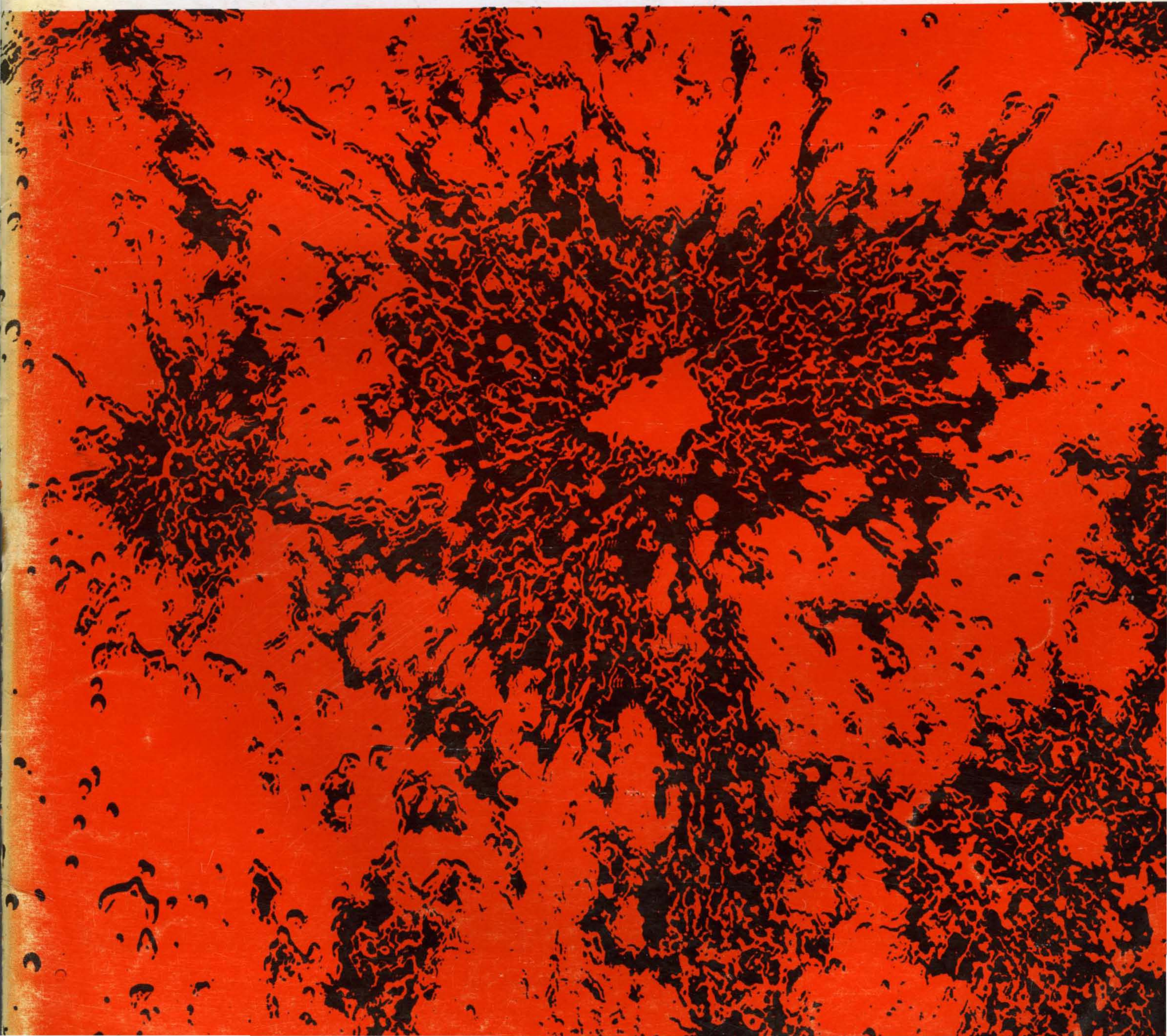
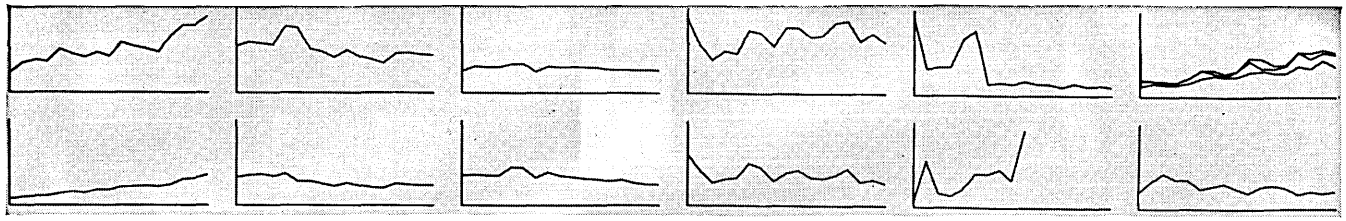
February, 1964

computers and automation

Computer "Lunacy"





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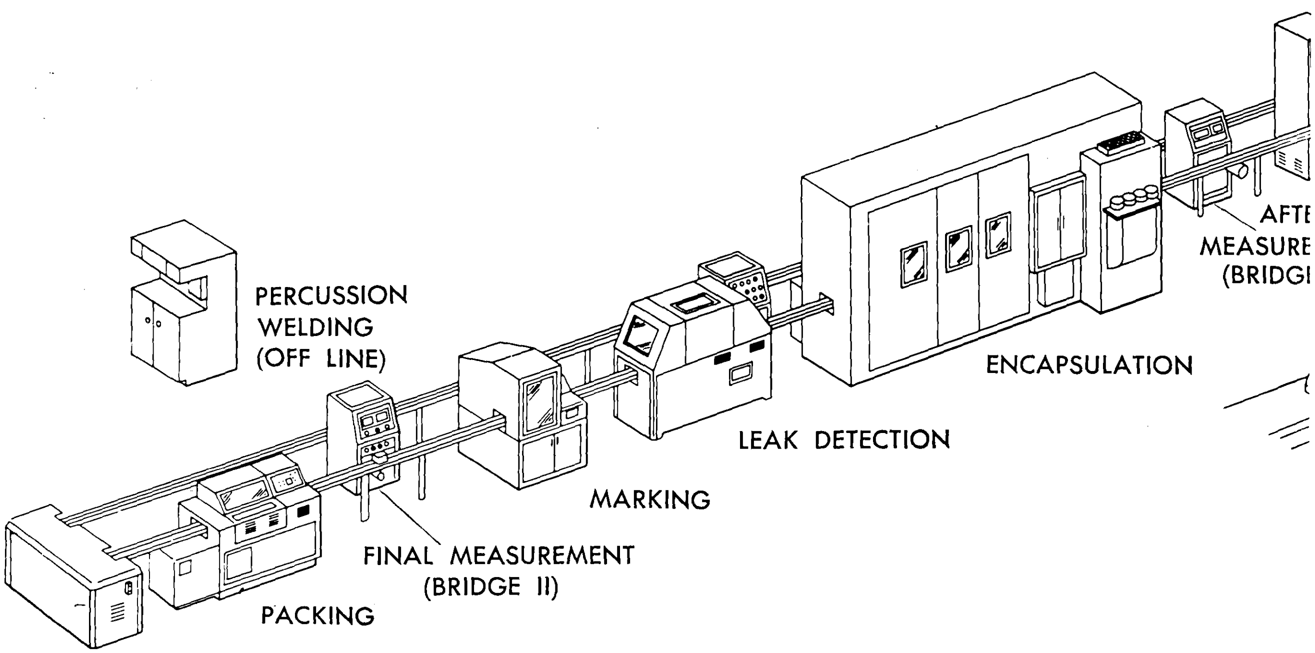
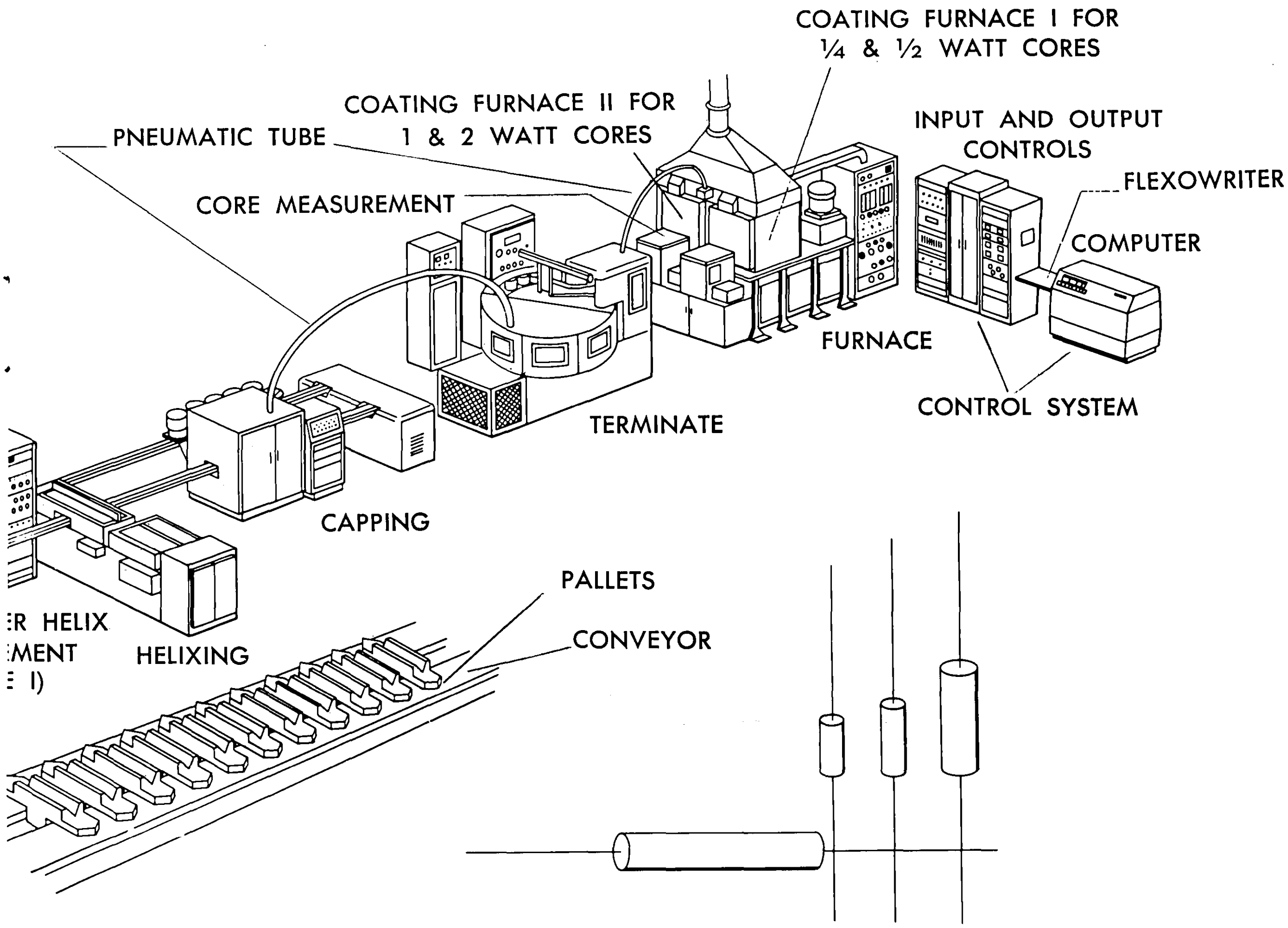


FIGURE 1. AUTOMATED PRODUCTION LINE F

USING A COMPUTER FOR QUALITY CONTROL OF AUTOMATIC PRODUCTION

J. H. Boatwright
Western Electric Co.
New York, N. Y.



OR DEPOSITED CARBON RESISTORS

At the North Carolina works of the Western Electric Company an electronic digital computer has been used in a completely closed loop to control an automatic production line by the use of statistical quality control methods.

Reliability

A significant outgrowth of Western Electric's activity in the development of complex anti-missile defense systems has been the need for much more reliable electrical building blocks. Components having a degree of reliability which gave quite acceptable performance in the simplest military electronics apparatus now produce an entirely unacceptable probability of system failure when combined in the nearly astronomical quantities required in the new systems. In order to make these systems practical, therefore, it has been necessary to undertake the improvement of the basic reliability of these components by an order of magnitude or more.

One such component is the Deposited Carbon Resistor. Consisting of a thin helical film of pure crystalline carbon, pyrolytically deposited on a short length of ceramic rod, this device must be so stable that its electrical resistance must change no more than a fraction of a per cent when it is plunged alternately into test chambers having the temperature of dry ice and the desert sands. Submicroscopic contamination of the film through the slightest touch of the human hand can result in almost certain future failure, as can any number of seemingly trivial errors throughout the manufacturing process.

Because of this necessity for near perfection in manufacture, it is essential to eliminate as much as possible the likelihood of human error. Accordingly, development was undertaken of a completely automated production line (see Figure 1) for the manufacture of these resistors. This was paralleled by a complete redesign of the resistor itself, to improve its basic ability to withstand environmental extremes and to adapt it to economical automated manufacture.

Computer-Controlled Production

The completely integrated automated production facility has been so designed as to operate under the full control of a central digital computer. This is believed to be one of the first attempts to bring such a completely integrated automated production facility under the full control of such a computer. Reliability of the resistors thus produced is augmented by two prime factors: First, the possibilities of contamination or damage through human handling and human error are eliminated. Secondly, much closer control of all processes can be obtained because of the rapid processing of inspection and measurement information and the automatic computation of any control or corrective action required.

Programming of production, including the initial setup and adjustment of each machine for any of a wide range of types and sizes is automatically accomplished. Statistical quality control inspections are continuously performed by the computer, permitting detection and correction of trends developing within the limits of acceptable product. Computed feedback control is provided to all critical machines, permitting the cycle of feedback control to be cut to seconds, as compared to hours or days under manual manufacturing methods.

The computer in use is an LGP-30 made by Librascope and sold through the Royal Precision Company. This particular model, when it was purchased, had just one input and one output—a Flexowriter and a high-speed punch. As the production line has 5 measurement (input) stations and 13 control (output) stations, input-output controls had to be provided and placed between the computer and the production line to allow the computer to select any of the 5 inputs, the 13 outputs, or the Flexowriter, in any sequence. The computer plus the input-output controls may be referred to as the Control System.

Automated Line Operation

A short description of the Automated Deposited Carbon Resistor Line follows (see Figure 1):

Blank ceramic cores are fed into the appropriate Coating Furnace. The Control System sends the proper core size to the proper Furnace.

The Coating Zone of each Furnace is kept in excess of 2000° F by a Control System Loop. Methane gas is introduced into the Coating Zone (of the particular furnace in use at this time) and is broken down, or "cracked" by the high temperature. This results in a deposition of crystalline carbon on the ceramic cores. (The ceramic cores are sequentially fed through the Furnace—each pushing the one ahead—on rotating ceramic rods to insure an even carbon coat.)

As the cores come out of the Coating Furnace, they are cooled in a water jacket to about or below room temperature. The cores then pass through the core Measurement Station. Upon receiving a resistor, this station sends a "Resistor Present" signal to the Control System. Within about three seconds, the Control System will put in the voltage value (in voltage form) of this resistor, convert it to binary, analyze it, record it, and send a Pass or Reject signal to the station. The other two measurement stations, Bridges I and II, also operate approximately like this one. The limits of the Pass/Reject band at the Core Measurement Station are ± 5% around Nominal—this Nominal is not the final desired nominal value of resistance (this is set at the Final Measurement Station), but is a value lower than the final value desired. We will see why when we get to the Helix Lathe.

The information from this Core Measurement Station is also used in a control loop, Figure 3, to maintain the product around the desired nominal value by control of the methane gas flow into the Furnace and the amount of the Core Drive, which determines the speed of the cores through the Furnace. Statistical Quality Control (SQC) $\bar{X}$ (average) and R (range) chart methods are used by the Control System Computer to determine *when* to make a correction.

The core is then transported through a plastic tube by air pressure to the Termination Machine where a thin layer of gold is applied to a small band on each end of the core. This band will act as a bond between the cap and the carbon coat.

The core is now transported, again through a tube, to the Capping Machine. The Capping Machine press-fits a gold-plated cap, complete with leads, onto each end of the core (over each gold band). The machine checks each core for missing leads and caps.

The cores now are put onto "pallets"—one core to a pallet. The pallets are on a conveyor line which will carry the cores along the remainder of the line.

The capped cores now go into the Helixing Lathe. This lathe cuts a spiral groove, through the carbon, around the core to bring the resistance value up to the value on the Helix Lathe Bridge (or, just Helix Bridge). This value is somewhat near the final value expected—the Helix Bridge has been offset by the Control System to compensate for overshoot and heat during spiraling, drift during the remainder of the line, etc., (and, of course, how the Control System is operating today).

The Spiralled Resistor now is carried by pallet into the Measurement Station after Helix (Bridge I). Bridge I is an ordinary Wheatstone bridge arranged for automatic operation. Instead of letting a galvanometer indicate the imbalance voltage, however, the voltage is fed into the Control System, converted to a binary number, and used in the control loop. The nominal, set on the dials of Bridge I, is the required final value of the resistor—the nominal value in the Computer's memory will be modified very slightly—less than 1%—to compensate for drift during Encapsulation, etc.,—up to the Final Measurement Station. The limits of Bridge I are ± 1% of the adjusted nominal held in the Computer's memory. Pass/Reject signals are sent from the Control System to Bridge I.

The data from Bridge I is also used by the Control System in a closed loop to control the Helix Lathe to produce product around the desired nominal value held in the Computer's memory by adjusting the Helix Bridge. SQC $\bar{X}$ and R chart methods are used by the Control System to determine *when* to make a correction.

The spiralled resistors are now carried by the pallets and the conveyor system into the Encapsulation Machines. Here the ceramic core is encapsulated in a shell of Epoxy Plastic. This combination passes through a curing oven for about 17 minutes and then is placed on another pallet at the exit of the Encapsulation Machine.

The encapsulated resistor is then passed into the Leak Detector. This Detector uses hot water and ten photoelectric cells to search for any bubbles caused by any hole in the epoxy shell. Any leakers are automatically rejected. The Control System is not tied into this machine.

The resistors are air-dried and fed into the Marking Machine. The Marking Machine is set up for each code or type of resistors by the Control System. This machine is an offset printer with four type wheels in turret form. Different combinations of these wheels are selected by the Control System. After Marking, the Resistors go into the Final Measurement Station. Bridge II is set up by the Control System to the exact required final value. The Pass/Reject Limits are ± 1% of this final value. Information from Bridge II is used by the Control System to give the Pass/Reject signal, and to offset the Bridge I nominal held in the Computer's memory. Each passed resistor is also counted for use in the statistical print-out and to determine the amount of product "shrinkage" between the Coating Furnace and Bridge II. The Control System uses this "shrinkage" factor to automatically adjust the required amount of cores to be produced at the furnace to end up with at least the proper number of packed resistors.

The resistors passed by Bridge II are now sent to the Packing Machine. The core size of the type of resistors

being packed is sent by the Control System. The Packing Machine packs the resistors edge-wise in blocks of Styrofoam—10 or 15 (depending on watt size) per block. The blocks are loaded on a tray for easy storage. The production line is programmed to produce one 1/4 or 1/2 watt resistor every three seconds or one 1 or 2 watt resistor every six seconds.

Duties of the Control System

The Control System has seven jobs. These are:

1. To "program" the types or codes of resistors in the line at once by recognizing when the last resistor of a given type has passed a given machine and then sending information to that machine to set it up for the next type to be made.
2. To measure the temperature at Furnace I and II and to send appropriate corrections to keep the temperature at some discrete value in excess of 2000° F.
3. To compensate for a change in resistance during encapsulation by examining the resistors measured by the Final Measurement Station (Bridge II) and adjusting the Nominal Value expected at the Measurement Station after the Helix Lathe (Bridge I).
4. To give a 100% Pass/Reject inspection to each resistor at the:
   A. Core Inspection Station (after the Coating Furnace)
   B. Measurement Station after the Helix Lathe (Bridge I)
   C. Final Measurement Station (Bridge II)

   The Pass/Reject limits are ± 5% at the Core Measurement Station and ± 1% at the other two stations.
5. To automatically account for shrinkage by adjusting the number of cores expected out of the furnace to produce the required number at the end of the line (Packing).
6. To produce a typed sheet at the end of each day's run showing the statistics of that run.
7. To use Statistical Quality Control Methods ($\bar{X}$ & R charts) to control
   A. The value of the cores coming out of the furnace by controlling the amount of methane in the furnace and the speed of the cores through the furnace.
   B. The value of the resistor coming out of the Helix Lathe by adjusting the dials of the Helix Bridge.

Method of Control

A useful way to control a process or machine is to examine the output of this machine or process by the use of Statistical Quality Control $\bar{X}$ and R Charts (also called average and range charts).* An example of an $\bar{X}$ and R Chart is shown in Figure 2.

Data is taken from the process to be controlled in random samples of N equal to 2, 5, or 10 items. The measurement in each sample is X_1, X_2, X_3 . . . . We shall here use N = 5. The definitions of other symbols are:

$\bar{X}$ is the average of 5 pieces of data or $\bar{X}$ =

* E. L. Grant, "Statistical Quality Control," 2nd edition, McGraw-Hill Publishing Co., New York.

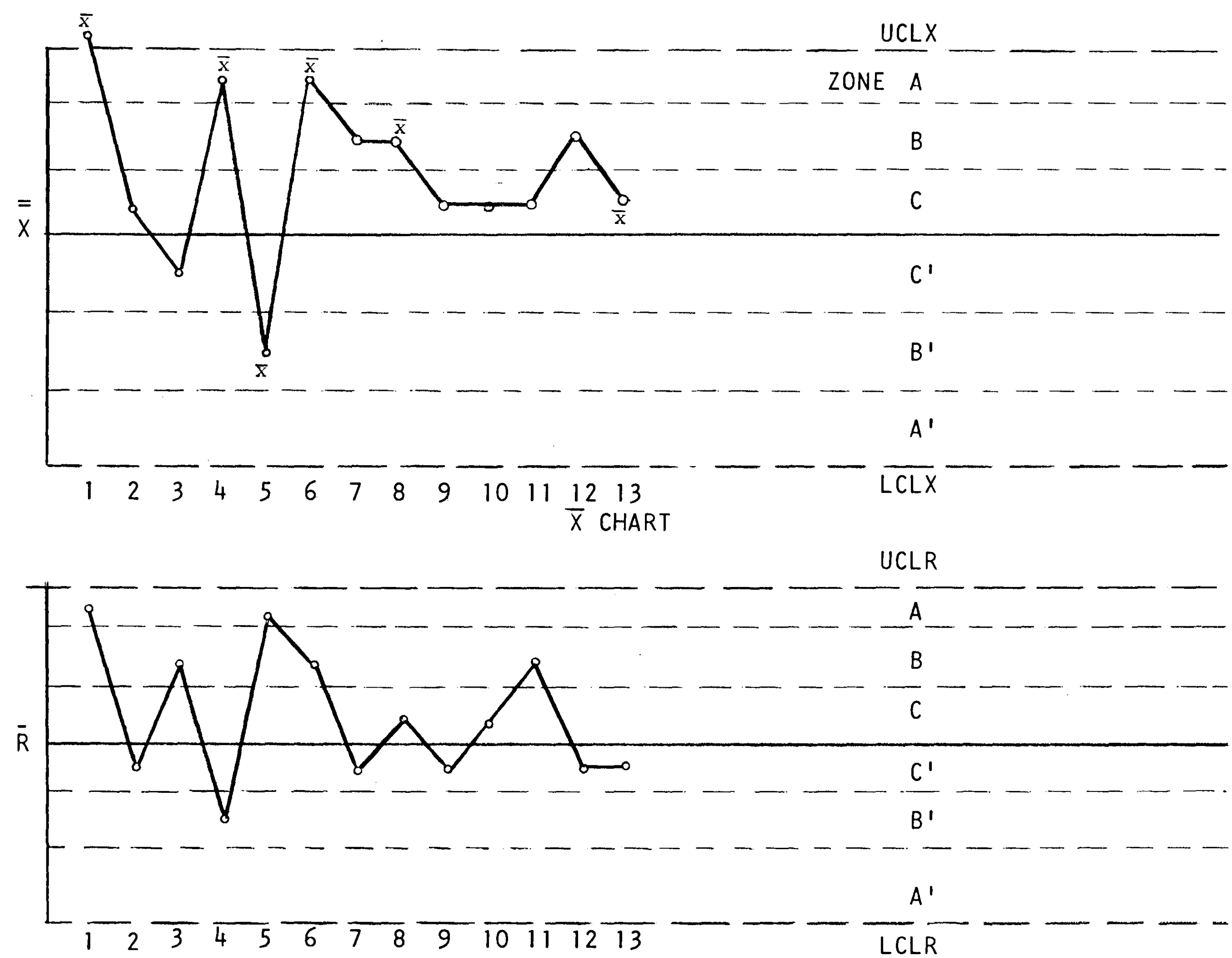


FIG. 2

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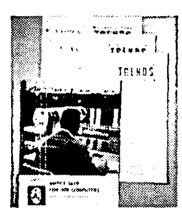
Now: who's got news for everyone with an IBM computer system? AMPEX

The news is inside an eight page booklet. It tells the what, the why and the how of Ampex computer tape—the tape that provides superior performance in IBM computer systems. If you think you might find the booklet helpful, just write and ask for it. Also, we'll put your name on our mailing list and regularly send you our informative periodical, "Tape Trends." It's a good way to keep abreast of the fast changing tape technology. In it, the latest tape developments are clearly explained by Ampex tape experts—the same experts who application-engineer Ampex tape to your system. This is just one of the many ways we assist you in obtaining maximum system efficiency. In addition to engineering the tape to your system, Ampex digitally checks each reel from end to end, and guarantees its performance. Write for free booklet, "Ampex Tape for IBM Computers," and your copies of "Tape Trends." Ampex Corporation, Redwood City, California. Sales and service engineers throughout the world.



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$(X_1 + X_2 + X_3 + X_4 + X_5)$ 5

$\bar{\bar{X}}$ is the average of the $\bar{X}$'s or $\bar{\bar{X}} =$

$(\bar{X}_1 + \bar{X}_2 + \ldots\ldots + \bar{X}_i)/i$ where i is the number of samples

R is the *range* or spread of a sample of N pieces of data, i.e.,

R = Xmax − Xmin, the largest X in the sample − the smallest X in the sample.

$\bar{R}$ is the average of the R's or $\bar{R} =$

$(R_1 + R_2 \ldots\ldots + R_i)/i$

The Upper (UCL) and Lower (LCL) Control Limits are determined as follows:

$UCLX = \bar{\bar{X}} + A_2\bar{R}$

$LCLX = \bar{\bar{X}} - A_2\bar{R}$

$UCLR = D_4\bar{R}$

$LCLR = D_3\bar{R}$

A_2, D_4, and D_3 are determined by N from tables. For N = 5,

$A_2 = 0.577$,

$D_3 = 0$,

$D_4 = 2.115$

In our system, however, $\bar{\bar{X}}$ is the desired nominal to be produced *NOT* the average of the $\bar{X}$'s and $\bar{R}$ is the estimated or observed spread or "range" of the machine in question and *NOT* the average of the R's. And as data (measurements) are entering the control system constantly, the chart limits, UCLX, LCLX, etc., must be calculated *first* based on the *given* $\bar{\bar{X}}$ and $\bar{R}$, and then the incoming $\bar{X}$'s and R's plotted around $\bar{\bar{X}}$.

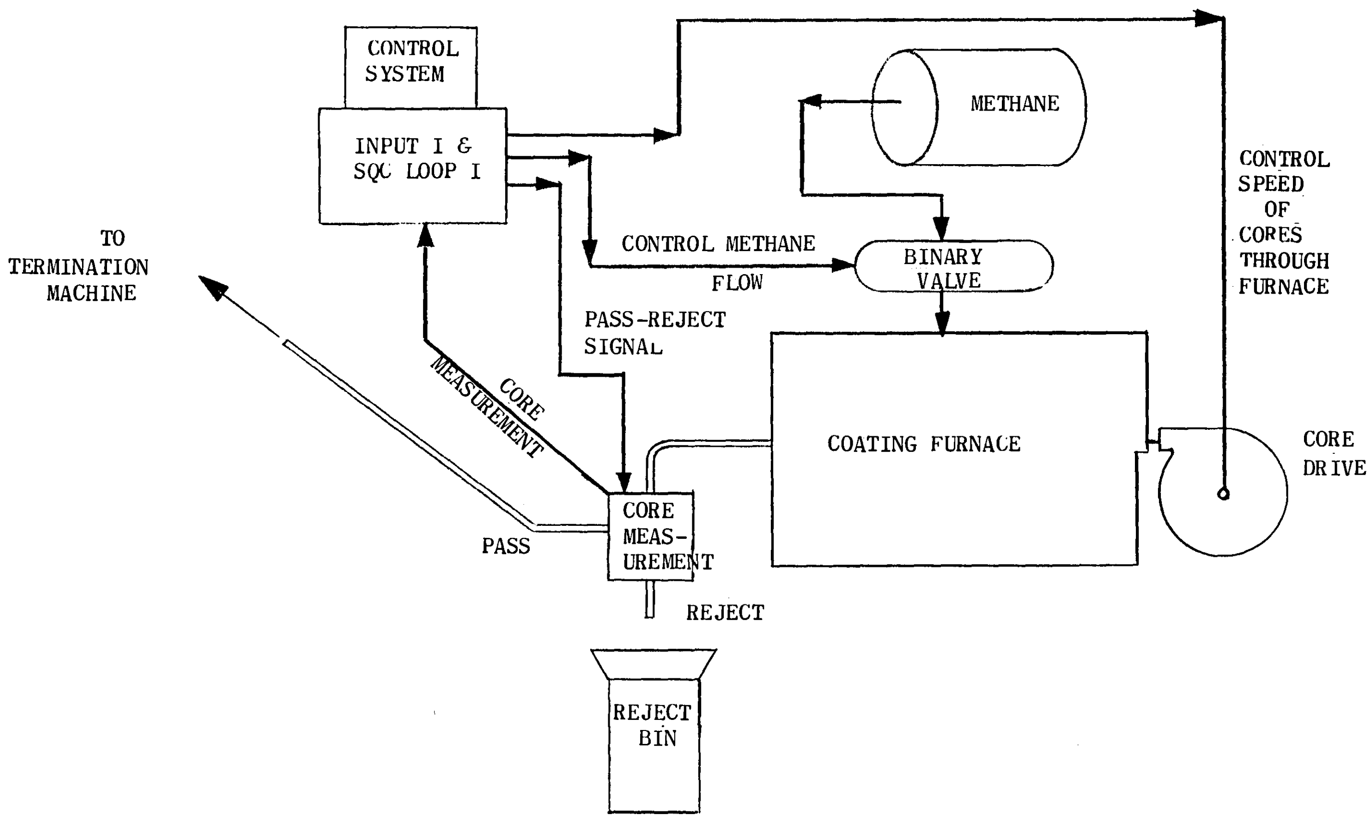
As each X is plotted, the resulting pattern is checked. If this pattern is "statistically probable," the process or machine is said to be "in control"; if this pattern is not probable, the process is said to be "out of control" and therefore, some action must be taken to try to bring the process back within control.

The tests used to check the pattern are sometimes called "non-parametric data tests" or simply "data tests." These tests are applied to each half of each chart. For N equal to 5, if any of the following conditions are met, an improbable pattern is said to exist:

1. If any single point falls outside of the control limits. (An example is Point 1 in the $\bar{X}$ chart in Figure 2.)
2. If any two out of any three sequential points fall in Zone A or above (Point 4 and Point 6).
3. If any four out of any five sequential points fall in Zone B or above (Point 4, 6, 7, 8).
4. If any eight sequential points fall in Zone C or above (Point 6 to 13).

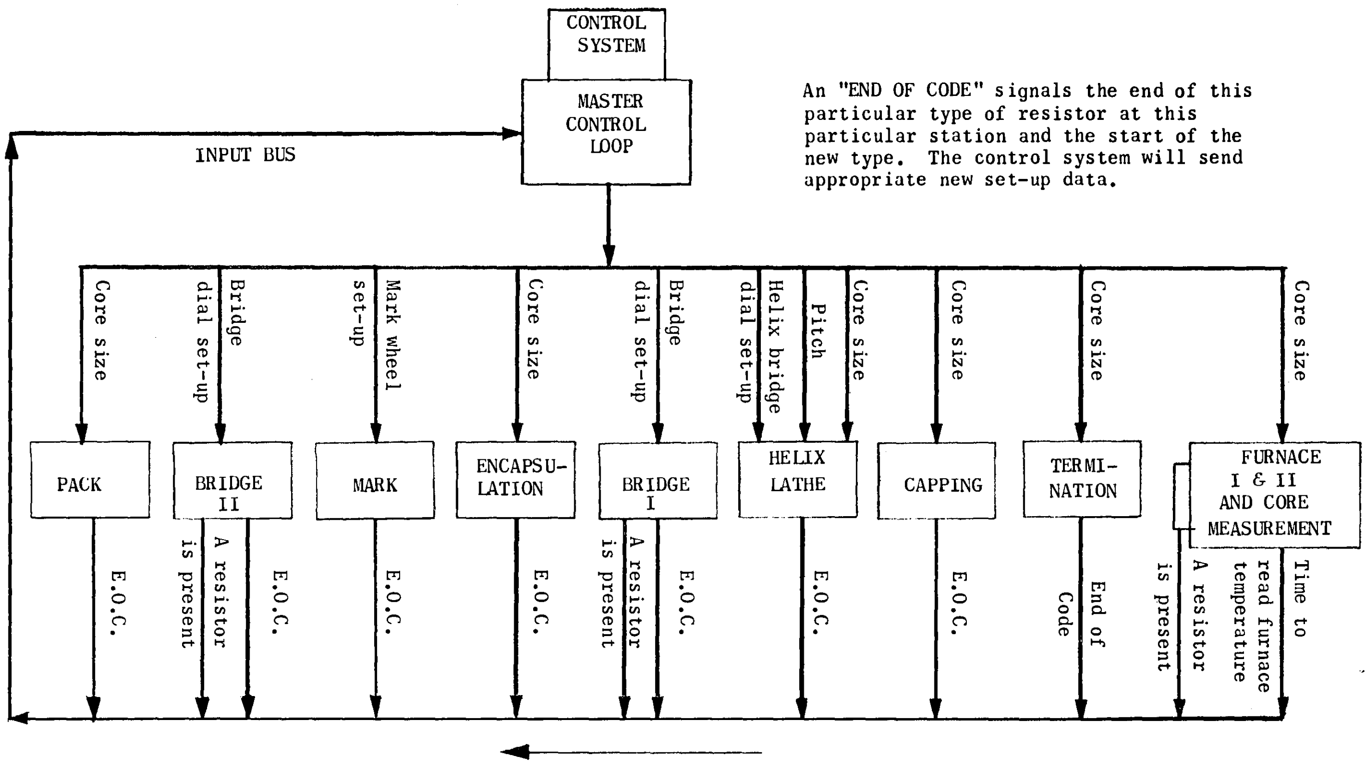
The occurrence of the last point in these conditions identifies the pattern as statistically improbable.

These tests would also be applied to the lower half of the $\bar{X}$ chart if the $\bar{X}$ in question fell there, and also to both halves of the R chart.



FURNACE - CONTROL SYSTEM - METHANE, CORE DRIVE
CLOSED LOOP

FIG. 3



MISCELLANEOUS AND SET-UP LOOPS

FIG. 4

The Program

The LGP-30 Computer is programmed to perform the "non-parametric data tests" necessary to analyze SQC $\overline{X}$ and R charts.

Four computer memory "words" are used for an $\overline{X}$ chart and four for the R chart. Let us pay attention to just the $\overline{X}$ chart—the R chart will be handled in the same way. Furthermore, let us consider only the upper half of the $\overline{X}$ chart.

Two of the four words for the $\overline{X}$ chart are used for the upper half of the $\overline{X}$ chart. One of these words is called the "Pattern" word—this holds the pattern of up-to the last 8 points ($\overline{X}$'s) which have been plotted. (Blanks or zeros are plotted in this word for those points falling in the *lower* half of the chart). The other word is called the "Sum" word—this holds the sum or total number of points which have fallen in the A Zone or above, in the B Zone or above, and/or the C Zone or above. Each of these words is divided (by the program) into three separate sections for Zones A, B, and C, respectively. Tests for an improbable pattern are made beginning in the Zone in which the point fell and continuing Zone by Zone to the C Zone. All numbers are in the binary system.

Corrections

When the Computer determines that a statistically improbable pattern exists, a suitable correction factor is formed and sent to the appropriate machine. If in the Furnace Control Loop, the correction is sent, first to the Core Drive (speed control); if the error is too large to be corrected by the speed control, the correction is sent to Methane Control and the speed control returned to mid-range. If in the Helix Lathe Control Loop, the correction is sent to the Helix Bridge Dials.

The correction sent is *NOT* based on how far the $\overline{X}$ causing the failure is from the Center Line, but is based on the average of a certain number of previous $\overline{X}$'s. For instance, in Figure 2, the correction would not be based on Point 8 alone, but possibly on the average of points 1 thru 8.

If, per chance, the $\overline{X}$ chart *AND* the R chart fail (or show improbable patterns) at the same time, the computer is programmed to consider that this $\overline{X}$ and R represent improper data or "sports." The computer will then disregard these "sports" and send no correction. Fortunately, this condition occurs very rarely in normal operation, only when something is happening to the process that warrants immediate human attention (perish the thought!)

After a correction is sent to a particular machine, the computer program inhibits further corrections being computed for a certain length of time so that the parts made under the old setting may pass by the measurement station and the parts made under the *new* corrections may have passed long enough for a valid chart to have been plotted.

Operation

The complete automated production facility was first operated in its entirety in 1960. Since then continued refinements have been made in the control equipment in the computer program and in the highly complex array of machinery designed and developed especially for this application.

The combined efforts of the engineering team resulted in extremely encouraging performance for the production line as a whole, and particularly for the control concept. Further development should make possible its application to an entire family of manufacturing facilities.

METHODS OF EVALUATING COMPUTER SYSTEMS PERFORMANCE

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This article begins a series of important reference reports on computing equipment and techniques. The author describes a reference service which evaluates computer system performance, and discusses the method, with examples, of achieving this evaluation. Further articles in the series will examine decision tables; input/output equipment, high speed printers, and optical character recognition equipment.

The Problem of Comparison and Evaluation

The prospective computer user must progress through fifteen painstaking steps in making an installation of electronic data processing equipment:

1. Analyze present system and needs
2. Establish requirements
3. Choose initial (or next) applications
4. Design system
5. Determine approximate time on possible computers
6. Time the best candidate computer systems in detail
7. Check availability
8. Analyze software for efficiency, availability, and ease of use
9. Evaluate costs, for growth and compatibility
10. Consider non-technical aspects
11. Select "best" computer system and configuration
12. Contract for system
13. Program the system
14. Plan conversion and convert
15. Plan operation and operate

Assuming that he has worked his way through the first four steps, he is next faced with the task of reducing the field of selection to a group of the computer systems that seem most likely to provide an economic and effective solution to his problem. By the time he has narrowed his range of interest down to perhaps five computers and is ready to begin a detailed analysis, he is probably faced with a six-foot shelf of assorted manuals on the characteristics of the pertinent systems and of the software packages the equipment manufacturers will furnish.

This is only the beginning of his problem. All he really has now is a collection of material that is not very suitable for his purposes for either of two reasons: either the material presents carefully selected data reflecting the

RUN DEFINITION FOR
FILE PROCESSING PROBLEM

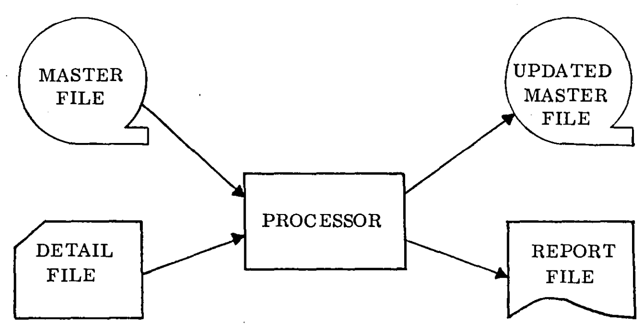

Figure 1

UNIVAC III SYSTEM PERFORMANCE

WORKSHEET DATA TABLE 1									
Worksheet	Item		Configuration						Reference
			III	VI	VII A	VIII B			
						C. P.	Blocked Details	Unblocked Details	
4	Unit of measure	(word)							
Standard Problem A Space		Std. routines	4,990†	4,990†	4,990†		4,183†	4,990†	4:200.1151
		Fixed	0	0	0		0	0	
		3 (Blocks 1 to 23)	162	162	162		162	162	
		6 (Blocks 24 to 48)	420	420	420		420	420	
		Files	1,344	1,344	1,344		2,400	1,344	
		Working	100	100	100		100	100	
		Total	7,016	7,016	7,016		7,265	7,016	

† Includes 3,000 words for the Executive routines.

Figure 2

emphasis chosen by the manufacturers' eager sales departments; or the material consists of detailed system, programming, and engineering information in various formats and terminologies, in quantity much greater than he can easily use. Somewhere in this glut of material are the equipment characteristics and the performance information important to him, but in order to find them, he must weed out the purely sales material and he must decipher the terminology that varies from manufacturer to manufacturer.

Having got this far, if he is not discouraged, he is ready to try to compare the specifications of the various systems and evaluate their performance. Now he makes the discovery that each manufacturer quotes performance figures on entirely different bases. In order to obtain comparable figures, he must make complex interpretations. Once this is done, he is finally ready for step five: measuring each computing system against the jobs he will require it to do.

A Solution

In order to save the prospective user much of this painstaking work and to get him through steps 5 to 15 in a reasonable amount of time and for a reasonable amount of money, the Auerbach Corporation developed *Standard EDP Reports* two years ago. As a technical-services organization specializing in the design and development of data and information systems, the company was frequently asked to compile detailed reports comparing various features of different computer systems. Out of this work grew an interest in the problem of generating standardized comparisons of computer performance. These standardized comparisons from system to system could be generally applied to the problem of selecting the system most suitable for a particular set of applications. As a result of the company's research, techniques were developed to generate comparative measurements; and these techniques became the basis for a published reference service useful to both current and potential computer users, *Standard EDP Reports*.

In April 1962, the reference service consisted of detailed reports on the characteristics of 7 commercially available systems. Currently, it consists of six volumes covering 50 general-purpose digital computer systems produced in the United States.

Computer-System Reports

The computer-system reports describe, in standard form and from the user's point of view, all the characteristics of each included computer system. Each computer system report is divided into the following sections:

1. Introduction: A summary of the system's characteristics and features, with particular emphasis upon its strengths and weaknesses relative to competitive systems.
2. Data Structure: How the system represents basic data units.
3. Internal Storage: The size, speed, and characteristics of each available type of data storage unit (core, thin-film, disc, drum, etc.).
4. Central Processor: A user-oriented specification of the capabilities of the processor, including operations performed, special features, and times required to perform standard tasks such as addition for five-digit numbers.
5. Input-Output Units: Specifications of each of the peripheral units available with the system, including basic speeds, error checks, compatibility of the external storage medium with other systems, etc.

6. System Configuration: Diagrams illustrating the number of typical equipment configurations, including inter-connection restrictions and component rentals.
7. Simultaneous Operations: A detailed description of the system's capabilities to reduce total job times by performing more than one operation at a time.
8. Physical Characteristics: A summary of the characteristics pertinent to physical installation problems.
9. Price Data: Rental, purchase and maintenance costs for each system component.

Software

The computer-system reports also contain sections devoted to description of the following software elements:

1. Source Languages: A description of the scope and features of each of the programming languages available for use with the system (COBOL, FORTRAN, assembly languages, etc.).
2. Translators: An analysis of each of the programming packages that translate source languages to machine language, including their features, performance, and availability.
3. Operating Systems: A review of the standard routines and conventions available to assist in the sequencing of runs, error detection and correction, and other operating problems.

Measurements of Over-All Performance on Bench-Mark Tasks

In addition, the computer-system report also provides measurements of the system's over-all performance in both data-processing and scientific applications. These are based upon typical but precisely defined bench-mark tasks, such as: file processing; sorting; matrix inversion; statistical data processing; and mathematical calculations. Each task is specified by detailed descriptions, parameters and flow charts.

Each computer system is measured at three levels: basic central-processor operations; operation of individual devices; and operation of particular system configurations. The fundamental performance specifications are established for each unit of the system; from them, times are developed for performing elementary tasks on each unit. These task times for the individual units are then combined to obtain times for sets of units working together in specific configurations. One of these bench-mark problems is file-updating. Figure 1 is a run diagram of the problem in an elementary form. A master file needs to be read in and updated. The detail file contains information for updating the master file. As items in the detail file cause activity, reports are generated.

Two basic rules are followed in measuring computer performance on bench-mark tasks. First, the external specifications of the job (i.e., the input and output data and the required results) are specified precisely and in the way that suits the user; the programmed computer system is expected to adapt and conform to these requirements. Second, although the computer system must conform to the specifications of *what* is to be done, *how* it is done is left flexible so that full advantage can be taken of the specific capabilities of each system.

Accordingly, the format and contents of the detail file and the report file are specified minutely, and the contents of the master file are also specified. However, the actual field allocation and editing techniques are chosen to portray each individual system in its best light.

Variables

In order to cover a variety of situations that users may face, a number of variables are established for the task. These problem variables fall into three groups: record size; computation volume; and activity factor. Other parameters of course are important to the user: basic speeds, optional facilities, storage volume, simultaneous operations, and the use of off-line facilities. These however are delimited by the system configuration being examined.

In order to produce truly comparable measures of the performance of competitive systems, criteria have been established for a set of typical configurations, which are matched as closely as possible from system to system.

Processing Times

The basic times computed for a task fall into three classes: input-output times per block for each individual unit; processor delays caused by input-output operations; and central-processor computation time.

Computation time is subdivided, in turn, into three types: the time to process one record from the master file; the time to process the activity caused by one detail record; and the time for the "housekeeping" necessary for moving each block of the master file.

After these times have been individually derived, they are then combined to suit the problem and configuration parameters. The results are presented as graphs which show the time required to process 10,000 records of the master file.

Uses of this Evaluation Technique

These techniques have been systematically applied to evaluate most of the major computer systems produced in the United States. The result is a collection of objective data that helps: a prospective computer user, to make more knowledgeable equipment decisions at less cost; a current computer user, to evaluate configuration changes; and both kinds of users, to analyze software efficiency, availability, ease of use, and the practicality of changes in system operation.

Big or Little Runs

Let's take a look, for example, at the frequent problem of deciding whether to consolidate all aspects of a program into a single run, or to divide the program into several runs.

The governing factor affecting this decision is the utilization of memory space.

A quick guide to the amount of memory space required for one of the bench-mark problems is shown in Figure 2. For the UNIVAC III it is seen that at least 7,016 words of storage will be necessary. The user can measure his program in terms of the additional degree of complexity that will require additional instructions and deduce whether the contemplated run will fit within the core storage size available.

Another typical question is: will faster tape units enable an IBM 1410 currently equipped with 729 II tape units to handle a file-processing job in less time?

Figure 3, a comparison chart from the computer-system report on the IBM 1410, shows there are five different tape units available for the 1410 system, with peak speeds ranging from 20,000 to 90,000 characters per second. Going from the 729 II to the 729 VI appears to increase the tape speed from 14,600 to 90,000 characters per second, for a 120% increase. The chart shows not only the apparent increase in speed but also the effective increase. If the block size is 1,000 characters, effective speed really increases from 27,000 to 50,000 characters per second, for an 85% increase and 46% saving. If the block size is only 100 char-

COMPARISON OF SMALL TO MEDIUM GENERAL PURPOSE SYSTEMS
HARDWARE: MAGNETIC TAPE

System Identity			IBM 1410				
MAGNETIC TAPE	Model Number		7330	729II	729IV	729V	729VI
	Maximum Number of Units	On-Line	20	20	20	20	20
		Reading/Writing	2	2	2	2	2
		Searching	0	0	0	0	0
		Rewinding	20	20	20	20	20
	Demands on Processor, %	Reading/Writing	100 or 11*	100 or 22*	100 or 33*	100 or 31*	100 or 47*
		Starting/Stopping	54 or 0*	89 or 0*	83 or 0¢	89 or 0*	83 or 0*
	Transfer Rate, Kilo-char/sec.	Peak	20.0	41.6	62.5	60.0	90.0
		1,000-char blocks	14.2	27.3	40.0	34.2	50.2
		100-char blocks	4.0	6.7	9.6	7.0	10.1
	Data Tracks		6	6	6	6	6
	Data Rows per Block		1 to N	1 to N	1 to N	1 to N	1 to N
	Data Rows per Inch		200, 556	200, 556	200, 556	200, 556, 800	200, 556, 800
	IBM Compatible		Yes				
	Checking	Reading	Track & row parity				
		Writing	Read after write				
	Features and Comments						

* With optional equipment.

Figure 3

acters, the increase is from 6,700 to 10,000 characters per second, an increase of only 50% and savings of only 33%.

On a tape-limited job lasting six hours a day with the present tape units, the potential saving is 2.8 hours for 1,000-character blocks and 2.0 hours for 100-character blocks.

The price data section of the computer-system report shows that the rental for the IBM 1410 will increase $250 per month for each tape unit upgraded from a 729 II to a 729 VI.

Other data in the computer-system report shows that the same controller can handle the 729 tape drive, Models II, IV, V, and VI in any combination. Therefore, it would not be necessary to change controllers and it is not necessary to change all the tape units. The comparison-charts section of the report shows that the typical monthly rental for a six-tape IBM 1410 installation is $12,930.00. Based on all this information, the user can easily calculate the increased cost and see whether the resulting savings in job time are justified (see the calculation in Figure 4).

Software Evaluations

In the computer-system reports, special emphasis is placed upon the key features of software that affect performance, versatility, and use. The common programming languages as used on a specific computer, such as FORTRAN and COBOL, are described in terms of how they differ from some standard. For example, Figure 5 shows information provided on the COBOL source lan-

EXAMPLE

Rental 6-tape 1410 system:	$12, 930 per month
	= $82 per hour
Extra rental for two Model VI over two Model II:	$ 500 per month
	= 4% increase
Total time of job:	6 hrs per day
New time (50% real increase in speed): .	33% decrease in time
Saving:	2 hrs per day
	= 25% of a day
Value of time saved:	$ 3, 240 per month
Extra rental:	$ 500 per month

Figure 4

guage for the IBM 1401. This clearly shows the deviation from the required COBOL specifications, and enables the user to quickly determine the degree of compatibility between two implementations. In cases where several versions of one translator are available, the system report on each translator shows the general structure of the translator, the translation times, the effects that various configurations have upon the translator, and the efficiencies, with respect to both execution time and memory space, of the resulting object programs.

IBM 1401

Procedure Division:

- The REEL option of the CLOSE verb, which provides for the closing of a reel prior to its normal end, is deferred.
- The EXAMINE verb and TALLY register, which make it possible to replace and/or count the number of occurrences of a specified character in a data item, are deferred. †
- A given file cannot be processed both as an input file and as an output file in the same Program.
- A literal used after the STOP verb must be numerical and less than four digits in length. †

† Deficiency applies only to the 12K-16K version of 1401 COBOL.

Extensions to COBOL 61: . . . . none. (The SORT verb and Report Writer facility of Extended COBOL-61 are not provided.)

Figure 5

For prospective users interested in measuring the performance of system choices or for the user interested in maximum utilization of system software, the computer-system reports list and describe all the major utility routines available, noting the major omissions and reporting all key criteria. The system-performance section shows the operation times for the routines, and sections of the comparison charts compare operation times from system to system for various standard configurations. The operating systems provided by the manufacturer or independent users are also described in detail.

These computer-system reports do not, of course, remove from the systems-analyst the burden involved in selecting computer equipment or in improving system operations. What they do do, however, is to provide him with a more objective and factual basis than has previously been available for making computer-system decisions. The comprehensive data provided are applicable to all classes of applications—statistical, mathematical, scientific, and commercial—and furnish the prospective or actual computer user with a set of basic, standardized bench-marks that can be readily adapted to fit his particular situation.

More detailed information on the cost and availability of *Standard EDP Reports* can be obtained from the publisher, Info, Inc. (a subsidiary of the Auerbach Corp.), 1634 Arch Street, Philadelphia 3, Pa., or by circling No. 3 on the Reader Service Card.

c & a
READERS' & EDITOR'S FORUM

"COMPUTERS, AUTOMATION, AND EMPLOYMENT" — DISCUSSION

I. To the Editor from W. H. Mandel
New York, N.Y.

Regarding the widespread and well-meant demand for full employment, if training or retraining alone cannot provide people with jobs, as you emphasize in your November editorial "Computers, Automation, and Employment", isn't it equally futile, in the long run, to attempt to create conventional jobs in the face of a secular trend eliminating them?

Can we rightly compare employment figures for West Germany and Russia with those for the United States as long as the former countries benefit (in this respect) from the impetus of reconstruction (Germany) or an intermediate stage of economic development (Russia), and the delayed advent of automation?

The problem for this country appears to be the novel one of distributing equitably among the entire population the abundant product of a relatively small labor force, without undue shock to tradition. This involves, in your image, the surrender of our "sacred cows", screaming eagles, etc.: the many worshippers of these animals may lapse, but not lightly.

For instance, one sacred cow still held dear even by some of those who have disavowed other fetishes is the notion that every able-bodied head-of-household between the ages of 20 and 65, roughly, should be "gainfully employed" in order to subsist. Automation will soon render this faith untenable, but not without a severe wrench.

As a first approximation to a solution, the multiple billions of dollars now marked, as you mention, for a marginally rewarding voyage to the moon, might instead expand the Social Security system so as to lower retirement-eligible ages and increase pensions to levels at which middle-aged withdrawals from the industrial labor market would bring the number of available jobs into approximate balance with the number of displaced workers and youngsters seeking paid employment.

Retraining and re-education in this context would make sense, wouldn't you say, both for the working-hired and especially for the working-retired freed from the curse of the cash requirement?

II. From the Editor

As long as 1/3 or 1/4 of the members of a society are deprived of an adequate standard of living which they would surely acquire if they had more money, there is useful work to be done. The problem that has to be faced up to is providing goods and services to people who have not "earned" them, because a scarcity society has changed into a society of abundance. The idea of lowering retirement ages to balance approximately the number of unemployed certainly has some merits.

ADVERTISING, PUBLICITY RELEASES, AND INFORMATION WORTH PUBLISHING

I. From Charles R. Cross
Long Beach, Calif.

When I received the October issue of "Computers and Automation", with the first glances through the magazine I noted the article "The Printing of Advertising as Publicity Releases". Upon closer examination, I was distressed to find an attitude by an executive such as was expressed by Mr. Ludka. While mistakes may happen, they can be corrected. This is evidenced in your return letter to him. What is distasteful is the presumptuous stance taken. It appears that they wish their "biggest in our history" budget to be a club with which they may mold opinions, and that all should grovel for a share of their dollars.

It is good to see that there are those who have formed solid principles and will refuse to have them abridged. The fact that your publication is above this type of pressure is the reason that it does contain the information which is "factual, useful, and understandable", rather than what those who have a financial stake want us to see. Continue to pursue this policy of self control, for it is the way to prohibit the spread of the tyranny of controlled information.

II. From R. W. Olmstead
Long Branch, N.J.

The exchange of letters between yourself and Mr. Ludka, noted in the pages of the October 1963 issue of Computers and Automation, has evoked from me a reaction of some amusement, some sympathy, and a very high degree of respect for you and Computers and Automation in the editorial standards you have set for your magazine and the courage with which you defend them.

As an Advertising Manager, I have many times been frustrated when certain books have failed to give appropriate attention to the product publicity generated by my department. However, whenever this failure to pick up my publicity has been the result of a consistently high editorial policy, the result has been to increase my respect for the magazine which defended such policy. I, personally, deplore the short-sighted attitude displayed by Mr. Ludka and I certainly congratulate you on sticking to your "editorial guns". I shall probably tangle with you personally in the future should you fail to pick up some publicity on my products, but I will be ready to respect your position so long as it follows the clean and clear principle you have demonstrated to date. Similarly, I shall not allow such disappointments to obstruct the objectivity of my advertising program philosophy.

(Please turn to page 28)

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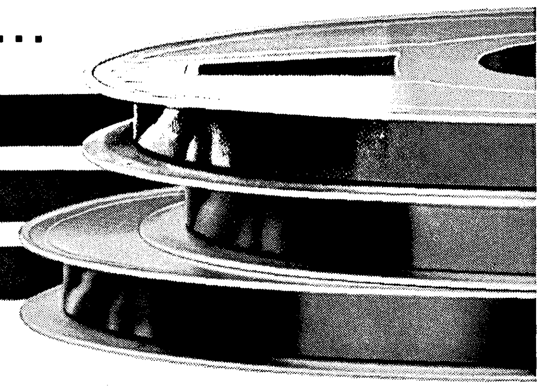

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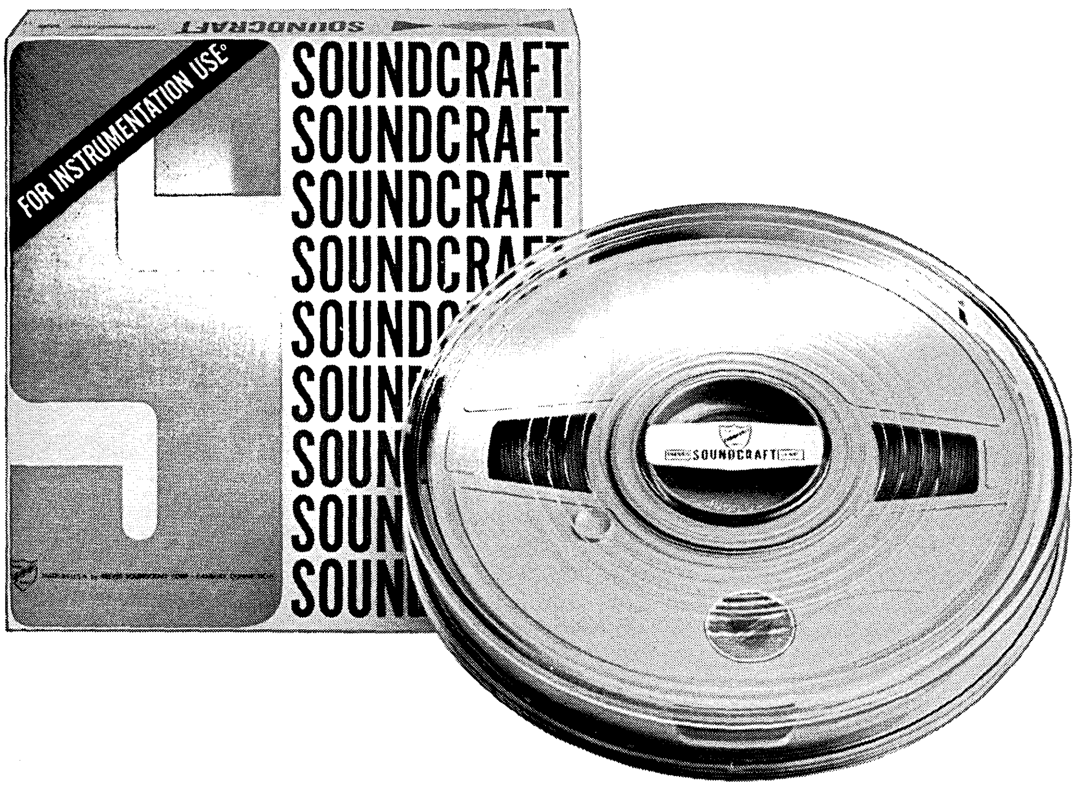

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SMALL SCIENTIFIC COMPUTERS VERSUS DATA COMMUNICATIONS SYSTEMS IN A LARGE COMPUTER ENVIRONMENT

Roger A. MacGowan
Chief, Scientific Digital Branch
Army Missile Command Computation Center
Redstone Arsenal, Ala.

Many large organizations have their organizational segments scattered over a fairly large geographic area, and this presents some problems for efficient digital computer operations. Frequently organizations in this situation have formed a centralized computer laboratory containing one or more large-scale computers and staffed with professional programmers, while at the same time permitting the use of small-scale computers in decentralized locations. In such a situation the very large problems are necessarily run on one of the large-scale computers in the central laboratory, while many small and medium-sized problems are run on the small decentralized computers.

These situations have created considerable interest in the outcome of the competition between small-scale computers, on the one hand, and remote input-output devices communicating with large-scale computers, on the other hand. The cost of small-scale computers has been declining rapidly, while simultaneously many computer manufacturers have been carrying out research and development on telephone and microwave communication equipment for decentralized computer input-output. Very recently, several remote input-output devices using data processing transmission have become commercially available; therefore, a direct cost comparison of the two differing approaches, at the present state of the art, is now possible. As a result, a reappraisal of the over-all computing philosophy is certainly in order for many organizations.

Small Computers vs. Messengers

The average distance of the computer users' groups from the centralized computation laboratory is a critical factor in a study of organizational computing policy. Large-scale computers are inherently much more efficient than small-scale computers, therefore, almost the only reasonable justification for the use of small computers in a large computer environment is the more ready availability of the small computer. This implies that the sponsor of the individual problem must make an inconvenient trip to the computer center with his small problems, and that a suitable problem pickup and delivery schedule cannot be arranged, or that turn-around time is excessive on the central, large-scale computers.

In order to achieve ready availability on a small computer, it must be assumed that the workload is moderate and that the problems are short, generally requiring less than thirty minutes each. If the daily workload exceeds about 5 hours, or a number of problems exceed about thirty minutes each, queues tend to develop and the "ready availability" justification, which is the sole justification for the small computer, vanishes. Often these queueing problems result in the scheduling of one time period per day for each user of these small computers, again defeating the purpose of the small computers.

Suppose the average travel time from decentralized locations to the central computation laboratory is thirty minutes or less, and the turn-around time on the large-scale computers is two to three hours. Then it should be possible for the user in the decentralized location to obtain two or perhaps three runs on the large-scale computer per day, if a reasonable messenger service is established. It is unlikely that more computer runs than this can be obtained on a small computer having a moderate workload and placed in the decentralized location. Therefore, two distinct disadvantages are apparent in using small computers in such a situation:

(1) An inferior computer is used to process all small and medium-sized problems.

(2) All small and medium-sized problems are solved at far greater expense than necessary.

Not even a reduction in development time is demonstrable to compensate for these disadvantages.

Table 1

COMPARATIVE COSTS
OF EIGHT SMALL COMPUTERS
VERSUS
EIGHT DATA COMMUNICATION SYSTEMS

	Cost of Small Computers	Cost of Expanded Small Computers	Cost of Communication Systems	
Computer Rental Card Punch Rental Line Printer Rental	$ 2,000./mo. 50./mo. 450./mo.	$ 3,000./mo. 50./mo. 450./mo.	Card Input-Output Rental Card Punch Rental Line Printer Rental Telephone Connection Rental Telephone Lines Rental Large Computer Rental	$ 800./mo. 50./mo. 450./mo. 75./mo. 25./mo. 400./mo.
Total for One System Total for Eight Systems	$ 2,500./mo. $20,000./mo.	$ 3,500./mo. $28,000./mo.		$ 1,800./mo. $14,400./mo.
Additional Costs of Data Communication Systems (In Central Computation Laboratory)			Magnetic Tape Unit Rental Telephone Connection Rental Telephone Lines Rental	$ 1,300./mo. $ 75./mo. $ 25./mo.
Total Cost (Eight Systems)	$20,000. mo.	$28,000./mo.	Total Cost (Eight Systems)	$15,800./mo.
% Savings by Converting to Data Communication Systems	21% Saving	44% Saving		
Dollar Savings per year by Converting to Data Communication Systems	$50,400./yr.	$146,400./yr.		

In the past, when most installations did not have efficient operating systems on large computers, the turn-around time was frequently a whole day, even for short problems or test runs. This resulted in impatience on the part of problem sponsors who were waiting until the following morning for their answers, and this computing service delay was a natural scapegoat for explaining any failure to meet project schedules. Originally, pressure developed in this way for the use of decentralized small computers in a large computer environment. However, currently, a good messenger service appears to be the only sensible economic approach for decentralized users who are located only a few minutes' travel time from the large computers.

Small Computers vs. Data Communication

If the average travel time to the central computer laboratory is measured in hours, then the messenger service approach may become increasingly expensive and may result in delays in research and development. The development time may be sufficiently important to warrant considering use of either decentralized small computers, in spite of their inefficiency, or data communication devices.

In considering the relative merits of small computers versus data transmission to a large computer it will be convenient to consider a fairly typical number of remote computer user groups, say eight, for comparative purposes. The problem of input to the central computer could involve complex system programming requirements if real-time interrupts and direct input to the central computer were sought; but this type of problem does not actually warrant real-time input. A much simpler solution would be to stack incoming problems on a magnetic tape in exactly the same manner that problems are stacked by an auxiliary computer for input into a large-scale computer. This would circumvent the need for any special programming procedures when utilizing a data communication system. A queueing problem in receiving or transmitting problems at the central magnetic tape station could readily be alleviated by the acquisition of an additional magnetic tape station.

Any cost comparison of small computers and data communication systems must take into account the rental for time used on the large computer as well as the rental for the data communication equipment itself. A computing speed ratio of the large-scale computer to the small-scale computer must be assumed for a typical problem mix. In Table 1 (which see), it has been assumed that the computing speed ratio is 150 to 1; in other words, 150 hours used on the small computer is equivalent to one hour used on the large computer, and that each hour of large-scale computer time costs $400. A detailed analysis of these assumptions will show compensating effects which imply that the conclusions cannot be greatly in error. The small computer rental may be based on the assumption that a minimum number of optional extra features is utilized, or that moderately expanded small computers (having extra core storage or tape units) are permitted.

One clear advantage that results from the use of data communication systems is that all problems can be run on a superior computer and there are no programming language or computer hardware compatibility problems. There is a strong tendency to expand the capabilities of the small computers by adding storage units, magnetic tape units, auxiliary arithmetic units, etc.; but such expansion of small computers to handle larger and more complex problems does not result in a significant increase in computing capability relative to a large computer and therefore it only compounds the economic inefficiency of the small computers as is clearly shown in Table 1. Future cost reductions of data transmission equipment will probably result in increasing the economic advantage of data communication systems over small-scale decentralized computers. Therefore, in most situations data transmission equipment should be preferred to small computers, and under no circumstances should expansion of small computers be permitted.

Operational Data Communication Problems

Scheduling may be considered by some as a critical problem in the use of a large central computer for the solution of small problems transmitted from remote locations, but it should be easy to achieve a turn-around time of four hours, or two runs per day, on the large computer, and this will generally be equal to or better than the turn-around time on a small computer having a moderate workload. In order to assure this satisfactory scheduling on a large computer the length of problem runs permitted during the day should be limited to those less than 10 or 20 minutes, and this type of restriction is already used by nearly all large computer installations.

One of the major problems in utilizing data communication devices in a large computer environment is the programming and operating problem. More explicitly, the decentralized organizational elements frequently have control over the use of their small computer or data communication system and they tend to assign one or more of their junior personnel to become full time programmers or operators to serve the rest of their organization, or they hire one or more new trainees to perform these tasks. This procedure is inefficient not only because the local technical supervisors have had no experience in selecting or training programmers or operators, but also because the new programmers are almost invariably inexperienced on computers and they do not have any concept of the different functions of the large and small computers. They are very likely to try to fit all problems into their own small computer. If professional programmers and operators are desired either temporarily or permanently in connection with a small computer or data communication system in a remote location, these programmers and operators should be selected, trained, and controlled by the central computation laboratory.

Who Should Program

It is of course desirable to encourage the scientist or engineer to become familiar with digital computation even to the extent of programming his own problems where this is feasible. The scientific and engineering problem sponsors should certainly be encouraged to learn and use an algebraic language such as Fortran for their own problems, since this reduces the great inefficiency of communicating the details of every problem to a professional programmer who may be initially unfamiliar with the problem. However, the use of symbolic programming takes more time and more experience, and may be regarded as wasting the specialized ability of scientists and engineers. In general scientists and engineers should be discouraged from learning and using symbolic programming systems.

The encouragement of scientists and engineers to prepare their own programs can have disastrous results if, after training, they proceed with their own programming and ignore the existence of the centralized programming staff and the reservoir of current programs. The scientists and engineers who are doing their own programming should be very strongly encouraged to consult with the centralized programming staff before undertaking any program. Major computer applications in an organization are likely to have a whole series of large and complex programs which are developed and run in sequence by the centralized computer programmers, and failure to utilize and maintain compatibility with these established sequences of programs can result in the waste of hundreds of thousands of dollars as well as a great loss of development time.

At the present time it is becoming apparent that efficient computer programming for major applications requires the development of very large application programs which consist of many independent, functional, general-purpose modules, and these modules must be planned and prepared by persons who are expert in both computer programming and the particular application areas. Many general purpose subroutines which are available in a large computation center would require weeks to be duplicated by a novice programmer.

It should be abundantly clear that the utmost cooperation is required between a centralized computation center and decentralized user groups if anything close to optimum computing efficiency is to be achieved. Users must refrain from duplicating the work of professional programmers and they must make proper use of small computers or communication systems, and professional programming staffs must make every effort to encourage the use of algebraic programming by engineers and scientists (for small independent problems) and to cooperate with engineers and scientists in the planning and development of general-purpose, modular, application programs.

READERS' AND EDITOR'S FORUM
(Continued from page 24)

III. From Roger W. Christian
New York, N.Y.

I would like to congratulate you on your handling of Mr. Joseph M. Ludka (October issue). I am an associate editor of a well-known trade magazine, and caught myself almost cheering out loud. It is unfortunate that there are a few men around who still feel that it is the prerogative of advertisers to bully publishers into lowering the quality of their editorial. As I am sure you have discovered, the people with this childish attitude are often the ones who bellow the loudest that the publisher has turned prostitute when one of his competitors gets a big play.

I congratulate you on your courage, and can assure you that you have gained stature in the eyes of your readers, and, I am sure, most of your advertisers. I only wish there were some way to bring the infantile antics of Mr. Ludka to the attention of someone capable of doing something about his spoiled-brat tantrums, and the image that he created for the company he represents.

NOSOAP

From Joseph S. DeNatale
Winchester, Mass.

A number of years ago I was founder, chairman, and sole member of NOSOAP (National Organization to Stamp Out Acronym Proliferation). This came about as a result of the change in name of ORAC (Oak Ridge Automatic Computer) to ORACLE (Oak Ridge Automatic Computer, Logical Entry). This was, I thought, carrying it too far. Shortly after, NOSOAP was dissolved in favor of a more promising crusade, SFTPAEOTPTIPPIH (Society For The Preservation And Elevation Of The Pun To Its Proper Place In Humor).

I would suggest you give up the foolhardy venture LSOAOFL* and dissolve it; however if you require at least a hollow victory then you may find solace and balm in the following proposition: Those names that are made up of five or fewer letters shall be called acronyms; those consisting of six or more letters shall be known as macronyms. How is that?

*Let's-Stamp-Out-Acronyms-Over-Five-Letters Club; see "Computers and Automation" Scratchpad, Aug. 1963, p.7

plays for presentation directly to the flight control teams.

The contract was awarded by the Philco Corporation, which has the responsibility of developing and equipping the control center for the National Aeronautics and Space Administration Manned Spacecraft Center

CONTRACT AWARDED TO ELECTRONIC ENGINEERING CO.

A contract totaling $76,000 for an EECO 751 scientific data processing system has been awarded to the Electronic Engineering Company of Santa Ana, Calif., by the Goddard Space Flight Center of the National Aeronautics and Space Administration. The system is known as a Computer Format Control Buffer and is designated the EECO 751. It controls and converts data telemetered from satellites. The system, scheduled for delivery in March, is the ninth to be ordered by the Goddard Space Flight Center.

HONEYWELL EDP GETS CONTRACT FROM ARMY

Honeywell Electronic Data Processing, Wellesley Hills, Mass., has been awarded a $99,000 contract to investigate advanced data processing techniques and make recommendations concerning design and development of a modular digital computer for the Army Command Control Information System. The contract was awarded by the Fort Monmouth Procurement Office, U.S. Army Electronics Materiel Agency, Fort Monmouth, N.J.

The twelve-month study project, called MILDATA, requires projection of the "state-of-the-art" in digital computers and related systems that will be usable by the field Army between 1975 and 1985.

TAPE HANDLER CONTRACT FOR AMPEX FROM SDS

Ampex Corporation, Redwood City, Calif., has received a contract totaling more than $500,000 from Scientific Data Systems, Inc., Santa Monica, Calif., for digital tape handlers for use with SDS series 900 computers. Units involved are standard Ampex TM-4 transports. They will be manufactured at the Ampex plant in Culver City, Calif.

CSC AWARDED LITTON CONTRACT

Computer Sciences Corporation, El Segundo, Calif., has been awarded a contract for programming services by the Guidance and Control Systems division of Litton Industries, Woodland Hills, Calif. The contract provides for programming of a major cost accounting system. Programming will be performed using the new COmmon Business Oriented Language (COBOL) processor for various computers. CSC's Commercial Applications Department will provide the services.

NEW INSTALLATIONS

FIRST ASI 2100 INSTALLED

The first 2100 digital computing system (see Computers and Automation, December 1963) has been installed at the Argonne National Laboratory, Argonne, Ill., by Advanced Scientific Instruments, a division of Electro-Mechanical Research, Inc., Minneapolis, Minn. The system includes an 8000 word memory, two card handling systems, input/output typewriters, a digital plotter system, line printers, several magnetic tape units, as well as a number of special-purpose units. It will be used for on-line nuclear physics experiments, as well as normal laboratory computation.
(For more information, circle 26 on the Readers Service Card.)

ANALOG COMPUTER TO BE INSTALLED AT TEXAS POWER & LIGHT COMPANY

Texas Power & Light Company, Dallas, Texas, has purchased a transistorized, analog computer from Leeds & Northrup Co., Philadelphia, Pa. The computer is to be installed in the utility's central load dispatching office in Dallas. It will automatically control the loading of the company's generating units to minimize the costs of system operations and production.

In addition to automatic control, the equipment is designed for use as a scientific engineering computer to study future operating conditions and their effects on systems production costs. Delivery is expected this fall.
(For more information, circle 27 on the Readers Service Card.)

BURROUGHS B200 INSTALLED AT FORD DIVISION

A Burroughs B200 Series Electronic Computer has been installed at the National Parts Depot, Ford Division, Ford Motor Company, Detroit, Mich. The major use of the computer will be for accounts receivable processing and inventory control. It consists of a solid state central processor, an 800 card-per-minute card reader, a 300 card-per-minute card punch, and a 700 line-per-minute printer.
(For more information, circle 28 on the Readers Service Card.)

DULUTH, MINN. BANK ORDERS B270

First American National Bank of Duluth, Minn., will install a Burroughs B270 computer system this year. The $90 million financial institution will first apply the system to sorting and routing the personal and business checks it now handles with conventional equipment. The bank's complete accounting operation eventually will be transferred to the computer. Data processing services for its customers are also planned.

The system will include both punched card and magnetic tape units and a document sorter capable of reading information directly from bank checks while sorting them at speeds up to 1560 checks a minute.
(For more information, circle 29 on the Readers Service Card.)

DDP-24 ORDERED FOR SPARK CHAMBER AUTOMATIC SCANNING SYSTEM

A DDP-24 general purpose computer has been purchased from Computer Control Company, Inc., Framingham, Mass., by the Lawrence Radiation Laboratory, University of California, Berkeley, Calif. It will be used in the laboratory's Spark Chamber Automatic Scanning System (SASS), consisting of the DDP-24 computer, a precision CRT, and a control unit.

Other uses of the DDP-24 will include on-line reduction of data acquired by physicists from Bevatron and cyclotron experiments, and the development of large scale storage devices for recording the results of nuclear particle accelerator experiments.
(For more information, circle 30 on the Readers Service Card.)

WALL STREET FIRM INSTALLS H-800

Eastman Dillon, Union Securities & Co., New York, N.Y., one of Wall Street's oldest and largest brokerage houses, has installed a large-scale Honeywell 800 electronic data processing system.

Eastman Dillon has begun integrating the H-800 into its operations by transferring data to the $1 million computer system from a punched card system. The computer will verify each trade and maintain customer-security and pending-settlement master files. During the next 24 months, the H-800 will be phased into more than 125 different output areas.

The initial system configuration includes a central processor with 4096 words of memory, six magnetic tape units, high-speed printer, a card reader and a card punch.
(For more information, circle 31 on the Readers Service Card.)

DATA PROCESSING SERVICES HANDLED BY B200 SYSTEM

Datatronic Service, Detroit, Mich., has installed a Burroughs B200 computer system to handle data processing services for clients in a 25-state area. Datatronic Service is a division of the accounting firm of Rutten, Welling & Company.

The system was installed to handle increased volume of Burroughs "Basic Record Control" plan and conventional data processing work. Punched paper tapes obtained by clients as a by-product of conventional office machine procedures are mailed to the Michigan accounting firm. Tape data is converted to punched cards for processing by the computer.

The computer system includes a B280 central processor, two card readers, card punch and 700 line-per-minute printer. It replaces a basic punched card installation.
(For more information, circle 32 on the Readers Service Card.)

MORTGAGE COMPANY INSTALLS ELECTRONIC SYSTEM TO SPEED PROCESSING

Palomar Mortgage Company, San Diego, Calif., has installed a half-million-dollar electronic system to process mortgage loan, insurance, and general accounts. Palomar, fourth largest mortgage banking firm in the nation, arranges mortgages on homes and commercial properties for nearly 100 other financial institutions. These include insurance companies, banks, savings and loan associations, and pension funds.

The new electronic system, based on an NCR 315 computer manufactured by the National Cash Register Company, Dayton, Ohio, uses three Card Random Access Memory (CRAM) units to magnetically store information pertaining to over 40,000 loan accounts. Three NCR "Class 41" machines are also used in the Palomar system.
(For more information, circle 33 on the Reader Service Card.)

AD SERVICE FIRM INSTALLS H-400

A Honeywell 400 data processing system has been installed at the headquarters of Leading National Advertisers in South Norwalk, Conn. The company, a statistical service organization for the advertising industry, will use the system to prepare PIB statistical analyses of page and dollar advertising data in magazines and the LNA-Bar network television analyses of advertising by dollars and minutes.

The LNA system includes a central processor with 2048 words of memory, four magnetic tape drives, a card reader-punch and a 900 line-per-minute printer.
(For more information, circle 34 on the Readers Service Card.)

ORGANIZATION NEWS

AFIPS PUBLIC RELATIONS CHANGE

The American Federation of Information Processing Societies (AFIPS) has centralized its Public Relations activities in the New York City area. The office of AFIPS public information director, formerly held by Phyllis Huggins in Malibu, Calif., has been discontinued. An AFIPS Public Relations Chairman, I. J. Seligsohn, has been appointed and will direct all press and public information activities.

The change is in line with a decision by the AFIPS Board of Governors to establish a headquarters office in New York City.

CHICAGO-BASED PUBLISHER TO BE AFFILIATED WITH IBM

Science Research Associates, Inc., Chicago, Ill., publisher of educational materials and psychological tests, will become affiliated with IBM Corporation. The business and operations of SRA will be carried on by a separate subsidiary of IBM under the direction of the present management and staff. Headquarters will continue to be in Chicago.

IBM will issue shares of its capital stock in exchange for the SRA business and assets. The arrangements are subject to working out the details of a formal agreement and to approval by both boards of directors and by the SRA stockholders.

RABINOW ENGINEERING ACQUIRED BY CONTROL DATA

Control Data Corporation, Minneapolis, Minn., has announced the acquisition of Rabinow Engineering Company, Inc., Washington, D.C. The agreement, subject to approval of Rabinow stockholders and final audit, covers acquisition by CDC of the business and principal assets of Rabinow Engineering Company, Inc., in return for an undisclosed amount of Control Data stock and other considerations.

Rabinow Engineering, known as a leader in the development of optical character and pattern recognition equipment, will operate as a wholly-owned subsidiary of Control Data Corporation.

OLIVETTI/FARRAND AGREEMENT

Farrand Controls, Inc., New York, N.Y., has entered into an agreement with Olivetti-Divisione Sistemi Controllo Numerico, Ivrea, Italy, to final assemble, market and service the Olivetti Numerical Contour Control system for milling and other machines in the United States. It is expected that the equipment will be available for delivery in April.

In connection with this, Farrand Controls, Inc. is setting up a Parts Program Computing Bureau in New York which will supply pro-

grams on digital magnetic tape to users of the equipment for machining parts from their drawings. The program bureau will produce the programs from drawing information supplied by the users. A 48-hour service anywhere in the United States is planned.
(For more information, circle 35 on the Readers Service Card.)

COMPUTING CENTERS

TRANSATLANTIC STOCK MARKET INFORMATION SERVICE

A new transatlantic stock market information service for European investors has gone into service at the Merrill Lynch, Pierce, Fenner and Smith offices in Geneva, Switzerland. Using a direct, on-line intercontinental computer system, the service represents the first known direct commercial computer connection between Europe and the United States.

The system, called Quotron II, was designed and produced by Scantlin Electronics, Inc., New York, N.Y. It provides split-second information on some 4000 listed and over-the-counter securities. It uses a push-button, desk top interrogator which is connected directly on-line to the Quotron Computer Center in New York via RCA transatlantic cable. A request for information in Geneva on any security listed on the New York or American Exchanges, or some 1400 securities traded over the counter, is automatically answered in seconds by the computer center.

The new Quotron service now makes it possible for Merrill Lynch customers in Geneva to obtain the same up-to-the-second financial information as Quotron users anywhere in the United States.
(For more information, circle 36 on the Readers Service Card.)

GE OPENING NEW COMPUTER CENTER

A new computer center for servicing area businesses and industries will be opened in mid-town Phoenix (Ariz.) by General Electric Company's Computer Department. Known as General Electric's Phoenix Information Processing Center (IPC), it will be located in the Central Towers building complex in a one-story, 10,000 square-foot annex connecting two 11-story high-rise office buildings.

The new IPC will supplement the one operated for the past three years at the Computer Department's Deer Valley plant. It will sell computer time and problem-solving services to such area customers as banks, utilities, educational institutions, manufacturing industries, construction firms, feed consultants and government agencies.
(For more information, circle 37 on the Readers Service Card.)

HONEYWELL EDP OPENS COMPUTER SERVICE CENTER IN AUSTRALIA

Honeywell Electronic Data Processing, Wellesley Hills, Mass., has announced the opening of a computer service center in Sydney, Australia. This is the fifth service center established outside the U.S. by Honeywell's EDP division in the past two years.

It is equipped with a Honeywell 400 system, which will be used to provide customer service, programming assistance, personnel training and marketing support for Honeywell's customers and sales organization in Australia.

Since Honeywell EDP entered the international markets in 1961, it has established sales offices and computer service centers in Toronto and Ottawa, Ontario; London, England; and, through a licensing agreement with Nippon Electric Company, in Tokyo, Japan, in addition to the Australian center.

EDUCATION NEWS

WHARTON SCHOOL USES COMPUTER

A small-scale analog computer has been made available to the University of Pennsylvania's Management Science Center by Computer Systems, Inc., Fort Washington, Pa. The computer will be used for research and instruction at the University's Wharton School of Finance and Commerce.

The small size computer is suitable for classroom demonstrations, and for investigating problems or subsystems, using the same methods as larger machines. Research objectives are toward the development of new business applications such as industrial system simulation, market simulation, linear and non-linear programming.

Wharton School anticipates installing a larger, hybrid computer this year, for the solution of problems of greater complexity. The Center and Computer Systems are interested in a basic study in the non-engineering applications of both analog and hybrid computers.
(For more information, circle 38 on the Readers Service Card.)

COMPUTER TO BE INTEGRAL PART OF EDUCATIONAL PROGRAM

Since the installation of its computer center was completed this fall, Pennsylvania Military College, Chester, Pa., is making the electronic computer an integral part of its educational program.

Instruction in using the computer and related equipment is now required for all engineering students. Some 200 are enrolled in a series of courses for each class within the division. It is expected that the science and business administration students will also be taking courses in computer programming by the spring semester.

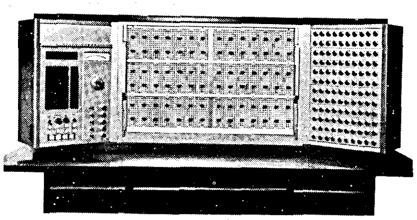
The director of each academic division within the college has been asked to work out ways in which the center can be incorporated into the division's teaching and research projects. By the beginning of the 64-65 academic year every division in the college will be making use of the computer center.

Equipment includes an IBM 1620 computer, a 1622 card input-and-output unit, two IBM 026 key punch machines, an IBM 548 interpreter, an IBM 407 accounting machine, an IBM 514 reproducing punch machine, a card-sorting machine, and a library of pre-processed data on punch cards for use in the solution of problems using basic tables and other standard information.
(For more information, circle 39 on the Readers Service Card.)

Analog

SOLID STATE ±100 VOLT ANALOG COMPUTER

The Donner Division of Systron-Donner Corporation, Concord, Calif., has developed a general purpose analog computer, known as the S-D 40/80 Series.



— S-D 80 Computer

The new computer is unlike other analog computers in several respects. Some of the design elements which distinguish it from other analog computers are: (1) it is completely transistorized; (2) a ±100 volt computing range; (3) compactness — only one-third the size of comparable vacuum tube computers; and (4) low cost.

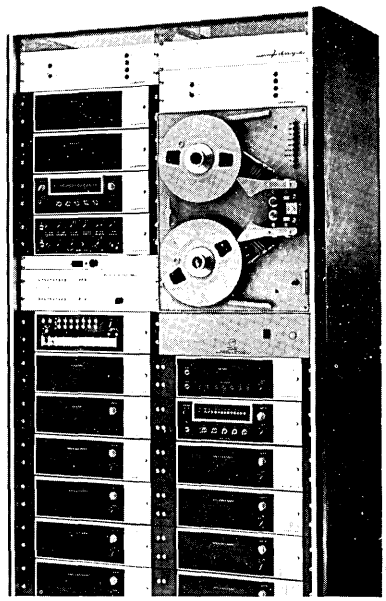
The basic design of the S-D 40/80 consists of a removable Problem Board that couples directly into the modular computing units, each housed in prewired slots. All controls and potentiometers are mounted into hinged wings for operator convenience. Its compact size, permits an operator seated in front of the computer to reach and observe every control, readout and patching element. Even in its fully expanded version of 84 amplifiers, the computer still retains its space-saving advantage as a desk top unit. The computer is available in two basic 40 or 80 amplifier configurations.
(For more information, circle 40 on the Readers Service Card.)

NEW PRODUCTS

Data Transmitters and A/D Converters

ADAGE 770 HYBRID COMPUTER LINKAGE SYSTEM

Adage, Inc., Cambridge, Mass., has announced the availability of its ADAGE 770 hybrid computer linkage system. This is a modular, expandable system, and has a wide selection of standard options. The 770 provides all the conversion



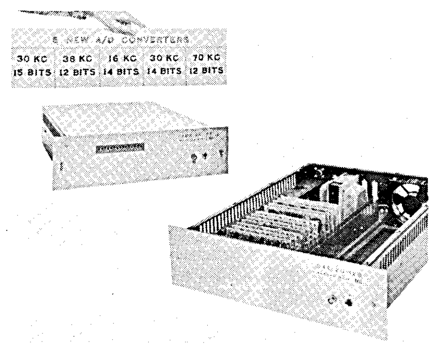
and control hardware necessary to link a digital computer and an analog computer to form a complete, fully integrated hybrid computing system.
(For more information, circle 41 on the Readers Service Card.)

PACKARD BELL COMPUTER OFFERS FIVE NEW A/D CONVERTERS AND TWO D/A CONVERTERS

An expanded line of analog-to-digital converters is now available from Packard Bell Computer, Santa Ana, Calif. Bit conversion speeds range from 1.2μsec to 4μsec, word lengths from 10 to 17 bits and accuracy to 0.01%. Designations of the five new converters are ADC20, ADC21, ADC22, ADC23, and ADC24.

All standard models offer synchronous or asynchronous and unipolar or bipolar operation. They also have precision temperature control of Zener diode (to 0.1°C) for voltage reference stability and isolation of digital output during digitizing by automatic delay of system clock.

Converter applications include data acquisition and recording systems, automatic checkout systems, digital systems for control of continuous processes, and seismic, biophysical, and nuclear data systems.



—Shown above are (left) a ADC20 15-bit 30KC analog-to-digital converter and (right) a DAC20 12-bit digital-to-analog converter.

Details on two new digital-to-analog converters, the DAC20 and the DAC22, have also been released by Packard Bell. The DAC20 is a 10, 12, or 14-bit unipolar or bipolar unit with accuracy of 0.01%; output voltage is ±10 volts. The DAC22 is an 8-bit converter with accuracy of ±0.5%; it has an output of 0 to +5 volts or 0 to -5 volts. Applications for the digital-to-analog converters include: (1) driving visual indicators such as scopes, x-y plotters; (2) outputting for control of variables; and (3) generation of stimuli sources for missile checkout.
(For more information, circle 42 on the Readers Service Card.)

SYSTEM HANDLES ANALOG SIGNAL IN DIGITAL MANNER

Telemetrics Model 640 decommutation system, developed by Telemetrics Inc., Gardena, Calif., provides direct input to digital computers and recorders. The 640 system accepts either PAM or PDM signals, regenerates input, and converts the data to a 10-bit parallel word. It compensates for baseline drift and corrects for zero and full-scale variations.

In addition to an output of 10 parallel binary bits plus parity, the base 640 system generates up to 50 channels of analog signals for strip chart and oscillograph recordings, and is expandable to power, display and calibrate up to 50 digital-to-analog converters. The Calibrator unit accepts as inputs 8 data lines and 50 DAC enable lines. Analog polarity output is switch selectable, as is a choice of two output modes: the Operating Mode — selected real time data is displayed on the digital-data-display lamps; and the Calibrate Mode — the calibration data is displayed and provided as inputs to all the DAC's.
(For more information, circle 43 on the Readers Service Card.)

300 PER SECOND A/D CONVERTER

The new Models 1234 and 1234A analog to digital converters, developed by Systron-Donner Corporation, Concord, Calif., use a combination of circuit techniques to achieve a sampling speed much faster than conventional digital voltmeters — but at a price well below available high-speed A/D converters. Instantaneous response and 2 millisec conversion make the device unusually good for measuring pulse amplitudes, rapidly changing inputs and step inputs as encountered in multichannel sampling systems.

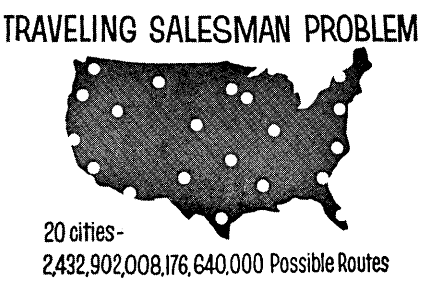
With an input of ±10 volts full scale, the Model 1234 samples at 300 per second to ±0.05% and the Model 1234A at 30 per second to ±0.01%. The series 1234, designed specifically for system use, offers fast response, in-line readout, stored BCD output, and complete synchronization with external programmers. A dual output provides one output changing with each sample and a second output with readout which stores only on command.
(For more information, circle 44 on the Readers Service Card.)

Software

COMPUTER PROGRAM FOR COMPLEX SCHEDULING TASKS

IBM Corporation, White Plains, N.Y., has announced a new computer program for handling a wide variety of complex business and industrial scheduling tasks. Known as the "Traveling Salesman Program", it is named for a type of mathematical problem which has long defied precise solution by man — or by the fastest computers he uses. Such a problem, stated in deceptively simple terms is as follows: A salesman wants to visit a certain number of cities, stopping once in each city, then return to the city where he began. Which route will involve the shortest distance? Which will require the least amount of travel time?

For a problem with 15 cities, there are 1.3 trillion different routes that could be followed — for 20 cities, there are 2.4 quintillion possible routes. It would take 38,000 years of round-the-clock computation to evaluate all the possibilities for a 20-city problem, even with a computer able to evaluate each route in a millionth of a second.



Through the efforts of IBM mathematicians Michael Held, Richard M. Karp and Richard Shareshian, a systematic procedure has resulted, based on a new technique known as dynamic programming, that can be used to efficiently solve Traveling Salesman problems. Problems of as many as 13 cities are solved directly and exactly by the dynamic programming procedure by considering combinations rather than permutations. Problems of more than 13 cities are broken down into a succession of 13-city subproblems that are solved by the dynamic programming procedure. By this means, successive improvements are obtained, finally yielding optimal or near optimal solutions.

The value of the new computer program is the fact that a Traveling Salesman problem may be present in any of a variety of situations involving the need to choose the best sequence for the performance of a number of steps in a given task. The "cities" may be any type of location or event and the "distance" to be minimized may be measured in dollars or hours. Actual travel need not be involved.

The program, a set of 4500 instructions, can provide cost-saving answers for such business and industrial problems as: (1) routing communication cable, piping or electrical wiring; (2) determining the order of various types of production operations; or (3) scheduling the printing of regional editions of a national publication. The new program is available at no charge to users of the IBM 7090 or 7094 computers.
(For more information, circle 45 on the Readers Service Card.)

Input-Output

KIMBALL HIGH SPEED READER

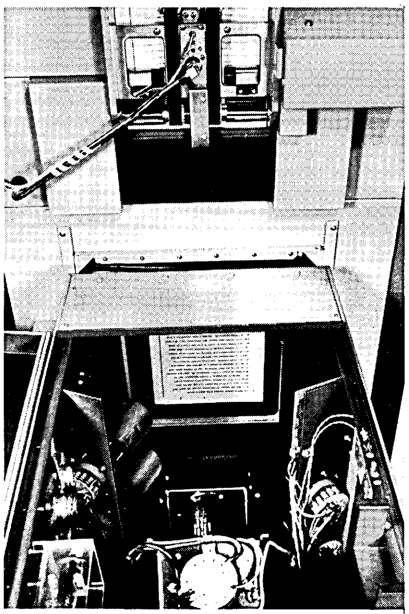
An on-line punched tag reader, for retail data processing, has been announced by the Business Machines Group, Litton Industries, Orange, N.J. The electronic device feeds information from merchandise tags directly into computer systems. Franc M. Ricciardi, President of the A. Kimball Company, a division of the Litton Group, explained that in all other tag processing systems, punched tags must be converted into punched cards before the data can enter the computer.

The Kimball High Speed Reader (shown above) is a solid state

machine which can read data photo-electrically into a computer at the rate of 1200 tags a minute. It can be programmed to sort out selected tags and reject tags with code errors. The machine eliminates all punched card processing and handling, and related machine costs. It is compatible with all existing computers and computer codes.
(For more information, circle 46 on the Readers Service Card.)

GENERAL PURPOSE PRINT READER

Philco Corporation, Philadelphia, Pa., has developed a General Purpose Print Reader system that will read typed or printed pages without the use of stylized or magnetic ink letters or numbers.



— Shown above is the paper transport and reading head. It is at this point the print reader system begins reading typed or printed pages.

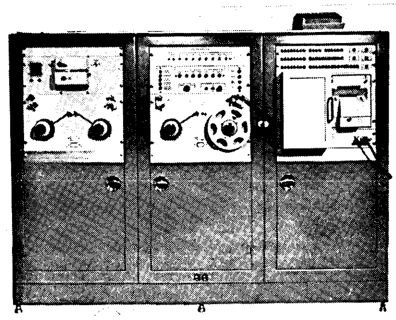
The system transports the documents, reads the documents, converts the printed words to machine language, and writes the information onto magnetic tapes, paper tapes or punched cards.

The system uses a cathode ray tube to scan typed or printed documents. The print reader then processes its signal information through the system, which converts the scanned information into machine language.

Instructions for programming of the reader are done by "Auto-Load", a system developed by Philco. The "Auto-Load" is a pre-printed sheet containing coded instructions which are recognized by the print reader, and automatically inserted into the internal memory. This system eliminates the need for plugboards and connecting leads.
(For more information, circle 47 on the Readers Service Card.)

TAPE PREPARATION UNIT

A special-purpose Tape Preparation Unit (TPU) has been developed by Link Division-Simulation & Control Group, General Precision, Inc., Binghamton, N.Y. The TPU consists of a tape reader, electric keyboard, electronic translating equipment, teletype punch, printer, and two tape handlers.



The TPU permits a simple and relatively rapid standard loading procedure. Introduction of minor modifications to a program may be accomplished without extensive control manipulation or excessive amounts of time for individual changes. Keypunching or typing of a program can be performed by non-technical personnel. The TPU can provide punched tape and/or hard copy printout from the electric keyboard and from the tape reader. Punched tape can be provided from an optional card reader. The potential exists to printout during various modes of the computer operation, through use of the electronic translating equipment.

The TPU, although designed for Link's Mark I computer, can be modified to function with other computers having different modes of operation.
(For more information, circle 48 on the Readers Service Card.)

Components

SELF-HEALING ELECTRONICS

Honeywell's Aeronautical Division, Boston, Mass., is developing electronic circuits that automatically repair themselves. Its ultimate aim is circuitry that will electronically care for itself somewhat as the human body heals cuts, bruises and even breaks.

Two approaches to self-healing electronics show promise for use in future aircraft and space systems. Both are said to be adaptable to current technology.

The first involves spontaneous growth by the conductor itself of metallic whiskers across circuit breaks. For this technique, circuits are constructed of special alloys which tend to "extrude" tiny metallic tendrils at breaks in the conductors. The tendrils, or whiskers, grow until the circuit is restored. This spontaneous generation of whiskers will occur several times at the same place if breaks are re-opened, but the process presently requires several days to bridge only hairline breaks, Honeywell reported.

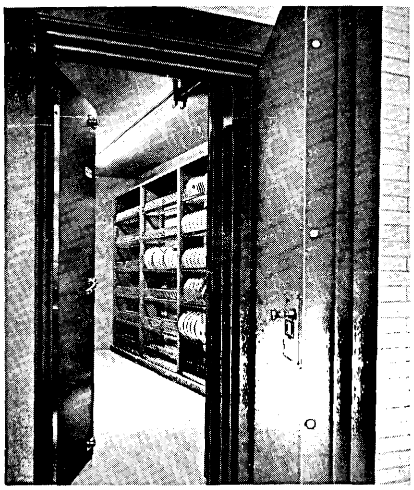
The second approach uses a special remeltable alloy coating over electronic conductors. In comparison to the whisker growth technique, remeltable alloys act almost before a failure occurs. Heat is generated by nearly failing connections as circuit resistance increases at the point of failure. The near-break of a conductor acts like the hot filament of a light bulb and melts the alloy where needed.

The work is being conducted under the sponsorhip of the Air Force's Rome Air Development Center, Griffiss Air Force Base, New York. Investigations into self-healing electronics were performed under a one-year feasibility study contract. Advanced studies of the whisker growth and remeltable alloy techniques as well as semiconductor self-repair approaches, during a second year program, are now under way.

BUILT-IN DATA-VAULT

A permanent type vault installation has been developed by Data-American Equipment Co., Chicago, Ill. It consists of a hermetically-sealed inner repository of welded steel construction, surrounded by a layer of air to minimize heat transfer from the outer masonry walls to the insulated walls of the inner repository.

A special inner door fits over a pressure seal within the door frame by means of high compression hardware and hinges. Once closed, no steam, water or moisture can penetrate the protected area. The massive outer vault door, approved by Underwriters' Laboratories, Inc., can be furnished for either four or six hours protection.



Although the vault is custom engineered and constructed to meet specific requirements of any size data processing operation, the average installation to date is approximately twelve feet wide and eighteen feet long in the inner repository. This size accommodates at least three rows of racks for safely storing over 2500 large reels of computer tape. (For more information, circle 49 on the Readers Service Card.)

DISK STORAGE COUPLER

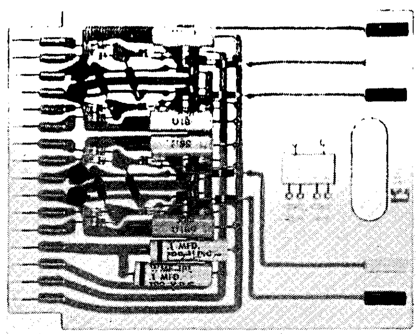
Scientific Data Systems, Santa Monica, Calif., has added to its peripheral equipment line, a coupling unit for IBM 1311, Model 2, Disk Storage Drives. The coupler is capable of controlling up to five disk drives (each with its own 2,000,000 character disk pack) to provide a total of 10,000,000 characters of random access storage.

Scan Disk Instruction and a Track Record Mode are standard with the SDS coupler. The scan disk mode permits the rapid search of a disk pack for a specific code or condition; the track record mode makes it possible to write one record, consisting of a 5-position address and 2980 positions of data, in place of 20 sectors of track.

Format recording allows disk packs used with SDS computers to be interchanged between other IBM 1311 disk drives used with IBM 1401, 1410, 1440, and 1460.
(For more information, circle 50 on the Readers Service Card.)

FLIP FLOP DIGITAL LOGIC CIRCUIT

Rese Engineering, Inc., Philadelphia, Pa., has developed a new type 2016 FF FLIP FLOP digital logic circuit. The 2016 FF plug-in package is a 25 MC transistor flip flop. There are two independent flip-flop circuits per card, each containing 2 set and 2 clear diode inputs. ONE and ZERO outputs of both flip-flops are brought out to test points on the front of the card. Ground is also brought out to a test point.



The 2016 FF consists of two 3-input cross-coupled NAND gates, each gate supplying one cross-coupling diode and two diode inputs. The flip-flop is triggered by applying a positive going pulse or level which is at least 10 nanoseconds wide. The flip-flop may be set and cleared at a 25 megacycle rate.
(For more information, circle 51 on the Readers Service Card.)

MT-75 TAPE TRANSPORT

A new tape transport, the MT-75, has been developed by Potter Instrument Company, Inc., Plainview, N.Y., with design features which simplify overall operation, improve reliability and lower service costs.

The device has fewer moving parts. Tension arms have been replaced by a dual under-and-over vacuum column tape storage system. Ample storage in the vacuum reservoirs provide restriction-free reading and writing. Secondary buffers integrally designed into the vacuum columns permit fast velocity stabilization. Vacuum tape cleaning and vacuum tape drag before the read/write head assure high operating reliability. Other design innovations include photo-electric loop sensing, vacuum hold-down of tape, precision-shaped vacuum trough guides, safety interlocks, 15-second tape loading, and muffled vacuum blower.

The MT-75 operates at standard tape speeds of 60 and 75 ips, with a two and one-half minute rewind. Data transfer rates are to 60 kc (bcd). Start time is 3 ms from receipt of command to within ±10% of tape speed. Stop time is 1.5 ms.
(For more information, circle 52 on the Readers Service Card.)

SAFE-FILE UNIT FOR MYLAR TAPE PROTECTION

Remington Rand Office Systems, (a Division of Sperry Rand Corp.), New York, N.Y., has introduced the Citadel SAFE-File Premier Insulated Cabinet for the protection of Mylar magnetic tape housed in its original plastic container. The three drawer cabinet has a capacity of 78 reels; extra heavy-duty overtravel roller suspension; and either key or combination lock.

An exclusive container inside each drawer forms a tight seal when the drawer is closed. In tests the seal was found to be so tight that at the end of a one-hour fire test (with a complete sweat-out period that extended the complete testing time to 5½ hours) the tapes were removed in perfect condition.

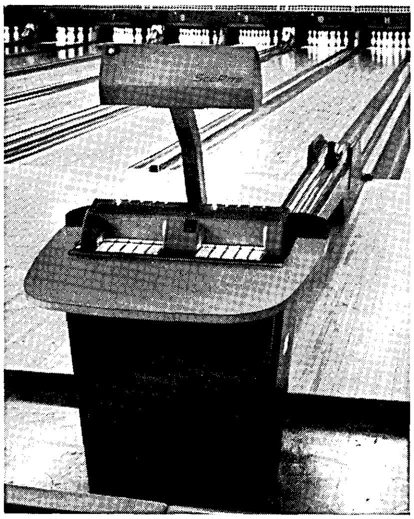
The new fire-resistant unit is styled according to the original line of Citadel SAFE-FILE units.
(For more information, circle 53 on the Readers Service Card.)

AUTOMATION

SCORITE

ScoRite, a fully automatic bowling score keeper, has been developed by Doban Labs Incorporated, Sunnyvale, Calif. The new device has been successfully tested in numerous Bay Area bowling centers.

ScoRite is, in fact, a high-speed, transistorized miniature computer, activated by a photo-electric pin sensor. Operation is independent of the pin setter and it may be installed in any lane regardless of the type of equipment currently in use. The device automatically prints a scoresheet for each team with frame by frame and game totals. Each ScoRite unit accommodates two lanes. In appearance, it is comparable to the manual score keeping "desks" now used in many centers.



ScoRite -- automatic, electronic bowling score keeper.

All the functions of a human score keeper are performed without errors of perception or mistakes in calculation. The rolling of "extra" balls is prevented, and league play is speeded up by eliminating score keeping disputes or delays.

Donald D. Miller, President of Doban Labs Incorporated, reported that initial distribution of ScoRite will be concentrated in the Bay Area and by the end of six months should be extended throughout California. National distribution will be undertaken within a year.
(For more information, circle 54 on the Readers Service Card.)

PEOPLE OF NOTE

M. O. KAPPLER JOINS CSC

The appointment of M. O. Kappler as Vice President of Computer Sciences Corporation has recently been announced. Mr. Kappler, a prominent executive in the field of information processing, was formerly President of System Development Corporation. He also is the author of various technical papers and articles including "The Opportunity for Innovation in Management Controls" published in the book, Management Control Systems (John Wiley & Sons, 1960).

At CSC, Mr. Kappler will have general administrative and executive responsibilities in the information sciences. Fields of special interest will include military systems analysis and design, systems programming for command and control, information storage and retrieval applications, and system simulation.

RR MANAGEMENT CONSULTANT APPOINTED BY GE

A. L. Davis was recently appointed as railroad management consultant, a newly-established position, for General Electric's Computer Department, Phoenix, Ariz. Mr. Davis was previously assigned to railroad systems studies for the Department and has more than 30 years' background of railroad operation and management work.

In his new assignment, Mr. Davis will assist railroads in applying latest electronic data-processing technologies to operating and management problems. His work will include advising on the application of General Electric total-information computer systems and data-communication equipment for planning, scheduling, controlling, monitoring and accounting for all functions of a railroad system.

ORENSTEIN ELECTED DDI PRESIDENT

Edward D. Orenstein, former vice-president of Data Display, Incorporated (DDI), St. Paul, Minn., has been elected president of the corporation by the directors. Mr. Orenstein was one of the four original incorporators of DDI in 1959, when the corporation was formed to develop and produce visual display units. Since its formation, he has been vice-president and treasurer of the corporation and director of the advanced engineering department.

DR. BECKMAN ELECTED CHAIRMAN OF THE BOARD OF TRUSTEES OF CALTECH

Dr. Arnold O. Beckman, businessman, scientist, and educator, has been elected chairman of the board of trustees of the California Institute of Technology. Dr. Beckman succeeds the late Robert L. Minckler.

Dr. Beckman is president of Beckman Instruments, Inc., which he founded in 1935. He has been a Caltech trustee since 1953.

NEW LITERATURE

MAGNETIC TAPE RECORDING

Memorex Corporation, Santa Clara, Calif., has inaugurated a series of informative problem-solving technical literature for distribution to persons interested in precision magnetic tape recording — instrumentation or computer.

Memorex Monograph #1, "GLOSSARY OF TERMS USED IN MAGNETIC TAPE RECORDING," is the first in the series. Memorex Monograph #2 is titled "CONSIDERATIONS OF HEAD WEAR IN MAGNETIC RECORDING." Other Monographs in the series are being prepared and will deal with a wide range of technical subjects related to magnetic tape use.
(For more information, circle 55 on the Readers Service Card.)

PAPER TAPE READER

Ohr-Tronics, Inc., New York, N.Y. is offering an 8 page bulletin describing the Model 119 paper tape reader. The bulletin includes isometric drawing, photograph, electrical schematic, dimensions drawing, general description and technical specifications.
(For more information, circle 56 on the Readers Service Card.)

BROCHURE OFFERED BY GE

A brochure, released by GE's Computer Department, describes the services of Chicago's Beverly Bank, which began its GE-225 operations 14 months ago. "'Integrated' Banking with the GE-225 at the Beverly Family of Banks" (CPB-340P) may be obtained upon request.
(For more information, circle 57 on the Readers Service Card.)

BOOKS AND OTHER PUBLICATIONS

Moses M. Berlin
Allston, Mass.

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.**

Fox, L. / Numerical Solution of Ordinary and Partial Differential Equations / Addison-Wesley Publishing Co., Inc., Reading, Mass. / 1962, printed in Great Britain, 509 pp, $10.00

This book is based on material presented at a summer school for representatives of industry, government, universities, and technical schools, held at the University Computing Lab., Oxford, England, September, 1961. It is an advanced-level text which presents theoretical and practical material needed for the numerical solution of all types of problems involving ordinary differential equations, partial differential equations, and integral equations. Included also are details of the solution of practical problems in partial differential equations—those involving nuclear reactors, one-dimensional unsteady flow, the linear transport equation, plasma physics, numerical weather forecasting, application of Monte-Carlo methods, and others. The book is divided into four parts as follows: "Ordinary Differential Equations," "Integral Equations," "Introduction to Partial Differential Equations," and "Practical Problems in Partial Differential Equations." This last part uses and develops the techniques described earlier for the treatment of problems of the greatest complexity. References and index.

Galler, Bernard A. / The Language of Computers / McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. / 1962, printed, 244 pp, $8.95

This book was written for the person who is interested in learning how problems are solved on electronic computers. The author has a twofold goal: he is interested in the discovery of "algorithms," or methods of solution of problems; and he is interested in the way a language is designed for the communication of algorithms to computers. Twelve chapters include: "The Change Problem," "The Secret Code Problem," "Monte Carlo Methods," "A Program to Produce Programs," and "Simultaneous Linear Equations." Three appendices include: "Summary of the Rules of the Language," "Translation to Fortran," and "Translation to Algol." Index.

Rosine, Lawrence L., editor, and 28 contributors / Advances in Electronic Circuit Packaging, Volume 3 / Plenum Press, Inc., 227 West 17th St., New York 11, N. Y. / 1963, printed, 457 pp, $16.50

This book constitutes the proceedings of the Third International Circuit Packaging Symposium, held at Boulder, Colorado, August 15-17, 1962. At this conference, 27 papers were presented, some on computer-oriented directions such as "Packaging for Maintainability of an Airborne Computer: A Case History," by Louis R. Critelli, and "High Frequency Analog Circuitry," by Stephen Slenker. No index.

Greiner, R. A. / Semiconductor Devices and Applications / McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. / 1961, printed, 493 pp, $12.50

This text, directed to the senior student or first-year graduate student, emphasizes the fact that an engineer must have a deeper understanding of the operation of electron devices than just the ability to use specific devices in circuits. The book includes a discussion of the origin of the characteristics of the devices as well as applications of these characteristics in electronic circuits, thus linking the physical structure and the circuit. An introductory section on the physical principles underlying the operating characteristics of semiconductors is followed by chapters on the most widely used semiconductors. Chapter 9, "Transistors, the Basic Mechanism," considers the simple triode transistor. Chapter 11, "Biasing and Stabilization," presents a detailed treatment of temperature stabilization of transistor circuits. Also included among the twenty chapters in the book are: "Small-signal Amplifiers," "Power Amplifiers," "Power Supplies," and "Sinusoidal Oscillators." Six appendices include: "Units and Special Functions," and "Parameter Interrelationships." References, problems and index.

Haas, Gerhard / Design and Operation of Digital Computers / Howard W. Sams & Co., Inc., Indianapolis 6, Indiana / 1963, photooffset, 272 pp, $6.95

Dr. Haas has attempted to explain in a practical manner how digital computer circuits may be designed. He has directed his text not so much towards the expert as to the beginner in the field. He describes basic principles behind computer circuitry, then clarifies related mathematical fundamentals. He describes many of the important physical components for digital computers and expounds a number of examples of practical circuits. This is a translation from the original German work published in 1962. Circuitry and principles are amply illustrated. Index. Bibliography.

Goodman, Richard, editor, and 18 authors / Annual Review in Automatic Programming / A Pergamon Press Book / The MacMillan Co., 60 Fifth Ave., New York 11, N. Y. / 1963, printed, 360 pp, $12.00

This is the third volume in a series published annually for the Automatic Programming Information Center, Brighton College of Technology, England. It contains twelve papers concerned with "the problems of languages for scientific computations," discussing such languages as JOVIAL, SEAL, ALGOL 60. The text assumes the reader to have a previous knowledge of programming. Included are the titles of papers which have appeared in Volumes 1 and 2 of this series, and also excellent reference lists which will be of value to persons interested in automatic programming.

Bellman, Richard, editor, and 17 contributors / Mathematical Optimization Techniques / University of Calif. Press, Berkeley 4, Calif. / 1963, printed, 346 pp, $8.50

The papers collected in this work were presented at the Symposium on Mathematical Optimization Techniques held in Santa Monica, Calif., Oct. 18-20, 1960. The book is divided into four parts. Part I, "Aircraft, Rockets, and Guidance," applies classical calculus of variations and modern dynamic programming techniques to computational problems for aircrafts and rockets. Part II, "Communication, Prediction, and Decision," is concerned with problems of information processing, communication, prediction, and decision processes. Part III, "Programming, Combinatorics, and Design" deals with linear and nonlinear (convex) programming, game theory, and some aspects of combinatorial mathematics. Part IV, "Models, Automation, and Control," summarizes the present status of automation and control studies in the U.S. and the U.S.S.R. Among the specific articles are "Simplex Method and Theory," and "Optimization in Structural Design." Index.

ADVERTISING INDEX

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