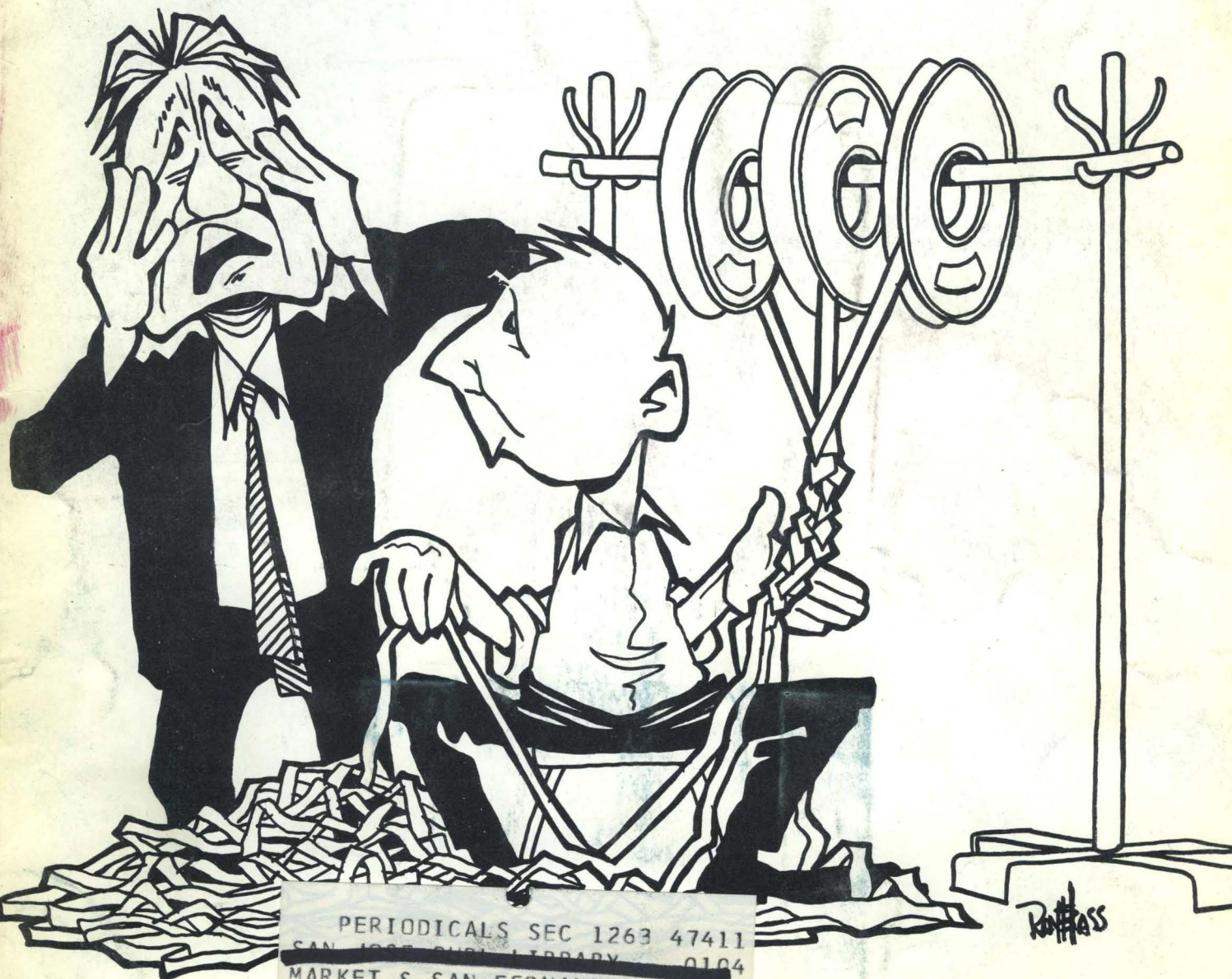


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computers and automation

Computer Installations: Experiences and Lessons



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COMPUTERS AND AUTO-
MATION
JULY, 1967

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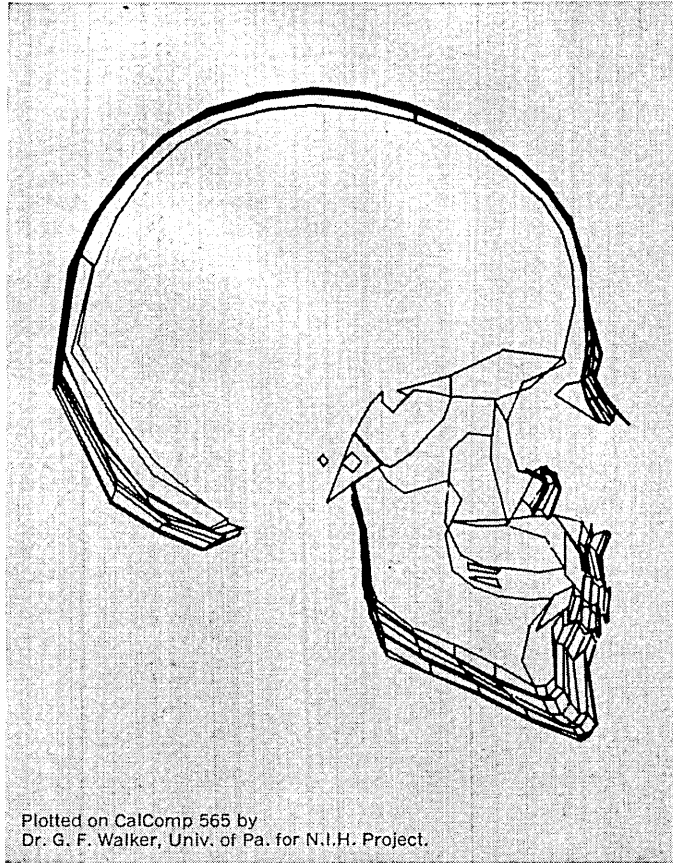
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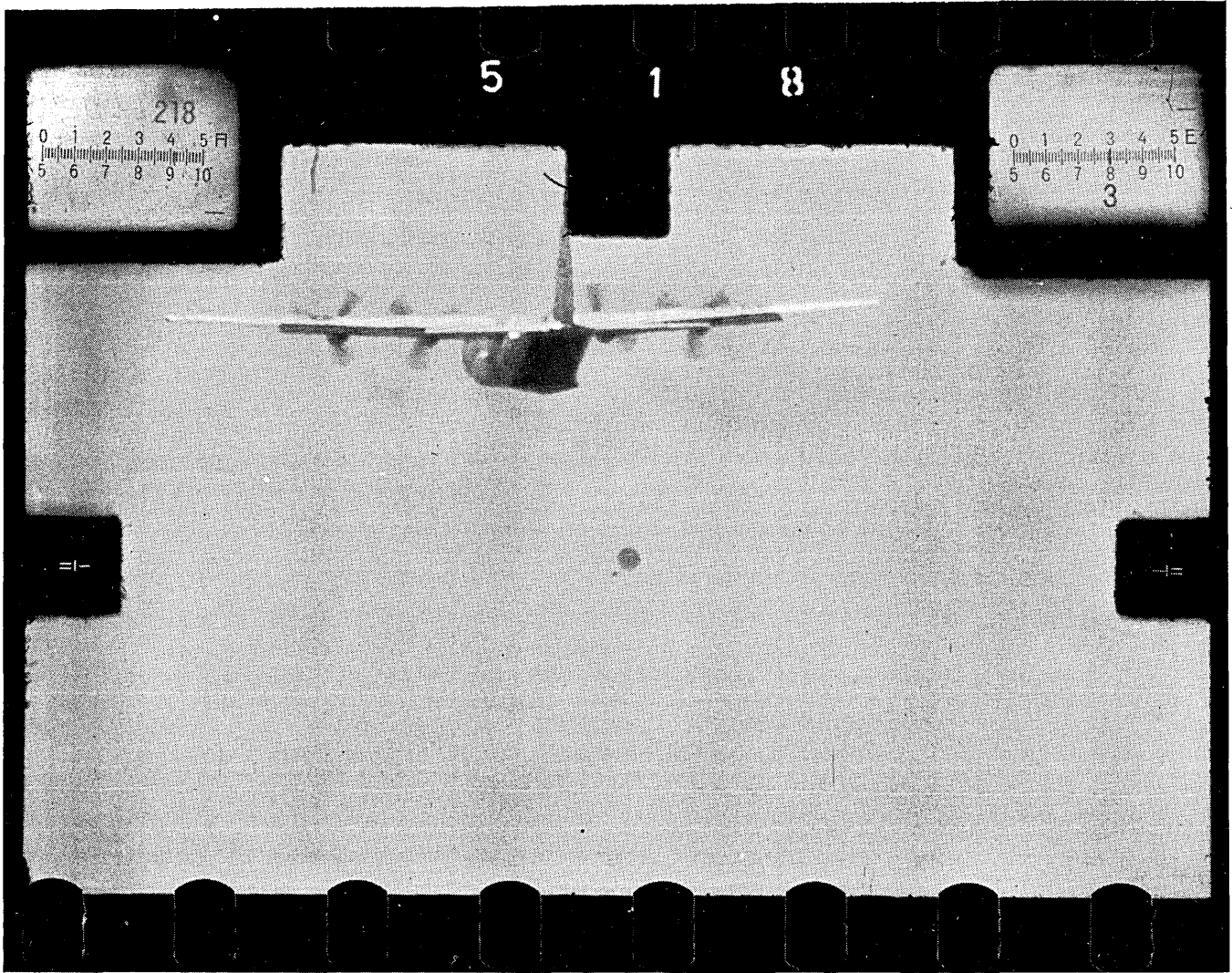
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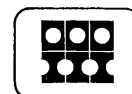
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computers and automation

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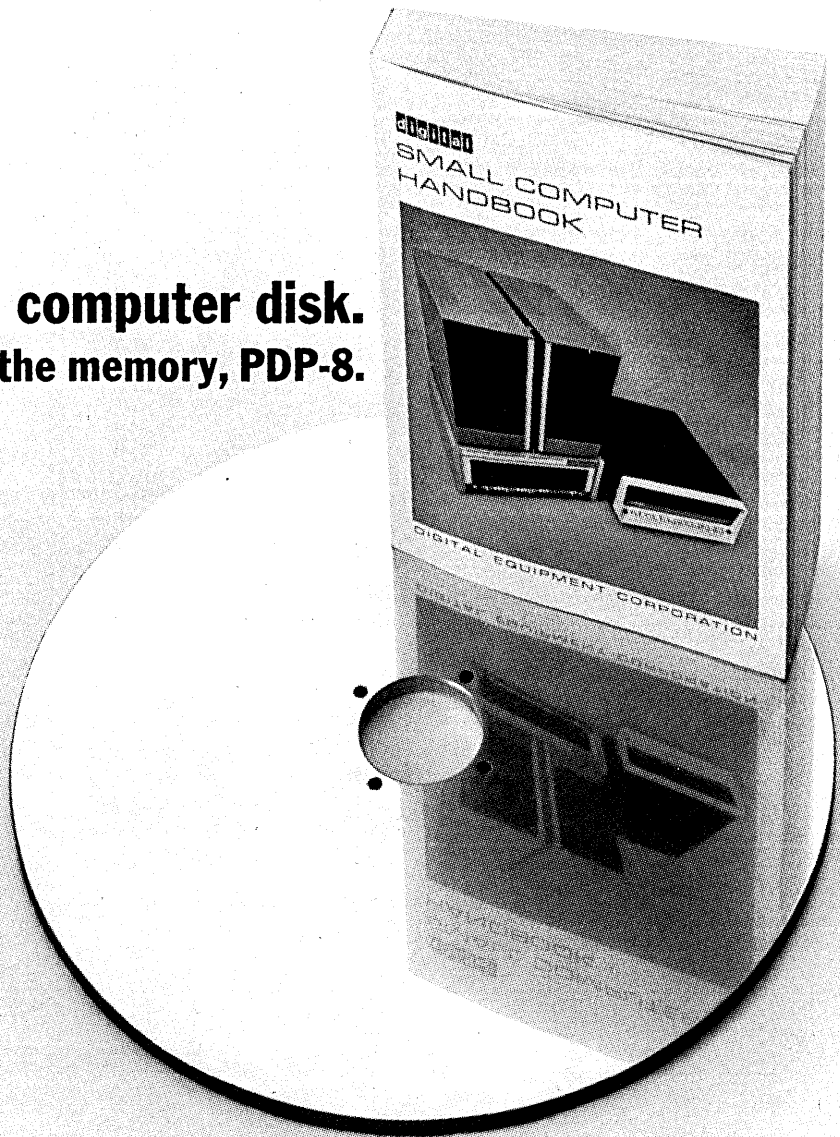
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MODULES • COMPUTERS

Tabu, Loaded Words, and Computer Applications

In another part of this issue appears Roundup I of responses on the dialog "Computers and Some Moral Questions", which was begun in our March issue by a ballot and an editorial. (For those who did not see this, the editorial and the ballot are reprinted at the back of this issue.) In Roundup I a good deal of pro and con has been argued, and we shall have more to say about the substance of the argument at a later time.

Two aspects of the argument are, however, so important to this dialog (and to the discussion of many other questions) that they need to be clarified here. We shall call these aspects the issues of TABU and LOADED WORDS.

One of the principles of tabu is that (for various anthropological reasons differing from one society to another) some subjects must not be questioned or discussed at all, and other subjects must only be discussed in accordance with certain approved procedures or accepted attitudes (or rituals). The enforcement of tabus enrolls a fair portion of society, including official force exercised by the government, the courts, and the police, and unofficial force including social discriminations, blacklisting, and extra-legal actions — and the voluntary conformity of "What will people think?" The word "tabu" comes from the Tonga Islands in the South Pacific, and means "a system or act of setting things apart as sacred or cursed."

One of the ways in which the principle of tabu shows itself clearly in some modern societies is in the doctrine that if a man is outstanding in one field such as astronomy, or relativity, or nuclear physics, or civil rights, and then engages in public discussion in another field, a controversial one, such as politics or military affairs, many voices are at once raised saying:

- "He is not qualified for discussing this subject."
- "He has done a disservice to the cause of . . ."
- "He should mind his own business."
- "It is inappropriate for him to discuss this."

Such statements are the functioning of tabus. Clearly, a man who has distinguished himself in one field by substantial intellectual achievements, is *more* likely and not less likely to be able to apply his intellectual abilities in other fields, including political questions. Certainly, his views are likely to be as important as polls of public opinion that include many ignorant people as well as some informed ones. Whatever his views, they should be judged on their merits, and not by invoking tabu.

In fact, in every society there is always a struggle between contending groups, and the stronger group quickly tries to take to itself the exclusive right to discuss controversial subjects on its own terms. It quickly invokes tabu.

To say that a relevant subject should not be discussed, that so and so is not entitled to talk about it, that such and such a magazine should not discuss a relevant subject in its pages — is to invoke tabu. This position is basically unsound, and is illogical for intelligent and educated people to take. Clearly, we have to turn the searchlights of scientific inquiry and free discussion on all topics relevant to a subject without exception. To conform instead with the principle of tabu is not rational.

In a computer field magazine it makes sense to discuss all kinds of applications of computers, with a judicious and sensible allocation of space: applications to business; applications to management; applications to science; applications to engineering; applications to privacy, dictatorship, war, arms control, peace, democracy, moral questions, and so on. A judicious and sensible allocation of space should not imply the complete elimination of a relevant topic.

The basic principle of LOADED WORDS is that if, when you are arguing, you use words with the right kind of emotional overtones, you can call forth emotions in your audience whereby they will like what you want them to like and hate what you want them to hate. In the United States today we can all think of epithets that are used to try to convert arguments into rabble-raising, and thinking into nonthinking.

In fact, we often find three grades of words for human characteristics and actions:

<i>Favorable</i>	<i>Neutral</i>	<i>Unfavorable</i>
• firm, resolute	determined	obstinate, stubborn, pigheaded
• liberate, borrow	take without permission	steal, purloin

Today in most of the world, we live in societies which increasingly try to control the flow of public information. This control is mainly in the hands of governments and establishments. So one of the techniques we need to learn early in life and do largely learn is to translate arguments from loaded words into neutral ones.

To say that an argument about anything is expressed in loaded words, does not dispose of the argument. What we need to do is to translate the argument into words that are as neutral as we can manage, and then consider its meaning and judge its worth.

As we have said before and will say many times again, the basic profession of the computer person, the data processing manager, the systems analyst, and all the other essential occupations developing in the field of computers and data processing is:

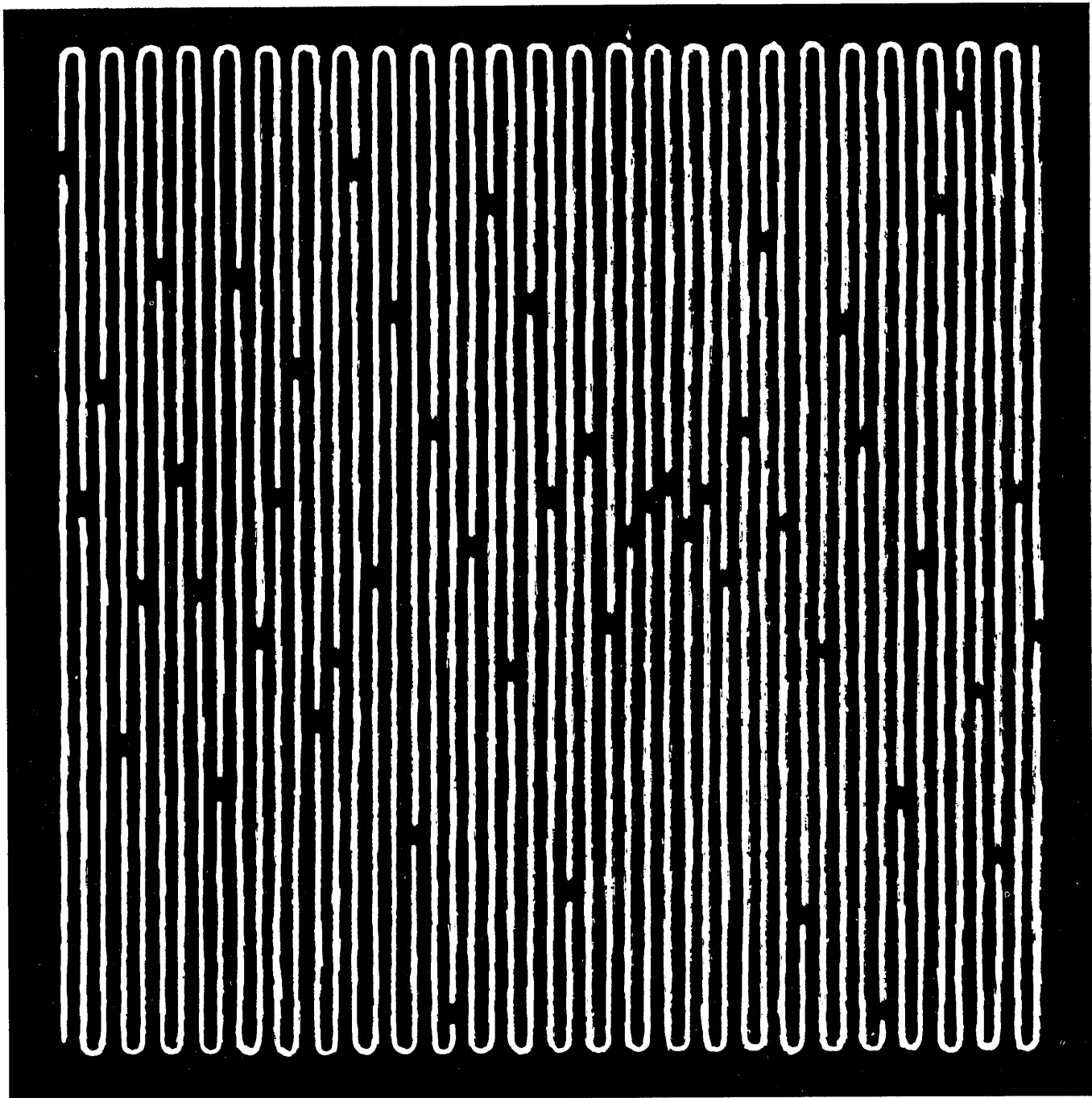
INFORMATION ENGINEERING

The responsibilities of the information engineer include the professional responsibilities of any engineer, and also include some special social responsibilities besides, because of the crucial importance of reliable information for the good of society and for real progress, world-wide.

These professional responsibilities include not being taken in or deceived by the logical fallacies of tabu and loaded words.

Edmund C. Bershteyn

Editor



**Just a few little bumps
can make a
magnetic tape a dropout.**

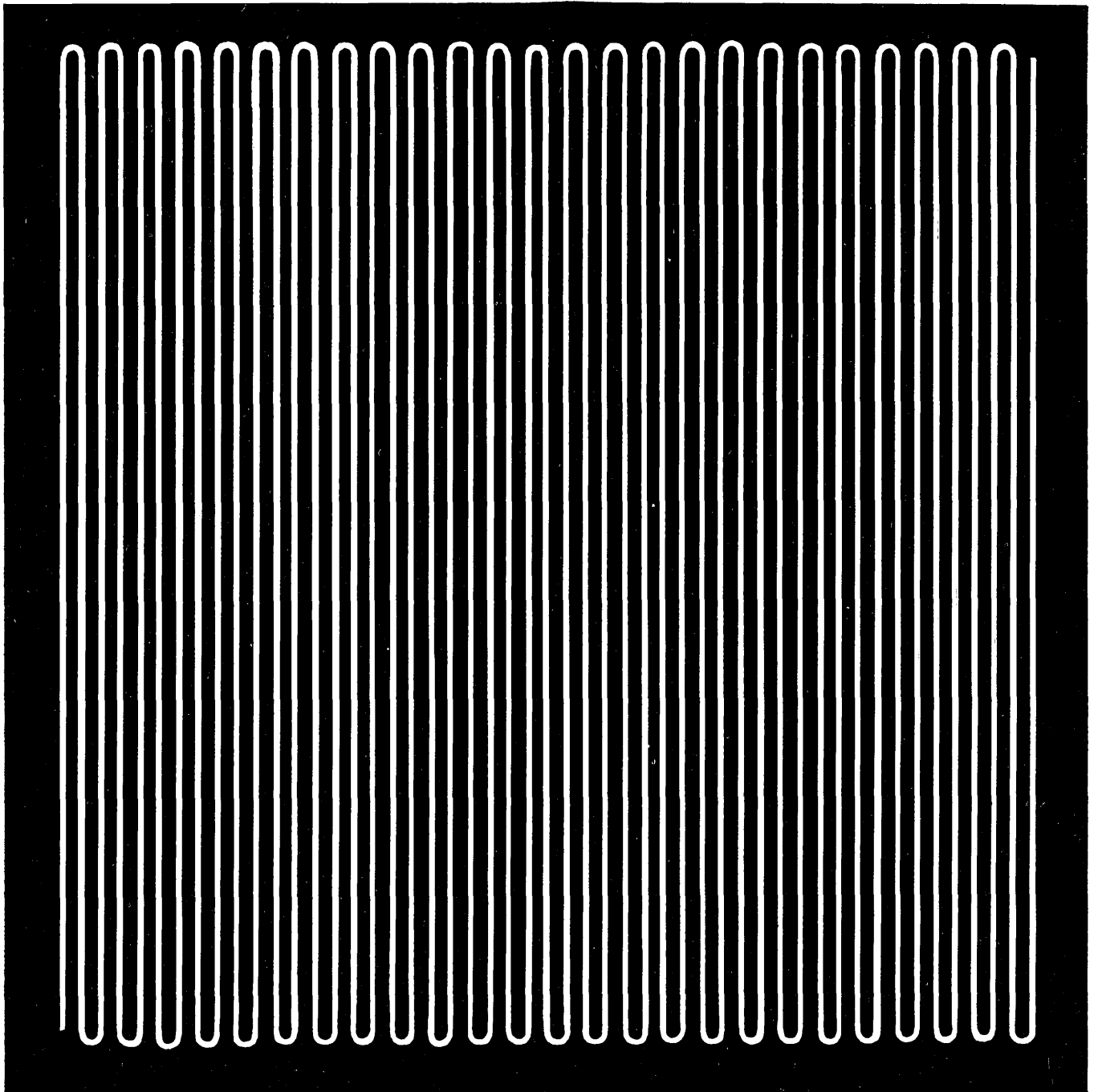
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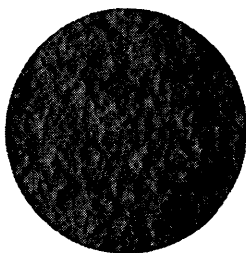
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MULTI-ACCESS FORUM

SOVIET AUTOMATION FOR FARMS

Warren Peter
The Calgary Herald
Calgary, Alberta, Canada

One of the recent English-language publications available from the Foreign languages publishing house in Moscow is a book entitled *Automation Serves Man*, by A. Merkulov.

One interesting chapter is devoted to automatic machines in crop and livestock farming on Soviet farms. The section on tractors controlled by feeler devices (which follows) provides an interesting insight into the scientific principles practiced by professional agriculturists there:

A tractor moves across a field. The shares of a heavy five-bottom plough turn over the rich soil of the Kazakhstan virgin lands. At the edge of the field the tractor turns by itself. Yes, by itself, for there is no driver in the cab; the levers are there, but there is nobody to manipulate them. The tractor is controlled by automatic governors which have better "sense organs" than man and react faster than the human brain. They can work in fog, rain, or storm. Nor is the impenetrable darkness of the night an obstacle to them. Such human failings as overstrain, sudden illness, or irresistible sleepiness are alien to these machines. They are always on the alert.

The devices and appliances have been designed by Ivan Loginov, a tractor driver from the Irtyshsky Grain State Farm, Pavlodar region.

"It is not so easy to shift the levers of a tractor all day long," says Mr. Loginov. "I had an idea one day of turning the tractor into a self-propelled machine. At first

I decided to solve a much simpler problem, that of replacing levers by push-button control. I designed a control panel with buttons for starting and stopping the tractor, turning it right and left and accelerating it. The controls were hydraulically operated, which made my work much easier."

"A little later I solved another, more complicated problem. I designed a feeler device, which made it possible to fully automate the control of the tractor. The automated tractor began to work on its own. The feeler mechanism moves in front of the tractor guiding it along a furrow. If the furrow turns aside, the feeler guiding does the same and closes the contacts. A servomotor brings the tractor back on its course parallel to the furrow, after which it continues straight on.

"Two drivers, one at each end of the field, can operate several tractors. The main requirement is to cut the first furrow and then direct the feeler wheel along this furrow. All the tractor drivers have to do is to turn the machines as they approach the edge of the field.

"In sowing and harvesting, the feeler device can be replaced by remote control of the tractor from the trailed combine or drill.

"The power driving the tractor engine is also remote-controlled. An automatic controller keeps watch over the lubrication system. A special automatic device stops the tractor if there is any danger of collision," Mr. Loginov concludes.

"TIME SHARING, BATCH PROCESSING, AND DIRECT ACCESS" — COMMENTS

I. From B. A. M. Moon, Director
University of Canterbury
Christchurch, 1, New Zealand

Thank you for the copy of *Computers and Automation* for April 1967 which I just received. I read the editorial with great interest. It makes good sense to me.

II. From John R. Sollberger
Somerset, N.J.

I have read with a great deal of interest your editorial and Mr. Moon's letter about time sharing (*Computers and Automation*, April, 1967).

I feel that the real potential of time-shared computers still seems to be overlooked. Computer development has two distinct aspects:

1. Technological advances have shrunk the physical size of the machines, have substantially decreased the investment (in terms of utility), and have boosted device reliability to a high (but not terminal level), which has resulted in ever larger installations.
2. These factors have shrunk the size and price of computers available a decade ago to a level where unit record installations are becoming uneconomical and small computers with sophisticated I/O routines are taking their place.

To date, I/O routines have not been able to keep pace with the calculating capacity of the central processing unit. Therefore, satellite operations to bundle input and output to use the central processor efficiently have developed. This is obviously not a true time-sharing concept.

Information dissemination today is so rapid and of such enormous bulk that good assimilation by decision-makers is hardly any longer possible. A different approach for data handling on the decision level is needed. The technology,

hardware and software, to provide decision-makers with remote consoles in the office is increasingly available.

It is easy to visualize a business environment where data evolution is continuous, resulting in automatically produced "health barometer" summaries, which place emphasis on not yet accomplished goals rather than on static measurements. This environment gives the engineer access to the central processing unit by a remote installation (including plotters) to suit his needs.

"Direct access" describes this concept a little more clearly than "time sharing," which really only implies technical sophistication of clustered computing for simultaneous processing.

Almost certainly there will always be a need for batch processing to handle jobs such as investigative procedures, program development, certain educational needs, and record restoration from accidental destruction.

But I would tend to disagree with your statement that "the pendulum of that fashion (time sharing) has swung too far." If anything it has not swung far enough because of an approach which is too centered around the individual rather than taking into account the elements of communal well-being. The tool is available; let us not be unwilling to use it.

368 CANDIDATES RECEIVE CERTIFICATE IN DATA PROCESSING

R. Calvin Elliott
Data Processing Management Association
505 Busse Highway
Park Ridge, Ill. 60068

The sixth annual examination for the "Certificate in Data Processing" (CDP) was given at 64 university test centers throughout the United States and Canada in February. Of 646 candidates who sat for the comprehensive three-hour examination, a total of 368 received passing scores and have been awarded the Certificate in Data Processing.

The CDP examination has been given annually at accredited universities, in the U.S. and Canada, since 1962. To date, more than 7600 candidates have been awarded the Certificate, which is generally regarded as a high measure of knowledge of data processing concepts and technology.

To qualify for the Certificate, a candidate must have successfully completed a prescribed course of academic study, have three years of work experience in data processing, and pass the CDP examination.

The general areas covered by the examination include:

- automatic data processing equipment;
- computer programming and software systems;
- data processing systems, concepts, design, and implementation; and
- quantitative methods.

"COMPUTERS AND SCIENTIFIC MODELS" — COMMENTS

I. From Clifford A. Woodbury, Jr.
Provident Mutual Life Ins. Co. of Philadelphia
Philadelphia, Pa.

In your May, 1967 editorial, "Computers and Scientific Models," the following sentence appears: "To believe 'what the scientists say' is perhaps not quite as dangerous as to believe what 'the computers say'."

I believe that those in cybernation want to avoid any statement that gives the impression that there is any basis for thinking that computers can do anything more than their human creators. All the computers can do is to perform a greater number of operations than humans can in a given time period. All the "thinking" that a computer can do is only what it is told to do by its programmer.

I hope no one would ever claim that programmers in general are any more accurate or any more moral in their thinking than scientists in general.

In spite of the above comment, I am grateful that the idea presented in the editorial received this publicity and I am very much in agreement with the entire essay.

II. From the Editor

Thank you for your comments. We are sending you a copy of the January, 1967 editorial, "LIES (Lying Invalidates Excellent Systems)," which you may not have seen, since it also refers to what "the computers say."

There is no doubt in my mind that computers can do much more "thinking" than their creators or programmers can; but this viewpoint may well be a difference between us in semantics rather than a real difference in our viewpoints.

INDEXING OF DATA PROCESSING LITERATURE: HOW SHALL IT BE DONE?

I. From Philip R. Bagley
University City Science Center
Philadelphia, Pa. 19104

This is to ask you, as editor of *Computers and Automation*, to consider an editorial addition to your publication which will eventually aid in the production of indexes to technical literature in the data processing field. The addition is that of printing index terms as part of each technical article. Such terms would: (1) serve as the basis for a centralized index file; and (2) aid a reader in deciding whether an article or paper might be of interest to him.

Index terms are defined here as *words* or *phrases* which characterize the subject matter of an article; and they should include proper names such as the names of systems, devices, and programs.

The first obvious question is: Who is to supply these indexing terms? Editors understandably are hesitant about such a chore; but research has shown that author-supplied indexing terms can generally be adequate. Some persons have suggested that index terms be chosen from a "standard" thesaurus; but author-indexers object to being constrained to a limited number of terms.

If a system of printing index terms in publications such as yours is to be implemented, it is up to editors to require the submission of index terms by an author just as they now frequently require an abstract. The editor would have to take some responsibility for seeing that adequate index terms are supplied. Terms that are too broad or too narrow should be revised.

It seems clear that of all fields, the field of data processing ought to put its own house in order by applying data processing techniques to the literature of the field. The inclusion of index terms as suggested should be a step in that direction.

The Defense Documentation Center has already accepted and put into practice the concept of author-supplied index

terms. They are now mandatory for all reports submitted under government contract. IEEE-TEC has just announced that it is instituting author-supplied index terms, but it is too early to have seen published examples.

Please give this matter your serious consideration.

II. From the Editor

Unquestionably there is a valid argument for a standardized system of indexing literature in the data processing field. But we are not certain that the method you propose would accomplish that.

Our objections to the system you outline are basically these: (1) It would be difficult and sometimes impossible to obtain author-supplied index terms. (2) We do provide capsule summaries in our Table of Contents and lead-in quotes for each article; these aid the reader in deciding quickly whether or not he wants to read a particular article; so publishing index terms at the beginning of an article would not be of particular value to us. (3) We do publish in each January issue an annual index which is thoroughly cross-referenced and which includes all information published in our magazine.

We refer you to the January, 1967, index as an example. It seems to us that a central indexing station that would utilize indexes such as we publish (and would survey the literature itself) could provide an index that contained considerably more meaningful and extensive information than could be obtained by the method you outline.

We invite your comments and comments from our readers.

ZIP CODES — THE BASE OF THE MODERN UNITED STATES POST OFFICE

I. From Mr. Ira Kapenstein
Information Service
Post Office Department
Washington, D.C. 20260

Much of the correspondence in scientific circles is prompted by articles printed in scientific journals with a notation giving the location of the author(s). In many instances, the listed addresses do not contain zip codes. The zip code system is the base upon which the modern Post Office Department is being built, and it is essential to the continued existence of adequate postal service.

Mail volume is rising at a spectacular rate; it has increased over 100 per cent in the past 20 years.

Your assistance in encouraging the use of zip code in addresses listed in your publication would be appreciated.

II. From the Editor

We shall do our best to publish zip codes in the addresses of all persons and organizations that we refer to in our pages. This data-processing innovation we fully support.

SOLDIER ANTICIPATES RETURN TO UNITED STATES; SEEKS JOB

I. From Donald C. Shumate
HHC 4th Transportation Command
APO 96307, San Francisco, Calif.

May I ask a favor of you? I hope it will not be too difficult to grant.

In three months, at the end of my present assignment in Vietnam, I will have completed my obligated two years of military service. I would like to begin looking for a civilian job now, but here in Vietnam we have no access to information re employment opportunities.

I would like to have a list of companies who employ engineers interested in applying computers to solve physical problems. Could you give me assistance by sending me a list of such firms located in the San Francisco area?

Your help would be appreciated.

II. From the Editor

Thank you for your letter.

Following is a list of several companies in the San Francisco area which we know of, and which might be interested in employing computer engineers:

Friden, Inc., 2350 Washington Ave., San Leandro, Calif. 94577
Hewlett-Packard, 1501 Page Mill Rd., Palo Alto, Calif. 94304
Memorex Corp., 1180 Shulman Ave., Santa Clara, Calif. 95052
Pacific Electro Magnetics Co. Inc., 942 Commercial St., Palo Alto, Calif. 94304

COMPUTER ASSOCIATION FORMED IN TAIWAN

Kenneth K. Fan
Utah State University
Logan, Utah 84321

The first computer association in Taiwan was formed in June, 1966, and has the name "The Chinese Society for Automation and Electronic Data Processing." The object of the association is to promote the study of the practical applications of Electronic Data Processing. The functions of the Society are:

1. To undertake the study of EDP, supplemented by seminars, group discussions, training classes, inspection tours, etc.
2. To assist public and private enterprises in the application of EDP.
3. To collect books, periodicals, and reference materials relative to EDP and make available to the interested public.
4. To publish a magazine quarterly and pocket books relative to EDP and Automation.

5. To keep in constant touch with the international development and application of EDP.
6. To discuss and translate terminology relative to EDP.

The use of computers in Taiwan is in its infancy, though several government-owned and private enterprises have computers including IBM 360, 1620, 1440, and Univac II. Before industry can be encouraged to utilize these computers, there must be a marked increase in trained programmers; and the general public needs to be informed of the operation and functions of computers.

The address of the society is:

c/o Prof. J. T. R. Liu
Taiwan Provincial Chung Hsing Univ.
Taipei, Taiwan, China

(Please turn to page 21)

c & a

PROBLEM CORNER

Walter Penney, C.D.P.
Problem Editor
Computers and Automation

Readers are invited to submit problems (and their solutions) for this column to: Problem Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

Problem 677: A Conversion Headache

Al's forehead had the typical corduroy appearance indicative of deep concentration when John Lawthorne came into the computing laboratory.

Al looked up from the piles of punched cards on the table. "Conversion is such a headache. These were punched with two columns for every symbol instead of the usual two holes in a column for alphabetical characters and one for numbers. Now we have to get the data in a form we can use."

John picked up one of the cards. "That shouldn't be too difficult; the alphabetical code seems to be the same only with the upper punch in the first column and the lower punch in the next."

"These are the ones I'm trying to straighten out," Al said, pointing to the largest pile. "These have only numerical data, and that blank for alphabetical data in front of every number is fouling things up. Look at this one, for example. It would come out 07060503, but it's actually 7653. Removing the zeros is proving to be a bigger job than I thought, and there are too many cards for repunching."

"Why don't you just arrange things so that only alternate columns are read?," John suggested.

"Well," replied Al, "sometimes the zeros are in even columns, and sometimes they are in odd columns. I've been trying to work out a formula for converting something like the 07060503 I showed you into 7653, but so far I haven't been able to figure it out."

John had been writing something on the back of a blank card. He handed it over to Al. "This should be what you're after. One FORTRAN statement could do the trick."

What did John write?

Solution to Problem 675 (May, 1967 issue of Computers and Automation):

The following formula will place 1's in the form of a Greek Cross in the nine center squares of a 7 x 7 array and 0's elsewhere:

$$F(I, J) = \frac{15}{(|I - 4| + 3)(|J - 4| + 3)}$$



PRODUCTION CONTROL FROM ORDER TO SHIPMENT – FOR COMPUTERS, BY COMPUTERS

*John D. Davis
Manager, Production Control
Systems Manufacturing Division
IBM Corp.
Endicott, N.Y.*

“Rapidly increasing production volume, inevitable alterations by customers during the manufacturing cycle, introduction of new products, and development of new systems of products in the future, all mean that any production control system must be complex yet flexible.”

Successful manufacture of any complex assembled product requires that a vast amount of information be recorded, transmitted, and updated, just to keep production going from day to day. No matter how simple the assembly may be, the information-handling job becomes complex when production control must span the full time from the moment the order is first placed to ultimate shipment — and must also include the necessary business data for management evaluation and planning. Computer-based production-control systems are therefore being more and more widely applied to improve manufacturing performance through faster, more accurate, and more economical information handling.

A particularly challenging industry for production control is computer manufacturing itself. This industry for many reasons, needs unusually tight control and at the same time presents many obstacles to achieving it.

The number of features available to a computer user has grown, making the ordering and production system complex; at International Business Machines Corporation the number of plants manufacturing computer equipment also has grown, further complicating the control problem.

Therefore, several years ago, a computer-based order and assembly system was designed at the Endicott, N.Y., Division to carry out the incredibly complicated information handling task that was building up. This system, first used to control IBM 1401 production, is now in full use in producing System/360 Model 30 central processing units (CPUs) at Endicott and in controlling production of input/output equipment, components and materials, both by other IBM plants and by independent suppliers. It has contributed substantially to reducing in-process time and to maintaining a rigorous delivery schedule

in manufacturing an entirely new and far more complex computer system.

Considerations in Planning

In planning the production control system, the Systems Engineering staff at Endicott faced some special manufacturing conditions that are common everywhere in the computer industry, others that resulted directly from IBM policy,

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and still other conditions that were simply demanded as matters of good business practice.

Here are some considerations they faced:

- A modern general-purpose computer, particularly one in the System/360 series, must be manufactured as a custom system to each customer's order. The large variety of I/O devices and special operating features available means that it is not economically feasible to maintain a finished machine inventory. Each Model 30 machine in the computer assembly line (as seen in the photograph) is markedly different from all the others.

- As in many other industries, the combination of incoming customer orders and outgoing CPU shipments causes peaks and valleys in the production load in final assembly. A method for leveling or smoothing work is then needed both to maintain a high productivity level in a constant work force and to insure meeting customer commitments.

- Endicott's production control procedures had to be extremely precise because of decentralized manufacturing and continual product improvement during production. The various boxes and components in a particular computer system are made in nine plants located throughout the United States.

- Another complexity in control is a concept that has been particularly effective in reducing the total in-process production time. Usually I/O equipment and other peripheral devices made at other plants are all shipped to the CPU production plant for testing together before shipment to the customer. In the manufacture of System/360 Model 30 computers, however, the CPU and other equipment are shipped independently to the customers' plant. Their compatibility in an operating computer system is tested separately through several new testing programs. Thus in all System/360 computers, the production control system must see to it that the CPU and all other units shipped separately from different plants arrive at the customer's location within the same calendar week.

Good Business Practice

The systems engineers responsible for developing the new production control system also had these programming goals which represent good business practice in any type of manufacture:

Low in-process CPU inventory. A low CPU inventory, of course, minimizes the investment in capital and space. In addition, the disrupting effect of constant engineering changes are minimized. The most

direct method of reducing CPU inventory is to start CPU production on the latest day which will safely meet customer commitments.

Easy adaptability to change. Rapidly increasing production volume, inevitable alterations by customers during the manufacturing cycle, introduction of new products, and development of new computer systems in the future all mean that any production control system must be flexible in both the scope of its influence and the detailed control criteria.

Better management information. The production control system should provide accurate, up-to-date information for both short-term and long-term management planning.

User orientation. The nature of information flow, format of report documents and control language should match the needs of the various groups involved in computer manufacture. No special knowledge of computer programming should be necessary for anyone using the system.

The Overall Production Control System

To fulfill these manufacturing objectives, the order and assembly system at

the Endicott plant has three basic functions: (1) order management, (2) information management, and (3) process management.

These three functions have been assigned separately to three interlocking production control subsystems — COSMOS, COP, and ACS. COSMOS (Computer Oriented System for Manufacturing Order Synthesis) automatically enters, audits, analyses, and controls customer equipment orders, primarily up to the point where production begins. COP (Customer Order Processing) first organizes and disseminates information (i.e., order changes, reschedules, cancellations, engineering changes) that varies the condition of an order before or after production begins. Secondly, COP stores and distributes statistical information for management control at all levels. ACS (Assembly Control System) controls assembly of the computer from the moment production begins to "field-merge" shipment to the customer. The COSMOS and ACS subsystems have been specifically designed to treat each customer order separately, while the COP system is capable of producing combined analytical data among all active customer orders.

The flow diagram in Figure 1 shows each of the three production control subsystems in relation both to the customer and to the many manufacturing departments and plants involved in producing his particular computer system. A few of the major production control reports prepared and printed out by computer are shown (the several reports that are shaded will be illustrated and described briefly below).

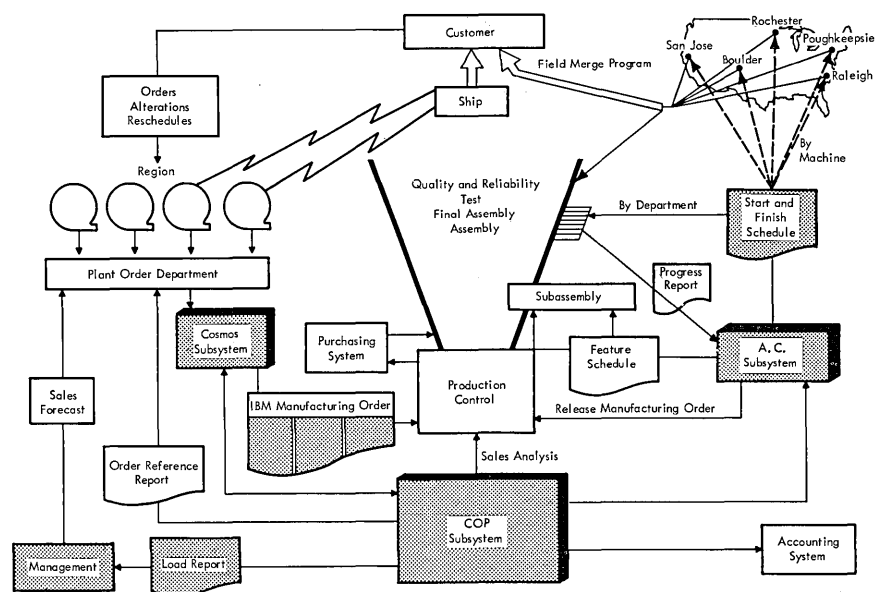


Figure 1: Flow diagram of overall production control system at Endicott.

Computer-Oriented System for Manufacturing Order Synthesis (COSMOS)

The major elements of the COSMOS subsystem are shown in the simplified flow diagram in Figure 2. COSMOS begins to function, as does the entire production control system, when a customer order is first entered at one of the 250 domestic IBM branch offices. All the special operating features and I/O devices for the particular computer system are recorded, together with the appropriate shipping date, and forwarded to one of four regional offices. There, the orders are put on magnetic tape and transmitted first to White Plains, New York, then to the Systems Manufacturing Division headquarters in Harrison, New York; finally System/360 Model 30 orders are sent to Endicott.

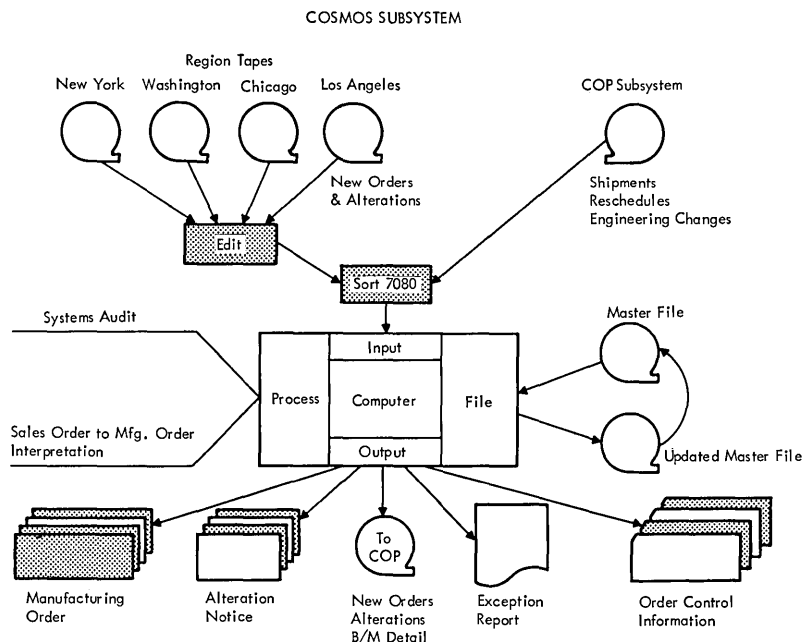


Figure 2: Flow diagram of COSMOS subsystem.

While computer orders were originally transmitted in handwritten form and later in machine-prepared paper documents, they are now sent to Endicott on reels of magnetic tape — in a form actually usable by a computer. Use of machine-readable magnetic tape as the primary form of input information contributes a great deal to the success of the production control system.

The major function of COSMOS is: to insure the accuracy of order information received on the tapes; to translate order detail into Bill-of-Material Codes; and to speed information flow throughout the production control system by taking over many information-handling tasks that otherwise would have to be done manually.

COSMOS's first job is to audit and analyze all the data previously recorded manually at the sales offices. The many different computer configurations and varieties of equipment which can be combined to fulfill a customer's special needs require that each customer order tape be analyzed to determine that the components recorded for the proposed system are mutually compatible and up-to-date. If the COSMOS audit of a customer order detects any incompatibility, an exception report is printed out and the information is wired to the regional office for action.

COSMOS then converts the Sales Manual feature codes to Bills of Material feature codes contained in the Machine Feature Index (MFI). The order is now in a form to allow parts planning, procuring, and building of the machine.

Flexibility

These two order preparation tasks of COSMOS must be flexible in order to account immediately for the frequent engineering changes (involving different MFI codes) and to react properly to further variations caused by new feature and product announcements. The necessary flexibility has been attained by basing the COSMOS system design on the application of externally controlled decision tables. A Systems Audit Table (SAT) checks for the completeness and validity of the order configuration, while an additional MFI table handles conversion of sales code data into Bills-of-Material. Clerical personnel can easily and quickly make changes in both the SAT

and MFI tables, without any special knowledge of computer programming.

Decision Tables

Experience has shown that the COSMOS decision tables provide substantially greater accuracy and permit clerical auditing personnel to concentrate on exception conditions. In addition, the use of decision tables in order control contributes substantially to shortening the order processing cycle time.

Once COSMOS has converted the order to feature Bills of Material, it is prepared to print out the detailed Manufacturing Order. The order print time is controlled by one of two methods: (1) control by a table using the shipping date as the trigger, or (2) control by a message received from ACS requesting that the Manufacturing Order be prepared. Until the order is printed, it is constantly updated on tape as alterations are received from the regions. After the order is printed, any subsequent alteration activity is printed out in the form of an Alteration Notice. COSMOS continues to track this activity until the order is shipped. The Manufacturing Order (shown in Figure 3) is the basic original production document which will follow the customer order through the plant. While COSMOS performs such other activities as providing backlog statistics on request, once the order is converted to feature Bills of Material, the COP and ACS subsystems take over.

Customer Order Processing (COP)

The COP subsystem is indicated in the flow diagram in Figure 3. This system encompasses much of the information flow between departments, plants and offices that is needed to keep the production control system in operation. The information handling functions of the COP subsystem are:

- (1) Receiving rescheduled orders from the sales regions and the Systems Manufacturing Division headquarters, through transceiver communications terminals, and updating customer orders.
- (2) Accumulating and printing out statistical information (such as number of orders of different types) for sales analysis, management and the Order Department.
- (3) Receiving and distributing production alterations, as the result of engineering changes or emergency revisions coming from data terminals in production.

COP SUBSYSTEM

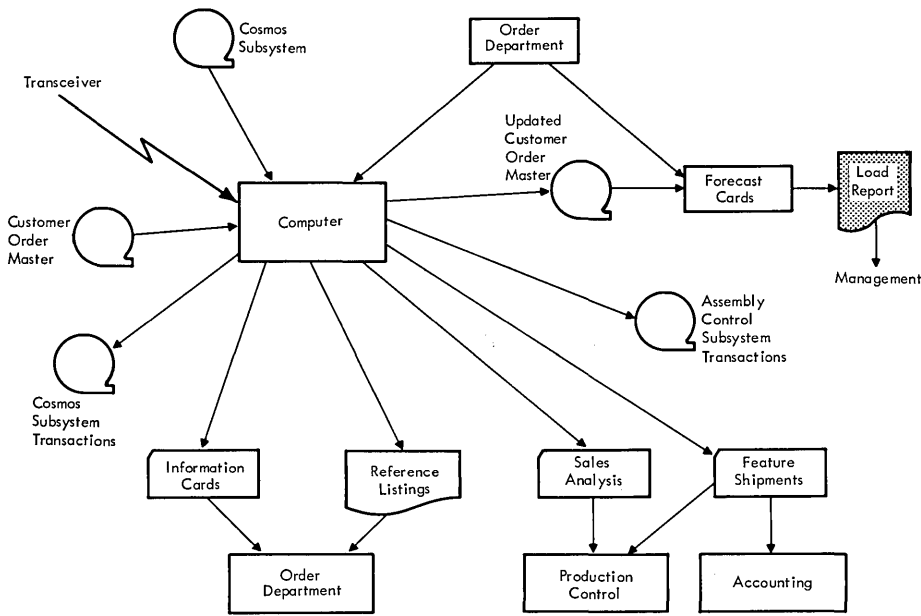


Figure 3: Flow diagram of COP subsystem.

- (4) Printing out activity reports, including complete order status reports once a month and exception reports daily.

One of the major reports produced regularly by the COP subsystem is the Load Report, which compares planned production ("Prod") with actual production ("Load") and tabulates the difference (plus or minus). The planned production listed in the Load Report is derived from the Master Shipping Schedule, which lists for a period of two years the projected quantities of various types of computer equipment and components that are planned for production at the plant. The Master Shipping Schedule is revised at regular intervals, as indicated by trends in order and shipment. The Load Report is useful to the Order Department in maintaining balanced-load against master schedule. The Load Report is also useful in reporting to the sales regions how their production loads compare with their order position.

COP data is also supplied indirectly in managing the Endicott Perpetual Inventory Control system. On the basis of the Master Shipping Schedule and COP data on short-term order and shipping status, it is possible to plan delivery of components and devices from other IBM plants and vendors from six to twelve months ahead.

Assembly Control System (ACS)

The ACS subsystem (Figure 4) can start the production process on a given customer order by triggering the COSMOS subsystem so that the Manufacturing Order is printed out in preparation for an upcoming start date. The primary

functions of ACS in controlling each production order are: to establish and maintain start and finish dates in each department at Endicott and at other IBM plants; and to feed the Requirements System, which sets up necessary shipping dates for components and materials from outside vendors. Starting and finishing dates for all operations in each department are printed out on the basis of the established shipping date, the specific process flow, and the known time needed for each operation. The

start date for the first department involved, as might be expected, is the trigger date for COSMOS to produce the Manufacturing Order.

One of the most critical production control functions of ACS is load leveling, which insures maximum productivity of personnel and equipment while maintaining planned shipping schedules. The ACS Master File is assigned an Original Start Date for each order. If needed to help level the production load, the ACS Master File also includes a Leveled Start Date, which for each order may be weeks earlier than the Original Start Date.

The ACS subsystem produces a Master Building Schedule which lists the quantities of CPUs and other products that must be produced in particular weeks to meet the Master Shipping Schedule. If there is an imbalance of the load indicated by the Master Building Schedule for any particular week, appropriate customer orders may be shifted to the Leveled Start Date in order to smooth out production. The selection of the optimum customer orders for shifting to Leveled Start Dates is done entirely within the ACS subsystem and printed out for review by the Order Department management.

During assembly and test of a computer, a corollary system insures that current engineering changes are incorporated and that all customer changes are added to the original order. This system, called Machine Level Control, also maintains a lifetime record of the status of each computer.

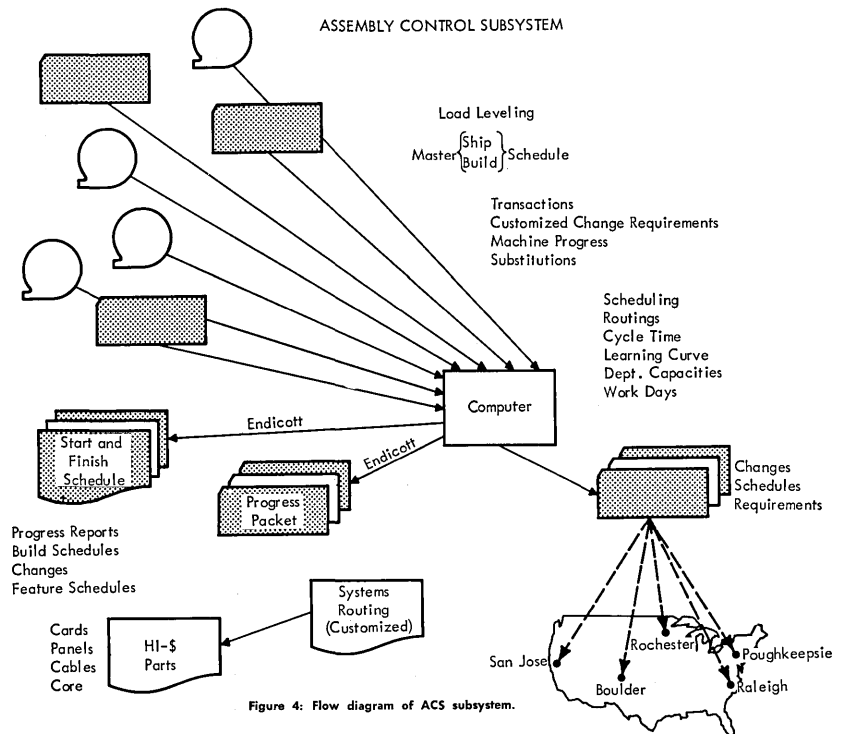


Figure 4: Flow diagram of ACS subsystem.

COMPUTERIZING THE MANUFACTURING COST SYSTEM IN A SMALL PRODUCTION SHOP

John P. Malloy
Modern Machine Works, Inc.
Cudahy, Wisc.

"Top management decided to plunge towards the heart of the information system — and its first computer application was the installation of a complex system for reporting manufacturing cost."

Much attention has been focused on the development of computers and computer applications for large manufacturing firms, but relatively little has been published concerning successful application of computers in small firms. This article describes the approach used and the results achieved when a firm with an annual sales volume of approximately \$2 million computerized significant portions of its information system.

A Non-Typical Approach

The typical approach used by most manufacturing firms when computerizing information systems is to convert payrolls, financial reports, and other relatively routine applications.

A very different approach was taken in the installation described here, where the first computer application was the installation of a complex system for reporting manufacturing cost. Top management in the firm decided to plunge towards the heart of the information system in this first installation in the belief that a larger and vital cost/profit improvement program could not be effected, unless "clean" cost data were available from the Manufacturing Cost System. The computerization of the information system was part of a four-year program for improvement of profits, and was aimed at rejuvenating a small, well-established firm which was suffering from lack of vitality and the erosion of assets and net worth.

The Firm

The firm supplies precision metal shafts for equipment for air conditioning, refrigeration, air compressors, internal combustion engines, pumps, and fans. It is forty years old, has a good reputation for quality and integrity, and is well established in its markets. The firm employs 135 people. It purchases forgings, castings, and bar stock. It produces finished precision products in lot sizes varying from fifty to five thousand pieces. It is a production shop as opposed to a job shop.

After a boom period during World War II, this firm was suffering from reduced productivity, inadequate marketing, and lack of valid, on-time, financial information. These factors helped set the stage for a near catastrophe for the corporation between 1959 and 1964. Sales volume dropped; losses accelerated; equipment was obsolete; and management effort was inadequate.

In the summer of 1964, a number of capable and tested managers and technicians for all levels in the firm were recruited. This group, combined with the best of the old, set for themselves the task of rebuilding the firm.

The Master Plan

An intensive survey of the corporation was made by a group of specialists from manufacturing, accounting, finance, marketing, and general management. From their reports a detailed five-year financial plan was formulated; and from this, long-range programs were developed in marketing, manufacturing, finance, and human relations.

An integral and key part of this effort involved the development of a new *management information system*. Study revealed that five major subsystems of the corporate information system were required: (1) A Financial Planning System; (2) A Marketing and Sales Information and Control System; (3) A Production Planning System; (4) A Production Scheduling and Operation Control System; and (5) An Accounting Information Feedback System.

Parts of these newly-planned systems were functioning and could be utilized. In general, however, an almost totally new system for each of the five subsystems was deemed necessary for good decision-making and improved operational control. The Manufacturing Cost Performance System was given the highest priority for development, installation and computerization. It was a subsystem of the Accounting Information Feedback System.

Why Choose the Manufacturing Cost Performance System?

There were several reasons for the high priority of the Manufacturing Cost Performance System: (1) The sales dollar contained a high direct labor component. Profits thus

Dr. John P. Malloy is President of Modern Machine Works, Inc., Cudahy, Wisconsin, and of Malloy and Associates, Inc., a management consulting firm. He is also Professor of Industrial Management (on leave) at Marquette University, Milwaukee, Wisconsin.

were quite sensitive to changes in labor costs. (2) A significant and rapid improvement in shop productivity was needed because of the competitive markets served. Working capital needs required faster shipments and improved profits, and the rate of inventory turnover had to be accelerated. (3) The existing actual cost system was highly unreliable because of the relative lack of coverage of measured day work. Substantial errors also were introduced into cost and financial data by the existing timekeeping system. (4) The price structure of the firm was hazarded by the unreliability of the existing factory cost system. (5) The development and initiation of other systems would depend on the validity of data generated for or by the Manufacturing Cost Performance System. (6) Substantial groundwork already had been laid for the required work measurement system and for the new cost system. Valid work standards obviously are an important part of any Manufacturing Cost System.

System Development

After the decision was made to install the Manufacturing Cost Performance System, it was determined that there were six important steps in the program:

1. The development of additional standards for estimated work for a day, to be used wherever incentive standards were not yet available.
2. A totally new timekeeping system aimed at taking the handling of time cards entirely from the hands of the worker.
3. The development of a punched card input/output document format for the Manufacturing Cost System, and for subsidiary output reports which would be derived from the basic data generated by the Manufacturing Cost Report (i.e., man costs, job costs, machine costs, and material costs).
4. Initiation of the programming necessary to computerize the system.
5. Orientation and training of all management and production workers affected.
6. Translation of all instructions and practices in the system into written standard practices.

Timekeeping

One it was determined that a computer would be needed, a survey was made of the card volume, and the time needed to key punch and verify cards was established. A review was then made of computer time available on a rental basis, and it was decided to program the system for a 1401 IBM computer.

Because of the peculiar demands of the timekeeping system, a Manufacturing Control Center was constructed on the shop floor. It contains the dispatching and timekeeping functions and the daily production scheduling information center.

Included in the system was the Universal Time Punch — a job-cost time recorder that punches start and stop time in a standard 80-column tab card. In this application, each employee is punched in and out by the timekeeper. The Key Punch was used to add certain other variable data. After each employee is punched out, the piece count is added and personally verified by the operator. In effect, the basic data for the Manufacturing Cost Performance System is completed and verified and no further key punching is required.

A separate data preparation center was also established. It contains the remaining hardware as well as files, work area, etc. In this center, master routings are key punched and other data for a variety of computer applications are prepared and verified.

Control Reports

Approximately six months were required to complete the installation of the system. However, during the year which followed, there was a continuous upgrading and additional sophistication of the system. In the second six-month period the shop payroll was computerized as were various other systems including all monthly corporate financial reports.

Computer runs are made once a week. The total computer time used for the following information is approximately two hours. The reports prepared include:

1. **Individual Earnings Register.** This report itemizes all jobs which each productive operator works on during the pay period. Ninety-eight percent of all direct labor jobs have either an engineered incentive standard or a measured day work standard. Individual operator efficiency on each job and his total pay period performance is computed. A distribution of all non-productive time is itemized.
2. **Departmental Labor Control Report.** This report summarizes the performance of each operator in each department. It supplies the distribution of operators' time according to elapsed hours, direct labor, indirect labor, percent of time measured, operator efficiency while working on incentive and on day work, the sales dollars produced, and the dollar portion of this which was productive labor and which was set up labor. It also gives the dollar distribution of the remainder of the productive operator's time in four accounts: indirect, unearned guarantee; non-productive work; rework; and non-standard work. The dollar volume of scrap produced is also summarized.
3. **Factory Labor Control Report.** This report provides a department-by-department cost summary of the entire factory including the indirect departments (tool room, inspection, maintenance, etc.). It includes: total elapsed hours paid to members of the work force for the weekly pay period; the measured hours; labor dollars produced; departmental efficiency; both incentive and measured day work; the distribution of payroll; and the dollar value of scrap by operator and by department. This report also summarizes the total variable labor cost for each pay period. Total value of labor sales produced and shipped provide the corporate inventory positions at the conclusion of each weekly pay period.
4. **Manufacturing Engineering Profit Report.** This report summarizes productivity according to those parts which are assigned as the profit responsibility of each manufacturing engineer.
5. **Actual Cost Performance by Part and by Customer.** When a production lot is closed, a summary of the cost performance by part is available to management (including the sales engineer). Periodically, these data can be summarized by customer to examine cost performance for a particular part by lot or by manufacturing process.
6. **Machine Utilization Report.** Quarterly time cards can be processed and the actual time utilization and productivity results on each machine tool can be determined. Such data are utilized in: (a) evaluating production capacity, down time, and machine efficiency; (b) purchasing new equipment and evaluating effectiveness of maintenance; and (c) verifying and up-dating the machine hour rate schedule.
7. **Individual Performance Record.** Once each quarter a summary of the performance of each operator can be made. This includes his productivity for the entire period on incentive and measured work day. In addition it reveals how much time he has spent on indirect

operations (such things as machine repair, clean up, etc.), on unearned guarantee (that portion of his paycheck which is paid to him but which he has not earned because he worked below the minimum work standard at a day work pace), and the dollar value of scrap charged to him.

How Management Uses Information

Information gathering is only part of the management process. The crucial test is whether the manager can make things happen which will improve the profitability of the unit under his direction and responsibility. Good information will not make a firm better unless the management team and the work force change their behavior appropriately.

Accordingly, a comprehensive effort for orientation and communication was initiated. The various facets of the program included: (1) Top Management; (2) Middle and First Line Supervision; (3) Operator Performance; (4) Union; (5) Sales and Customers; and (6) Long-Range Financial Planning.

1. **Top Management.** Clear understanding of the impact of changing factory productivity (in a detailed way) on the profit and loss statement is imperative. To achieve this it is necessary that an effective manufacturing operating statement be generated. It should have an appropriate group of accounts tied directly to the Manufacturing Cost Performance Report. Thus, the weekly, daily and even hourly performance of direct labor and its impact on variable cost must be clearly visible and understood. This manufacturing operation statement should also include appropriate detailing of all fixed and variable costs under the responsibility of manufacturing. It is helpful if budgeted and/or targeted figures are a part of this report. An examination of variances can be made as these variances depart from the current corporate financial plan.

The great advantage of the computer-oriented information system (with appropriate and controlled input of clean information at the individual operation level) is that it clears away the communication "noise" that first line supervision and middle management often unknowingly or deliberately introduce in the communication channel to fog the view of top management. An additional portion of the reality that exists on the factory floor is thus revealed vividly. Fair but stable standards emerge to evaluate individual operators, foremen, process or manufacturing engineers, superintendents, plant manager and the Vice President of Manufacturing. Obviously these are not the only standards of performance which must be used to evaluate competence, but they are more valid, quantitative and impersonal performance criteria than are generally available to executives.

2. **Middle and First Line Supervision.** The data developed by the Manufacturing Performance Report introduces a hard task master for the first line supervisor. The great advantage, however, is that the foreman (or his supervisor) can trace directly to the individual operator or the job inferior or superior performance. Strategy can be developed and plans formulated to eliminate deficiencies of the operator, the operation (process), or inadequate tooling or machine tools.
3. **Operator Performance.** The Earnings Register, which is a byproduct of developing the paycheck of the operator and is a step in the development of the Cost Performance Report, supplies each operator with a clearly spelled out record as regards how his paycheck

was computed. It gives him a clear picture of his "profit" contribution. He can then compare his performance with others and with the department as a whole. Needless to say, the capable person likes this. The incapable detests it. A successful and profitable company can only be built on the output of the capable person, however.

4. **Union.** Where there is a good work measurement program and a comprehensive cost information system, the management has available a powerful tool to reveal to the bargaining unit the productivity of its individual members. Wage increases only can be given (over the long run) where either productivity increases or prices are increased. Where price increases alone are available to pay wage increases, it is not unusual for a firm to eventually lose its competitive position. Thus, the firm will find itself in serious financial straits. The latter will mean the loss of security, jobs and future wage increases.

Needless to say, the proper communication of these data to the Bargaining Committee and Union members requires an effective communication program. The latter can only be built where management has integrity and the people choose to believe the information provided.

5. **Sales and Customers.** An important by-product of an efficient Manufacturing Cost Performance Reporting system is the help provided in developing a rational price structure. Further, industrial customers are interested in developing long term relationships with suppliers. Customer Purchasing Agents, Design Engineers and other on their management and technical staff develop confidence in a supplier when they see and believe that a vendor has a highly effective cost reporting system such as the one described here.
6. **Long Range Financial Planning.** Lastly, the output of a well developed Manufacturing Cost Performance System supplies the variable cost information needed to help generate detailed long range pro forma financial plans. Profit and Loss Reports and resulting Balance Sheets can be predicated on certain assumptions which become detailed targets for operating supervision. As the firm moves through time the projected financial reports can be adjusted to give a flexible and more realistic guide to the future.

Results

The system described above in its general configuration has been operational for approximately eighteen months. What have the results been? Without describing in detail the financial benefits (which have been substantial) the following can be said:

1. The company has moved from a loss to a profit position.
2. The breakeven point of the firm has been lowered significantly.
3. Additional productive capacity has been discovered.
4. A significant change in sales strategy has evolved. The company has increased confidence — it knows what business it should get and what it doesn't want.
5. By combining these data with a monthly financial review with the management team, a substantially greater awareness of, and concern for, profits has been developed at all levels of the management team. Of particular significance is the increased awareness of the detailed role of productivity (and reduced variable labor costs) in lowering or raising profits.
6. A heightened sense of importance of the contribution (or lack of it) of each operator has been developed.

The people in the shop have become keenly aware that they are closely measured. To reinforce this and to force recognition by a supervisor of his strong and weak producers, each foreman is required to submit the names of his three highest producers and his three lowest producers each week. These data play an important role in all merit reviews, opportunities to progress to higher skill classifications, and for advancement to management training positions.

7. The manufacturing engineers have developed productivity performance consciousness of the parts for which they are responsible. Thus, both the line and staff people work towards cost reduction and profit improvement.
8. A significant increase in labor utilization by the productive departments has resulted (i.e., there has been a much greater effort by line supervisors to avoid charges to non-productive and indirect accounts).
9. The labor force has become increasingly aware of the need for increased individual and group productivity if favorable wage settlements are to be achieved in labor contract negotiations.

Summary

The approach taken by a small production shop producing precision metal shafts to computerize their factory cost system has been described. It should be added that, with experience and data gained in this first installation, the management team proceeded to install a computer-oriented production planning and production scheduling system. The benefits gained from the cost system have been extended and enlarged as these two new systems have become fully operational.

FORUM

(Continued from page 13)

IFIP TECHNICAL COMMITTEE ACTIVITIES

International Federation for Information Processing IFIP Congress Office

23 Dorset Square
London, N.W. 1, England

Tech. Comm. 1 — Terminology:

A new working group is being established under the chairmanship of Mr. I. Gould of the United Kingdom to revise and prepare a second edition of the English language vocabulary of data processing terms. Translations of the vocabulary are also now being prepared in Dutch, German, Hebrew, Norwegian, and Spanish.

Tech. Comm. 2 — Programming Languages:

This committee organized a conference on simulation languages in Oslo, Norway, in May. Twenty papers were presented, and a series of panel sessions were held.

Tech. Comm. 3 — Education:

An international training seminar lasting six months and sponsored by the IFIP Technical Committee on Education is being held in London beginning this summer. The purpose of the seminar is to train graduates so that they may return to their respective countries as competent instructors and teachers in electronic data processing techniques.

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COMPUTER INSTALLATIONS:

EXPERIENCES AND LESSONS

— SOME PERSONAL NOTES

Sheldon J. Dansiger
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EDP Associates Inc.
New York, N.Y. 10017

“Early in my experience, I first took note of the fact that the programming department and the operations department interacted in a manner roughly equivalent to the way that cattlemen and sheepherders got along in the Old West.”

In the course of a nine-year career in EDP consulting work, I have had the opportunity too observe a rather large number of computer installations from an intimate vantage point.

I remember one installation that had a computer operator on the midnight shift who also played a cello in a string quartet. He would play until 11:30 P.M.; then, cello in hand, depart for work at the computer. There, in the stock room on his lunch hour, he would again play the cello because, as he said, “My lunch hour is 3:45 A.M. — what else can I do?” One night the computer went down. The customer engineer (repairman) arrived at four in the morning, sleepy-eyed as one might expect. He went to hang up his coat in the stock room, and moments later came running out, wide-eyed, screaming, “Quick — Tell me — Is there someone playing a cello in there?” To this day, I wonder what would have happened if I had said there wasn’t.

Early in my experience, I first took note of the fact that the programming department and the operations department interacted in a manner roughly equivalent to the way that cattlemen and sheepherders got along in the Old West. Generally, the programmers are convinced the operators perform with malice aforethought, while the operators are certain the programmers are charlatans who are just on the edge of public exposure of fraud.

Since this alienation seemed to be peculiar to the general nature of EDP types, I began to wonder (a) what caused this situation, and (b) what, if anything, could be done about it.

After much deliberation, I realized the cause of friction could be best summed up as the principle of Difference of Dedication.

The programmer is working on one, two, or at most three programs at any given time. Therefore, any given program is given a Dedication Ratio (DR) of about 33% by the programmer responsible for it. The operator on the other hand has to deal with at least 40 different programs which are run on his computer, thereby establishing a DR of approximately 2½% per program. The difference in dedication, at the outer limit, is thus over thirty per cent. Naturally, these figures vary, since the programmer’s ratio of dedication is drastically affected by such factors as Distance of Deadline (DD).

The operators DR has been known to be adversely affected by such factors as Turnover Time Approach (TTA) and the variation in the Sex Appeal of Programmer of Opposite Sex (SAPOS). Still, the DR’s remain wide apart under most circumstances.

Installations generally fall into two types: (a) those in which only operators can run the computer machine (i.e., the programmers submit all jobs with written operating instructions for the operator who is to run it); and (b) those in which programmers can come and go in the machine room freely, operating the computer if they wish. (This system is sometimes known as Every Man for Himself).

The second method of operation of course rules out such evils as favoritism by operators, based on their personal likes and dislikes; but it produces overcrowding in the machine room by dozens of programmers needing five minutes ("Well, maybe closer to ten minutes"), for their Cobol Compile and Modified Sort.

The first method eliminates the probability of having indistinguishable overflowing of test data, object decks, program listings, printed output and unlabeled tapes lying around. ("How could you not know it was my tape? It was clearly marked #343, 800 bits per inch?").

However, this method also brings with it a significant number of negative aspects. There is no known correlation between a programmer's technical ability and his ability to express himself clearly. In fact, there is a principle known as the Inverse Ratio Principle that is said to be applicable here.

At two o'clock in the morning, some operators have been known to falter under such wordage as "Run in deck, load tapes, after a few records, turn on switch C, no-op the printer, rewind output, and hit start a couple of times."

Method B; of course, has its own great advantages, one of the primary ones being the ability of the programmer to repair program patches on the spot. ("I am sure the patch will work this time.") One can also be present to leap swiftly into action should another program explode leaving available previously reserved periods of time for others (Every Man for Himself) to use.

It is said that this method of maximizing the machine's functions was the forerunner of certain sophisticated program control aspects of third generation computers. Disadvantages not previously mentioned include violation of existing fire laws, and the forcing of greater effort from the air-conditioning system.

It soon becomes obvious to a student of the problem that the solution lies in a blending of the two methods, perhaps along the following lines:

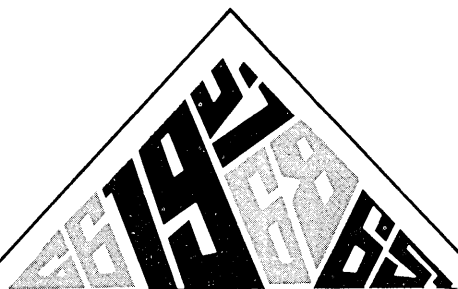
1. As a result of the comparatively swift turnover in personnel in the EDP field, it is reasonable to ask for fully documented running instructions for any completed program. However, the amount of forms needed for programs being debugged or production tested should be kept to a minimum.

2. It is important that the programmer should be present, in the computer room whenever his program is run — at least. He should be encouraged to be present and, at the same time, no other programmers should be allowed in the computer room. But this rule should be liberalized on off-hours and week-ends. Any programmer who is concerned enough about his program to show up at midnight or on a Sunday morning should be given every opportunity to test it.

3. Probably the greatest contribution that programmers could make is to tell the truth. If a consistent policy of scheduling what one really believes is necessary is followed, it will, in the long run, be of great benefit to a smoother operation. Distortion of needed time works in two directions. In a depersonalized system, where the operators run the computer, the tendency is for the programmer to grossly overestimate his needs. ("I need an hour; I'll schedule two; I'll think of something else to do.") Where the programmer is allowed to loiter in the computer room, the "only five minutes" story is by now a classic.

4. It should never be forgotten that in every week there are 40 hours of prime time and 128 hours of off-time available, and that any hour wasted (like sunlight) can never be recaptured.

If these suggestions are followed consistently (and they are really not that hard to conform to), relationships will improve, and, this in turn, will improve the overall operation.



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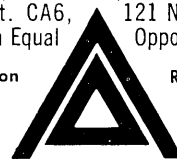
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THIRD GENERATION: HARDWARE OR FUNCTION?

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"The third-generation computer needs to include a number of important functions for real-time multi-use, most of which are independent — in an absolute sense — of the hardware used to implement them."

The three distinct generations through which digital computers have evolved in the last fifteen years are commonly described in terms of their hardware construction: first, vacuum tubes; next, transistors; and now, monolithic integrated circuits. However, a more meaningful distinction of the differences between computer generations can be made in terms of capability and organization rather than components used.

First Generation: Solving the Unsolvable

In these terms, the first computer generation was distinguished by its emphasis on computational capability — that is, by the fact that it could now handle problems in pure computation that were previously unsolvable in a practical sense. The emphasis on computation was also reflected in much numerical analysis and programmed error checking to make sure the computations were correct. Since most of these problems involved relatively little data, there was little emphasis on the input/output capability of the computer.

The Computer Structure Changes

With increased experience in the use of computers, their structure changed to meet new needs. Certainly, the second generation offered the higher speed and improved reliability made possible by new hardware such as semiconductors. The availability of lower cost logical and storage elements made possible simple, but independently operating, buffered input/output. These permitted the handling of large amounts of data associated with the problems being solved, without the significant loss of computation time experienced in first generation computers that lacked such buffering. Second-generation computers thus could do several different kinds of problems by completing one type and then switching to another type.

Now, the third generation of computers is here. It is characterized primarily by the ability to perform several jobs, of different types, concurrently and in real-time.

Thus, first-generation machines usually performed only a single type of job, primarily computational. Second-generation machines did several kinds of jobs, one at a time, automatically switching from one job to the next in sequence. Third-

generation machines do many different kinds of jobs concurrently, switching so rapidly from one to another that to the user it appears that all these jobs are taking place simultaneously.

Functions of the Third-Generation Computer

This kind of third-generation computer needs to include a number of important functions for real-time multi-use, most of which are independent — in an absolute sense — of the hardware used to implement them. For example, the computer requires high-speed input/output to deal with very high-speed secondary storage devices and other peripherals. In addition, because the computer will be servicing many users at the same time, it needs the ability to deal with many input/output requests concurrently.

To accomplish both of these functions, the computer must have an input/output system that is capable of handling both high-speed and concurrent input/output, one with many I/O channels, some of which have the capability of handling very high data rates. Moreover, to permit the high-speed computation, the input/output must proceed independently once the central processor has told it what to do.

In second-generation equipment, the input/output was buffered through only a single path to the memory. While computation was going on, only one kind of input/output could be proceeding at the same time. Input/output channels did not operate independently; they required a good deal of attention from the central processor. In third-generation machines, the channels can multiply through a single path or work through many paths to memory so that *several* high-speed input/output operations can be proceeding with simultaneous computation.

Context Switching

Working in a real-time, multi-use environment the computer must change from one user to another in order to accommodate all of them. It requires the ability to do rapid context switching; i.e., the changing of the working environment from one user to another without time-consuming overhead. Context switching involves the ability to store the current operating status information of the current user quickly

and easily and then to bring in the status of the next user. At the same time, the machine must save any interim computation results of the first user and then bring in any previous interim results of the new user. This context switching must be repeated for each user, and a positive method must be provided to protect the user and the system against destruction of data or improper access.

Real Time in a Multi-Use Situation

A third generation machine must also have quick response to the real-time situation, since that situation might involve a large number of users (all sharing the system in a conversational mode) or it might be a real-time process, such as data acquisition.

Just as in a single-use computer, real time is the most difficult case in a multi-use situation. To provide real-time capability in a multi-use application, a number of specific functions must be included in the design. These include a powerful priority interrupt system in which the hardware does much of the work to save programming. When an interrupt occurs, the computer must recognize what caused the interrupt and must examine the relative priorities to determine whether the current interrupt signal is as important as what the computer is already doing so it will know whether to interrupt the earlier process. In many second-generation computers, both of these functions are performed by programmed software with attendant loss of time, space, and reliability; in some third-generation computers they are done by the hardware, automatically. If the computer is involved in a fairly complex computational task, the response to the real-time interrupt may be delayed because the current routine or single instruction must first be completed. Third-generation computers designed for real-time response, however, permit the immediate interruption even of single instructions, so response is quick enough to control the real-time situation.

The third-generation real-time oriented interrupt system also encompasses the ability to dynamically change priorities of various users as the situation is progressing. Thus, although the priority for one event may be at one level early in the process, it may change later. A third-generation system permits such priority changes in assignment to be accomplished by the hardware, under program control.

Job-Oriented Software

The cost of using a computer is not only that of the hardware but also that of the software. As a matter of fact, in many cases the cost of the software for a particular job actually exceeds the cost of the hardware. Therefore, the software tools that are provided with a third generation computer must be job-oriented. Rather than being general in nature and satisfying every user slightly but not satisfying any user completely, the software meets most of the needs of a specific type of user.

If the system is to satisfy several classes of users, then a hierarchy of software types must be available. Small, medium and large users each have differing requirements for operating systems. The small user is willing to pay the price of a system that is simpler in operation in exchange for lower cost and lower configuration requirements. But as the system grows larger, the requirements of the user become more complex. Therefore, a third-generation computer offers a series of operating systems within which each separate operating system increases in capability as it becomes larger — a larger hardware configuration uses larger, more capable software.

The same holds true for the other kinds of software. The small scientific user is satisfied with a compiler that offers him most of the features he needs; he is willing to "program

around" those features that are not available because they do not occur very often in his problems. But the larger user needs a software system that is as powerful as possible and that makes his programming easier.

Job-Oriented Hardware

Similarly, the third-generation computer must offer job-oriented hardware. There should be specialized hardware features available that simplify the job of the scientific user, the business user, or the real-time user. These hardware features can be built-in or optional, but they must permit the user to tailor-make his system to meet his needs. These features must include: floating point, decimal, byte string, conversion, and direct input/output capabilities.

In designing any system, there are many kinds of trade-offs possible. The design of a third-generation machine must represent trade-offs not only within the hardware or within the software but also across these boundaries, from hardware to software and back. Thus, although it might first appear to be most economical to eliminate certain hardware features in a smaller machine in a series, it might really be better to keep these features to save costs in the software. From the user's point of view, it would be most desirable if a single set of software ran in more than one machine so he could be sure of getting software that had been checked out on earlier machines and that still runs on later machines. This would also give the user capability for future expansion.

Data and Memory Protection

Since many users are on the system at the same time, the third-generation computer needs a well thought out, flexible system of data and memory protection. It is not enough merely to provide a write protection feature that prevents one user from destroying another's program; the system really needs to be much more flexible than that. For a public library area of memory that might be shared among several users and might in effect be a free-access area, there should be read/write restrictions on a user. In the system library area, the user should be able to read instructions, but not data, from that part of the memory, and he certainly should not be able to write into that area. For other areas the user should be able to access both instructions and data but should not be able to write into the area. And finally, for those parts of the memory that contain the operating system itself or highly sensitive or proprietary information, the user should not be able to read or write there at all.

As the third-generation system grows in size it is not enough merely to have it modular; it should also become more capable, with a synergistic effect. If the system is doubled in size, the result would be more than twice as much capability. This implies that the software and the hardware are not only modular but also that they are flexible. For example, a given user may want his generation configuration to have 32,000 words of memory in two large blocks of 16,000 words because this is most economical. Another user may choose to have instead eight blocks of 4,000 words each because this gives him the maximum amount of input/output overlap. For programming, either system should appear the same although the second may be vastly more capable in throughput.

Conclusion

The advent of the kind of hardware that is used heavily in third-generation computers — notably integrated circuits and fast memories — made it possible to design systems at a reasonable price for the first time. But it was not those components alone that formed a third generation; the distinguishing characteristic of the third generation is the conceptual design of its systems.

MARKET REPORT

EDP Supplies Industry Tops Billion Dollar Annual Volume

Michel Feuche
 Editor, *Moody's Computer Industry Survey*
 Brandon Applied Systems
 New York, N.Y.

The least spectacular area of the EDP business, the supplies industry, may also be that with the steadiest profitability, according to a survey conducted by the Business Supplies Corp. of America (BSC). The survey indicates that annual supplies expenditures are now over the billion dollar mark and correspond to roughly 20% of the value of machine rentals. The industry's growth rate matches that of new computer installations and thus stands at between 15% and 20% for the main types of EDP supplies.

Supplies fall in four main classifications. Their nature and their projected volumes this year are shown in the accompanying table.

The EDP supplies industry is unlike most others in that it can point to the exact date of its birth. This was on January 25, 1956, when IBM agreed under an antitrust consent decree to make its punched card patents available to other manufacturers. With the end of IBM's monopoly, new card-making organizations sprang up with remarkable speed. Some were led by former members of the IBM supplies division. Among them was Tabco, now part of BSC, incorporated by BSC president L. Stanley Crandall on April 16, 1956, two months after the IBM consent decree. BSC currently holds second place in the supplies industry (after IBM) and ranks as its largest independent firm. The company holds about 11% of the total punched card market.

There are now about 24 major card manufacturers, including divisions of IBM and Univac. These firms are either independents, such as BSC, or subsidiaries of paper converters. The cost of shipping cards to customers, often in rather small quantities, is relatively high. The tendency is, therefore, to locate card plants close to individual major markets.

Card sales have expanded faster than the 15% rate common to the whole industry. They have grown from two to three billion cards in 1956 to about 159 billion used in 1966.

Their growth rate is, however, now down to 15% and is expected to level off and reach a plateau in future years, due to new equipment trends. These include the growing development and use of optical scanning equipment and direct entry remote terminal devices.

Manufacturers believe that once optical scanning equipment is more fully developed and in wide use, OCR cards and supplies will represent a major market which will compensate the decline of tab card business. They are, however, still encountering problems in developing suitable OCR cards. The latter's printing and dimensional tolerance requirements are far more exacting than in the case of tab cards. Work is being done to develop dimensional tolerances which will permit the use of lighter card stock, thus reducing costs.

The magnetic tape market is variously estimated at from two million to five million reels of tape for 1966. Computer tape represents about half of this consumption. IBM accounts for about 60% of EDP sales. Other leading firms include Ampex, 3M, and Memorex. Activity in the tape field has expanded beyond manufacture to testing and cleaning of reels from existing magnetic tape libraries. This need has become greater with the use of high density tapes whose signals can be virtually obliterated by the adherence of minute oxide and polyester particles. IBM and several other established firms now provide these services. At least one new company, Certron Corp., has been formed (by former Ampex employees) for this purpose. The establishment of strict tape maintenance standards is still a problem in this area.

Magnetic tape is expensive and existing tape libraries represent an investment by users of over \$175 million. Tape marketing may be changed in the near future by the leasing

(Please turn to page 53)

1966-1967 EDP SUPPLIES INDUSTRY VOLUME
 (in \$ millions)

	<u>1966 (est.)</u>	<u>1967 (est.)</u>
Punched cards	\$ 170	\$ 195
Magnetic tapes	80-100	92-115
Continuous forms	700	805
Ribbons and other supplies	20-30	23-35
TOTAL	<u>\$970-1,000</u>	<u>\$1,115-1,150</u>

Controversial Air Force Award to IBM

Stakes are getting higher in the procurement process for computers in Washington. Billed as "The hottest EDP topic in Washington" by the trade papers, the controversial award by the Air Force to IBM for a reported \$114 million worth of 360/30-40's was under fire by the losing bidders, congressional subcommittees, and the General Accounting Office.

What took place during the demonstration and capability tests is still not clear. The Air Force sent out requests for proposals, was reported to have changed the rules at the last minute, refused to give RCA, Honeywell, and Burroughs a tape recording of the debriefing session (or even an accurate transcript), and generally ignored the loud complaints of unfairness voiced by the losers. Honeywell said that they had offered the same equipment for some \$50 or \$60 million less than IBM. The Air Force said that it was not a question of difference in "price" but a difference in "cost". They judged on "cost/effectiveness".

Honeywell Protests

In a rare formal complaint to the General Accounting Office, Honeywell asked that the award be delayed until an investigation is conducted. Senator Eugene McCarthy (D-Minn) responded to Honeywell's plea for facts surrounding the case, and called in the Air Force, the General Accounting Office, and Honeywell officials. The Air Force said they would come up with their defense the next day. They balked, however, and let it be known that it would take 2 or 3 weeks at least. The General Accounting Office has said it can't move until it gets the Air Force data; the Air Force is reported to be going ahead with installation plans for the first 2 units "as if the award had never been questioned".

A Senate spokesman said that the Air Force would not agree to hold off the procurement simply because of the protest by Honeywell. There is speculation that all the General Accounting Office will do when it gets the Air Force data is to decide if they negotiated with responsible bidders. If they did, the award will stand. Apparently, there is no legal basis for requiring the Air Force to make the details public, even though it was a "competitive" procurement. The General Accounting Office has said it will let Honeywell look at *some* of the details when it gets them from the Air Force.

After meeting with Assistant Air Force Secretary Leonard Marks, General William C. Pratt, and Honeywell officials, Sen. McCarthy said that the Air Force had given "unsatisfactory answers to Honeywell's allegations that the award was \$50 million high." Technically, there was only one responsive bidder — IBM. RCA, Honeywell, and Burroughs were all thrown out as unresponsive because they allegedly failed to meet Request for Procurement specifications. They say the specs were changed at the last minute, and leaked a statement that the changes were "unorthodox and beyond the realm of possibility". Opinion has it that the General Accounting Office can only challenge the award if it finds that the Air Force has acted illegally in some obvious way. Throwing out the award and trying to go through the entire procurement process again would create "chaos", according to one source.

Representative Jack Brooks (D-Texas) will get the first official try at finding out whether the Air Force acted in good faith with the losing manufacturers. Senator McClellan deferred to Brooks's automation subcommittee because his subcommittee hearings were scheduled earlier. The Air Force and IBM, meanwhile, are continuing with their plans to install the first equipment at Bolling Air Force Base near Washington this month.

Debate on National Data Center Continues

Officials of the recent annual one-day symposium of the Washington Chapter, ACM, called the proposed National Data Center "too hot to handle" and ruled out discussion during the meeting. The moderator termed it a "big and complicated issue".

A few days earlier, the Institute of Management Sciences held a panel discussion on the subject of "Policies and Issues Associated with a National Statistical Data Center". Co-sponsored by the Washington Statistical Society, the meeting was moderated by Dr. Ezra Glaser, Special Assistant to the Director of the National Institutes of Health.

The Census Bureau seemed to dislike the idea of the Center, and said that data could already be found and used in separate agencies. Although the Census Bureau says that matching is an enormous problem, it maintains that what is needed is to deal with what we have.

The Budget Bureau is in favor of a National Data Center, but in two hours of discussion, not one of the four panelists identified a potential user, a specific application (except 'longitudinal' studies), or an estimate of the cost of establishment and operation. Finally, the Budget Bureau was pinned down by three audience questioners; and the Office of Business Economics, the Council of Economic Advisors, the Bureau of Labor Statistics, the Department of Health, Education & Welfare, and many Universities were suggested as potential users.

Pros and Cons

Everyone on the panel said that there were no guarantees of protection for the individual citizen. A man in the audience quoted the published statement of a panelist: Can a statistical system be developed and administered in such a way that we can be assured it will not be used as an intelligence system? The author is sure that the answer is YES! Can a foolproof system be developed to prevent the misuse of a statistical system for intelligence purposes? The answer is NO!

According to the National Bureau of Standards, "Patterns of individual establishments are concealed in aggregated data. We want to associate the Census records on investment expenditures with the Internal Revenue data on corporate income and profit. We also want to relate personal consumption expenditures reports and IRS detailed data from tax returns. . . . We want to interrelate the characteristics on individuals and households, which come from income data, health data, and education data."

(Please turn to page 52)

COMPUTERS AND SOME MORAL QUESTIONS —

ROUNDUP 1

In the March issue of *Computers and Automation* appeared an editorial and a ballot on the subject of computers and some of the moral questions connected with them. (The editorial and the ballot are reprinted on a back page in this issue for those readers who did not see the March issue.)

Here we present:

1. The Results of the Balloting
2. Some Comments Favoring Discussion
3. Some Comments Opposed to Discussion
4. Other Comments

We invite further letters and comments from our readers on the subject of computers and their application to moral questions.

The ballot resulted in a very strong vote in favor of discussion and a humanist position.

Therefore this magazine particularly invites discussion and articles, both general and technical, on the applications and implications of computers and data processing to social,

political, and moral problems of importance. Some of these would be:

- Peace gaming (an example is the article "A Vietnam Peace Game" by Jerome Laulicht in the March issue)
- International regional planning
- Privacy of individual records in national data banks (an example is the article "A National Data Center and Personal Privacy" by Peter Warburton in the May issue)
- International systems research
- Unclassified prediction of results of future military campaigns
- Planning political strategies for election
- Ethics for persons in the computer profession
- Forms of political control over nuclear weapons
- International arms inspection systems
- The implications of the Nuremberg Trials for computer persons

1. THE RESULTS OF THE BALLOTING

The total number of responses was 145, including some letters which commented on the ballot but did not vote on any question. The most distant response came from Rome, Italy. We greatly thank all those persons who were kind enough to respond to our inquiry.

The results of the balloting are as follows:

1. When thousands of human beings are being killed in a war with some help from computers, computer people

Y () should
N () should not

examine the conflict, and try to do something constructive about it, including discussing it in a computer field magazine.

RESULTS: Yes: 122
No: 15

2. If a computer scientist thinks that one side in such a conflict is in the wrong; he

Y () should
N () should not

accept employment in a company which is producing weapons for the wrong side.

RESULTS: Yes: 16
No: 114

3. If a computer scientist knows that false and lying information is being produced with the help of computers, he

Y () should participate (by remaining silent, etc.)
N () should not participate (by becoming vocal, etc.)

in allowing that information to be believed,

RESULTS: Yes: 5
No: 125

4. The subject of political control over missiles armed with nuclear weapons and guided by computing mechanisms

Y () should
N () should not

be discussed in a computer field magazine.

RESULTS: Yes: 111
No: 26

In the balloting 84 persons specifically said their names could be released, and 32 persons specifically asked that their names be kept confidential. A few responses were received from persons who did not give their names; no attention was paid to these responses.

The charge that the questions were expressed in loaded words or phrasing was made in eight responses. The other responses did not mention this.

The request or demand (with or without stated threats or penalties) that these questions should not be discussed in a computer field magazine was made in eleven responses. The other responses did not mention this.

All in all, these results are astonishing to us, the editors of *Computers and Automation*. Even if these results are only half valid, and so actually thus represent only half of the community of computer people, then it is still clearly evident that the subjects referred to in these questions should be discussed (to a reasonable extent) in *Computers and Automation*, so as to satisfy some of the interests and concerns of many of our readers.

2. FAVORING DISCUSSION

SCIENTISTS ARE NOT "ABOVE" OR "BEYOND" MORAL QUESTIONS

E. J. Karchmar, Analyst
Mountain View, Calif. 94040

I do not believe that scientists are "above" or "beyond" moral questions. As members of the human race they have responsibilities toward the other members and if they do not trouble themselves with "moral questions" then they are

simply deficient individuals. I myself am careful to avoid the destructive types of computer applications. I mention this because I want it to be known that some of us do more than pay lip-service to Question No. 2.

THERE IS NO DILEMMA AT ALL

Joseph W. Lowell Jr.
Director of an ADP Management Training Center
Washington, D.C.

It seems to me that there is no way in this real world of ours that a professional man can legitimately separate himself from his humanity. "Human people" and "computer people" are not mutually exclusive, though, heaven knows, the latter often appear to resent being a sub-group.

We read with horror the comments by Father Merton in the same issue with your ballot. And yet, with only minor adjustments, couldn't his words about Eichmann form the basis for the retirement party eulogy of a "computer person" who considered not the impact of his work on the whole human condition: "He was thoughtful, orderly, unimaginative. He had a profound respect for system, law and order. He was obedient, loyal, a faithful officer of a great state [corporation]. He served his government [organization] very well."

Are we who are in the computer business so young and naive that we think we are the first — or the most important — profession to face up to this dilemma? When, in reality, there is no dilemma at all. We are human by design, computer people by accident, at best. If we are in no way concerned with the consequences of our professional activities, we are not very professional at all.

I do not suggest that computer people — wearing their human hats — will all arrive at identical moral and ethical conclusions. Quite the contrary. But let them at least be self-determined in accordance with their own reasoned judgments. Otherwise the academic "Do computers think?" question must give way to the more tragic question — when it has to be asked — "Do computer people think?"

THE USE OF COMPUTERS IN THE POLITICAL REALM

Helen Solem
Accountant
Hillsboro, Oregon 97123

Your quiz for computer people on war effort requiring their cooperation is a fine, practical approach to get computer people to think about their social responsibilities.

"A Vietnam Peace Game: Computer-assisted Simulation of Computer Situations in International Relations" in your March, 1967, issue left me wondering if all decision games must be so complex?

With the marvelous illumination of hindsight, would the Nazis, if they had had computers, been able to show clearly that Hitler could be so completely mentally unbalanced as to dictatorially send battalion after battalion of crack German troops to certain defeat in the frozen winterlands of Russia?

Would computer simulation in 1914 have spelled in clear, effective terminology the ignominious defeat up ahead for Austria and the untold suffering in store for the German people?

In either event, if the computer had been able to decisively predict disaster, would it have been believed? Hitler was extremely confident after his successful blitz across Europe that backward Russia would crumble long before winter. In fact, he knew as well as any cursory student of history that to wage war on two fronts, one of them thousands of miles into Russia, had proved fatal time and again for others.

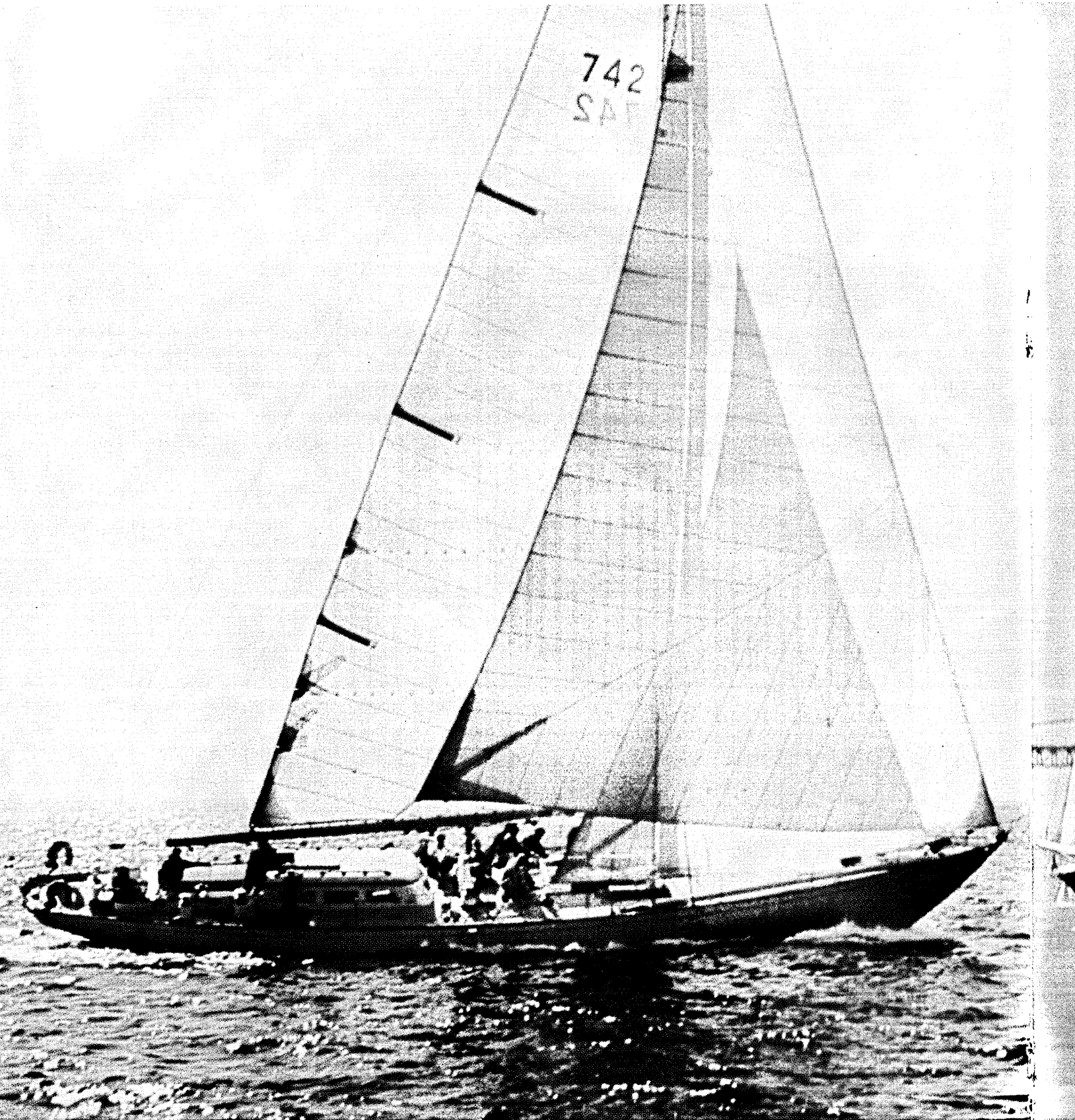
In 1914 Austria felt she could be severely demanding of Serbia with Germany's "blank check" in her pocket.

Does it make any difference today if computer simulation should tell us that foreigners should not interfere with Civil War in Vietnam?

I think there is an example of successful, effective use of computers in the political realm. This is the use of computers by an advertising agency in mapping the strategy for John F. Kennedy's campaign in 1962. The direction in which the "480 categories" pointed (described in detail by Eugene Burdick in his book, "The 480") was, of course, strictly followed. Maybe Madison Avenue has something to teach us about game theory and the "human element."

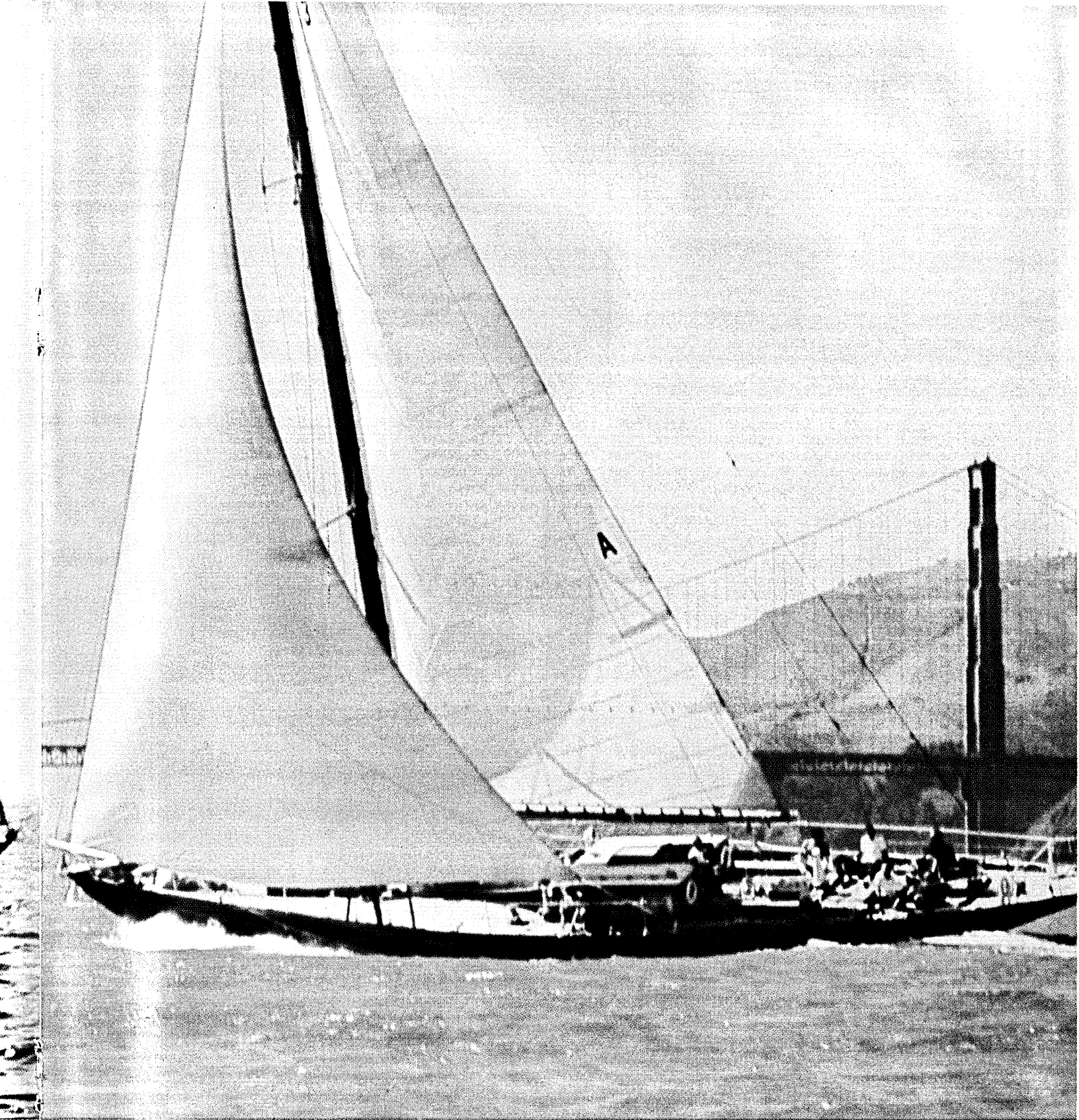
The road to peace is little traveled, seldom constructively sought. Daily, newspapers report of peace demonstrations, students for peace, mothers for peace and occasionally tell of intelligent heretics harranguing for peace. Although peace is certainly a laudable attainment, we haven't much faith in these assorted types achieving any real progress.

In fact, such efforts can be compared to the proverbial ant trying to budge the rubber tree. However, just as tractors are practical instruments to move rubber trees, computers may be our hope to show us the way to lasting peace.



The sloop on the left is Kialoa II; on the right, Baruna. For quality reproductions of this photograph, write us at Memorex.

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pass without a drop-out, long after other tapes have failed. But compare one with the other, and they won't necessarily perform exactly the same.

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MEMOREX

Computers have been used with great success to perfect war maneuvers. It ought to be possible to use them to perfect peace maneuvers.

Computers which can make the computations necessary for orbiting the moon can certainly make computations to cool the hot spots, feed the hungry, and salve the sores of the oppressed.

When we make war, we have a great many precedents on how this should be done. Methods of war are time-tested and proven throughout history. In war we shoot to kill. In peace we must doctor to heal. In war we burn and loot. In peace we must build and distribute. In war we starve and torture. In peace we must educate and feed. In war we imprison. In peace we must insure freedom. Computers can be used to map peace strategy from which a master plan can be developed.

Although our progress seems feeble and inconsequential, we have nonetheless made some progress. Albert Einstein, Linus Pauling, Albert Schweitzer, Dag Hammarskjold are men who worked constructively toward peace, as their talents and

creeds prescribed. If the citizens of the world who are striving for peace could be segregated, they would seem a small band indeed. If their achievements were to be examined, they would look even less momentous. Nevertheless, the holocaust which was Nagasaki and Hiroshima has not been repeated. The United Nations convenes every year despite differences of race, affluence, and opinion.

Recently the State Department established a Center for International Systems Research. This is a fledgling experiment, to see if the problems of foreign countries can be reduced to mathematical models for study. This would seem to be sensible. The answers we seek may well be in the depths of a dispassionate, mechanical mind. What else but computers could be truly neutral and objective concerning the fate of nations?

"My apple trees will never get across
And eat the cones under his pines, I tell him.
He only says, "Good fences make good neighbors."
— Robert Frost

COMPUTERS WILL HAVE AS FAR-REACHING EFFECTS AS NUCLEAR WEAPONS

Stephen M. Rosenthal
Programmer Analyst
New York, N.Y.

I think it is extremely important that technically oriented professionals with the capability to create mechanisms of mass destruction become involved in the moral problems of the use of such mechanisms. The physicists associated with the Manhattan Project have (belatedly (?)) paved the way in this respect with the publication of *The Bulletin of the Atomic Scientists*.

It certainly seems at least as appropriate for members of

the computing profession to do likewise, as computers have or will have as far-reaching effects upon society as nuclear weapons. Other moral questions that should be considered are the effects of computer-directed automation on the makeup of society, privacy vs. the computerized central data-bank, etc., which are not limited to computers and nuclear weapons.

You are to be commended for your involvement in these issues. I certainly hope more happens in this area as a result.

ESTABLISHING DIALOGUE WITH POLITICAL AND SOCIAL SCIENTISTS

S. D. Irwin
Systems Representative
Los Angeles, Calif.

Not only should computer people consider their role in the "negative" or "necessary evil" endeavors of man, e.g., missile systems and war logistics, but also the "positive" endeavors. Examples of these would be legislative reapportionment and city planning. Such questions as the following come to mind: Does the system have the ability to incorporate and apply flexibility in human terms and needs? Are the facts from the computer understood? Are they applied correctly? Is there bias in the design to force a picture compatible with a certain point of view?

When computers take over the accounting and record-keeping functions in local, state or Federal government, are the results still as intended in the original legislation? Or to pose this in another way, the reason for employing computer controlled systems is for increased efficiency — but in the execution and transition have new interpretations crept into the results and uses?

Computer technicians must consider these consequences and establish dialogue with political and social scientists about them.

A JOURNAL REFLECTING INTERNATIONAL AND HUMANITARIAN INTERESTS

Craig C. Wier
Student Scientific Data Analyst
Berkeley, Calif. 94705

The Bulletin of Atomic Scientists needn't stand alone as the only American professional journal serving international and humanitarian interests and reflecting scientific advances in their light.

A continued policy, as reflected in the inclusion of the Thomas Merton quote, will compel me to read your publication each month.

THE HOLD MILITARY PSYCHOLOGY HAS ON THE GREAT MAJORITY OF PEOPLE

Clifford A. Woodbury, Jr.
Supervisor, Tabulating Statistics
Philadelphia, Pa.

Kindly allow me to express thanks to "C & A" for taking the initiative to raise the subject of moral responsibility in our field. I fear there are all too few people in the world today

who realize how late it really is in dealing with the dangers of a cataclysmic war, and how great a hold military psychology has on the great majority of people.

BRIEF COMMENTS

The computer has the potential of being a "perfect Eichmann" unless computer people are made aware of their personal responsibility.

— H. F. W. Perk, Faculty Member, Carbondale, Ill. 62901

Congratulations on your progressive attitude!

— J. T. Powers, Jr., Programmer, Mt. View, Calif. 94040

I take off my hat to you.

— Senter Stuart, Tech. Writer, Arlington, Va.

Professional ethics is a social matter, even concerning computer scientists.

— Paul J. Livers, Mathematician, Indianapolis, Ind. 46220

In any issue, all that evil need do to triumph, is that good men remain silent.

— H. Kugel, Programmer, Rockville, Md.

The intent of the computer is to make the world a better place for man by aiding in the solution of his problems. Thus, computer use for machine control or for social control, etc., are valid subjects, since the end beneficiary in all cases is man himself.

— John F. Paugstat, Systems Engineer, Dayton, Ohio

A person is responsible for his actions. This is the basic assumption of the laws of most societies, particularly this one.

— Miss E. R. Seidman, Technical Specialist, Bedford, Mass.

Christ spoke out against the locals — can I do less?

— Ronald E. Medei, Engineer, Easton, Pa.

The "American Way" is not necessarily the "right" way; it's just the American way.

— G. McPhillips, Programmer, Malvern, Pa. 19355,

Freedom of speech and thought are just as necessary to the computer scientist as to the individual.

— M. Bailey, Systems Analyst, Arlington, Va. 22201

The profession is in dire need of a code of ethics (formalized).

— A. L. Kilinski, Section Mgr., Rochester, N.Y. 14611

Keep up the fine work.

— David Moses, Consultant, Brooklyn, N.Y. 11219

Hope you continue.

— Ronald Spriestersbach, Engineer,
Los Angeles, Calif. 90046

Refer to the Nuremberg Trials.

— Ralph R. Dunhower, Pricing Specialist,
Lafayette, Calif. 94549

These are responsibilities of any good citizen, not just of computer people, or because computers are used. The fact that computers are involved or not would not change my answers to the questions, and shouldn't change anyone's.

— R. E. Utman, Vice Pres. for Information Systems

3. OPPOSED TO DISCUSSION

THE COMPUTER IS A TOOL AND WE ARE MECHANICS USING IT

Dick H. Brandon
Manager and Director
New York, N.Y. 10017

Your "March Ballot" is going too far, and I feel compelled to comment.

1. Since when are "computer people" different from normal people? Why are our responsibilities greater or less than other humans?
2. Do you honestly believe a lumberjack worries about the possible pornography produced by the tree he is felling?
3. The social responsibilities of human beings, and their rights, are defined by the Constitution. I don't think that you oppose Rousseau, Hobbs, or Jefferson, but the implication of your question 2 is that we should all stop working. Examine the input-output tables of the U. S. economy, and you find *no industry* not involved in weapons for "the wrong side" in some way. As taxpayers we all contribute, under the social compact to

which we all agreed.

4. The computer is a tool, and we are mechanics using it. To attempt to question each purpose for which it is used is ridiculous, and impossible.

The obvious conclusion: As *human beings* we have a definite responsibility to speak out against wrongs, to defend our views, to work and vote for what we think right. This comes before our "responsibility as 'computer people'."

I hope that our rights as human beings will never be subjugated to the rights of small pressure groups, whether industry-oriented or philosophy-oriented. Your efforts to establish an industry-oriented pressure group are wrong.

However, I will defend your right (as a human being) to be wrong. My answers must be NYYN, therefore.

NO MORE OR LESS DEADLY THAN A TYPEWRITER

James L. Donnellan
Sales Representative
St. James, N.Y. 11780

I believe that the computer, being basically a mindless idiot incapable of doing nothing more than making yes or no decisions, albeit millions of times per second, must be viewed as a tool to fulfill an ultimate goal. In war, this places it as no more or less deadly than an M1 rifle, ballistic missile, jeep or typewriter. It is for this reason that I feel the computer may be used effectively.

As far as the negative answers to the remaining answers are concerned, we must realize that the computer, in actuality, is subordinate to the individual. Therefore, each of these questions must be answered by the person involved, using his conscience and sense of moral values as a guide.

It is my opinion that, if an individual is aware of the fact that a company is producing weapons for the enemy, it would be no less than treasonable for him to take part in any way at all in their production. It would, in fact, be incumbent upon him to voice his objections.

Finally, no discussion should be conducted in a computer field magazine on *political control* over missiles armed with nuclear weapons. At best, such a discussion could only be general and of a surface nature. There are far too many outside factors that determine the pros and cons of such a subject.

I am, however, very much in favor of seeing articles divorced from the political arena on such subjects as computer control of weaponry in a magazine such as yours.

DISCUSSION RELATED TO COMPUTER USAGE OR TECHNIQUES IS A BETTER USE OF PAPER AND INK

Michael Winnick
Systems Analyst
Orange, N.J. 07051

The question you are really asking in your ballot is whether the people connected with computers, (programmers, analysts, engineers, managers, etc.) should feel morally responsible for any and all purposes that the computer may be used for.

The help a computer gives to kill people may be in the design of an airplane, or a bomb, or in trajectory calculation.

If anybody thinks that a company is not doing what he believes in — producing weapons for the wrong side, smut magazines for sale to minors, democratic or republican leanings of top management — etc. — then certainly he must decide whether or not to work for them. His being a computer scientist has very little bearing on the question.

Question two might also read — should a draftee who does not think a war is just refuse to be employed by the wrong government?

Whether or not computers are involved, if you know someone is lying or giving false information, it is your decision to stand up or not.

We definitely should discuss control and guidance of missiles by computer in computer magazines — but more for the techniques and algorithms used rather than the politics involved.

Your ballot leads me to believe that, somehow, someone thinks that the computer industry is responsible for any computer's decisions.

I think that if page 7 of your March issue were devoted to discussion relating to computer usage or techniques, instead of politics, that it would have been a better use of the paper and ink — and my subscription fee, which I pay for computer information — not politics.

THE QUESTIONNAIRE BALLOT IS A DISSERVICE TO THE PROFESSIONALISM OF YOUR JOURNAL

F. R. Shute
Statistician and Systems Analyst
Bethesda, Md.

As a subscriber to your magazine, I expect to be able to receive information on new managerial innovations and technology, and information on industrial and governmental systems utilizing automation and computers.

Other magazines and news media provide me with background and information on national and international political, sociological and economic events and environments.

The questionnaire "Ballot" on page 7 of the May 1967 issue, is a disservice to the professionalism of your journal. It is biased in the phrasing of the questions. It will not provide a valid sample of opinions of your readers.

Question one refers to "examining the conflict." We have duly elected representatives who hold hearings and propose legislation and provide the funds for implementing the processes of government. They have a greater amount of facts upon which to recommend and approve a course of action, than any non-government organization or individual. If the syllogism in your question may be extended, "thousands of human beings are being killed" by automobiles, yet I am unaware that any computer people examined the facts and appeared at the automobile safety hearings in Washington, and tried to do "something constructive about it."

The second question assumes that "one side is wrong." Who can make the value judgment that a particular piece of computer hardware manufactured by a sub-sub-contractor is wrong for any side?

The third question lends itself to a discussion in an academic or professional meeting, where a monitor could permit free discussion of this subject matter which is very complex. This subject has been debated by every professional society since the Greeks.

Question four relating to "political control" over a weapons system would generate enough discussion to negate the primary purpose of your magazine. If the "social responsibility" of computer people continues to have increased coverage, then other magazines will provide me with information on the state-of-the-art, and trends in this managerial and technological field.

4. OTHER COMMENTS

THE QUESTIONS REFLECT A SIMPLISTIC VIEW

W. C. Haueisen
Pepperell, Mass.

I found the questions of the March issue ballot disturbing, and I feel obliged to comment. First, I find that I can't respond, for the simple reason that I am unable to answer for others. It is unfortunate that the questions are so phrased that respondents are asked to legislate the moral behavior of others. However, assuming that was unintentional, I should like to make some additional remarks.

I think it also unfortunate that the questions address only one of the moral issues before the world today; i.e., war. It is difficult for some to understand the utility of the race to the moon (in which the use of computers is abundant) when thousands are starving. It is difficult for some to understand the application of computer graphics to automobile styling when thousands may die this year for lack of adequate safety standards. It is difficult for some to believe that our technology is such that we match young couples but don't match the unemployed to available jobs.

I think it unfortunate, too, that the alternatives reflect so rigid a perspective of the issue raised. For some, accepting employment in an organization producing arms for any side is unacceptable. For others, avoiding such employment is just a matter of side stepping the issue. For still others, paying taxes abets an unjust cause.

I think a simplistic view of right and wrong is not functional or efficacious in the world of today. Each individual perceives the moral issues of his world in a unique way. If there is to be a dialogue among individuals, it will not materialize from a narrow perspective of a particular moral issue but from a broad perspective of moral issues in general.

Finally, I should prefer that the questions be addressed to individuals and not to members of a profession. Members of the computing profession have, for the greater part I suspect, little say in the application of computers. Their membership does not give them special authority, nor does it give them responsibility beyond that which falls on every individual.

AN AREA OF INTENSE INTEREST AND DISCUSSION

Patrick F. Gallagher
Systems Director
Chicago, Ill. 60654

In response to your questions in the C & A Editorial:

1. Should — both to prevent the loss of life, where possible, and to improve the methods which attain tactical advantage, as they exist. Greater "bang for the buck" may be one method of attaining greater tactical advantage.
2. Should not — This is a personal opinion which I would not dare apply to any other individual.
3. Should not participate — Not participating and becoming vocal concerning the situation probably depends upon the degree of involvement of the individual. You cannot honestly be vocal about any situation without knowing the facts as they exist, not as you believe them to exist.

Should not — Let me ask you a question, "Why should they be discussed in a periodical such as C & A?" Why should you want to expose your magazine to the potential political claptrap which would probably follow from an opening such as this? Please, let us really learn what we are doing now before we plunge into an area such as this.

Closing comment — This could become an area of intense interest and discussion but if any of your contributors has a paper for our consideration, please ask him to submit it to the Lanchester Committee of the Operations Research Society of America for consideration. Let us approach agreement on COBOL and PL-1, some of today's technical questions, before we attack the questions of computers, operations research, and morality.

WORLD REPORT — GREAT BRITAIN

While Britain again prepares to sacrifice a thousand years of national sovereignty on the European altar of political and economic expediency, signs and portents are multiplying of undercover governmental activity on the data processing front.

There was, of course, the abortive 1965 attempt to get the French interested in breeding a "Concorde" computer of super number-crunching size. But at that time the Plan Calcul was in gestation; and the French midwives were clearly unable to accept the idea of coping with the forthcoming offspring as well as a gigantic brute of mixed ICT-English Electric-RCA antecedents.

Britain Approaches the Continent with Computers

Now, Prime Minister Harold Wilson has disclosed that in his view a strong and viable computer industry is one of Britain's aces in the approach to Europe.

Coming at a moment when Germany has earmarked \$200m to support a domestic computer industry based on Siemens and Telefunken, and France is advancing credit from the first 600m francs to be poured into what is a very new organization, the Wilson statement is significant. It underlies the material of talks between the U.K. Minister of Technology, Mr. Wedgwood Benn, and his equivalent from West Germany which took place a few days before the speech. After the talks, Dr. Stoltenberg said agreements between companies in Common Market countries and Britain were under negotiation with his blessing and Mr. Wedgwood Benn's.

The first of these will probably involve English Electric and Siemens, the latter making virtually a direct copy of Spectra 70, and the former a range using RCA technology but coincident only in one machine, the 70-45 or System 4-50. English Electric has as its biggest machine a design in many ways well ahead of the 70-55. It has sold outstandingly well to the Government in Britain and the company hopes to see it taken up not only by Germany but also by RCA in the U.S. But English Electric will have to do better in its smaller machines.

ICT aspirations for the moment seem to be limited to exports of peripherals to other makers. But as the third company in France (after IBM and Bull-General Electric in numbers of 1900 machines installed), ICT must be thinking, if not of a second manufacturing base, at least of securing a major ally among the uncommitted electronic companies in France.

All this must look like the posturing of pygmies from the Olympian heights of IBM World Trade which has immense investments in Germany and France and sizable bases in most of the other European countries. If, however, the giant Philips organization could be included in any agreement linking European computer companies not under U.S. control, the picture would change radically.

Big Five Banks Computerize

The Big Five banks are in the news again. Barclays, Lloyds, and National Provincial, having 7000 branches between them, have ordered some special terminal equipment from IBM to link up with the 360/50 computers they are using.

The equipment — 3940 and 3980 — is an offshoot of work especially for the banks, carried out at IBM's Hursley laboratory in Britain. The second unit has accounting functions similar to those of the Burroughs TC 500 of which Barclays has ordered \$18m worth to go with its \$12m B-8500.

Barclay DP staff is not yet able to say whether the whole of the bank's operations will go on the giant Burroughs machine. They counter any observation that at \$45m, they are spending far more on computers than other members of the Big Five, with the claim that the latter are not out of the woods yet and will have to spend well beyond what they have so far announced.

Though Barclays and the Midland have together taken some \$24m worth of TC500 and the IBM equipment has been ordered by a number of banks, the terminal battle is far from over. DP managers are having second thoughts on terminals which do a fair amount of pre-processing for the central computer and may in the end choose much cheaper equipment which feeds raw information over data links to the main machine, leaving it to do real man-sized multi-access work.

Computers Reach Steel Industry

Steel has also been in the news, the first move disclosed being at the publicly-owned Steel Company of Wales which is spending \$4m on equipment from three manufacturers.

For the Port Talbot steel mills, a hybrid integrated management system will have a hierarchy of computers with two 360/40's at the top interfaced with an IGE 412 process control computer on the hot strip mill and 24 specially designed steel shop floor units by twin Elliott ARCH 102 computers. This is not the end of the story, since before very long there will be an AEI Automation computer of basic IGE design controlling the cold mill — a British first in this most important facet of control techniques. At the same time, the steel maker has ordered two English Electric machines for its tin plate lines and further automation plans are expected to materialize there.

United Steel, Britain's main steel concern, has gone in the opposite direction, and chosen to standardize on ICT computers. It is spending an initial \$5.6m which by 1970 will be translated into an interconnected system of five major machines, the largest of which will be a 1906E at Appleby-Frodingham linked core-to-core with Ferranti Argus 500 process control computers (both derived from the same parent). On-line mill control and real-time production control is the target.

Head Office will have display consoles and interrogation keyboards and the R & D Department will use the system for large scale simulations.

C-E-I-R Plans 400-Console Time-Sharing Service in U.K.

At the time of writing there was no decision by C-E-I-R of Britain — wholly-owned by the BP petroleum giant — which is having second thoughts on the 360/67 ordered last November for installation in 1968 as the center for a 400-console time-sharing service.

A spokesman for C-E-I-R told me that his group had not chosen to reconsider but had been forced into a second look round the market because the equipment on offer from IBM had been down-graded from the original specification.

Ted Schoeters

Ted Schoeters
Stanmore
Middlesex
England

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

CHEVROLET'S CAMARO, A COMPUTER AGE PRODUCT

Chevrolet's new Camaro, perhaps more than any other of today's cars, is a product of the computer age. Its chassis components were designed, studied and engineered through an unparalleled use of computer analysis by an automaker. Details of the Camaro's development were disclosed in a special engineering paper by Donald H. McPherson, Chevrolet's chief engineer for passenger cars. McPherson said the Camaro project got under way with several basic stipulations.

These "absolute musts" included sports-like handling and roadability with a good, firm ride and a full range of performance capability from which the customer could select power train equipment to meet his particular needs.

Both analog and digital computers and systems were used in the three-phase work project. They involved basic study on the complete car desired, detailed problem solving in the design of the components and implementation of the selected component systems to ensure smooth interaction.

Before any hard design lines of the final car were put on paper, McPherson said, a complete analysis of the handling characteristics desired in the Camaro was made in conjunction with the Engineering Department of the General Motors Research Laboratories. "Through analog computer simulation techniques," he added, "engineers from Research Laboratories and Chevrolet

investigated, studied and predicted directional control characteristics of this new car analytically, to an extent never possible by older traditional methods."

Before starting to analyze the Camaro's handling characteristics, engineers determined basic definitions and target specifications of what the new car should be. This information then was analyzed through the use of computers to determine the best possible interaction of all parts and components of the total car.

One carefully controlled computer program was set up to analyze suspension reaction to bushing changes. The object was to gain as complete a body isolation as possible, while maintaining the exceptional suspension control planned for this vehicle. As a result of the study, a pre-stressed single-piece rubber bushing of lower durometer is used at the front spring eyes, in place of the two-piece bushing used for some other cars.

"The soft mounting of the rear suspension gives excellent body isolation from driveline and road noises, being achieved without compromise to rear suspension control," McPherson said.

Another example cited was how computers helped achieve the desired results without sacrificing valuable space in certain areas of the car. It was deemed desirable to have a fairly large fuel tank for the Camaro line. With the short rear overhang and the need

for a muffler location behind the rear axle, space was at a premium, however. Through the use of another computer program, it was determined that the rear springs could be splayed a sufficient amount to allow the necessary space with, once again, preservation of the high standards of suspension control set for the Camaro line.

Still another of the numerous computer programs helped engineers analyze the Camaro's aerodynamic qualities with the use of a quarter-scale wood and clay model. A detailed check of the car's aerodynamic properties was made in jet wind tunnel tests after the shape of the exterior body surfaces became well defined.

Data obtained from the tests was fed into computers and processed into working data for an actual-size Camaro.

CITY OF RENO AUTOMATES SURVEYING CALCULATIONS

The City of Reno now is using a computer to perform in minutes surveying calculations which used to occupy engineers for hours or even days. The calculations, known as "traverse closure", are being handled by an NCR Series 500 system.

Traverse closure deals with the difficulties encountered by engineers and assessors in surveying new parcels of land or reestablishing the boundaries of old land surveys.

Newsletter

In the manual method, readings for the bearings and distance of the parcel must be carefully noted. From these computations, the sine and cosine of the angles are manually computed, thus providing the tools by which the latitude and departure (east-west measurement) of the area within the boundaries is measured.

Since manual computations often lead to error, this can mean costly repeated trips to the parcel of land for resurveying. The NCR 500 computes the sine and cosine to eight decimal places, and automatically makes such adjustments as are necessary to get an accurate closure.

DETROIT HOUSE-HUNTERS WILL LET THE COMPUTER "DO THE WALKING"

A computer with a voice soon will be employed to "do the walking" for Detroit area house-hunters. Starting this Fall, real estate salesmen will use the new system to scan the reservoir of 4000 homes usually available in Detroit. The computer will select homes based on the buyer's budget limitations, family size, type of architecture preferred and neighborhood desired.

To provide the city-wide real estate communications network for Detroit's 1600 agent members of the United Northwestern Realty Association (UNRA), the association is installing an IBM 7770 audio response unit and a computer at its Detroit headquarters. UNRA's plan to use a computer with an audio response unit in the selection and classification of homes is believed to be the only one of its kind in the country.

Forty different salesmen at a time, using touch-tone telephones, will be able to communicate with the system. Using the telephones, the salesmen will tap out a series of numbers advising the computer of the specific requirements of the prospective home buyer. Within seconds, the computer will: scan all of the available homes listed by UNRA in Detroit; select those that meet the buyer's specifications; and direct the audio response unit as it relays a verbal response to the inquiry over the telephone.

Jack J. Jominy, executive vice president of UNRA, said that as a result of the new system, the buyer can be confident that he has seen everything on the market that

suits his needs. The seller, on the other hand, will be showing his home only to those who have a genuine interest.

COMPUTER AIDS PSYCHOLOGICAL TESTING OF U.S. NAVY AVIATION CADETS

Navy psychologists report that psychological testing of U.S. Navy aviation cadets through use of real-time digital computers promises to become an important part in future pilot selections. As part of a program underway at the U.S. Naval Aerospace Medical Institute, Pensacola, Fla., psychologists have devised a computerized technique of personnel testing. The program is designed to conduct various types of psychological tests of aviation candidates to help determine their ultimate suitability to become Navy pilots.

In a report given at the 38th annual meeting of the Aerospace Medical Association in Washington, D.C., Lieutenant Lewis E. Waldeisen, a Navy psychologist, described the WALWHC System, a computer-controlled system for psychomotor testing. The System is being developed by a team of Navy psychologists in conjunction with Sperry Rand UNIVAC and Weismantel Associates, Inc.

The system equipment consists of three sections: testing booths for the cadets, a supervisory monitor control and computer interface section and a real-time computer system.

Eventually the Navy psychologists hope to develop a complete battery of psychomotor tests that will be administered to each air cadet in training at Pensacola. Periodic tests will chart the progress of the student from the day he enters flight training. The computerized data will then be used to supplement current psychological data on each cadet.

COMPUTERS SPEED FIGHT AGAINST JOB DISCRIMINATION

For the first time computers are being used to relate the legal history and experience of a government body working against discrimination in employment. Chairman Stephen N. Shulman reports that the Equal Employment Opportunity Commission is computerizing the substance of its 22 months

of work including decisions, conciliations, opinions of general counsel and regulations.

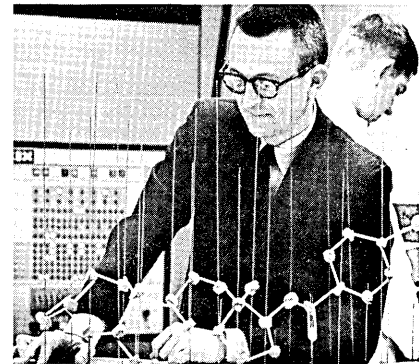
This latest move to streamline the Commission's procedures will enable the speedy identification and recall of patterns and procedures in job discrimination.

The new process will enable the Commission to improve its work in obtaining compliance with Title VII of the 1964 Civil Rights Act prohibiting discrimination. Mr. Shulman said it also would help in the development of new and better means of technical assistance by the Commission, using past experience and procedure to assist the voluntary activities of those covered by the law.

The texts of these materials are being placed on magnetic tape under contract signed with the University of Pittsburgh. These tapes will be used for computer storage and retrieval and to provide answers to inquiries from the Commission's Washington headquarters and its regional offices. The Commission will edit all materials before processing to preserve the confidentiality required by Title VII.

COMPUTER AIDS IN STUDY OF STEROIDS

Dr. Robert A. Sparks, director of research information and data processing at Syntex Corporation's Research Center, Palo Alto, Calif., is shown studying a molecular model of a chemical substance called a steroid. Such substances are used to treat conditions ranging from poison ivy to pregnancy problems, but no one knows what makes them work the way they do. Syntex is using an IBM 1800 data acquisition and control system (background) and an IBM System/360 to help solve this medical mystery.



The data acquisition system receives signals directly from the

scientific instruments that Syntex uses to study steroids. It translates these signals into computer code for Transmission to the System/360 where the information is processed.

Syntex researchers believe that there is a direct relationship between a steroid's molecular structure and its affect on the human body. When a sufficient number of steroids have been analyzed, Syntex hopes to link structural characteristics with specific effects on the body. With this information, they hope to develop more effective drugs.

BUICK USING IBM 1800 AT QUALITY AUDIT FACILITY

Buick Division of General Motors Corporation in Flint, Mich., has built an advanced quality testing laboratory around an IBM 1800 system. At the new Quality Audit Facility, up to 80 cars a day are selected at random to undergo a battery of stringent inspections controlled by the 1800 system.

A key test now underway makes certain that exhaust systems conform to Federal and state air-pollution standards. This test will be used to check anti-smog devices on Buick's 1968 cars.

In the exhaust test, the 1800 triggers a tape-recorded voice which instructs the driver to start the car, idle the engine and then accelerate to various speeds while the rear wheels spin on rollers to keep the car stationary.

Measuring devices linked to the exhaust system generate voltages representing concentrations of different gases. The 1800 analyzes these voltages to determine the amounts of carbon monoxide, carbon dioxide and hydrocarbons in the fumes.

Other computer-controlled stations are being developed to inspect safety factors such as wheel alignment and balance, engine performance and brake effectiveness.

COMPUTER DRIVES ACROSS PENNINES

A computer doing part-time work for the Ministry of Transport, London, England, has helped drive

the new M.62 superhighway across the Pennine mountains in Lancashire and Yorkshire. The M.62, Britain's first trans-mountain highway project, was designed by the West Riding County Council's highways & bridges team, lead by county surveyor Col. S. M. Lovell.

The choice of the most economic and viable route for the M.62 was a particularly difficult problem in light of the variety of terrain to be crossed. Many requirements such as minimum severance to agricultural land and established property, preservation of landscape features, minimum cut and fill and ease of junction construction had to be built into the computer program.

Programs run on the council's Honeywell 400 computer investigated an array of possible routes and levels that would have been impractical otherwise, it was said. The computer tested alignment alternatives, gradients and curves. Bridge design work also was included in the M.62 program, with the proposed Scammonden bridge — at more than 500 feet — slated to be the longest concrete bridge in the country.

DIGITAL COMPUTER CONTROLS NEW TRAINER FOR NAVY PILOTS

At Pensacola Naval Air Station a unique instrument flight trainer, controlled by a computer, teaches novice pilots to fly with both feet on the ground. Supplied by General Precision's Link Group to the Naval Training Device Center, the new flight simulator system uses a Honeywell DDP-124 computer to accustom Navy pilots to basic instrument flight procedures by simulating the T-28B aircraft, a single-engine propeller-driven training plane.

Daniel Inabinett, Link's program manager for the system, said, "The new computer system is unique in two respects. It is the first digital computer to perform all the calculations for a basic instrument flight trainer and the first to control as many as four cockpits simultaneously."

Within each of the four cockpits, the trainee is faced with virtually all the controls and instruments found in the actual aircraft. He is required to operate and interpret the flight and navigational instruments, coordinate

the flight and navigation systems and scan the various cockpit instruments.

Realistic problems can be presented to the student pilots by their instructors from four instructor stations connected through the computer to the cockpits. A special feature of the system allows one instructor to work with all four cockpits from one instructor station.

The T-28B's power plant, braking and steering systems, landing gear, surface controls and radio navigation and communication systems are all simulated by the training device. Aircraft flying qualities are also simulated by the system to add realism to the instrument interpretation and navigational training.

The DDP-124 computer is located behind the instructor stations. From his post there, the computer operator monitors and controls the over-all trainer. The only item of special test equipment associated with the trainer is an oscillograph used to record data during static and dynamic test routines.

COMPUTING SYSTEM CUTS SHOE PATTERNS

A computing system that cuts shoe patterns has been developed by IBM Corporation. The system uses an IBM 1130 computer plus a digitizer and a pattern generator manufactured by Gerber Scientific Instrument Company of Hartford, Conn.

The computer is programmed using punched cards instructing it to cut patterns in a variety of widths within any one size from a master design. The outline of the master pattern is traced by the digitizer, an electronic drafting table with an arm that moves along the pattern and records the dimensions on punched cards as mathematically precise points on an imaginary graph.

The punched cards are then fed into the computer and the cutting is performed by the pattern generator, a second table-like device. The result is a more accurate and faster method of preparing patterns.

ORGANIZATION NEWS

RECOGNITION EQUIPMENT FORMS TWO SUBSIDIARIES

Herman L. Philipson, Jr., Recognition Equipment Inc. president, has announced that the board of directors of Recognition Equipment has approved the formation of two wholly owned subsidiaries.

The Docutel Corporation will develop automatic devices capable of accepting currency and vending documents that are suitable for processing on Recognition Equipment's Electronic Retina[®] Computing Reader. Corporation S will provide programming, systems, and methods services on a contract basis to users of the Electronic Retina Computing Reader.

In connection with the formation of the Docutel Corporation, Recognition Equipment has entered into an agreement with the Automated Machine Corporation, Nashville, under which it has acquired the nonexclusive right to all patents, technology, and know-how associated with Automated Machines' Lectro-Teller (an electronic device that accepts U.S. currency — both bank notes and coins — for bank deposit and automatically provides a printed record of the transaction).

The agreement also gives Recognition Equipment certain exclusive rights, for a period of 9 months, to obtain the services of Milgo Electronic Corp., Miami, in the development of devices using the Lectro-Teller technology. Milgo participated in the development of Lectro-Teller for Automated Machines.

SPEEData SERVICE OPENS NEW OFFICE IN CHICAGO

A new Chicago regional office has been opened by SPEEData Inc., a data processing service that provides manufacturers and marketers with comprehensive reports on grocery product movement.

SPEEData's services are used in the management, sales, merchandising, advertising and research areas of a rapidly increasing number of national grocery product manufacturers. Monthly reports now cover more than 150 product groups, 412 categories, and 100,000 items.

SPEEData Inc., with home offices in New York City, is a subsidiary of Computer Applications Inc., one of the nation's largest independent data processing firms, serving business, industry and government.

HONEYWELL ENTERS EUROPEAN REAL TIME COMPUTER MARKET

Honeywell Inc. has announced the formation of a new control computer operation in Europe. The formation of Honeywell's Computer Control Operations, Europe, stems from the merger of the Computer Control Company, Inc. in Framingham, Mass., with Honeywell in May, 1966, according to Claude H. Smith, vice president for computer operations in Europe.

He said that DDP-516 and DDP-416 computers, introduced in the U.S. by the Computer Control Division in October and November, and made in Framingham, would be built at Newhouse, Scotland for the British and European markets. "Marketing and support operations for the new computer line have already been established in England, Scotland, Germany, France, Switzerland and Holland," he said.

Computer Control Operations, Europe, will be based at Honeywell's London (Brentford) headquarters.

C-E-I-R TO INVEST \$1.8 MILLION IN MULTI-ACCESS COMPUTING

C-E-I-R, Inc. plans to invest an estimated \$1.8 million over the next two years to expand its present Washington, D.C. "multi-access" computer operations into a national network of large central computers serving hundreds of clients over ordinary telephone lines of other data communication channels.

Dr. Herbert W. Robinson, chairman and president, said that C-E-I-R's eight-man board of directors has approved a major project to "direct a significant portion of our resources toward establishing a firm position in what we believe is an entirely new industry." A more sophisticated service, involving an enlarged professional staff and new computer hardware, is now being developed and will be offered in other metropolitan areas in a series of "carefully-timed steps," he declared.

"We will concentrate our initial efforts in Eastern states," he said. "Under consideration for this Eastern phase are about a dozen metropolitan areas which will require 18 computer installations by the end of our 1968 fiscal year. We also intend to move into Midwest and Western business centers as rapidly as possible, with a program of comparable intensity."

Dr. Robinson said that C-E-I-R is launching an intensive drive to recruit top level computer programmers and analysts for this new venture. They will develop proprietary computer programs and work with C-E-I-R's customers in applying this new tool to government and business problems.

EDUCATION NEWS

BELL SYSTEM BUSINESS COMMUNICATIONS SEMINAR

The Bell System has inaugurated business communications seminars in New York City for executives. The Communications Seminar is a continuing program developed by the Bell System to help executive management better understand the role of communications in effective information systems. The seminars study communications in relation to the information explosion and the development of management information systems and stress the interdependency of systems planning, data processing and communications. By means of films, case histories, lectures and discussions, the seminars give the executives deeper insight into the ways modern communications can contribute to improving corporate planning, growth and profits.

Seminar sessions have been planned for executives representing all types and sizes of business, government and military agencies, trade associations, municipalities and other organizations that rely on business communications. To permit maximum participation, each session normally is limited to 25 persons. Sessions are conducted on a continuing basis during every month except August.

Sessions are varied to meet the needs of different groups of participants. For top corporate officers there are one-day sessions that examine communications from a broad viewpoint. Two-day sessions

for operating management and representatives of business equipment manufacturers delve more deeply into specifics.

In addition to the regular seminar programs, special sessions can be arranged for executives from individual industries, individual companies, and federal, state and local government agencies.

Applications and questions concerning attendance are handled by the major account managers and communications consultants of the Associated Bell Telephone Companies.

STATE UNIVERSITY OF NEW YORK AT BUFFALO WILL ESTABLISH A COMPUTER SCIENCE DEPARTMENT

A Department of Computer Science will be established within State University at Buffalo's new Faculty of Engineering and Applied Science, President Martin Meyerson has announced. Dr. Anthony Ralston, currently director of University's Computing Center, is expected to be named head of the new department by the State University of New York Board of Trustees.

Starting in the fall of 1967, the new department will be offering graduate programs leading to the degrees of Master of Science and Doctor of Philosophy in the field of computer sciences. Possible areas of specialization will include numerical mathematics, programming and programming systems, artificial intelligence and symbolic manipulation, and structure of computers and automata theory.

Dr. Ralston, noted that these will be the "first graduate programs in computer science to be offered by the State University of New York." He stressed that in addition to the formal degree programs, the department will make available "service" courses for instruction on computers and their use to the rest of the University.

NEW PRODUCTS

Digital

TIME-SHARING SYSTEM FROM PHILCO

Philco-Ford Corp., Philadelphia, Pa., has developed a time-sharing computer system using Philco Model 102 and 212 computers in combination. Initial availability is being limited to current users of Philco computers.

The Model 102 computer is a digital communications data processor in production for the overseas AUTODIN military communications network. The Model 212 is a large scale, high speed computer with 1.5 microsecond memory.

Lloyd Cali, director of Communications Switching and Data Processing, in Philco-Ford's Communications & Electronics Division, said, "Solving the communications problem is one of the essential elements in achieving a true, real-time, time-sharing system. We have accomplished that by using the Philco 102 Communications Switching System as the front end of our system."

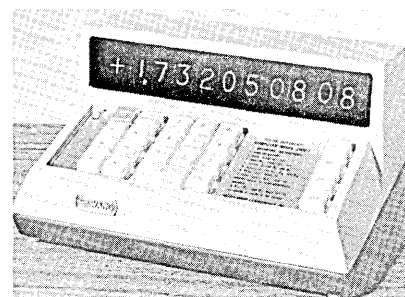
As Cali explained the Philco-Ford approach, the Philco 102 provides the computer capability required for communication with approximately 100 remote terminals. At the same time, on a separate functional level, the 102 organizes incoming data into a form acceptable to the main processor. The Model 212 computer is entirely free to perform the computational duties of the system, channeling finished work back to the Model 102 for retransmission to the user.

The system, while providing real-time service for about 100 users, will accommodate as many as 200 remote terminals without significant delays in service. Applications are seen for the Philco time-sharing system in scientific problem solving, design automation, data collection and distribution, numerical analysis, file maintenance and inquiry processing. (For more information, designate #41 on the Readers Service Card.)

LOW-COST COMPUTER FOR PRECISE COLOR MATCHING

A compact, versatile electronic computer system, produced by Wang Laboratories, Inc., Tewksbury, Mass., can be adapted to solve complex color comparison problems almost instantaneously.

Typical of the new Wang 400 Series is a special color-difference digital computer (shown here) which is used in the production of paints and dyes. An operator enters specific instrument readings by means of the keyboard on the small display console. When sev-



eral special function keys are depressed in sequence, the computer solves a set of equations and reads out numbers, on a lighted Nixie-tube display, which indicated directly the closeness of the color match obtained. The simple operating instructions are printed on the console, and the computer is run by persons without special training. Detailed calculations are controlled by a hard-wired programmer.

In general, the Series 400 system consists of a processor package which may be connected to as many as four individual desk-top consoles, any one of which may be operated at a given time.

The Wang system has complete arithmetic capability. It also can automatically generate logarithms and anti-logs. A great variety of special programs and functions can be hard-wired into a Series 400 System, to permit quick, simple, accurate solution of complex production problems by untrained personnel. (For more information, designate #42 on the Readers Service Card.)

IBM INCREASES POWER OF ITS SMALLEST COMPUTER

A four-way expansion of the low-cost IBM 1130 computing system recently was announced by IBM Corporation. The 1130, originally de-

Newsletter

veloped as a small scientific computer, has been improved in four major areas to help users tailor it to their individual needs.

Expansions of the 1130 include: five times the disk storage; four times the magnetic core memory size; an additional processing speed almost 40% faster than previously available; more and faster peripheral equipment, including an optical mark reader; and an improved commercial programming package.

Other peripherals include high-speed printers, card and paper tape readers and punches, and a plotter that represents data in graphic form. Printing speeds of 600 lines per minute and card reading speeds of 1000 cards per minute now are available. (For more information, designate #63 on the Readers Service Card.)

Digital-Analog

MULTI-CHANNEL SOLID-STATE PROGRAM CONTROL COMPUTER

CompuDyne Corp., Hatboro, Pa., now is offering a Multi-Channel Solid-State Program Control Computer to industry for the automatic control of commercial processes and programs.

The Model DCS-1010 system consists of sequence and distribution logic, core memory, processor registers, and ramp generators with input through either a directly-connected or remote teletypewriter utilizing alpha-numeric coded tape.

The Digital/Analog Computer has a 12 bit 1024 word basic memory and a 5 micro-second memory cycle with 8 clocked output channels which are expandable as an option to 65 channels. Outputs are precisely synchronized sequences of line segments with three selectable ramp rates from 100 milli-seconds to 999 seconds full scale with output voltages selectable between positive and negative 9.99 volts in increments as small as 0.01 volts. (For more information, designate #43 on the Readers Service Card.)

Memories

2.7 MILLION BIT, 2-1/2D MEMORY BY ELECTRONIC MEMORIES

A 2.7 million bit, 900 nano-second cycle core memory system recently was produced by Electronic Memories, Inc., Hawthorne, Calif., for a government agency computing system.

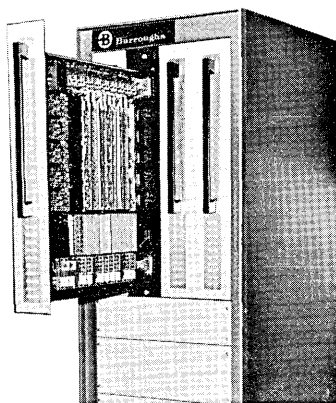
The "double-size" NANOMEMORY[®] system, contains twelve digitized storage drawers of 14 bits by 16,384 words each for a total capacity of 2.7 million bits. The largest sub-microsecond system previously produced by the Company was a six-drawer memory with a total capacity of 1.4 million bits.

The system weighs approximately 1300 pounds and measures 5'W x 6.5'H x 2'D. It contains 2,700,000 30-mil ferrite cores and more than one and one half miles of Teflon coated wire for interconnecting the memory circuits.

In addition to capacity and cycle time, the NANOMEMORY system has an access time of 350 nanoseconds. Input power is 115 VAC \pm 10 VAC, 60 cps, three wire, single phase. (For more information, designate #45 on the Readers Service Card.)

A 20% FASTER CORE MEMORY SYSTEM ANNOUNCED BY BURROUGHS

Burroughs Corporation has announced their fastest core memory system is in production at their Electronic Components Division in Plain field, N.J. This new system



has a cycle time of 0.5 μ sec. Up until now the fastest core memory system from Burroughs had a cycle time of 0.6 μ sec.

The new systems are 20% faster and will fulfill the requirements of the modern high speed computer system. The basic memory module and associated control module is 26-3/4" high (including mounting slides) by 20-1/2" deep (including mating connectors) by 4-1/4" wide. The modules are front access slide mounted units. Four of these modules will mount in a standard 19" rack.

The Burroughs lines of BFC core memory systems now range in cycle time from 0.5 μ sec. to 1.0 μ sec. (For more information, designate #44 on the Readers Service Card.)

FERROXCUBE DOUBLES SPEED AND CAPACITY OF THE FX-12 MEMORY SYSTEM

In an expansion of its line of small core memory systems, Ferroxcube Corp., Saugerties, N.Y., has developed the FX-12/F, a 1024 word x 8-bit coincident core memory with less than 5 microseconds full cycle time. This represents a doubling of both speed and capacity of the basic FX-12 system which Ferroxcube brought out a year ago. The latter has found wide application in the commercial/industrial market.

The new FX-12F is expected to extend the range of these applications considerably. Display refresh, data acquisition, small computers and certain types of communications buffers present areas of application which are suited to the 5 microsecond speed and 1K x 8 capacity of the FX-12/F. The low price and off-the-shelf availability of the new memory are likewise seen by Ferroxcube as favoring its use over more costly, if slightly faster, systems.

Ferroxcube supplies the FX-12/F with a full complement of I/O facilities, including data registers and timing and control circuitry. Memory and data control circuits together with the core stack are concentrated on three large-area printed circuit boards to improve reliability through a minimum of interwiring. (For more information, designate #46 on the Readers Service Card.)

Software

ANALOG SIMULATOR PROGRAM OFFERED TO HONEYWELL USERS

A digital computer program for simulating analog computers on Honeywell 24-bit machines has been announced by the firm's Computer Control Division. Designed for development-oriented university, research and industrial uses, the program is an adaptation of MIDAS (Modified Integration Digital Analog Simulator) for DDP-24, DDP-124 and DDP-224 computers. It allows analog and hybrid computer users to set up problem parameters or verify test results on a digital computer.

The program can be used to calculate derivatives and integrals, solve systems of differential equations and perform linear or quadratic interpolation and function generation.

MIDAS-24 is available in two versions both requiring minimum 16,384 word systems. A general program is designed for any input/output configuration and a special version applies to systems with card reader and line printer options.

The program, written in FORTRAN IV, consists of a "scan/sort" and an "execute" phase. Source program input is translated into a set of pseudocodes and sorted in the first phase and executed in the second. (For more information, designate #47 on the Readers Service Card.)

COMPUTER PROGRAMS FOR INSURANCE INDUSTRY

A series of new computer programs for gross premium evaluation develops profit pictures of entire companies or individual agents quickly and efficiently. The programs are being made available to the insurance industry by Bowles, Andrews & Towne of Atlanta, Ga., actuaries and management consultants with complete data processing facilities.

The new programs instruct a computer to analyze all important factors related to profit in an insurance company. The computer develops and prints: an over-all profit evaluation of present and future insurance on the books at

any point in time; and immediately available management information which helps to isolate the profit or loss contribution of each business factor analyzed.

The new gross premium evaluation programs are applicable to most types of insurance operations. They utilize existing information available to any insurance company with adequate data processing systems. By using the programs with its own computer equipment, or on a service bureau basis through Bowles, Andrews & Towne, a company can analyze profitability on a nationwide, regional, departmental, agency or individual agent basis.

The new evaluation programs can be used with all types of computer systems having 12,000 or more memory positions in their main core storage. The programs are currently available for punched card computer systems and soon will be available for systems equipped with magnetic tape or disk units. (For more information, designate #49 on the Readers Service Card.)

COMPUTER SOFTWARE PACKAGE FOR CARD-TO-TAPE SORT

A new computer software package, KS-2, now is available for lease from Essco, Inc., a subsidiary of Edmap Industries, Walnut Creek, Calif. The KS-2 program is designed to facilitate the sorting, selection and summarizing of data being transferred from punched cards to tape.

The KS-2 program instructs the computer to perform random sorting, random selection, and random summarizing, all simultaneously. It also provides for any combination of tape, punched-card or print output. Only three control cards must be prepared by the operator in order to adapt the program to a specific problem. In addition he may prepare up to two cards each for header and trailer information.

The minimum equipment required for the use of the KS-2 program is an 8000-core memory, four magnetic tape drives, a card-read-punch device, and an on-line printer.

When applied to computers such as the IBM 360 and IBM 1401, the ESSCO KS-2 program not only eliminates the need for writing a special software program, but also

saves up to 20% of the computer time while running the problem and 80% to 90% of the operator's time compared to that of a mechanical card sort.

(For more information, designate #48 on the Readers Service Card.)

Data Transmitters and A/D Converters

DATA COMMUNICATIONS SYSTEM, SERIES M-1000

A data communications system with features that include the capability of transmitting at twice the rate of existing equipment is being introduced in August by Marshall Communications Division, a subsidiary of Marshall Industries, San Marino, Calif. Melvin Doelz, president of Marshall Communications, says that the new system for the first time will offer a complete and integrated systems solution to the data communications problem.

The system, designated Series M-1000, will provide point-to-point bulk data transmission as well as store and forward, message switching and data communications capability. The system will use hardware and programs specifically designed for communications applications.

Other features of the M-1000 system will include: load sharing; graceful degradation; expandability; message protection; adaptive high-speed voice-grade trunk; systems configuration; and low incremental cost. (For more information, designate #51 on the Readers Service Card.)

PHONE-TO-KEYPUNCH TRANSLATOR

Any Touch-Tone telephone becomes a computer input station with the new Phone-To-Keypunch Translator developed by Computer Telephone Corporation, Silver Spring, Md. With this new device, it now is possible to enter data into punched cards without actually having a keypunch machine present...long distance or local.

The telephone instrument takes the place of an operator sitting at a keypunch machine punching both alphabetic and numeric information.

Newsletter

The translator attaches to the key-punch, receives incoming signals sent by pressing Touch-Tone keys, and immediately causes them to be punched and printed into data processing cards.

The Comput-A-Phone translator which employs a unique "TWIN-TONE" technique, opens the way to direct linkage of any telephone with a computer, instant computer response to credit checks, bank deposits, stock exchange sales and similar operations in the transportation, financial, service, manufacturing and communications industries.

Mr. Peter James, President of Computer Telephone Corp., says also that other models of the translator will permit scientists and designers to use their telephone instruments as calculator keyboards, sharing the use of a centrally-located computer, based on the translator technology. Ultimately, libraries, students, housewives, gas station attendants, and many others will be able to link directly into data processing operations through the Comput-A-Phone development. (For more information, designate #50 on the Readers Service Card.)

ULTRONIC MT-3000 SERIES MAGNETIC TAPE TERMINAL

A new 9-level, IBM 360 compatible, magnetic tape terminal, for the transmission and reception of magnetic tape data over both standard telephone lines and wide-band Telpak, has been developed by Ultronic Systems Corp., Data Communication Products, Pennsauken, N.J.

The MT-3000 series terminal transmits up to 4800 bits/second on voice-grade lines and up to high-speed data rates on Telpak channels. The company says that it is capable of handling any 8-level code. The new system writes, reads and checks digital data in IBM 9-level 360 compatible format with densities of 200, 556 and 800 bits per inch.

Transmitted data may be used to make punch cards or paper tape, to duplicate another magnetic tape or to produce a hard copy, depending on the requirements of the receiving station. Incoming data can be received into the terminal from paper tape transmitters, keyboards or punch card readers, depending on the requirements of the transmitting station.

In addition to transmitting data, the MT-3000 terminal util-

izes control characters during transmission to maintain communication and control of data records.

Record size of the system is variable up to 8192 characters per record, and the terminal is compatible with specifications of EIA RS232. It operates in a temperature range from 60° to 90°F. The complete cabinet measures 73 1/4" high, 50" wide and 24 1/8" deep. (For more information, designate #52 on the Readers Service Card.)

Input-Output

GERBER SERIES 500 AUTOMATIC DRAFTING SYSTEM

The advent of the high speed digital computer solved many problems and created certain others. Computers make computations and process programs so rapidly that conventional data output devices, operating at hundreds instead of millions of cycles per second, degrade computer operation to a totally unacceptable degree. The Gerber Series 500, from The Gerber Scientific Instrument Co., Hartford, Conn., is a computer output system that solves this problem, providing on-line graphic display yet permitting the computer to complete other tasks at its normal work rate.

Using micro-integrated circuitry throughout, the Gerber 500 uses priority-interrupt techniques to obtain data from the computer, mediating between the computer and the drafting table as a buffer to allow for most efficient computer operation and to provide continuous direction of the drafting process.

The computer may be programmed to pre-compute the graphic output data, store this data in core or on disc memory, then recall and output the data as called for by the Series 500. In this manner, the drafting program can operate at a low priority, as the 500 System will merely wait at completion of the last output until new data becomes available.

The Series 500 system is well suited for applications in which the output system time-shares the computer with a CRT console. In this way, hard copy output of the CRT operations may be obtained. Standard options permit adaptation to nearly any output requirement.

The Gerber Series 500, designed to operate with direct input from nearly any general-purpose digital computer presently available, forms a complete graphic output system when mated with any of the standard Gerber plotting tables and accessories. (For more information, designate #53 on the Readers Service Card.)

COMPUTER TERMINAL/COUPLER FOR TIME SHARING, FROM COM-SHARE, INC.

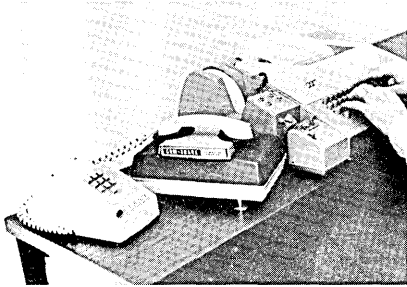
A new coupler providing computer time sharing has been developed by COM-SHARE, INC., Chicago, Ill. The Time Share Terminal is an input/output device designed to provide access to a computer through the use of an ordinary telephone by means of the coupler and a modified Model 33 Teletype Unit. The terminal set-up provides hard copy results and can be operated from any convenient telephone location in plant, office or home.

The Terminal, completely portable, can operate into any system using 103A2 Data Sets and ASCII

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Coded input. The coupler is available in two models for compatibility with most telephone equipment — one operates acoustically, the other magnetically.

Standard features include: half of full duplex operation, 115 volt, 72 character line, 10 characters per inch, 6 lines per inch, four-row ASCII keyboard, data communications type wheel, copyholder, operating and maintenance manuals, and a 90-day warranty for parts & labor.
(For more information, designate #54 on the Readers Service Card.)

PTR90 SERIES OF READERS FROM GENERAL ELECTRIC

The Printer-Reader Business Section of the General Electric Company has announced the availability of their high speed paper tape readers, the model PTR90 series. This series of readers uses General Electric Company's reflected light principle to read paper tape at speeds up to 1000 characters per second in synchronous type operation. These readers have the ability to read perforated paper tape — opaque to transparent, or printed paper tape, with ease.

The PTR90 series achieves a very high speed rate and reliability in asynchronous (start-stop) operations where they will read up to 225 characters per second. In addition, no mechanical adjustments are required in the drive mechanism.

Other features include 5-to-8 level reading through individual and separate amplifier channels. Radio frequency interference and susceptibility is minimized. A variable tape guide permits the use of all standard tape sizes between 11/16 and 1 inch widths. The standard model is equipped with negative 10-volt logic but other options are available to provide readers for all applications.
(For more information, designate #55 on the Readers Service Card.)

UNIVERSAL GRAPHICS PROCESSOR PROVIDES MAN-COMPUTER COLLABORATION

Concord Control Inc., Boston, Mass., has announced the Universal Graphics Processor. This system, designated the Mark 8, consists of an Automated Plotting Table joined to a high-speed general purpose digital computer. Mark 8 may be operated in any one of three modes: (1) as an Input Tracing Digitizer; (2) as an Output Digital Plotter; and (3) as both an Input and Output System simultaneously.

The general purpose digital computer has a memory storage capacity of 4096 words of 12 bits each and functions as the controlling element for the system. It provides on-line computation and analysis and acts as a buffer interface to other equipment. An ASR 33 Teletype is connected to the computer. Other input/output equipment such as high speed paper tape readers and punch card readers, IBM compatible magnetic tape transports, etc., may also be used as desired.

Complete software is provided, including a standard utility package and special programs for a point-recording, line-tracing, plotting and executive control.

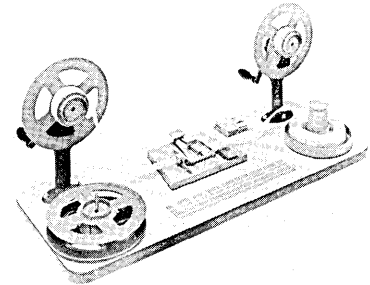
The Mark 8 system has wide application in all fields of high accuracy automatic drafting. These include map making, surveying, engineering design, graphic compilation and the analysis of graphic data.
(For more information, designate #64 on the Readers Service Card.)

DATA PROCESSING ACCESSORIES

PUNCHED TAPE PROCESSOR STATION

The Data-link Corporation, Los Altos, Calif., has introduced a new punched tape processor station which has in one convenient location a punched code registration gauge, a precision punched tape splicer, a manual tape punch and two manual winders.

This flexible processor handles 5, 6, 7 and 8 channel code punched tape. With the two manual winders the operator can wind in either direction. The addition of a center feed unwinder to the pro-



cessor station allows the selection of either end of the tape in one operation.

Other optional equipment is available with the processor, such as attachments for teletype and for NAB hub and reels.
(For more information, designate #57 on the Readers Service Card.)

NEW JOGGER EXCLUSIVELY FOR USE IN BANKS NOW AVAILABLE

The new OMNITEC 1004 Jogger, offered by OMNITEC Corp., Phoenix, Ariz., has been designed expressly to serve data processing centers in banks by automatically, rapidly and safely aligning the read edges of documents. Each of four bins will easily hold 500 checks, and alignment is accomplished in seconds.

The 1004 model "sifts" out paper clips, staples, rubber bands and paper debris, preventing foreign particles from damaging costly reader heads. Other safety features include an electrical design that eliminates the possibility of generating inductive spikes or other electrical noise that could feed back and cause read errors.

The patented actuator sharply raps documents into a precise straight line position in seconds rather than just shaking them. Documents are aligned against resilient pads minimizing noise and operator fatigue. A single knob turns the device on and off and regulates the intensity of the jogging action. A rugged, stable steel stand with 4 swivel casters that provide easy movement over all floor coverings, also is available.
(For more information, designate #56 on the Readers Service Card.)

QUIK-START MODEL II KEYPUNCH GUIDE

Data World Corporation of Canoga Park, Calif., has announced the development of the Quik-Start

DOES YOUR PRINTOUT LOOK LIKE THIS?

NELSON JUNIUS 44 MAIN - - -
 NELSON KATHERINE 146 BIDWL AV
 NELSON KENNETH W 282 DGLAS RD
 NELSON KNUD 65 DU BOIS AV -
 NELSON KURT 24 SHMIDTS LA -
 NELSON LAWRENCE JR 317 RUDYRD
 NELSON LOUIS B 11 COALE AV -
 NELSON MARIE MRS 29 HATFLD PL
 NELSON MARTIN B 139 REGAN AV
 NELSON MARY 21 PEARL - - - -

OURS IS BETTER

Nelson Mary J Mrs 71 Lamprt Blvd - - - - YU 1-
 Nelson Maurice K 55 Austin Pl - - - - YU 1-
 Nelson Mildred 81 Detroit Av - - - - YU 4-
 Nelson Nels 86 Coale Av - - - - GI 8-
 Nelson Nels 68 Marx - - - - GI 2-
 Nelson Nels Victor 7 Nash Ct - - - - YU 4-
 Nelson Norman 435 Delafld Av - - - - GI 8-
 Nelson Norman I 53 Mildrd Av - - - - GI 2-
 Nelson Oscar C Mrs 93 Hamln Pl - - - - SA 7-
 Nelson Otto S 418 Wds Ardn Rd - - - - YU 4-
 Nelson Patk 53 Grant Pl - - - - EL 1-
 Nelson Robt L 36 Constnt Av - - - - GI 2-
 Nelson Robt P 29 Idaho Av - - - - YU 4-
 Nelson Roy C 452 Clark Av - - - - YU 7-
 Nelson Russell G 1609 Castltn Av - - - - GI 7-
 Nelson Russell M 95 Circl Rd - - - - YU 7-
 Nelson Stanley 96 Sawyr Av - - - - GI 2-
 Nelson Ter Inc catrers 23A Nelsn Av - - - - 984-
 Nelson Theresa 19 Rokwl Av - - - - GI 2-
 Nelson Thos A 21 Stratfrd Rd - - - - SA 7-
 Nelson Thos P 527 Craig Av - - - - YU 4-
 Nelson Wallace 647 Coleg Av - - - - GI 2-
 Nelson Wayne M Jr 161 Wardwl Av - - - - YU 1-
 Nelson Wilfred B 79 Bodin - - - - GI 2-

From your magnetic tape, we can compose a complete page of your directory, parts list, phone book or abstract, in a wide range of type styles and sizes. Our high speed phototypesetting service utilizes the Photon 901 system.

We can save you money in printing, paper and binding by adding up to 30 per cent more information per page, and by eliminating page make-up.

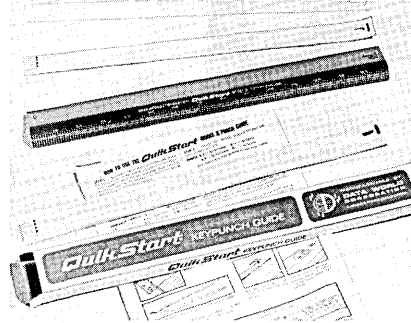
The cost for a complete page is less than \$4.00.

**SEDGWICK
PRINTOUT
SYSTEMS**

410 East Sixty-Second Street,
 New York, N.Y. 10021
 New York 212-838-5304.

Designate No. 10 on Reader Service Card

Model II Key punch guide. The manufacturer claims this Quik-Start II rule makes keypunching faster, more accurate and reduces learning time. It is designed to provide keypunch instructions on the operator's source document at all times.



Quik-Start II includes specially designed form-pads with spaces and a method for writing easily recognizable symbols common to most keypunch instructions. Extra space is provided for operators to develop their own symbols that may be more meaningful to them individually. These are areas for: field identification, special handling indicators, card columns and special notes. Any operator may quickly and easily "format" the keypunch operation.

The manufacturer asserts, that after short use, the Quik-Start II speeds punching, reduces errors and eliminates the necessity for operators to re-check against previous instructions. (For more information, designate #58 on the Readers Service Card.)

PAPER TAPE SPLICER, MODEL 5200

Dresser Products Incorporated of Providence, R.I., recently has marketed a new paper tape splicer for trimming and splicing two separate tape ends or for repairing a torn or damaged tape.

The Model 5200 Splicer has a number of advantages and improvements over previous models, such as automatically positioned steel blades, precision-spaced pins, four counterbalanced tape covers, self-locking clamps with adjustable pressure screws and detachable steel cutting edges.

The Model 5200 is constructed of solid cast aluminum for maximum wear and minimum weight and is finished in gunmetal black to eliminate eye strain. (For more information, designate #59 on the Readers Service Card.)

NEW LITERATURE

SOVIET AUTOMATION AND COMPUTER ADVANCES REPORTED IN NEW 1967 JOURNAL

A brand new Soviet journal, "Avtomatika i Vychislitel'naya Tekhnika," which commenced publication in the USSR with the January-February 1967 issue, has been scheduled for cover-to-cover translation into English by The Faraday Press, New York.

AUTOMATIC CONTROL, as the journal will be titled in its English version, provides broad coverage on the particular problems of synthesis, analysis and optimization of complex discrete systems. The new bi-monthly will contain original research papers dealing with the synthesis of optimum discrete automatic circuits in preset modules; automation of process control by means of computers; ways and means of system simulation (modelling); automatic control systems and supervision of complex control units; methods of statistical searching; multi-channel optimizers and synthesizers; optimum control in biological systems, etc.

AUTOMATIC CONTROL is the latest in the Faraday journal program of thirty-one cover-to-cover translations from Russian. (For more information, designate #60 on the Readers Service Card.)

WHICH TAPE PERFORATOR?

"A management decision in favor of tape-controlled typesetting must inevitably involve the selection of appropriate input keyboarding devices. With at least two dozen alternatives offered by a dozen manufacturers, isolating the best model can be a formidable undertaking if the problem is approached in a haphazard manner."

With this preface, Composition Information Services, Los Angeles, Calif., has announced the completion of a comprehensive study designed to facilitate this increasingly important equipment decision. In addition to a report entitled "Which Tape Perforator?" detailing the various criteria involved in perforator selection, CIS members have received an 11 x 17 inch Comparison Chart specifying the significant characteristics of all popular justifying and non-justifying

ing keyboards. A supplement to the chart amplifies various aspects of perforator decision-making and cites special features distinguishing each of the various models.

In conjunction with this practical analysis of keyboarding equipment, CIS also emphasizes that "... while keyboarding equipment may represent the least expensive part of one's investment in tomorrow's type-setting, the effectiveness with which perforating units are selected and employed will, to a very great extent, determine the economic success or failure of one's entire plunge into tape control!"

The tape perforator selection study and Comparison chart are available to CIS members without charge. (For more information, designate #62 on the Readers Service Card.)

A COMPREHENSIVE LOOK AT MAGNETIC TAPE REHABILITATION

A definitive brochure describing the latest state-of-the-art in magnetic tape rehabilitation is available free from Cybetronics, Inc., Waltham, Mass. The folder contains explanations of such terms as tape cleaning, testing, certification, and describes new tape conversion techniques at length. Other subjects covered are tape life, head-to-tape separation, tape cleaning processes, hypercritical testing techniques.

The folder is designed to help the magnetic tape user establish a certification program in-house. The text includes hints on organizing a tape library, provides up-to-date control procedures and indicates the relative costs for various types of rehabilitation equipment and services. (For more information, designate #61 on the Readers Service Card.)

BUSINESS NEWS

CSC REPORTS RECORD REVENUES AND EARNINGS

Record operating revenues and earnings of Computer Sciences Corporation for the 52 weeks ended March 31 were markedly higher than the comparable figures for the like year-earlier period.

Fletcher Jones, president of CSC, announced that earnings for the 52 weeks rose to \$1,704,000 after provision for federal income taxes. On a comparable basis earnings for the year-earlier period totaled \$485,000 after provision for federal income taxes.

Fiscal 1967 revenues also rose sharply, to \$38,860,000 from \$25,298,000 in the previous fiscal year.

The year-earlier figures include operations of companies acquired during the year on a pooling-of-interests basis. Excluded from fiscal 1966 results are revenues of \$2,900,000 and earnings of \$1,989,000 arising from the sale of an interest in the CSC-developed Computax system for the computer preparation of income tax returns.

C-E-I-R REPORTS IMPROVED EARNINGS FOR FIRST HALF

C-E-I-R, Inc. has reported net income for the first half of its 1967 fiscal year was \$152,600 on sales of \$11,309,400 compared with income of \$47,900 on sales of \$11,806,600 during the same period in fiscal 1966.

Dr. Herbert W. Robinson, chairman and president of the Washington-based applied research and computer services company, said the six-month period ended March 31, 1967, "was devoted almost entirely to streamlining and reorganizing operations and cutting back investment expenses in order to eliminate the heavy rate of loss — about \$1.2 million per annum — which existed at the end of fiscal 1966. We are pleased to report the successful completion of this task."

C&S EARNINGS CLIMB TO NEW HIGH

Earnings of Computing and Software, Inc. (C&S) climbed to an all time high of \$151,000 for the second fiscal quarter ended April 30, 1967. These earnings amounted to an increase of 36% over the \$105,000 reported for the comparable period of 1966.

Sales for the quarter ended April 30, 1967 also reached a record high of \$3,674,000, a substantial increase over the \$2,555,000 for the comparable period in 1966.

N. E. Friedmann, President of C&S, said earnings for the first six months of C&S' 1967 fiscal year were \$259,000 compared with \$194,000 for the comparable period one year ago. Sales for the first six months of 1967 increased to \$7,194,000 from \$5,176,000 reported one year ago.

COLLINS RADIO REPORTS 67% INCREASE IN NET INCOME

Net income of Collins Radio Company for the nine months which ended April 28, 1967, was \$8,937,000, an increase of 67% over net income of \$5,357,000 for the first nine months of the previous fiscal year, Arthur A. Collins, President, reports.

Sales for the nine months ended April 28, 1967 were \$322,274,000, an increase of 18% over the \$272,062,000 for the corresponding period of 1966.

The company's backlog at April 28, 1967 was \$430 million, compared with \$337 million at the end of the same period in 1966, and \$403 million at January 27, 1967.

INFORMATICS ANNOUNCES ANNUAL REPORT

Informatics Inc. reported income of \$279,020 on revenues of \$6,427,558 for the fiscal year ended March 25, 1967, compared with a net income of \$171,258 on revenues of \$4,496,162 in fiscal 1966.

Dr. Walter F. Bauer, President, told stockholders that "profits had increased substantially, despite investments in the development of proprietary programs. These programs will be made available for sale to many users rather than custom-tailored to a particular user."

He reported that one "off the shelf" product, MACS, Media Account Control System, developed for advertising agencies in conjunction with the United California Bank, is now producing "modest royalty revenues." Another proprietary program, the Mark IV File Management System, being developed with financial support from four large companies, can be applied to most business data processing applications on the IBM 360 computer, he said.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Potter Instrument Company, Inc., Plainview, N.Y.	Burroughs Corporation, Detroit, Mich.	Purchase of Potter's high-speed HSP-3502 Chain Printers to be used with various Burroughs data processing systems	over \$9 million
University of Utah, Salt Lake City, Utah	Advanced Research Projects Agency, Department of Defense	Research in the field of man-computer systems — contract covers about 3 years	\$5,028,542
Shell-Mex and B.P. (British Petroleum) Ltd., London, England	Sperry Rand Corp., Univac Div., Philadelphia, Pa.	Two UNIVAC 1108 computer systems over two-year period as part of plans to develop use of data processing in its business operations	\$5,000,000
Scientific Data Systems, Santa Monica, Calif.	Martin-Marietta Corp., Denver Division	Two Sigma 7 computer systems to be used for on-line ground checkout of launch facilities for USAF's TITAN-III M Launch Vehicle	\$3.5 million
Standard Telephones and Cables Ltd. (ITT affiliate) Great Britain	British Post Office	An automatic exchange for the Telex service, which is a customer-to-customer teleprinter message exchange system	\$2.8 million
Data Trends, Inc., Parsippany, N.J.	ITT World Communications, Inc., New York, N.Y.	A totally computerized communications switching center	\$2,000,000
Honeywell Computer Control Division, Framingham, Mass.	Stromberg-Carlson Corp., Data Products Div., San Diego, Calif.	Sixty DDP-516 computers which are used as components in Stromberg-Carlson systems	about \$2,000,000
California Computer Products, Inc., Anaheim, Calif.	National Aeronautics & Space Administration, Goddard Space Flight Center	Design, development, construction, test and integration support of command clock subsystem for NIMBUS D (weather) spacecraft	\$1.5 million (cost+ incentive)
Ampex Corp., Redwood City, Calif.	Systems Engineering Laboratories, Inc., Fla. Hewlett-Packard Co., Calif. Autonetics Div., North American Aviation, Calif.	Model Aztec magnetic core memory stacks; Systems Engineering and Hewlett-Packard will use the stacks in various special data processing systems; Autonetics will use the core memories in electronic navigation systems	\$1.4 million
Computer Sciences Corp., El Segundo, Calif.	U.S. Army, Fort Monmouth, N.J.	Development of an improved automatic data processing system for the U.S. Army's Pacific depot supply network	\$1.3 million
	Defense Communications Agency	Provision of computer-based services to the National Military Command System Support Center	\$1 million
Rixon Electronics, Silver Spring, Md.	Telex Corp., New York, N.Y.	Data Message Composers (DMC) which will be used in the expansion of the nationwide Telex Reservation System	\$600,000
Sperry Rand Corp., Univac Division, New York, N.Y.	Buckbee Mears Co., St. Paul, Minn.	UNIVAC 418 II computer system to form heart of new system for generation of high precision artwork	about \$450,000
Laboratory for Electronics, Inc., Electronics Div., Boston, Mass.	Air Force Materials Laboratory, Wright-Patterson AFB, Ohio	Follow-on effort in final project phase aimed at developing manufacturing process and techniques applicable to production of non-mechanical random access mass memory system with storage capacity to 10 ⁸ bits	\$300,000
The National Cash Register Co., Dayton, Ohio	U.S. Post Office Department, Bureau of Research and Engineering	Development, fabrication and testing an engineering model of a machine which will find the address side on parcels, rotate the packages so the address is right side up, then arrange the packages so the addresses all face the same way	\$244,000
		Perform statistical study of parcel post packages; consider the mechanized address reading problem as defined by the statistical analysis and recommend best method for scanning address information	\$111,000
Gilmore Industries	Laval University, Quebec, Canada	Building of a structural loading system which will simulate wind and snow loads, earthquakes, and other stresses on structural building components	\$225,000
Digital Logic Corp., Orange, Calif.	S. Sterling Co., Data Sciences Division, Detroit, Mich.	Design and production of 6 Concentrator and Message-Switching Units for a national computer time-sharing network	over \$100,000
System Development Corp., Santa Monica, Calif.	New York City Board of Education, New York, N.Y.	Design of a computer-aided system to improve effectiveness of Board's monitoring of federal education-assistance funds	\$86,000
Philco-Ford Corp., Communications and Electronics Div., Philadelphia, Pa.	U.S. Army Tank-Automotive Command (ATAC), Warren, Mich.	Investigating, studying, and analyzing new concepts for automatic diagnostic systems for the detection of malfunctions and impending malfunctions in military vehicles	\$66,700
B-R Data Systems, Inc., a subsidiary of Bunker-Ramo Corp., Silver Spring, Md.	Department of Interior, Bureau of Outdoor Recreation	Design of a management information system and computerizing nation's "Grants-in-aid" outdoor recreation program	\$48,400
Programming Service, Inc., Tarzana, Calif.	United California Bank	Development of a scientific farm management system for the dairy industry	—

NEW INSTALLATIONS

<u>OF</u>	<u>AT</u>	<u>FOR</u>
Control Data 3300 computer system	CDP Computer Data Processors Ltd., Calgary, Alberta, Canada	Reduction of petroleum exploration data in the geological and geophysical fields; other applications will include engineering computations and automated mapping procedures
Control Data 3600 computer system	Control Data Corporation's Twin Cities Data Center, Minneapolis, Minn.	Fulfilling growing demand for more commercially-available computer time; will nearly double time for users throughout Upper Midwest
Control Data 6400 computer	Batelle Memorial Institute, Colum- bus Laboratories, Columbus, Ohio	Use by researchers in studies ranging from inform- ation retrieval to simulation of railroad systems
Control Data 6600 computer system	Control Data Corporation's Los Ange- les Data Center, Los Angeles, Calif.	Computer users on a straight time-charge basis
GE-415 computer	The First National Bank of Erie, Erie, Pa.	Use initially to maintain checking account book- keeping
	United States Steel Corporation, Duquesne Works, Duquesne, Pa.	Manufacturing applications such as order entry and customer service
Honeywell 120 computer system	Medusa Portland Cement Co., Cleve- land Heights, Ohio	Customer billing, pricing analyses, payrolls, cost reports and market studies
	Steiner American Corp., Salt Lake City, Utah	Payroll processing, general accounting; labor, cost, and project analyses; inventory controls; and pur- chasing data
Honeywell 200 computer system	London Trustee Savings Bank, London, England	Processing all savings and current accounting for 82 branches having over 750,000 active accounts
	The Acadia Parish School Board, Crowley, La.	Attendance records, mark reporting, testing and test analysis and cumulative records; general aim is to build an information system to be used as a base for curriculum research
	Gallaher Ltd., Northolt, Middle- sex (2 systems), and Belfast, North- ern Ireland (1 system)	Part of a complex sales accounting system at Northolt; Belfast computer controls tobacco leaves used in producing variety of brand name tobacco products, and handles payroll for Gallaher employ- ees in Northern Ireland factories
Honeywell 1200 EDP system	Public Service Co., Albuquerque, N.M.	Customer billing and accounting, general ledger, payroll, inventory control and a variety of engi- neering applications
IBM 1440 computer	Big Apple Foods, Central Islip, N.Y.	Keeping a perpetual inventory thereby reducing op- erating expenses (and prices to consumer)
IBM System/360 Model 30	First National Bank in St. Louis, St. Louis, Mo.	Addition to bank's complex three-computer system to provide greater data processing capacity
	Alco Products Inc., a Worthington Corporation subsidiary, Schenec- tady, N.Y.	Expanding computer center, handle more models of diesel engines and locomotives, offer more custom- er services. Also will handle payroll and account- ing functions, inventory and schedule production and make capital investment decisions
	Massachusetts Casualty Insurance Co., Boston, Mass.	Step one in a program to provide its field offices throughout the country with 'instant information'
IBM System/360 Model 40	General Dynamics, Electric Boat Division, Groton, Conn.	Help in speeding the construction and repair of nuclear submarines
NCR 315 computer system	Genetti's Super Markets, Inc., Hazelton, Pa.	Inventory, sales analysis and payroll problems
	Banco Argentino de Comercio, Argentina	Handling checking accounts, savings accounts, loans and discounts, customer securities accounts, pay- roll, general accounting and all required statis- tics and special reports
NCR 315 Rod Memory Computer	London Computer Center of Martins Bank at Bucklersbury House, Wal- brook, London, England	Serving branches of Martins Bank in central London area, initially; later extension to branches in provinces by means of data transmission links
RCA Spectra 70/25 system	Iron City Sash & Door Company, Pittsburgh, Pa.	Inventory and accounting functions
RCA Spectra 70/45 system	Amarillo Hardware Co., Amarillo, Tex.	A broad range of applications including inventory control of a million bales of cotton and the blend- ing of cattle feed
	State of Missouri, Revenue Depart- ment, Jefferson City, Mo. (2 computers)	A \$2.5 million EDP system to collect taxes, issue drivers' licenses, form nucleus of state-wide com- munications network involving major law enforcement agencies and other applications
UNIVAC 491 real-time computer system	Gordons Transports Inc., Memphis, Tenn.	Processing about 8000 freight bills daily, obtain- ing up-to-the-minute shipment information, keeping track of equipment, dispatching, revenue accounting and general accounting (system valued at \$1.2 million)
UNIVAC 1108 computer system	Ontario Hydro, Toronto, Ontario, Canada	Engineering and scientific work; also extension of management information services (system valued at \$3 million)
	Carnegie Institute of Technology, Pittsburgh, Pa.	Meeting the increased computation needs of teachers, student researchers and production personnel (system valued at \$1.8 million)
UNIVAC 9200 computer system	Automated Records Corp., Richard- son, Texas	General accounting tasks and payroll processing

MONTHLY COMPUTER CENSUS

The number of electronic computers installed or on order at any one time has been increasing rapidly during the past several years. New models have been offered in the computer market, and familiar machines have gone out-of-production and subsequently been retired from active use and dismantled. Some new computers have been received with open arms by users — others have been given the cold shoulder.

To aid our readers in keeping up with this rapidly changing profile of computer use, COMPUTERS AND AUTOMATION presents this monthly report on the number of general purpose electronic digital computers made by U.S.-based companies which are installed or on order as of the preceding month. These census figures include installations and orders outside the United States. The figures are compiled and updated each month by the International

Data Corporation, Newton, Mass., a market research firm specializing in the computer industry. We hope they will serve as a useful "box-score" of progress for readers interested in following the growth of the American Computer Industry and of the computing power it builds.

In general, manufacturers in the computer field do not officially release installation and on order figures. The figures in this census are developed through a continuing market survey conducted by the International Data Corporation. This market research program compiles and maintains a worldwide computer installation locator file which identifies, by customer, the installation sites of electronic computers. The resulting census counts are submitted to the individual computer manufacturers for their review and voluntary confirmation.

AS OF MAY 10, 1967

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFULFILLED ORDERS	
Autonetics	RECOMP II	Y	\$2495	11/58	32	X	
	RECOMP III	Y	\$1495	6/61	6	X	
Bunker-Ramo Corp.	BR-130	Y	\$2000	10/61	160	X	
	BR-133	Y	\$2400	5/64	40	28	
	BR-230	Y	\$2680	8/63	15	X	
	BR-300	Y	\$3000	3/59	33	X	
	BR-330	Y	\$4000	12/60	28	X	
	BR-340	Y	\$7000	12/63	20	X	
Burroughs	205	N	\$4600	1/54	39	X	
	220	N	\$14,000	10/58	31	X	
	B100	Y	\$2800	8/64	184	8	
	B200 Series	Y	\$5400	11/61	590	6	
	B300 Series	Y	\$9000	7/65	155	70	
	B2500	Y	\$5000	2/67	7	65	
	B3500	Y	\$14,000	5/67	1	60	
	B5500	Y	\$22,000	3/63	68	8	
	B6500	Y	\$33,000	2/68	0	15	
	B8500	Y	\$200,000	8/67	0	4	
Control Data Corporation	G-15	N	\$1600	7/55	275	X	
	G-20	Y	\$15,500	4/61	25	X	
	LGP-21	Y	\$725	12/62	160	X	
	LGP-30	semi	\$1300	9/56	132	X	
	RPC-4000	Y	\$1875	1/61	63	X	
	160*/160A/160G	Y	\$2100/\$5000/\$12,000	5/60;7/61;3/64	462	X	
	924/924A	Y	\$11,000	8/61	28	X	
	1604/1604A	Y	\$45,000	1/60	59	X	
	1700	Y	\$3500	5/66	75	180	
	3100/3150	Y	\$10,000	12/64	105	30	
	3200	Y	\$14,000	5/64	66	X	
	3300	Y	\$19,500	9/65	68	55	
	3400	Y	\$18,000	11/64	19	X	
	3500	Y	\$30,000	9/67	0	10	
	3600	Y	\$48,000	6/63	45	X	
	3800	Y	\$49,300	2/66	19	12	
	6400/6500	Y	\$52,000	5/66	15	24	
6600	Y	\$117,000	8/64	25	18		
6800	Y	\$130,000	6/67	0	2		
Data Machines, Inc.	620	Y	\$900	11/65	59	10	
	620I	Y	\$500	5/67	0	44	
Digital Equipment Corp.	PDP-1	Y	\$3400	11/60	59	X	
	PDP-4	Y	\$1700	8/62	55	X	
	PDP-5	Y	\$900	9/63	115	X	
	PDP-6	Y	\$10,000	10/64	20	1	
	PDP-7	Y	\$1300	11/64	150	26	
	PDP-8	Y	\$525	4/65	760	150	
	PDP-9	Y	\$1000	12/66	15	64	
	PDP-10	Y	\$7500	7/67	0	14	
	Electronic Associates, Inc.	8400	Y	\$12,000	6/65	18	9
		ASI 210	Y	\$3850	4/62	26	X
ASI 2100		Y	\$4200	12/63	7	X	
ADVANCE 6020		Y	\$4400	4/65	15	12	
ADVANCE 6040		Y	\$5600	7/65	8	12	
ADVANCE 6050		Y	\$9000	2/66	8	9	
ADVANCE 6070		Y	\$15,000	10/65	5	6	
ADVANCE 6130		Y	\$1000	2/67	12	24	
General Electric	115	Y	\$1800	12/65	340	650	
	205	Y	\$2900	6/64	42	X	
	210	Y	\$16,000	7/59	46	X	
	215	Y	\$6000	9/63	54	X	
	225	Y	\$8000	4/61	202	X	
	235	Y	\$10,900	4/64	78	4	
	415	Y	\$9600	5/64	255	60	
	425	Y	\$18,000	6/64	92	45	
	435	Y	\$25,000	9/65	30	16	
	625	Y	\$50,000	4/65	23	16	
	635	Y	\$56,000	5/65	22	17	
	645	Y	\$90,000	7/66	2	9	
	Honeywell	DDP-24	Y	\$2500	5/63	86	X
		DDP-116	Y	\$900	4/65	170	44
DDP-124		Y	\$2050	3/66	36	34	
DDP-224		Y	\$3300	3/65	52	8	
DDP-516		Y	\$700	9/66	45	160	
H-120		Y	\$3900	1/66	520	250	
H-200		Y	\$8400	3/64	1090	100	
H-400		Y	\$8500	12/61	100	X	
H-800		Y	\$28,000	12/60	90	1	
H-1200		Y	\$8800	2/66	118	90	
H-1400		Y	\$14,000	1/64	12	X	

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFULFILLED ORDERS
Honeywell (cont'd)	H-1800	Y	\$42,000	1/64	20	1
	H-2200	Y	\$12,000	1/66	40	65
	H-4200	Y	\$20,500	5/67	0	10
	H-8200	Y	\$35,000	4/68	0	5
IBM	305	N	\$3600	12/57	120	X
	360/20	Y	\$2000	12/65	2900	6700
	360/30	Y	\$7500	5/65	4300	4300
	360/40	Y	\$15,000	4/65	2250	1850
	360/44	Y	\$10,000	7/66	65	190
	360/50	Y	\$26,000	8/65	375	900
	360/65	Y	\$50,000	11/65	90	300
	360/67	Y	\$75,000	10/66	9	52
	360/75	Y	\$78,000	2/66	22	38
	360/90 Series	Y	\$140,000	6/67	0	18
	650	N	\$4800	11/54	150	X
	1130	Y	\$1200	2/66	1550	4700
	1401	Y	\$6600	9/60	7650	X
	1401-G	Y	\$2300	5/64	1610	X
	1401-H	Y	\$1300	5/67	1	60
	1410	Y	\$14,200	11/61	818	46
	1440	Y	\$4800	4/63	3600	180
	1460	Y	\$11,500	10/63	1700	X
	1620 I, II	Y	\$4000	9/60	1650	90
	1800	Y	\$7600	1/66	180	360
	701	N	\$5000	4/53	1	X
	7010	Y	\$22,600	10/63	218	5
	702	N	\$6900	2/55	7	X
	7030	Y	\$160,000	5/61	6	X
	704	N	\$32,000	12/55	27	X
	7040	Y	\$22,000	6/63	121	5
	7044	Y	\$32,000	6/63	133	8
	705	N	\$38,000	11/55	46	X
	7070, 2, 4	Y	\$27,000	3/60	314	X
	7080	Y	\$55,000	8/61	85	X
709	N	\$40,000	8/58	8	X	
7090	Y	\$63,500	11/59	40	X	
7094	Y	\$72,500	9/62	106	X	
7094 II	Y	\$78,500	4/64	140	2	
National Cash Register Co.	NCR-304	Y	\$14,000	1/60	24	X
	NCR-310	Y	\$2500	5/61	15	X
	NCR-315	Y	\$8500	5/62	500	125
	NCR-315-RMC	Y	\$12,000	9/65	50	45
	NCR-390	Y	\$1850	5/61	300	15
	NCR-500	Y	\$1500	10/65	1300	800
Philco	1000	Y	\$7010	6/63	16	X
	2000-210, 211	Y	\$40,000	10/58	16	X
	200-212	Y	\$52,000	1/63	12	X
Radio Corporation of America	RCA 301	Y	\$7000	2/61	640	X
	RCA 3301	Y	\$17,000	7/64	74	2
	RCA 501	Y	\$14,000	6/59	96	X
	RCA 601	Y	\$35,000	11/62	4	X
	Spectra 70/15	Y	\$4100	9/65	110	125
	Spectra 70/25	Y	\$6700	9/65	65	56
	Spectra 70/35	Y	\$10,400	1/67	25	142
	Spectra 70/45	Y	\$17,400	11/65	65	110
	Spectra 70/55	Y	\$40,500	11/66	4	15
	Raytheon	250	Y	\$1200	12/60	175
440		Y	\$3500	3/64	20	0
520		Y	\$3200	10/65	27	1
Scientific Control Corporation	650	Y	\$500	5/66	13	13
	655	Y	\$1800	10/66	1	2
	660	Y	\$2000	10/65	2	1
	670	Y	\$2600	5/66	1	2
	6700	Y	\$30,000	10/67	0	1
Scientific Data Systems, Inc.	SDS-92	Y	\$1500	4/65	100	75
	SDS-910	Y	\$2000	8/62	215	46
	SDS-920	Y	\$2900	9/62	158	38
	SDS-925	Y	\$3000	12/64	42	33
	SDS-930	Y	\$3400	6/64	210	48
	SDS-940	Y	\$10,000	4/66	15	27
	SDS-9300	Y	\$7000	11/64	32	12
	Sigma 2	Y	\$1000	12/66	13	195
	Sigma 5	Y	\$6000	8/67	0	24
	Sigma 7	Y	\$12,000	12/66	7	26
	Systems Engineering Labs	810	Y	\$1000	9/65	24
810A		Y	\$900	8/66	24	18
840		Y	\$1400	11/65	4	X
840A		Y	\$1400	8/66	8	24
UNIVAC		I & II	N	\$25,000	3/51 & 11/57	23
	III	Y	\$20,000	8/62	68	X
	File Computers	N	\$15,000	8/56	14	X
	Solid-State 80 I, II, 90 I, II & Step	Y	\$8000	8/58	225	X
	418	Y	\$11,000	6/63	116	35
	490 Series	Y	\$35,000	12/61	154	60
	1004	Y	\$1900	2/63	3180	40
	1005	Y	\$2400	4/66	680	220
	1050	Y	\$8000	9/63	285	18
	1100 Series (except 1107)	N	\$35,000	12/50	9	X
	1107	Y	\$55,000	10/62	35	X
	1108	Y	\$65,000	9/65	50	76
	9200	Y	\$1500	6/67	0	1050
	9300	Y	\$3400	6/67	0	600
	LARC	Y	\$135,000	5/60	2	X

TOTALS

X = no longer in production.

* To avoid double counting, note that the Control Data 160 serves as the central processor of the NCR 310. Also, customers ordering a new computer model intended to replace a computer model in the same product line may continue to use much of their current peripheral equipment, which can account for 30-70% of the value of the total computer system.

WORLD REPORT — AUSTRALIA

Australia to Play Key Role in World Weather Watch

A \$A4 million computer system ordered by the Commonwealth Bureau of Meteorology will enable Australia to play a key role in the World Weather Watch planned by the World Meteorological Organization. The system will be installed in Melbourne and will exchange global data and charts with the two other world weather centers, Washington, D.C., and Moscow.

The order, one of the most valuable awarded by the Australian Government, was placed with International Business Machines. IBM will supply two System 360 Model 65 central processors and an extensive array of peripheral equipment, in addition to substantial research and development support to the bureau, mainly in the field of new programs and procedures.

The Melbourne center will supply weather information of vital importance to rural industries, airlines, shipping, tourism, and other industries in Australia. Data on temperature, humidity, rainfall and wind strengths will be gathered from nearly 1000 surface reporting stations stretching from South Africa to South America and including readings from earth-orbiting satellites and balloons.

The center will prepare daily weather bulletins and monthly and seasonal summaries, and will carry out statistical processing of meteorological data. It will also prepare weather maps for analysis and prediction of both surface and upper air conditions, at first for the Australian region and eventually for the whole southern hemisphere.

The first Model 65 is scheduled to be installed in Melbourne by next March, and the second about a year later. Slave equipment will include several high-speed printers, magnetic disc drives, magnetic tape units, visual display stations, and plotting equipment.

One Model 65 processor will extract and analyze meteorological data and carry out prognosis on a "real-time" basis, simultaneously with the arrival of data via communication lines. The second processor will be used for research and development and many of the center's non-routine tasks, while providing back-up to the first processor.

While the system is being installed, the bureau is expected to invite tenders for an advanced communications system capable of linking the Melbourne computers on-line with data sources and information users throughout Australia.

Placement of the contract with IBM ended a hard-fought struggle among computer suppliers who regarded it as one of the most prestigious, as well as one of the most lucrative, to come from the Federal Government. IBM has been making strenuous efforts to win a major share of the Federal Government market in big systems, which has until now virtually been monopolized by Control Data and Honeywell.

University of Sydney Expands Facilities

A powerful computer utility network which will link six computers is now being developed at the University of Sydney

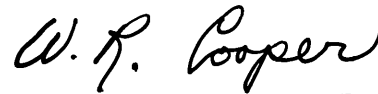
with the ultimate aim of providing an extensive remote console system. It is expected to be completed later this year.

The project has attracted wide interest among Australian computer technologists because it involves equipment supplied by five different manufacturers.

The University's Basser Computing Department, headed by Professor John M. Bennett, Professor of Physics (electronic computing), has already connected its original computer, known as Silliac, with its main machine, an English Electric KDF-9, and has just taken delivery of a combined IBM 7040/1401 donated by IBM.

The two other computers are a Control Data 1700 and a PDP-8, which are due to be installed within a few weeks.

The project — one of the most complex to be undertaken in Australia — is similar to what is known as the Joss Project at the Rand Corporation in the United States. It is described by Professor Bennett as an "ornate desk calculator" type of scheme which will allow a maximum number of users to carry out their work without interruptions to continuity of thought.



W. R. Cooper
Wahroonga, N.S.W.
Australia

CAPITAL REPORT

(Continued from page 27)

The number of inconsistencies and outright contradictions voiced by the panel was staggering. One panelist said, "The system is concerned with generating aggregates." Another, "We need data made available in as little aggregated form as possible . . . a facility where data is collected in completely unaggregated form." Another, "We are not talking about a collection of records . . . but a servicing capability."

The press was characterized as full of "purple phrases creating Frankenstein monsters". The public fared little better. "Can the system be made foolproof?" was considered to be an irrelevant question. "Mankind has never been able to devise a foolproof system for safeguarding any human value. It is unreasonable to ask anything more here."



Senter Stuart

CALENDAR OF COMING EVENTS

- July 31-Aug. 4, 1967: MEDAC '67 Symposium and Exhibition, San Francisco Hilton Hotel, San Francisco, Calif.; contact John J. Post, Executive Secretary, AAMI, P.O. Box 314, Harvard Square, Cambridge, Mass. 02138
- Aug. 7-11, 1967: 12th Annual Technical Symposium of the Society of Photo-optical Instrumentation Engineers, International Hotel, Los Angeles, Calif.; contact Dr. John H. Atkinson, Technical Program Chairman, S.P.I.E. Symposium, P.O. Box 288, Redondo Beach, Calif. 90277
- Aug. 22-25, 1967: WESCON (Western Electronic Show and Convention), Cow Palace, San Francisco, Calif.; contact Don Larson, 3600 Wilshire Blvd., Los Angeles, Calif. 90005
- Aug. 23-25, 1967: International Conference on Computational Linguistics, Grenoble University Campus, St. Martin-D'Herès, France; contact Professor Bernard Vauquois, C.E.T.A., B.P. No. 8, 38- St. Martin-D'Herès, France
- Aug. 26-28, 1967: ACM Symposium on Interactive Systems for Experimental Applied Mathematics, Sheraton-Park Hotel, Washington, D.C.; contact Melvin Klerer, Columbia University, Hudson Laboratories, Dobbs Ferry, N.Y. 10522 or Juris Reinfelds, Computing Ctr., University of Georgia, Athens, Ga. 30601
- Aug. 28-Sept. 2, 1967: AICA (International Association for Analogue Computation) Fifth Congress, Lausanne, Switzerland; contact secretary of the Swiss Federation of Automatic Control, Wasserkwerkstrasse 53, Zurich, Switzerland
- Aug. 29-31, 1967: 1967 ACM (Association for Computing Machinery) National Conference, Twentieth Anniversary, Sheraton Park Hotel, Washington, D.C.; contact Thomas Willette, P.O. Box 6, Annandale, Va. 22003
- Sept. 6-8, 1967: First Annual IEEE Computer Conference, Edgewater Beach Hotel, Chicago, Ill.; contact Professor S. S. Yau, Dept. of Electrical Engineering, The Technological Institute, Northwestern University, Evanston, Ill. 60201
- Sept. 11-15, 1967: Fifth International Cybernetics Congress, Palais des Expositions, Place André Rijckmans, Namur, Belgium; contact J. Lemaire, Managing Director, same address.
- Sept. 11-15, 1967: 1967 International Symposium on Information Theory, Athens, Greece; contact A. V. Balakrishnan, Dept. of Engineering, U.C.L.A., Los Angeles, Calif. 90024
- Sept. 25-28, 1967: International Symposium on Automation of Population Register Systems, Jerusalem, Israel; contact D. Chevion, Chairman of Council, Information Processing Association of Israel, P.O.B. 3009, Jerusalem, Israel
- Sept. 25-29, 1967: The British Computer Society, DATAFAIR 67, Southampton University, Southampton, England; contact Clive Wilkins, The British Computer Society, 23, Dorset Square, London, N.W.1, England
- Oct. 1-4, 1967: 1967 International Systems Meeting, Cobo Hall, Detroit, Mich.; contact Richard L. Irwin, Systems and Procedures Association, 24587 Bagley Rd.; Cleveland, Ohio 44138
- Oct. 16-19, 1967: UAIDE (Users of Automatic Information Display Equipment), Statler Hilton Hotel, Washington, D.C.; contact George E. Perez, Box 6749, Fort Davis Station, Washington, D.C. 20020
- Oct. 18-20, 1967: Eighth Annual Symposium on Switching and Automata Theory, University of Texas, Austin, Tex.; contact Prof. C. L. Coates, Room 520, Engineering Sci. Bldg., Univ. of Tex., Austin, Tex. 78712
- Nov. 10, 1967: Annual Symposium on "The Application of Computers to the Problems of Urban Society", New York Hilton Hotel, New York, N.Y.; contact Dan M. Bowers, One Millet St., Deer Park, N.Y. 11729
- Nov. 14-16, 1967: Fall Joint Computer Conference, Anaheim Convention Center, Anaheim, Calif.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N.Y. 10017
- Aug. 5-10, 1968: IFIP (International Federation for Information Processing) Congress 68, Edinburgh, Scotland; contact John Fowlers & Partners, Ltd., Grand Buildings, Trafalgar Square, London, W.C. 2., England

MARKET REPORT

(Continued from page 26)

of reels of tape to users, according to BSC which is considering this plan. The relatively long tape life would permit both substantial leasing revenues and lower costs to users.

The growth rate of magnetic tape sales (15% to 20% per year) may have reached a peak with third generation computers. Manufacturers are anticipating severe competition from improved drum and disk random-access mass storage devices. To meet this threat, they are considering an entry into the disk pack business. Memorex, for one, has acquired Disc Pack Corp., a specialized development firm, and has formed a manufacturing subsidiary, Substrate Corp. The leasing of disk packs to users is also being considered. This activity, however, is probably still in the future due to IBM's present dominance of the disk pack market.

Sales of continuous forms account for the bulk of the EDP supplies volume. Over half of these sales are of manifold forms (multiple form sets interleaved with carbon sheets) and this proportion is still growing. The forms business is expanding, in line with the rate of new computer installations, by about 20% annually. This rate, however, is also expected to fall. A major factor in the decline will be the spread of real-time systems with less frequent print-outs of master files and transactions, and the use of large data banks which will produce combined reports for several departments, or provide information on an inquiry basis. Volume will also be hurt by the growing use of output media other than hard copy, such as visual and vocal response. Offsetting these prospects is the increased rate of installation of small computers. Few of these will use sophisticated peripherals.

There exists another factor which, while it will not greatly affect volume, will curb the forms business profits. This is the introduction of xerography devices for reproduction and formatting of computer output. The first of these units, the Xerox 2400-IV, can reduce bulky print-out sheets to the size of an 8½ x 11-inch page. It can also be used with suitable masks to duplicate any desired headings or logotypes. Its impact should, therefore, be focused on preprinted forms, the most lucrative area of the business. Manufacturers expect only limited returns from sales of actual forms and look to printing for real profitability. A lack of emphasis on printing could seriously affect their prospects.

Other EDP supplies, including printer ribbons, panels, and specialized furniture and storage racks and cabinets will continue to represent high cost items for computer users. The growth rate of this segment of the industry is likely to remain in line with that of computer installations.

BOOKS AND OTHER PUBLICATIONS

Neil Macdonald
Assistant Editor
Computers and Automation

We publish here citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning *Computers and Automation*.

Reviews

Gruenberger, Fred, ed., and 13 authors / Computer Graphics: Utility—Graphics—Art / Thompson Book Co., National Press Bldg., 14th and F Sts., N.W., Washington, D.C. 20004 / 1966, hardbound, 221 pp., \$12.00

This book is the proceedings of a Graphics Symposium in 1966 jointly sponsored by Informatics, Inc., and the University of California at Los Angeles. The book contains 12 papers grouped in three parts: "Setting the Stage," "The Tools of the Art," and "Graphics in Action." Biographical sketches of each author are given.

This book is a compilation of findings to date in the field of graphic data processing and its applications.

Halstead, Maurice H. / Machine-Independent Computer Programming / Spartan Books, 1250 Conn. Ave., N.W., Washington, D. C. 20012 / 1962, hardbound, 267 pp., \$6.50

This text is based upon a lecture series on "Neliac, a Dialect of Algol" presented by the author at the University of California. The book is designed to teach the student how to "write to" computers in the Neliac language, and then how to "teach" a computer to read Neliac if it does not already know.

Chapters include: How to Write in the Language: Input-Output, Program Testing or Debugging; Basic Concepts of Self-Compilers; Processing Noun Lists; and Decompiling with D-Neliac. Four detailed appendices are included.

This is a useful book on machine-independent computer programming.

Hammond, P. H., ed., and 37 authors / Theory of Self-Adaptive Control Systems / Plenum Press, 227 West 17th St., New York, N.Y. 10011 / 1966, hardbound, 363 pp., \$15.00

This book contains 37 papers presented at the Second International Federation of Automatic Control Symposium on the Theory of Self-Adaptive Control Systems held in September, 1965. Papers are grouped in seven parts, giving broad

coverage to the field of analysis and synthesis of self-adaptive, optimal, and multilevel control systems. Some sections conclude with general discussions.

Iverson, Kenneth E. / Elementary Functions: An Algorithmic Treatment / Science Research Assoc., Inc., 259 East Erie St., Chicago, Ill. 60611 / 1966, hard-bound, 231 pp., \$4.95

This text is intended for a freshman-level, pre-calculus course. It grew from the author's conviction that "the discipline naturally imposed by the formalism required in programming would prove a boon in the exposition of mathematics from a very early level onward." The main topics, polynomials, circular functions, logarithmic and exponential functions, are defined through the systematic use of formal algorithms or programs. It contains over 250 exercises; a book of solutions is available separately from the publisher.

Marcovitz, Alan B., and Earl J. Schweppe / An Introduction to Algorithmic Methods Using the MAD Language / The Macmillan Co., 866 3rd Ave., New York, N.Y. 10022 / 1966, paper-bound, 433 pp., \$6.50

This book is written as an undergraduate textbook for introducing methods which are applicable to the implementation of algorithms on computing machines. It covers effective solving of problems with the aid of a computer, and relates them to other analytic techniques. Numerous examples and flow charts are included.

Mr. Marcovitz is a Professor in the Department of Electrical Engineering at the University of Maryland; Mr. Schweppe is with the Computer Science Center at the University of Maryland.

Sanders, Donald H. / Introducing Computers to Small Business / Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068 / 1966, hardbound, 197 pp., \$7.75

This book is the result of a study into the uses and misuses of computer and EDP equipment by small businesses. 100 small EDP-using business firms were contacted to produce the information reported.

The purpose of this book is to help small businessmen determine whether the use of a computer has potential benefits for his firm, and to investigate ways of making more efficient use of personnel resources during the transition period. The book includes 42 tables, a bibliography, and an appendix on study methodology. It is nontechnical and concise.

Shubik, Martin, ed., and 30 authors / Essays in Mathematical Economics: In Honor of Oskar Morgenstern / Princeton University Press, Princeton, N.J. / 1967, hardbound, 475 pp., \$12.50

This book contains 27 essays on the general subject of the application of modern statistical analysis to temporal economic data. Parts include: "Game Theory," "Mathematical Programming," "Decision Theory," "Economic Theory," "Management Science," "International Trade," and "Econometrics." It includes an extensive bibliography of the work of Oskar Morgenstern. There is no index.

Spiegel, Joseph, and Donald Walker, eds. and 60 authors / Information System Sciences; Proceedings of the Second Congress / Spartan Books, Inc., 1250 Conn. Ave. N.W., Washington, D.C. / 1965, hardbound, 525 pp.

This book contains the complete papers presented at the November, 1964 Congress on the Information System Sciences. The purpose of the Congress was to increase communication among scientists, engineers, and military personnel in the technology of information systems. Emphasis is on requirements in various areas of information systems rather than on practical applications.

Von Neumann, John, author; edited and completed by Arthur W. Burks / Theory of Self-Reproducing Automata / University of Illinois Press, Urbana, Ill. 61803 / 1966, hardbound, 388 pp., \$10.00

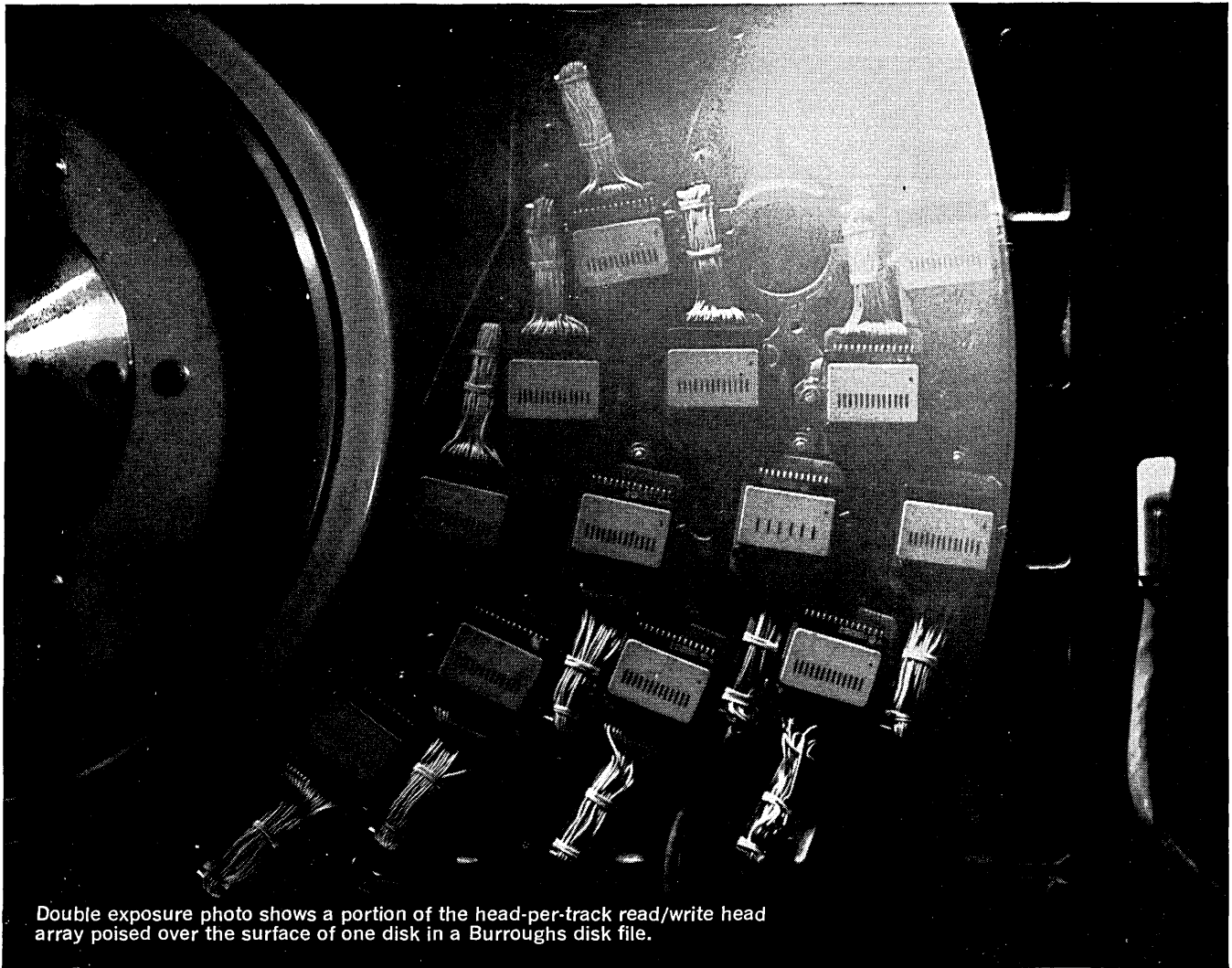
Because of his premature death, von Neumann was unable to put in final form any of the research he was doing in automata theory. The manuscripts used by the editor for this book were first drafts; they have undergone considerable rewriting and editing.

The book is in two parts: Part I — "Theory and Organization of Complicated Automata" — is a series of five lectures treating complicated automata in general and comparing artificial automata with natural automata. It includes a "kinematic model of self-reproduction." Part II — "The Theory of Automata: Construction, Reproduction, Homogeneity" — is devoted to the logical design of a self-reproducing cellular automaton. Von Neumann made significant contributions to the development of a theory of automata.

Lecht, Charles Philip / The Programmer's ALGOL: A Complete Reference / McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N.Y. 10036 / 1967, hardbound, 252 pp., \$8.95

This book provides a technical description of ALGOL, graded from the simplest to the most complex forms of its elements. The ten statements and declarations of ALGOL have been expanded to appear as if they were composed of many more instructions. The author's purpose in doing this was to reduce much of the inference and deduction commonly required of programmers when they use the general forms customary in ALGOL presentations. Appendices present a list of mathematical functions available in most ALGOL compilers, a set of representative ALGOL programs, and a glossary of terms.

(Please turn to page 57)



Double exposure photo shows a portion of the head-per-track read/write head array poised over the surface of one disk in a Burroughs disk file.

Burroughs head-per-track disk files mean: speed, simplicity, reliability, capacity, economy

because head-per-track design means all-electronic accessing.

Speed: All-electronic accessing provides average access times as low as 17 milliseconds — much faster than the fastest moving arm files.

Simplicity: All-electronic accessing eliminates complications. With no physical movements to optimize, users of Burroughs disk files may store records in any convenient available location. With no moving arms to juggle programmatically, disk file storage is as easy to deal with as core storage.

Reliability: All-electronic accessing frees Burroughs disk files from the potential for mechanical failure inherent in moving arm files. The result is extremely high reliability.

Capacity: All-electronic accessing is available in 15 Burroughs disk file models. Total capacities range from one million to hundreds of billions of characters; average access times from 17 to 60 milliseconds. There is a speed-and-capacity combination to fit almost every need.

Economy: All-electronic accessing provides freedom from organizational restraints. And Burroughs disk

file users don't have to allocate inter-record gaps. So, Burroughs customers can use the total advertised capacities of their disk files. When usable capacities are compared, Burroughs disk files generally provide a lower cost-per-character than moving arm files. And they always provide fast access, easy use, high reliability, and large capacity.

For more information about Burroughs disk files—or the multiprocessing Burroughs 500 Systems—contact your local Burroughs office or write us at Burroughs Corporation, Detroit, Michigan 48232.

Burroughs 

Computers and Some Moral Questions

In this issue we publish an article by Jerome Laulicht on the application of computer methods to the analysis of the conflict in Vietnam. This article is an outgrowth of work done at the Canadian Peace Research Center, using computer time on two IBM 7090's, one at Leeds, England, and the other in Stockholm, Sweden.

This article raises a flock of important questions, such as:

- When thousands of human beings are being killed in a war with some help from computers, should computer scientists examine the conflict, and try to do something constructive about it, including discussing it in a computer field magazine?
- If a computer scientist thinks that one side or the other in such a conflict is in the wrong, should he accept employment in a company which is producing weapons for use on the wrong side?
- If a computer scientist knows that false or lying information is being produced with the help of computers, should he participate in allowing this information to be believed?
- Since hundreds of missiles armed with nuclear weapons and guided by computing mechanisms are installed here and there all over the world, ready and waiting to be used under national (not international) control, should computer scientists leave out of discussion the subject of the political control of such missiles?
- Should computer people discuss and argue the social responsibilities of computer scientists?

In 1958, in *Computers and Automation*, that last question was asked, in just that phrasing. And we organized a ballot and collected votes on that question. The results of the balloting were reported in our September 1958 issue and amounted to some 250 yes's and some 140 no's. Since that time, there have been a number of meetings where the questions of the social implications of computers and the social responsibilities of computer people were discussed. In fact, the Association for Computing Machinery now has a Special Interest Group on the Social Implications of Computers. This group continues what was formerly the ACM Committee on the Social Responsibilities of Computer People, which functioned 1958 to 1966.

So, in the years from 1958-1967, it has become accepted that computer people have a special responsibility for considering questions and trying to reach conclusions about the social implications of computers and the social responsibilities of computer people.¹

Has the time come to take some more steps in the exercise of social responsibility by computer people? We believe that it indeed has.

So we have prepared another ballot on the four other questions. We ask you, our readers, to express your own view on each of these four questions. You may tear out the ballot and vote on it; you may copy it on any piece of paper and

vote on that; you may mark a reader service card with the number of the question and your vote on it (Y or N), and return it to us. We also welcome your remarks and comments on these matters.

No unsigned ballot will be counted but how you voted will be kept confidential unless you release us. The deadline for receiving ballots is Friday, April 7.

Because we feel these questions are important, we invite all our readers (and their computer field friends) to participate in this balloting. The results could become a stimulating dialogue, and may exert wide influence besides.

Edmund C. Berkeley

EDITOR

"COMPUTERS AND AUTOMATION" BALLOT —
MARCH, 1967

(May be copied on any piece of paper)

1. When thousands of human beings are being killed in a war with some help from computers, computer people
Y () should
N () should not
examine the conflict, and try to do something constructive about it, including discussing it in a computer field magazine.
2. If a computer scientist thinks that one side in such a conflict is in the wrong, he
Y () should
N () should not
accept employment in a company which is producing weapons for the wrong side.
3. If a computer scientist knows that false or lying information is being produced with the help of computers, he
Y () should participate (by remaining silent, etc.)
N () should not participate (by becoming vocal, etc.)
in allowing that information to be believed.
4. The subject of political control over missiles armed with nuclear weapons and guided by computing mechanisms
Y () should
N () should not
be discussed in a computer field magazine.

Any remarks and comments? (attach paper if needed) _____

Name _____ Occupation _____

Address _____

() Please treat my name as confidential.

() You may release my name.

When completed, please send to March Ballot Editor, "Computers and Automation," 815 Washington St., Newtonville, Mass. 02160, if possible before April 7, 1967.

¹ See Chapter 15, "Dangers from Computers", and Chapter 16, "Discussion and Argument", pp. 175 to 191, in "The Computer Revolution" by E. C. Berkeley, published by Doubleday & Co., 1962 — out of print at the publisher's but available from "Computers and Automation".

BOOKS

(Continued from page 54)

Nyers, Charles A., Editor and 10 authors / **The Impact of Computers on Management / The M.I.T. Press, 50 Ames St., Cambridge, Mass. 02142 / 1967, hardcover, 310 pp., \$10.00**

The papers on which this book is based were presented at a research conference in April 1966 at the Sloan School of Management at M.I.T. Subjects include: "The Impact of Information Technology on Organizational Control"; "Computers and Organization Structure in Life Insurance Firms"; "The External and Internal Economic Environment"; "Computers and Profit Centers"; and "Changes in Management Environment and Their Effect Upon Values." Edited versions of taped discussions at the conference follow the presentation of each paper. The appendix presents a case study of the implementation of computerized programs in an integrated manufacturing company.

Golde, Hellmut / **Fortran II and IV for Engineers and Scientists / The Macmillan Co., 60 Fifth Ave., New York, N.Y. 10011 / 1966, paperbound, 224 pp., \$**

This is a thorough study of the FORTRAN language, independent of any particular computer. The author is an Associate Professor of Electrical Engineering at the University of Washington, and the book is based on his experience in teaching students how to use FORTRAN. The language is illustrated with a number of typical scientific and engineering problems taken from many different disciplines such as: the analysis of a simple electronic circuit; the numerical integration of a function and the refraction of light by a prism. About half of these problems are accompanied by a reproduction of the actual computer output. Exercises are presented at the end of each chapter.

Taunt, James E. / **Digital Tape Drives / The Business Press, 288 Park Ave. West, Elmhurst, Ill. 60128 / 1965, hardbound, 161 pp., \$7.45**

The author is a principal systems-engineer at General Electric Company's Computer Department in Phoenix, Ariz. The book is intended for computer operators, programmers, analysts, managers and consultants. Chapters including various aspects of digital tape drives: reels, buffer storage, capstans, head guides, electronics, operator controls and human factors.

Favret, Andrew G. / **Introduction to Digital Computer Applications / Reinhold Publishing Corp., 430 Park Ave., New York, N.Y. 10022 / 1965, hardbound, 246 pp., \$10.00**

This text is intended for an introductory course surveying the capabilities and limitations of digital computers. The three parts are: How a Computer Works; Computer Applications; and Computer Systems.

NEW PATENTS

Raymond R. Skolnick
Patent Manager
Ford Instrument Co.
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Long Island City, N.Y. 11101

The following is a compilation of patents pertaining to computers and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U.S. Commissioner of Patents, Washington, D.C. 20231, at a cost of 50 cents each.

March 7, 1967

- 3,308,285 / Robert O. Winder, Trenton, N.J. / Radio Corporation of America / Logic Networks for Realizing Associative Functions.
- 3,308,440 / Thomas D. Truitt, Princeton, and Donald F. Fraipont, Princeton Junction, N.J. / Electronic Associates Inc. / Memory System.
- 3,308,441 / George J. Dusheck, Jr., Riverton, N.J. / Radio Corporation of America / Information Processing Apparatus.
- 3,308,442 / John F. Couleur, Philip F. Gudenschwager, and William A. Shelly, Phoenix, Ariz. / General Electric Co. / Data Processing Unit for Providing Data Shift under Selective Control of External Apparatus.
- 3,308,443 / John F. Couleur, Philip F. Gudenschwager, and William A. Shelly, Phoenix, Ariz. / General Electric Co. / Data Processing Unit for Providing Serial or Parallel Data Transfer under Selective Control of External Apparatus.
- 3,308,445 / Jan A. Rajchman, Princeton, N.J. / Radio Corporation of America / Magnetic Storage Devices.
- 3,308,447 / John G. Valassis, Chicago, Ill. / Automatic Electric Lab., Inc. / Electrically Alterable Semi-Permanent Magnetic Memory.
- 3,308,448 / Rabah Shabbender, Princeton, N.J. / Radio Corporation of America / Magnetic Memory Matrix Having Noise Cancellation Word Conductor.

March 14, 1967

- 3,309,676 / Paul R. Hickey, Tujunga, Calif. / General Precision, Inc. / Data Mass Memory System.
- 3,309,679 / Joseph A. Weisbecker, Cherry Hill, N.J. / Radio Corporation of America / Data Processing System.
- 3,309,681 / David R. Boyles, Van Nuys, John S. Davis, Glendale, and Paul E. Wells, Los Angeles, Calif. / The Bunker-Ramo Corp. / Multi-Apertured Memory Arrangement.
- 3,309,682 / John J. King, Jericho, N.Y. / Sperry Rand Corp. / Magnetic Core Interrogation Circuits for Core Array.

March 21, 1967

- 3,310,782 / Robert Samuel Sinn, Seaside Park, and Dennis W. Habgood, Magnolia, N.J. / Ultronic Systems Corp. / Data Message System.
- 3,310,784 / Thomas C. Hilinski, Camden County, N.J. / Radio Corporation of America / Information Processing Apparatus.
- 3,310,785 / John F. Couleur, Philip F. Gudenschwager, and William A. Shelly, Phoenix, Ariz., and David L. Bahrs, Liverpool, N.Y. / General Electric Company / Data Processing Unit for Selectively Controlling Access to Memory by External Apparatus.
- 3,310,786 / Russell G. Rinaldi, Poughkeepsie, and Brian B. Moore, New Paltz, N.Y. / International Business Machines Corp. / Data Compression / Expansion and Compressed Data Processing.

March 28, 1967

- 3,311,301 / Henri Chabrier, Lyon (Rhône), and Andre Saint-Joanis, Sainte-Foy-les-Lyon (Rhône), France / Societe d'Electro-chimie, d'Electrometallurgie et des acieries electriques d'Ugine / Fluid Actuated Logical Devices.
- 3,311,885 / Charles H. Propster, Jr., Phoenix, Ariz. / General Electric Company / Electronic Data Processor.
- 3,311,890 / Sigurd G. Waaben, Princeton, N.J. / Bell Telephone Lab., Inc. / Apparatus for Testing a Storage System.
- 3,311,891 / Richard L. Brady and Bernard R. Gandler, San Jose, Calif. / International Business Machines Corp. / Recirculating Memory Device with Gated Inputs.
- 3,311,893 / William F. Landell, Ardsley, Pa. / Sperry Rand Corp. / Memory Organization Wherein only New Data Bits which Are Different from the Old Are Recorded.
- 3,311,896 / James W. Delmege, Jr., Saugerties, and Ralph W. Pulver, Jr., Red Hook, N.Y. / International Business Machines Corp. / Data Shifting Apparatus.
- 3,311,897 / Frederick L. Post, Poughkeepsie, N.Y. / International Business Machines Corp. / Neuristor Associative Memory.
- 3,311,901 / George A. Fedde, Norristown, and Lester M. Spandorfer, Cheltenham, Pa. / Sperry Rand Corp. / Plated Wire Content Addressed Memory.

April 4, 1967

- 3,312,945 / Evelyn Berezin, New York, Jack Knoll, Plainview, and Eugene Leonard, Sands Point, N.Y. / Digi-tronics Corp. / Information Transfer Apparatus.
- 3,312,947 / Matthew Raspanti, Lincroft, N.J. / Bell Telephone Lab., Inc. / Plural Memory System with Internal Memory Transfer and Duplicated Information.
- 3,312,953 / An Wang and Ge-Yao Chu, Lincoln, Mass. / Wang Laboratories Inc. / Data Processing System.

- 3,312,955 / Robert L. Lamberts and George C. Higgins / Eastman Kodak Co. / System for Recording and Retrieving Digital Information.
 3,312,958 / William F. Eiseman, North Linthicum, and John C. Donohue, Hanover, Md. / Westinghouse Electric Corp. / Magnetic Core Matrix Assembly.

April 11, 1967

- 3,313,055 / Eugene H. Irasek, Garden Grove, Calif. / Houston Fearless Corp. / Random Access Storage and Retrieval Device.
 3,314,054 / Edward R. Higgins, North Linthicum, Md. / Westinghouse Electric Corp. / Non-Destructive Readout Memory Cell.
 3,314,055 / Edward R. Higgins, Jr., North Linthicum, Md. / Westinghouse Electric Corp. / Multiaperture Magnetic Storage Device.

April 18, 1967

- 3,315,088 / Lloyd Elwood West, Lexington, Ky. / International Business Machines Corp. / Readout of Phase Coded Data.
 3,315,235 / Richard J. Carnevale, Union, Arthur F. Collins and Jack E. Greene, Vestal, William P. Hanf, Endicott, Albert A. Magdall, Vestal, Charles B. Perkins, Jr., Endicott, John W. Rood, Vestal, and Anthony E. Villante, Binghamton, N.Y. / International Business Machines Corp. / Data Processing System.
 3,315,236 / Clarence W. Hewlett, Jr., Hampton, N.H. / General Electric Co. / Electrolytic System for Sampling and Storing Information.
 3,315,237 / Heinz E. Kallmann, N.Y. / Gulton Industries, Inc. / Ferrite Memory Cells and Matrices.
 3,315,241 / Donal A. Meier, Inglewood, Calif. / The National Cash Register Co. / Two Magnetic Element per Bit Memory.
 3,315,268 / Alfred G. Edde, Dayton, Ohio / The National Cash Register Co. / Information Storage Checking Means.

April 25, 1967

- 3,315,884 / Ralph V. Bennett, Norwalk, Conn. / Sperry Rand Corp. / Mechanical Memory Unit.
 3,316,542 / George A. Fedde, Norristown, and Charles A. Nelson, Phila., Pa. / Double Signal to Noise Ratio in a Search Memory.

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 Cleveland, Ohio 44101

- 3,316,543 / Andrew Charles Tickle, Stevenage, England / International Computers and Tabulators Limited / Magnetic Thin Film Information Shifting Registers.

May 2, 1967

- 3,317,900 / Genung L. Clapper, Vestal, N.Y. / International Business Machines Corp. / Adaptive Logic System.
 3,317,901 / Genung L. Clapper, Vestal, N.Y. / International Business Machines Corp. / Adaptive Logic System with Inputs Applied Randomly only during Conditioning Cycles.

May 9, 1967

- 3,319,224 / Friedrich Ulrich, Stuttgart-Weilimdorf, Germany / International Standard Electric Corp. / Circuit Arrangement to Compare Two Information Items.
 3,319,226 / Lucile E. Mott, Ardmore, Ronald B. Lounsbury, Broomall, Blair C. Thompson, King of Prussia, S. Peter Beauregard, Malvern, James L. Murtaugh, Jr., West Chester, and August A. Sardinas, Berwyn, Pa. / Burroughs Corporation / Data Processor Module for a Modular Data Processing System for Operation with a Time-Shared Memory in the Simultaneous Execution of Multi-Tasks and Multi-Programs.
 3,319,230 / Morton M. Astrahan and Bennett Housman, Santa Clara County,

- Calif., Hrand L. Kurkjian, Montgomery County, Md., and Bernard L. Sarahan, Harris County, Tex. / International Business Machines Corp. / Data Processing Machine Including Program Interrupt Feature.

- 3,319,231 / Donald Sears Oliver, West Acton, Mass. / Itek Corporation / Data Processing Apparatus for Retrieving Information-Bearing Media.
 3,319,232 / Joseph W. Crownover, La Jolla, Calif. / by mesne assignments to Control Data Corporation / Memory Systems and Devices.
 3,319,233 / Hiroshi Amemiya and Thomas R. Mayhew, Levittown, and Richard L. Pryor, Haddonfield, N.J. / Radio Corporation of America / Midpoint Conductor Drive and Sense in a Magnetic Memory.
 3,319,234 / Yves-Jean Francois Brette, Sevres, France / Compagnie des Machines Bull. (Societe Anonyme), Paris, France / Matrix Memory Device.

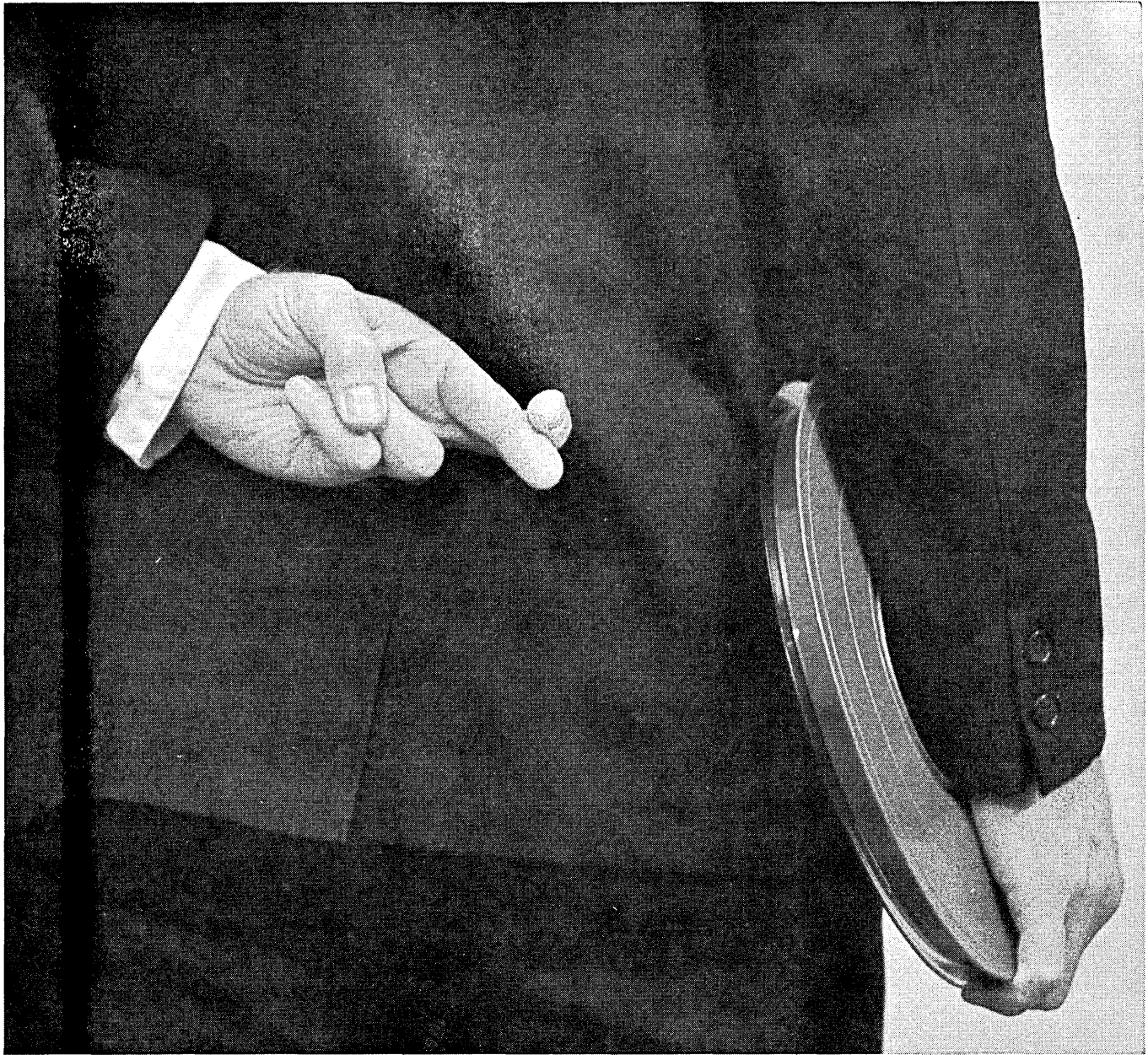
May 16, 1967

- 3,320,588 / Bennie L. Gallien, Hurst, Tex. / Sperry Rand Corp. / Character Reader.
 3,320,591 / Robert H. Mix, Central Valley, Calif. / United States of America as represented by the Secretary of the Interior / Metering System Responsive to Interrogations from a Central Station.

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

- American Telephone & Telegraph Co., 195 Broadway, New York, N. Y. 10017 / Page 2 / N. W. Ayer & Son
 Auerbach Corp., 121 N. Broad St., Philadelphia, Pa. 19107 / Page 23
 Burroughs Corp., 6071 Second Blvd., Detroit, Mich. 48232 / Page 55 / Campbell-Ewald Co.
 California Computer Products, Inc., 305 Muller Ave., Anaheim, Calif. 93804 / Page 3 / Campbell-Mithun, Inc.
 Celanese Corp., 744 Broad St., Newark, N. J. 07102 / Pages 8 and 9 / West, Weir & Bartel, Inc.
 Digital Equipment Corp., 146 Main St., Maynard, Mass. 01754 / Page 6 / Kalb & Schneider Inc.
 Graham Magnetics Inc., Graham, Texas 76046 / Page 59 / Witherspoon and Associates
 Information International, Inc., 545 Technology Sq., Cambridge, Mass. 02139 / Page 4 / Kalb & Schneider Inc.
 International Business Machines Corp., Data Processing Div., White Plains, N. Y. / Page 60 / Marsteller Inc.
 Memorex Corp., 213 Memorex Park, Santa Clara, Calif. 95050 / Pages 30 and 31 / Hoefler, Dieterich & Brown
 Miller-Stephenson Chemical Co., 15 Sugar Rd., Danbury, Conn. / Page 21 / Solow-Wexton Inc.
 Randolph Computer Corp., 200 Park Ave., New York, N. Y. 10017 / Page 44 / Albert A. Kohler Co.
 Sedgwick Printout Systems Corp., 410 East Sixty-Second St., New York, N. Y. 10021 / Page 46 / Dowden & Solovitz



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