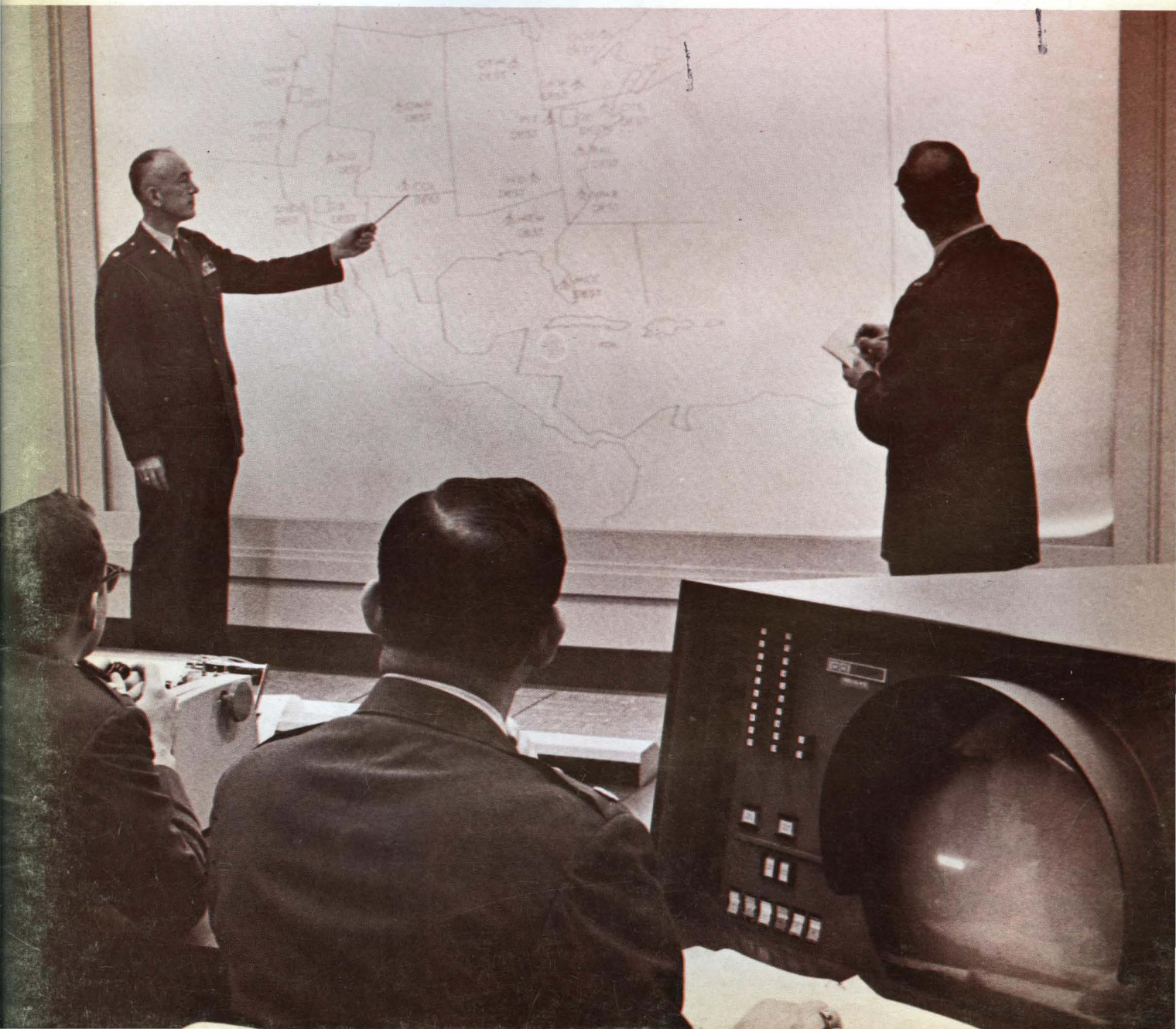
April, 1964

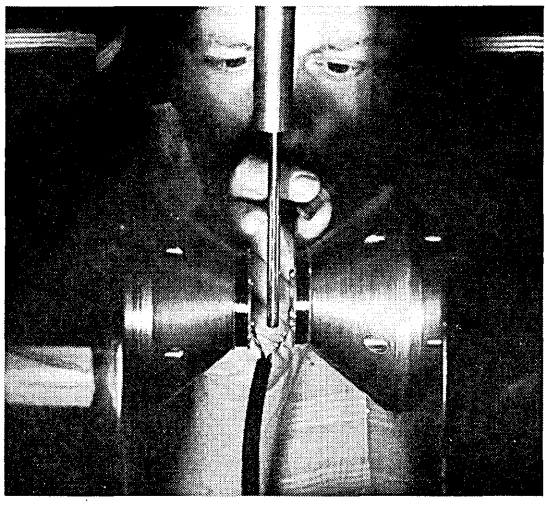
computers and automation

Automating the Information for Military Command



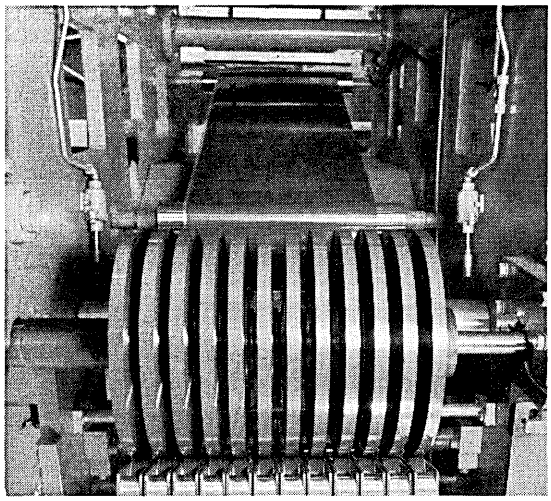
4 WAYS TO IMPROVE COMPUTER TAPE

(And how Memorex did it!)



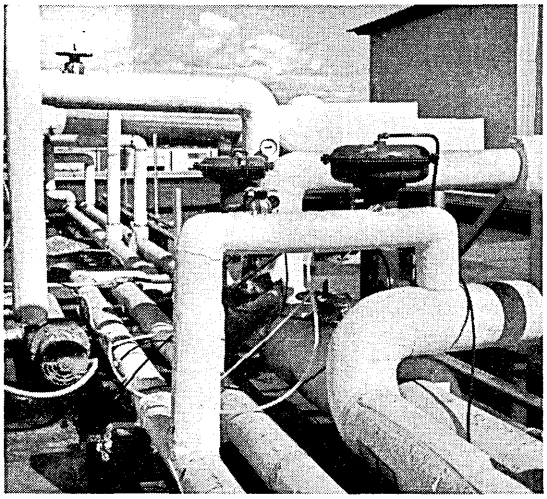
Exercise greater quality control.

The Memorex-designed Vibrating-Sample Magnetometer (VSM) tests basic characteristics of oxide raw material and precise concentration of oxide particles in the tape coating. Extra tests of this kind guarantee the improved performance and reel-to-reel uniformity of Memorex computer tape.



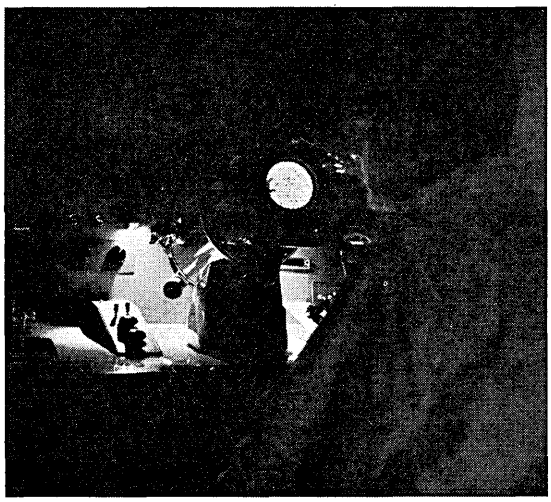
Employ advanced production techniques.

Specially constructed equipment — used to slit Memorex computer tape from jumbo rolls — produces tape with clean, straight edges free from ripples and ridges. A new slitting technique is but one of seventeen manufacturing improvements made to insure superior performance of Memorex tape.



Use a superior production facility.

A conspicuous aspect of the Memorex plant is the complex system of air filtration, humidification, dehumidification, heating and cooling. The unusual high-purity system, equal to that used in pharmaceutical processing, provides a contaminant-free environment — prerequisite to production of improved error-free tape.



Apply research in depth.

Research in oxide, coating materials, and tape-making processes has equipped Memorex with a fund of new technology. Combined with manufacturing competence, this fundamental knowledge is manifest in Memorex computer tape by freedom from dropouts, longer life, and improved uniformity and reliability of performance.

Memorex tape is premium tape. No need to pre-check it. You can place Memorex computer tape directly in service — reel after reel.

Memorex certification means what it says: Memorex computer tape is error-free. Extra care, extra steps and scrupulous attention to every detail make it that way. We know the importance to you of having a tape you can depend on.

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PRECISION MAGNETIC TAPE

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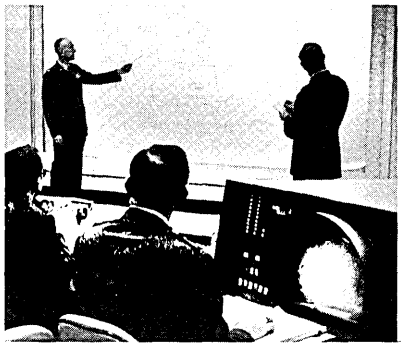

Our front cover shows a command post orientation being given on a computer-generated battle map at the new System Design Laboratory of the Air Force's Electronic Systems Division at Hanscom Field, Mass. For more details, see story on page 44.

computers and automation

APRIL, 1964 Vol. XIII, No. 4

computers and data processors: the design, applications, and implications of information processing systems.

In This Issue

In Every Issue

COMPUTERS AND AUTOMATION IS PUBLISHED MONTHLY AT 815 WASHINGTON ST., NEWTONVILLE 60, MASS., BY BERKELEY ENTERPRISES, INC. PRINTED IN U.S.A. SUBSCRIPTION RATES: UNITED STATES, $15.00 FOR 1 YEAR, $29.00 FOR 2 YEARS, INCLUDING THE JUNE DIRECTORY ISSUE; CANADA, ADD 50c A YEAR FOR POSTAGE; FOREIGN, ADD $1.50 A YEAR FOR POSTAGE. ADDRESS ALL EDITORIAL AND SUBSCRIPTION MAIL TO BERKELEY ENTERPRISES, INC., 815 WASHINGTON ST., NEWTONVILLE, MASS., 02160. SECOND CLASS POSTAGE PAID AT BOSTON, MASS.

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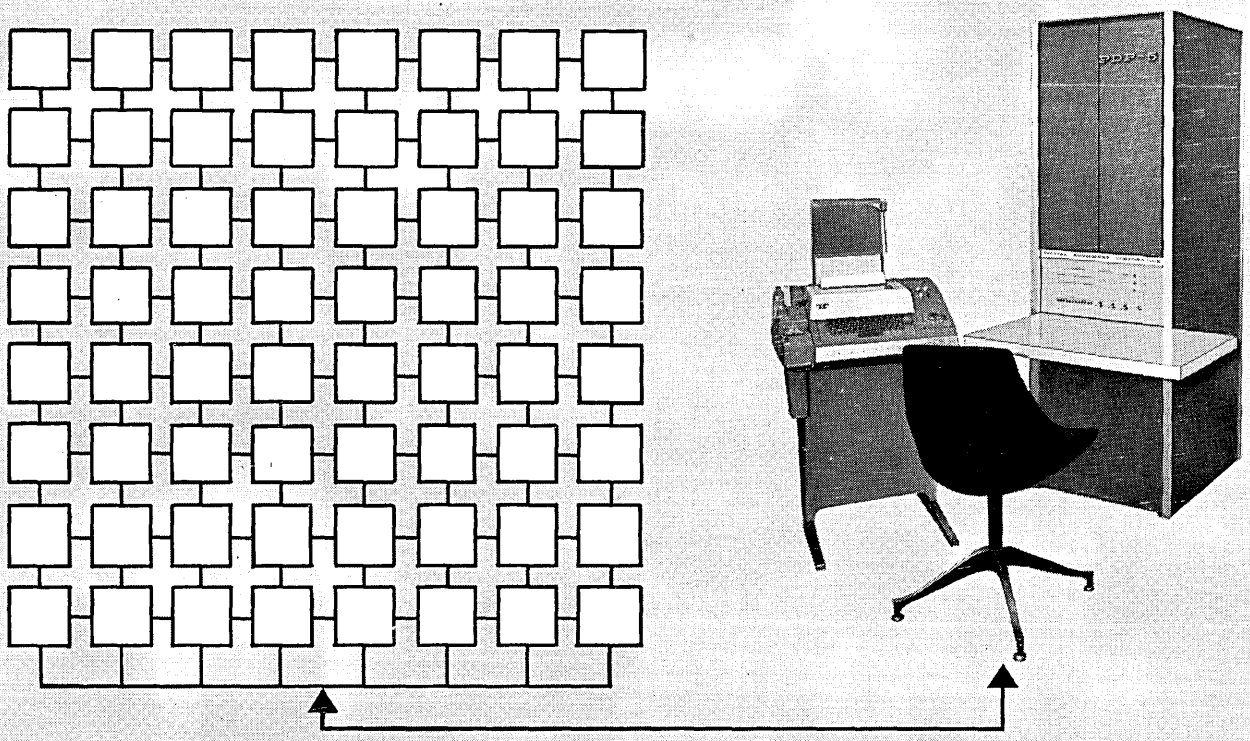
PDP-5



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- 55,555 additions-per-second computation rate
- 2-megacycle bit input via built-in data channel
- 24-bit arithmetic
- 1024- or 4096-word, random access, magnetic core memory
- Analog-to-digital converter wired into basic machine (converter modules optional at slight additional cost)
- Software package includes FORTRAN, assembler, double-precision, floating point, and maintenance routines

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Computers and Skills

"New Tool, New World" is the title of a "Special Report" on computers in "Business Week" for February 29, 1964, pp. 70-90, published by McGraw-Hill, Inc., New York, N.Y. This report contains much interesting information and some important ideas:

> "As more and more human abilities are transferred to the computer through . . . programming, and thereby become part of a new kind of library of skills, . . . the effect may be equal in kind to the change that occurred when written language appeared.
>
> "Writing freed mankind from total dependence on memory and permitted the accumulation and selection of effective knowledge. The computer program in turn accumulates and preserves skills. There are enormous implications in this for business, education, training, and future employment. There is not much point in having someone spend a great deal of time in mastering the kind of skill that a computer can learn in a few seconds by having a program fed into it."

It is a striking statement: "the computer program accumulates and preserves skills." — And there are many situations in which this statement applies correctly. The way in which 1000 stock items should be manufactured by 15 plants and stored in 26 warehouses under various conditions such as sale prices, production costs, etc., can be figured out once and for all and stored in a computer program. The way to design and machine 700 different engine turbine blades can be figured out and stored in a computer program. Production formulas, such as the precise way to make a Stradivarius violin, or the Roman cement that lasts 2000 years, will no longer be lost. Such formulas can be stored in computer programs, which placed on appropriate equipment will again produce the identical product.

We need to point out however some limitations affecting the accumulation and preservation of skills by computer programs, and the matter of human beings mastering skills that are being programmed on computers.

First, the skills that are needed by society change. Accordingly, many of the programs that preserve the skills of 1960 may not be too useful by the year 1970. This implies the alteration of computer programs recording skills. Although one can conceive of programming computers to alter their own programs, there seems to be in the real world a race between the complexity of programs and the capacity of human beings to understand and alter the programs when needed. Often the departure of an experienced programmer who understands the program which he has created and put into a computer, leaves the organization almost unable to change the program intelligently. The documentation of the program is often insufficient to understand the detailed relations between the parts of the program and the parts of the skill. In fact it seems to be a theorem: a really good programmer can think so fast that he hates to write, and so he resists to the utmost writing an adequate explanation of what he has programmed on the computer. The computer field may be encountering here a serious and lasting obstacle to the progress of computer programming — the increasing inability of people other than the high priests to understand the sacred writing in all its varieties.

Second, if a human skill involves perception of a complex environment and responding to it appropriately with a wide variety of actions, it is likely to be many years and perhaps many decades before the computerized machine can take over. For example, take the work of a good motor car repairman. He listens to the symptoms reported by his customer; he listens to the sounds of the engine and the car; he makes some tests, decides what is needed, looks up the part numbers in a big catalogue like a telephone book, orders them by phone, sends one of his helpers to fetch them from the local supplier, removes the old parts, installs the new parts, and finally checks the car to be sure it is once more operating correctly. The human skill of a motor car repairman is likely to endure for years and years in competition with the computerized machine.

Finally, there is the divergence between the way in which you program a computer to use skill, and the way in which you program a human being to use skill. The computer is an "idiot monster": if you substitute one hyphen for one space in a computer program 5000 instructions long, your satellite may miss its rendezvous completely. The computer may have high intellectual capacity but it often seems to have no common sense. If you try to tell a computer "This is about the way in which you should do such and such — now use your judgment," the computer nearly always replies by its actions that it has no judgment whatever.

Not all the accumulation and preservation of skills can be accomplished by the computer program. A great many skills will be left for human beings to learn, master, apply, and teach to computers.

Edmund C. Berkeley
EDITOR

1964 FALL JOINT COMPUTER CONFERENCE — CALL FOR PAPERS

The technical program committee for the 1964 Fall Joint Computer Conference has issued a call for papers to be considered for presentation October 27-29 at the San Francisco Civic Center.

The scope of the program is planned to be the entire information processing field. There is special interest in: Analog and hybrid computers, artificial intelligence, business data processing, components and circuits, display, education and computers, information storage and retrieval, input-output devices, logical design, mathematical techniques, multiprocessors, process control, programming, standards for hardware or software, storage, and systems.

Drafts of complete papers (up to 10,000 words) in quintuplicate and 150-word abstracts are required by May 1. Submissions and inquiries should go to David R. Brown, chairman of the 1964 JCC Technical Program, Stanford Research Institute, Menlo Park, Calif. Authors need to provide any needed company and security clearances at the time of the submission of the paper.

SCIENCE, PRIVACY, AND FREEDOM

I. From Professor Alan F. Westin
Special Committee on Science and Law
The Association of the Bar of the City of New York
320 Park Ave.
New York, N.Y. 10022

For almost two years, this Committee, working under a grant from the Carnegie Corporation, has been exploring the impact of science and technology on the conditions of privacy in America. Our survey has ranged from the latest electronic eavesdropping devices to new restraint-removing drugs, and from brain-wave research to subliminal suggestion. Our approach has been to acquire precise scientific data on each development, to measure its present impact on privacy, and to think through the implications on our institutions.

From the start of our work, one of the areas that has seemed to us most significant has been the relation of automatic data processing to privacy. Apart from the socially beneficial uses of computers, and those dictated by national security interests, how is the spread of the computer into increasing areas of private and government life going to affect informational areas that the individual (and various business and civic groups) has traditionally been able to keep private in America? As we have tried to approach the problem, there are several facets to this issue:

1. the question of acquiring and storing more and more information from individuals and groups;
2. the question of making such information freely exchangeable with other information-acquiring and processing systems;
3. the uses made of such stored information by government and private agencies;
4. the costs to essential areas of privacy resulting from such acquisition and uses, looking at costs such as vastly increased efficiency and information for government, and its effect on the balance of power between government and the private sectors in the United States; and
5. possible safeguards for crucial areas of privacy, either through arrangements possible in computer applications themselves, or through laws protecting confidentiality of information, or through public opinion affecting decisions as to expanding the computer into various new areas.

We have been aware that a few persons especially interested in the computer field — such as Bernard Benson, of Benson-Lehner Corporation, Dr. Richard W. Hamming, of Bell Laboratories, and Edmund C. Berkeley, of *Computers and Automation,* among others — have specifically commented on the need to be aware of the potential pressure of the computer on American privacy.

To gain more detailed information and further ideas, we are now inquiring particularly in regard to the following questions:

1. Is the shrinking of privacy through computer-processed data already a serious problem, or one coming in the near future, or still quite far away, or is it not a serious concern now and not likely to become such in the foreseeable future?

2. What, if any, scientific developments looming ahead promise to make this issue more acute? When may such developments be expected and what will be the specific nature of their impact?

3. Is this a problem that should be of active concern to "computer people", or is it primarily a problem for the users of computers, such as business firms, schools, law enforcement agencies, etc.?

4. Do you have any suggestions as to the most desirable way for state and/or federal legislatures, regulatory agencies and/or the courts to respond to this issue?

We would be glad to have any ideas that may be offered us on this problem, not only in relation to the statement and questions posed in this letter, but in any other aspect of the issue that we have not mentioned but which may be important and relevant to our work. We plan to publish the results of our study in a book aimed at the thoughtful general reader, which will be put out later this year by Atheneum Press under the tentative title *Science, Privacy and Freedom.*

II. From the Editor

A rather fearful increase in the invasion of privacy can be expected from the spreading of computer and data processing activities throughout government. A governmental intelligence agency will be able to correlate enormously more activities, protests, letters to congressmen, etc., of nonconforming persons; the harmfulness of blacklisting will be multiplied when it is computerized.

The subject of computerized invasion of privacy should be one of concern to computer people. The readers of "Computers and Automation" are invited to express their views on this subject.

Here is one comment: it may be that the harm from the invasion of privacy will not be as great as the harm from the invasion of the mind, which is accomplished by control over the great media of expression — television, radio, newspapers, and advertising — such as is found in most societies at many times. In such a situation the government and the establishment effectively (if not apparently) control nearly everything that most people read. For example, how many Americans know that about 10% (or 40,000 men) of the forces of the South Viet Nam dictatorship went over to the other side (the National Liberation Front or Viet Cong, whose platform is independence, democracy, neutrality, and peace), during 1963, most of them taking their weapons with them? (Source: a Canadian publication.) And how many Americans are able quickly and automatically to translate "strategic hamlet" into "concentration camp"? One of the big advantages of reading the press from other countries is the light shed by the variations in the informational intake within different nations.

AUTOMATION AND UNEMPLOYMENT

Helen Solem
Hillsboro, Oregon

"To oppose automation is to oppose progress. The time has come for us to squarely face the problem of job displacement. If American economy is not to suffer, something must be done soon about this growing segment of our population." The keynote speaker at the convention of the American Manufacturers' Association brought into the daylight a festering social problem.

While the AMA was publicly recognizing this problem, the following letter was delivered to a new member of that growing population, the unemployed:

> "The purpose of this letter is to confirm and put in writing our agreement as of April 1 in which you would be given until June 1 to find a new job. Although this was a longer time than I had originally intended, I think this amount of time is warranted because of your 20 years service and our concern for you personally.
>
> "As I pointed out, and as we discussed, the reasons for this decision to terminate your employment were based upon the fact that you seemingly could not adjust to changes created by automation. I sincerely regret this action, but as you are aware the tension generated by your attitude toward the changes of duties brought about by new methods . . ."

Heartless? or realistic? Couldn't a person with 20 years satisfactory service be trained for some other position? Or are there just too many untrained people for the available jobs? Whatever the foregoing situation can be termed, it is by no means an isolated instance.

Looking at the other side of the picture, industry also has a problem. One doesn't stay in business long at today's productive pace with horse and buggy methods.

Taking a look at the statistics[1] of unemployment, one finds that there are pronounced shortages as well as oversupply. Skilled, educated people are as scarce as ever. This is difficult to understand with all the emphasis and money being spent on American education, not only today, but for a generation or longer. If West Germany and Russia enjoy full employment for every person able and willing to work, why can't we?

Taking another look at the graphs and charts put out by the Bureau of the Census, it seems true that older, long-time employees are hardest hit by change. New, inexperienced, job seekers also have trouble finding work. Increasingly, middle managers have to return to production work — if they can find a spot. These are the types of people who form the "hard core of unemployed," the ones who resist the change automation brings with all their strength, by organizing, by strikes and by legislation. These are not basically constructive approaches toward solving the problem, but retaliatory, defensive measures.

Congress passed the Manpower Development and Training Act in 1962. It is a matching funds federal-state program originally authorized for three years. There are many obstacles to such a retraining program, not the least of which is the outlook of the unemployed themselves. The ones most needing the retraining and help, are often reluctant to participate. In a Massachusetts[2] attempt at retraining letters were sent to 3,500 people who were felt to be candidates for clerical-sales training. Only 233 responded to the letter. 35 actually took the course.

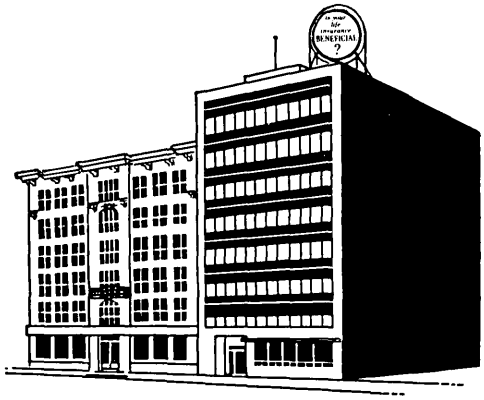
Contrary to appearances these people were not indifferent or apathetic to their plight. But many refused to face the fact they needed help, saying the situation was only temporary, a seasonal layoff. Many feared trying something new and different. Going away from home, a possible move, prevented many from accepting retraining. Many felt even a small tuition was an insurmountable obstacle. There were a great many who are perplexed and not capable of evaluating their own potential and forming a new plan for gainful employment. And last, but not least, there were far too many who lacked even the fundamental skills of reading, writing and arithmetic.

In another attack on the problem in Massachusetts, which was far more successful, implemented in connection with unemployment compensation, the retraining was largely a matter of individual choice. Here 1,300 persons participated. 90% successfully finished their course and 35% increased their yearly income by $1,000. Analysis of the follow-up questionnaire showed this group to be highly motivated and less typical of the hard-to-place unemployed.

An experience in Maine[3] with an elementary course in sewing was highly successful. After this 3-week course the Employment Service was able to fill jobs for stitchers for which these same women previously could not qualify. This would have seemed a basic knowledge for women and therefore training unnecessary, but experience proved otherwise. Food-handling, another occupation seemingly so common that no training would ever be needed, might be as fruitful. Good personal grooming and hints for meeting and making friends with the public might be as necessary.

Thoughtful people across America are taking the issue to heart. Fortunately the majority of willing and able persons are gainfully employed. Our Gross National Product has never been greater — 550 billions of dollars. Average income for the ten year period from 1950 to 1960 almost doubled for approximately half our working population. Farmers, the unskilled and managers however didn't fare as well. Table 1 shows who is producing this tremendous GNP.[4]

(Please turn to Page 31)



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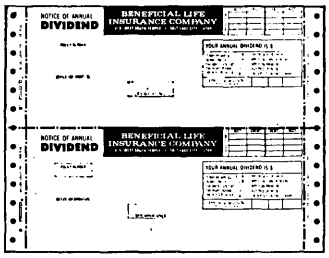

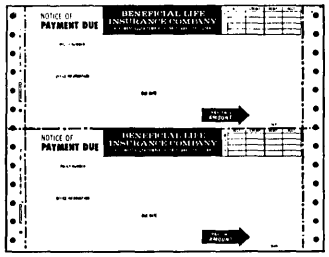

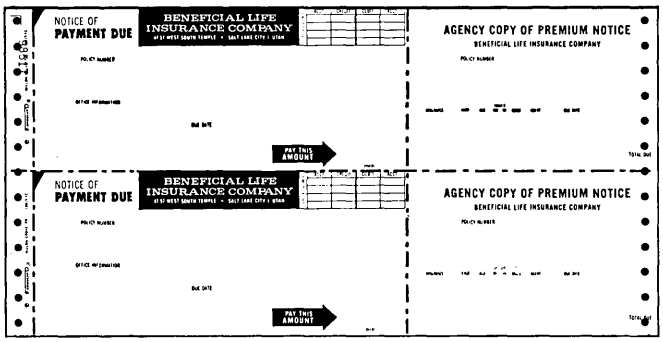

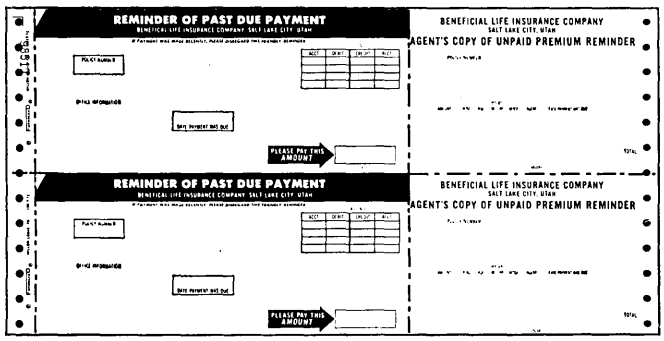

■ Like all life insurers, Beneficial Life Insurance Co., of Salt Lake City, Utah, uses many different forms to remind policyholders of premiums due and past due, to announce dividends, for internal accounting, etc. In many cases, local agents must be informed when such notices are sent to policyholders.

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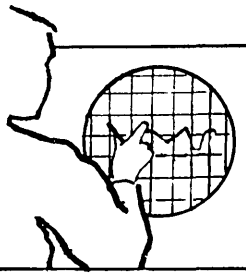


c&a EDITOR'S SCRATCHPAD

COMPUTER SWAPPING COMPETITION GROWS

As mentioned in last month's SCRATCHPAD, one of the most significant things about the success of the Honeywell 200 computer in capturing orders from current users of IBM 1400 series machines, is that it encourages other manufacturers to enter more deliberately the 1401 replacement market. This effect has not been long in coming, as recent announcements from Burroughs and General Electric reveal.

Moving quickly, Burroughs announced last month the availability of a program translator which converts 1400 series programs into B200 series programs. Burroughs claims that the translated programs from a card system run 50-to-100% faster on the B200's, and tape programs run 25% faster on the B200's. As Burroughs DP sales manager V. J. Ford likes to put it, the "availability of this translator removes the time and cost barriers to conversion to more productive systems."

General Electric has just officially taken the wraps off its 415 computer which extends its compatible 400 series down to the $5000 to $9000 per month range. Basically a slowed-down 425 (memory cycle time of 2.3 usec. per character versus 1.28 usec. for the 425), the 415 offers the same software and peripherals as the 425. A minimum configuration of the 415 with a 4K memory, card reader and punch, and printer goes for $4770 per month. A 32K memory, four tape 415 system with a card reader and punch, and printer, would be about $8500 per month, rather than the $5000 per month reported mistakenly in last month's SCRATCHPAD.

For the current 1400 series user who would like to convert to the 415, GE is offering three months of free use of a CAPACITRIX (Capacitive Matrix) memory, a special permanent store memory unit, which enables the 415 to simulate the operations of the 1401. This special memory is offered to keep the current 1400 series user "on the air" while he is reprogramming his jobs in 415 instructions. To encourage the user to reprogram expeditiously, GE nudges the price of the CAPACITRIX up to $300 per month for the fourth thru sixth month, $600 per month for the seventh thru ninth month, and $900 per month thereafter. GE is also offering a 1401 simulator program with its 415 for those users who would rather not reprogram, but are willing to go the cost of the extra core memory needed to store it.

GE has been promoting the 415 to prospective customers for about a month before its official announcement, and current estimates are that GE already has about 45 orders for the system outside of GE. One New England user we talked to said he is planning to replace two 1401's with a 415 in the fall of this year.

GE can be expected to move into the IBM 7000 series market with an official announcement of its 600 series computers this month. GE, as one of the largest current users of IBM equipment, has already struck at the 7000 series from within when it recently decided to replace eight 7090's used internally with their own 625 computer this year.

Of course, one of the big and as yet unanswered questions, is what IBM will offer in the small to medium class computer range when it makes its upcoming new computer series announcement this month. We conducted an informal survey among some current major users of IBM equipment, and found to our surprise that many of them had already been briefed by IBM personnel on the new series. Most of these people expressed an "about time" attitude toward the new IBM equipment, noting that at last IBM is planning to offer the type of computing power per dollar that their competitors have been touting for a year or two. As one data processing manager, who has four 1401's in operation, and a 1440 and two H-200's on order, mentioned to C&A, "I have been up to Poughkeepsie and have been given the story on the expected capabilities of the new IBM computer series. Unless the computing cost of the smaller machines comes in materially lower than I currently anticipate, I will be sticking by my H-200 orders. My company sees a definite advantage to dealing with two vendors."

At the time you are reading this issue, several of these questions will probably be answered by IBM's new computer series announcement currently scheduled for April 7.

SOMETHING NEW VIA SOMETHING USED FROM BURROUGHS

Burroughs has come up with a bright new way of handling one of the effects of the growing computer replacement activity. It is taking its Model 0 B200 processors which have been returned

by users who have been up-graded to the B263, 273, 283 or other systems and surrounding them with some low-cost peripheral equipment. This Burroughs is calling its new B100 computer series.

The B100 series includes a B160, the B170, and B180. The B160 is a punched card system which rents for about $2000 per month. The B170 can use card, magnetic tape or MICR and rents for about $2800. The B180 with six magnetic tapes will rent for just over $4000 per month. The peripheral equipment for the series includes a 400 cards per minute reader, 475 lines per minute printer, 250 lines per minute multiple lister, and a 1200 check per minute sorter reader. Magnetic tape units have a 24 kc transfer rate.

According to a Burroughs spokesman, the computer is immediately available for delivery, and several have already been sold, although the first official announcement of the series is not expected until the beginning of April.

UPDATING THE COMPUTER COUNT IN EUROPE

Many of our readers may remember reading the report on "The Development of the Computer Market in Europe" which appeared in the September and October, 1963, issues of C&A. This report, prepared by the Netherlands Automatic Information Processing Research Center, gave a detailed description of the growth of the market for computers in the countries of Western Europe up to the end of 1961.

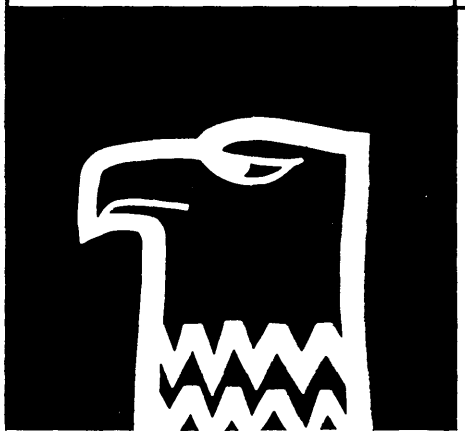
Computer Consultants Limited of Enfield, Middlesex, England, one of the leading British consulting firms in the computer field, has just completed a detailed study of the use of computers in Western Europe which serves to bring the information in the Netherlands-based report up to date. CCL's report, called "A Special Survey of European Computer User Systems," is stated to be accurate up to the end of 1963.

The table below gives a comparison of the computer census figures in the recent report from CCL with those in the original Netherlands Center study.

	COMPUTERS INSTALLED			COMPUTERS ON ORDER		
COUNTRY	NUMBER (END OF 1961)	NUMBER (END OF 1963)	VALUE (END OF 1963) ($MILLIONS)	NUMBER (END OF 1961)	NUMBER (END OF 1963)	VALUE (END OF 1963) ($MILLIONS)
Austria	25	66	16.1	20	50	12.3
Belgium	65	142	36.2	50	105	29.7
Denmark	10	74	17.2	25	30	10.5
Finland	---	19	4.1	---	35	9.5
France	260	791	136.0	300	406	69.6
Germany	390	993	131.2	385	455	58.1
Gr. Britain	340	626	81.1	260	381	57.2
Greece	---	50	15.1	---	20	5.4
Irish Rep.	---	10	2.3	---	39	6.3
Italy	200	592	159.1	165	339	63.9
Netherlands	70	156	42.3	50	134	44.2
Norway	10	54	14.8	20	71	14.7
Portugal	---	16	5.9	---	29	8.5
Spain	---	23	5.9	---	19	5.2
Sweden	70	147	42.0	80	121	31.7
Switzerland	70	160	56.7	65	101	39.8
TOTALS	1,510	3,919	766.0	1,420	2,335	466.7

When you think EDP, now think NCR. They did.

30¼	18⅝	HoudIn 1.20a	14	30¼	30⅜	30⅛	30⅜	+ ¼
46	40⅜	Houd pf 2.25	4	45	45	45	45	+ ½
61⅜	45½	House F 1.50	13	51⅜	52½	51⅜	51⅞	+ ¾
92½	87	Hous F pf 4	z10	91	91	91	91	+ 1
49⅜	42	HoustLP .72	18	48¾	48¾	47¾	47¾	— ¾
55¾	39⅝	HowJohn .88f	12	51⅛	51⅛	51	51	....
25¼	20	Haw Tel .70	12	21⅞	21⅞	21¾	21¾	— ⅛
14	9⅞	Howe Sd .40	8	10¾	10¾	10⅝	10⅝	— ⅛
59¼	47¾	Hud Bay 3a	6	57⅞	58	57¾	58	+ ¼
36½	26⅛	HumtFds .50b	25	27⅛	27⅛	26⅝	26⅞	— ⅛
103¼	98¼	HumtF pfA 5	z20	100	100	100	100	— ½
103	98½	HuntF pfB 5	z10	100	100	100	10	+1
9⅛	6½	Hupp Cp .31t	33	7⅜	7¾	7⅜	7¾	+ ⅛
40½	31	Inspirat 1.20h	22	39	39½	38¾	38¾	— ¼
42½	30⅝	Interch 1.40	29	43¼	43½	42¾	43	+ ½
27½	23½	Interlak 1.60	13	27⅜	27⅜	27⅛	27⅜	+ ¼
567	384¼	IntBusMch 5	93	558	559	553	553	—2½
63⅛	49½	IntlHarv 2.40	29	60	60⅛	59¾	60	— ¼
175	157⅛	IntlHarv pf7	z80	165	165¾	165	165¼	+ ¼
71⅞	40¼	InMiner 1.80a	111	71¾	71⅞	71	71⅛	— ⅜
11¼	7	Int Mng .30g	5	7¾	8	7¾	8	+ ⅜
74¼	56⅜	IntNick 2.20a	69	72	73	71¾	72⅜	— ½
20¾	12⅞	Int Pack 1	16	15⅜	15⅞	15⅜	15⅜	— ⅜
36¼	26⅛	IntPap 1.05b	x103	31½	32	31¼	32	+ ½
35¼	20⅞	IntPipeCer 1	4	22¼	22¼	22¼	22¼	+ ⅛
114¼	101	Int Pipe pf5	2	104	104	104	104	....
10⅝	6	Int Rectif	30	6⅞	6⅞	6⅝	6⅞	— ⅛
29⅜	16	IntResis .40a	23	16¼	16⅝	16⅛	16½	....
89	71	Int Salt 4	1	88½	88½	88½	88½	— ½
28¼	24	IntlShoe 1.20	26	25⅞	26¼	25⅞	26¼	+ ⅜
42¾	34	IntlSilv 1.20b	14	41⅜	41½	40¾	41½	— ½
57¾	41¾	Int T&T 1	178	55	55¾	55	55½	+ ⅜
109½	101	IntT&T pfC4	z18	108¼	108¼	108¼	108¼	....
109½	100½	IntT&T pfD4	z230	107¾	108½	107¾	108½	+ ½
25⅜	20	IntUtil .80	15	22	22⅛	22	22⅛	+ ⅜
52	42½	Int Util pf 2	1	44⅜	44⅜	44⅜	44⅜	+ ⅛
52¾	28¼	InterDS .70b	35	44	45½	43½	45½	+1½
27½	20⅜	IntMotFrt .80	17	21⅝	21⅞	21½	21⅝	....
28¼	23⅞	InterPw 1.05	9	26½	26⅜	26¼	26⅜	— ⅜
31⅞	27⅜	IowaEILP 1	1	28½	28½	28½	28½	+ ⅜
58⅞	49	IowaIll GE 2	1	59¼	59¼	59¼	59¼	+ ⅜
34½	19¾	IslCrkCl 1.50	18	33	33	32¾	32¾	....
20⅞	13⅞	ITE Ckt .15g	24	20⅜	20¾	20⅛	20⅛	— ¼
13¾	10	JaegerM .60	17	11⅛	11⅞	11⅛	11⅞	+ ¾
		Japan Fd fn .33g	1	8⅜	8⅜	8⅜	8⅜	....
9½	8	JapanFd .18e	8	8⅜	8⅜	8½	8½	....
19¼	12	Jeff Lak S	38	18¼	19	18¼	18¾	+ ⅜
90	84¼	JerCPL pf 4	z30	86½	86½	86¼	86¼	— ½
61¼	47⅜	Jewel T 1.60	26	53	53⅜	52	52	— ¾
55¾	42	JohnsManv 2	60	55⅜	56	55⅜	55¾	+ ¼
124½	73½	JohnJ 1a	16	112	112	111	111½	— ¾
21¼	14¼	JonLogan .70	21	19⅜	19⅜	18⅞	18⅞	— ½
71	47½	Jones&L 2.50	39	68¼	68¼	67⅜	67¾	— ¼
105¾	100½	Jones&L pf5	z120	105	105	105	105	....
16	13½	Jorgens .80	3	15⅞	15⅞	15⅝	15⅞	+ ¼
29¾	19⅜	Joy Mfg 1	30	28¾	29	28½	29	+ ⅛
42⅛	31⅛	KaiserAl .90	40	36½	37	36½	36⅞	+ ⅛
110	102½	Kais Syp4.75	1	103⅜	103⅜	103⅜	103⅜	+ ⅜
100¼	90	Kais pf 4.12	1	90¼	90¼	90¼	90¼	....
52¼	50	Kais ncpf2.37	1	51	51	51	51	....
44½	37½	KanCPL 1.32	10	44	44	43¾	43¾	....
48¾	38¼	KCSoln 2.50g	9	43	43⅛	43	43⅛	+ ⅜
21¾	19⅝	KC Sou pf 1	3	20¼	20½	20¼	20½	+ ¼
35½	27⅜	Kan GE 1.04	13	33¾	33¾	33½	33½	— ¼
55	47½	KanPL 1.60	21	54¼	54¼	53½	53½	— ¾
24¾	16½	KaysrR .40a	25	22	22¼	21¾	21¾	— ¼
44¾	36	Kellogg .80a	7	42¼	42⅜	42⅛	42⅛	+ ⅛
42	33	KelseyHay 2	6	38	38⅛	37¾	37¾	— ¼
47	30	Kendall 1.20	11	45¼	45¾	44¾	45	— ⅜
80⅜	66¼	Kennecott 4	111	80	80½	79¾	80	— ¼
		Ky Util 1	35	31¾	32	31⅝	31⅝	....
78¾	60¾	KernCL 2.40	22	63¼	63⅝	63⅛	63⅛	+ ⅛
42¾	34⅜	KerrMcG 1	24	37	37⅛	36½	36½	— ½
72¾	52⅜	KimbClark 2	9	64⅞	65	64¼	64½	— ¼
50	32⅛	KingS 1.60	58	42¾	42¾	42¼	42⅜	— ⅛
25	15⅛	KirkNat .40	77	20⅞	20⅞	20¼	20¼	— ⅝
		KLM Airl fn	8	18⅛	18⅜	18⅛	18⅝	....
43⅞	39¼	Koppers 2	17	40	40½	40	40⅛	+ ⅛
93	84½	Koppers pf 4	z10	90¾	90¾	90¾	90¾	— ¾
40½	25	Korvette	48	32⅞	33⅛	32⅝	32¾	....
30	21½	Kresge 1.20	27	28⅞	29¼	28¾	29⅛	+ ¼
20	13¼	Kroehler .20g	67	19⅞	21¼	19⅞	20⅞	+1⅛
31⅜	23¾	Kroger 1.10	42	27	27⅞	27	27⅜	+ ¼
34¾	27⅜	KVPSu 1.40a	5	30⅝	30¾	30½	30½	....
15⅞	6⅞	Lab Electron	26	7	7	6⅞	7	+ ⅛
35⅜	25	LacGas 1.05b	14	25½	25¾	25⅛	25½	....
29⅜	22½	Lane Bry 1	2	25⅞	25⅞	25⅜	25⅜	— ¼
17⅜	15⅜	Lanv Ritz	15	16	16⅛	15⅞	16	— ⅛
18¾	13⅛	LearS .40b	16	13¼	13½	13¼	13½	+ ⅜
24	13⅞	Lee Rubber	10	23¾	23¾	23¼	23½	....
44¼	21	Leesona .50	6	37⅞	37⅞	37½	37½	— ¾
20¼	14¼	Leh Port 1	17	15⅛	15¼	15⅛	15¼	+ ⅛
1¾	1⅛	Leh Val Ind	259	1⅝	1¾	1⅝	1⅝	— ⅛
23	21	LVInd pf1.50	1	23¼	23¼	23¼	23¼	+ ⅜
32	26¾	Lehman 1.34e	21	29⅛	29¼	29	29⅛	— ⅛
39½	27½	Lehn&Fink 1	12	29½	29½	28⅞	28⅞	— ⅞
12½	9⅜	LeonardR .60	13	10½	10¾	10½	10¾	+ ⅛
56⅞	50⅞	LOFGls 2.60	x64	54	54⅛	53¾	53¾	+ ⅛
17⅜	12⅛	Lib McN .16f	32	16½	16⅝	16¾	16⅜	— ¼
83⅞	66½	Liggett&M 5	40	76⅝	77	76¾	76¾	— ⅞
159½	150	Ligg&My pf7	y10	152⅛	152⅛	152⅛	152⅛	+ ¾
47⅛	33¼	Lily Tulip 1	16	37⅛	37⅜	37⅛	37⅛	....
20¼	13½	Ling TV .12g	127	19⅜	19⅜	18½	18½	— ¾
59⅜	46½	LinkBlt 2.40a	7	59⅛	59¾	59	59⅜	+ ½
44	32¾	LockAirc 1.60	x79	36⅜	36⅜	36⅛	36½	+ ⅜
24½	22·	Lone S Gas 1x	100	23	23	22⅜	22¾	— ⅜
34½	29½	LongIslLt .86	68	31	31⅜	30⅞	31⅛	+ ¼
18⅜	7¼	Loral Electr	44	8⅛	8¼	8	8	— ⅛
54⅞	40⅛	Lorillard 2.50	103	44⅛	45	44⅛	45	+ ⅞
154	142¾	Lorillard pf7	z100	149	149	149	149	+ ¾
39	32	LouisGE .98	2	36½	36½	36⅛	36⅛	— ⅜
94¾	59¾	Lou Nash 3a	8	85	85	85	85	+ ½
13⅞	9⅜	Lowenstein	15	12⅞	12⅞	12½	12½	— ⅛
22⅛	19⅜	LuckySt .80b	4	19¾	20	19¾	19⅞	+ ¼
49⅞	38	LukensSt 1.40	5	41½	41⅝	41½	41½	+ ⅛
23	15½	Lykes SS .80	4	19¾	19¾	19⅝	19⅝	....
30	24	MacAnd 1.60	4	26½	26½	26¼	26¼	— ⅜
		MacNR 1.60	82	39	39⅝	38¾	38¾	— ⅛
80¼	56	MacyRH 2.20	13	77½	78⅜	77½	78⅜	+2⅛
2½	1½	Mad Sq Gar	14	1⅝	1¾	1⅝	1¾	+ ⅛
9¾	8	MadSG pf.60	4	8	8	8	8	....
38¾	25	MagmaC .25e	10	37	37	36⅜	37	— ⅜
48¼	35½	Magnavx .90	226	39¼	39⅞	38	38	—1⅛
33¼	28¾	Mallory 1.20	21	30⅛	30½	30	30⅜	+ ⅜
33½	21	MnShirt .70b	6	22½	22½	22	22	— ¼
27¾	21½	Manning 1.40	12	27½	27½	27⅛	27⅛	— ⅛
9⅜	5⅜	Marac Oil	2	9⅛	9⅛	9⅛	9⅛	....
59⅜	43½	Marathon 2b	33	58¾	58⅛	58⅛	58¼	— ⅜
35	19¾	Maremont 1	13	24¼	24½	24⅛	24⅛	— ¼
35¼	26¾	MarMid 1.15	67	31⅞	32¼	31⅞	31⅞	— ⅛
36¼	24⅜	MarIRk 1.40	58	35⅞	35¼	35	35⅛	— ⅛
15⅜	9½	Marquar .25e	3	9¾	9¾	9¾	9¾	....
40⅜	30¼	Marq C 1.80	20	34⅜	34⅞	34⅛	34⅞	+ ⅝
40⅝	32	MarshFd 1.60	11	38½	39⅞	38½	39⅞	+1¼
22⅝	18	Martin M 1	83	20	20	19⅞	20	+ ⅛
48⅞	36¼	Masonit 1.20b	18	47¾	48⅜	47¾	48⅛	+ ½
61	35½	Mattel .40	74	39	40⅛	39	40⅛	+1⅞
75	53	MayDSt 2.20	27	73	73½	72¾	73½	+ ½
19⅝	14⅞	MaysJW .80	11	15¾	15¾	15⅝	15⅝	.
39⅞	29½	Maytag 1.40a	11	35⅛	35½	34⅞	35½	+ ½
68¾	48	MCA Inc	188	56¼	56½	56¼	56¼	.....
39¼	34¼	MCA pf1.50	3	35⅜	35⅝	35½	35½	— ⅛
23⅞	21½	McCall .40	4	23⅜	23⅜	23¼	23¼	— ¼
23⅞	20⅜	McCord 1.20	6	22½	22½	22½	22½	+ ⅛
17¾	9⅞	McCrory .80	46	11⅜	11½	11⅜	11½	+ ⅛
89	70⅛	McCro pf3.50	z50	72	72½	71½	71½	+ ½
73¾	52⅜	McCro pf4.50	z190	60¾	61¾	60¾	61¾	+ ¼
94	77	McCro 6pf6	z120	84¼	84¾	84¼	84¾	+1¼
31½	21⅛	McDerm .80a	55	22¾	23⅛	22⅝	23⅛	+ ⅜
60¼	47	McDonAir 1b	15	55⅞	55⅞	55⅝	55⅝	+ ⅛
40⅜	34½	McGEd 1.40a	38	36¾	36⅞	36½	36¾	....
33¾	23⅜	McGHill .60a	46	33½	34	33½	34	+ ⅝
18⅞	15½	McGreg A 1	1	15¾	15¾	15¾	15¾	+ ⅛
53½	40	McIntyr 1.60	2	51⅜	51⅜	51⅛	51⅛	— ½
19	10⅞	McKee 1	4	18¾	18¾	18⅛	18⅜	+ ¼
51⅜	39¼	McKess 1.50	7	44⅝	44⅝	44	44	— ¼
12	9⅞	McLean .40a	12	10¾	11	10¾	11	+ ⅛
56	46	McLouth 1.40	19	50	50⅜	49¾	49¾	— ⅛
29⅜	20⅜	McNeilM 1b	11	21⅞	21⅞	21⅜	21⅜	— ⅜
23⅜	19½	McQuay 1a	5	20⅞	20⅞	20½	20⅜	— ¼
47⅜	37½	MeadCp 1.70	10	43⅞	44¼	43⅞	44	+ ¼
27⅞	16¼	MelvShoe .80	26	16¾	17	16⅝	17	+ ¼
27⅜	20¼	Merc St 1	xz	26⅝	26⅝	26⅝	26⅝	+ ¼
120½	77½	Merck 2a	9	115⅞	116¼	115¼	115¼	—1⅜
13⅜	11½	MerrCh .30g	30	11¾	12	11¾	12	....
15⅜	11¼	Mesabi .14e	16	14⅜	14⅞	14⅜	14¾	— ⅛
37⅞	27	MestaM 1	6	32	32	31¾	31¾	....
37¼	26½	MGM 1.50	18	29½	29¾	29	29	— ⅝
38⅜	15	Metrom .40a	21	30	30¼	29½	29½	— ⅜
89	84½	MetEd pf3.85	z180	85½	86	85½	86	+1
41½	34¾	Mid SU 1.16	44	40	40¼	40	40¼	— ⅛
72	49⅜	MidlRoss 3.20	6	70	70¼	69⅞	69⅞	+ ⅛
80¼	60¼	MidOil 1.80b	2	70¼	70¾	70¼	70¾	+ ¼
33¾	24¼	Miles .70a	3	32⅛	32⅛	32	32	— ⅛
24⅜	18⅜	MinerCh .70	20	19⅞	20	19⅞	20	+ ⅛
150¼	84½	Mpl Hon 2	x34	133⅞	135	133¼	134⅞	+1⅞
96	79¾	Mpl Hon pf3	3	94¾	94¾	94¼	94¼	....
73¼	52½	MinnMngM 1	x147	69	70	69	69⅜	+1¾



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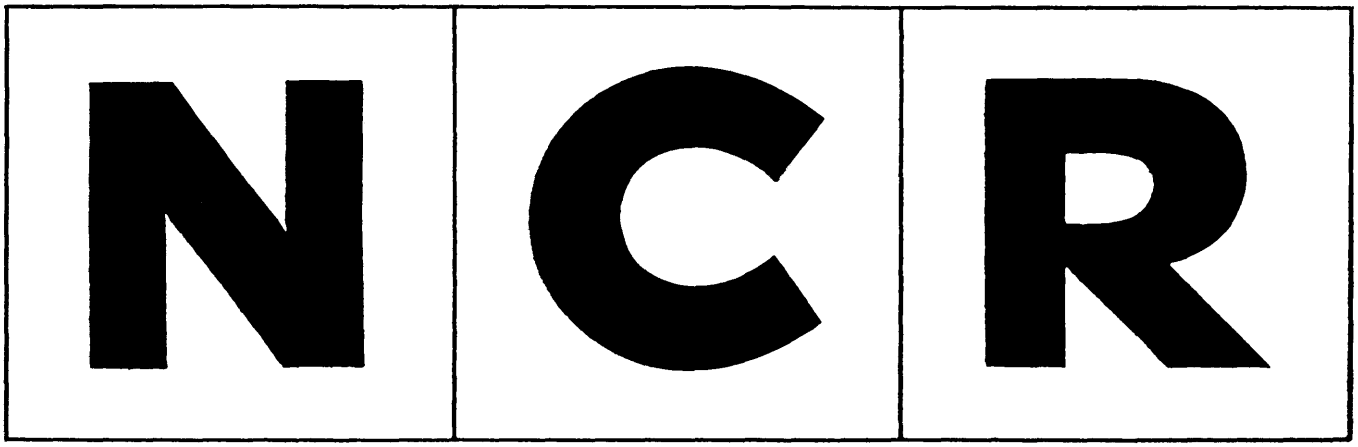

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DECISION TABLES AND THEIR APPLICATION

Paul Dixon
Auerbach Corporation
Philadelphia, Pa.

Introduction

The purpose of this article is to describe the fundamental principles of decision tables and give some indication of the power and applicability of this technique as an analytical and programming tool. Although the literature on decision-table development and potential directions of application is extensive, relatively little use has been made of decision-table techniques, particularly when compared to the programming tool of flowcharting.

One reason given for this situation is that the decision-table technique is generally considered as being an "advanced" tool. To a certain extent this is true. As a systems analysis and programming tool, relating to the use of computer equipment to perform decision-making functions, decision tables are of relatively recent origin. The tabular form of recording, however, has been known and used for many years as a means of summarizing facts and previous experience in statistical tables and accounting reports.

To many people, the designation "advanced" also implies complex. In this particular case, the inference is erroneous. The basic principles of decision tables are quite simple, and one of the major advantages of the tables is that they provide a powerful means for expressing complex problems in a greatly simplified form, which makes possible more effective analysis. They enable the analyst or programmer to partition a complex decision-making process into a set of small interconnected tables in which the process is shown in a series of easily digestible, parallel steps. This format shows the decision logic much more clearly than the sequential format of a flowchart and is much easier to revise and expand. The latter advantage makes decision tables particularly helpful in situations where the decision process is subject to frequent changes over a period of time. Far from being complex, decision-table documentation is considerably more effective than flowcharts as a means for expressing complex problems to non-specialists, such as top management. What's more, the clarity of their format is such that they provide a very effective means of checking the completeness of a problem description.

Another reason given for the relatively sparse use being made of decision tables is that their utility is limited to only very complex problems. This belief is valid only if you define a complex problem as one composed of numerous inter-related conditions, actions, and decision points. Complexity of this type is not, of course, a very severe restriction of decision-table utility. The truth is, a majority of business problems are complex enough in this sense to require a more effective means of expression than the flowchart.

The utility of decision tables is further broadened by the ease with which they can be adapted to computer operation. The tables can be prepared in either a symbolic language or in a restricted form of English, such as DETAB-X, the experimental decision-table language extension to COBOL-61, for automatic compilation into an object program. Although not many decision-table compilers have yet been developed and there are problems (discussed later in this article) to be overcome in developing very efficient ones, the use of decision tables as part of a source program is a practical possibility.

This is not to say that decision tables should completely supplant flowcharts. Functionally, the two are quite different. Decision tables are primarily an analytical technique, while flowcharts are a documentation technique—one that is, in fact, completely oriented toward computer processing. Although the process of flowcharting may be

	RULE
CONDITION STATEMENT	CONDITION ENTRY
ACTION STATEMENT	ACTION ENTRY

FIGURE 1. DECISION TABLE ELEMENTS

	RULE 1	RULE 2	RULE 3
Credit OK	Y	N	N
Pay Experience 'Favorable'	-	Y	N
Approve Order	X	X	-
Return to Sales	-	-	X

FIGURE 2. CREDIT APPROVAL DECISION TABLE

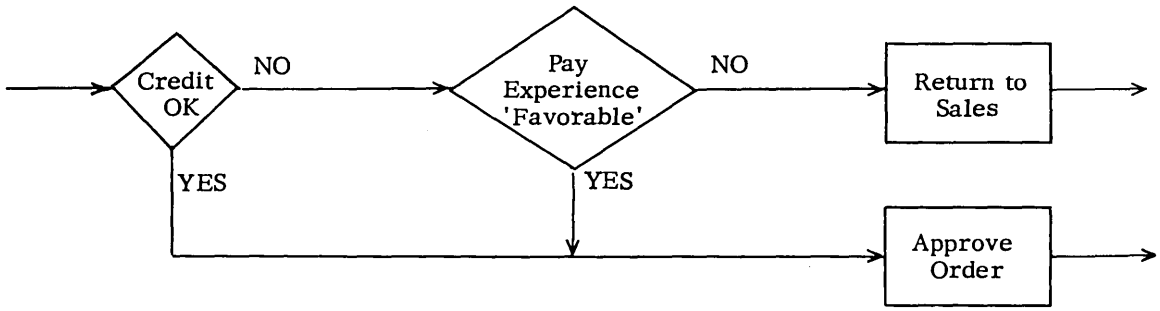

FIGURE 3. Credit Approval Flow Chart

	RULE 1	RULE 2	RULE 3	RULE 4
CREDIT OK	Y	N	N	N
PAY EXPERIENCE 'FAVORABLE'	-	Y	N	N
SPECIAL CLEARANCE OBTAINED	-	-	Y	N
APPROVE ORDER	X	X	X	-
RETURN ORDER TO SALES	-	-	-	X

FIGURE 4. EXAMPLE OF LIMITED ENTRY TABLE
CREDIT APPROVAL TABLE

used by an analyst to arrive at the full complexity of the problem in stages, through a series of pencilled versions of the problem, it imposes upon him a rigid sequence of problem-solving operations. In practice, the sequential format of flowcharts forces the user to carry on two steps concurrently: in order to document the logic of the problem, he must choose a particular sequence of problem-solving operations, even though he may not yet fully comprehend the problem.

In contrast, decision tables are completely problem-oriented. Their tabular and parallel format permits the analyst to express the problem in a way that clearly shows the interactions among decision rules without having to bother with the methodology of the solution; he is free to work that out (and usually do it more effectively) after he fully understands the problem. Actually then, decision tables, most often complement flowcharting, except in those instances where the availability of a compiler permits the tables to be used as part of the source programs.

Experience has proved that, in many classes of applications, the use of decision tables to complement, or replace, flowcharting leads to a more thorough definition of the problem and to more efficient use of both systems-analysis and programming manpower. There is little reason, therefore, why a tool of this power should remain an "advanced" technique, used by only a few, when, with relatively little effort, discipline, and practice, it could benefit the many who are seeking to reduce system design costs and improve performance.

Decision Tables

The decision-table principle, as pointed out above, is neither particularly new nor revolutionary. As a concept it is very easy to understand. Its significance lies primarily in its power as a technique of system analysis and, where practical, in its use as a source program that can be directly compiled into object computer programs.

A decision table is a tabular representation of particular sets of:

(1) Conditions: variables that must be considered in reaching a decision;
(2) Actions: operations that must be carried out when a given set of conditions exist;
(3) Rules: specific sets of conditions and the actions dictated by these conditions;
(4) Entries: additional information about either a condition or action pertinent to a particular rule.

These elements are defined in a decision table (see Figure 1) as:

(1) Condition Statement
(2) Condition Entry
(3) Action Statement
(4) Action Entry
(5) Rule

Statements (both condition and action) are placed to the left of the vertical double line (this portion of the table is sometimes called the stub), entries (both condition and action), to the right. All information about conditions is shown above the horizontal double line; all information about actions is shown below the horizontal double line. Rules are shown at the top of each entry column.

Figure 2 shows how this format would be used to express a typical credit situation, i.e., "if credit is OK, approve order; if credit is not OK, but pay experience is favorable, approve order; otherwise, return order to sales."

The structural difference between decision tables and flowcharts is shown by looking at the flowchart of this same situation, shown in Figure 3. While the flowchart depicts the decision-making process in sequential steps, the decision table depicts it in vertical, parallel columns.

Decision tables may take any one of three forms:

(1) Limited-entry table
(2) Extended-entry table
(3) Mixed-entry table

In the limited-entry table (Figure 4), the condition statements are complete, defining both the variable that must be considered and the value of the variable. The condition entries merely tell whether or not a particular condition must exist for the rule at the top of the entry column. The condition entries are "Y" (yes), "N" (no), or "-" (irrelevant). Similarly, the action statements in a limited-entry table completely define the actions to be taken for the sets of conditions shown. The action entries merely approve or disapprove an action statement for the particular set of conditions shown in the column. The action entry per rule per action statement, therefore, is limited to an "X" (executed) or "-" (don't execute).

In an extended-entry table (Figure 5), the condition statements only identify the variables to be considered. The condition entries define the values (either absolute or relative) of the variables. In similar fashion, the action statements in an extended-entry table only identify the variables to be modified; the way they are to be modified is stated by the action entries.

The third type of decision table, the mixed-entry table, is shown in Figure 6. This combines both the limited and extended entry forms. Although the limited- and extended-entry forms can be mixed within a table, one form must be used exclusively with a horizontal row of the table.

As pointed out earlier, one of the primary advantages of decision tables is that they permit a complex decision-making process to be partitioned into its various component parts, each part of the process documented by an individual table. This means that the tables must allow for a transfer of control from one table to another. This is accomplished with appropriate action entries, such as those shown in the last two lines of Figure 7. An action entry of this type will either unconditionally pass control to another table or provide for entry into another table and, then, the return to the original table and column, where the entry following the one that caused the exit is picked up.

In the DETAB-X language used in Figure 7, this facility is provided by the "DO" statement and the "GO TO" statement. The example, Figure 7, implies the existence of seven other tables: AB-Process, AC-Process, A-Edit, B-Edit, C-Edit, Errors, and Next Job. In Rule 1 of the table shown, the action entry to execute "DO AB-Process" will cause table "AB-Process" to be entered, and, upon completion of that table, control will be returned to the Rule 1 action entry for the "DO AC-Process" action statement.

A table to which temporary control is transferred with a "DO" action should have no rules terminating with an action entry to execute a "GO TO" action, since this would contradict the return of control that is indicated by the controlling "DO" action. While the control-transfer terminology used here applies to the proposed DETAB-X language extension to COBOL, any other equivalent may be used where the tables are not to be compiled.

The final example given below illustrates the use of a limited-entry table in defining the logic of a simplified file-maintenance application. Starting and ending procedures are excluded, and would be normally found in other tables. The file names and data fields are:

Inputs:	*File Names*	*Data Fields*
	1. Master File	1. STOCK-NR-A
		2. ON-HAND-A
	2. Change File	1. STOCK-NR-C
		2. QUANTITY
		3. CHANGE-CODE

Outputs:

1. New Master File (same as master file)
2. Ship-Order File (same as change file)

The work to be done is as follows:

When an item from the master file does not have a change record to apply against it, write the master-file record into the new master file.

When an item from the change file does not correspond to a master-file record, it must be a "NEW ITEM." In this case, create a new master-file record from the change-file record.

When the stock number of the master file agrees with the stock number of the change file, update the master-file record as follows:

(1) If the change-code is equal to "REC," adjust quantity on hand.

(2) If the change-code is equal to "SHIP" and the quantity requested is available, adjust "ON-HAND-A" and write shipping order. If the quantity requested is not available, modify the change-code to read "BACK-ORDER" and write shipping order.

	RULE 1	RULE 2	RULE 3	RULE 4
AGE	LE 25	LE 25	GR 25	GR 25
SEX	"M"	"F"	-	-
ACCIDENTS	-	-	EQ 0	GR 0
SET RATE EQ (RATE)	+ RISK FACTOR	-	- SPECIAL RATE	-
SET NEW RATE EQ	RATE	RATE	RATE	RATE

FIGURE 5. EXAMPLE OF EXTENDED ENTRY TABLE
RATE DETERMINATION TABLE

	RULE 1	RULE 2	RULE 3	RULE 4	ELSE
IS IT AN ANIMAL	Y	Y	Y	N	-
NUMBER OF LEGS	4	4	4	2	-
HAS IT FEATHERS	N	N	Y	Y	-
NOSE	LONG	SHORT	LONG	-	-
NECK	SHORT	LONG	LONG	-	-
IT IS	ELEPHANT	GIRAFFE	HALLUCINATION	BIRD	-
GO TO	TABLE E	TABLE G	PSYCHIATRIST	TABLE B	TABLE X

FIGURE 6. EXAMPLE OF MIXED ENTRY TABLE: WHAT IS IT?

	RULE 1	RULE 2	RULE 3	ELSE
JOB-CODE EQ	"A"	"B"	"C"	-
ADD 1 TO	A-COUNT	B-COUNT	C-COUNT	-
DO AB-PROCESS	X	X	-	-
DO AC-PROCESS	X	-	X	-
DO	A-EDIT	B-EDIT	C-EDIT	ERRORS
GO TO NEXT-JOB	X	X	X	X

FIGURE 7. EXAMPLE OF TRANSFER OF CONTROL
CODE TEST TABLE

(3) If the change-code is equal to "ADJUST," apply quantity in change file to ON-HAND in master file.

Table 8 shows this specification in tabular form. It is obvious that the tabular presentation, when compared to the text description, is more concise and permits easier comprehension and checking of the logic involved.

Applications of Decision Tables

The advantage of decision tables varies with the complexity of the decision logic, not with the type of application. If the process is logically complex and involves many logical decision points, then decision tables generally will be the most effective method for expressing the logic of the problem. This will be so whether the application is file-processing, manufacturing, engineering-scientific, or the executive-control program of a real-time system.

Evidence of the power of the technique and the manpower economies that can be achieved is available from the experience of a number of large users, covering a wide range of applications. Most of the original work on developing decision table techniques to the point of practical application has been done by General Electric and IBM, and users within General Electric provide the widest range of successfully implemented applications. Available literature on decision tables, including reports presented at a Decision Tables Seminar, held in New York in September 1962, describe the use of the technique in, for example, manufacturing applications ranging from quality control and operational planning, through inventory control and production scheduling, to dispatching, shipping, and traffic control. In marketing, decision tables have been used to show the relationship between market requirements and engineering decisions. Companies have also reported success in using decision tables to design and implement complex file-processing systems involving problems with conditional decision chains, which could not be successfully resolved using flowcharting techniques.

While the detailed description of these, and other applications, is not contained in the scope of this article, the bibliography at the end of this report will provide interested users with detailed descriptions of these applications. Many basic advantages may be gained through the use of decision tables in the above mentioned applications, including (1) cutting the analysis and programming time needed to develop and implement the program by as much at 50%, (2) greatly simplified updating procedures, and (3) drastic reductions in debugging effort, due to almost error-free development of the process logic.

	RULE 1	RULE 2	RULE 3	RULE 4	RULE 5	RULE 6	ELSE
STOCK-NR-A EQ STOCK-NR-C	Y	Y	Y	Y	N	N	-
STOCK-NR-A LR STOCK-NR-C	-	-	-	-	Y	N	-
STOCK-NR-A GR STOCK-NR-C	-	-	-	-	-	Y	-
CHANGE-CODE EQ "REC"	N	N	Y	N	-	-	-
CHANGE-CODE EQ "SHIP"	Y	Y	-	N	-	-	-
CHANGE-CODE EQ "ADJUST"	-	-	-	Y	-	-	-
CHANGE-CODE EQ "NEW-ITEM"	-	-	-	-	-	Y	-
QUANTITY LR ON-HAND-A	N	Y	-	-	-	-	-
MOVE (ON-HAND-A+QUANTITY) TO ON-HAND-A	-	-	X	X	-	-	-
MOVE (ON-HAND-A-QUANTITY) TO ON-HAND-A	X	-	-	-	-	-	-
SET CHANGE CODE EQ "BACK-ORDER"	-	X	-	-	-	-	-
WRITE SHIP-ORDER FROM CHANGE	X	X	-	-	-	-	-
WRITE NEW-MASTER FROM MASTER	-	-	-	-	X	-	-
WRITE NEW-MASTER FROM CHANGE	-	-	-	-	-	X	-
READ CHANGE	X	X	X	X	-	X	-
READ MASTER	-	-	-	-	X	-	-
DO ERROR ROUTINE	-	-	-	-	-	-	X
GO TO TAB-006	X	X	X	X	X	X	X

FIGURE 8. FILE UPDATING ROUTINE
FILE MAINTENANCE TABLE TAB-001

Directions of Further Development

In addition to the wider application of decision tables as a system-analysis and programming tool, a major area of future promise is the use of decision tables as a source programming language. To achieve the desired efficiency in object programs generated from decision tables, the user will have to assign frequency-of-execution values for the rules within a table and incorporate these values into the table. The compiler would, first, analyze the table; then, reorder the columns according to decreasing frequency of use; and, finally, generate an object program in which the number of condition tests for each path is inverse to the number of times the path is used. While this would increase compiling time, it would provide a high degree of object-program efficiency.

Further work is also required to develop more sophisticated decision-table methodology in specific application areas. In particular, studies are required to develop and evaluate techniques for the application of decision tables to the design and programming of large real-time systems, one of the areas in which the inadequacy of present methodology is most obvious.

Summary of Advantages of Applying Decision Tables

Experience with the use of the decision-table technique indicates it provides a number of important advantages in the system-analysis and programming areas:

(1) It forces a clear problem statement and shows where information is missing.

(2) It forces a complete logical description of the problem.

(3) It completely defines, at system level, decisions to be implemented.

(4) It leads to low-cost translation of a defined system into a working computer program.

(5) It permits development and orderly presentation of systems too complex for effective flowcharting.

(6) It allows extensive use of subroutines through the segmentation of the over-all system into logically manageable tables.

(7) It is a superior form of documentation for communication among system analysts, programmers and management.

(8) It is easy to update and revise and shows more clearly than flowcharts the effects system changes will have upon the decision logic.

(9) It permits system definition and description without imposing a premature sequence of problem-solving operations.

(10) It is a technique that is easily learned.

(11) Decision table language is suitable for direct translation into machine language; i.e., it lends itself to direct compiling.

The benefits are many. With relatively little effort and management direction, there is no reason why decision tables should be restricted to the few practitioners of the art whose complex problems have forced them to learn and innovate.

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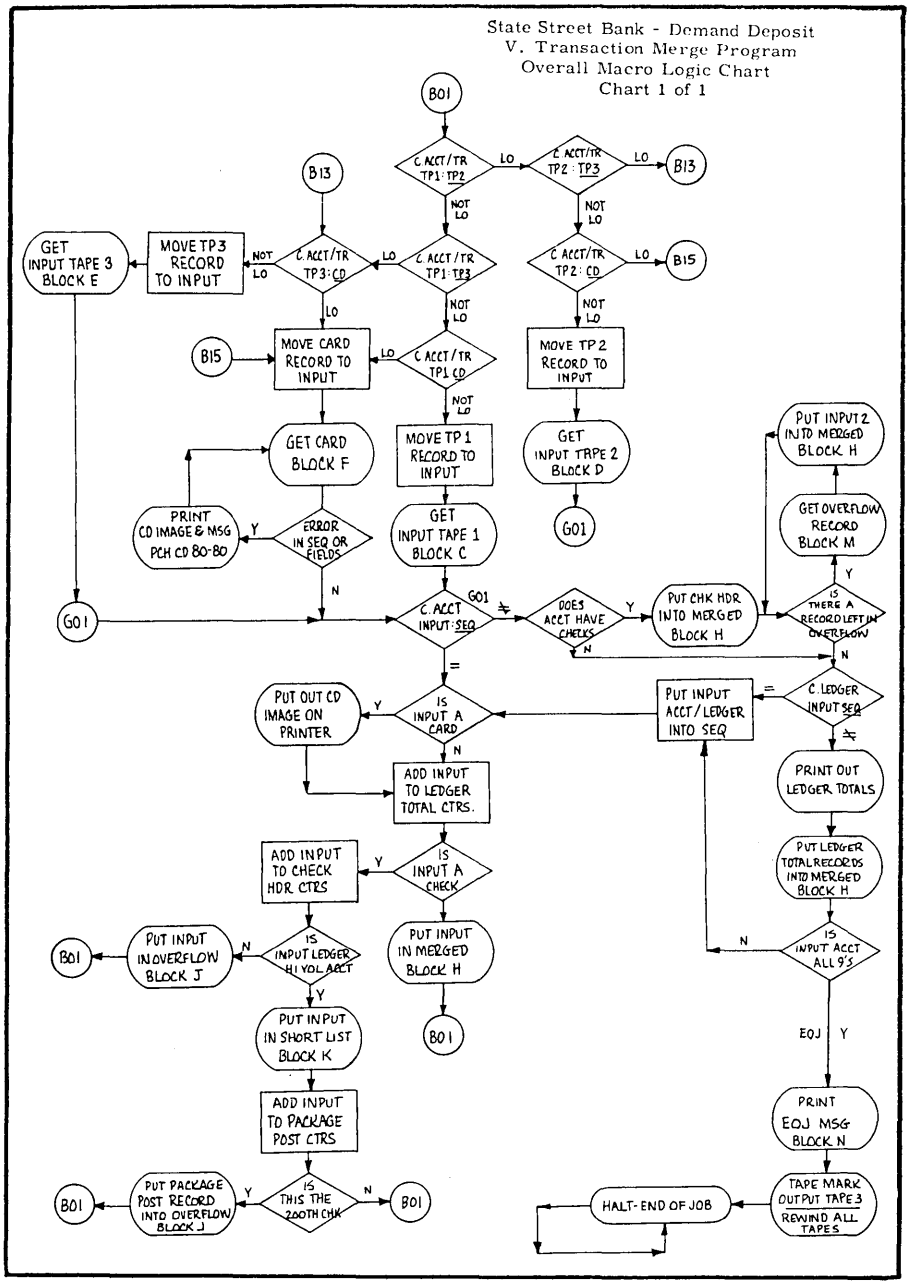
STANDARDS FOR COMPUTER PROGRAMMING PART 1



Example of a Macro-Block Diagram. (Courtesy, State Street Bank and Trust Company and The Diebold Group, Inc.)

In the second article of this series (see "Computers and Automation" for December, 1963), standards for systems analysis were described. Standards were established for the several tasks included in the systems analysis function. This process led up to the development of a Job Specification Manual which describes a system in sufficient detail to allow a program to be written. This article picks up at that point.

After the specifications of the job have been completed and expressed in a Job Specification Manual or its equivalent, the manual should be reviewed by the systems analyst, to assure completeness, before the actual programming of the job is begun. This will avoid much communication between the specifier of the job to be done and the programmer of the job, with consequent loss of time and other waste motion.

Assuming that the job specification is complete, programming is started, and the programmer then performs the following tasks:

- Logical analysis — translation of program functions into block diagrams to provide a graphic representation of steps the machine will follow.
- Coding — translation of the block diagrams into symbolic language.
- Desk checking — a detailed review and verification (before putting on the Computer) of program coding.
- Test data preparation — creation of input data samples to verify that all conditions will be properly recognized and processed by the program.
- Assembly and test — machine translation of the symbolic language into machine language, actual program operation under test conditions, and any correction of the programming needed to achieve correct performance of the job.

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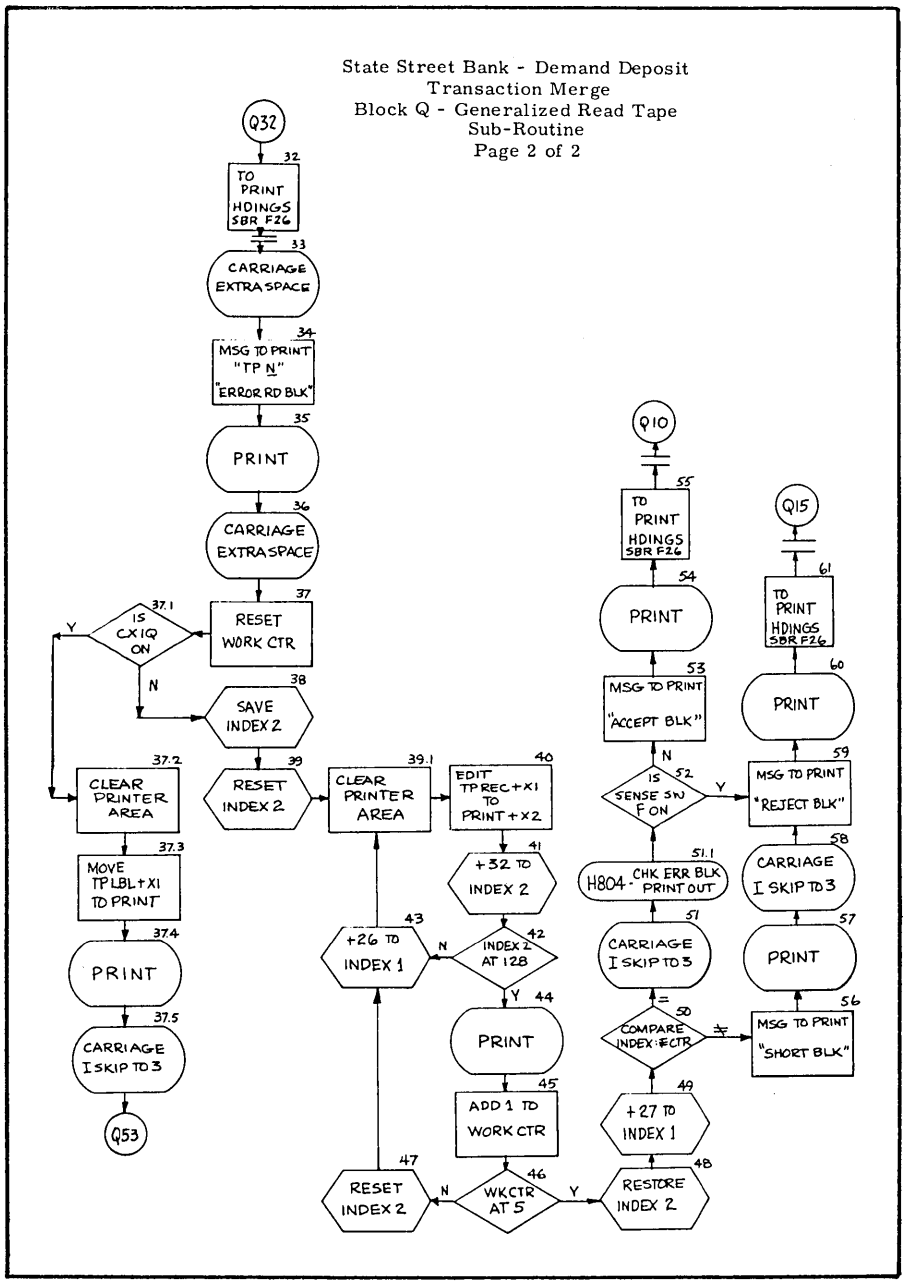

Example of a Micro-Block Diagram.

- Documentation — preparation of a detailed description of the correct program and its operation.

For each of these tasks, a rigid discipline is necessary to assure:

- A uniform product
- Efficient scheduling
- Performance evaluation
- Interchangeability of personnel

Block Diagrams

The programmer's first task, in organizing the computer solution of the problem, is to recognize major areas or blocks of the programming, which may be called *macro-blocks,* and make a diagram showing the relation of the macro-blocks. Each macro-block is then diagramed separately and on a much larger scale showing detailed operations, and these may be called micro-blocks.

Standards For Logical Diagraming

The drawing of block diagrams can become individualistic and arbitrary. To avoid this, a detailed set of rules should be drawn up and they must specify:

- Kind of diagrams to be drawn
- Format
- Method of diagraming
- Complexity or level of detail
- Coding scheme

Basic specifications, such as the following, should be included in the set of rules:

1. Two kinds of block diagrams shall be prepared for each program. The first shows the relation of the *major logic* steps of the program and are referred to as macro-

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block diagrams. The second kind is more detailed, showing the composition of *each* of the major logic steps. This kind is referred to as the *micro-block diagram.* (It is not necessary however to show one box or symbol for each machine instruction; if that were done, a diagram would hardly be necessary.)

2. The purpose of the macro-block diagram is to show all the major elements that make up the program and their relationships. The purpose of the micro-block diagram is to show the calculations and linkages which fulfill the objective of the program. Both diagrams should be machine-independent: i.e., The program logic shown should be translatable into the language of any machine of a suitable configuration.

3. Each symbol or block on the macro-diagram should correspond precisely to a micro-diagram on which the detail is shown.

Format Rules

Certain rules of format are necessary and must be specified, even though they may appear rudimentary. Do not allow assumptions to be made; instead state precisely the requirements. For illustration:

1. Paper shall be white bond, size 8½ x 11″. A margin of 1″ shall be maintained on the left side for binding. Reasonable margins shall be observed on all other sides.

2. All block diagrams shall carry a complete identification in a particular area or block on the upper right corner of the page. This block will show the following minimum information:

a. Program Number
b. Program Name
c. Programmer's Name
d. Date and Revision Number
e. Block Number and Block Description

3. The page number and the total number of pages (page X of Y) shall be clearly noted on the bottom right corner of each page of the diagram.

Method of Diagraming

Although the manufacturer-supplied template almost forces a uniform method of diagraming, basic rules and symbol definitions must be included as part of the programming standards manual. Variations should not be allowed, even if the programmer argues from the status attached to ownership of a ten-year old "original" template!

The operations shown should be concise and self-explanatory. Whenever symbols or abbreviations are used they should conform to established standards. Nonstandard abbreviations should be separately defined on a legend page to precede the block diagram.

Complexity

The most difficult standard to establish is the degree of block diagram detail. A meticulous programmer often draws too many blocks, thus creating a diagram with nearly as many symbols as program instructions. In this case the diagram is hardly necessary since the coding serves this purpose. A hasty programmer will frequently insert a symbol stating "calculate" or "update" without adequate regard to the many detailed steps that make up the calculation or the updating. It is necessary to control the level of diagraming, with such rules as these:

1. The program shall be divided into major logical segments or subroutines, referred to as blocks. Each program shall have no more than twenty-four (or some other stated number) of such blocks.

2. A program block shall be subdivided into logical functions called steps. Each program block shall have no more than 99 steps and no fewer than 10 (or other stated numbers).

The above illustrative rules serve to set limits on complexity. Dependent on the nature of the programs and the size of the computer, the limits may be changed to fit the circumstances.

3. A macro-block diagram shall be limited to one page. It shall show all links between the macro-blocks.

4. A micro-block diagram shall consist of not more than two pages for each macro-block. Only one macro-block may appear on any one micro-diagraming page.

Coding Scheme

It is necessary to provide appropriate linkage and permit cross references among the macro-diagrams, the micro-diagrams, and the coding. Therefore a meaningful coding scheme must be developed. The following scheme has been designed to provide a direct, automatic connection with the coding. It uses a "standard labeling system" discussed later in this article, which is often, though perhaps not always, applicable.

1. Each macro-block will be assigned a letter, in sequence, as related to the normal program flow. The first macro-block should always be assigned the specific letter, such as "A", and the sequence maintained through Z. Capital I and capital O should not be used.

2. Each micro-block within a macro-block shall be assigned a number from 01 to 99 consecutively. The general sequence of numbers is from top to bottom on the micro-block diagram page, but exact numerical order is not required. The number is written outside of the block symbol, on the upper right corner. (Later insertions and changes may be given a decimal notation within the same sequence.)

3. The macro-block diagram shall clearly specify the block letter for each of its macro-block symbols for which a micro-diagram exists.

4. "Exit connectors" shall be labeled with the macro-block letter and the micro-block number of the step to which an exit is made. If the macro-block letter is not shown, the connection must be made to another micro-block within the same macro-block. If the micro-block number is not shown, the connection must be made to micro-block X01, where X designates "temporarily undetermined." There is no need to indicate the entry connector, since the block letter and the symbol number appear clearly on the page.

5. The first symbol on each page shall be an entry connector denoting the block letter (macro-block letter) and symbol number (micro-block number) of the first step on this page. This will simplify review of diagrams.

6. Formulas and other special relationships in the logic of the program should be shown on the micro-block diagram on the right margin in a special oversize block. This will emphasize their presence, and the manner in which the depicted logic has been derived.

Character Writing Conventions

It is important that alphabetic and numeric characters be written clearly, so that key-punch operators can make the distinction between similar characters. The letter O is frequently confused with the number 0, since the con-

text in which they appear is often meaningless to a punch operator. Since the methods vary from one installation to another and programmers do change jobs, it is important that one set of characters is used. There are installations today using the symbols, O, Ø, Θ, Ɵ, and Ō, to distinguish the letter from the numeral, and other installations that use the same symbol for both letter and numeral! This should be changed.

CONVENTIONS FOR CHARACTER WRITING

CERTAIN SYMBOLS MAY BE MISTAKEN FOR OTHER SYMBOLS WHEN CODING SHEETS ARE BEING KEYPUNCHED.
THE FOLLOWING SYMBOL CONVENTIONS MUST BE STRICTLY COMPLIED WITH TO MAINTAIN A FLOW OF WORK WHICH IS ACCURATE.

NUMBERS

1 2 3 4 5 6 7 8 9 0

ALPHABETIC CHARACTERS

A B C D E F G H I J
K L M N O P Q R S T
U V W X Y Z

SPECIAL CHARACTERS

12-0	PLUS ZERO	0-1	SLASH
12-3-8	PERIOD	0-2-8	RECORD MARK
12-4-8	LOZENGE	0-3-8	COMMA
12-5-8	LEFT PARENTHESIS	0-4-8	PERCENT
12-6-8	LESS THAN	0-5-8	EQUAL
12-7-8	GROUP MARK	0-6-8	APOSTROPHE
12	AMPERSAND	0-7-8	TAPE SEGMENT MARK
11-0	MINUS ZERO	3-8	POUND SIGN
11-3-8	DOLLAR	4-8	AT SIGN
11-4-8	ASTERISK	5-8	COLON
11-5-8	RIGHT PARENTHESIS	6-8	GREATER THAN
11-6-8	SEMICOLON	7-8	TAPE MARK
11-7-8	DELTA		
11	MINUS		

Character Writing Conventions.
(Courtesy, Bulova Watch Co.)

Coding Standards

After the block diagram has been completed and reviewed, the program is ready to be coded. For all machines, the basic elements of coding format are:

- The identification: page and line number, to pinpoint sequence relationships.
- The label or tag: a name or number assigned to an instruction or a constant, for convenient reference.
- The operation code: the name or numeric designation of the instruction to be executed.
- The operands: the address(es) of the data to be operated upon, with increments, indexes, or other designations, according to the machine characteristics.
- Comments: words of explanation.

The best standards for coding therefore include rules for:

- Coding format
- Coding method
- Program organization

Standards established for coding are generally the most significant. The program code listing is used to test, change, review, or segment the program. The code listing to be intelligible to everyone concerned must therefore be written in a standard manner. The listing must also relate directly to the block diagram, so that standards must include a method for linking the two.

The Use of Mnemonics

Machine coding is oriented to computer design. Machine instructions and addresses are usually meaningless abbreviations of letters and numbers.

The lack of standards (and disciplined adherence to them) in the use of these abbreviations is a major factor in preventing information exchange and understanding among programmers. One programmer may call his first instruction START, another BEGIN, and still a third by the name of the first function performed, such as READ. In large programs, which may require from 400 to 1,000 distinct mnemonic tags, confusion and lack of organization prevail. Misspelling, duplication, lack of sequence, and loss of meaning all contribute to the continuing confusion; the establishment of a rigorous discipline is almost the only way in which these unnecessary problems can be eliminated.

A further disadvantage of programmer-generated mnemonics is that it becomes extremely difficult to check a large program completely.

The burden of assigning distinct names to many program elements frequently forces programmers into a second language, to prevent duplication. It is not uncommon to find French or German tags, proper names, and even zoological names such as CAT and DOG in a large program. The lack of relevant meaning of such tags further obscures the complexity of the program.

The coding standards developed on the following pages limit the programmer's ability to generate personal mnemonics. Although this may cause initial resentment among programmers, the expense of a program which cannot be understood by anyone except its author is never justified.

Coding Format

The format of the coding is restricted by the format which the symbolic translator uses. There are certain rules which further assist uniformity. Illustrations of such rules are indicated below:

1. The language or translator to be used shall be . . . . . (For example; "All 1401 programs shall be assembled using the Symbolic Programming System. Autocoder and the Report Program Generator may not be used unless permission is given by the Data Processing Manager. All 7090 programs shall be written in FORTRAN. FAP may be used only in cases where FORTRAN cannot be used, and only with permission of the Data Processing Manager.")

2. All coding sheets shall carry the programmer's name, program name, program number, and date of completion.

3. Page numbers shall be assigned in numeric sequence. An extension of this rule segregates page numbers for certain functions as:

Page 00 for Identification and Statement
Pages 01 to 10 for Input-Output System
Pages 11 to 20 for Housekeeping Functions
Pages 21 to 79 for Main Program
Pages 80 to 89 for Areas
Pages 90 to 99 for Constants

4. All coding shall be in pencil, using a soft graphite lead to facilitate erasure and correction. Erasures shall be made completely.

5. All coding shall be double-spaced to permit proper positioning of insertions. The last five lines of every page shall be left blank for later insertions.

6. Insertions made at the bottom of the page must be given a line number to correspond to the place where the instruction is to be inserted. In addition, the place where the insertion is to go shall be marked with an arrow in the left hand margin to allow easy review of coding.

Coding Method

To prevent the use of individual mnemonics and to insure readability, the framework of standards should be simple, yet provide uniformity to the point where two programmers referring to the same point in the program will unconditionally use the same tag. Similarly, two programmers using the same constant must use the same tag, thereby conserving memory space. Sample rules follow:

7. Comments shall be given and maintained for all lines of coding where appropriate. These comments shall be written in English in the space provided in concise, terse phrases descriptive of the function of the instruction. It is good practice not to spread comment sentences across more than one line; if this is done, subsequent insertions will destroy the meaning.

8. A Comments card shall be inserted at the beginning of each new macro-block specifying the block letter and the block name or function. If the routine is a generalized subroutine, it shall also specify the conditions of entry and exit. (Comments cards use the operator TITLE, SAY, REM, etc., to indicate a pseudo-operation which produces a listing line only.)

9. Whenever a major logical change occurs within a block, a Comments card will be used (it may be left blank to generate an extra space on the listing).

10. Whenever it is necessary to use a reference label for a constant or an instruction the standard labeling system outlined below will be used. Variation from the standard labeling system is not permissible except as noted. If it is necessary to use a series of designations for special purposes, the scheme used should be noted both on the program listing and in the documentation.

Standard Label System for the 1401

The method suggested below for standardizing labels represents what is believed to be a new approach to the problem of coding uniformity, applicable particularly to the IBM 1401. (The actual standards used depend on the machine, type of translator, permissible size of the labels, and the degree of complexity settled on. The suggested approach for designing a standard labeling system consists of analyzing the labels used in an average program, and determining major classifications, and then developing a coding scheme for each major category of label.)

According to a requirements analysis, the major breakdown of label types appeared to be as follows:

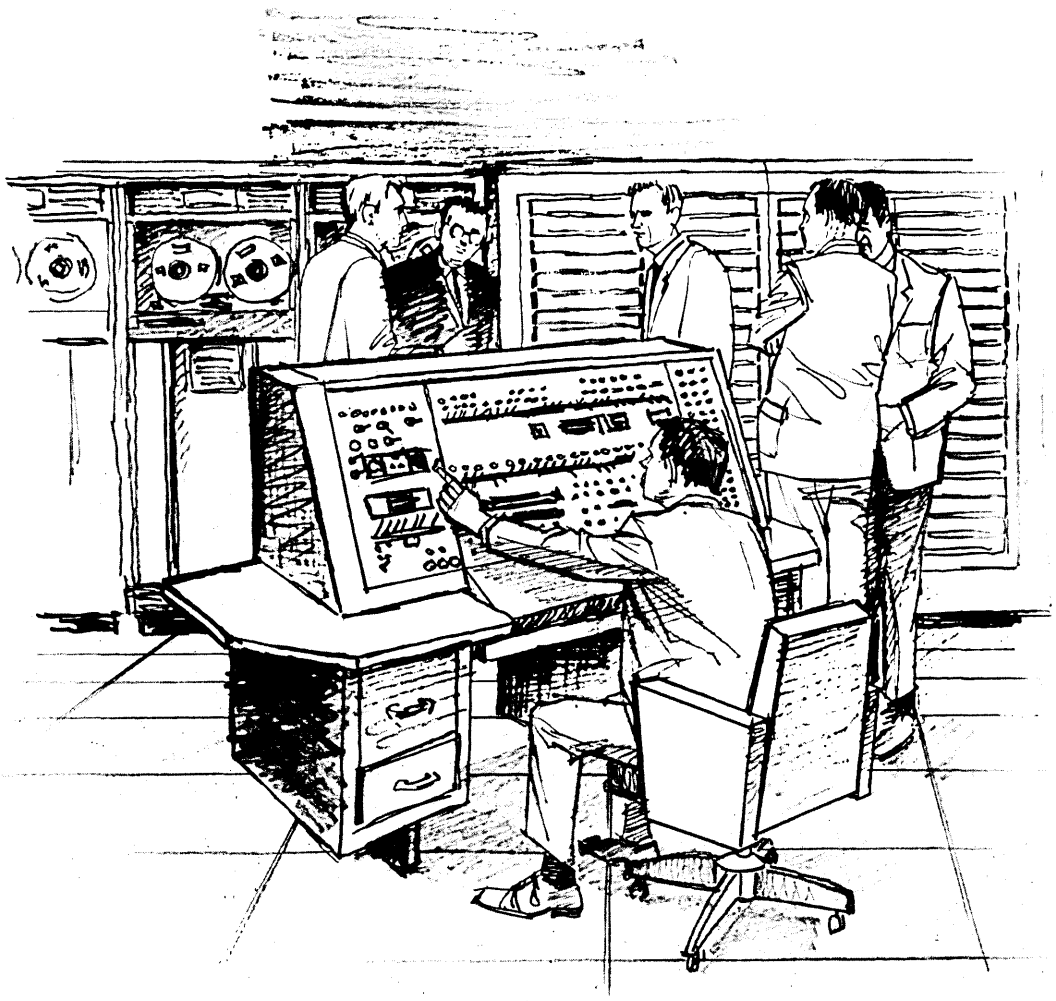
- Instructions (Branch points)
- Areas
- Constants
- Halts

Character 1											
A AREA	Char. 2	L - LABEL AREA		T - TAPE AREA		P - PUNCH CARD AREA		R - READ CARD AREA			
	Char. 3	Unique Character to Define The File as Specific File Within Program									
	Char. 4 - 6	Blank for Overall Area Name Mnemonic for Field Name				Blank for Overall Area Name Equivalent Card Column Number					
B BRANCH POINT	Char. 2	Block Letter - From Diagram - Do not use I, Ø, S, X									
	Char. 3 - 4	Step number - From Diagram Left justified, including leading zero.									
	Char. 5 - 6	Instruction number Left justified, omit leading zero.				USE ONLY IF REQUIRED					
H HALT	Char. 2 - 4	Halt Number (Location of Halt / 4)									
C CONSTANT	Char. 2	L LITERAL	N NUMERIC	C COUNTER	W TEMP WORK AREA	E EDIT WORD	T TABLE	X SWITCH	A ADDRESS CONSTANT	H HEADING	M MESSAGE
	Char. 3	SIZE OF CONSTANT (CODED ALPHA IF EXCESS 9)					Entry sz.	Switch	Block Letter	Report Number	Mnemonic Message Name or Contents
	Char. 4	Actual last three significant Characters		Block Letter		Size of Data Field	No of Entries	Number	Step Number		
	Char. 5			Step Number		Number of Decimals	Entry Number				
	Char. 6	No Sign	Sign Control			Block Letter			Instruction No., If Required	Heading Line No. if > 1	
		L	N	*C	*W	*E	T	X	A	H	M

* Elimination of block and/or step results in the establishment of a reusable constant.

Note: Where a tag cannot be properly identified, the use of an X in the 6th position will signal the tag as a rule exception. This exception can only be made if a condition does not fit the standards outlined above.

Summary of the Standard Label System.



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A maximum of characters may be used in the 1401 Symbolic Programming System. In the standard label system, major label type designations are given one alphabetic character:

- B for Branch point
- A for Areas
- C for Constants
- H for Halts

The SPS requires that all tags start with a letter. The above four letters make it impossible to accidentally use a number.

It is now possible to use the other 20 letters of the alphabet (excluding I and O) with complete freedom for standard "closed" subroutines, which can become a part of any program.

The remaining five characters of the tag are used in each of these categories as follows:

B-Branch Point: In order to provide both sequence and linkage to the block diagram, the second character of the label will be the block letter, and the third and fourth character will be the step number. Thus, the first instruction of most programs is tagged BAO1, indicating the first step of block A. A branch to BN24 which occurs in the D block can immediately be traced to the N block, which should follow the M block on the listing.

A-Areas: — Using the 1401, four basic input-output areas can be defined:

- L for Label Area
- T for Tape Area
- P for Punch Area
- R for Read Area.

Since the read and punch areas are in fixed locations, the latter two categories are used only to indicate additional storage areas for card images.

The second character of the Area label is used to distinguish the area type. AT refers to a tape area, and AL to a label area.

C-Constants: The designation for constants is the most complex but also the most helpful in debugging and program review. The second character of any C-tag always designates the type of constant:

L for Literal — an unsigned numerical constant

N for Numeric — a signed algebraic constant

C for Counter — a field into which other fields are accumulated

W for Work area — a field used as temporary storage

E for Edit word — the mask control word used in printer edit operations

T for Table entry — a storage area for a related group of data

X for Switch — an in-memory device for program switching

A for Address constant — the actual address of another variable

H for Heading — the page headings used on printed reports

M for Message — a notification to the operator of action required or taken.

The most useful and the most frequently used types are the Literal, the Counter, the Edit word and the Switch.

H-Halt: Characters 2, 3, 4, and 5 are used for the number of the halt. A halt numbering system is defined in a later section of this article.

The system may at first appear complex, but very short experience with a standard labeling system of this kind makes it completely familiar to the user. The sudden acquisition of the ability to review easily other programs as well as ease of desk checking and testing, rapidly convinces the user of its merits. In reviewing hundreds of programs, the author has found that the total time for review can be reduced by half when a standard label system is used.

Since it is possible to have exceptional conditions which do not fit the coding scheme outlined, one additional rule provides that any label which is "non-standard" must have an X in the 6th position.

Program Organization

It is necessary to indicate rules for the manner in which coding should be organized to make up a complete program. Two kinds of rules are required; the first sets up the original organization of the symbolic entry deck, which will then produce a consistent listing. The second relates to the set-up of the object program produced by the translator. This should be done in a standard manner so that the sequence of input information can be controlled. Both kinds of rules are illustrated below:

1. The first page of coding of each program shall consist of Comments cards which carry the following information:

- Program number
- Program name
- Programmer name
- Revision date and revision number
- Console set-up conditions
- Alternation switch usage
- Input-output device usage
- Input tapes to be mounted
- Output tapes to be mounted

During testing the programmer or operator will thus be provided with complete operating instructions as a part of the program listing. It will then act as temporary documentation in advance of the final operating manual.

2. All temporary routines used for initial housekeeping functions should be located following the identification information. This includes assignment programs, execute routines, or basic housekeeping such as printer line-up, or date card entry.

3. The next program segments to be loaded are the main blocks of the program, in sequence by Block Letter.

4. Standard subroutines follow, in sequence by subroutine designation.

5. Area definitions are next, in sequence by type and file identifier.

6. Constants are last, in direct label order.

7. The last item in the symbolic deck is a card, indicating the end of the program. (Using the 1401 Standard Label System, this will always have the format END BAO1.)

Similar rules can be established for the organization of the object deck, which is in constant use by the operating department. If variable data must be added to the program or entered each day in the run, then it is best to color code segments of the deck where the variable data is entered.

Programming Rules

Rules should be established for the actual coding in order to prevent common errors and to improve quality. These can be grouped in the following categories:

- General programming rules
- Machine-imposed rules
- Symbolic translator rules

General Programming Rules

Typical general programming rules are indicated below.

1. *Never* use a part of an instruction as a constant. This creates confusion and may cause errors if program changes are required.

2. In establishing a loop, always reset the loop at the beginning, not at the end.

3. Never assume that memory has been cleared (set to blanks or zeroes) at the beginning of the program. Always clear the necessary areas during initialization.

4. Always set counters and switches to their initial conditions during the housekeeping operation.

5. When reading input created externally to the computer, always check the validity of the information.

6. *Never* use address adjustment to refer to instructions. Always use a label.

7. Always print a heading on blank paper; this is an excellent way to sell management on the effective use of the system.

Machine-Imposed Rules

Rules imposed by the design of the machine should be divided into two categories for emphasis. In the first category are the machine restrictions that must be observed; the second category should be presented as a list of common causes of errors. As examples:

For the IBM 1401: When using Edit (e), the number of blanks and zeroes in the control field may not be less than the number of characters in the data field.

Many other rules are possible; the most important factor to be considered is that the rules are documented in a central location so that novice programmers can benefit from the experience of the rest of the staff.

Standard Halts

It is a very common practice for programmers to number halts in a fairly random manner. Some use a consecutive system, others use simple configurations of numbers, and others use their own telephone number to signal critical conditions. Even though this practice has certain direct advantages, it is better to use a system of standard halts which will enable rapid recognition by the operator.

Halts should be standardized in two categories. Each installation should establish a series of halts which are standard for all programs and are included as a standard package in all programs. It is obvious that all programs will have an "end-of-job" halt; it should not be discretionary with the programmer to assign a unique number since it should be rapidly recognized. Other standard halts include:

- Sequence error
- Printer line-up
- Tape reading error
- Tape writing error
- Input tape end
- Output tape end
- Tape label error, input
- Tape label error, output
- End of phase.

If operator decisions can be avoided altogether, the amount of rerun time will be greatly reduced.

The next article in this series "Programming Standards, Part 2," continues with a discussion of standards for the functions of program testing and program documentation. This article will appear in a subsequent issue of *Computers and Automation.*

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3. FREQUENCY OF ISSUE: monthly	
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5. LOCATION OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS *(Not printers)*: same	
6. NAMES AND ADDRESSES OF PUBLISHER, EDITOR, AND MANAGING EDITOR	
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POD Form 3526 Aug. 1963

THE PUBLIC IMAGE OF COMPUTING

Harold J. Bergstein
Computer Sciences Corporation
El Segundo, Calif.

What is the public's impression of computers and computing — and what should it be? In publishing this provocative and controversial essay by Harold Bergstein, formerly an editor in the computer field, we invite more discussion of this significant subject.

Once upon a computer salesman, there was little concern about the public impression of fun and sport in flashing buttonland. The fundamental premise which heralded the opening of the computer grab bag during the post-von Neumann era was a simple one:

> Every good business executive and government agency deserves a computer. Or perhaps two computers. The first one is necessary for the proper maintenance of modern procedures and high fashion. The second is reassuring.

During the early and mid 50's, the frequently asked question "How do those things work?" was often ignored or abruptly answered, "It's none of your business."

At this time, professionals in the computer field were largely concerned with technical directions for their industry, such as to centralize or decentralize; to enlarge memory capacities or speed existing cores, and of course, how to program in or around various black boxes. Computer salesmen were a breed apart and rarely considered professionals by professionals.

Public Favor and Government Funding

However, as the motivation for resolving many technical issues became stimulated by specific customer requirements, computerites suddenly shed their well buffered robes in order to obtain public favor and government funding. They were confronted in their nudity by the perplexed stares of nervous consumers and requests for satisfying some basic curiosities.

The result was a barrage of adulterated science fiction and pretentious sales literature which proved embarrassing to the conscientious practitioner of computing skills. Magic brains, electronic gadgetry and odors of 20th century sorcery ruled the day.

To fill the information vacuum, industry "spokesmen" of the self-appointed variety became active in defining the field to the public. Even the social implications of computing were outlined in considerable depth by this dubiously select group of leaders and subsequently, misinterpreted by their peers in both organized labor and management.

By the late 50's, the resultant conglomeration of external reporting about the industry was further burdened by the

advent of the public relations "objective." This pot of gold was often pursued by observing the dictum that the larger number of favorable mentions obtained for a client, the more salable will be the client's wares.

Menace

Today, the public's image of computing may be compared to viewing an oddly dressed mannequin in a department store window. The clothing appears expensive; the function is misunderstood, and while the shape of the figure is easily recognized, there is a suspicion that this oddly clad display will someday leap through the glass and physically attack the onlooker.

An indictment of such severity warrants the support of specific examples. Consider the following headline in a recent edition of the Los Angeles Times, "MATHEMATICIAN SAYS COMPUTER IS MENACE."

Reporting on an interview with ACM President Dr. Alan Perlis, the Times article explained, "western civilization has turned away from man as an ideal and substituted the 'super computer.'"

The not-so-super computer, however, was responsible for the following Associated Press story, "Couple, 81, and 62, Got Together by Computer, Start Honeymoon."

The use of a card sorter was apparently required to encourage the belated nuptials and the questionable success of the gimmick has rarely been repeated.

Unemployment

In a more serious vein, the onrush of headlines, features, and frantic messages related to unemployment and computers are seldom without implicit bias and threat. The director of the U.S. Office of Manpower, Automation and Training, Dr. Seymour Wolfbein, has frequently been quoted as pronouncing "22 million jobs will be lost to automation by 1970" and 12.5 million new workers will be looking for jobs in the same period.

Such constructive evaluations are subsequently qualified in a less obvious segment of the text to the extent that most workers will find new jobs and the gross national product has been increasing rather substantially since the advent of the computer.

But when the gloom of the future is supported by such professionals as Dr. Wolfbein and Dr. Perlis, it is difficult to be optimistic about the public's impression of the industry. The director of the computation center at Carnegie Tech is quoted as looking upon the future of mankind "with foreboding, foreseeing a time, not too distant, when the machine may actually have succeeded in mechanizing man and robbing him of creativeness, imagination, emotion, and tolerance."

Scientists and engineers who are leading mankind down this path to a mechanistic future are little concerned with what they are bringing about, the Perlis report continues.

Their attitude, he said, is best expressed by the phrase, "So what!"

In recent months, the state of reporting on the industry has improved considerably and a heretofore unhealthy image is being fed some necessary medication. Examples include an extensive two-part series in the New Yorker and a five-part series on computing in Fortune.

However, professionals in the field should take cognizance of their own problems which contribute to the confusion and maze of unrealistic evaluations.

Lack of Definitions

For example, the industry lacks basic definitions of such innocent essentials as "computer," "programming," and "system."

In addition, the varied divisions of the industry provide the occasional onlooker with an initial appearance of chaotic behavior. Business data processing and scientific applications appear to some as remotely connected as analog and digital computing, logical design and systems programming, or special and general purpose applications.

If computing people are to be considered professionals, is there an organization which truly represents the field? The layman must ask with good reason why there is a need for AFIPS, IFIPS, ACM, DPMA, Simulation Council, SHARE, POOL, GUIDE, JUG, BEMA, ASA, X.3.2.4.5.-6.7.8, etc. The answer is difficult to rationalize with logical honesty.

Even the size of the industry in terms of personnel, companies, number of installations or applications is difficult to accurately determine. For example, is a tab room supervisor a member of the computer field and if not, does this same individual achieve a form of magical status if his domain suddenly includes a 1401 or another small, internally programmed machine? Many individuals boast of 25 years experience in the field despite the advent of ENIAC in 1947.* And even the beginnings of the field appear confused. According to some rather biased versions, Hollerith was a co-inventor of the Babbage machine.

As for the producers of equipment, there is a corresponding lack of clarity as to what constitutes a computer manufacturer. For example, does a firm selling calculators improve its reputation by referring to its product line as "high speed electronic computers"? And are manufacturers whose output consists largely of micro-miniaturized hardware for the aerospace field, to be considered competitors in the general-purpose arena?

Self-Regulation

While other professions provide self-regulation on the promotional activity of their members, the computer field offers no such protection to the consumer. In no other industry is a product announced and fully treated in technical literature several years prior to its availability with implications of off-the-shelf delivery. Other industries frequently abort the application of computers in promotional literature, television commercials, etc., and yet there has never been sufficient interest evidenced by computing professionals to provide cautionary or punitive action against the offenders. An excellent example is the recent television commercial which offers the "unbiased" computer as testimony for the virtues of a leading brand of toothpaste. In professions such as medicine, law, and even the closely allied field of accounting, associations exercise a strong discipline over unprofessional activity associated with their respective fields. However, in an industry that is and will continue to be intimately associated with every aspect of the public welfare, the computer field has never encouraged the disciplines implicit in a strong professional society.

As a speculative source for investment, the computer field has both disappointed and handsomely rewarded its early supporters. Widely recognized for its "losers," the industry and its manufacturers are now turning their economic corners and earlier reputations for virtually uncontrolled spending are being drastically revised. With some obvious exceptions, the balance between earnings and stock price is leveling to a position of reasonable stability.

An important aspect of the industry which has contributed to an unfavorable image concerns the experience of initial users with hardware and programming. In numerous

* *Editor's Note:* Professor Howard Aiken's Harvard-IBM Automatic Sequence-Controlled Calculator began operating in 1944; Vannevar Bush's First Differential Analyzer began operating at Mass. Inst. of Technology in 1930; etc.

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installations and in virtually every new application, users are discovering the high cost of economizing.

In the conversion from card to computerized operations, the potential economic advantage is seldom realized during the initial year or two of operation and in fact, a substantial increase in costs frequently occurs. As management demands greater accountability for their computer operations, real cost factors are becoming known and disenchantment quickly follows. The present status of the field is one in which inexperience dominates in many installations and the accompanying cost during training and stumbling exercises is far higher than basic salaries indicate. At present, manufacturers have been unable to meet the demand for adequate programming support, and users frequently resort to the classical accountant or management consultant firm in which inexperience may be disguised by publication of comprehensive reports fully analyzing a problem but failing to provide for its solution.

Professional Qualifications

Unlike other professions, qualifications for professional services are neither apparent nor implicit. There is no industry-wide method of evaluating either individuals or firms; and professional opinion within the industry ranges widely on the degree of competence or for that matter, its definition. The Data Processing Management Association has been a lonesome leader in the field attempting to establish basic credentials. Nevertheless, it should be noted that the DPMA effort is only an initial stab into darkness and many years ahead of reasonable accomplishment of its goal. The Association for Computing Machinery has sponsored no such activity and at present, it is unlikely that the older association will lend its "dignity" to such a program.

Since education is an important remedy in curing a distorted image, encouragement of professional efforts in this area is strongly recommended. Once again, however, efforts remain disorganized and while improvement has been indicated recently and there are many glowing words of respect for the role of education, curriculums at all levels of learning are in a state of apparent disarray.

Leadership from the universities has shown remarkable improvement during the past few years, but is still far below the quality and quantity needed for a broad professional educational program in computing. Manufacturers have been far too preoccupied conducting customer training and sales courses to have significantly contributed in the direction of computer education. Professional associations have shown considerable interest in sponsoring divergent activities but do not seem to share agreement on such fundamentals as what should be taught and to whom.

Applications of Computers

The burgeoning number of new applications for computers has done much to interest the public in the profession although at the same time, it adds to the general confusion. In most reporting on the field, there has been little segregation between interest in artificial intelligence, for example, and the conduct of inventory or payroll problems; trajectory analyses are frequently intermingled with stock market projections; and discussions of critical path methods are included in articles describing numerically controlled machine tools.

The fact that many new applications are still in early stages of conception and many years removed from practical accomplishment, does not seem to hamper current

propaganda devoted to proclaiming another "first" in the field. Articles in publications such as Time Magazine have reported on a professional conference by stressing such oddities as how computers are being used in varying the parameters in swimsuit design and the preparation of sausage recipes. Complex systems for airline reservations, defense communications, and information retrieval are described as if their operation had been successful for countless years. In the latter instance, accuracy of reporting may well prove harmful to the manufacturer or user and is seldom encouraged. In this case, the glittering generality is preferred and when the consumer is ultimately confronted with the facts of schedule slippage, disrespect for the industry and its professionals becomes apparent.

Automation?

It is in the field of unemployment and computers, however, that the industry has suffered the most serious damage to its reputation. The lack of discrimination between the use of computing equipment and automation in general has resulted in a grotesque lumping together of all facets of manual labor replaced by a device. Although it has been frequently pointed out that electric pencil sharpeners and conveyor belts are not reasonably comparable to computers, the computing industry has been characterized as the principal contributor to "automation." It is, therefore, peculiar that whenever committees are established within the Federal Government to study the problem, computer professionals are seldom invited to participate.

"Spokesmen" for the industry are still largely self-appointed and self-perpetuating. Their concern for the problem is vastly limited by their experience in the field and their conclusions indicate that the problem either does not exist or it is of such gravity as to warrant considerable personal publicity for the purveyors of gloom. Seldom has a professional association in the computer field taken an active stand to foster a program to study the problem. One fact, however, remains unfortunately clear and that is the public response which hovers about fright and uncertainty. It is reasonable to assume that the image of the profession could be improved by specific attention devoted to a program of fact finding and dissemination on unemployment and its correlation to the introduction of computers.

Improvement of the Image

In the near future, the image of the computing field will undergo the close scrutiny of a variety of audiences including students considering the profession as a career, business executives attempting to swell the ranks of new users, and legislators influenced by the fears of constituents and their individual exposure to the future effect of the industry on society.

Acceptance of the rationalization "we're still a young industry" is gradually diminishing as demands increase for signs of professional maturity.

The leadership for movement in this direction still lies dormant within the ranks of the industry's younger participants. The motivation for improvement of the profession must be stimulated from individuals who have not yet indicated an active concern for the reputation of their profession.

Unlike the magic wizardry associated with the computer, there is no magic to improve the image of the industry. Regretfully, it requires work!

CALENDAR OF COMING EVENTS

April 7, 1964: Control Data 160 and 160-A Users Group (SWAP) Meeting, Hilton Hotel, Albuquerque, N. M.; contact J. L. Tischhauser, Organization 7242, Sandia Corp., P. O. Box 5800, Albuquerque, N. M.

April 8-10, 1964: Control Data Large Scale Computer Users Group (CO-OP) Meeting, Hilton Hotel, Albuquerque, N. M.; contact J. L. Tischhauser, Organization 7242, Sandia Corp., P. O. Box 5800, Albuquerque, N. M.

April 13-15, 1964: 3rd Symposium on Micro-Electronics, Chase-Park Plaza Hotel, St. Louis, Mo.; contact H. H. Margulies, P. O. Box 4104, St. Louis, Mo. 63136.

April 15-17, 1964: Spring Meeting of Honeywell 400 Users Association, Executive House, Chicago, Ill.; contact Norman P. Teich, Honeywell EDP, 60 Walnut St., Wellesley Hills, Mass. 02181.

April 19-22, 1964: 1964 National Convention of the Association for Educational Data Systems, Santa Barbara, Calif.; contact Don D. Bushnell, System Development Corp., 2500 Colorado Ave., Santa Monica, Calif.

April 20-22, 1964: Univac Users Association Spring Conference Meeting, Sheraton-Chicago Hotel, Chicago, Ill.; contact David D. Johnson, UUA Secretary, Ethyl Corp., 100 Park Ave., New York 17, N.Y.

April 20-24, 1964: Institute on Research Administration, The American University, 1901 F St., N.W., Washington 6, D. C.; contact Marvin M. Wofsey, Asst. Director, Center for Technology and Administration, The American University, Washington 6, D. C.

April 21-23, 1964: 1964 Spring Joint Computer Conference, Sheraton-Park Hotel, Washington, D. C.; contact Zeke Seligsohn, Pub. Rel. Chairman, 1964 SJCC, 326 E. Montgomery Ave., Rockville, Md.

April 22-24, 1964: SWIRECO (SW IRE Conf. and Elec. Show), Dallas Memorial Auditorium, Dallas, Tex.

April 24, 1964: Digital Equipment Computer Users Society (DECUS) Spring Meeting on Information Processing, Hotel Washington, Washington, D. C.; contact Elsa Newman, Digital Equipment Corp., Maynard, Mass.

May 4-5, 1964: 5th National ISA Chemical & Petroleum Instrumentation Symposium, du Pont Country Club, Wilmington, Del.; contact G. H. Robinson, Engineering Dept., E. I. du Pont de Nemours & Co., Wilmington, Del. 19798

May 4-6, 1964: 10th National ISA Aerospace Instrumentation Symposium, Biltmore Hotel, New York, N. Y.; contact J. Stotz, Jr., Grumman Aircraft Engineering Corp., Plant No. 5, Bethpage, L. I., N. Y.

May 4-7, 1964: 2nd National ISA Biomedical Sciences Instrumentation Symposium, Student Union, Univ. of New Mexico, Albuquerque, N. M.; contact Dr. P. F. Salisbury, St. Joseph Hospital, 501 So. Buena Vista St., Burbank, Calif.

May 5-6, 1964: 5th National Symposium on Human Factors in Electronics, San Diego, Calif.; contact Wesley Woodson, Convair Astron. Div., San Diego, Calif.

May 11-13, 1964: NAECON (National Aerospace Electronics Conference), Biltmore Hotel, Dayton, Ohio; contact IEEE Dayton Office, 1414 E. 3rd St., Dayton, Ohio.

(Please turn to Page 58)

READERS' AND EDITOR'S FORUM

(Continued from Page 9)

Table 1

EMPLOYMENT[1] AND GROSS NATIONAL PRODUCT[2] BY OCCUPATION

	1950	1960
Manufacturing[3]	12,523 / $81.9	12,417 / $140.9
Wholesale & Retail	9,386 / $54.0	11,571 / $ 89.1
Finance, Insurance and Real Estate	1,919 / $30.3	2,793 / $ 61.3
Service	5,382 / $25.8	7,757 / $ 54.9
Government	6,026 / $23.6	9,185 / $ 52.9
Construction	2,333 / $12.6	2,696 / $ 23.8
Transportation[3]	4,034 / $15.8	3,925 / $ 22.4
Mining[3]	901 / $ 8.2	647 / $ 11.0

[1] in thousands of people

[2] in billions of dollars

[3] decreasing number of employed, and rising productivity

The fear many average people have of being replaced by a machine is not imaginary. An interesting statistic supporting the fear of the worker[5] is that since 1949 a billion dollars upswing in the business cycle meant between 45,000 and 65,000 new jobs. In the most recent upswing each billion dollar advance added fewer than 3,700 jobs. The historically established relationship between high productivity and high employment is being destroyed.

More and more we are beginning to realize the incongruity existing side by side across the nation of high earnings and a high standard of living for those employed, while the unemployed, 5.9% of the working force, stumble in search of an open door to a steady income, a chance to contribute in a worthwhile way to our economy. If America's conscience awakens to the plight of the unemployed, a giant step will have been taken toward a solution for the problem. The program Congress has begun must be strengthened. Employers, most particularly those who have highly automated plants, should be invited to serve on the governing boards of *local* employment centers, so that they can participate in a more concerted effort right at the heart of the problem, and so work towards attaining the goal of full employment by 1970.

Table 2

THE UNEMPLOYED

by Age and Calendar Year
(in thousands of people)

Age	1957	1958	1959	1960	1961	1962[6]
14 to 19 years	574	757	727	792	921	816
20 to 24 years	429	701	543	583	724	636
25 to 44 years	1,072	1,865	1,308	1,424	1,738	1,401
45 to 64 years	749	1,202	1,009	1,009	1,266	1,015
65 and over	112	155	135	121	158	140

BIBLIOGRAPHY

1. Statistical Abstract of the United States, 1963, U.S. Dept. of Commerce
2. New England Business Review
3. New England Business Review, September, 1962
4. Op. Cit., Statistical Abstract
5. "The Personnel Administrator and Technological Change," Ida R. Hoos, *Public Personnel Review*, July 1963
6. Op. Cit., Statistical Abstract

c & a
CAPITAL REPORT

A Special Report from C&A's
Washington Correspondent

COMPUTER CONSULTING FIRMS have received some resounding pats on the back through recent words of two Government officials in Washington. Biggest boost came from Charles C. Weaver, of Agriculture's Office of Management Appraisal & System Development. Weaver addressed himself to the problem of the Government EDP user who does not have the in-house ability to properly evaluate and select computing hardware. He said this user should go to the outside consulting firm for help rather than to the manufacturer, because the latter traditionally emphasizes the strong points of his equipment.

Weaver also took up the problem of overall Federal EDP selection and again plugged the consultant. "If the Government had to choose between building the capacity to correctly select equipment and going to the private consultant, I would pick the latter," he said.

A less categorical but still significant boost came from Brig. Gen. Kenneth G. Wickham, commander of the Army Data Services & Administrative Systems Command, which oversees Army's business-type EDP services in the U. S.

Gen. Wickham told a meeting of systems men that although the military's past experience with consulting firms has not generally been a happy one, the Army is now "on the threshold" of using such firms. Although he did not elaborate, the change in thinking is obvious.

BOTH THE NEW YORK AND THE AMERICAN STOCK EXCHANGES are being pushed to automate the surveillance of stock transactions. Securities & Exchange Commission Chairman William L. Cary told the House Subcommittee on Commerce & Finance recently that computers could bring "dramatic improvement" in the ability of the exchanges (and SEC) to fulfill their regulatory responsibilities.

Cary told the subcommittee that part of the necessary surveillance is reconstruction of the market for particular days by "time consuming manual methods" that result in data "often inaccurate and incomplete." To remedy this problem, SEC "... is insisting that the New York and American Stock Exchanges develop programs to assure that automated surveillance techniques are used to the maximum extent feasible."

Advantages of automated reporting listed by Cary include:

(1) Comprehensive surveillance rather than on a sample or partial basis;

(2) Continuous review by the exchange of each specialist's performance instead of only for eight weeks out of the year as at present;

(3) Improvement in timeliness of surveillance — several kinds of "rule violations" could be detected almost immediately after they occur on the floor of the exchange;

(4) Enhancement of quality of surveillance through availability of more accurate and complete information.

INDUSTRY WILL BE BRIEFED at the end of either May or June on what the Dept. of Defense has in mind for command and control in the remainder of calendar 1964. The briefing will be classified and will probably be held in Washington, although DOD will announce the definite time and place later.

Command and control is one of 13 areas to be outlined by DOD in this series of classified sessions. The original announcement in January had scheduled it under the general electronics area, but DOD set it up as a separate session in order to better cover the particular C&C subjects of strategic communications, information processing, display systems, and other electronics industry segments involved in C&C.

Attendance will be limited to not more than three persons from each organization and will be further restricted to the following: Chief executive officer; board chairman, president or general manager; senior officer responsible for research planning, director of research, and director of corporate planning. For purposes of the briefings, divisions of large corporations will be considered as separate entities.

Firms interested in being represented at the C&C briefing should send names, titles and security clearances of persons to attend to:

Col. Robert F. Todd
Deputy Chief of Staff (Plans)
Air Force Systems Command
Andrews AFB, Md.
Phone: (301) 981-9111, ext. 5309

THE AIR FORCE IS SEEKING a standard space guidance system and has awarded a contract to IBM Corp. for program definition studies for the system. Development of individual guidance systems is costly, Air Force said, and a standard system could be used for numerous space missions. Approval for hardware development will depend upon findings from the definition study. Award was for $700,000. AF Space Systems Division, Los Angeles, is program manager.

President Johnson sent legislation to Congress in March that would create a NATIONAL COMMISSION ON AUTOMATION AND TECHNOLOGICAL PROGRESS, composed of 14 members from top talent outside the Government. The commission would study effects of increased automation and recommend necessary steps to effectively direct it toward the most beneficial economic goals.

In its present form, the legislation's scope is quite broad. Areas to be studied include: job requirements; worker displacement; specific industries, occupations and geographic areas most likely to be affected by further automation; the social and economic effects of future automation developments on the nation.

The Commission would be backed up by a high-level intra-Governmental committee to advise and act as liaison with Government resources. Committee members would be heads of agencies and departments under the chairmanship of the Secretary of Labor.

This action by President Johnson is further evolution of many hearings and proposed bills in both houses of Congress, plus statements by both President Kennedy and President Johnson that they favored setting up such a commission.

As current legislation, the draft bill that would establish the Commission is now before the Senate Labor and Public Welfare Committee as S. 2623 and before the House Committee on Education and Labor as H. R. 10310. Further hearings are expected.

RECENT HEARINGS BY A HOUSE BANKING SUBCOMMITTEE on pending legislation have thrust two professional associations into opposing camps. Principal combatants are the Association of Data Processing Service Organizations (ADAPSO) and the American Bankers Association (ABA). The prize they are competing for is the increasing market for data processing services.

Rep. Abraham J. Multer (Dem., N. Y.) introduced House Bill H. R. 9548 last December that would prevent banks from offering many accounting services through use of their computers. ADAPSO and ABA spokesmen appeared before Cong. Multer's subcommittee and presented conflicting testimony on the bill.

Herbert W. Robinson, president of ADAPSO and president of C-E-I-R, Inc., told the subcommittee that ADAPSO not only favored the provisions of the bill but thought it should be broadened to prohibit banks "expressly from engaging in the general data processing and computer business except for their own internal operations." Robinson said data processing services constitute a "separate and distinct" business from banking operations.

On the other side spoke G. Edward Cooper, chairman of the ABA bank management committee and vice president of the Philadelphia National Bank. Cooper said:

"ABA views with great concern any suggestion that bank customer services should be arbitrarily and artificially circumscribed simply because banks are found to be competing with other business in offering certain services. Any such proscription against one class of business and in favor of another seems to us to be in sharp conflict with a fundamental precept of our competitive, free-enterprise economic system."

Cooper also said enactment of the bill would interfere with installation of EDP equipment by small and medium sized banks, which, he said, are able to install such equipment because they can use excess machine capacity for services for their customers.

"If limited to servicing the banks' needs only," he said, "many banks would find it financially prohibitive to purchase or lease such equipment."

Robinson countered that, "... any contention that banks need to sell excess computer time and data processing services to the public in order to operate economically is untenable. This completely ignores the fact that computers can be bought or leased in all sizes and shapes; that leased equipment from most hardware manufacturers, including IBM, can be terminated on 30 to 90 days' advance notice without penalty; and, therefore, that at any one time the capacity installed need be no greater than the bank's requirements for its own internal accounting operations."

According to Dale L. Reistad, director of the ABA automation and marketing research committee, between 200 and 300 banks are now actively offering automated services to customers. He said ABA has records of the services being offered by 138 of these banks, and the most popular services are account reconciliation, payroll, accounts receivable, production accounting, and sales analysis.

"This indicates," Reistad said, "that at the present time banks are busy converting their existing customer services from punched card to computer and attracting new customers in the process."

Reistad concluded: "At this point, it does not appear likely that the bill will ever become a law."

THE DEPARTMENT OF DEFENSE has now identified the $200 million worth of computers it purchased recently under pressure from Congress. This EDP list was sent to Congress from the General Accounting Office appended to a GAO report titled, "Plans for Purchase of Leased Automatic Data Processing Components in Use at Military Installations."

In all, Defense will buy $225.5 million in computing equipment. It dug up about $201 million from the current fiscal year budget and will probably ask for the remainder in future budgets.

IBM equipment makes up the majority of the list, totaling some 180 computers out of 275. Following way back are RCA with 22 and Univac with 14. The remainder is spread evenly among the other manufacturers. Army's list of 85 systems shows the cost and break-even point for some 24 non-classified systems that it did not identify.

Although expressing approval over the Defense action, GAO held back any outright enthusiasm because it said DOD did not identify all equipment that, if purchased, would result in savings to the Government nor the particular items that would result in maximum savings.

It criticized DOD for considering the individual EDP needs of military installations instead of the need of Defense and Government in general.

A summary of the EDP "shopping list," as Defense calls it, appears below. Slight variations in the actual computers bought are expected due to last minute changes.

SUMMARY OF LEASED COMPUTER SYSTEMS AT
MILITARY INSTALLATIONS PLANNED FOR PURCHASE BY THE GOVERNMENT

Model	Number of Systems	Average Cost/System	Total Cost
ASI 210	1	$ 160,000	$ 160,000
B 5000	1	851,000	851,000
CDC 924 A	1	250,000	250,000
CDC 1604	3	1,063,666	3,191,000
CDC 3600	1	2,634,284	2,634,284
GE 225	4	352,570	1,410,280
H 400	1	248,741	248,741
H 800	1	1,228,098	1,228,098
IBM 305	1	534,612	534,612
IBM 1401	94	237,619	22,336,160
IBM 1410	13	765,573	9,952,438
IBM 1460	2	450,360	900,720
IBM 1620	16	98,022	1,568,355
IBM 7040	2	1,406,947	2,813,895
IBM 7044	1	2,118,000	2,118,000
IBM 7074	2	860,769	1,721,539
IBM 7080	14	2,592,792	36,299,082
IBM 7090	3	2,199,821	6,599,463
IBM 7094	9	2,895,873	26,062,863
IBM 1410/1401	10	1,315,100	13,151,000
IBM 7070/1401	1	1,325,000	1,325,000
IBM 7090/1401	3	2,436,193	7,308,580
IBM 7094/1401	2	3,134,500	6,269,000
MONROBOT XI	1	34,500	34,500
NCR 315	5	474,758	2,373,750
NCR 390	1	59,400	59,400
PHILCO 2000	2	1,878,275	3,758,551
RCA 301	5	247,551	1,237,758
RCA 501	17	428,320	7,281,445
SDS 920	1	146,500	146,500
UNIVAC III	7	1,386,000	9,702,000
UNIVAC 490	4	3,150,000	12,600,000
UNIVAC SS 80	3	360,500	1,081,500
Unidentified Computers	28		14,633,460
Punched Card Accounting Equipment			23,544,692
TOTALS	260		$225,547,567

"ACROSS THE EDITOR'S DESK"

Computing and Data Processing Newsletter

TABLE OF CONTENTS

COMPUTERS SCHEDULE CLASSES, KEEP PUPIL RECORDS

The New England Education Data Systems (NEEDS), a non-profit educational organization, has begun a comprehensive classroom scheduling and record-keeping program which utilizes large-scale computers at the Boston (Mass.) research center of C-E-I-R, Inc.

NEEDS, an offshoot of the New England School Development Council (NESDEC), is presently scheduling classes for 18 secondary, junior and senior high schools with approximately 17,000 pupils in 14 New England towns and cities. By the end of 1965, it is expected that some 100 schools will be involved in the NEEDS system.

Besides scheduling classrooms for students, NEEDS is using the computers to prepare bi-monthly report cards for 12 schools and expects shortly to increase this number substantially. In addition, the organization is laying the groundwork to handle a greatly expanded computer record-keeping role for public schools in the six-state New England area. This would involve maintenance and processing of intelligence tests, ability and aptitude questionnaires, psychological data and cumulative grade reports on pupils.

The programs used on C-E-I-R's computers to schedule classes, fill out report cards, etc., can be used by any public school district in the country. To schedule classes for the average high school requires about 2 minutes processing time on the IBM 7090 computer and up to an hour of IBM 1401 time to print student schedules and class lists.
(For more information, circle 26 on the Readers Service Card.)

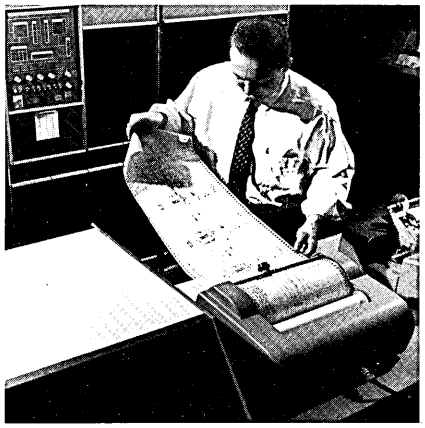
NEW APPLICATIONS

COMPUTERS FED OVER 100 YEARS OF EXPERIENCE TO ASSURE OPTIMUM DESIGN

Approximately two man-years of programming were necessary to develop the modern method which enables Allis-Chalmers, Milwaukee, Wisc., to quickly and accurately fit many variables into optimum design patterns. The Allis-Chalmers West Allis Works computer center is now making it possible for the firm to parlay over 100 years of experience into todays process design. Coming up with an optimum design of processing equipment hardware and combinations to complete a plant flow is a recent example.

Computerized processing machinery design at Allis-Chalmers, in most instances, begins with analyses of the operator's raw materials, plant layout intricacies, and desired goal. The information is fed into the computer complex.

In the case of a kiln, engineering data developed in an IBM 704 and a Cal-Comp plotter attached to an IBM 1401 computer accurately furnishes an analyses of all weight factors, location of the supports, and exact printed dimensions on a drawing as shown in the picture at upper right.



The computer program also permits design of a process flow sequence for a new plant or for one which most economically balances a plant's present requirements with its future growth potential.

ELECTRONICS COMPOSITION TECHNIQUE

Navy tests indicate that a new electronics composition technique, which transfers catalog information from magnetic tape to microfilmed pages, may cut over-all production costs of printed catalogs as much as 40 per cent.

Information stored in a computer is fed into a General Dynamics/Electronics S-C 4020 computer recorder, which can convert the data from magentic tape to letters, figures, graphs and charts. Transfer of catalog information to microfilmed pages (88 lines per

page) by this method is done at a speed of 7000 lines per minute. The new system electronically reduces letter width and white space between printed lines and letters with little or no loss in readability.

The technique has been applied to printing one section of its stock list catalog by the Naval Aviation Supply Office (NASO), Phildadelphia, Pa. In the test run, the one section of the catalog shrank from 28,000 to 16,000 pages. The Navy estimated it saved $68,000 of the normal $141,000 cost of this particular section of the catalog. The test was so successful that future NASO stock list supplements will be printed by the new method. The Navy Bureau of Supplies and Accounts expects to shave its annual $240,000 NASO stock list printing bill by about $96,000, and to multiply savings through other printing applications.

As a first step in producing the NASO stock list, information regarding 400,000 aviation stock items is recorded on punched cards. An IBM 1401/1410 computer is fed this information to produce a master tape which contains all the items, arranged by stock number and divided for printing on 88-line column pages. The S-C 4020 computer recorder accepts the master tape. It displays the contents of the master tape by cathode ray tubes and converts to microfilm the contents of each page. The tape is "read" by the recorder at a speed of 17,400 characters per second — the equivalent of 7000 page-wide type lines per minute.

The microfilm produced by the computer recorder is then used to produce black and white page proofs, as well as negatives, from which offset printing plates are made. Afterwards, the microfilm is stored for permanent, compact record purposes.

The Navy Publications and Printing Service has worked with General Dynamics/Electronics, San Diego, Calif., to develop the electronic printing technique. (For more information, circle 27 on the Readers Service Card.)

POWDER PUFF DERBY TO BE SCORED BY COMPUTER

A Honeywell computer will be keeping track of the whereabouts of some 75 women pilots during the 18th annual Powder Puff Derby this summer, which will originate from Fresno, Calif., on July 4th. The derby, known internationally as the All-Woman Transcontinental Air Race, will pit women pilots from the U.S. and foreign countries against one another in a four-day race that will end at noon on July 8th, at the Federal Aviation Agency's National Aviation Facilities Experimental Center (NAFEC) in Atlantic City, N.J.

Contestants will fly single or multi-engine stock model aircraft over the 2,573 mile course. Their predetermined handicaps, based on rated engine horsepower, type of aircraft, fuel capacity and similar considerations, will be maintained in the computer, along with starting times, sunrise and sunset tables and pilot and co-pilot data. As each contestant finishes her daily leg and stops at one of nine official stop-over airports, her elapsed time will be transmitted to the centrally-located computer, which will maintain an up-to-the-minute unofficial standing of each participant.

The computer will provide a complete list of scores each day minutes after sunset, the official daily cut-off time. At the end of the four-day race, it will compile final standings as well as winners in specialized categories such as best-score-between-stops and best-in-class of aircraft.

The Powder Puff Derby is planned and managed by the All-Woman Transcontinental Air Race, Inc., a non-profit corporation supported by the Ninety-Nines, a national organization of women fliers. Mrs. Kay A. Brick, Teterboro, N.J., is chairman of AWTAR, Inc.

NEW CONTRACTS

DOCUMENTATION INCORPORATED AWARDED $½ MILLION CONTRACT FOR CANCER DATA PROCESSING

The National Institutes of Health (NIH) has awarded a $537,000 contract to Documentation Incorporated, Bethesda, Md., for continuation of a contract to process test data of drug effects on cancer. Under the contract, DOC INC will begin its seventh year of work with the Cancer Chemotherapy National Service Center of the National Cancer Institute.

Through the NIH-DOC INC cancer data processing system, a master file of more than 200,000 chemical compounds and natural products screened in 26 different cancer systems has been made available to cancer researchers. The NIH-DOC INC program is one of the nation's most highly-automated systems of medical data processing. The program is readying an even more advanced processing system to help the center increase its scientific and analytical capability on the test data results.

GT&E ANNOUNCES RECEIPT OF $2 MILLION ARMY CONTRACT

Sylvania Electric Products Inc., Needham, Mass. (a General Telephone & Electronics Corporation subsidiary), has received a $2,045,000 contract to modify a mobile digital computer (MOBIDIC) which is in operation at Fort Huachuca, Ariz. The award was made by the U.S. Army Electronic Proving Ground Procurement Office at Fort Huachuca. Work will be performed at the eastern operation of Sylvania Electronic Systems, a division of the company, with support at Fort Huachuca by the division's Product Support Organization.

The MOBIDIC (one of five designed and produced by Sylvania for military use) will be improved to include magnetic tape transports, a high-speed printer, an additional high-speed card reader punch and a memory capability expansion to 28,000 words.

KORVETTE SIGNS CONTRACT WITH C-E-I-R, INC.

E. J. Korvette, Inc., New York, N.Y., has signed a contract giving C-E-I-R, Inc. the total responsibility for the data processing job of the $400 million retail chain's 50 store operation. C-E-I-R's New York Center has already begun processing for Korvette's 50 stores in nine eastern and midwestern states. Using its IBM 1401 and 7094 computers, C-E-I-R initially will process some 15,000 payroll checks and analyze sales for 400,000 items each week as well as perform other accounting functions. C-E-I-R computer experts also will assist Korvette in the design of management control systems.

AIR FORCE NAMES PACKARD BELL TO BUILD COMPUTER-BASED TELEMETRY SYSTEM

The Air Force Systems Command has awarded a $324,000 contract to Packard Bell Computer, Santa Ana, Calif., for a telemetry data conversion system to be installed at the Air Proving Ground Center, Eglin Air Force Base, Fla.

The system will center around a Packard Bell PB440 dual memory stored logic computer and additional Packard Bell equipment including an analog-to-digital converter, multiplexer, digital-to-analog converter and a PCM Simulator. Major use of the system will include conversion of Pulse Code Modulation (PCM), Pulse Amplitude Modulation (PAM), Pulse Duration Modulation (PDM) telemetry and other data on analog and digital recorded magnetic tapes to IBM-format gapped tape for further reduction.

SIX DDP-24 COMPUTERS FOR MELPAR TRAINERS

Computer Control Company, Inc., Framingham, Mass., has received an order for six DDP-24 general purpose digital computers from Melpar, Inc. (a subsidiary of Westinghouse Airbrake Company). The computers will be used in helicopter trainers being built by Melpar for the U.S. Naval Training Device Center, Port Washington, N.Y. Two DDP-24's will be used in each trainer.

The DDP-24 will simulate all flight characteristics of the Navy SH-3A single rotor and CH-46A tandem rotor helicopters in real-time and read out data through the trainer's instruments. The computer also will automatically simulate up to 50 pre-assigned navigational facilities.

The trainers, the first U.S. digital computer controlled helicopter flight trainers, will be mounted in trailers for portability.

EMI RECEIVES CONTRACT FOR SATELLITE MEMORY

A contract to develop and deliver severe environment satellite memory systems for use in the government sponsored Nuclear Detection Satellite and Spacecraft Program No. 823, has been awarded to Electronic Memories, Inc., Hawthorne, Calif. The contract, issued by Space Technology Laboratories, is in excess of $650,000. The serial memory, designated EMI Model #SE 30K 21, will be used in a STL designed Data Storage unit. It contains 30,464 bits in a 120 cubic inch package weighing only 3.3 lbs., with an operating power requirement of 250 mw, and 20 mv standby. Operating temperature range of the memory is -30°C to +90°C.

TSI WINS DATA REDUCTION SERVICES CONTRACT AT WSMR

Telecomputing Services, Inc. (a subsidiary of Telecomputing Corporation), Los Angeles, Calif., has been selected by the U.S. Army to provide data reduction services at White Sands Missile Range, New Mexico under a $1,888,000 contract. Working as an integral part of the WSMR Data Reduction Division, TSI will reduce and process large volumes of range test data. The raw data records to be reduced and processed by TSI originate from a multitude of range instrumentation systems, used for the collection of raw data during each range test.

Data reduction services under this contract will be for high-speed sled runs, a variety of missile and rocket firings, aircraft performance tests, high-altitude balloon flights, special parachute recovery systems, spacecraft tests and various aeromedical studies. In carrying out its operations, TSI will use a variety of equipments including high-precision scientific film measurement systems, a complete telemetry ground station, a high-speed data transmission system and electronic computing systems. As an integral part of the WSMR Data Reduction Division, TSI's services will be provided to various users of the test range and will include support for Army, Air Force, Navy and NASA programs.

NORTH AMERICAN AVIATION AWARDS $330,000 CONTRACT TO CPI FOR COMPUTERS

Computer Products Inc., Belmar, N.J., has received a $330,000 contract for three Mark III general purpose analog computers from North American Aviation Inc. The three computers, which can be operated as one large system or three separate units, will be installed at the North American Aviation Flight Simulation Laboratory, Los Angeles Division. Delivery will be in May.

U.S. AIR FORCE CONTRACT AWARDED TO GENERAL PRECISION

General Precision, Inc., Librascope Group, Glendale, Calif., has been awarded a $1,693,556 supplemental U.S. Air Force contract to produce navigation computer sets for the C-141 jet aircraft. The computers will be produced at Librascope's Avionic Equipment Division in San Marcos, Calif.

CONTROL DATA AWARDED FOLLOW-ON POLARIS CONTRACT

A follow-on production contract for 11 additional fire control computer systems, to be used aboard the Navy's newest and largest Polaris-class submarines, has been awarded to the Control Data Corporation, Minneapolis, Minn. These computer systems will be produced in the company's new Government Systems Division, Bloomington, Minn., under sub-contract to General Electric Company, prime contractor on the Polaris fire control and guidance systems. Control Data has already delivered 23 of the Polaris computer systems, the most recent in December, 1963. Each system includes two general purpose digital control computers.

NEW INSTALLATIONS

UNIVAC 1218 INSTALLED AT GODDARD SPACE FLIGHT CENTER

The first of 11 UNIVAC 1218 computer systems, purchased by the National Aeronautics and Space Administration for back-up of the flight controllers' role in the manned Gemini and unmanned Agena space mission, was received in March at the Goddard Space Flight Center, Greenbelt, Md.

The new 1218 computer system will provide summaries of in-flight data for display at Goddard and the mission control center. Additionally, the system will permit the controllers to select and examine specific types of spacecraft information on a 'real-time' basis. (For more information, circle 28 on the Readers Service Card.)

COFFEE DAN'S TO INSTALL MONROBOT XI

Coffee Dan's, Inc., a Los Angeles restaurant chain, will in-

stall a Monrobot XI electronic computer for general business accounting, payroll processing and sales analysis. The desk-sized computer will be installed at the offices in Beverly Hills, Calif. Monrobot XI is a product of Monroe Calculating Machine Company, a division of the Business Equipment Group of Litton Industries.
(For more information, circle 29 on the Readers Service Card.)

CONTAINER CORPORATION OF AMERICA TO INSTALL BUNKER-RAMO TRW-340 SYSTEM

The Bunker-Ramo Corporation (see Computers and Automation, March 1964), Canoga Park, Calif., has announced that Container Corporation of America will install a TRW-340 control computer system at their Fernandina Beach, Fla. linerboard plant. The system will be applied to the No. 2 kraft linerboard machine and its associated equipment. The TRW-340 system has capacity for later extension to control the nearby No. 1 machine, and other mill areas. Delivery of the system is scheduled for late this year.
(For more information, circle 30 on the Readers Service Card.)

TRUCKING COMPANY TO INSTALL COMPUTER AND DATA LINK

St. Johnsbury Trucking Co., St. Johnsbury, Vt., has ordered a Honeywell 200 computer and an on-line data communications network. The system will link 24 terminals in New England, New York and New Jersey to the firm's headquarters in Vermont. It will monitor the movement of freight from the time it is picked up until it reaches the consignee; automatically rate all shipments; and produce all financial reports required by the corporation

The 200 system includes a central processor with 20,480 characters of main memory, a 25-million-character random access memory, six magnetic tape units capable of transferring 20,000 characters a second, a high-speed printer able to print between 900 and 1200 lines of type a minute, a paper tape reader and the communications consoles.
(For more information, circle 31 on the Readers Service Card.)

UCB INSTALLS IBM COMPUTING AND TELEPROCESSING EQUIPMENT

United California Bank's (UCB) Los Angeles Electronic Data Processing headquarters, Los Angeles, Calif., has installed a new system which provides "overnight statewide customer account reporting", referred to in brief as OSCAR.

The system uses IBM computing and Teleprocessing equipment. Transmission devices, known as IBM 7710 data communication units, enable the computers to "talk to one another" over long distances at high speeds using telephone cables. Although the installation may be used for high speed transmission of any type of coded data, its primary purpose will be to centralize in minutes the bookkeeping function for UCB's branches in both northern and southern California in the Los Angeles EDP Center. The bank also plans to offer use of the equipment to other financial institutions or business concerns with similar accounting requirements.
(For more information, circle 32 on the Readers Service Card.)

GE-225 COMPUTER SYSTEM TO AID IN HIGHWAY AND BRIDGE DESIGN

The District of Columbia Department of Highways and Traffic has ordered a GE-225 computer system to aid in the design of this area's new highways and bridges. The computer will be used to help highway engineers quickly solve problems concerning structural design, traffic control and other engineering and planning factors involved in constructing local traffic facilities. The computer will be installed this month at the Highway Department's recently acquired computer facility in the Ford building, Washington, D.C.
(For more information, circle 33 on the Readers Service Card.)

SPRINGFIELD SAFE DEPOSIT BANK PLANS NEW AUTOMATION SYSTEM

The Safe Deposit Bank & Trust Company, Springfield, Mass., will install a new automation system to provide its customers with the speed and accuracy of electronic banking. The system, built around an NCR 315 computer, will use two CRAM (Cram Random Access Memory) units for storing all customer information. The equipment will serve the 12 branch offices as well as the bank's main office.
(For more information, circle 34 on the Readers Service Card.)

UNIVERSITY OF KARLSRUHE ORDERS MARK III

The University of Karlsruhe (Technischen Hochachule Karlsruhe) has ordered a MARK III general purpose analog computer from Computer Products Inc., South Belmar, N.J. The computer will contain 48 operational amplifiers, 20 potentiometers, 6 medium accuracy electronic multiplier products, 2 variable diode function generators, 4 relay comparators and an electronic digital voltmeter. The MARK III is scheduled for delivery this month.
(For more information, circle 35 on the Readers Service Card.)

PACKARD BELL TRICE COMPUTERS SHIPPED TO THREE AEROSPACE JOBS

Three Packard Bell Trice special purpose computers, shipped recently to three different aerospace installations in a single day, are now fully operational. The computers went to North American Aviation's Space and Information Systems Division, Downey, Calif.; NASA's Marshall Space Flight Center, Huntsville, Ala.; and the Army Missile Range at White Sands, N.M.

North American's computing system, an expanded version of Trice, uses a PB250 digital computer and other elements making it particularly applicable to vehicle dynamic and kinematic analyses and parameter optimization. This is the second Trice unit ordered and utilized by North American.

The Trice system delivered to the Marshall Space Flight Center is it's second such unit. The new Trice computer is in use by NASA's Computation Laboratory for orbital calculations, various control system studies, and investigations of wind effects on Saturn launchings. This system also uses a PB250 digital computer, but this will be replaced with a dual memory stored logic PB440 digital computer early this year.

The third Trice system, installed in the Flight Simulation Laboratory of the White Sands Missile Range Test and Evaluation Directorate, will be used in missile control and trajectory simulation

studies, including hybrid operation in conjunction with other computing equipment.
(For more information, circle 36 on the Readers Service Card.)

UNIVAC III USED BY FCC TO ISSUE LICENSES

The Federal Communications Commission, Washington, D.C. has installed a UNIVAC III, for the electronic processing of licenses. Over the next few years almost all of the nearly 1,300,000 radio station licenses issued by the Commission will be handled electronically. The program calls for handling of applications in the marine, aviation, public safety, industrial and land transportation radio services to be mechanized by the end of fiscal year 1965.

The computer also will be used to make broadcast station and ownership data available for quick reference as well as engineering computations for AM, FM and TV broadcast facilities, such as radiation and service contour patterns and channel studies.
(For more information, circle 37 on the Readers Service Card.)

TWO COMPANIES WILL SHARE COMPUTER

Executives of two firms — First National Bank of Mason City and Iowa Hardware Mutual Insurance Company, both of Mason City, Iowa — jointly announced plans for cooperative use of an IBM 1240 banking system. Equipment will be installed in the bank building and is expected to be operational by September. Benefits and costs of the system will be shared.

The system's major function for the bank will be in processing it's demand deposit accounts. Later, the system may be expanded to handle other banking functions such as loans and savings accounts. First National will also be able to provide data processing services to other banks and businesses in the area.

Iowa Hardware Mutual will use the computer to keep more accurate, up-to-date records on its 80,000 policyholders. The system's random access 1311 disk pack will permit review of the master policy file on a daily basis. Other computer uses anticipated by Iowa Hardware Mutual include automatic rating and writing of policies and bookkeeping functions.
(For more information, circle 39 on the Readers Service Card.)

ORGANIZATION NEWS

CONSOLIDATED SYSTEMS ACQUIRES INTERNATIONAL COMMODITIES

Consolidated Systems Corporation, Monrovia, Calif., has acquired International Commodities, Inc., manufacturer of automated information systems. Immediate expansion and a change of company name to TEL-A-DEX Corporation are planned for the subsidiary. The new name is the same as that of the company's principal product, TEL-A-DEX (see New Products, Input-Output), the first automated information system to be marketed.

Expansion of the TEL-A-DEX Corporation marketing organization, now under way, will provide national coverage for sales and service and include an office in Hawaii. Opening of facilities in Europe is now being planned.

Consolidated Systems is an associate company of Allis-Chalmers, Bell & Howell, and Consolidated Electrodynamics.

HONEYWELL OPENS EUROPEAN SALES OFFICE IN GERMANY

Honeywell Electronic Data Processing, Wellesley Hills, Mass., has opened its first European sales office in Frankfurt, Germany. The Frankfurt office has marketing responsibility for Honeywell's full line of small-, medium- and large-scale computer systems in Germany, Austria and Switzerland. Addition of the Frankfurt office brings to 12 the number of Honeywell EDP international facilities.

SBC FORMS COMPUTING SCIENCES DIVISION

The Service Bureau Corporation, New York, N.Y., has announced the formation of the Computing Sciences Division which will provide a full range of problem solving and machine services using large scale data processing equipment through locations in eight cities.

SBC's Computing Sciences Division provides large scale binary computer services to companies which need scientific computing capability in addition to their commercial requirements, or those which need added computing capacity. Other users are companies which choose not to have their own equipment. The Division provides mathematical, analytical and programming support for problem solving in management sciences, engineering, economics, statistics, and operation research. A series of preplanned computer services is also marketed by the Division.

NEW SYSTEMS & MANAGEMENT CONSULTING FIRM FORMED

The formation of Systems & Management Consulting, Inc., Shawnee Mission, Kansas, recently was announced by Dallas C. Patton, Vice-President, who observed that while many businesses are concentrating on the automated procedures they tend to neglect "routine office paper work flow". The newly formed company is specializing in design and modification of systems and data processing procedures for paper flow and control.
(For more information, circle 40 on the Readers Service Card.)

DSA ABSORBS COMPUTER SYSTEMS ANALYSTS

In an organizational change, Computer Systems Analysts has been absorbed by Data Systems Analysts, Inc., Pennsauken, N.J. Mr. Charles H. Margolin has been elected President of DSA. The company specializes in real-time communications programming and also does work in the general area of programming and system definition of computer installations.

EASTERN EXPANSION PLANS FOR COMPUTER SCIENCES

Computer Sciences Corporation has revealed plans for expanding their Eastern operations. CSC projects and customers normally serviced from the company's New York Division will be centralized in a new facility planned for the Washington, D.C. area. In addition to the Washington office, a second center has been planned by CSC for a city in the Northeast.

COMPUTING CENTERS

FRONT COVER STORY

SYSTEMS DESIGN LABORATORY

The Systems Design Laboratory (designed and operated by The MITRE Corp., technical advisor to ESD) has been established at the Electronic Systems Division (ESD) of the Air Force Systems Command, Laurence G. Hanscom Field, Bedford, Mass., to support planning and development of large computer-based systems required by the Air Force. The overall program in the Laboratory is a joint ESD/MITRE effort planned for optimum use of both military and civilian technical resources.

In the windowless, two-story facility, designers can simulate and test systems operations or subsystems. Hardware can be evaluated before incorporation into proposed or operational systems and optimum systems programs can be determined.

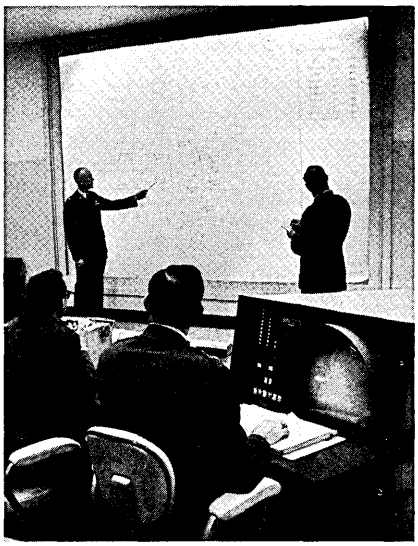
Heart and brain of the Laboratory is the IBM 7030 (STRETCH) computer. In its SDL configuration, it is one of the largest and most powerful computer systems in operation. The computer has a processing rate of 200,000 to 500,000 instructions a second; magnetic core storage is 65,000 words (64 bits per word) expandable to 262,000 words; and the disc unit has a storage exceeding 25,000,000 characters with the computer able to utilize up to 32 disc units.

— STRETCH, nerve center of the Systems Design Laboratory.

Command posts on the upper level of the building are fully equipped to permit Air Force technical personnel to operate the desired system or subsystem configuration. The equipment includes tactical situation display consoles; closed-circuit projection television with 9 x 12-foot dynamic and static wall display screens; input-output typewriters; touch-tone repertory-dial telephone equipment; monitoring and recording devices; and remote, high-speed hard-copy printers.

Observation rooms in the rear corners of the command posts allow working personnel to evaluate conduct of system exercises. The test-control rooms contain equipment for changing environment of systems under test.

An important feature of the Laboratory is that Commanders and their staffs can participate in the design of new systems or use the facilities for familiarization programs and training in systems coming under their command.



— Command post orientation is carried out by Air Force Electronic Systems Division personnel. The large "battle map" in the background is one of many displays that can be generated by the laboratory's 7030 (STRETCH) computer. All displays which military commanders might need to make decisions can be displayed on the consoles in the foreground as well as on the large "battle map".

The Systems Design Laboratory Institute, an intitial contribution of the SDL, has a program to train key senior military and civilian personnel who are in need of current information and orientation in the system design and acquisition process of command and control systems. In addition, it will have an advanced laboratory program which will provide sutstantive knowledge in military command technology to officers and selected civilians.

The curriculum covers such areas as determination of requirements; evaluation of design alternatives; selection of man/computer information transfer procedures; uses of laboratory simulations; and modeling, management, and operations.

Results at SDL are not restricted only to expediting the design, development, and operation of command and control systems. Techniques developed for command and control are beginning to be applied to other types of computer-based systems. Problems destined to be solved within a short time by a stepped-up technical program include study of computer system modules, new mathematical techniques of systems evaluation, common language techniques, and others. Future applications of the technological base developed in the Systems Design Laboratory are unlimited.

CARDS, INC.

In Lima, Ohio, a group of professional and business men have pooled their resources and experience to form a combined financial and commercial electronic data processing service center. The new center, called CARDS, Inc. (Conventional and Research Data Systems), is located five miles west of Lima. It is designed to serve the small and medium size businesses that cannot afford their own electronic data processing system, but, in today's mounting volume of paper work, need EDP advantages to compete favorably.

CARDS, Inc. computer system is a Burroughs Corporation B270. Unlike strictly commercially-oriented service center operations, the system includes a high speed sorter-reader and magnetic tape units (capable of reading or writing 50,000 characters of information per second). In addition to processing magnetic encoded documents, the computer system also is equipped to handle other forms of computer data including punched paper tape and punched cards.

The center will operate on a service-fee basis, offering its services to financial institutions such as banks and savings and loan associations as well as commercial operations such as utilities, hospitals, professional groups and manufacturing concerns. The workload will be handled in two shifts. It is expected to be in operation about 20 hours per day, operated by six personnel, including the corporation's three vice presidents. Bank accounting will be processed

during the evenings to provide the necessary updated daily accounts; commercial work will be prepared during the daytime.

Officers and major stockholders of the corporation are Dr. Alford C. Diller, a general practitioner in Convoy, president; Dr. Diller's brother, Mark O. Diller of Elida, vice president of Computer Engineering; Robert L. Gray of Lima, vice president of Computer Programming; and Fred A. Marsee of Convoy, vice president of Banking Services.
(For more information, circle 43 on the Readers Service Card.)

EDUCATION NEWS

LEHIGH UNIVERSITY EXPANDING GRADUATE PROGRAM TO TRAIN INFORMATION SCIENTISTS

Lehigh University, Bethlehem, Pa., will expand its graduate program in the Fall of 1964 to include the training of information scientists. The program will be conducted by Lehigh's Division of the Information Sciences.

The new graduate curriculum is designed to provide a broad practical and theoretical base in the sciences and technologies required in understanding the behavior, organization, and accessibility of information. Courses offered by the Division of the Information Sciences will include analysis of information, information systems design, general linguistics, syntactic concepts, logico-mathematical theories of retrieval, and environment of information systems. Students will be able to specialize in a systems, behavioral, or logico-mathematical option.

Coursework relevant to information storage and retrieval will also be provided in the University's departments of electrical engineering, industrial engineering, mathematics, social relations, economics, psychology, philosophy, and others as determined by the requirements and interests of the individual graduate student.
(For more information, circle 44 on the Readers Service Card.)

U.S. ARMY SIGNAL SCHOOL TRAINS OFFICERS FROM ALLIED COUNTRIES

Representative armed forces officers from allied countries around the world learn to use electronic computers in tactical operations and administration through actual programming and operation of a General Electric 225 computer at the U.S. Army Signal School, Fort Monmouth, N.J. Courses ranging from six hours to 14 weeks are given at the school.

Eight hundred officers a year, including about three score from 47 allied countries, will be trained in the use of a GE-225 computer system to aid them in problems of fire support, intelligence, tactical operation control, logistics and administration.

In the picture above, left to right, are Captain Richard W. Lee, instructor from the Army Signal School, demonstrating the use of magnetic tape to Major Angel N. Manzini of Argentina; Major Julio Perez Polloni of Chile, and Captain Keith Paul Morel of Australia. The GE-225 system was supplied by the General Electric Computer Department, Phoenix, Ariz.

USDA GRADUATE SCHOOL, C-E-I-R COOPERATE IN TRAINING PROGRAM FOR FEDERAL EMPLOYEES

A picked group of Federal Government employees are attending a 16-week course in computer systems design in an off-premise training program developed by the U.S. Department of Agriculture's Graduate School in cooperation with C-E-I-R, Inc. The full-time study course will extend through June 5, and will be attended by from 12 to 15 Government employees selected from a number of Federal agencies. Training site is the C-E-I-R research and computing center located in Arlington, Va., which has a large-scale IBM 7090/1401 computing system.

The course curriculum has been designed to provide the broad range of training needed to develop effective systems designers. Classes to be given include Applied Statistics, Operations Research, Computer Programming, Human Factors and Applied Psychology, Computer Engineering and Systems Design.

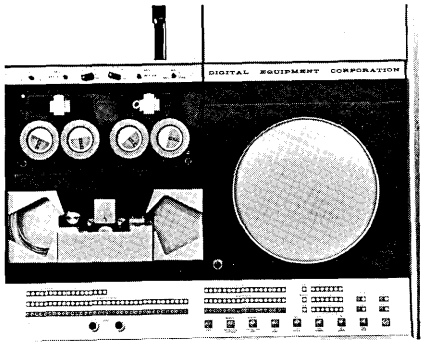
NEW PRODUCTS

Digital

PDP-6 COMPUTER HAS BUILT-IN TIME-SHARING CAPABILITY

Digital Equipment Corporation, Maynard, Mass., has introduced the first commercially available computer offering a time-sharing capability, the Programmed Data Processor-6 (PDP-6). All the system components needed for time-shared operation have been built into the PDP-6.

The new system is larger and faster than Digital's other general-purpose computers. It uses a longer word length (36 bits) and adds in from 2.7 to 4.3 microseconds. Its programming system includes the MONITOR, FORTRAN II, MACRO-6 Assembler, debugging, utility, and library.



— Close-up view of new PDP-6 computer shows Control Panel, Dual Microtape System (upper left), High Speed Tape Reader (lower left), and Precision Incremental Display (right).

The standard PDP-6 system includes: core memory of 16,384 words, memory protection and program relocation registers, 7-channel priority interrupt system, and pro-

vision for 128 input-output devices. A monitor program provides the functions of stacking, scheduling, assigning priorities, allocating facilities, and in general, supervising the utilization of the computer and peripheral equipment.

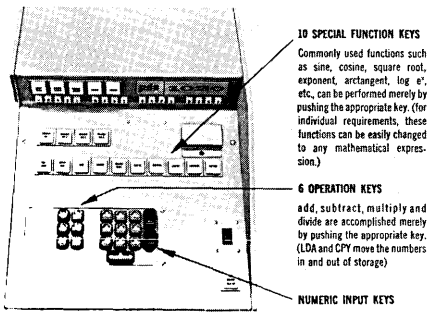
PDP-6 will be able to carry on scientific data processing for one operator while others use it to convert their programs from card to tape, edit their programs, read out their programs from memory to printer, or carry out other keyboard operations on line. Each operator will use the machine without conflicting with the other operators.

On PDP-6, users prepare, debug and run their programs on the main computer and remain in control of the processing. Errors can be corrected as soon as they are detected. Turn around time, as such, vanishes. The system is expected to be able to outperform in speed, volume, and versatility, computers costing considerably more than the PDP-6.
(For more information, circle 45 on the Readers Service Card.)

ENGINEERS' COMPUTER USES FAMILIAR TERMS

A new computer designed for direct use by engineers and scientists has been developed by Pacific Data Systems, Inc. (subsidiary of Electronic Associates, Inc.) Santa Ana, Calif. By using familiar terms, not machine language, all instructions and data can be quickly and easily entered at the keyboard. Complex problems can be solved within minutes after introduction to the machine.

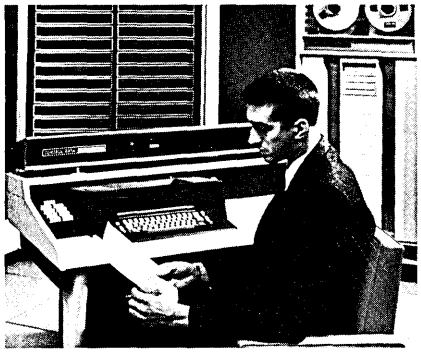
The computer consists of a 50 cps paper tape I/O, 15 cps typewriter output and a keyboard with six operation keys and 10 special function keys.



The pds 1020 computer, a decimal machine, has a basic capacity of 2048 words expandable to 4096 words. Word lengths are 4, 8, 12, 16, 20, 24 digits plus sign. Arithmetic speeds are 9.2 milliseconds for add and subtract (average) and 45.2 milliseconds (average for multiply and divide). The pds 1020 also uses a built-in command list to provide full scale computer capabilities for advanced programming techniques.
(For more information, circle 46 on the Readers Service Card.)

CONTROL DATA 3400 — NEWEST OF "3600 FAMILY"

Control Data Corporation, Minneapolis, Minn., has introduced the newest member of its "3600 Family" of computers — the Control Data 3400. The 3400 fits between the 3600 and the 3200. It has a 48-bit word (plus 3-bit parity) and storage capacity of either 16K or 32K. Machine cycle time is 1.5 microseconds.



This versatile, large-scale computer system permits individual users to determine many features specifically required for their operations and to dispense with those not necessary. Complete upward compatibility with the 3600 provides immediate and long-range advantages. Full programming systems will be operational on the 3400, including FORTRAN, COBOL for business data processing, monitoring systems, plus assembly routines and simulators. Delivery of the first system is expected this fall.
(For more information, circle 47 on the Readers Service Card.)

Digital-Analog

AMBILOG 200

Adage, Inc., Cambridge, Mass., has developed the AMBILOG 200, a stored-program data processing system using hybrid computational techniques which combine analog and digital logic. The machine is designed especially for data acquisition and reduction systems involving one or more analog inputs and analog and/or digital outputs.

The AMBILOG 200 is organized with parallel use of multiple hybrid arithmetic units. A typical operation time for simultaneous addition and multiplication or division is 10 microseconds. Solid-state multiplexers, analog signal conditioners, typewriter, and punched-paper and magnetic tape units provide a variety of input-output capability in both analog and digital domains.

The stored program design permits changes to be made in a system to accommodate new computing or simulation problems, merely by changing the program. Modular design and organization of the hardware allows easy expansion to meet future problem requirements. Complete software support is available to solve specific user problems. Typical applications include: waveform analysis; pattern recognition; signal generation; simulation; data acquisition; and real-time data processing.
(For more information, circle 49 on the Readers Service Card.)

Data Transmitters and A/D Converters

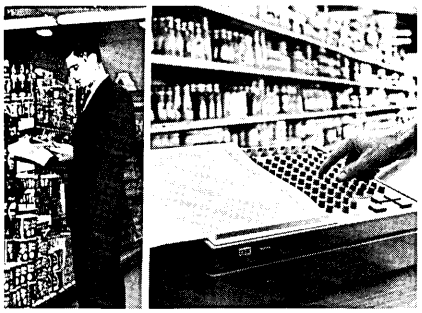
IBM 1094 LINE ENTRY TERMINAL

IBM Corp., White Plains, N.Y., has developed a new device, the IBM 1094 line entry terminal, to simplify and speed store-to-warehouse ordering.

This device makes it possible for personnel to order merchandise from a central point in seconds by pressing a few buttons on a keyboard. Order information is transmitted from the tabletop unit over communications lines to the warehouse, where it automatically is punched into cards. The order is then processed and assembled for shipping.

A manager whose store is equipped with a 1094 begins this ordering process with a survey of shelf stock. He notes items that need replacement in a specially-designed 1094 order entry book. The book lists each item of store inventory, by number, on a separate line. The book is then placed alongside the 1094 and keys are

pressed to indicate the items to be ordered from the warehouse.

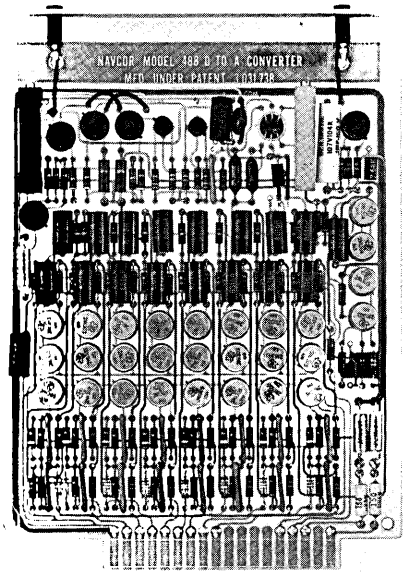


— First new IBM 1094 line entry terminal (right) is installed on a pilot basis at Kroger Co., Midwestern food retailer. Store manager surveys shelf stock (at left) and (at right) presses keys to indicate items to be ordered.

The 1094 — about the size of a typewriter — is designed for use wherever order forms are filled out. By speeding the order-filing process, the 1094 makes it possible for stores to reduce order-to-delivery time from as much as several days to less than 24 hours.
(For more information, circle 50 on the Readers Service Card.)

COMPLETE D/A CONVERTER ON PC BOARD

Navigation Computer Corp., Norristown, Pa., has announced that Model 488 Digital/Analog Converter is now available as part of the complete line of NAVCOR 400



Series Modules. The 488 incorporates complete D/A conversion circuits on one standard module. It contains a highly regulated reference voltage supply, precision resistor ladder, and a stable operational amplifier. The Model 488 accepts eight binary input bits and produces an analog output voltage at one of 256 discrete steps. Model 488D accepts two decimal digits in binary-coded-decimal form and provides an analog output voltage at one of 100 discrete steps. Both models produce an analog output voltage proportional to the value of the input data. The 488 may be used wherever digital data must control analog devices such as oscilloscope displays and plotting devices, driving pen recorders, and process control sensors.
(For more information, circle 51 on the Readers Service Card.)

ANALOG-TO-DIGITAL INTERFACE SYSTEM

A real time analog-to-digital Interface System, for use between a CDC 160A general purpose digital computer and any analog computer, has been developed by General Applied Science Laboratories, Inc., Westbury, N.Y. The equipment, known as the GASL Interface System ADI-1, performs multiple channel analog-to-digital and digital-to-analog conversions and supplies control functions for an X-Y plotter, an oscilloscope with a solenoid operated camera, a tape recorder, and 12 miscellaneous contact controls. Disconnect and interrupt functions between the computers are also furnished.

Two built-in clocks, one real time and one controlled by the analog computer, provide additional system supervision. Control is normally exercised by the digital computer through programmed function codes. When 'allowed' by the digital computer, the analog computer can control the digital computer through "interrupt" and disconnect lines.

With only minor modification, the GASL Interface System may be used with any digital or analog computer.
(For more information, circle 52 on the Readers Service Card.)

DIGITAL DATA RECEIVER

A digital data receiver, model KD-5050, has been developed by ITT Kellogg Communications Systems (division of ITT Corporation), Chicago, Ill. The new receiver accepts high-speed serial data, converts it to 8-bit parallel data, and forwards the data to an output or storage device at rates up to 10,000 bits per second.

In processing data received by a transmission link, the receiver converts serial data to parallel form, recognizes specific message headers, generates control functions for other equipment, and checks vertical and horizontal parity. It also initiates certain commands regarding disposition of the received data.

The receiver may be used for transmission subsystems and as a serial-to-parallel code converter with control functions.
(For more information, circle 53 on the Readers Service Card.)

Software

MATHEMATICAL TECHNIQUE AID TO MEDICAL RESEARCHERS

A new mathematical technique to help medical researchers with the difficult and time-consuming task of analyzing statistical information has been reported by IBM Corporation, White Plains, N.Y. An experimental computer program, written for an IBM 7090, uses this technique to analyze a number of medical cases and to assign, or "cluster" those with similar characteristics into separate groups.

In medical research, a physician or psychiatrist may accumulate a mass of data on the properties or characteristics of hundreds of patients. This source information is coded into the language of the computer. The computer program first calculates a numerical average for each characteristic using data on all the patients. One group of patients is then chosen as a trial cluster. The program establishes a numerical measure of value for this initial cluster by comparing the averages of patients' characteristics in the trial grouping with the averages established previously for the entire group. The greater the difference between these averages, the greater the justification for separating this cluster from the over-all group.

Two thousand new clusters are formed each minute as the data is rearranged in the computer in an attempt to form new groups with higher values. Finally, the computer produces one or more clusters

of related information which the scientist, using his experience and observations, can then analyze.

This experimental IBM program, was developed by Dr. Raymond E. Bonner, an engineer with IBM's Advanced Systems Development Division, Yorktown Heights, N.Y. It has been used to cluster personality test data assembled by psychiatrists at the Institute of Living, Hartford, Conn. The data consisted of Minnesota Multiphasic Personality Inventory (MMPI) profiles of 374 psychiatric patients. Each contained 14 personality characteristic scores achieved on the MMPI. Previously, it was too complex a process for a psychiatrist to cluster patients on more than two scores at a time. With the IBM program, all 14 scores for each patient were averaged and compared with the scores of the other patients. The result was eight patient groups or clusters, each with characteristics that fit distinct clinical entities.

Dr. Bernard C. Glueck, Jr., director of research at the Institute, said these groupings are now undergoing careful evaluation. "If the validy of the groupings withstands more detailed scrutiny, this new program may represent a significant advance in the statistical handling of medical data, especially in the areas of psychological and psychiatric evaluation where currently there is dissatisfaction with standard diagnostic procedures," Dr. Glueck said.
(For more information, circle 57 on the Readers Service Card.)

COMPUTERIZED MANAGEMENT TECHNIQUE

Computer Concepts, Inc., Washington, D.C., has announced a computerized management technique — MENTOR — designed to monitor and control project, contract, budgetary and cost accounting activities. It can automatically predict performance based on historic performance patterns.

In addition to prediction of future status, MENTOR will filter and extract significant information, report current status, evaluate past performance, and report significant departures from predicted performance — operating quickly and consistently, free of human intervention.

MENTOR is designed to operate on all available data including PERT and other CPM system data on scheduling or cost. The basic operating mode of the system differs, however, from existing techniques. MENTOR closes the management cycle by continually updating forecasts in terms of the quality of past forecasts.

Computer Concepts is currently scheduling demonstrations for interested organizations. MENTOR is designed in a form which is compatible with the IBM, CDC, Univac, Minneapolis/Honeywell and RCA computers.
(For more information, circle 58 on the Readers Service Card.)

PROMOCOM

PROMOCOM (for Project Monitor and Control Method) is a General Electric computer program which monitors and controls those projects where timing and costs are critical. Essentially, it is an extension to the GE/CPM (Critical Path Method) program. It is used to calendar date the CPM schedule and finally becomes a means for reporting project progress and providing project status for management control. CPM plus PROMOCOM satisfies the five steps to project management: planning, scheduling, activity progress reporting, project status reporting and controlling. PROMOCOM can be used on any of the "Compatibles" — General Electric's new group of computers including the GE-215, 225, or 235.
(For more information, circle 56 on the Readers Service Card.)

MANAGEMENT OPERATING SYSTEM (MOS) FOR TEXTILE FINISHING

Management of textile firms can exercise improved control of business operations through a new method for using computers which was recently introduced by IBM Corporation, White Plains, N.Y. The new method, called Management Operating System (MOS) for Textile Finishing, enables a textile firm to develop a central system to process the large volume of information generated by its operations.

Such a system can incorporate and control the information associated with any or all of six basic functional areas of textile finishing: (1) expanding the finishing order; (2) applying greige inventory; (3) plant loading; (4) raw materials requirements planning; (5) scheduling; and (6) operations evaluation. It can be used by companies involved in the finishing of cotton, wool, or synthetic cloth.

MOS for Textile Finishing identifies the cause and effect relationships among such operating variables as production schedules, customer commitments and greige goods inventory. The textile finishing company can then translate these relationships into a set of instructions — or program — and store them in a computer. The program instructs the computer how to process the stored information as well as new information fed into it as operating conditions change. The computer then can automatically determine the effects of change on the functional areas of the firm.
(For more information, circle 59 on the Readers Service Card.)

Input-Output

TEL-A-DEX

TEL-A-DEX Corporation, a subsidiary of Consolidated Systems Corporation, (see Organization News), Monrovia, Calif., has developed an automated information system. The system, called TEL-A-DEX, offers voice answers to repetitive questions with virtually no delay between question and answer. Already in use by airlines, supermarkets, and other public facilities, TEL-A-DEX is changing the concept of public service information.

Hundreds of messages of varying length are stored by the system, and they can be updated quickly and easily by an operator after a half-hour's training. The fact that any language can be used is expected to make the system of special interest to operators of all types of transportation terminals dealing with international travelers.

Using TEL-A-DEX is the same as dialing a phone, except that only three digits are used. The user looks up the question he wants answered on a panel display and dials the number shown. Several of these inquiry stations can be supplied with each TEL-A-DEX system, providing the convenience that would normally require a half-dozen or more manned information booths. Lease cost of the system is less than one clerk's salary.
(For more information, circle 61 on the Readers Service Card.)

INFORMATION DISTRIBUTION SYSTEMS

The Teleregister Corporation, Stamford, Conn., has developed the Series 100 (designed for large scale data communications networks) and Series 200 Information Distribution Systems. The systems use individually buffered CRT Inquiry Stations as the terminal devices and are designed to operate in conjunction with any of the currently available general purpose computer systems. Both series are fully adaptable to on-line information systems including inventory control, financial reporting, policy inquiry, manufacturing scheduling, credit checking, management reporting, and airline reservations.

The CRT Inquiry Stations have complete numeric or alphanumeric keyboards for data entry and message composition, as well as up to 17 procedure sequencing and program identifier control keys. A third bank of operational keys provides for electronically positioning an "electronic eraser", to a given point within the message content for deleting, adding, or modifying input or output data. The CRT Inquiry Stations are designed to operate off a common Station Control Unit which can serve from one to 36 terminal devices. The link between the control unit and the computer can either be by direct cable connection or through normal communication networks.

— Messages, queries and replies to and from the computer are composed on the alphanumeric keyboard and confirmed on the CRT screen.

The system contains a full library of alphanumeric and symbolic data. The designated codes conform with the ASC II standard approved for general communications usage.
(For more information, circle 70 on the Readers Service Card.)

MAGNETIC TAPE RECORDER ELIMINATES PUNCH CARDS, PAPER TAPE

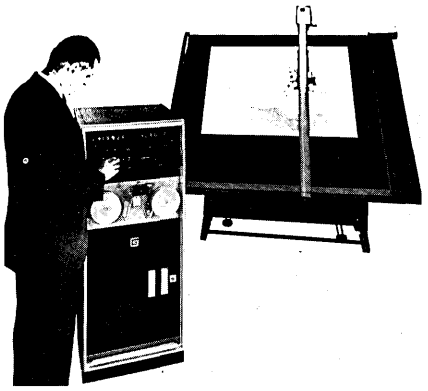
Precision Instrument Company, Palo Alto, Calif., has announced a new magnetic tape recorder, the RSL-150, which collects business statistics, financial information or technical data for direct transmittal to data processing equipment. The device, called an incremental recorder, can receive data at random intervals and automatically record this material in the proper packing density for electronic data processing. The recorder transcribes data received at intervals ranging from zero to 100 times per second from a wide variety of presently used equipment, including teletype, Data-Phones, and paper tape system inputs.

Using a tape drive mechanism that moves the tape precisely .005-inch for each digital "bit", the 7-channel recorder packs data at 200 characters per inch. The tape does not move between inputs. By electronically packing data to this precise density (as required by IBM, Control Data and other equipment), the recorder eliminates the cost and time required by present punch card and paper tape conversion methods. Billing, sales, inventories, payroll, traffic information, technical data for computer analysis and other asynchronous data can be accumulated in a format immediately compatible with processing equipment, and flash totals can be made available even before final processing.
(For more information, circle 71 on the Readers Service Card.)

VP 600, ALL-DIGITAL DISPLAY SYSTEM

The VP 600, an all-digital display system, recently has been introduced by the Gerber Scientific Instrument Company, Hartford, Conn. Basically a continuous path automatic drafting machine, it is capable of producing a high quality graphic display of digital information on drafting film, paper, vellum, cloth, Mylar, sensitized sheet metal or comparator screen material. It can accurately draw a line of any slope and any length within the limits of the plotting surface from a single input command. Graphic display is produced with an overall maximum accumulative accuracy of ±.010 inch anywhere on the plotting surface. Repeatability is ±.004 inch.

The device is composed of the electronic control unit and a plotting table. These units are connected by electrical cables only, and may be located as desired. The plotting surface



(50 x 60 inches) is readily adjustable to any desired angle from a horizontal to a vertical position. The horizontal position of the plotting surface can be adjusted from 37" to 46" from the floor. The drawing head is positioned by X and Y carriages which execute the commands of the control system. The electronic control unit houses the digital control logic, the input tape reader and all operating controls and indicators. All command pulses to control the X and Y axes are generated by the control unit.

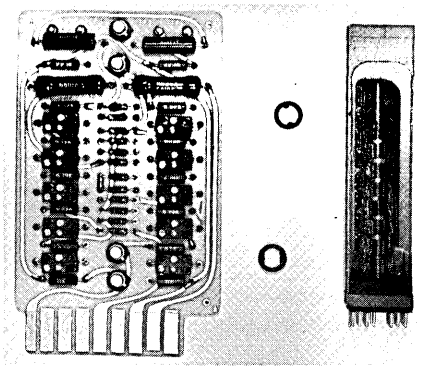
Input data in the form of punched paper tape is entered into the control unit via the self-contained tape reader. The operator may select any two axes from three-axis tape. Controls are provided for producing right and left hand drawings from a single tape. Drawing speeds up to 200 inches per minute are internally computed. Manual speed reduction is available for high precision applications. Full jog controls are provided to allow the operator to manually position each axis independently at a preselected speed.
(For more information, circle 62 on the Readers Service Card.)

Components

MAGNETIC MULTI-APERTURE DEVICES (MADs)

Small ring-like, magnetic devices, the size of shirt buttons, are used in a new system developed by Sylvania Electric Products Inc., (subsidiary of General Telephone

& Electronics Corp.), Needham, Mass. to reduce the costs of military electronic systems while increasing reliability up to 400 per cent. Use of the tiny rings, which replace conventional storage circuit cards, reduces from 70,000 to 7000 the number of components required in the console display of a major weapons system.



The rings, called magnetic multi-aperture devices (MADs), are small ferrite cores wired together through two small holes on each side. They eliminate the need for intervening vacuum tubes, transistors or other semiconductor devices. MADs are the two small circular devices in the center of the picture. They perform the work of the transistor storage circuit and amplifier card shown at the left. At the right, a group of MADs are shown as they appear in a module or "stick" ready for use. The module at the right performs the work of eight cards, similar to the one at the left.

In the Sylvania system, a single ring decodes computer output, remembers the status of an item and activates a lamp showing its status. The use of a single MAD as a combination memory element, logic circuit and power drive makes possible a more reliable system.
(For more information, circle 65 on the Readers Service Card.)

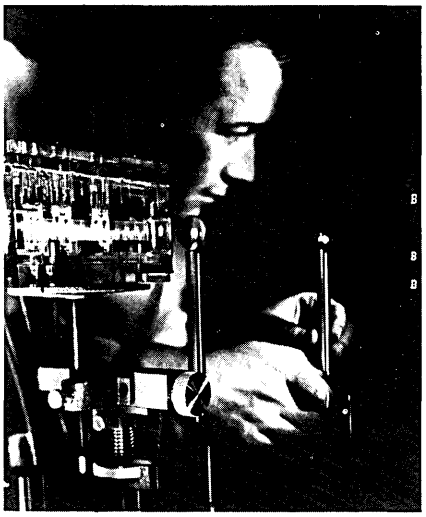
DIGITAL LIGHT DEFLECTOR

The first reported precise high-speed directional control of a laser light beam has been achieved by scientists of IBM Corporation, Poughkeepsie, N.Y. An experimental device, called a digital light deflector, has been developed for electronically deflecting a laser beam to precise locations on any surface.

Light deflection at electronic speeds has been a major problem in harnessing light for use in data processing. Deflection under mechanical control is far too slow for most computer applications.

The newly developed device uses laser light to project letters, numbers or other images at high speed to exact positions. The principle of the light deflector is based on crystal optics. In operation, laser light is passed through pairs of crystals which can deflect the path of the beam under electronic control. Each successive pair of crystals placed in the beam's path doubles the number of possible directions. With ten pairs, for example, the light could be directed to any one of more than a thousand positions. As more crystals are used, brightness is lost through absorption. For this reason, laser light is used because the image projected by a laser beam is very bright despite this absorption loss. The deflector, however, will operate with any light source.

With further development, IBM scientists expect that several million deflections per second can be achieved. The capabilities of the deflector indicate potential applications in high-speed display systems, or in other areas of computer technology where data might be transmitted or processed using light rather than electrical signals.
(For more information, circle 72 on the Readers Service Card.)



— IBM physicist Thomas J. Harris is shown adjusting a lens on a digital light deflector. Light can be seen passing through the deflection assembly (at left), then through a pair of focusing lenses onto a screen. The letters are formed by a stencil-like mask (not visible here) to the left of the deflector.

PEOPLE OF NOTE

REALIGNMENT OF TOP MANAGEMENT RESPONSIBILITIES AT PACKARD BELL

The board of directors of Packard Bell Electronics have approved a realignment of top management responsibilities and the creation of two newly defined executive posts.

Robert S. Bell, formerly president, chief executive officer and chairman of the board, becomes board chairman and chief executive officer, concentrating his efforts upon long-range growth and development efforts of the company.

Dr. Wendell B. Sell, previously executive vice president, becomes president and chief operating officer, supervising all line and staff managers.

PERSONNEL NEWS FROM SDC

Wesley S. Melahn has been elected President of the System Development Corporation, Santa Monica, Calif., and a member of the SDC Board of Trustees. He formerly held the title of Acting President.

Hasan Ozbekhan has been appointed as Director of Planning at SDC.

The appointment of Eugene H. Jacobs as Head of SDC's Advanced Programming and Compiler Staff also has been announced. He will be responsible for managing research and development activities in new programming techniques.

TWO NEW OFFICERS ELECTED AT ADAGE

Adage, Inc., Cambridge, Mass., has elected Robert P. Talambiras and Irving R. Schwartz to the positions of Vice President.

Mr. Schwartz will continue to direct the Company's marketing activities. Mr. Talambiras will direct engineering efforts.

BUSINESS NEWS

VALUE OF PRODUCT SHIPMENTS IN COMPUTER FIELD RISES 45.7% PER YEAR IN LAST NINE YEARS

Recently released figures from the U.S. Census Bureau's Current Industrial Reports show that value of product shipments for electronic computers and associated information processing equipment has risen an average of 45.7% per year during the years 1955 to 1963.

The actual growth in each year varied widely, from an increase of 119% between 1957 and 1958, to a decline of 0.3% between 1958 and 1959 (the period of production change-over between vacuum tube and transistorized computers).

The table at the right summarizes these figures. All figures are FOB Plant Values for the equipment shipped.

ELECTRONIC COMPUTING AND ASSOCIATED INFORMATION PROCESSING EQUIPMENT

YEAR	$ VALUE OF PRODUCT SHIPMENTS	ACTUAL INCREASE IN $ (Current Yr. less Previous Yr.)	% INCREASE (Current Yr. vs. Previous Yr.)
1964*	852	$152	13.6%
1963	750	103	15.9
1962	647	103	18.8
1961	544	72	15.3
1960	472	154	44.2
1959	318	- 1	-0.3
1958	319	174	119.0
1957	145	51	54.2
1956	94	47	100.0
1955	47	--	--

*1964 estimate prepared by the Business and Defense Services Administration of the U.S. Department of Commerce.

Notes: All dollar figures are in millions. The Standard Industrial Classification Code of this industrial activity is 35711. Figures before 1955 are not available.

NCR'S 1963 SALES SET RECORD FOR NINTH STRAIGHT YEAR

National Cash Register Company reports that sales in 1963 set a new high for the ninth consecutive year. Revenue from sales, services, and equipment rentals totaled $592,580,000 for the year, according to preliminary figures, compared with $564,021,000 in 1962, or an increase of 5%. Reported net income for 1963 after taxes was $20,082,000, compared with $20,645,000 in 1962, or a decrease of 3%.

Research and development expenditures reached a new high of $20,027,000 in 1963, NCR Chairman and President Robert S. Oelman said. Concurrently, the Company invested record sums for additional training of sales and service personnel and for other marketing support activities. Earnings were also affected by the fact that during 1963 the company installed its greatest volume of electronic data processing equipment to date. By the end of 1963 more than 700 NCR computer systems were in use, which was double the number of such installations a year earlier ($30,716,000 in new systems and machines were added to NCR's pool of rented equipment).

Despite the current earnings impact of the company's rapidly increasing rental business, Mr. Oelman said, this development offers the potential of an improvement in earnings and greater income stability.

CALCOMP SALES TRIPLE

California Computer Products, Inc., reports net income of $187,816 for the first six months of fiscal 1964 ended December 29, 1963. This compares with earnings of $21,573 for the same period last year.

President Lester L. Kilpatrick reported a sales increase of 300% for the period, from $896,169 in the first half of fiscal 1963 to a record $2,537,768 this year for the first half of fiscal 1964. He said that sales reflected "continued excellent acceptance of the CalComp line of digital graph plotting equipment" and that company effort has continued on the development, fabrication and test of electronic control and monitoring equipment under contracts with the U.S. Army Ordnance and the National Aeronautics and Space Administration.

TRW REPORTS RECORD SALES AND EARNINGS FOR 1963

Thompson Ramo Wooldridge Inc., manufacturer of aerospace, electronic and automotive products, today reported all-time record sales and net income for 1963. Board Chairman J. D. Wright announced preliminary unaudited figures indicating sales of $482.6 million for 1963, an increase of $22.3 million over the $460.3 million reported for 1962. Unaudited net income for 1963 was indicated as $15.2 million compared with $12.5 million at the end of 1962.

"Both of the company's major product areas — commercial and industrial, and defense and space — contributed to the improvement," the board chairman said.

COMPUTER APPLICATIONS POSTS CLIMB IN SALES, EARNINGS

Computer Applications Incorporated reports nearly trebling its net earnings on an 83% increase in sales volume during the fiscal year ended September 30, 1963. Total revenues reached $2,775,000, up from $1,513,000 in the previous year, while net profit after taxes climbed to $154,268, compared with $55,684 in fiscal 1962. These figures included the results of Electronic Business Services Corporation, a data processing service company acquired by Computer Applications last summer.

"Our internal growth during fiscal 1963," President John DeVries explained, "came both from an increase in the number of organizations utilizing our programming, analytical and computer operation services, and from an expansion of responsibilities given us by customers we were already serving."

MONTHLY COMPUTER CENSUS

The number of electronic computers installed or in production at any one time has been increasing at a bewildering pace in the past several years. New vendors have come into the computer market, and familiar machines have gone out of production. Some new machines have been received with open arms by users — others have been given the cold shoulder.

To aid our readers in keeping up with this mushrooming activity, the editors of COMPUTERS AND AUTOMATION present this monthly report on the number of general purpose electronic computers of American-based companies which are installed or on order as of the preceding month. These figures included installations and orders outside the United States. We update this computer census monthly, so that it will serve as a "box-score" of progress for readers interested in following the growth of the American computer industry, and of the computing power it builds.

Most of the installation figures, and some of the unfilled order figures, are verified by the respective manufacturers. In cases where this is not so, estimates are based on information in the market research reference files of COMPUTERS AND AUTOMATION. The figures are then reviewed by a group of computer industry cognoscenti.

Any additions, or corrections, from informed readers will be welcomed.

AS OF MARCH 20, 1964

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Addressograph-Multigraph Corporation	EDP 900 system	Y	$7500	2/61	18	7
Advanced Scientific Instruments	ASI 210	Y	$2850	4/62	15	2
	ASI 2100	Y	$3000	12/63	2	3
Autonetics	RECOMP II	Y	$2495	11/58	78	X
	RECOMP III	Y	$1495	6/61	21	X
Bunker-Ramo Corp.	TRW-230	Y	$2680	8/63	10	X
	RW-300	Y	$6000	3/59	35	X
	TRW-330	Y	$5000	12/60	27	6
	TRW-340	Y	$6000	12/63	3	6
	TRW-530	Y	$6000	8/61	20	X
Burroughs	205	N	$4600	1/54	68	X
	220	N	$14,000	10/58	46	X
	E101-103	N	$875	1/56	135	X
	E2100	Y	$535	8/64	0	160
	B250	Y	$4200	11/61	41	12
	B260	Y	$3750	11/62	68	60
	B270	Y	$7000	7/62	60	45
	B280	Y	$6500	7/62	83	58
	B5000	Y	$16,200	3/63	25	15
Clary	DE-60/DE-60M	Y	$525	2/60	160	3
Computer Control Co.	DDP-19	Y	$2800	6/61	3	X
	DDP-24	Y	$3080	5/63	11	28
	SPEC	Y	$800	5/60	10	X
Control Data Corporation	G-15	N	$1000	7/55	306	X
	G-20	Y	$15,500	4/61	27	X
	160/160A*	Y	$1750/$3000	5/60 & 7/61	345	22
	924/924A	Y	$11,000	8/61	23	8
	1604/1604A	Y	$35,000	1/60	56	15
	3600	Y	$52,000	6/63	12	18
	3400	Y	$32,000	11/64	0	10
	3200	Y	$9000	5/64	0	30
	6600	Y	$150,000	3/64	1	2
Digital Equipment Corp.	PDP-1	Y	Sold only about $120,000	11/60	54	7
	PDP-4	Y	Sold only about $60,000	8/62	32	12
	PDP-5	Y	Sold only about $25,000	9/63	12	26
	PDP-6	Y	Sold only about $300,000	7/64	0	1
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	25	X
Friden	6010	Y	Sold only about $22,000	6/63	77	88
General Electric	210	Y	$16,000	7/59	72	4
	215	Y	$5500	11/63	14	15
	225	Y	$7000	1/61	160	30
	235	Y	$10,900	12/63	5	10
	425	Y	$6500	7/64	0	22
	435	Y	$12,000	10/64	0	8
	455	Y	$18,000	6/65	0	2
	465	Y	$24,000	6/65	0	1

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
General Precision	LGP-21	Y	$725	12/62	90	45
	LGP-30	semi	$1300	9/56	440	3
	RPC-4000	Y	$1875	1/61	98	3
Honeywell Electronic Data Processing	H-200	Y	$4200	3/64	0	375
	H-400	Y	$5000	12/61	92	34
	H-800	Y	$22,000	12/60	60	5
	H-1400	Y	$14,000	1/64	4	12
	H-1800	Y	$30,000	1/64	3	6
	DATAmatic 1000	N	--	12/57	5	X
H-W Electronics, Inc.	HW-15K	Y	$490	6/63	3	3
IBM	305	N	$3600	12/57	580	X
	650-card	N	$4000	11/54	435	X
	650-RAMAC	N	$9000	11/54	90	X
	1401	Y	$3500	9/60	6550	750
	1401-G	Y	$1900	5/64	0	750
	1410	Y	$12,000	11/61	285	205
	1440	Y	$1800	4/63	630	2650
	1460	Y	$9800	10/63	150	350
	1620	Y	$2000	9/60	1450	60
	701	N	$5000	4/53	1	X
	7010	Y	$19,175	10/63	8	24
	702	N	$6900	2/55	2	X
	7030	Y	$160,000	5/61	7	X
	704	N	$32,000	12/55	48	X
	7040	Y	$14,000	6/63	30	55
	7044	Y	$26,000	6/63	18	17
	705	N	$30,000	11/55	100	X
	7070, 2, 4	Y	$24,000	3/60	450	100
	7080	Y	$55,000	8/61	63	19
	709	N	$40,000	8/58	12	X
	7090	Y	$64,000	11/59	72	5
	7094	Y	$70,000	9/62	235	70
	7094 II	Y	$76,000	4/64	0	145
ITT	7300 ADX	Y	$25,000	7/62	8	2
Monroe Calculating Machine Co.	Monrobot IX	N	Sold only - $5800	3/58	169	X
	Monrobot XI	Y	$700	12/60	355	185
National Cash Register Co.	NCR - 304	Y	$14,000	1/60	26	0
	- 310*	Y	$2000	5/61	45	4
	- 315	Y	$8500	5/62	155	102
	- 390	Y	$1850	5/61	535	205
Packard Bell	PB 250	Y	$1200	12/60	150	10
	PB 440	Y	$3500	3/64	1	9
Philco	1000	Y	$7010	6/63	14	10
	2000-212	Y	$52,000	1/63	6	6
	-210, 211	Y	$40,000	10/58	19	6
Radio Corp. of America	Bizmac	N		-/56	4	X
	RCA 301	Y	$6000	2/61	396	150
	RCA 3301	Y	$20,000	7/64	0	9
	RCA 501	Y	$15,000	6/59	94	5
	RCA 601	Y	$35,000	11/62	3	2
Scientific Data Systems Inc.	SDS-910	Y	$2000	8/62	44	42
	SDS-920	Y	$2700	9/62	31	15
	SDS-930	Y	$4000	4/64	0	6
	SDS-9300	Y	$7000	4/64	0	2
UNIVAC	I & II	N	$25,000	3/51 & 11/57	36	X
	Solid-State II	Y	$8500	9/62	38	7
	III	Y	$20,000	8/62	53	82
	File Computers	N	$15,000	8/56	45	X
	Solid-State 80, 90, & Step	Y	$8000	8/58	360	5
	418	Y	$11,000	6/63	3	5
	490	Y	$26,000	12/61	27	21
	1004	Y	$1500	2/63	990	1430
	1050	Y	$7200	9/63	22	176
	1100 Series (except 1107)	N	$35,000	12/50	18	X
	1107	Y	$45,000	10/62	16	13
	LARC	Y	$135,000	5/60	2	X
				TOTALS	17,836	8931

X = no longer in production.
*To avoid double counting, note that the Control Data 160 serves as the central processor of the NCR 310

'64 SJCC PREVIEW

"Computers '64: Problem-Solving in a Changing World."

April 21-23
Sheraton-Park Hotel
Washington, D.C.

Sponsored by American Federation of Information Processing Societies

MESSAGE FROM THE SJCC CHAIRMAN

On behalf of the American Federation of Information Processing Societies, I wish to extend to all members of the information processing community a sincere invitation to come to Washington this April for the 1964 Spring Joint Computer Conference.

The technical program sessions, which will cover a wide variety of fields, will each include question and answer periods as well as searching panel discussions by outstanding people in each area covered. Several tutorial sessions will complement those in which new developments are presented.

The Computer Science Theater will offer a number of significant recent motion pictures. Among other features of the Conference will be a special session on Computer Education for the Blind. Manufacturer's exhibits will be supplemented by displays of historical and educational content.

An attractive program has been planned for those ladies who join their husbands in the nation's capitol during the spring time, which well deserves its reputation as Washington's most pleasant season.

I hope that you will justify the efforts of the Conference Committee to make this a successful meeting by attending and participating in the 1964 Spring Joint Computer Conference.

Herbert R. Koller
U.S. Patent Office
Chairman, 1964 SJCC

Tuesday, April 21, 1964

OPENING SESSION
10:00 a.m. Sheraton Hall
MODERATOR: Jack Roseman, C-E-I-R, Inc., Program Chairman, 1964 SJCC
OPENING REMARKS: Herbert R. Koller, U.S. Patent Office, Chairman, 1964 SJCC
J. D. Madden, IBM Corporation, AFIPS Chairman
KEYNOTE SPEAKER:

Dr. Jerome B. Wiesner

COMPILERS: TUTORIAL and TECHNICAL SESSIONS
1:30 p.m. Cotillion Room
Session Chairman: Dr. Bernard Galler, University of Michigan, Ann Arbor, Mich.

APPLICATIONS
2:00 p.m. Sheraton Hall
Session Chairman: Dr. Jack Moshman, C-E-I-R, Inc., Washington, D.C.

Wednesday, April 22, 1964

SOCIAL IMPLICATIONS OF DATA PROCESSING
9:00 a.m. Sheraton Hall
Session Chairman: Dr. James Singleton, System Development Corporation, Falls Church, Va.

NUMERICAL ANALYSIS
9:00 a.m. Cotillion Room-B
Session Chairman: Dr. R. W. Hamming, Bell Telephone Laboratories, Murray Hill, N.J.

COMMAND AND CONTROL
9:00 a.m. Cotillion Room-A
Session Chairman: Dr. Ruth Davis, Office of the Director of Defense Research and Engineering, Washington, D.C.

HYBRID SYSTEMS: TUTORIAL
2:00 p.m. Cotillion Room-A
Session Chairman: T. D. Truitt, Electronics Associates, Inc., Princeton, N.J.

HYBRID SYSTEMS: TECHNICAL
3:30 p.m. Cotillion Room-A
Session Chairman: J. Sherman, Lockheed Missiles and Space Co., Sunnyvale, Calif.

ARTIFICIAL INTELLIGENCE
2:00 p.m. Cotillion Room-B
Session Chairman: Dr. H. L. Gelernter, IBM Research Center, Yorktown Heights, N.Y.

EVALUATING COMPUTER SYSTEMS
1:30 p.m. Sheraton Hall
Session Chairman: J. D. Porter, Mitre Corp., Bedford, Mass.

Thursday, April 23, 1964

MULTI-PROGRAMMING
9:00 a.m. Sheraton Hall
Session Chairman: Dr. Walter J. Bauer, Informatics, Inc., Culver City, Calif.

LOGIC, LAYOUT AND ASSOCIATIVE MEMORIES
9:00 a.m. Cotillion Room
Session Chairman: William Papian, Massachusetts Institute of Technology, Cambridge, Mass.

INFORMATION RETRIEVAL: TUTORIAL
2:00 p.m. Sheraton Hall
Session Chairman: Dr. Robert Hayes, Hughes Dynamics, Los Angeles, Calif.

INFORMATION RETRIEVAL: TECHNICAL
3:30 p.m. Sheraton Hall
Session Chairman: Louis C. Ray, Hughes Dynamics, Inc., Santa Monica, Calif.

BUSINESS DATA PROCESSING
1:30 p.m. Cotillion Room-A
Session Chairman: Dr. C. C. Gotlieb, University of Toronto, Toronto, Ontario, Canada

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.**

Current Research and Development in Scientific Documentation No. 11 / National Science Foundation, Office of Science Information Service / Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C. / 1962, printed, 440 pp, $4.00

This is the eleventh in a series of descriptive reports on current research and development in scientific documentation. All pertinent activities in the U. S. and abroad that have come to the attention of the Nat'l Science Foundation staff are included. The descriptive statements are grouped under five major headings: Information Needs and Uses, Information Storage and Retrieval, Mechanical Translation, Equipment, and Potentially Related Research. Each section is preceded by an introductory summary which calls attention to the work of organizations reported for the first time, and projects and studies completed or discontinued. This issue includes 423 statements describing over 500 research projects, studies, and experiments in 264 organizations. Also included: Glossary; List of Acronyms and Abbreviations; Index of Individuals and Organizations; Index of Sponsors; Equipment Index, and Subject Index.

Hunter, J. A. H., and Joseph S. Madachy / Mathematical Diversions / D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. / 1963, printed, 178 pp, $4.95

This book offers a wide range of subjects dealing with the relationships and patterns of numbers and geometrical figures. New concepts and problems only now becoming important in the field of mathematics are included. Nearly one hundred problems are provided—accompanied by answers, most with detailed solutions. Eleven chapters include: "Friendly Numbers and Others," "From Paradox to Parastichy," "Mystic Arrays," "Topological Delights," "Some Inferential Problems," "Diophantos and All That," "Potpourri," "Fun With Shapes," "Alphametics and the Like," "What are the Odds?" and "Story Teasers." An appendix, "A Fundamental Property of the Fibonacci Series," and an index.

NEW PATENTS

RAYMOND R. SKOLNICK
Reg. Patent Agent
Ford Inst. Co., Div. of Sperry Rand Corp., Long Island City 1, New York

The following is a compilation of patents pertaining to computer and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U. S. Commissioner of Patents, Washington 25, D. C., at a cost of 25 cents each.

December 3, 1963

3,113,294 / Bernhard Dollman Parker, London, England / Decca Limited, London, England, a British Company / Binary Digital Data Transmission Systems.

3,113,295 / Thomas J. Blocher, Jr., Monroeville, Pa. / Westinghouse Air Brake Co., Wilmerding, Pa., a corp. of Pa. / Data Handling System.

3,113,297 / Wolfgang Dietrich, Adliswil, Zurich, Switzerland / I.B.M. Corp., New York, N. Y., a corp. of New York / Binary Information Transfer Device.

December 10, 1963

3,114,006 / Alfred H. Faulkner, Redondo Beach, Calif. / Automatic Electric Labs., Inc., a corp. of Delaware / Data Storage Unit.

3,114,133 / Gerald N. West, Endwell, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of New York / Magnetic Core Matrix.

3,114,134 / Leonard D. Seader, Santa Clara County, Calif. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / Switching Circuit.

3,114,135 / Wilbur David Pricer, Wappingers Falls, N. Y. / I.B.M. Corp., New York, N. Y., a corp. of N. Y. / High Speed Memory.

3,114,137 / Walter L. Morgan, II, Princeton, N. J. / U.S.A. as represented by the Sec. of the Navy / Dual String Magnetic Shift Register.

3,114,138 / John C. Mallinson, Harrisburg, Pa. / AMP Inc., Harrisburg, Pa., a corp. of New Jersey / Magnetic Core Circuit.

December 17, 1963

3,114,883 / Merwyn E. Arthur, Endicott, N. Y. / International Business Machines Corp., N. Y., a corp. of N. Y. / Reversible Electronic Counter.

3,114,885 / Delmar V. Payne, Ferndale, Mich. / The Bendix Corp., a corp. of Delaware / Integrating Circuit.

3,114,896 / William M. Carey, Jr., South Lincoln, Mass. / Minneapolis-Honeywell Regulator Co., a corp. of Delaware / Multi-Directional Storage Register.

3,114,897 / Way Dong Woo, Newton Center, Mass. / Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., a corp. of Delaware / Magnetic Shift Register Coupling Loop.

3,114,898 / Harrison W. Fuller, Needham Heights, Mass. / Laboratory for Electronics, Inc., Boston, Mass., a corp. of Delaware / Magnetic Interdomain Wall Shift Register.

December 24, 1963

3,115,617 / Nikolaus Fries, Stuttgart-Feuerbach, Germany / International Standard Electric Corp., New York, a corp. of Delaware / Selector Circuits.

3,115,618 / Arthur Rothbart, Bronx, New York / International Telephone and Telegraph Corp., Nutley, N. J., a corp. of Maryland / Signal Storage System.

3,115,619 / George T. Barrett, Woburn and Thomas E. Baker, Jr., Framingham, Mass. / Sylvania Electric Products, Inc., Wilmington, Del., a corp. of Delaware / Memory Systems.

December 31, 1963

3,116,410 / Richard J. LaManna, Hanover Township, Verne H. Wilson and Vincent T. Pogorzelski, East Orange and Mark Pivovonsky, Lyndhurst, N. J. / Monroe Calculating Machine Co., Orange, N. J. / Simple General Purpose Digital Computer.

3,116,411 / Roy A. Keir, Inglewood, Calif. / Control Data Corp., Minneapolis, Minn., a corp. of Minnesota / Binary Multiplication System Utilizing A Zero Mode And A One Mode.

3,116,412 / Morse Minkow, Bronx, N. Y. / Curtis-Wright Corp., Carlstadt, N. J., a corp. of Delaware / Reflexed Binary Adder With Interspersed Signals.

3,116,426 / Shintaro Oshima, Musashinoshi, Hajime Enomoto, Ichikawa-shi, Shiyoji Watanabe, Shinjuki-ku, Tokyo-to and Kitsutaro Amano, Ota-ku, Tokyo-to, Japan / Kokusai Denshin Denwa Kabushiki Kaisha, Tokyo-to, Japan, a joint-stock company of Japan / Logic Circuits Employing Bridge Networks Comprising Transformer Secondaries and N-Type Conductivity Curve Negative Resistance Elements.

3,116,476 / Gerson H. Goldstick, Manhattan Beach, Calif. / The National Cash Register Co., Dayton, Ohio, a corp. of Maryland / Memory Sensing System.

January 7, 1964

3,117,236 / Virgle E. Porter, Country Club Hills, Ill. / International Telephone and Telegraph Corp., New York, N. Y., a corp. of Maryland / Magnetic Flip-Flop Circuit.

3,117,242 / Frederick F. Slack, 495 Williams St., Stoneham, Mass. / — / Analog Multiplier Using Solid-State Electronic Bridge.

3,117,306 / Henry A. Reitfort, Vestal, N. Y. / International Business Machines Corp., N. Y., a corp. of N. Y. / Multiplex Computer Inquiry Stations.

3,117,307 / Julian Albert Walter Davie, Stevenage, England / International Computers and Tabulators Ltd., London, England / Information Storage Apparatus.

3,117,309 / Gerhard Wolf, Munich-Solln, Germany / Kienzle Apparate G.m.b.H., Villingen in Schwarzwald, Germany / Arrangement for Controlling a Magnet Core Matrix.

January 14, 1964

3,117,368 / William J. Bartik, Hatboro, Penna. / Sperry Rand Corp., New York, a corp. of Delaware / Method and Apparatus for Wiring Memory Arrays.

3,118,055 / Lowell S. Bensky, Levittown, Pa. / Radio Corporation of America, a corp. of Delaware / Electronic Digital Information Handling System With Character Recognition for Controlling Information Flow.

3,118,056 / Gunther Martens, Schliersee, Upper Bavaria and Gerhard Wolf, Munich-Pasing, Germany / Kienzle Apparate G.m.b.H., Villingen, Black Forest, Germany / Magnetic Core Matrix Accumulator.

3,118,131 / Esmond Philip Goodwin Wright, London, England / International Standard Electric Corp., N. Y., a corp. of Delaware / Data Processing Equipment.

3,118,133 / Thrygve R. Meeker and Henry L. Stadler, Whippany, N. J. / Bell Telephone Laboratories, Inc., N. Y., a corp. of N. Y. / Information Storage Matrix Utilizing A Dielectric of Pressure Changeable Permittivity.

3,118,134 / Irwin Dorros, Livingston and Alexander Feiner, Boonton, N. J. / Bell Telephone Laboratories, Inc., N. Y., a corp. of N. Y. / Magnetic Memory Circuits.

3,118,135 / Arthur R. Tomek, St. Paul, and Ronald J. Haskell, Minneapolis, Minn. / Sperry Rand Corp., N. Y., a corp. of Delaware / Floating Mark Data Transfer System.

January 21, 1964

3,119,011 / Abraham Framck and George F. Marette, Minneapolis and Berc I. Parsegyan, St. Paul, Minn. / Sperry Rand Corp., N. Y., a corp. of Delaware / Digital Data Analyzing Devices.

3,119,024 / Yoshiaki Endo, Tokyo, Japan / Nippon Electric Co., Ltd., Tokyo, Japan, a corp. of Japan / Parametric Storage Element For Digital Computers.

3,119,031 / Jack C. Smeltzer, Woodland Hills and Elliott E. Rech, Canoga Park, Calif. / Thompson Ramo Wooldridge Inc., Canoga Park, Calif., a corp. of Ohio / Shift Register With Input Memory Converting Logic Level Signals to Positive or Negative Clock Pulses.

3,119,101 / Gerhard Wolf, Munich-Solln, Germany / Kienzle Apparate G.m.b.H., Villingen im Black Forest, Germany / Storage Register.

3,119,110 / John M. Coombs, Poughkeepsie, N. Y. / Sperry Rand Corp., a corp. of Delaware / Data Storage Apparatus Controls.

January 28, 1964

3,119,984 / William E. Brandt, Cambridge, Mass. and William P. Margopoulos, Poughkeepsie, N. Y. / International Business Machines Corp., N. Y., a corp. of N. Y. / Analog Voltage Memory.

3,119,985 / Melvin M. Kaufman, Merchantville, N. J. / Radio Corp. of America, a corp. of Delaware / Tunnel Diode Switch Circuits for Memories.

3,119,986 / Alan B. Fowler, Wappingers Falls, N. Y. / International Business Machines Corp., N. Y., a corp. of N. Y. / Superconductive Storage and Logic Devices with Nucleation Properties.

3,119,989 / William J. Wasylenko, Philadelphia, Pa. / Burroughs Corp., Detroit, Mich., a corp. of Michigan / Electromagnetic Transducer Apparatus.

CALENDAR OF COMING EVENTS

(Continued from page 34)

May 12-14, 1964: Annual General Meeting of POOL (Users of General Precision Computers), Palmer House, Chicago, Ill.; contact Dr. Roebert L. Stearman, C-E-I-R, Inc., 9171 Wilshire Blvd., Beverly Hills, Calif., or Al Erickson, General Precision, Inc., 808 Western Ave., Glendale, Calif.

May 13-15, 1964: Second Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Shamrock Hilton Hotel, Houston, Tex.; contact Chairman, Biomathematics Symposium, Univ. of Tex. Graduate School of Biomedical Sciences at Houston, 102 Jesse Jones Library Bldg., Texas Medical Center, Houston, Tex. 77025

May 18-20, 1964: 7th National ISA Power Instrumentation Symposium, Denver-Hilton Hotel, Denver, Colo.; contact H. A. Van Wassen, Duquesne Light Co., 435 Sixth Ave., Pittsburgh, Pa. 15219

May 25-27, 1964: 10th National ISA Aero-Space Instrumentation Symposium, Biltmore Hotel, New York, N. Y.; contact J. K. Stotz, Jr., Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y.

June 24-26, 1964: 5th Annual Joint Automatic Control Conference, Stanford University, Stanford, Calif.; contact D. A. Rodgers, Consolidated Systems Corp., 1500 Shamrock Ave., Monrovia, Calif.

ADVERTISING INDEX

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

What makes ASI's 2100 today's outstanding computer buy?

ASI's new 2100 is designed to satisfy both small and medium scale computer needs, combining high operational speed, expanded input/output capabilities and low cost-to-answer ratios in a convenient to use, compact unit. Check just a few of the 2100's features:

MEMORY—2 microsecond total memory cycle time . . . 21 bit word . . . 4096 word core memory expandable in modules of 2,048 words.

ARITHMETIC AND CONTROL—Three index registers . . . double precision hardware . . . fast indirect addressing . . . convenient subroutine access . . . instructions to facilitate floating point operation . . . rapid instruction execution.

Add— 4 usec.
Multiply—30 usec.
Double Add—12 usec.
Unconditional Transfer— 2 usec.

INPUT/OUTPUT—Up to eight complete, buffered, bidirectional input-output channels . . . 500 KC total word input-output rate . . . channels will accept information in 6 to 48 bit fields as specified by the program . . . any channel may be connected to as many as 32 external devices . . . each external device has its own unique interrupt address to which program can be automatically transferred . . . multiple priority interrupts, each with its own order of priority . . . external device operations require program attention for initiation only . . . central processor may communicate directly with external devices without using buffered channels.

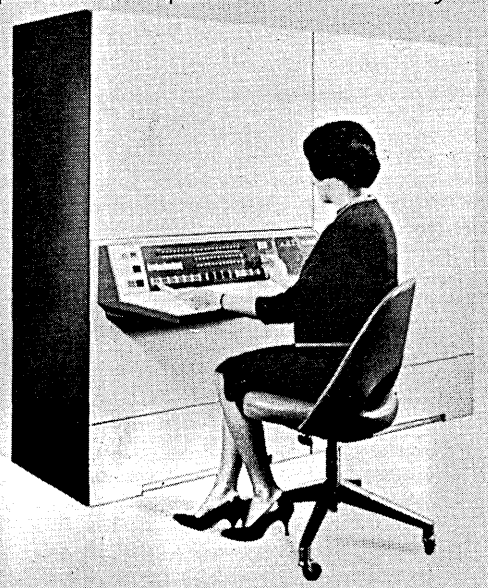
SIZE AND POWER REQUIREMENTS—A single upright cabinet includes all electronics power supply and operator control and display panel . . . over-all height 67 inches, depth 25.5 inches, width 72 inches; power consumption is less than 1.8KW . . . standard 110/120 volt 60 cycle AC. No special temperature or humidity controls required.

PERIPHERAL EQUIPMENT—Available with the 2100 is a complete line of proven peripheral equipment . . . high and low density magnetic tape units . . . 800, 200 and 100 cpm card reader . . . 250 and 100 card punches . . . incremental plotter systems . . . 500 character per second paper tape reader . . . 100 character per second paper tape punch . . . input/output typewriter . . . 400 and 200 lpm line printers . . . A-to-D and D-to-A conversion units.

SOFTWARE—A complete package of programs, compilers and routines . . . field tested FORTRAN II . . . symbolic assembler . . . mathematical subroutines . . . available at delivery of 2100 system.

PRICE AND DELIVERY—The prices of the 2100 begin at $87,800 . . . monthly lease price $2,590 . . . first deliveries in December 1963.

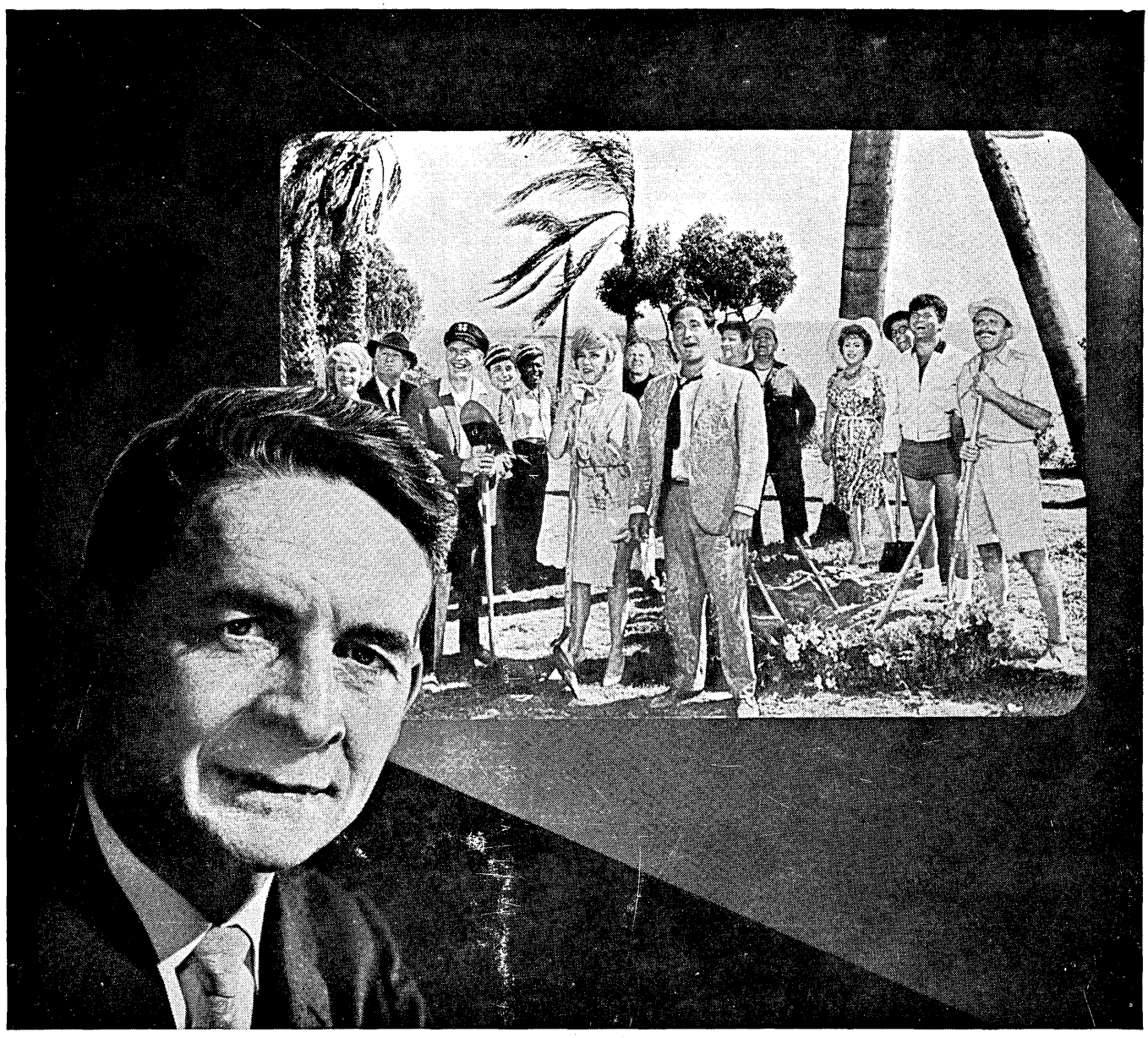
For complete descriptive data on ASI's 2100, call or write today.



See the 2100
at the SJCC
Booths 33-35
Sheraton Park
Hotel

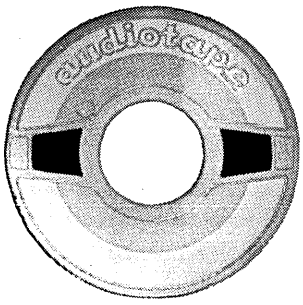
ASI 2100

ADVANCED SCIENTIFIC INSTRUMENTS / DIVISION OF ELECTRO MECHANICAL RESEARCH, INC.
8001 Bloomington Freeway, Minneapolis, Minnesota 55420



"In the mad, mad, mad, mad world of movies, Computer Audiotape plays an important role,"

says Mr. John Fitzgerald, Data Processing Manager for United Artists Corporation **UA**



"In the colorful motion picture business even accounting is unique. For example, here at United Artists we use an IBM 1401 Computer for the sole purpose of processing producers' settlement statements. United Artists circulates as many as 1,000 films throughout the world at any given time. Our computer prepares detailed financial statements for each of these films. To do this job, we use Computer Audiotape. We first tried it two years ago, and it worked out so well we've often recommended it to other companies. As a matter of fact, we now use it exclusively."

United Artists Corporation is another prominent firm that consistently specifies Computer Audiotape. You can "test run" Computer Audiotape on your computer. "Test run" it on your own equipment, at no cost and at your convenience. For complete details write to Audio Devices, Dept. CA.

AUDIO DEVICES, INC., 444 Madison Avenue, New York, New York

Circle No. 6 on Readers Service Card