc and/or printer. Cash price is $3,000 . . . but the vendor lists itself as an "exchange," so maybe they would accept a trade-in. NATIONAL SOFTWARE EXCHANGE, INC., Great Neck, N.Y. For information:

CIRCLE 185 ON READER CARD

cobol preprocessor

COBOL programmers are given a shorthand of sorts with ACOPP (Abbreviated COBOL Preprocessor). The system of abbreviated keywords and user labels is designed to cut programming time, and to minimize keypunching test errors. The supplied vocabulary may be extended by the addition of user-chosen abbreviations, and any of the words employed may be imbedded in any statement. The minimum configuration for ACOPP's operation is a 360/30 with the hardware for supporting DOS or OS at release level 14 or above. Processing times for the 22K-byte program are quoted as: 600 cpm for a model 30 with DOS, and 1900 cpm for a 65 with OS/MVT. The selling price of the package is: $950. SYNERGISTIC SOFTWARE SYSTEMS, INC., Houston, Texas. For information:

CIRCLE 186 ON READER CARD

typesetting software

Regular text or intricate advertising copy for books, magazines or catalogs may be set automatically by the Photostet system offered to Honeywell customers. Input to the program may be in the form of paper tape or mag tape, or may originate at a keyboard. The data input is justified, formatted, and hyphenated, and necessary typesetting machine control codes are added. Routines are included for storing work in progress on direct access memory devices, and for making corrections, deleting copy, and inserting copy. The minimum hardware configuration required for Photostet applications is: a

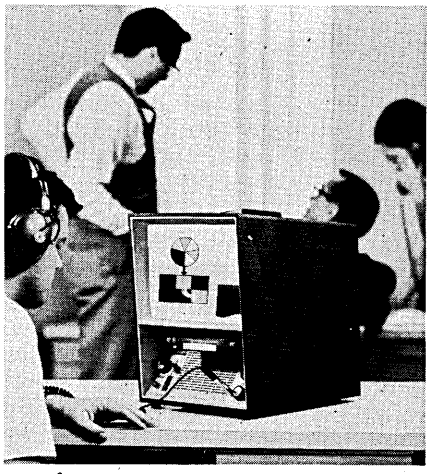
Honeywell model 120, 28K characters of main memory for drum storage or 32K characters for disc, a 270A drum or 258/259 disc pack, three mtu's, paper tape reader and punch, card reader and line printer. If you have that much Honeywell equipment, or are willing to get it, then the Photostet system is yours free. HONEYWELL EDP DIV., Wellesley Hills, Mass. For information:

CIRCLE 187 ON READER CARD

animated edp courses

A television-like screen, a set of earphones, film cartridge complete with sound track, and a workbook make up the "front half" of this Animated Computer Education (ACE) system. A set of "Guidelines for Professional Development" constitutes the half of the system of instruction that the student rarely, if ever, sees.

The animated films, complete with color and sound, depict computer sys-



tem functions in proper time sequence. The first available film sequence falls into two parts, "File Organization" and "Design and Processing." The vendor claims that an average student can absorb as much subject matter in the one hour viewing time as he would from attending 15 hours of classroom instruction. Other courses will cover sequential file processing, systems analysis, and concepts of information systems.

In deciding what topics to cover in the courses, the supplier made intensive studies of data processing personnel and functions. Once a course of training to bring up an employee from one level to another had been defined, available courses and study techniques were examined. For this reason, the "Guidelines for Professional Development" include references to courses not available from the developer of the guidelines . . . who has attempted to "plug the holes" rather than try to be all things to all men. As a study of the

Sanders cracks the computer-input barrier.

Your third-generation computer is still held back by first-generation input. One look in your keypunch room will confirm that. It takes time to punch cards, verify them and convert to magnetic tape. And good keypunch operators are harder and harder to find.

The new Sanders System 6000* Display Data Recorder can help bring computer input out of the keypunch room. And get data into your computer faster and at less cost. How? It's simple.

The screen of the System 6000 Recorder is formatted to show a replica of the source document. The operator merely fills in the blanks on the screen using a typewriter-style keyboard. She can verify the data instantly and transfer it to computer tape automatically. Before recording she can verify and correct errors by backspacing, inserting, deleting or overtyping data.

Formats are loaded conveniently from a replaceable magnetic tape cassette. And the System 6000 Recorder can display up to 1,024 character records. Compare that to 80 in a punched card, or 160 in key/tape devices. Output from as many as twelve units can be automatically merged on a single tape reel. No tape pooling necessary.

It's a proven fact. Just about anyone with basic typing skill can become qualified on System 6000 Recorder after only 10 minutes' instruction. Crack *your* computer's input barrier. It's simple. Call your nearest Sanders sales office or contact: Marketing Manager, Data Systems Division, Sanders Associates, Inc., Daniel Webster Highway South, Nashua, New Hampshire 03060. Or call: (603) 885-4220.

SA* SANDERS ASSOCIATES, INC.

*TM Sanders Associates, Inc.

CIRCLE 112 ON READER CARD

It's simple.

relationships between edp positions and training, a specification of training steps, and a definition of professional levels, the "Guidelines" are useful to management even without the courses, reportedly. One copy of the "Guidelines," two dozen copies of user guides, the projector, headset, and a one-hour course will lease for $395/mo. Additional courses are priced in a decreasing manner, so that a five-hour library and user gear package would lease for about $995/mo. EDUTRONICS, INC., Costa Mesa, Calif. For information:

CIRCLE 188 ON READER CARD

software/hardware packages

Infocom, Inc., a five-month old spin-off from Digital Equipment Corp., is offering systems for the preparation of numerical control tapes and for commercial dp applications. Both types of systems include the software and hardware in a package offering, and, appropriately enough, PDP computers are used. Their nc system includes programs for two- and three-axis point-to-point and two-axis contouring. Called TAPEPREP, it is offered with a PDP-8/L for $13,500. A Teletype, paper tape reader and tape punch, the PDP-8/L, and a programming language called SAIBOL make up the commercial dp package, which is capable of executing such tasks as payroll, job cost analysis, accounts payable, accounts receivable, and inventory control. The commercial package sells for $23,000, or leases for $375/mo. INFOCOM, INC., Wellesley Hills, Mass. For information:

CIRCLE 189 ON READER CARD

tape/disc locks

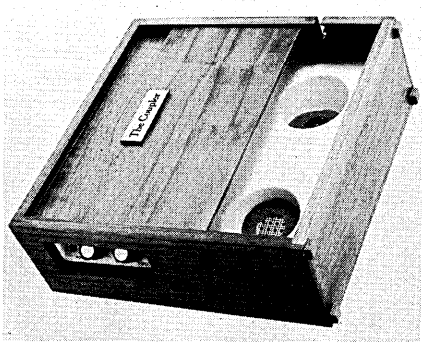
Data Lock is the name of three locking devices intended to prevent unauthorized use of tapes or discs. The first is inserted into the center of a tape reel and covers the circumference of the mounting hub; it sells for $4.95. The second is a special tape cannister for 1200- or 2400-foot reels, selling for $5.95 and $6.95, respectively. The third Data Lock is a special disc pack base which prevents mounting of the disc and costs $4.00. Each lock uses a different internal design of four chambers and five tumblers. No duplicate key blanks are available, and additional keys may be obtained only through the manufacturer by request on a purchase order signed by an officer of the user firm. The locks are available in a series using a single master key, or as separate locks with individual keys, and are furnished in a variety of colors for identification. DYNANAMICS, INC., Lansing, Ill. For information:

CIRCLE 190 ON READER CARD

the coupler

This acoustic or magnetic device is called The Coupler, apparently to avoid confusion in case someone else starts making one. Built by a subsidiary of ComShare Southern, it has been tested in its prototype stages by ComShare customers.

The set transmits at these frequencies: mark 1270 Hz and space 1070 Hz. The corresponding receive frequencies are 2225 Hz and 2025 Hz. Half or full duplex modes of operation can be selected by a switch. In use, the handset is completely enclosed to shut out background noises by a sliding panel, unlike the swing-open door of the Anderson-Jacobsen devices. The sliding panel does not cover or hide the control switches as the swing-out door does. A light on the outside of the hand-rubbed walnut box indicates when the carrier frequency is being received from the sending site. Selling price for The Coupler is $495 on a single unit basis. Apparently the opulence of hand-rubbed walnut does not add appreciably to the cost, since, for instance, the manufacturer claims a $60 savings over Omnitec's coupler in matched oem quantities ($300 compared to $360). COMMUNICATIONS LOGIC, INC., Houston, Texas. For information:



CIRCLE 191 ON READER CARD

forms deleaver

Up to six copies of continuous forms can be decollated at speeds to 425 feet/min with the 1735 Deleaver. A large carbon rewind system makes it possible to separate a full box of the forms without stopping to remove the carbon paper from its rollers. The unit is equipped with margin trimmers so that any kind of glued or crimped form can be handled. Other standard features include curved paper chutes for neat stacking, and pinwheel feeds to assure proper paper tracking through the Deleaver. Price of the 6-part Deleaver version is $1942; a 4-part version (the 1733) sells for $1491. The 1733 can be upgraded to the 1735 for about $577. UARCO, INC., Barrington, Illinois. For information:

CIRCLE 192 ON READER CARD

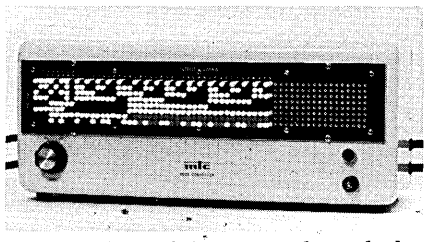
inventory scanning

Accu-Sort is an optical scanning system which obtains product identification information by scanning specially encoded cartons as they pass on a conveyor belt. Data thus acquired may be used for inventory control, order processing, production scheduling, etc. The unit consists of: an electronic scanning head with light sources and photo transistors, which recognizes ⅞ × ¼-inch colored bars encoded on a carton or label, permitting differentiation of up to 32,000 products; a logic enclosure which formats data for transfer from the scanner to the interface; and an interface unit which drives a paper tape punch, a card punch, a magnetic tape recorder, or interfaces directly with a computer. Price of the system for interface with a paper tape punch is about $11,000. Interface with a computer adds about $5,000 to this price. Delivery requires 90 days ARO. Accu-Sort is the first entry of the manufacturer into the edp field; other products include communications and radar equipment, and cathode ray tubes. INDUSTRIAL DIV., GENERAL ATRONICS, Philadelphia, Pa. For information:

CIRCLE 193 ON READER CARD

code converters

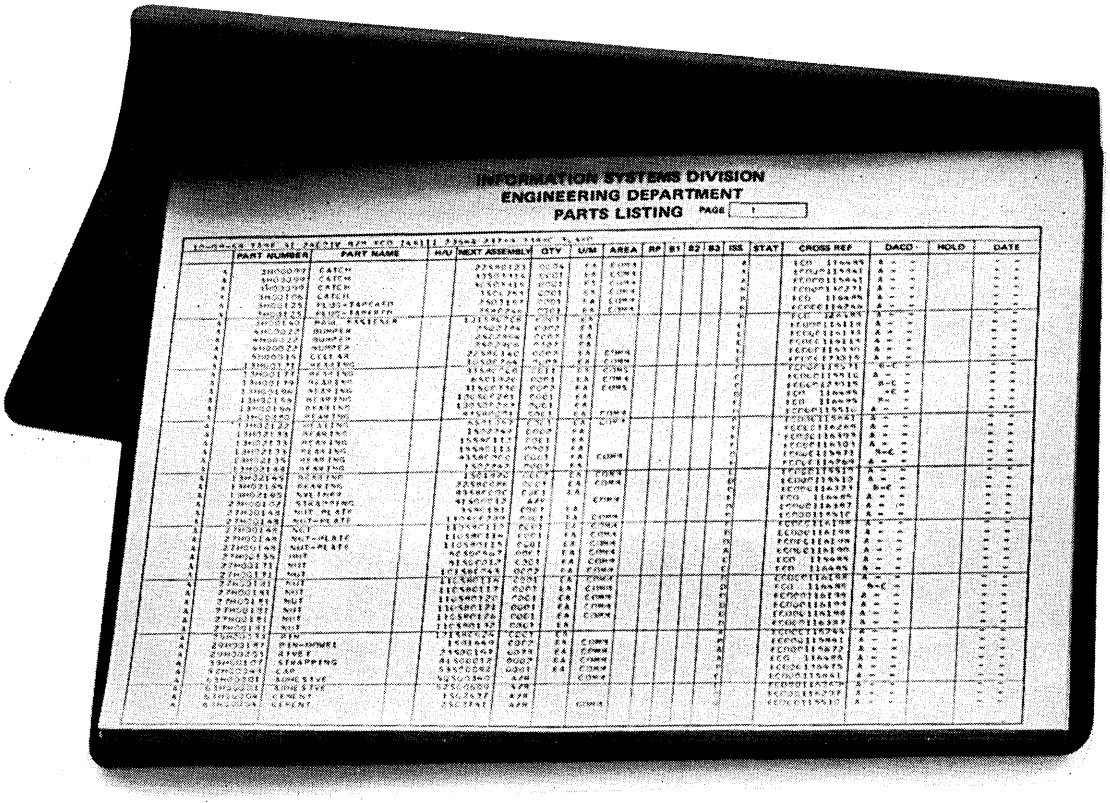
Input to the mtc Code Converters may be in any 5, 6, 7, or 8-level code; output may be in any other code. For instance, a hard-wired version can be provided to translate ASCII input to IBM BCD output. A greater flexibility



can be achieved, however, through the use of an external plug board for specifying the code translations.

The converters may be used to interface peripherals to cpu's, to data sets, or to other peripherals and peripheral controllers, in one-way or two-way transmissions. Conversion speeds to 10,000 codes/sec are claimed through the incorporation of plug-in

Asset.



(Easy for you.)

Your company has spent a lot of money for a computer in order to give information to decision makers fast.

But bulky computer printout can cost plenty in time and money.

It's hard to route.

Hard to work with.

Copies are limited unless expensive computer time is tied up for additional passes.

Result: People on a decision-making level don't always get computer information on time...and have trouble using it when they do get it.

The Xerox Computer Forms Printer (CFP) changes printout from a liability to an asset.

Printout is converted into clean, clearly printed 11" x 8½" reports, easy to organize and route.

Headings and guidelines can be superimposed to make the figures easier to understand.

There are copies for everyone who needs them, all at the same time.

So all decision makers can act promptly, armed with the latest information.

And the computer spends less time printing, has more time for new problems.

Telephone your nearest Xerox Information Systems Representative today.

He'll show you how to get more of what your company's paying for.

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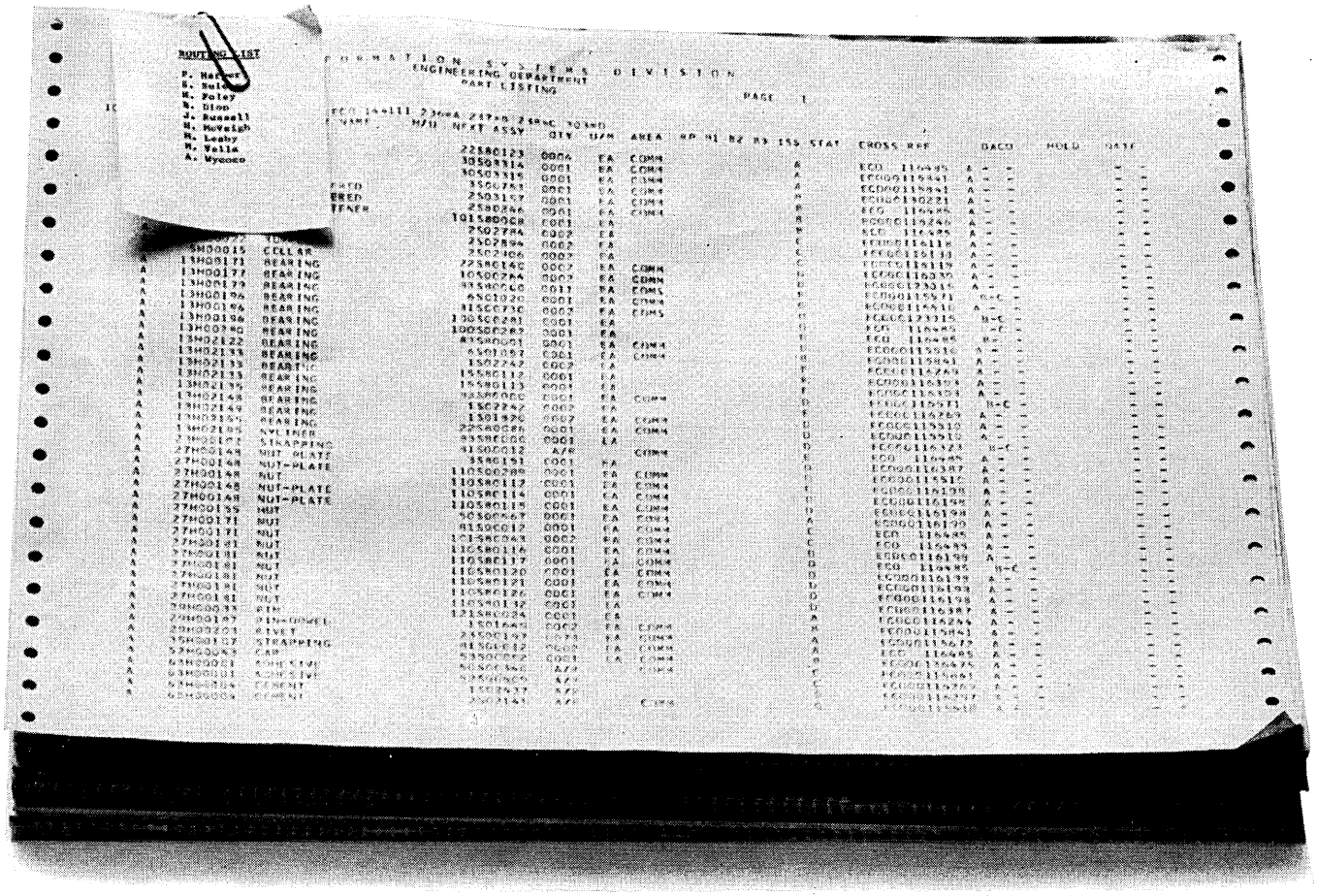
XEROX CORPORATION, ROCHESTER, NEW YORK 14603. IN CANADA: XEROX OF CANADA LIMITED. OVERSEAS: SUBSIDIARIES THROUGHOUT LATIN AMERICA; AND IN ASSOCIATION WITH RANK

Liability.



(Easy for the computer.)

Probably the same person who piled all the tape reels on the desk. And who filed the cards all over the floor while transferring them.

Sound familiar?

If it does, it could mean irreplaceable data being misplaced or lost, expensive disk packs being damaged, costly computer time wasted.

At Tab, we think it's time haphazard and inefficient data media storage came to an end.

That's why, for example, we offer the widest selection of disk pack storage units in the business, for all size disk packs. And to carry them to and from drives, we have shelf trucks, cabinet trucks, and individual carrying cases. All designed for maximum convenience and protection. You can see them all in our catalog.

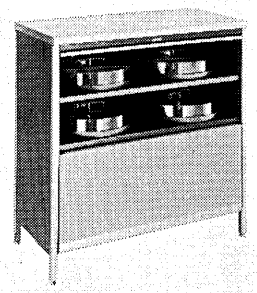
Even more important, though, we've come up with a Data Media Control Survey, designed to give you a clear, over-all picture of your entire current data media inventory and handling capacity. Present *and* future.

This survey can lead to the Data Media Control System best suited to your company's own specific needs.

We'll be glad to send you a copy of our Data Media Control Survey. (If you'd like help with the survey, we'll gladly do that, too. Without obligation.)

Write or call us: Tab Products, 633 Battery Street, San Francisco, California 94111.

And leave Mrs. Murphy's locker for Mrs. Murphy.



Computer Companions by

TAB

PRODUCTS CO.

Who put the disk packs in Mrs. Murphy's locker?

CIRCLE 113 ON READER CARD

circuit card modules for level conversion, coding and decoding functions. Prices begin at $1,500. MEASUREMENT TECHNOLOGY CORP., Canoga Park, Calif. For information:

CIRCLE 194 ON READER CARD

acoustic coupler

The Telemate 300 was designed by the marketing arm of a time-sharing service bureau. It is intended for use with I/O devices such as Teletypes, and features a data rate of 300 baud, half and full duplex operation, and options including originate/answer capability, a loudspeaker, and several cable interface options. Basic price is $395, with discounts for quantity orders. COMMUNICATIONS EQUIPMENT GROUP, DIRECT ACCESS COMPUTING CORP., Southfield, Mich. For information:

CIRCLE 195 ON READER CARD

keypunch controller

A 12,500- to 25,000-bit delay line memory and a drawer full of ic logic combine to give a keypunch or verifier operator immediate access to 15 stored programs . . . with all the automatic options such as skip, dupe, shift, and left zero fill . . . plus repetitive punching of common constant information such as date or card code, plus error recovery features, plus instruction lighting which directs her to the next data field on her source document.

Earlier series of the Datafinder were constructed with 2nd-generation hardware and punched tape controls. With the new Series 400 machines, entering programs into storage is as easy as punching a program card; once done, retrieving that program requires only a push of a button. Multi-card input records are handled automatically, again with a push of a button on the console. Errors can be corrected by a correction key which causes the keypunch to remake the card up to the field in error.

Options include a 31-program memory, a 15-column left zero fill feature, and the instruction lighting, a bar of light which moves from position to position on a glass plate on which the source document is placed. The system, which consists of the keypunch machine, desk, and control electronics, is priced at $3,510 and leases for $78/mo. The instructional lighting feature is listed at $995 or $22/mo. TAB PRODUCTS CO., San Francisco, Calif. For information:

CIRCLE 196 ON READER CARD

2000 bps data modem

The Sangamo T201A data set is a completely solid state, phase-modulated data modem, which is electrically and functionally identical to the Western Electric 201A, and can be incorporated into communications systems containing the Western Electric unit with no modifications. It transmits and receives serial binary data at a fixed synchronous rate of 2000 bps over the switched (DDD) network or private lines. The T201A interfaces with Bell 804A data auxiliary sets for alternate voice/data communication and automatic answer. The 804A also provides control functions and permits use of 801A and 801C automatic call units. Several versions of the T201A are available, including the T201A3 which has an internal crystal-controlled clock for controlling the data flow, and the T201A4 which is used in applications where the timing signal is provided by another cpu. The sets are available in a desk top cabinet or an enclosure for mounting in a 19-inch rack. Price is $2200. Delivery requires 30 days ARO. SANGAMO ELECTRIC CO., Springfield, Ill.

CIRCLE 197 ON READER CARD

acoustic coupler

Active filtering techniques are used in the Series 301 acoustic couplers to alleviate humidity problems experienced with cheaper techniques. The resultant 300 baud data sets can be used with either inverted or upright frequencies on regular dial-up lines and are compatible with the Bell 101 and 103 data sets or their equivalents. Options provide for half/full duplex operation, originate/answer facilities, and tty/EIA RS-232 interfacing. Unit prices start at $395, with substantial discounts for oem quantities. COMDATA CORP., Niles, Ill. For information:

CIRCLE 198 ON READER CARD

time-sharing nc service

Parts programming is made conversational with CAMPTURN, a service for providing access to large computers for developing and punching tapes for numerically controlled lathes. The vendor estimates that half of all metal removed in machining operations is done on an nc lathe of some sort. The CAMPTURN program makes the necessary calculations, detects errors, optimizes machine operations, and prints a listing of the control program developed. Inputs to the program are in the form of control words such as TURN and BORE, as well as the expected APT-type geometry information. If no errors are detected in the machining program, the program can be ordered to punch a tape at the user's terminal. The service is presently available only from Westinghouse t-s centers. MANUFACTURING INFORMATION SERVICES DEPT., WESTINGHOUSE ELECTRIC CORP., Pittsburgh, Pa. For information:

CIRCLE 199 ON READER CARD

dual mode digitizer

Both lines and points can be digitized by the Model 485 Digitizer. Pressing a pushbutton changes the mode of operation between a "whole value" mode for digitizing straight lines and an "incremental" mode for tracing curved lines or digitizing single points. The manufacturer provides the basic digitizer with the dual mode of operation, three keyboard consoles, a mag tape drive, and a program to translate the taped coordinates into computer-readable format.

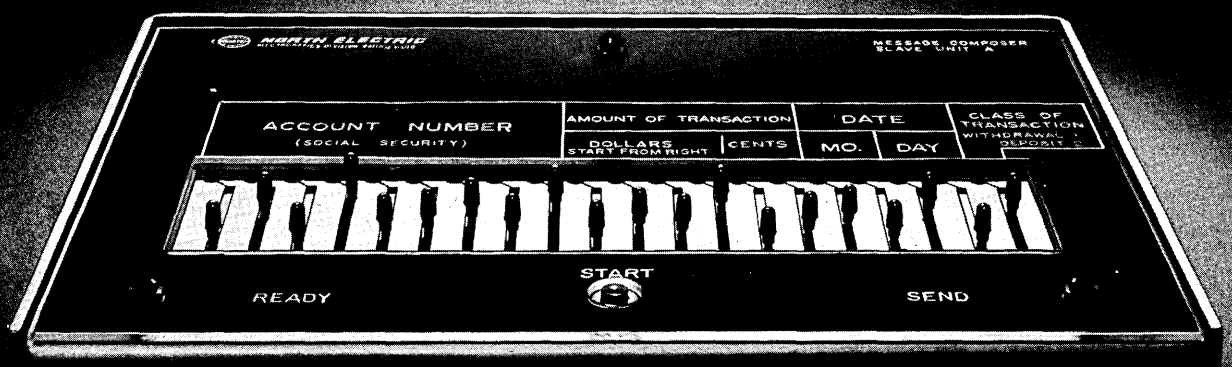
A Selectric typewriter, a fixed keyboard on the plotting surface, and a

floating keyboard on a cable constitute the trio of consoles. Instructions or points keyed into the consoles are printed on the typewriter for verification as they are recorded on tape. The mtu handles 8½ inch reels and is available in two versions, model 600 for 7-channel 556 bpi, and model 800 for 9-channel 800 bpi. The calibration programs—for 16 different computer models, including IBM, SDS, Univac and other lines—are written in compiler languages for ease of alteration.

The package, including digitizer, mtu, and software, sells for $39,500 with the model 600 drive. The drives are available separately at $4,000 for the 600 and $5,000 for the 800; they feature pinch roller tape movement and a rewind speed of less than two minutes. CALMA COMPANY, Sunnyvale, Calif. For information:

CIRCLE 200 ON READER CARD

Despite what you've heard, there's only one Data Entry System that does it all!

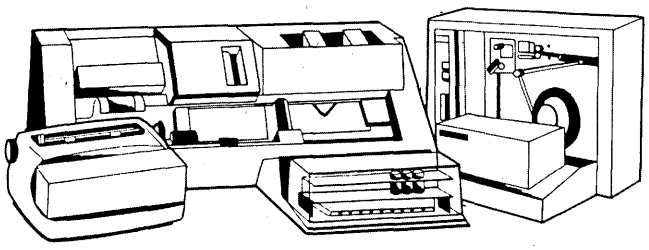


The North Electric Message-ComposeR™ System is the only complete system adaptable to any and all tasks that require punch cards, key tapes, hard copy or any combination of these. It is designed to work with all existing computer feeding equipment. The Message-ComposeR System is available for immediate delivery from stock on an outright purchase plan...or, can be leased for under $95.00 per month.

NED—2A

The keyboard is so simple any unskilled operator can encode a message and scan it for accuracy. He can then transmit it (by pressing a button) over owned or leased lines. With North's Acoustic Coupler he can transmit over switched telephone networks.

Easily changed overlays serve as a guide to the operator. They are laid out in the language of the job and are coordinated with a program plug that automatically encodes required fixed data into the message.



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

Truly the most spectacular breakthrough in data entry and retrieval in years!

NORTH ELECTRIC Electronetics Division/Galion, Ohio 44833/419-468-8100
A subsidiary of United Utilities, Incorporated

new literature

ACCOUNTING SYSTEM: Eight-page brochure describes EBS/1230 electronic business system that prepares original business documents, updates account ledgers and develops and prints out totals as a by-product of original entry procedures. Central processor features stored program control, minimizing operator's manual participation. Other system components include a 25-cps printer, photo-electric standard alphanumeric keyboard with 10-key numeric keyboard and control section, and Distributape card/tape reader/punch. AUTOMATED BUSINESS SYSTEMS DIV. OF LITTON INDUSTRIES, Carlstadt, N.J. For copy:
CIRCLE 215 ON READER CARD

PROGRAMMING INTRODUCTION: 425-page book contains a complete introductory course for high school, university and training school students in programming digital computers, particularly the company's PDP-8 family. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:
CIRCLE 216 ON READER CARD

INFORMATION AS A COMMODITY: 64-page paper (presented at the Fourth National Congress on Data Processing, Israel, April, 1968) examines information systems from the viewpoint of implementations based on current knowledge and experience and reviews studies on how information has been and can be communicated for its exploitation. The report contains sections on cases of use of information; performance of information services; requirements for information systems; and payoffs from information systems, particularly with respect to technologically developing societies and potential small-industry users. AD -677 197. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

SUPPLIER EVALUATION: 20-page booklet describes a quarterly register of aerospace suppliers evaluated by 31 prime contractors. The names of participating contractors, the MIL-specs which guided their evaluation, a list of the processes and services evaluated, and sample page formats are included. D.A.T.A., INC., Orange, N.J. For copy:
CIRCLE 217 ON READER CARD

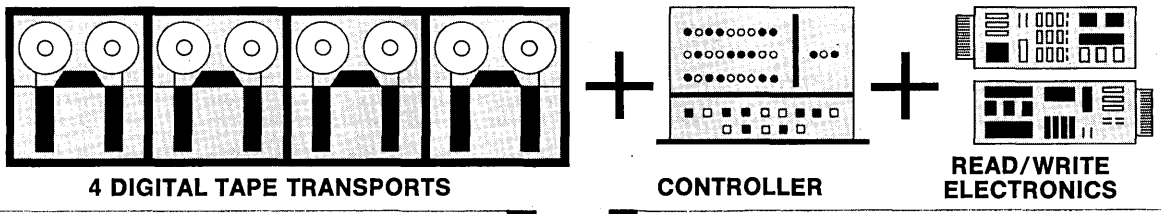
IC GUIDE: 32-page booklet describes the 5400/7400 family of standard gate and flip-flop circuits. Material in the guide was originally developed for a series of seminars on integrated circuits given by company application engineers and includes a section on getting the most from an integrated circuit technical publication. SPRAGUE ELECTRIC CO., North Adams, Mass. For copy:
CIRCLE 218 ON READER CARD

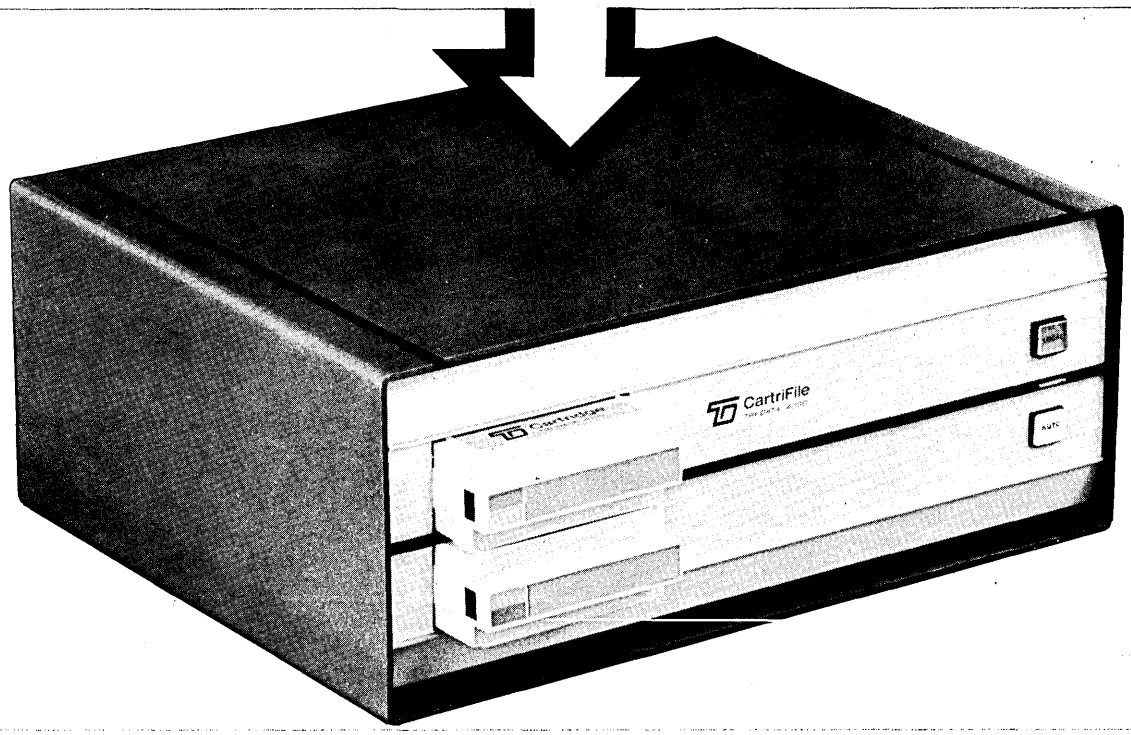
LAB DP SYSTEMS: 20-page booklet describes SpectroSystem 100/200 family of laboratory data processing systems for automating analytical instruments. Basic 100 system consists of operating console, instrument/computer interface, 620/i computer and ASR-33 teleprinter. Applications include NMR and EPR spectroscopy, mass spectrometry, Fourier transform spectroscopy, spectrophotometry, and gas chromatography. VARIAN DATA SYSTEMS, Palo Alto, Calif. For copy:
CIRCLE 219 ON READER CARD

CAI BIBLIOGRAPHY: "A Computer Assisted Instruction Annotated Bibliography" contains 113 citations descriptive of research, programs, facilities. Cost: $.50. PHI DELTA KAPPA, Eighth & Union, Bloomington, Ind.

REMOTE TERMINAL: Six-page brochure describes capabilities, peripheral devices, applications, interface characteristics and specifications of the Computerminal remote data terminal. WYLE LABORATORIES, El Segundo, Calif. For copy:
CIRCLE 220 ON READER CARD

DATA ACQUISITION AND CONTROL SYSTEMS: Two brochures describe the Honeywell Series 16 data acquisition and direct digital control systems. Series 16 is designed to allow a "knowledgeable user," who has had previous





4 Mag Tape Units & Controller

A computer peripheral for program loading, data sorting and data-terminal use

Number of tape units	4 with integral controller and read/write electronics
Number of cartridges	2 — each containing 2 tapes
Simultaneous operations	Data may be written on one tape while data is read from another. Other tapes may be in Load-Point Search.
Capacity of system	600,000 6-bit words
Capacity per tape	150,000 6-bit words in 1,000-character records. Capacity varies with tape length and record length.
Record length	Variable
Word length	Selectable: 4, 6, 8, or 12 bits
Tape speed	10 inches per second
Transfer rate	857 6-bit words/second. Varies with word length.
Inter-record gap	0.2 inch
Start time	15 milliseconds
Stop time	10 milliseconds
Recording density	600 bits per inch
Recording technique	Bit-serial, phase-encoded, 2-track redundant
Error correction	Built-in multi-bit error correction based on redundant tracks and redundancy of phase encoding.
Mounting & size	Desk top or 19-inch rack-mount, 17 x 7 x 13.5 inches.
Price	**$5,200** includes all electronics, power supply and cabinet, two tape cartridges and interface connectors.

CartriFile TAPE CARTRIDGES

File protect	Switch and indicator for each of two tapes in each cartridge.
Tape	Endless loops of ¼-inch-wide computer-grade magnetic tapes, two per cartridge.
Certification	Tapes are tested and certified error-free.
Number of tapes	2 per cartridge.
Length of tape	50 feet 100 feet 150 feet

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

process control experience, to set up and operate his own system. It provides hardware and software packages for on-line control and data acquisition for industrial processes, manufacturing operations, test functions, etc. The brochures provide systems descriptions, function data, software and applications information. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For copies:

CIRCLE 221 ON READER CARD

BUFFER MEMORIES: This guide to delay line types of serial memories presents the theory of operation, plus the capabilities and limitations of glass, quartz and wiresonic type digital stores for specific applications. It lists the factors to consider for choosing the correct type of ultrasonic store for buffer applications to enable the systems designer to use the most appropriate equipment. Topics covered for each type include storage capacity limitations imposed by signal absorption and temperature coefficients; frequency ranges; consideration of size, mechanical characteristics, power consumption, and cost. ANDERSEN LABORATORIES, Bloomfield, Conn. For copy:

CIRCLE 222 ON READER CARD

SIMULATION PROCEEDINGS: Proceedings of the Second Annual Simulation Symposium (1969) are available for $10. ANNUAL SIMULATION SYMPOSIUM, P.O. Box 1155, Tampa, Fla. 33601.

LIC'S: 28-page brochure is intended to help electronics engineers solve design problems by means of second generation linear integrated circuits. The first section describes seven off-the-shelf devices and provides all the information needed to incorporate them into circuits. Section II discusses applications for these products, and the third section outlines electrical characteristics and parameters that will appear as standard products in the near future. FAIRCHILD SEMICONDUCTOR, Mountain View, Calif. For copy:

CIRCLE 223 ON READER CARD

COMPUTERS IN HIGH SCHOOLS: 172-page report, intended as a general guide for high school administrators who are interested in the installation of a computer terminal, gives results of one high school's experience with a project to teach students how to program and solve problems in mathematics using a computer. Appendix includes a printout of student-written programs, a program for recording student off- and on-line time, charts pertaining to the evaluation study, and copies of materials given to the students during the course. AD-678 741. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

MEASUREMENT ANALYSIS: Brochure describes 460-page volume containing 30 hours of lectures, edited from tape, on the measurement and analysis of random data. The work includes over 300 reproductions of slides used in the series. MEASUREMENT ANALYSIS CORP., Marina del Rey, Calif. For copy:

CIRCLE 224 ON READER CARD

FILE CREATION: 59-page booklet, written for management, discusses the problems associated with the selection, collection and conversion of the basic information needed in computer-assisted production control systems. Price: $2.40. THE NATIONAL COMPUTING CENTRE, Quay House, Quay St., Manchester 3, England.

ANALOG SIMULATION COURSE: Course outline folder and brochure describe 16-lesson educational program depicting the envolvement of the student with the GP-6 computer and crt display in a step-by-step advancement from basic fundamentals of the analog computer to efficient programming. COMDYNA, INC., McHenry, Ill. For copy:

CIRCLE 225 ON READER CARD

FIELD-EFFECT TRANSISTORS: Six-page selector guide and cross reference chart covers the company's complete line of more than 100 JFET and MOSFET field-effect transistors categorized by application. MOTOROLA SEMICONDUCTOR PRODUCTS INC., Phoenix, Ariz. For copy:

CIRCLE 232 ON READER CARD

NONNUMERIC DP IN EUROPE: 63-page field trip report describes 80 nonnumeric dp research projects in Belgium, Sweden, the Netherlands, Italy, United Kingdom and West Germany. "Nonnumeric" includes linguistics, optical character recognition, information storage and retrieval, cybernetics. NBS Technical Note 462. Cost: $.65. SUPERINTENDENT OF DOCUMENTS, U.S. Government Printing Office, Washington, D.C. 20402.

(Continued on page 185)

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CIRCLE 133 ON READER CARD

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Just for the record, top dollar means $20,000-$30,000-$50,000 annually for owners of AAMCO Transmission Centers from coast to coast. *No automotive ability required.* But you must have a good head for business and the burning ambition to make the kind of real money you're worth. The world's largest chain of franchised transmission centers takes care of the rest.

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Arlington, Virginia 22201

CIRCLE 115 ON READER CARD

new literature

COMPUTER SYSTEM: 20-page booklet describes PCP 88 multi-computer system for direct digital control of industrial processes and explains the advantages of dividing control and supervisory functions between separate computers. Installations in chemical and petrochemical refineries are described. THE FOXBORO CO., Foxboro, Mass. For copy:

CIRCLE 226 ON READER CARD

KEYBOARD GUIDE: Sixteen-page brochure reviews the major features of the division's wired and encoded solid state keyboards. Also included are product specifications—operating characteristics, switch module mounting dimensions, switch specifications, double-shot molded button specifications, legends, key spacing, keyrow offset and keytop orientation—and encoding techniques and interface outputs. MICRO SWITCH, DIV. OF HONEYWELL, INC., Freeport, Ill. For copy:

CIRCLE 227 ON READER CARD

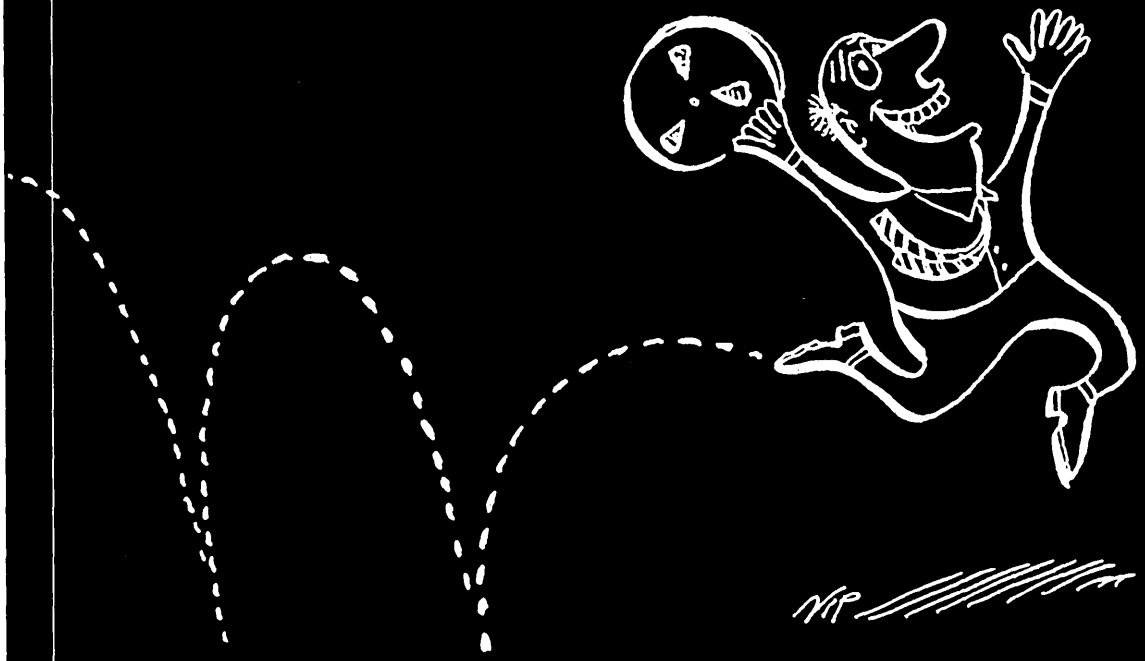
BIBLIOGRAPHY/ABSTRACTS: 90-page bibliography with abstracts lists available reports concerned with federally sponsored research and development in the computer field. PB-180 137. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

CURRENT TRENDS IN CAI: Six-page papaper, adapted from one presented to The National Society for Programmed Instruction last year, includes sections on defining computer-assisted instruction, an overview of CAI in the United States, and the potentials of CAI. INST. FOR COMPUTER-ASSISTED INSTRUCTION, Doylestown, Pa. For copy:

CIRCLE 228 ON READER CARD

TASK ANALYSIS: 41-page instructional manual contains detailed guidance to personnel analysts in producing and updating task analysis diagrams by an adp method developed in 1967. The diagrams can be used by personnel responsible for system design, equipment design, work design, determination of manning and training requirements, and the preparation of training curricula and materials, maintenance manuals, training aids, and job aids. AD-677 794. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

IT WORKS!



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is a retrieval and reporting system that provides tailor-made analyses and reports without the costs and delays associated with writing special purpose computer programs.

Nonprogrammers can learn in three hours or less how to interrogate data and obtain reports in user selected sort sequence.

QQS is designed for CDC, IBM, GE, UNIVAC, etc. For more information on QWICK QWERY, call or write J. R. Parker:

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CONSOLIDATED ANALYSIS CENTERS INC.

CORPORATE OFFICES: 225 SANTA MONICA BOULEVARD, SANTA MONICA, CALIF. 90401, (213) 451-5771

letters

Specs With 2980" in the January issue, page 94.

I, for one, do not expect the "banking institutions . . . to flock to buy it," or that a "line forms" behind a single purchaser.

Indeed, a line has formed here at Stamford for the Bunker-Ramo Series 1000 Teller Terminal (pre-September, 1967 specs). Hundreds are in service with institutions like Bowery Savings and Glendale First Federal; more were sold in 1968 than in any other year; and in January, 1969, more were sold than in any single month previously.

Those of us who face the Giant every day, everywhere, know they have great designers, great systems people, great marketing, etc. We don't all have to sue 'em—but for Heaven's sake, they don't need DATAMATION's editorial endorsement!

RICHARD CASEY
Stamford, Connecticut

watch out

Sir:

If Mr. Rankine (Letters, January 1969) is *really* IBM's Director of Standards, all of us need to be especially wary:

1. I, for one, know of no mechanism for *authorizing* representatives of the data processing industry to establish standards; USASI is one of the most voluntary organizations known to me.

2. I would that I could regard as legally binding Mr. Rankine's statement that "IBM will provide the facility to enable those who see benefits in moving to PL/I to make *maximum* (my emphasis; RMG) use of the language." If experience with IBM software is any guide, Mr. Rankine and his company will continue to miss the mark by the proverbial country mile. Would, instead, that they had scored a bullseye!

ROBERT M. GORDON
Univ. of California, Irvine

managing the middle

Sir:

Robert V. Head makes some incisive and worthwhile observations in his January article, "Obsolescence in Business Organizations and Management." His conclusion that computerized information systems will cause profound changes—and obsolescence—is of course correct.

One can, however, overemphasize the effect computers will have. Mr. Head moves most dangerously in this direction when he says that information systems built around computers and high speed communications will obsolete regional or intermediate levels of management.

In most cases, middle managers do *not* exist solely to receive and process information. Their most vital function is to personally direct, motivate, train, lead—in short, to interact with the people below them. Because the number of personal interactions one manager can have is limited, organizations are necessarily multileveled or hierarchical.

Better information systems may reduce or contain the number of levels in an organization, but they cannot *obsolete* them. A similar comment can be made about Mr. Head's view of the boundaries between departmental functions. Separate departments will exist when their activities are essentially different. The boundaries will not go away because departments use a common data base.

The lesson, I think, is that one cannot look at an organization merely as a system of information flows. The systems theory of organizations, like the behaviorist, the scientific management and the classical economic theories, is a useful viewpoint but only a partial one. Boundaries between departmental functions and organizational levels may continue to exist in spite of what information systems theory may lead us to believe.

RONALD S. KINTISCH
Abington, Pennsylvania

no comparison

Sir:

R. A. McLaughlin's statement in his article, "The CDC 7600," that "The CDC 7600 super-super-scale machine may even outperform the rumored 360/85 mod II and 360/105" is the understatement of the year! His comparison between a deliverable system (CDC 7600) and nonexistent IBM equipment is certainly out of place and is an insult to the intelligence of the reader.

DAVID L. OSBORNE
Ft. Lauderdale, Florida

joy and blessings

Sir:

It is with joy that I have discovered MARC (*Ma*chine *R*eadable *C*ataloging) has gone religious in addition to its wide acceptance in the library world. (*"EDP in Religious Organizations,"* Dec. '69).

A bibliographic communication format, MARC II is blessed by the Library of Congress, USASI, the American Li-

letters

brary Association, and forward looking librarians throughout the western world, all of whom may have *World Vision*, but are not necessarily Christian.

JOHN KOUNTZ
Orange County Public Library
Orange, California

record threatened

Sir:

If Philip Dorn does not now hold the CPA (cliches per article) record (Jan. '69), he soon will.

MICHAEL WOODARD
Sacramento, California

standards reply

Sir:

Your Editor's Readout in the February issue paints a rather gloomy picture of the national information processing standardization program via USA Standards Committee X3. It dramatically points to some of the shortcomings of the present efforts and in doing so implies that, up to this point in time, nothing has been done in the way of improvement.

But more to the points made by your editorial.

1. Are the links between the USASC x3) members and the grass roots information processing world so weak and tenuous? Not quite. With input from over 30 national independent and producer-sponsored user groups and Government agencies such as NBS, DOD and GSA, one could hardly term the links tenuous.

2. Are the technical working committees composed of casually selected people who do their standards work when the boss isn't looking? This is a grievious charge of time embezzlement and is just not true. The members of technical groups do change, sometimes due to personnel mobility internal to or between organizations. But they do not steal time!

DATAMATION's hope that the standardization effort will improve is one that is shared by USASC x3 and its sponsor, BEMA. Determined that hope shall be translated into accomplishment, the X3 Systems Advisory Committee (SAC) considered reorganization of the Committee and presented its first concepts of a new structure over a year ago. At the same time the Sponsor formed an ad hoc Committee on X3 Procedures. The latter has received the SAC documentation and over one hundred inputs from the en-

tire spectrum of "that crummy world where information processing is done" (DATAMATION's description). A USASC x3 Operating Procedures Manual is expected to be published this Spring. It will present a streamlined Committee designed to produce anticipatory standards with a minimum of redundant voting levels and with a maximum effort at the standards planning phase. Standards will be managed both technically and administratively by groups with short umbilicals to those who must use the standards. A public relations policy and reporting system is promulgated which will deliver timely and well-documented information on the proposed standards as well as on their technical and economic implications. Perhaps the Editor was not aware of the depth and scope of progress already made in this area.

Lethargy, on the part of users, producers and the general public, is always a difficult problem to cope with. But the Sponsor and USASC x3 itself are determined to prove that standards are indeed a profit center for all parties and will permit the achievement of those goals mentioned in your editorial.

ALEXANDER C. GROVE
Secretary, USA Standards Committee X3
New York, New York

The editor replies: We think the links are rather tenuous between the real world of information processing and such organizations as the American Gas Assoc., American Library Assoc., Edison Electric Institute, Printing Industries of America, Inc., and similar "user" organizations that are supposed to represent the edp interests of their members.

As to the second point, we were not trying to imply that standards workers embezzle time; after all, their companies have officially blessed their X3 subcommittee work. Still, they must also perform their regular duties under a manager who may be forced to view his projects as more important than those of X3. The real point is that it is doubtful if part-time effort can be as productive as full-time effort.

Finally, we are happy to learn of improvements in standards organization and procedures, and await with interest—as we work over our Fudgsicle (we misspelled it in last month's "Readout")—their implementation. (For further information on USASI, see page 111.)

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.

FR-80 is for certain birds

People close to computers think they see the graphic output problems very well. To render an engineering drawing from a digital tape, they might recommend a Stromberg 4060. For charts and graphs from tape, a Calcomp 835 is an excellent choice. 3M's EBR is suggested for forms generation. An E-K KOM-90 qualifies for outputs of personnel records.

But a man somewhat above the action can see that all of these things might be done by one machine. Instead of four trained operators, he'd need only one. Instead of four maintenance contracts, one. Instead of four rooms and four sets of supplies, one. Instead of four partly idle, special purpose systems, a busy all-purpose one.

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Write. Even a wise man needs more information.

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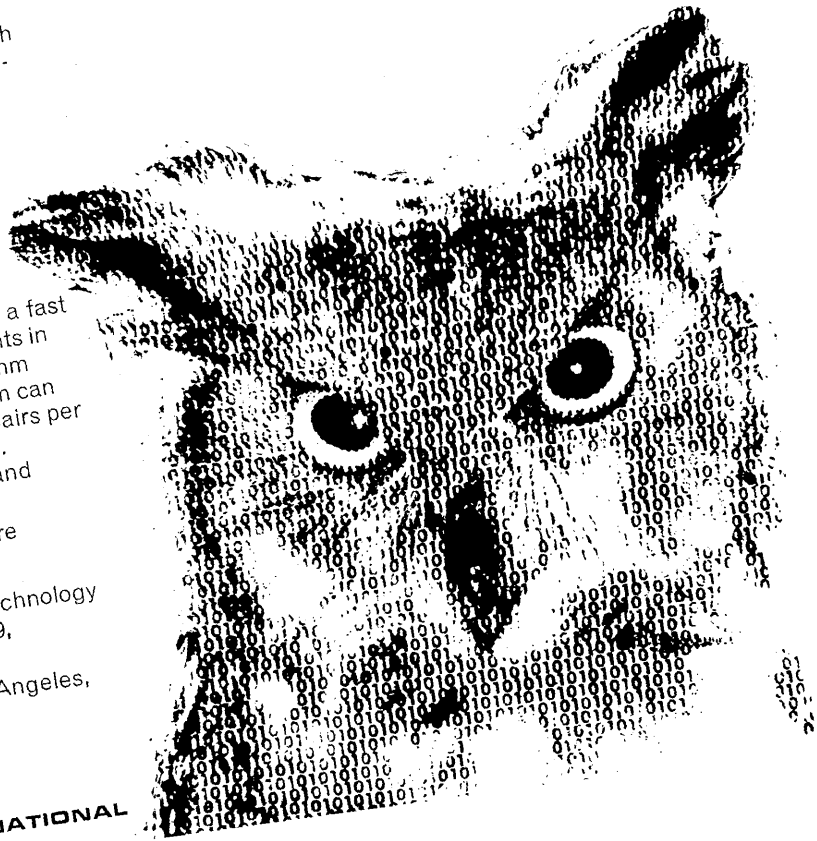

INTERNATIONAL

books

DECISION TABLES, by Marion L. Hughes, Richard M. Shank and Elinor Svedsen Stein. MDI Publications, Wayne, Pa. 1968. 175 (oversize) pages, $15.95.

This is the second book on decision tables that I have had the occasion to review and it is a significant improvement over the first (*An Introduction to Decision Logic Tables*, by Harman McDaniels). However, we are still not there.

Before commenting on the contents of the book, I want to congratulate the person who was responsible for its format. The book is physically easy to read and is fully illustrated by good examples. As one of my colleagues pointed out, the book's artwork is fine enough to be part of an art collection. The pages are 8½″ × 11″ with excellent, sharp bright printing and drawings. These large-size pages are necessary to properly portray decision tables. Hopefully, later books on this subject will adopt the same format.

About 100 of its 175 pages are filled with figures, mostly decision tables. For those who have read the scattered articles on decision tables or attended day-long seminars on the subject, this book covers little that is new. However, initiates into the decision table area will find these illustrations extremely useful. They will have the advantage of having a single well-edited, artistically pleasing book from which to learn.

The authors, recognizing the general reluctance of people to go into something new and the possible resistance that the term "decision table" may generate, have been careful to bring their reader carefully into the arena. The first chapter deals with tables (not the formal decision table) with which the reader can be comfortable. For 13 pages, he is told and shown the advantages of these tables over narrative and flow charts for problem description. Very clever!

Once the selling is done, the authors focus on decision table techniques (single tables), describing such things as advantages of decision tables, decision table structure, rules, limited-entry, extended-entry and mixed-entry tables, comparison of the three types of tables, the ELSE-rule, and another comparison of decision tables and flow charts.

The discussion on a comparison of the three types of tables (limited-entry, extended-entry and mixed-entry) catches the essence within a couple of pages and a few examples.

The next chapter deals with the constructing of individual decision tables—review of some basic principles and how to build decision tables. The procedure for constructing tables is illustrated in six reasonable problems. The authors then describe the referencing of other tables. They discuss such topics as open and closed tables, the flow of logic and the ELSE-rule for open and closed tables.

Several examples that require multiple decision tables are then described and illustrated—a mail order problem, an audit, and a budget chart problem.

The next chapter—Decision Table Mechanics—received special mention in the preface. The authors said:

"Some of the material in this book has been buried in little known journals, some of it has been our own discovery. Each one of us has had the thrill of discovering something which has furthered the science of decision tables. Our studies and discoveries have resulted in the chapter entitled *Decision Table Mechanics*, and it has been the mastery of the material in this chapter which has made us adept at using tables correctly."

Unfortunately, too much of the material—completeness, the ELSE-rule, compressing tables, incompleteness and redundancy, optimizing extending and mixed-entry tables—looked too familiar to me, like something I had written or read elsewhere, not under the byline of this book's authors. Yet no names are mentioned nor is there a bibliography to lead the reader to the original source where he "can drink deep . . . the Pierian Spring."

This chapter also shows the reader how to sort the rules in the table so that (1) it becomes easier to detect errors of redundancy, incompleteness or inconsistency and (2) to enable programmers to program from the decision table. This topic of sorting really does not belong in an introductory book. The authors have done so well up to this point in bringing the reader along. Now they'll scare him to death with something he really doesn't have to know or do. The decision table writer can check for contradictions, redundancy and completeness easily without having to sort the rules. As for converting the decision tables to computer programs: if I had to go through that, I would go back to flowcharting. A big factor in inhibiting the use of decision tables was the absence of a processor to convert the tables to code. Now we

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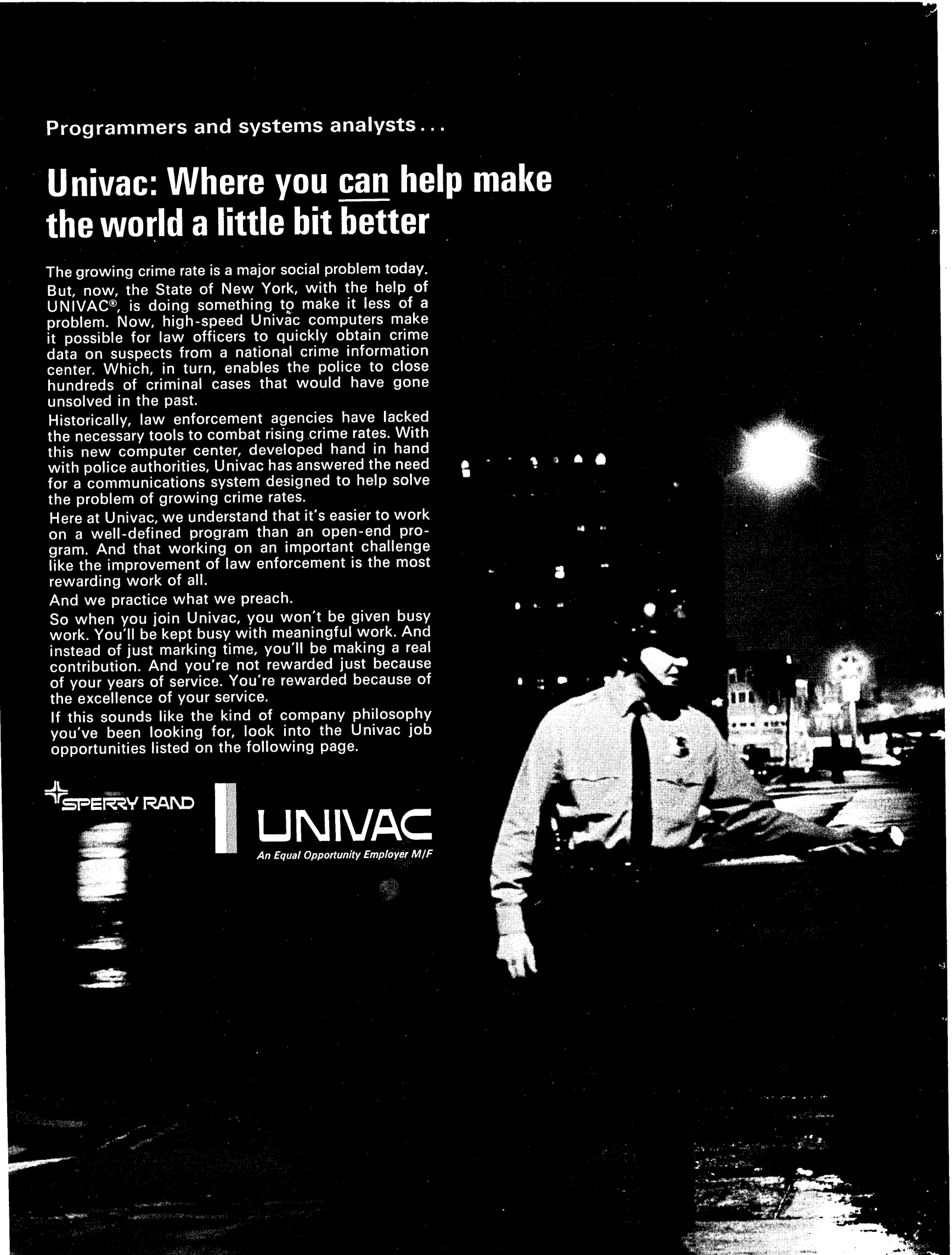

have processors, and this manual conversion is both unnecessary and undesirable.

The next chapter—Decision Tables at Work—discusses the use of decision tables in practical applications and their advantages for programming and systems. It also illustrates by means of another example how decision tables have the edge over flowcharts for problems that change.

I approached with foreboding the review of the last chapter—Decision Table Processors; I had seen the jacket that advertised *their* decision table translator. My fears were only partially realized. The book omits a few of the processors that have been available for over a year. This may, however, be attributable to publication lag time. The book's treatment of the processors it does cover is a fair one. It may be a borderline case of impropriety for it to state that while many of the available translators are inefficient and unsatisfactory, good processors can be produced and that their processor and the processor of an industrial firm are examples of processors which effectively extend decision table capabilities to the computer level.

I have one final point before summarizing. The writer of the foreword should have checked the book to avoid contradiction. The following is a quote from the foreword:

"I want to stress strongly, however, that decision tables are not a technique."

We get no further than page 4 and find:

"An important characteristic of the decision table technique is that it permits the statement and communication of decisions without regard to the processing medium."

To summarize, this is the best book currently available for those needing an introduction to decision tables. The book appears to be written for them and they will find it useful. If they approach it seriously, doing the many exercises provided for them, they will have acquired a technique that will be quite valuable for problem definition and solution. —SOLOMON L. POLLACK

book briefs

(For further information on the books listed here, please write directly to the publisher mentioned.)

***Mechanized Information Storage, Retrieval and Dissemination*, edited by Kjell Samuelson. North-Holland Publishing Co., Amsterdam, The Netherlands. 1968. 711 pages, $27.50.**

This collection of papers represents the proceedings of the June 1967 conference in Rome sponsored by the Federation Internationale de la Documentation and the International Federation for Information Processing. Emphasis of the conference was on operational methods and systems. Chapter headings include an introduction to the field; file organization and search strategy; operational and projected systems; economics and comparison of documentation systems; computer-aided production of publications; information networks and on-line systems. The management of Informatics, Inc., may be interested to learn that the word "informatics" was suggested as a generic name for the field of information science and automated documentation.

***Introduction to Electronic Digital Computers*, by Herbert Maisel. McGraw-Hill Book Co., New York, N.Y. 1969. 386 pages, $9.95.**

Still another introductory book aimed at the text-for-undergraduates market. After a few chapters on history and the nature of computers, this one concentrates on System/360, FORTRAN, and PL/I. A sign of the times is that software gets attention even in the first chapter.

***Nonlinear Programming*, by A. V. Fiacco and G. P. McCormick. John Wiley & Sons, Inc., New York, N.Y. 1968. 201 pages, $9.95.**

Subtitled Sequential Unconstrained Minimization Techniques, this formula packed volume was written by two technical staff members of Research Analysis Corp. in the course of research sponsored by the U.S. Army Research Office. The authors note that the primary purpose of the book is to "provide a unified body of theory on methods of transforming a constrained minimization problem into a sequence of unconstrained minimizations of an appropriate auxiliary function."

***Fortran Programming*, by Fredric Stuart. John Wiley & Sons, Inc., New York, N.Y. 1969. 345 pages, $7.95.**

This is another offering for the textbook buyers. The author includes exercises for the students and recommends that FORTRAN be accepted as a universal programming language.

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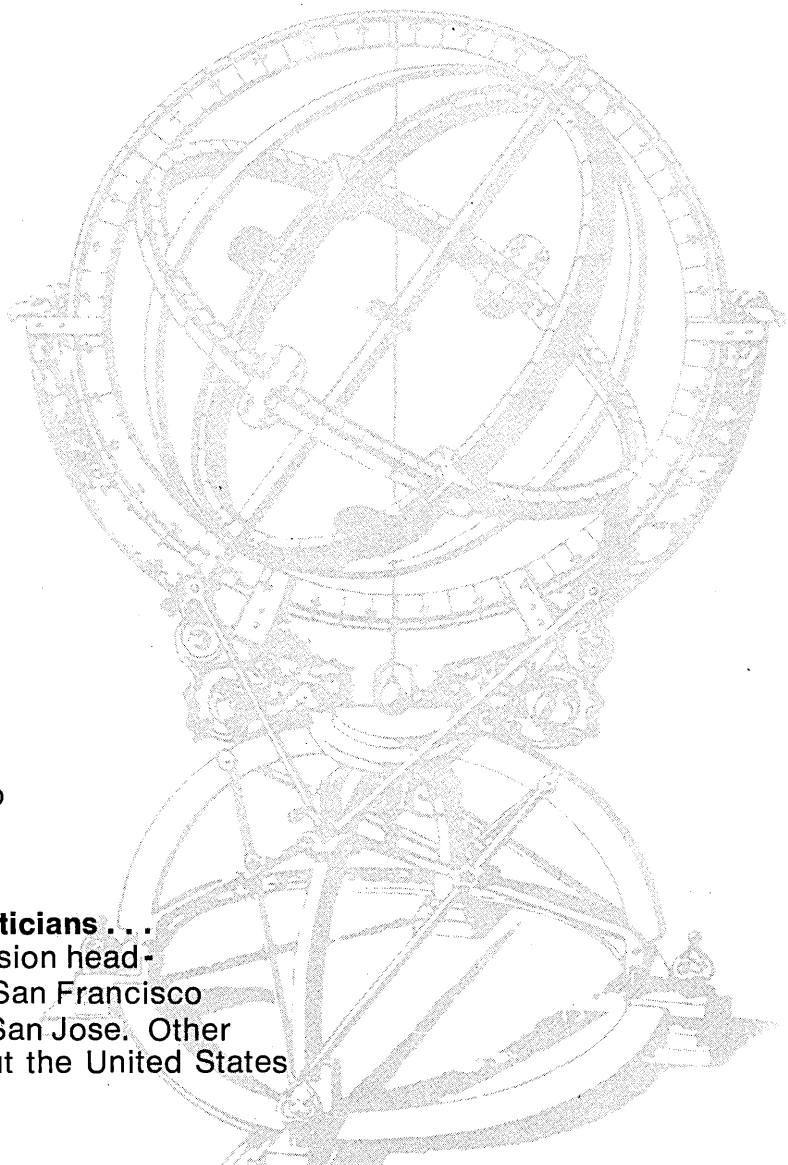

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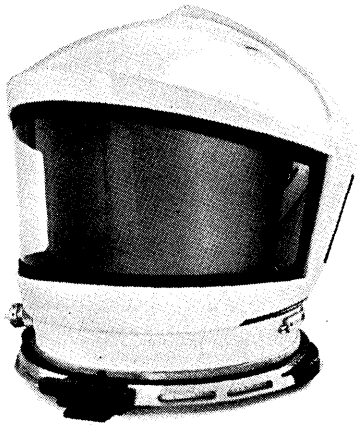
people

Computer Planning Corp., Torrance, Calif., has announced the appointment of **Howard C. Bedford, Jr.,** former project administrator of IBM's PARS division, to the position of vp and director of the company's east coast activity, On-Line Sciences, Inc. . . . **Roger E. Bremer,** former vp for corporate development of AMBAC Industries, has been elected president and board member of Data Trends, Inc., Mountain Lakes, N.J. **Robert W. Hughes,** chairman, resigned as president but continues as chief executive officer of the company. . . . **Chase Morsey, Jr.,** a former marketing vp, has been elected to the new position of exec vp, operations staff, for RCA, with over-all responsibility for corporate staff functions in marketing, corporate planning, manufacturing services and materials, patents and licensing, research and engineering, and international activities. . . . **Bernard Goldman** has been named president and treasurer of Bankers Leasing Corp., Boston, subsidiary of Southern Pacific Co. He succeeds **Alvin Zises,** founder of the company, who will remain with the firm as a consultant. Goldman has been with Bankers Leasing since its formation in 1955. . . . **Harold H. Kantner,** Evanston, Ill., former senior scientific advisor at IITRI, has become a private consultant in new product potentials relating to data teleprocessing. . . . **Robert Kisberg,** formerly secretary, has been elected president of Private and Computer Schools, Inc., New York City, succeeding **Arthur Garson,** who becomes board chairman. . . . **Edward F. Kearns** has been named to the new position of vp of the Computer Sciences Div. of Computer Sciences Corp. He had been a vp for RCA's Information Systems Div. in Cherry Hill, N.J. Meanwhile, CSC has formed an Information Network Div. to establish and operate a transcontinental network of regional time-sharing centers. The new division will be headed by **Marvin J. Franklin,** formerly of IBM. . . . Control Data has announced the promotions of **Paul R. Sultzbach** to vp and gm of computer manufacturing operations and **John F. Huele** to gm of the Digital Control Systems Div., Minneapolis. . . . **Richard E. Sprague** has joined Science Management Corp. . . . **John D. Stewart,** president of The Bureau of National Affairs, Inc., has been named president of Fisher-Stevens, Clifton, N.J., direct mail and dp service organization. . . . **David F. Alison** is president of University Computing's new Institute for Professional Education which will operate under the Professional Services Div. **Dr. Dan W. Scott,** head of UCC's FASBAC project, has been named vp for research and development for the Computer Utility Network. UCC's manufacturing arm, Computer Industries, Inc., has formed the Field Services Div. to provide a source of systems maintenance for CII and other equipment. The new division will be headed by vp-gm **Bert R. Harrigan.** . . . **Paul W. Sage,** former gm of General Electric's Mississippi Test Support Dept., is the new general manager of the Information Services Div., the organization in charge of the company's time-sharing and specialized computer services. He succeeds vp **Jerome T. Coe,** who will work directly with Information Systems Group exec **J. Stanford Smith** on advanced studies in GE's information services business. The appointment of **Michael F. Popowniak** as manager of training for General Electric's Information Systems Sales and Service operation, Phoenix, coincides with the company's current effort to double its computer sales staff. . . . ITT Data Services' new national programming services dept. will be headed by **Edward W. Karn** as vp and gm. He had been vp and director of the division's eastern region. . . . **Harold I. Lyvers,** founder of Hal Lyvers & Assoc. acquired last year by Serendipity, Inc., has joined Profimatics, Inc., Woodland Hills, Calif., as director of programming. . . . DEI Industries, Inc., formerly Defense Electronics, Inc., has announced the election of **Miller S. Redden, Jr.,** as president. A founder of the company, he had served as exec vp and general manager. . . . **George D. Butler,** past president of Electra/Midland Corp., has been elected president of the Electronic Industries Assn., Washington, D.C. . . . **Donald J. Jones** is the new president and chief operating officer of Vernitron Corp., replacing **Bernard Levine,** who continues as chairman of the board and chief executive officer. Most recently Jones was vp of Globe-Union, Milwaukee, and general manager of that company's Centralab Electronics Div. . . . **Edward Leonard Ginzton,** chairman of the board of Varian Assoc., has been awarded the Medal of Honor of the Institute of Electrical and Electronics

We went into the service in 1956

We went into outer space in 1961



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Engineers. **L. C. Hobbs,** president of Hobbs Assoc., Corona del Mar, Calif., was named chairman of IEEE's Computer Group for a second term. . . . **Gorden N. Selby, Jr.,** has been elected president and a director of Computer Update, Inc., Salt Lake City-based computer time-sharing and geophysical services company. He had been with IBM for ten years in various capacities. . . . **Dan McGurk** has been promoted to executive vp of Scientific Data Systems and will have charge of all the company's operating divisions. . . . **E. G. "Bud" Shuster,** president and chairman of Datel Corp., has been elected to the board of C3, Inc., Falls Church, Va. . . . **Herbert S. Glick** has been elected president and chief executive officer and **Ronald K. Banister** board chairman of the new corporate holding company structure of Continental Computer Assoc., Inc. Glick had been chairman of CCAI; Banister was chairman of the Banister companies prior to the acquisition by CCAI. . . . **Paul H. Stone,** exec vp, is now president of Moore Assoc. Div. of The Rucker Co. He succeeds **Dan G. Sully,** who recently established a consulting business. . . . Hewlett-Packard Co. has named **W. Noel Eldred** and **Ralph E. Lee** executive vice presidents. . . . **Allyn W. Falls,** formerly vp for corporate development of Friden, Inc., has joined Computer Time-Sharing Corp. of Palo Alto as senior vice president. . . . **Kenneth R. Anderson** has been named president of Raytheon Learning Systems Co., Michigan City, Ind. He had been vp-product engineering for Recognition Equipment, Inc., Dallas. . . . **Robert J. Schurheck,** former director of corporate planning for Imperial Eastman Corp., has been elected vp for corporate development of Greyhound Computer Corp. . . . **James J. Bartlett,** former vp in the Computer Systems Div. of Booz, Allen & Hamilton, has joined Shearson, Hammill & Co. as first vice president in charge of the computer program. . . . **Edward G. Jordan,** formerly vp of Avery Products Corp., has been appointed vp of Computing and Software's Educational and Personnel Services Group. . . . **V. A. Kluesner** has been named director of service center operations for Honeywell's new Information Services Div. and will be responsible for management of the 11 regional data centers planned by the division. **David E. Joel** is director of time-sharing operations, responsible for managing the seven commercial t-s centers also planned by the division. . . . **James E. Navarre** has been elected president of Tally Corp., Seattle peripheral manufacturer, replacing **Russell C. Dubois,** who resigned. Navarre, most recently president of United Control Corp., Redmond, Wash., will also serve as chief executive officer, a post previously held by board chairman **Philip E. Renshaw.** . . . **Thomas A. Clark,** formerly with 3M Co.'s International Div., has joined Telecredit, Inc., Los Angeles check-verification firm, as assistant to the president. . . . **Donal A. Meier** has been appointed director of research for NCR's Electronics Div., Hawthorne, Calif. He has been a division staff member for 15 years. . . . Cognitronics Corp., Mt. Kisco, N.Y., has announced the election of **Leonard M. Smith,** former corporate director of data processing for General Dynamics, to the new post of executive vp. . . . **Barry J. Shillito,** formerly an Assistant Secretary of the Navy, has been named Assistant Secretary of Defense for Installations and Logistics. He is responsible for procurement of computers used for defense logistics purposes, the bulk of DOD computer procurement. He replaces **Thomas D. Morris,** who has joined Litton Industries as corporate vp. . . . Fabri-Tek has announced that the name of A.I.M., Inc., a subsidiary acquired last November, has been changed to Fabri-Tek Information Management, Inc., and that the new subsidiary will be headed by vp-gm **Richard A. Carlson,** manager of dp at Fabri-Tek since 1964. . . . **Norman F. Knowlden** has been appointed vp-operations for Telos Scientific. He had been project manager for corporate operations research at Allied Chemical. . . . **Stephen G. Marvin** has been appointed to the new position of graphic products manager at Avco Computer Services, Wilmington, Mass., and will assume responsibility for the development of graphics software and hardware capability for the company. He has been with Avco since 1958. . . . **Robert Carlson,** a founder of Business & Computer Devices, Inc., a new company planning to develop peripheral equipment for the computer and communications field, has been appointed chief engineer for the firm. . . . **Edward J. Schneider,** 12-year EAI veteran, has joined Computer Products, Inc., Ft. Lauderdale, as director of manufacturing. . . . **Charles S. Pedler,** formerly with IBM, is now manager of EDP Resources' communication systems activity. . . . **Dr. G. S. Sebestyen** has been named vp of systems engineering at Sanders Assoc., Nashua, N.H. He had been associated with the Office of the Director of Defense Research and engineering where he served as Assistant Director for Tactical Systems Plans and Analysis.

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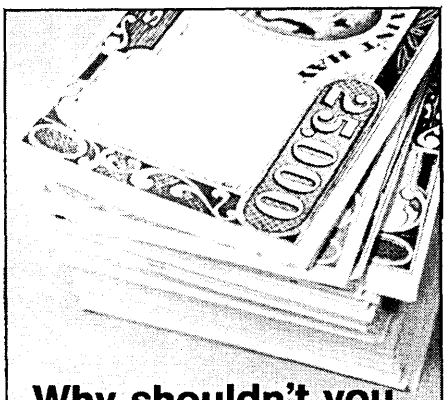

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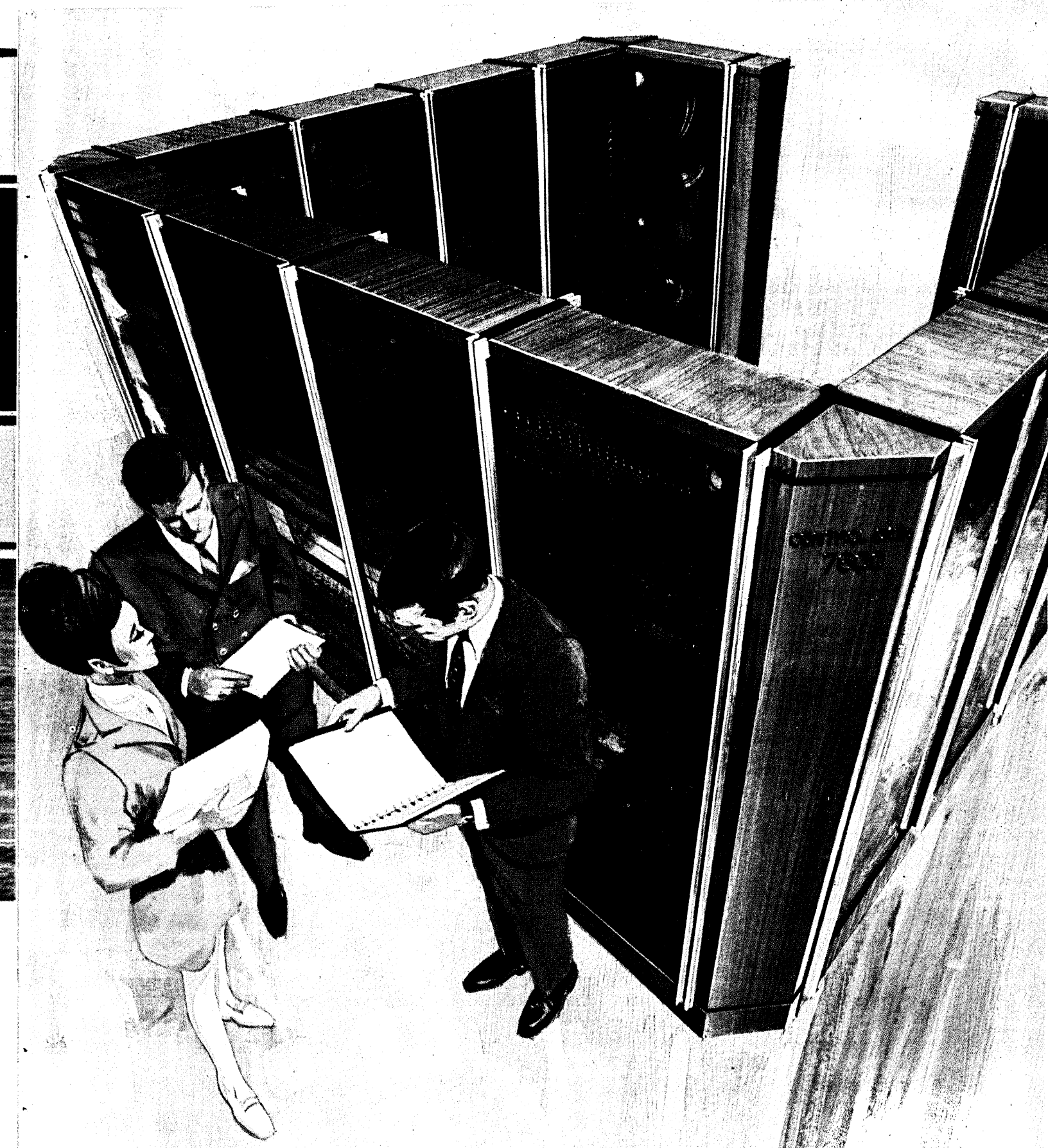

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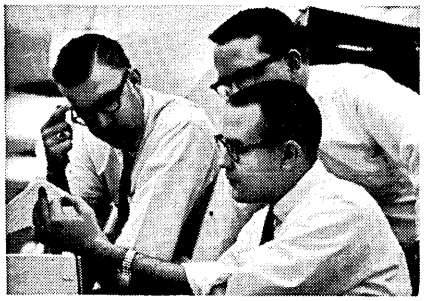

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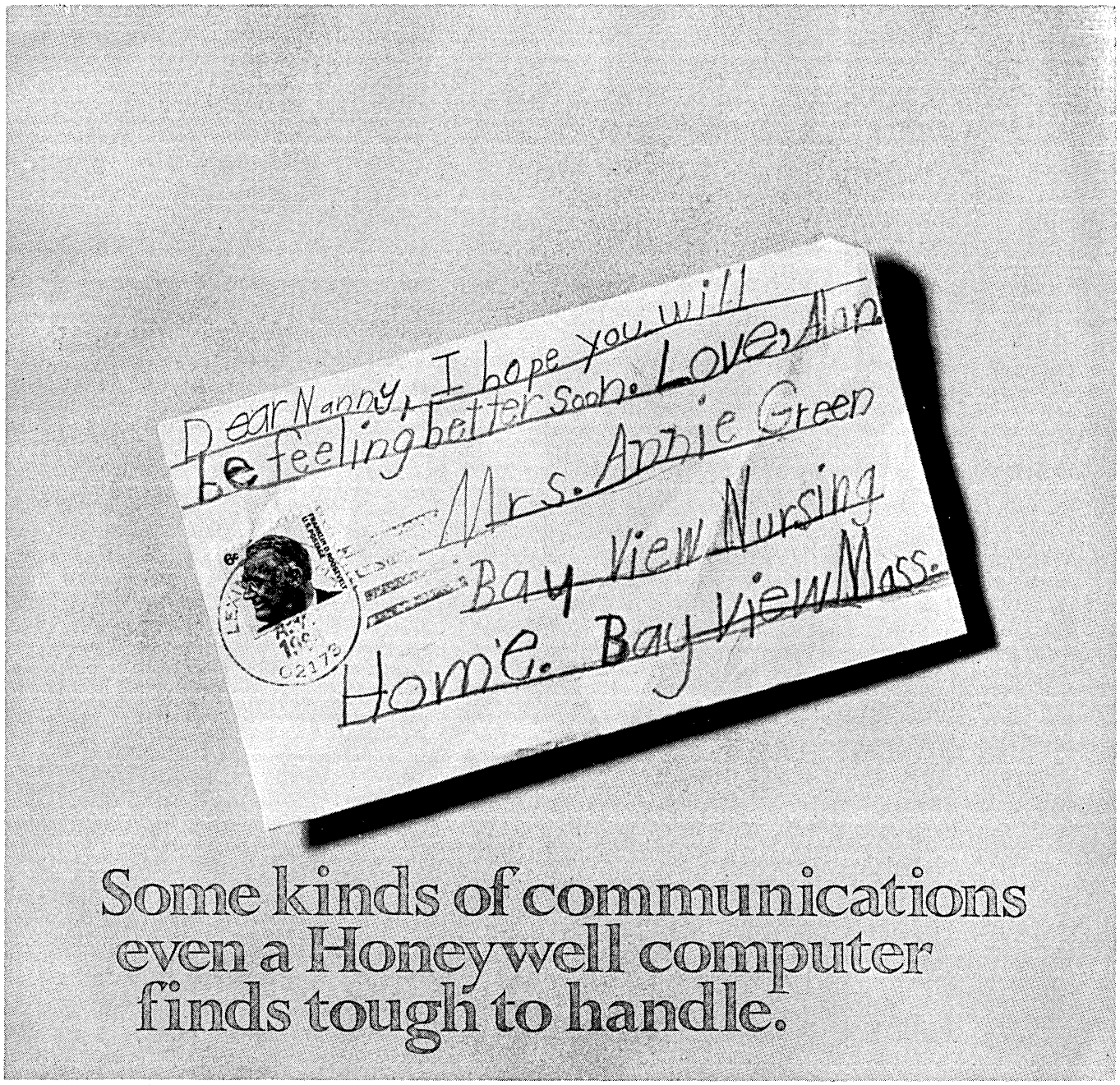

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world report

SOFTWARE GROUP SPLITS OVER ALGOL 68

That dedicated band of software men, the European Algol loyalists, have met with a serious setback. For after 18 months of painful negotiation, the working group attached to the IFIP Technical Committee 2 has had a serious split over the draft for Algol 68, that long awaited language with all the bells and whistles with which some Europeans hoped eventually to nail PL/I. The problem of sorting out the mess has landed in the lap of Heinz Zemanek, chairman of TC2 and of IBM Vienna. Even Zemanek, who was responsible for a cleanup of the structure of PL/I some months back, is having difficulty in achieving a compromise between the dissident groups.

Trouble came with the presentation of a report tagged MR100 containing the final draft for Algol 68. It included a seven-man minority appendix which proposed basically that the working group should be revised and the job done again. In fact, this group, which included Edska Dijkstra of Holland and Mike Woodger and Fraser Duncan of the UK, presented a moderate line. One of the dissidents said: If you thought the original PL/I proposals contained an overcomplex structure, you should see the ambitions behind MR100.

SAAB DRIVES AHEAD WITH MEDICAL SYSTEM

A medical data processing and information retrieval system called J5 has been developed by the Swedish aviation and electronics group SAAB. It has been devised for the D22 series, the latest micromin range of the Datasaab division of the group. System J5 has been designed with a medical research group for retrieval of records on display screens from a patient record bank. D22 has a main store from 16K to 260K bytes in 4K modules at a 1.6 usec cycle time. Maximum number of channels is 127. And the interchangeable discs, backing stores and so forth have that now familiar look.

UK UNIVERSITIES STILL LACK COMPUTER POWER

Control Data has met its crash delivery date for a 6600 for London University that will provide a service to the central university group and some on-line facilities to the multitude of university colleges that proliferate around the Greater London area. In fact, the arrival of the new system is likely to trigger fresh disquiet over the lack of computing hardware around UK higher education and research institutions. The installation will include CDC 1700s at Imperial College, Kings College and London School of Economics connected to the 6600; and a special link between Queen Mary College's ICL 1905 and the centre. CDC and ICL have collaborated on an interface design round the National Physical Laboratory's British Standard Interface and language for this link. A number of other connexions are being made for remote batch processing, together with an initial 15 terminals for a limited multi-access programme.

The main software development in hand at London University for the project is an operating system to smooth out the job mix, which includes a vast number of small programmes from students, and to provide central programme and data storage to cut wastage on use of links of repetitive data. Although the installation

(Continued on page 207)

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provides a much needed extension of capacity, the 6600 does not give a satisfactory answer to the dilemma of computing scientists and users in the London area.

In the UK, the finance for university big machines comes through the Computer Board set up three years ago. Some cash is available also through the Science Research Council for hardware that can be legitimately described as experimental equipment necessary for a specific research project. Following a gathering protest from the computing men two years ago, the Computer Board promoted a study that led to recommendations for two big machines to go into London posthaste. However, the money for only one could be raised from Government coffers. This was expected to go to Imperial College, the most voracious consumer of computer time, which had been sorely neglected in budget allocation. Its biggest system is an upgraded 7090 that was donated from IBM's magnanimous heart six years ago. But the all-powerful administrative clique at London University won the day to get the CDC to sit adjacent to its Atlas installation, a fact that caused resentment at Imperial and led to angry cries that Imperial College should invoke that clause in its charter that allows secession from the union of London University Colleges.

These rumblings were to no avail, but there has been a gradual drift of key computing men at Imperial to industry and to the States. Probably what hurt most was the fact that Imperial has been elected in the first study of the Computer Board as a regional centre to provide a whopping time-sharing service for the southeast of England, which included universities and colleges of technology much further afield than London. The space provided for this task in the new building activities at Imperial has had to pass into other hands for postgraduate work.

LEASCO PLANS AEROSPACE DATA BANK RETRIEVAL SERVICE

An information retrieval service from a data bank of information on aerospace subjects is being developed by Leasco's Information System's Division for the European Space Research Organization, the umbrella club in which most of the west European nations join in collaborative space science ventures. The system will run on a 360/65 at Darmstadt, West Germany, with links to main Esro units at Paris and Noordwijk, Holland. This will be similar to the NASA information retrieval project from which the bulk of data is drawn already.

The idea is to produce a monthly updating service under 111 different subject headings or Standard Profiles. The Esro man running the scheme is Andrew Martin, a former United Kingdom Atomic Energy Authority information systems man. The Atomic Energy Authority has probably accumulated more operating hours on information retrieval with a number of projects that have stemmed from collaboration with the Atomic Energy Commission. At present the Authority is working on the biggest time-sharing system in Europe connected with a classified military project.

FRANCE SUITS IBM

IBM France is adding model 65s to its production plant at Montpellier where 40's and 50's are currently rolling off the line. Coupled with a twofold increase of the working space at the La Gaude research labs, IBM will be smartly stepping up capital investment in France above the $200 million of last year.

Southeast

meet Bill Barnett

Bill Barnett is a computer professional.
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XEROX

washington report

TREASURY AND PATMAN TAKE SOME BANK SHOTS

A Nixon Administration move to allow "financially congeneric" bank activities has produced the first direct confrontation between conservatives and liberals in Congress.

The Treasury Dept. and Rep. Wright Patman of Texas have introduced bills that would make one-bank holding companies subject to the Bank Holding Company Act of 1956. The Treasury version would allow these companies to engage in such "congeneric" activities as equipment leasing, factoring, and mortgage, credit card, and dp services. Patman's bill would bar them from operating service bureaus and engaging in any activities not directly related to banking. Both bills would curb nonbanking conglomerates from taking over banks.

A possible compromise between these positions has been presented by Sen. William Proxmire (D.-Wis.). He would authorize a 15-man National Commission on Banking to study the role of banks in the economy with a view towards liberalizing some of the restrictions on banking activities.

GOVT. MAY ESTABLISH ITS OWN THINK TANK

A GAO survey of 15 nonprofit "think tanks" has produced a recommendation for a Presidentially directed interagency study of the government sponsored firms. Among the organizations investigated were Rand Corp., Institute for Defense Analyses, and Logistics Management Institute. GAO loked into fees paid by the government and the government's rights to the assets of the think tanks in case of sale or dissolution. An earlier study done by David Bell in 1962 recommended establishment of a government institute "to reproduce within the government structure some of the most positive attributes of the nonprofit corporation." The new GAO report supports the same conclusion, principally on the belief that such an institute would operate with its own career merit system and establish a compensation system equal to that of private industry.

GSA MEASURES TAPE SAVINGS

The latest GSA buy of mag tape has produced about a 15% savings to the government. Five firms received awards covering the period March 1 to August 1: 3M, $1.7 million; Ampex, $1.2 million; Computon, $621K; Magtape, $600K; RCA, $300K. The price for 7 channel, 800 bpi tape in canisters was $12.13/reel compared to $13.19 last year. The price for similar tape, sealed, was $11.70. The bulk type price was $11.28. For 7 and 9 channel tape, the winning bids, respectively, were $12.31 (compared to $13.66 last year), $11.84, and $11.57. FSS Commissioner Hy Abersfeller said these prices represent a savings of $1.5 million on an annual rate.

CAPITOL BRIEFS

A teleprinter at the House Banking & Currency Committee connects it to a computer at the Library of Congress, allowing full summaries of any bill's status to be obtained in less than a day's time; this could be the launching pad for a computerized Congressional information retrieval system...Congressional approval of a copyright bill this year is in doubt because of the controversy over CATV copyright payments.

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lower prices. GSA is also advised to get together with NBS and establish a testbed where interfaces of plug-compatible peripherals can be checked, and where interface specs for peripherals not plug-compatible can be developed. (Both agencies agree that such a facility is needed, but each wants to run it.)

The GAO report suggests that current DOD efforts to acquire more independently made peripherals are minimal and could be easily expanded—for example, by inviting the independents to bid directly on at least some computer system buys.

To buttress these recommendations, the report compares the pricetags of specific peripherals offered by main frame makers and independents; the figures show that the latter are substantially less expensive.

GESTATION "TERMINATES" AFTER THREE FULL YEARS

For the past three years Digital Logic Corp. of Anaheim, Calif., has been building special terminals and cpu interfaces for Univac, SDS Sigma 7, IBM 360, CDC 6000, and GE 600 series computers. The 30-man firm now plans to come into the marketplace with two standard lines of gear.

The firm's first standard product line, the Mark IV, will be a hard-wired terminal for 360 users. It will offer a high-speed line printer and card reader, both from Data Products, and a communications link. "High-speed" to DLC means "running at the full rated speed of the peripherals," and Mark IV buyers can expect to get 600 lpm from their printers and 500 cpm from their card readers, using normal voice-grade 2400-baud phone lines. System tailoring is a part of the standard offering in the $45K price tag, but software updating is not.

The second product in development, called the Compak II, offers the same peripherals with a PDP-8 based controller. Originally designed for CDC 6000 series users, the II is actually more flexible and will be adapted to other hardware. Software and tailoring are included in the $70K tag on this one.

HENDRIX HAS LOW-COST DEVICES READY FOR SJCC

Several new products will come out of crt-maker Hendrix Electronics at SJCC. One will be a keyboard available in special configurations and using a digital filter scheme to produce "any code," including decimal, ASCII, binary. Other features are a proprietary (reed) switch module and keytops interchangeable with standard IBM keytops. Cost is a low $1/key in lots of 500 keyboards.

Another product of the group, a division of Hendrix Wire & Cable Co., Milford, N.H., is a $2K-3K time-division multiplexer, already being ordered by Bell Telephone. It compacts 16 teletype lines into one high-speed line. Hendrix has also made logic changes in its text-storage crt terminal which permit random access of any page of text stored on the terminal's local drum. The drum holds 240K characters, or 102 pages, which previously were accessed only serially. New editing features have also been added.

The firm also has a new interface which allows the text terminal to dial a Mohawk 700 Data Recorder and input records to it automatically.

SANDERS SWITCHES INTO COMMUNICATIONS MARKET

Sanders Associates, Nashua, N.H., once a completely defense oriented firm, has gradually deepened its commercial market penetration—first with a crt line and now with a sizeable communications processor, the Sandac 200. The new system, to be announced this month, can be used as a system controller, message concentrating preprocessor, or message switching system. It handles 256 I/O channels linked to a

(Continued on page 217)

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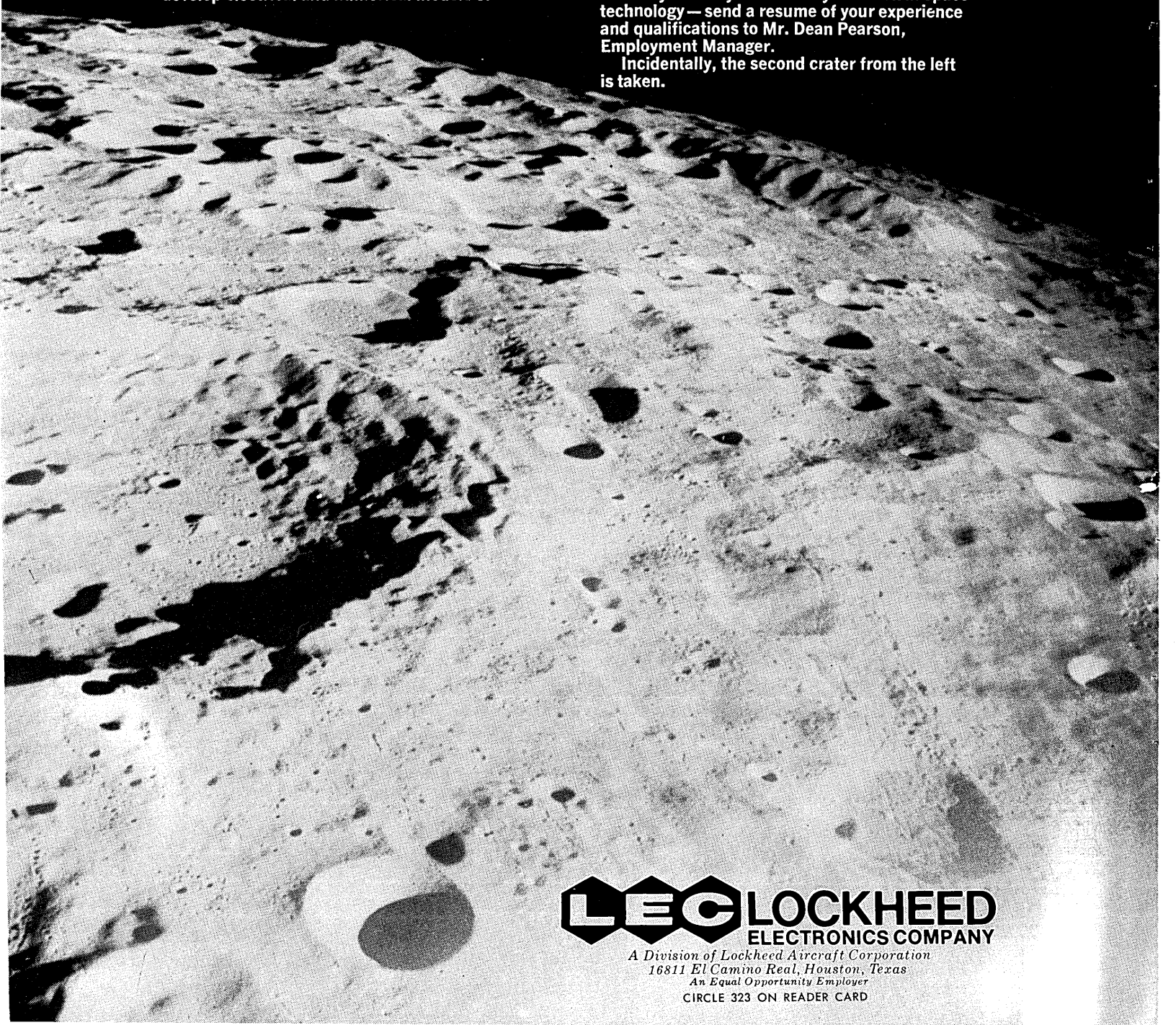

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"variety" of terminals (crts, teletypes, etc). Core storage ranges from 4-64K; memory transfer capability is by bit, character, or word. Other features are multi-level interrupt capability and independent block transfer in each channel.

KETTELLE TO SELL TURNKEY PREPROCESSOR

A communications preprocessor is also coming out of the new Terminal Support Systems Division of the John D. Kettelle Company, Greenwich, Connecticut. The system, developed by ex-IBM time-sharing software designer Andy Kinslow, is for direct attachment to a System 360 multiplexer channel. A major feature of the $50K-85K system is that it comes with software operable under OS/360, including interface and direct access method and an assembler—making it a turnkey system. The model has communications adapters for line speeds ranging from 75 to 2400 bps, thus accommodating a variety of terminals. It will handle eight to 40 lines and produce a transfer rate of 40K cps over the multiplexer channel.

A specially wired Interdata 3 computer with a tailored instruction set for multiplexing and 8K-65K core make up the mainframe.

GENERAL RESEARCH METAMORPHOSIS YIELDS NEW NAME, MEN, PRODUCT

GR Industries, Inc., neé General Research, Inc., Newton, Mass., has taken on a new president and a new vp mkts., to help move its new product, a control-oriented 16-bit computer. Called a "new generation" machine—maybe because GR wants to be one up on the 4th generation when it gets here—the 32K device will offer users a choice of implementing much-used functions through hardware tailoring or through software. Designed by Sol Denman, one-time "RCA Engr. of the Year" for his development of the RCA 110, the Sycon I (for "systems controller") will sport a new kind of architecture, and GR spokesmen will be very close-mouthed about the design until patent protection is assured.

New personnel include pres. and chief exec., Samuel Ochlis, ex-vp of Infotech, and vp mktg., Win Stone, ex-vp Brogan Associates. They'll head up a new, appropriately named Sycon Div.

ISS BEGINS DRIVE ON IBM DISC MARKET

Information Storage Systems has moved to Cupertino, Cal., will shortly announce a disc drive which will be plug-plug compatible with the IBM 2841 control unit, data compatible with the 2311. Features include an average access time of 35 msec (less than half that of the 2311), and 15-sec startup time. Improved reliability should result from using electronics to replace many mechanical functions. Deliveries will begin this year. The new unit is the first of a family. Best bet for the next member: a 2314-compatible device.

RUMORS AND RAW RANDOM DATA

Programmatics' Dave Ferguson says his firm has over 1000 inquiries on its PI SORT package, has signed 27 customers...We hear IBM is considering removing software overhead from peripherals...Thorny rumors continue on whether Viatron can produce the cheapie ($39/mo.) terminal for its crt/data recording system, who will supply it, when first system will appear. But Viatron's lips are sealed for 90 days after it hits the stock market (OTC) in late Feb.

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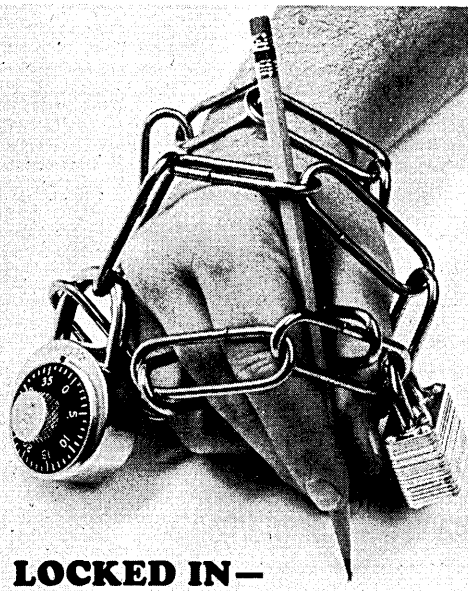

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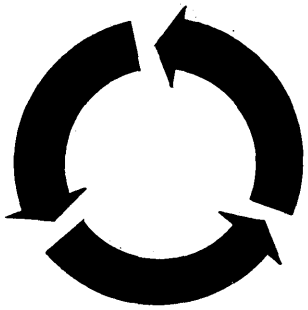

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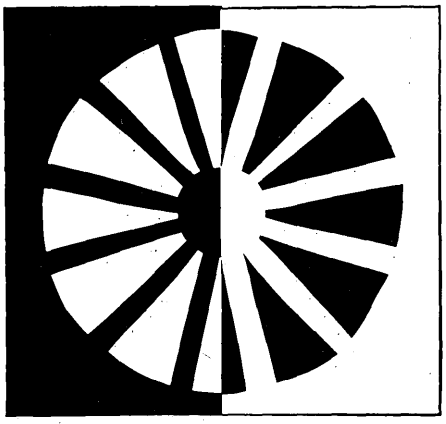

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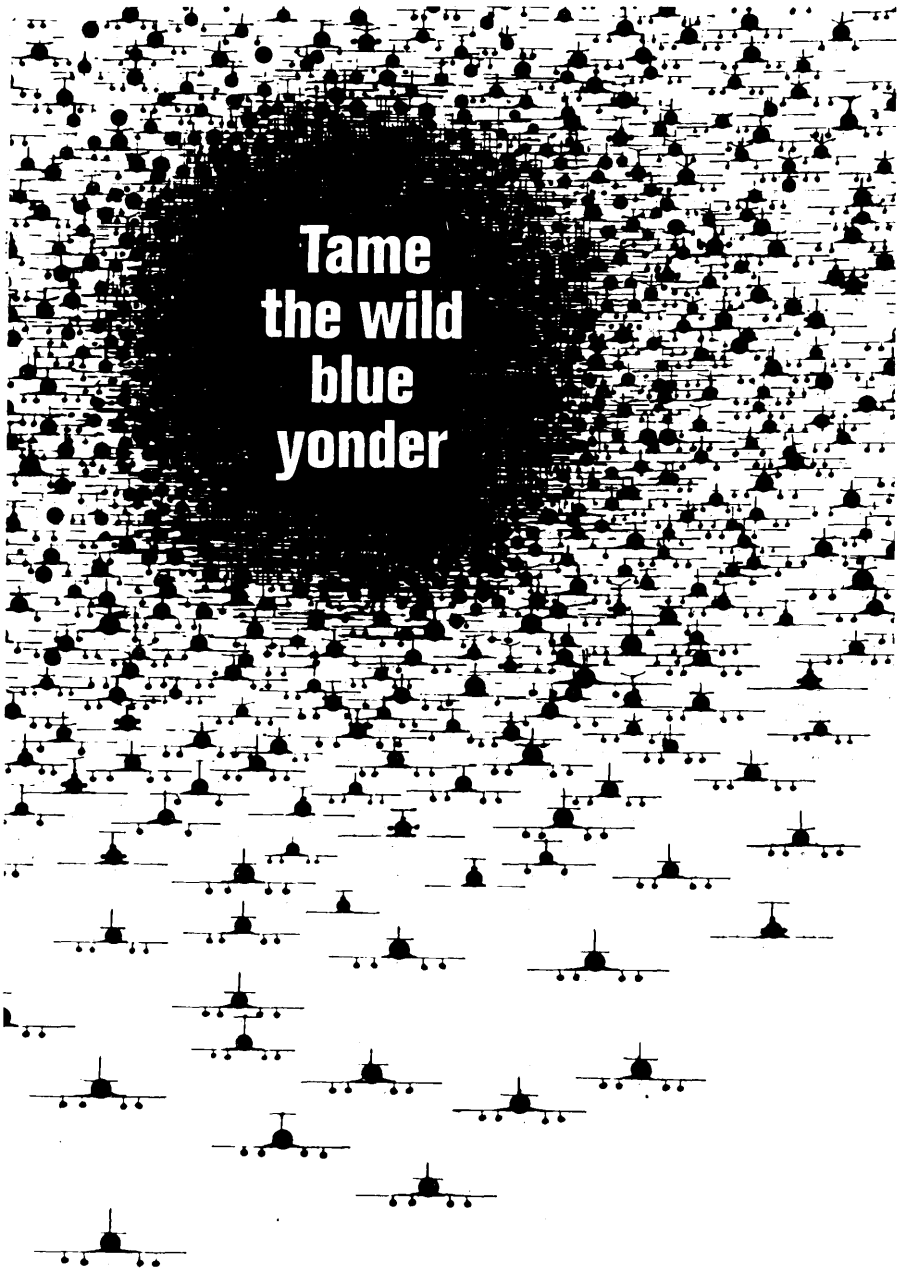

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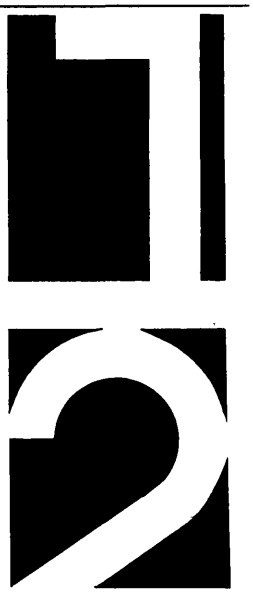

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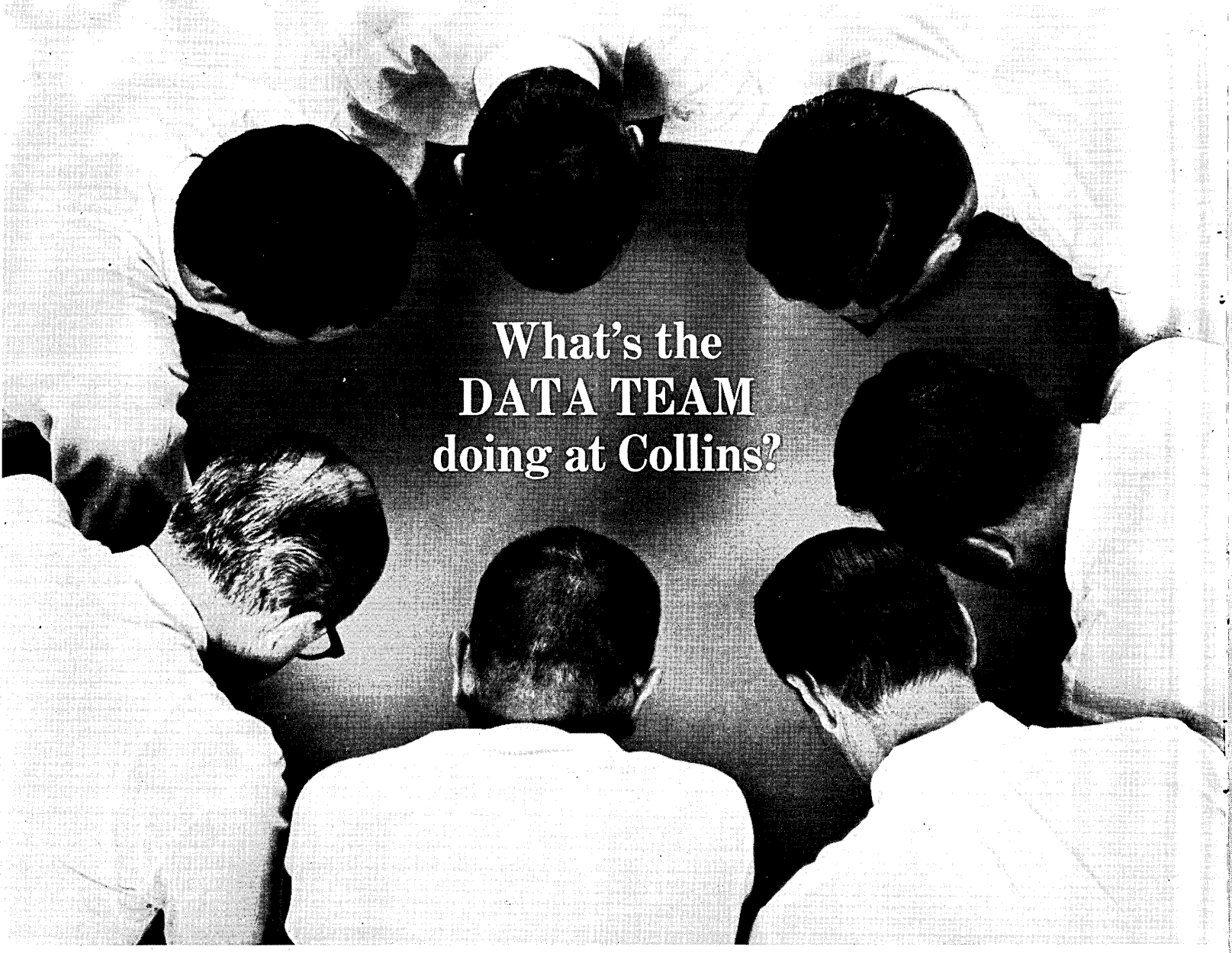

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the forum

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

OLD PROGRAMMERS MUST NEVER DIE

How many times do you recall seeing discussions in the literature concerning the number of computer installations that have failed or have not lived up to expectations? How many times have you heard from the same few internal-industry critics some astronomical figure representing the number of installations that have indeed failed? I hesitate to recall how many times I have considered these same critics "charlatans" and "half-truth mongers." For they could never offer any verification of the figures that they were quoting, nor for that matter could anyone offer facts to dispute these same figures. Let us assume for the moment that there exists some degree of truth in these assertions. At least let us say it is reasonable to assume that no installation operates at its fullest efficiency. Where then shall the blame be placed?

The arts and crafts of current data processing are excessively complex. The individual pursuing a professional career in today's information processing industry is as different from his second-generation counterpart as an astronaut is from a B-52 pilot. Definitions normally associated with third- and second-generation data processing are totally artificial. The differences between these generations are not in the components used to create the generations, but rather in the techniques required to employ these components.

To further aid my forthcoming hypothesis, let me offer the following definitions. The first-generation programmer is one who has had less than 10 years' direct experience in programming. A second-generation programmer is one who has had between 10 and 15 years' programming experience and a third-generation programmer is one who has had over 15 years' experience.

I assert, therefore, that data processing computer installation failures or "semi-successes" are primarily caused by using first-generation programmers for second generation programmers' jobs, second-generation programmers for third-generation programmers' jobs, and third-generation programmers (and second and first as well) for systems analysts' jobs. What we have done in our two decades of existence is to:

1. Deprecate the term "programmer" and
2. Confuse the functions of programmer and systems analyst.

Thus, in our current environment, no one wants to be an old programmer. How many old programmers do you know? We have created a system whereby young programmers with demonstrated talents are prematurely converted into mediocre managers and systems analysts. A microscopic analysis of any current programming group would disclose the untalented, the inexperienced and those talented neophytes waiting for promotion.

If we were able to conduct an in-depth analysis of programming groups across the country we would find a shocking similarity. Our journeymen programmers with a technical background that would allow them to flourish in today's complex technical environment are no longer directly involved in technical decision making.

In today's multiprogrammed, time-shared, telecommunicated, operating systemed world relative neophytes are responsible for major systems implementations on huge expensive equipment. Whether our current tools are satisfactory is not the question. If there is any blame for unsuccessful installations I suggest that we first determine how satisfactory are the users of these tools.

I recently visited an installation of a multidivisional, multimillion-dollar corporation. It had centralized all of its programming and machine operations. Every single new application that was being implemented had assigned to it a programming group whose average experience was two years. Each manager of these programming groups had been a programmer with transistorized or vacuum-tubed tools and the attitude was that they will meet their deadlines and have something running no matter how hard their 200 programmers and IBM SE's had to work. Yet how responsible to the functional capabilities of the new equipment will these new systems be? How wasteful will these programs be, and how many times will that company's management be repaying for these same programming systems?

As in most problems, the solution to this one is simple. The implementation of this solution, however, may be a bit complex. First, those corporations employing programming departments should revise their policies to enable programmer growth, that is to say, establish a wage earning potential commensurate with technical accomplishments. It should not be at all outrageous to pay a senior programmer $30,000 a year, or, for that matter, in some cases $50,000.

Consider for a moment the cost for one minute of computer time wasted daily over a year's time, for each daily run. Such a revised policy would then enable an individual to remain in a technical position without having to leave in order to gain greater financial reward. It would also enable those good programmers of bygone days who were cajoled or pressured into taking other jobs to return to their technical trade.

Second, these same companies should carefully observe the increasingly large number of new programming companies that are being started. Not banks or insurance companies or airlines or department stores, or any application-type, but programming houses. Besides the obvious ease of establishing such companies, the main reasons for starting them can be turned to a corporate entity's advantage. These reasons are greater financial reward and the ability to work on "differ-

ent" jobs. I suggest that it is an undue hardship to allow your own programmers to start a business without you.

Having suggested a solution for the problem of developing and keeping programmer talent, there remains the problem of the systems analyst. To the best of my knowledge a systems analyst is either an old programmer who is a lousy manager or an old systems analyst who is a lousy programmer. In any case, "systems analysts" seems to be a catch-all for those who have outgrown the programming trade. As a programmer, he was concerned with building systems, and as a systems analyst he is concerned with designing systems.

What bothers me is how we fell into such a nonsensical trap. A programmer is and must be a good designer as well as an implementor. These indeed are the basic capabilities of his profession. Yet to separate them for the sake of artificial specialization is a tragic blunder. The design and implementation of computer systems is programming. Promoting a programmer to a systems analyst is a corporate technique which most often inhibits technical growth and ultimately provides a product of lesser desirability.

To be sure, there are activities both valuable and necessary that can be performed in the area of analyzing systems. What I propose is that these activities, whatever they may be, not be confused with those required to develop bigger and better programming staffs. This situation seems to be quite analogous to the legal profession which recently learned that those disciplines required for a lawyer differ from those required for a judge. Thus, to elevate a lawyer to the position of a judge is relatively foolhardy as the change requires crossing functional lines. They are now establishing two separate types of schools: one for lawyers and one for judges. It seems that as a new industry we could profit from such a wise maneuver by not cutting the programmer in two and making one half of him a builder and the other half a designer.

Bring the old programmers back from oblivion, remove the opprobrium associated with their title and let us attempt to create a profession of "programming statesmen" for all our sakes.

—HOWARD BROMBERG

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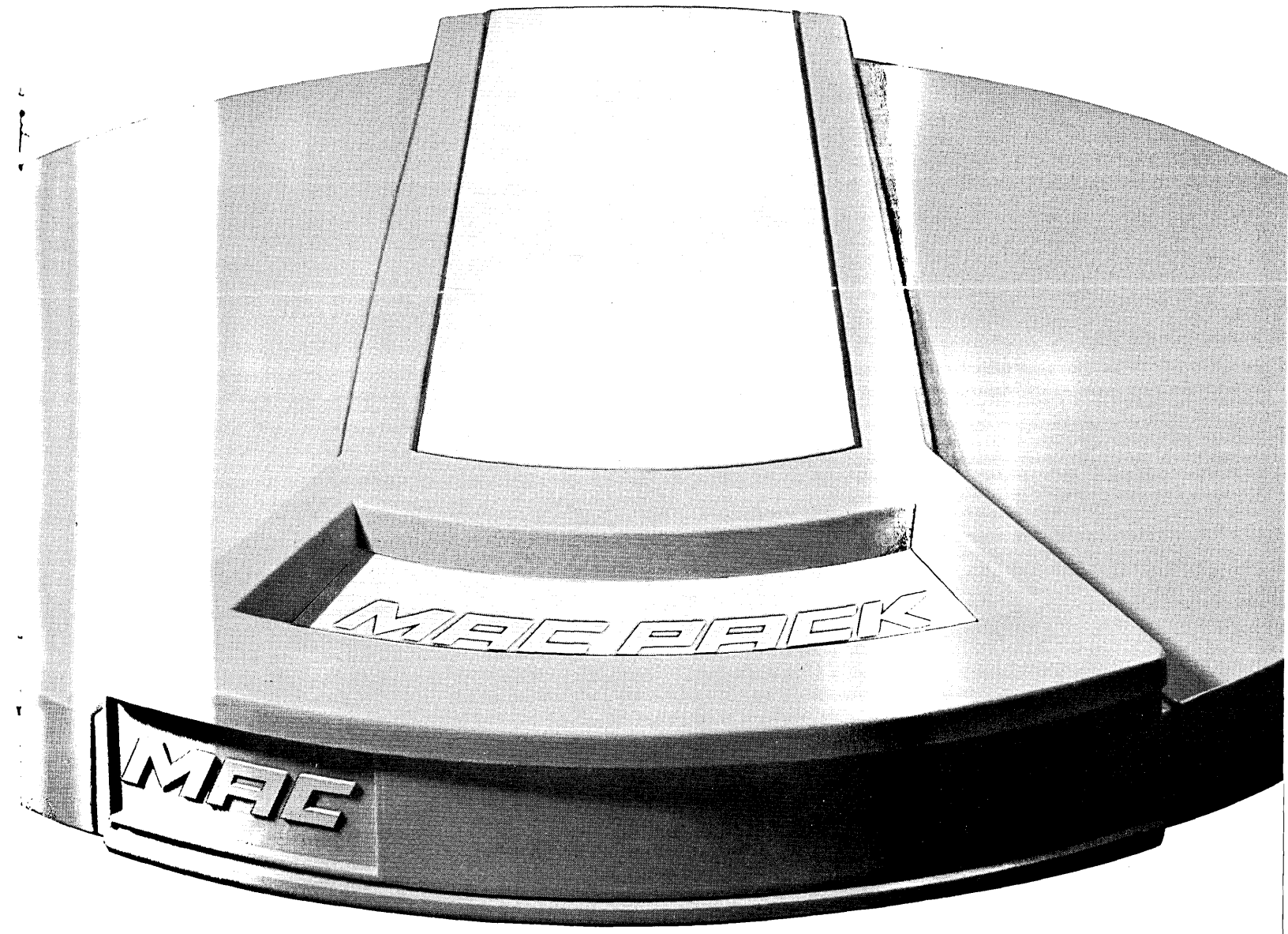

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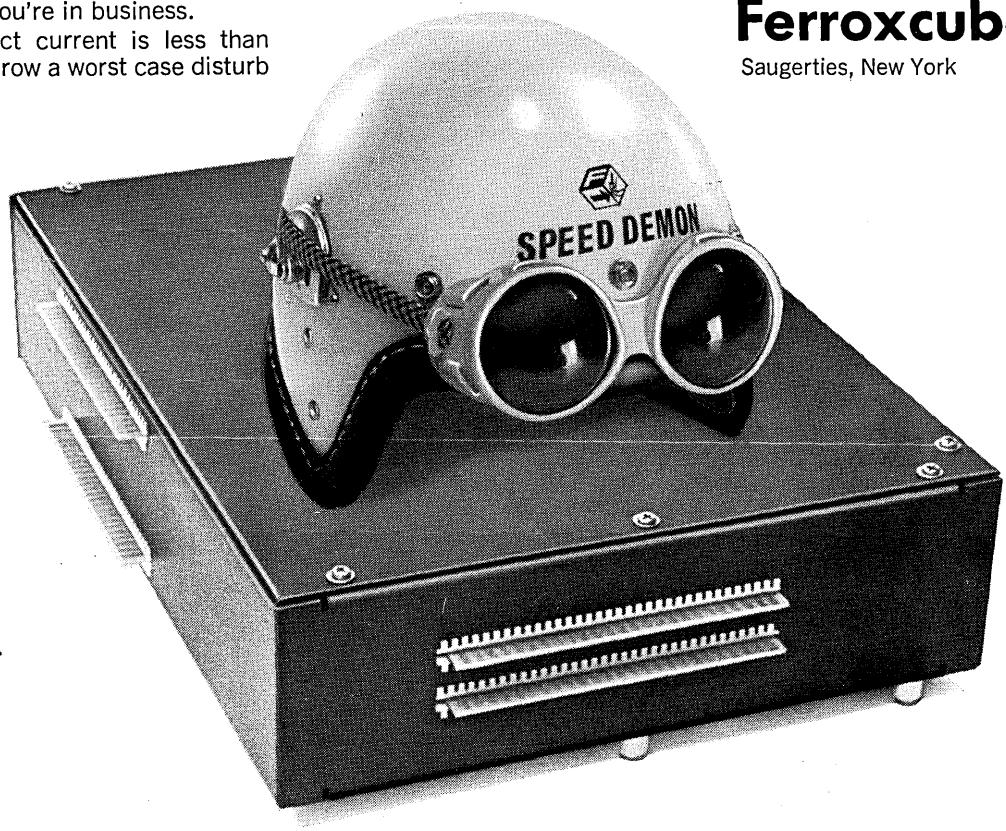

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