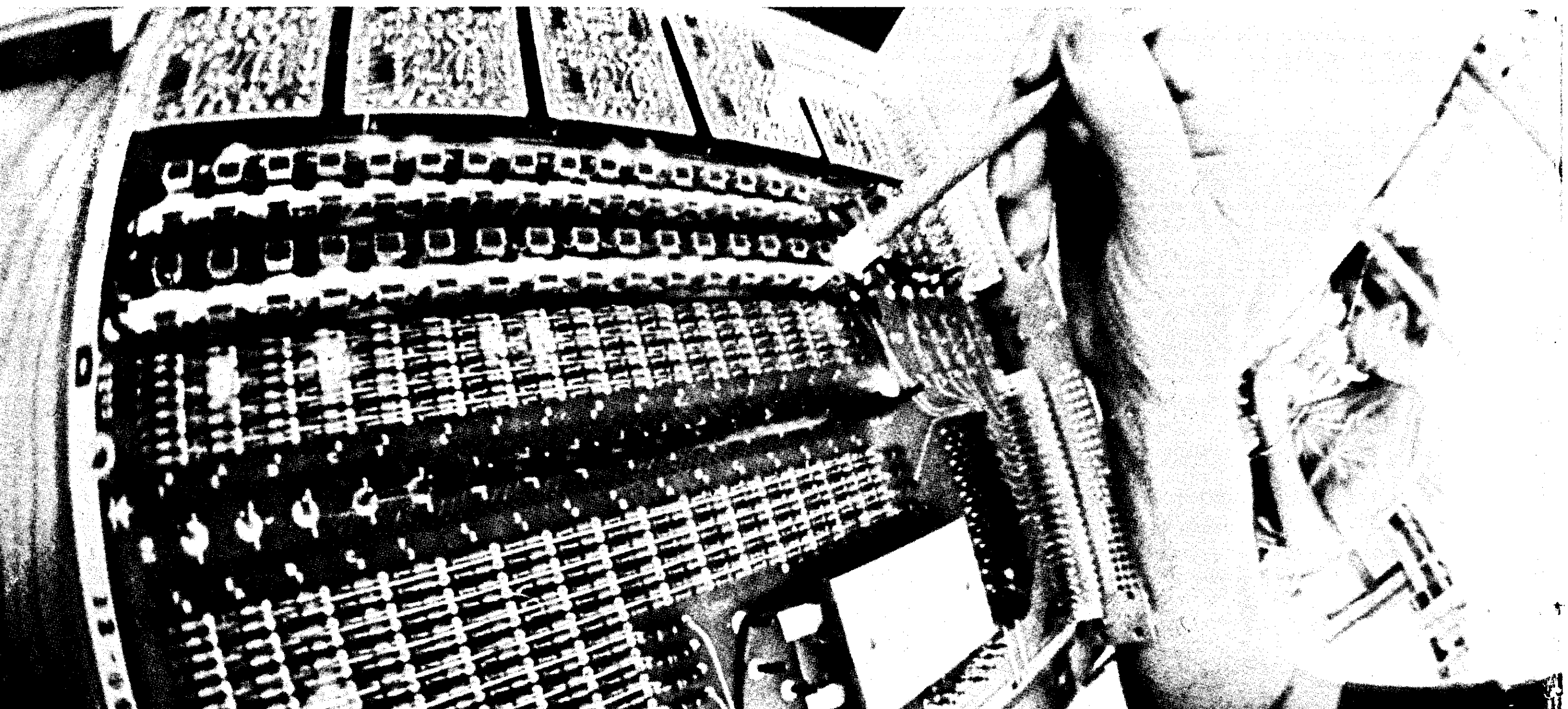
May, 1969

computers and automation

Abacus vs. Computer



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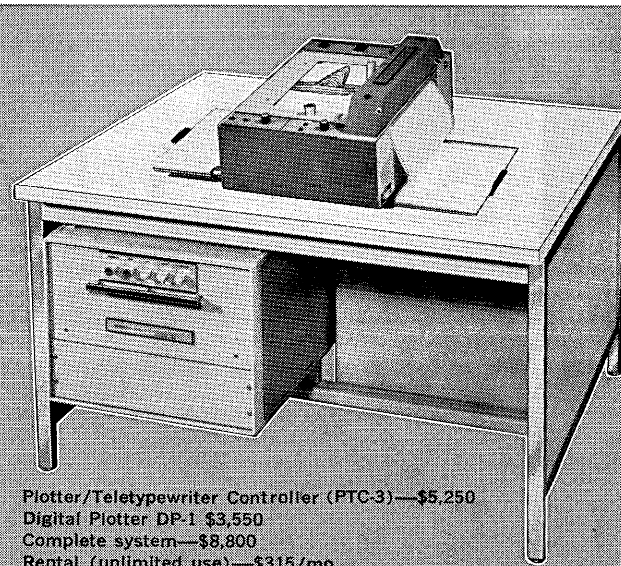

Plotter/Teletypewriter Controller (PTC-3)—$5,250
Digital Plotter DP-1 $3,550
Complete system—$8,800
Rental (unlimited use)—$315/mo.
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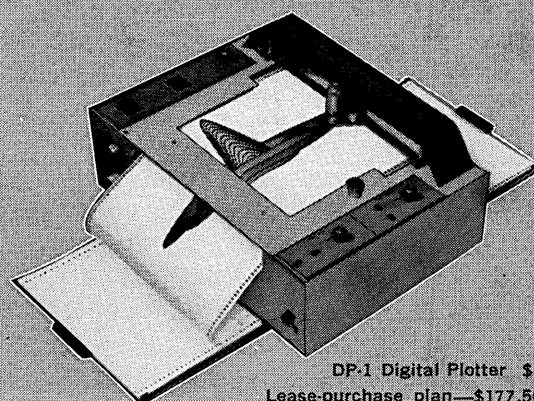

DP-1 Digital Plotter $3,550
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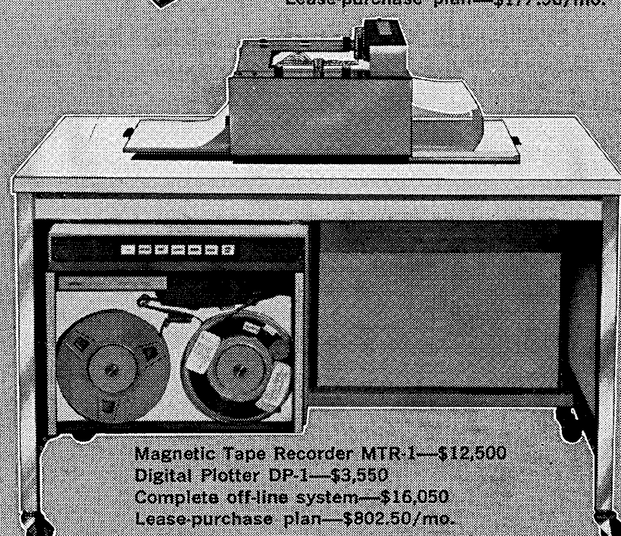

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Vol. 18, No. 5 — May, 1969

Editorial Offices
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AUDIT BUREAU OF CIRCULATIONS

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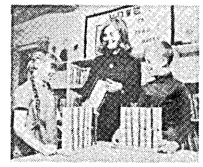
computers and automation

Vol. 18, No. 5, May, 1969 — *The magazine of the design, applications, and implications of information processing systems.*

Special Feature: Data Communications

Regular Features



Modern technology has apparently not yet found a replacement for the abacus — the ancient ingenious instrument for performing mathematical calculations. On the front cover, Miss Patricia Rupert, fourth grade teacher at the Glade View School, Lower Burrell, Pa., is showing two of her students, Megan Massarelli and Daniel Squire, how to use an abacus. The school uses the ancient instrument to teach modern math in grades one through four.

For a report on a newly developed "electronic" abacus, and a calculating contest in which an ancient abacus competed with the electronic computer, see page 68.

NOTICE

*D ON YOUR ADDRESS IMPRINT MEANS THAT YOUR SUBSCRIPTION INCLUDES THE COMPUTER DIRECTORY. *N MEANS THAT YOUR PRESENT SUBSCRIPTION DOES NOT INCLUDE THE COMPUTER DIRECTORY. SEE PAGE 69.

Departments

c.a EDITORIAL

The Cult of the Expert

It is an old human habit, when you are puzzled and do not know what to do, to ask somebody else to say what he thinks about your problem. Out of this perennial situation grows the notorious conflict between the ordinary man and the expert, and the cult of belief in the expert.

The ordinary man says "Should we have an anti-ballistic missile system — what is it any way?" The expert says, "Yes, of course you should. It will cost you a great deal of money; it may not work, but there is a chance that it will increase your security, and you know how dangerous the world is, and besides I am an expert, and I can give you good advice!"

Or the ordinary man says, "Should I have a management information system in my business? — I don't really know anything about computers, but everybody around me seems to be getting computers, and here is a statement by the president of a big business firm that I have just read:

> If a business does not have a management information system by 1973-1975, the business will just not be able to compete.

And the expert says, "Yes, of course you should. It will cost you a great deal of money; it may not work well for a while at the start, but there is a good chance that it will increase your ability to compete, and you know how dangerous the world of competition is, and besides I am an expert, and I can give you good advice!"

These dialogs, though slanted and exaggerated, contain some important and interesting questions:

- What is an expert?
- Should you take his advice? How do you judge him?
- When should you use common sense, the specialty of the ordinary man — and when should you use expertise, the specialty of the expert?

The adjective "expert" means "taught by use, practice, or experience", as in an "expert surgeon". The noun "expert" means "an expert or experienced person; hence, one who has special skill or knowledge in a subject; a specialist".

The word "cult" means: "1. A system of worship of a deity. Hence, a: The rites of a religion. b: Great devotion to some person, idea, or thing, especially such devotion viewed as an intellectual fad. c: A sect." And so "the cult of the expert" means devotion to the idea that so many questions are so complicated and so difficult that we should regularly and probably always rely on persons with special knowledge or experience to tell us the answers.

In examining the argument between the ordinary man and the expert, several important factors should be remembered.

First, no matter how great the expertness of an expert, he is limited in two ways: (1) in the field in which he has become experienced; and (2) in the time duration of his experience. Furthermore, once a man becomes classified as an expert, his duties very often change from actual experience in his field, to some kind of sublimation — supervising or reporting or lecturing or something else — in an office instead of a laboratory — and so his experience (his expertness) is cut off, and his expertness begins withering on the vine. So common sense should be applied to judging the worth of the expert and the soundness of his advice.

Second, the ordinary man himself eventually has to make his own decisions about his own problems on the basis of common sense. He is more experienced, and therefore more "expert", in his own problems than anybody else. He and not the outside expert has to suffer the losses in the event of wrong decisions. So what the ordinary man regularly needs to apply is a great deal of common sense, including applying it to what the expert advises.

But how does one learn common sense? particularly "enlightened" common sense?

Some would say "in the school of hard knocks". A good textbook on common sense would be helpful in getting through this school; I have often searched for such a book, but never found one, and so I have begun to put one together; it is tentatively entitled: *Common Sense, Elementary and Advanced.* (The effort so far has produced some 90 pages of manuscript and a two-page publication, "Right Answers — A Short Guide for Obtaining Them".*)

Third, an expert who is engaged in business as an expert, has to gain acceptance for his consulting services by undertaking promotional or selling behavior. A management expert, a computer expert, an expert in operations research, regularly has to have a sales force in order to stay in business. Every sales force tends to produce a distorted picture of the world, usually not actively untruthful perhaps, but regularly seriously biased in an optimistic direction. For example, over and over again the success of a management information system for a business will not depend nearly as much on the computer system recommended by the expert as it will on the people in the business who implement it: the systems analysts and the department managers whose knowledge and experience are translated into the computerized system. Second rate people plus first rate computers make third rate systems. And the ordinary man is likely to be appalled at the results. The expert for a number of reasons may not draw attention to this crucial factor — nor others. An expert is likely to provide biased advice.

Fourth, before any recommendation from an expert is accepted as a basis for a decision by the ordinary man to go ahead, he should decide in what way and over what time he will test or check the recommendation. He should raise the questions, "What are the bad things that can happen? What are the chances that they will happen?", and examine the answers. A recommendation from an expert, if it is accepted, should in general be accepted tentatively, as a basis for experiment, test, feedback, and correction — because it may not be successful in the situation to which it is applied.

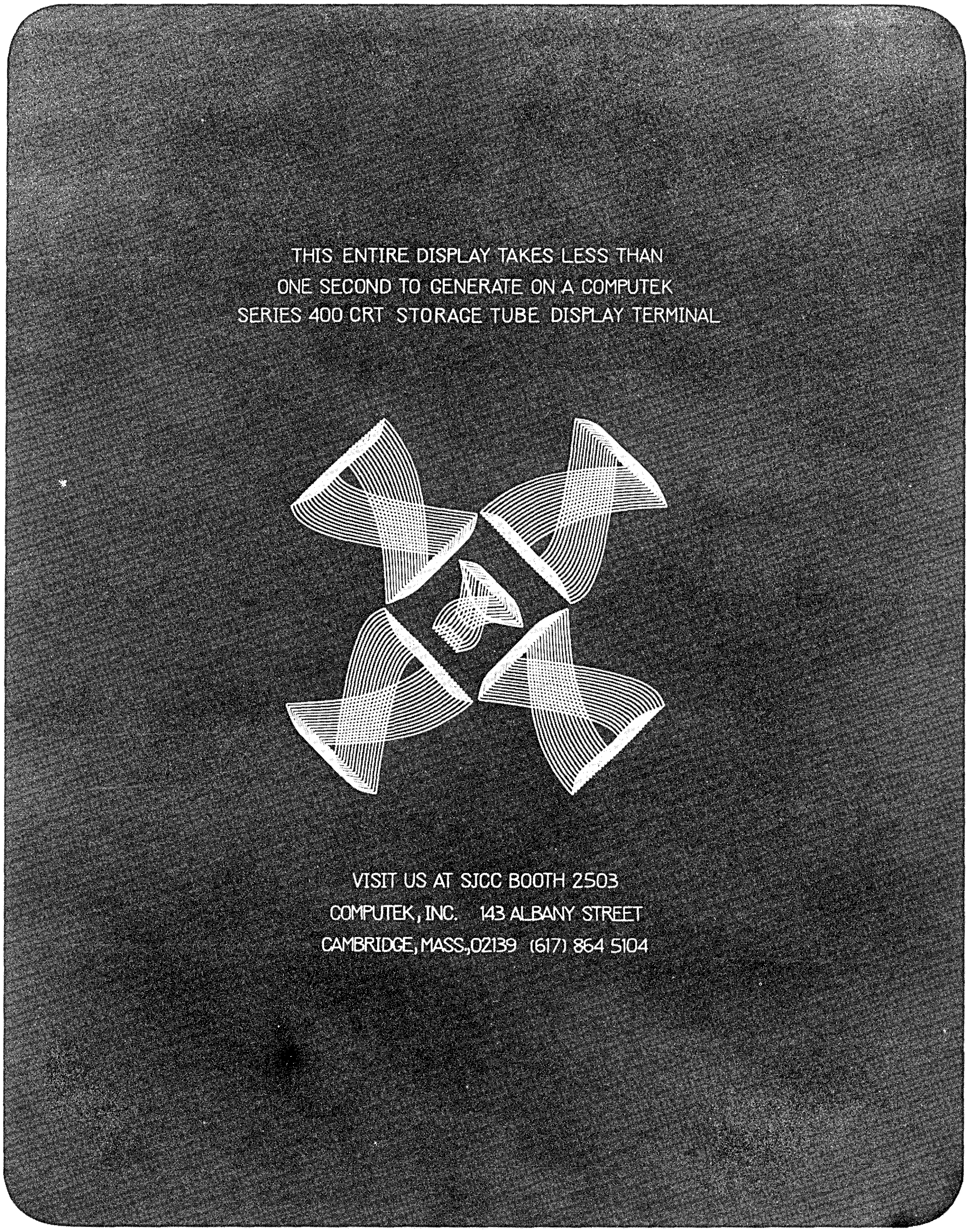
And so finally, we can say:

> The ordinary man should NEVER BELIEVE AN EXPERT without arranging for common sense testing of the expert's recommendation, and should always seek to apply enlightened common sense.

Edmund C. Berkeley

Editor

*Note: We shall be glad to send a copy of "Right Answers — A Short Guide for Obtaining Them" to any reader who circles No. 3 on the reader's Service Card.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AS WE GO TO PRESS

THE ASSOCIATION OF INDEPENDENT SOFTWARE COMPANIES (AISC) DECLARED ITSELF IN FAVOR OF COMPLETELY SEPARATE PRICING FOR HARDWARE AND SOFTWARE in a formal vote at a meeting in Washington on April 17.

The Association, which is made up of 12 independent programming and consulting companies, also believes that maintenance and education services, as well as all software (both systems programming and application programming) should be priced separately.

Richard C. Jones, group president and president of Applied Data Research, Inc., Princeton, N.J., says a formal position paper will be ready for distribution in about 4 weeks. It will be sent to the Justice Department and to anyone else interested in AISC's position.

HONEYWELL INC. AND AUERBACH CORP. HAVE FORMED AN INDEPENDENT COMPUTER SERVICE COMPANY that will develop advanced information systems for specific industries and businesses. The new company, to be called Honeywell-Auerbach Computer Services, will be an autonomous and independent enterprise that will seek "a significant share" of the developing market for "dedicated" computer information services.

The announcement was made on April 16 by Charles L. Davis, vice president and group executive of Honeywell's Computer and Communications Group, and Issac L. Auerbach, president of Auerbach. The two firms indicated that the market for dedicated computer services is expected to reach $650 million by 1972, compared with a market of approximately $100 million in 1968 and $30 million in 1967.

Unlike general data processing service bureaus, which handle the batch data processing needs of all kinds of customers in a localized area, dedicated service companies design computer systems to serve specific industries, markets, or applications, usually on a regional or nationwide basis. The first Honeywell-Auerbach dedicated service center is expected to open in 1970.

Honeywell-Auerbach will reportedly have two major advantages in providing its services: (1) a highly flexible organizational structure that will permit investment in, as well as internal development of, new dedicated service ideas or operations; and (2) more advanced and complete range of data management services for the industries the firm plans to serve.

President of the new firm is Francis A. Rowe, formerly general manager of the Univac Information Services Division. The company's first endeavor, Rowe said, will be the development of a comprehensive line of Automated Industry Management Services (AIMS) for the $140 billion savings and loan industry. Only about 4% of the nations 62,000 savings and loan associations are presently automated, according to Rowe.

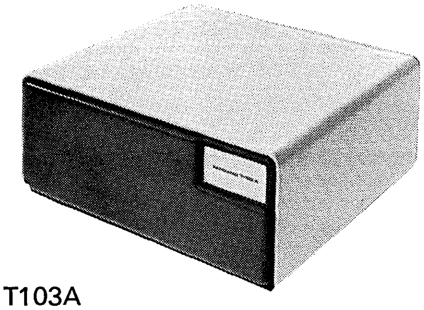
The new company will be based in Philadelphia. Temporary headquarters are at Auerbach's offices at 121 N. Broad St.

THE FULL TEXT OF ALL THE LAWS OF ALL 50 STATES AND THE UNITED STATES CODE have been stored in an information retrieval system developed by Aspen Systems Corp., Pittsburgh, Pa.

The system, called Aspen System 50, works on the basis of key words, rather than indices. Any word or group of words describing a specific law will generate a printout of laws relating to that subject. Printouts can include any or all of the states on any individual question.

John F. Horty, president of Aspen Systems, expects the primary users of the Aspen System 50 will be legislative bodies and government agencies which are trying to draft new laws, set up guidelines for operating under existing laws, or achieve more uniformity in laws.

THE QUESTION OF WHETHER SICSIC (The Special Interest Committee on the Social Implications of Computing Machinery) SHOULD OR COULD HAVE BEEN SUSPENDED has apparently not yet been satisfactorily answered. There will be a meeting for those interested in keeping SICSIC alive (or resurrecting it) in Boston in connection with the Spring Joint Computer Conference. The meeting is to be held on May 14 in Room 204 in the War Memorial Auditorium where SJCC will be held.



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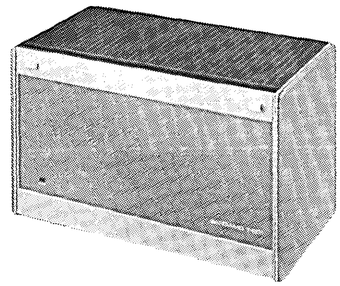

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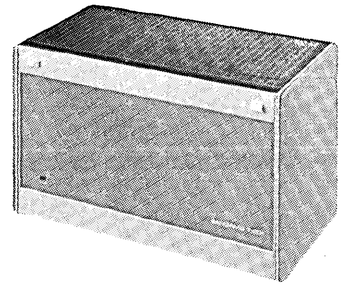

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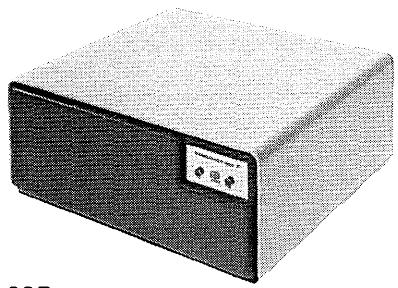

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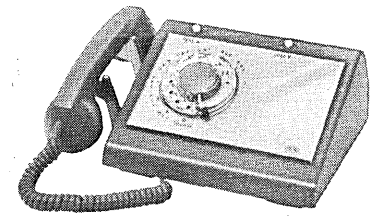

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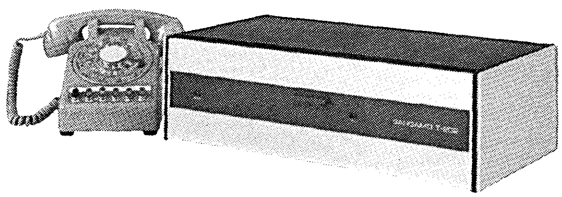
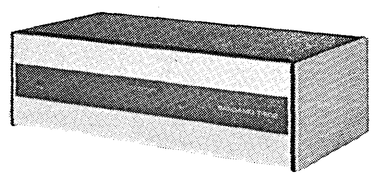


T202C



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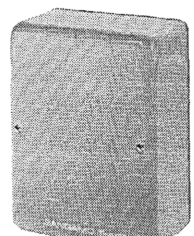

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201B3	202D2	202C5	401E5
201B4	202D3	202C6	401H1

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Letters To The Editor

Automated Retrieval of Legal Information

I read Mr. Ratliff's letter on page 10 of the March issue [reprinted below] concerning Mr. Furth's article ("Automated Retrieval of Legal Information: State of the Art") in the December, 1968 issue. For your information, I enclose a release from Mr. Ratliff that was distributed at the Annual Meeting of the American Bar Association in August of 1968, describing "a computer program to aid lawyers by indexing legal documents and information" available from his company.

I have no knowledge of whether Mr. Ratliff's system of indexing legal documents is good, bad, or indifferent. However, I feel your readers should be aware that Mr. Ratliff is the proprietor of a commercial package for lawyers, and also that Mr. Furth has been intimately involved in the development of legal retrieval systems for ten years, particularly the development of the system now being used by the Federal Government and at least ten states.

ROBERT P. BIGELOW
Hennessy, McCluskey, Earle & Kilburn
28 State St.
Boston, Mass. 02109

Tunnel Vision

I found your editorial, "Tunnel Vision" (January, 1969 issue), extremely interesting. It really tugged at the cultural shroud that has been covering my eyes for a long time.

You implied that you knew of several good books that deal with fallacies, and then went on to mention one of these titled *Applied Logic.*

Would you list the other books that you were referring to in the article? I am extremely interested in following through with your idea.

R. C. COTHES
3265 Cuesta Dr.
San Jose, Calif. 95122

Ed. Note — *I appreciate your kind remarks very much. Among the books that I would recommend are: (1)* Plants, Man and Life *by Edgar Anderson, Univ. of Calif. Press, Berkeley, Calif., 1967, 251 pp. Although this author is writing about botany, actually he is very often talking about science and knowledge in general; I have read the book four times and found it extremely interesting. (2)* The Step to Man *by John R. Platt, John Wiley &*

Sons, New York, N.Y., 1966, 216 pp. A physicist here looks at many important problems outside of physics. (3) Language, Thought, and Reality *by Benjamin Lee Whorf, John Wiley & Sons, New York, N.Y., 1956, 278 pp. In this book, the author discusses often whether the language man uses conditions, confines, or distorts the thoughts man is able to think.*

If I may, I would also like to refer you to one of my own books: A Guide to Mathematics for the Intelligent Nonmathematician, *published by Simon and Schuster, 1967, 352 pp. In this book, I try to talk about the relation of mathematics to the real world, in which it is found as an activity.*

Blind Computer Scientist

Your periodical gave me the first inspiration several years ago to start on my way to becoming a programmer in spite of the fact that I am blind. When *Computers and Automation* published my letter (May, 1966, page 52), a lot of people from all over the world wrote me about their favorable experiences with blind programmers.

At that time computer technology in Hungary was just beginning. Now it is used widely in all branches of industry. So I am faced with the next difficulty: How to be a blind systems analyst in the area of process control.

The help you gave me before encourages me to ask the following: (1) What kinds of experiences have blind system analysts had? How do they work? (2) What kind of bibliography would you advise for me about operation control in the primary metals industry? (3) If possible, could you send me descriptions about process control systems like IBM's OCS (Operation Control System)?

I will be thankful for the needed answers.

GEORGE HODI
Mechanical Engineer
Karpat utca 7/a
Budapest XIII, Hungary

Ed. Note — *We are, of course, replying to Mr. Hodi. And we cordially invite any of our readers who feel they might be helpful to him to write him as well.*

A Paid Subscription

When I asked to be put on your subscription list, I asked to be put on your controlled or qualified subscription list.

I was quite surprised when I received a bill for a one-year subscription, and I delayed payment, thinking you would realize I had wanted to be on a controlled subscription list.

When I read the February, 1969

"Letters to the Editor" section, I learned that *Computers and Automation* is a paid subscription magazine only. I didn't realize this before that time.

Your magazine is the most educational trade magazine I have read. I'm enclosing remittance for my one-year paid subscription. Please keep my issues coming.

STANLEY R. FOSTER
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Alexandria, Va. 22302

C&A at Sea

I am sending my subscription payment, which I know is late. I am sorry it has taken me so long to attend to this. The mail service for magazines to the Far East is very slow, and it took a long time for me to receive my first issue.

Your publication has been a good morale factor to us in the computer field aboard ship; it keeps us abreast of new developments stateside. I will have the Navy renew the subscription for next year.

DPC JOHN L. GRAFT
U.S.S. Coral Sea CVA-43
CPO Mess
FPO, San Francisco, Calif. 96601

NEW PATENTS

Raymond R. Skolnick
Patent Manager
Ford Instrument Co.
Div. of Sperry Rand Corp.
Long Island City, N.Y. 11101

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

January 21, 1969

3,423,736 / William W. Ash, Ithaca, Kurt M. Kosanke, Wappingers Falls, and Glenn T. Sincerbox, Poughkeepsie, N. Y. / International Business Machines Corporation, New York, N. Y., a corporation of New York / Apparatus for reading information selectively from storage devices.

3,423,737 / Leonard Roy Harper, San Jose, Calif. / International Business Machines Corporation, Armonk, N. Y., a corporation of New York / Nondestructive read transistor memory cell.

3,423,738 / Raymond H. James, Bloomington, and Charles W. Lundberg, St. Paul, Minn. / Sperry Rand Corporation, New York, N. Y., a corporation of Delaware / Magnetic memory comparator.

3,423,739 / James H. Scheuneman, St. Paul, Minn. / Sperry Rand Corporation, New York, N. Y., a corporation of Delaware / Nondestructive read memory selection system.

3,423,740 / Euvanl S. Barrekette and Eric Donath, New York, N. Y., and Harold H. Herd, Pacific Grove, Calif. / International Business Machines Corporation, New York, N. Y., a corporation of New York / Information handling device.

3,423,741 / Rodger L. Gamblin and Philip A. Lord, Vestal, N. Y. / International Business Machines Corporation, Armonk, N. Y., a corporation of New York / Memory addresser in a microwave readout system.

3,423,744 / Richard K. Gerlach, Gardena, Robert A. Melnick, Los Angeles, and Noboru Kimura, Gardena, Calif. / The National Cash Register Company, Dayton, Ohio, a corporation of Maryland / Binary magnetic recording system.

January 28, 1969

3,425,041 / Alain Gayet, Paris, France / Societe Industrielle Bull-General Electric (Societe Anonyme), Paris, France / Data storage device.

(Please turn to page 77)

Three readable alternatives to unreadable printout.

If you're involved in inputting, editing and updating text material and formatting it for publication, chances are you're using a specialized system such as Datatext, Text 360 or ATS. This being the case, you're aware of the basic limitation that exists in all of these systems . . . the inability to produce output of consistently high quality on line printers and typewriter terminals.

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Efficient additions, deletions, and changes to the file

Disk actions, which include complete maintenance of an active (working) storage and a less active (permanent) storage

In short, the ATS/360 software provides many of the functions necessary in most online terminal systems. A user's programmer, experienced in System/360 Assembly

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c.a

MULTI-ACCESS FORUM

"TIME-SHARING vs. INSTANT BATCH PROCESSING" — DISCUSSION

I. From George W. Perrett, Jr.
Asst. to the President
Com-Share Inc.
1919 West Stadium Blvd.
Ann Arbor, Mich. 48106

After reading the article, "Time-Sharing vs. Instant Batch Processing: An Experiment in Programmer Training," by Jeanne Adams and Leonard Cohen in the March 1969 issue of *Computers and Automation,* I am compelled to criticize the article and the study described in it.

One's impression after completing the article is that programmers have a preference for instant batch processing as opposed to time-sharing, even though the authors occasionally allude to the fact that that was not a statistical conclusion:

> The number of students participating in the NCAR case study (only eight) *might be considered too small a group* from which to draw valid conclusions. But a statistical analysis of numbers of events was not the purpose of this study. What the study did emphasize was the personal evaluation by the students of their work, and the averages and the figures showing how the students spent their time on any given day.

Not only was the number of participants just eight, but those eight people were broken into two groups. In addition, the two groups were broken into four different classifications of programming levels. It is further stated in the article that the groups switched computer equipment after one week:

> In any future experiment, we would probably not switch computers midstream. Although the change did not seem critical for the experienced participants, it did seem to produce a certain amount of confusion for the rank beginners. [*All two of them.*]

In addition to the sample being as described above, the equipment used was a General Electric 265 computer located in Dallas, Texas, for time-sharing, and a Control Data 6600 computer located at the test center for batch processing. An interesting quote about the equipment being used is:

> The batch processing computer went 'down' at times, and the students had to wait for keypunches at peak periods. The time-sharing computer also went 'down' at times, and at peak periods the terminal sent back a busy signal. In both modes the students suffered all the ordinary frustrations encountered at any computer facility.

At this point I think it is necessary to comment that the number of times that the batch processing system went down and the number of times that the students had to wait for keypunches at "peak periods," the number of times that the time-sharing system went down and the number of times that a busy signal was obtained, are all meaningful statistics that would directly affect the students' choices of a computing system.

In addition, the article alluded to the fact that the students had no preference for the editing features, etc., available in time-sharing. It should be pointed out that the General Electric 265 system may or may not have had good editing features at that time, and that the General Electric 265 is not, in fact, representative of all time-sharing systems at the present time for G.E. or for its competitors.

My letter of criticism could go on and on with regard to the number of programs, the various general conclusions drawn, the heavy reliance on statistics although statistics in the study were disavowed, and questioning whether or not those programmers who had experience had experience in time-sharing computers or in batch processing computers, etc., etc.

In general, I do not feel that this article is up to the usual level of *Computers and Automation.* I also feel that if the authors are truly trying to answer the questions as they indicate in the article, they should do a more thorough study.

II. From Allen F. Goldenson,
Manager, Technical Services
Computer Sharing of Canada
4214 Dundas St. W.
Toronto 18, Ontario

The article "Time-Sharing vs. Instant Batch Processing" in the March, 1969 issue of *Computers and Automation* was a disgraceful exercise in fallacious extension of maliciously unfair comparisons to the obvious end of discrediting an entire industry.

The "objective measures" utilized in the experiment included running a CDC 6600, one of the fastest machines available for remote batch processing, against a GE 265, which is, next to Quiktran's 7044, the slowest time-sharing computer available.

Further objectivity was ensured by providing a CRT display for the 6600 while retaining a teletype for time-sharing I/O.

Even more objective was the use of CDC's Extended FORTRAN (IV) as a standard of comparison against GE's rather gross form of FORTRAN II.

And, as if all of that were inadequate, a price comparison at $300 per hour of 6600 time; a rate far from commercially available, against the standard GE rates.

The "results" were indeed predictable.

Since the GE 265 is virtually obsolete; since a vast multitude of faster, more versatile time-sharing services exist; and since the authors, given even a modicum of common sense, could have realized the total futility of this exercise — one can but conclude malicious intent to discredit the time-sharing industry to those (hopefully) few people ignorant enough to accept the article at face value.

It is amazing that the editorial board of *Computers and Automation,* by publishing the article, falls into one of the above two categories.

At the very least, a public apology is due.

If you have to service time-sharers while running batch.

Get one Sigma.

Most machines can't handle both. A few fake it by treating batch like a time-sharing terminal, so it gets worked on a few milliseconds at a time.

Sigma 5 and 7 handle both, concurrently. Our new BTM software allocates core memory and time for effective batch time-sharing. But if all your 38 time-sharers aren't time-sharing, BTM automatically takes up the slack to speed batch processing.

As a result, batch runs smoothly at central site, or from remote batch terminals. BTM even lets time-sharers have access to the batch job stream for greater computing power and flexibility.

If batch isn't running fast enough for you, terminal users can be gracefully dismissed from the system so all available time and memory can be given to batch. Without stopping the system or dumping files just to change modes.

But just because Sigma uses half its mind for batch and half for time-sharing, don't expect half-witted programs. There's a long list of conversational languages and services such as SDS Basic, Fortran IV H, and Symbol, which are compatible for batch operations. Plus powerful batch processors like SDS Fortran IV, SDS Cobol 65, FMPS, SL-1, Manage and others.

This sounds like a promise of things to come. It isn't. We'll come to your office and demonstrate it. Now.

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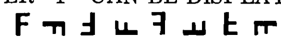

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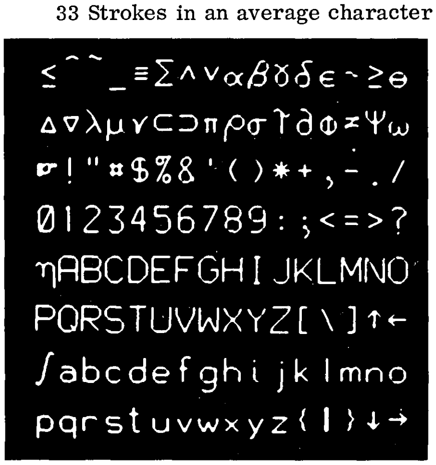

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See our display at Computers and Automation's Booth No. 503 at the Spring Joint Computer Conference.

III. A letter to Mrs. Jeanne Adams from
Prof. Melvin Klerer
New York Univ.
School of Engineering Science
University Heights
Bronx, N.Y. 10453

Your article (co-authored by L. Cohen) comparing Time-Sharing and Instant Batch Processing (*Computers and Automation,* March, 1969) was very interesting. I would like to avail myself of your offer to send the test problems on request. Also, I would be interested in seeing preprints of your further studies in this area.

IV. From Darrell L. Vines, Asst. Prof.
Dept. of Electrical Engineering
Texas Technological College
Lubbock, Tex. 79409

I have just finished reading the excellent article in your March 1969 issue: "Time-Sharing vs. Instant Batch Processing: An Experiment in Programmer Training" by J. Adams and L. Cohen. I believe that their experiment was a valid one and the results are *very* interesting. However, experience has been that "instant turn around" is a very elusive concept! In real life it just does not exist. I suggest that the next experiment be entitled, "Time-Sharing vs. Normal Batch Processing".

V. A letter to Mr. Leonard Cohen from
Arthur B. Woolsey
Otis Elevator Co.
260 11th Ave.
New York, N.Y. 10001

Your article, "Time-Sharing vs. Instant Batch Processing" was appreciated. I would like to have a copy of the problems referred to, as well as any available back-up data.

VI. From Mrs. Jeanne Adams and Leonard Cohen
Computing Facility
National Center for Atmospheric Research
P.O. Box 1470
Boulder, Colo. 80302

We would like to respond to the letters we have received concerning the article on "Time-Sharing vs. Instant Batch Processing" which we wrote for the March, 1969 issue of *Computers and Automation.*

Approximately 75 people a year learn to program in FORTRAN at NCAR, and we are always looking for better ways for them to learn. We conducted a pilot study with a regular class of eight students to see if the interactive aspects of time-sharing would increase the effectiveness of our method. The purpose of the study was to get the students' responses as a guide to future planning for our training programs. We made no attempt to draw definitive conclusions from this small sample; it was conducted as a pilot project. The intent of the article was to present what we did at NCAR as a case study.

Since the study was done at NCAR, we were limited to our batch processing computer (CDC 6600) and to the time-sharing services available in this area. The GE 265 service was chosen as being most representative in terms of system availability and cost at the time of the study, after consideration of all those to which we had access. The GE 265 may not be the best time-sharing system, but for our purposes in a training program (we purposely kept the problems simple) it was more than adequate. The GE staff was most cooperative and helpful.

For the first two weeks of training, which was the period of the study, we taught only FORTRAN II statements, so that the limitations of the GE 265 FORTRAN were not a factor. The display unit on the 6600 was used only to display job status and not as an interactive or input/output device. The DD80 microfilm recorder was not used for these two weeks, since no plotting was introduced. The main difference between the two systems was the interactive characteristics of time-sharing in contrast to the rapid turnaround of our batch processing system.

No statistical measures were applied to the daily logs of the student participants; these logs were merely tabulated and summarized. No measures of central tendency were used, only counting techniques. What these numbers showed was that individual differences among students far outweighed any differences between the two systems or between two students of similar experience.

Since the study described in the March 1969 issue, we have introduced our professional programming staff to time-sharing on an SDS 940. They were introduced to BASIC and CAL, QED (a text editing subsystem rather than a language), conversational FORTRAN IV and SNOBOL. At the end of this introductory period (2-3 weeks) they were invited to use the time-sharing if they wished. Since that time, however, none of the programmers have used the time-sharing system though it has been, and still is, available. At the end of the introductory period, they were asked to make comments on the advantages and disadvantages of time-sharing. They liked the simplicity of BASIC for learning and for programming small jobs, but preferred the flexibility and power of CDC 6600 FORTRAN for medium to large problems. They also felt that time-sharing would be more effective in an environment where access to the batch computer is limited or difficult and/or turnaround time is slow (> 1 hour). The consensus of opinion was that time-sharing does have a place in the computer industry, but that because of the easy access, rapid turnaround and flexibility of the 6600 at NCAR, a time-sharing system here is superfluous and would probably go unused. This is an opinion shared by the eight students who participated in last summer's training program.

Our article stands. It is what happened here at NCAR to a small class. Our measures of performance showed no noticeable differences whether the students used time-sharing or batch. The students themselves preferred the batch computer, although they said they would prefer time-sharing if batch turnaround were slow.

The goal in our training programs is to encourage the students to learn. When a "responsive environment" is provided, the student "explores" new ideas, using the equipment that best satisfies his needs to learn more about what he is studying. This case study shows that further experimentation is required in this field. There is a wealth of equipment available, and what best suits a need will not be the same for all organizations. We are not endorsing or criticizing any product; we are trying, as computer users, to make intelligent choices with regard to our equipment needs.

We feel that sharing ideas among industrial and scientific computer users is important. There is a need to know how other users fare in coping with specific needs. *Computers and Automation* has an excellent record of presenting just this kind of information, whether or not they agree with the presentation. More experimentation is needed to discover how computers may be best used; this includes the social and psychological implications of their use.

VII. From the Editor

We are glad to have comments from all our readers in regard to any of the articles which we publish.

In regard to the article's comparison of time-shared access to one computer system and instant batch access to another computer system, even though only eight students were involved, this article, we believe, presented some interesting, useful, and factual information, and so was worth some consideration from our readers. The limitation of observations and experience to eight persons, to one time-shared system, and to one instant batch system, of course limits the applicability of the article. On the other hand, if the article raises ideas, questions and possibilities in the minds of some of our readers, it will have fulfilled most of its purpose.

In regard to the charge of biased attack on the time-sharing computer industry, this was clearly not the intention of the authors, and it certainly was not our intention in publishing the article. It does seem to me personally that the time-sharing industry does suffer from some basic technological disadvantages, which may in the long run outweigh the evident current advantages, which have led to the recent great growth of time sharing and suppliers of time-sharing services:

1. *Line Cost.* Distant computers require long communication lines. Long communication lines require money. This is an undesirable expense.
2. *System Overhead.* Multiple users require complicated software and complicated systems to supervise the computer and to apportion slices of seconds to different users. This is an undesirable expense.
3. *Minicomputers.* The cost of an entire, powerful, small computer is going rapidly downward from $20,000 to $10,000 and much lower. In a few years, a powerful central processor is likely to be the size of a football, and to be pluggable into an electric typewriter. Such a computer will probably perform 95% of nearly all computing tasks; and a half minute telephone connection to a large file system will probably fill up the disc file associated with the small computer with enough data so that the user of the minicomputer can work several hours. In fact, many of the advocates of time-shared systems seem to give the game away when they talk of the expansion of the terminal or console to include a small computer!
4. *Pressure from Many Users.* Every time-sharing system becomes sluggish as the number of users increases. There is a continual conflict between keeping cost down and keeping service up.
5. *Direct Access.* The biggest appeal of the time-shared computer to a user is direct access. But for a great many problems, much greater direct access can probably be gained by (1) steady access to an entire small computer, or (2) instant batch processing, and this feature can be much more satisfactory to the user for many problems than access to a large time-shared computer.

Perhaps these very features cause some of the impassioned defense of the time-sharing industry by some of its advocates. □

PROLIFERATION OF BUREAUCRACY

Philip H. Abelson, Editor
Science*
1515 Mass. Ave. N.W.
Washington, D.C. 20005

Federally operated programs providing assistance to the American public number more than 1000 and cost more than $20 billion annually. In the field of education alone, there are at least 490 programs sponsored by 20 agencies. Representative Roth (R–Delaware) has listed 211 programs for college or graduate students; he states that no one knows precisely how many government assistance programs exist. In keeping with the increase in number of programs during the 1960's, there has necessarily been a growth of bureaucracy in Washington. What is worse, there has been a corresponding proliferation of bureaucratic activity in thousands of institutions and local government units.

This proliferation has occurred for three reasons. First, the local unit must have the means of becoming aware of federal programs. Second, there is a massive amount of paper work involved in applying for grants. Finally, there is the problem of accountability.

Numerically, the most extensive bureaucratization is in local government, where nearly 100,000 units compete for federal funds. However, the colleges and universities have also been affected. The smaller colleges and universities find it particularly difficult to compete for funds. At the large universities problems are not so great. These institutions can afford to support the needed staffs. Moreover, many of their faculty members serve on various federal panels and are a valuable source of information for their universities. Some universities operate what might be called an intelligence network. Faculty members returning from Washington prepare written reports on information they have gleaned. Because of their superior connections, the large "have" universities are in an excellent position to exploit changing opportunities. The amount of staff effort need not be large relative to the funds obtained. In contrast, the smaller institutions having poor contacts with Washington find it difficult to operate there very well, and must devote a disproportionately large effort to the study of federal programs.

To those not well versed in preparing grant requests, the great variety of requirements is irritating and frustrating. The man who becomes accustomed to furnishing information to one agency finds that another has totally different forms. Even within some agencies different programs have different requirements.

Other sources of irritation are the variable practices with respect to accountability and to changes in plans for procuring equipment. There are differences in the definition of what constitutes equipment and in rules concerning its ownership. The rules of the various agencies as to what is allowable as an expense are at times inconsistent. Indeed, auditors from the same agency have at times been inconsistent.

The bureaucracy that has been forced on universities is costly in three major ways. There is, of course, the cost in money to support it, which ultimately must be paid by Washington. A second cost is a deterioration in the intellectual atmosphere of the university. A third cost is the fact that university irritation at the time-wasting inefficiency of some aspects of the grants system destroys respect for the federal government.

Few scientists feel that a single Federal Department of Science is the answer to these problems, but most agree that greater uniformity of procedures among agencies is highly desirable and would save a great deal of money and friction. A thorough review leading to consolidation of some programs and an effort to produce more uniform regulations should be given a high priority by the new administration. □

*Editorial from *Science*, Vol. 163, Feb. 28, 1969, No. 3870, reprinted with permission from and copyright 1969 by the American Association for the Advancement of Science.

PERSONAL DATA IN COMPUTERS — A DISCUSSION IN THE BRITISH PARLIAMENT

(Based on a report in the March 7, 1969 edition of The Times, **Printing House Square, London E-C-4, England**

On March 6 in Parliament, Lord Winterbottom, the Undersecretary of Defence for the Royal Air Force, moved the second reading of the Vehicle and Driving Licences Bill. The Bill, which proposed positive liability for licence holders, set up the framework for the change to a new centralized vehicle and driving licences system using computer equipment.

In the course of the discussion of this bill Lord Nugent of Guildford made the following comments:

The proposal for positive liability for licensing is dangerous for the individual citizen who might move and fail to notify that his car was not being used, thus remaining liable for duty. Notifications might go astray. Is evasion so massive as to justify the big change in the law?

Some people have a rooted objection to being put on a computer. I understand that there is a society set up for the sole purpose of campaigning against this innovation in our modern lives: the computerization of the human being.

I suppose that the objection sprang from the feeling that the individual, by yielding details of personal information about himself, in some way put himself in the power of the Minister behind the system.

The last British witch was burned only in 1727 in Scotland. Our ancestors believed that magic spells could be cast for malevolent purposes and this kind of belief persisted in the backs of some people's minds.

Magic used to be operated by getting hold of some intimate possession of an individual. This was a reality for some people — that if one collected enough personal information about an individual, one could strike a sort of psychological identity and predict a person's behaviour within certain limits.

There is an obligation on this Government and on future Governments not to ask for one extra syllable of information not directly required for the licensing of a vehicle or the issuing of a licence.

Lord Winterbottom replied:

As one who lived for a time in a totalitarian society, I share the fear expressed by Lord Nugent of Guildford about computers.

There is an even greater risk in the computerization of the social services, which implies that every child would go on to a computer and from birth to death be listed on the central computer, so that the computer always knew where the man or woman was and what were his or her liabilities.

I share the fear of individuals mainly because of knowing, from a totalitarian society, how this system can be misused. This is a matter of great concern and something we should consider.

I assure Lord Nugent of Guildford that the minimum of information will be fed into the computer, but unfortunately that means a lot of information.

The Bill was then read a second time. □

COMPUTER TIME FOR BOY SCOUTS

Lester Freedman, Area Coordinator
Watchung Area Council, Inc.
Boy Scouts of America
133 East 6th St.
Plainfield, N.J. 07060

Eagle Scout Steven Wedell, age 14, of Van Nuys, Calif., last year became the first Boy Scout to earn the Computers Merit Badge. The badge was awarded at the Data Processing Management Association International Conference in Washington, D.C. This event is significant for two reasons: (1) it brings to light yet another potential source of personnel for the computer industry; and (2) it provides the computer industry with an opportunity to add a new dimension to the Scouting program by helping to prepare Scouts for the contact with computers they will have as our future leaders.

Some work in this area has already begun. The Mountainside, N.J. regional office of General Electric Company's Information Systems Division has been sponsoring semi-monthly classes in computer science for Explorer Post 415 since 1967. The courses they teach cover the basic fundamentals of computer technology, and prepare students to meet the requirements for the Computers Merit Badge. At the end of the first year's course, Post 415 visited GE's Information Processing Center and Information Systems offices in New York City. Technical papers prepared as one of the requirements for the merit badge were presented by several of the boys.

Computer users who have computer time available are encouraged to volunteer it to enable the Scouts to work with computers. Anyone interested in more information is invited to write to the address above. □

THE COMPUTER: NEW HANDMAIDEN OF AESTHETICS

Lawrence Lerner, Pres.
Saphier, Lerner, Schindler, Inc.
Div. of Litton Industries
600 Madison Ave.,
New York, N.Y. 10010

The computer, up to now the handmaiden of the scientist and the industrialist, will soon become an "activist" in the heretofore sacrosanct world of design. It will enlarge the mind of the designer to a profound extent, and will be used widely in the field of design by the latter part of the 20th century.

Already a really exciting evolution of computer application is taking place in the area of design. An architectural firm in Memphis, Tenn., for example, is preparing its working drawings for new motels on a computer-driven plotter. And computer art has emerged as one of the technological areas being explored by contemporary artists.

The computer will free the serious designer from the "household" chores of designing, such as sketching, and will thus accelerate the aesthetic process. It has become acceptable to use machinery in clerical work, in printing, in manufacturing, and in delivering the components which go to make up a contract premise. Why not then use a simple tool — the computer — in the aesthetic process? Such a tool, which would speed up the design process and offer unlimited choice, could help designers to better interpret the evolution of society.

The prospect of the very mention of the concepts of computer and designer in the same breath would seem to be a contradiction of the very essence of the artistic involvement we have come to associate with the architectural and design professions. There is, however, really no paradox, no contradiction, no heterogeneity.

Design is a discipline of function, logistics and economics, always carried on in the ambience of aesthetics. The first three — function, logistics, and economics — can safely be turned over to the computer, freeing the artist for his most meaningful contribution, the aesthetic one. The computer, then, acts as a sophisticated pencil.

The design field presently suffers from a desperate shortage of creative talent. People who are good designers have no time available to spend in preparing working drawings; those who do not make the grade as good designers aren't satisfied to spend their lives as draftsmen. The latter group, however, may very well have the temperament to learn to systematize and operate a computer.

The computer has already invaded the peripheral design fields. Furniture and equipment specifications, estimating take-offs and purchase orders are being processed by computers. Now, patient manipulation of binary sequences have enabled computer scientists to invade a discipline heretofore considered to be non-automatable. □

COMPUTER ART AND MUSIC FESTIVAL — CALL FOR CONTRIBUTIONS

Glyn Jones
Burroughs Corp.
460 Sierra Madre Villa
Pasadena, Calif. 91109

The Second Annual ACM Computer Art and Music Festival will be held August 26-28, 1969, in San Francisco in conjunction with the ACM 1969 National Conference. Individuals are invited to submit computer-generated art, music, or sculpture for display at the Festival. Interested contributors should send a one-page description of their art to the address above. Further details will be mailed to those expressing an interest in exhibiting at the Festival. □

HALT!

A sudden cybernetic pause on rationale
    intruding,
In evidence of unknown cause an unlit lamp
    protruding;
A beastlike buzz, atonic hum, now belching
    a betrayal
Of task undone, ere scarce begun, its
    efforts to curtail.

All this, and then, as I begin to find my
    scattered wits,
An answer, crisp invective, spits; across
    the silent veil now splits,
A cataclysmic chatter, clatter, stammering
    in cryptic fits.
I read, indeed, portent of doom, catastrophe
    now fills the room.

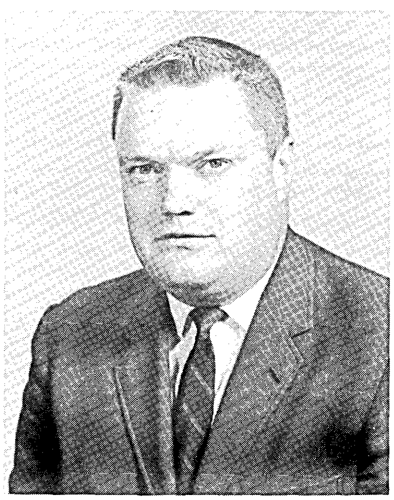
The message clear, the end is here, my heart
    now fills with terror.
The fate forebode, confirmed by code,
    "INPUT TAPE READ ERROR".

Marshall Rathbun, CDP
3507 Genesse
Kansas City, Mo. 64111

COMPUTERS AND COMMUNICATIONS: COMPLEMENTING TECHNOLOGIES

"With the broad implementation of a 'distributed computer' concept, a computer could become part of an interactive, automated information processing system which would provide swift and easy access to a really *huge information base."*

Dr. Ervin K. Dorff
Vice Pres., Systems
Computer Communications, Inc.
701 W. Manchester Blvd.
Inglewood, Calif. 90301



Dr. Dorff's industrial experience includes areas of systems and configuration analysis, software systems design and development, and applications programming. He is currently responsible for all systems operations of Computer Communications, Inc. He received his B.S. in Mathematics from the Univ. of Minnesota, and his M.S. and Ph.D. in Mathematics from Lehigh University.

The rapid union of two giant technologies — computers and communications — is a singular phenomenon that may well change the nature and value of what we call information and what we think of as communication.

Writing in the magazine *Science & Technology* recently, Charles J. Lynch concluded that the time is past when communication implies exchange of words between people. "Today," he said, "communication can just as often mean an exchange of data between machines — data that represents sales figures, handbook values, equation parameters, stock quotations, names, text, photographs, experimental measurements, charts, blood pressure readings — anything that can be reduced to an electrical signal."

The results of a recent survey indicate a 350% growth in data communications terminals in on-line applications within the next three years. By 1975, it is estimated that the traffic between computers will be occupying as much communications capacity as all the traffic between people.

Obviously the impact on the way we do things now is going to be a mighty one. But, while the computer-communications explosion is real and accelerating, its full potential depends on technological developments which, while clearly visible, have yet to be broadly accomplished.

The Marriage Between Computers and Communications

The impetus for the marriage between computers and communications (which, for our purpose here, is defined as any combination of modems, lines, and switching networks designed to forward messages from one point to another) came from both industries. The computer itself is a giant communications system with complex switching techniques. As the power and utilization of computers increased, it was only natural to connect the internal communications circuits of the computer to existing external communications circuits and thus provide wide geographic dispersion to the capabilities of a computer.

Within the communications industry, the sheer growth in message volume increased the magnitude and complexity of switching networks and required increasingly sophisticated control mechanisms. The computer was the natural choice.

So it is that the two technologies support and complement one another: communications facilities are used to expand and extend the capabilities of computers; computers are used to control and expand communications systems.

Components

There are three basic components in a computer-communications system: communications facilities and their interfaces to digital equipment, computer hardware and software, and remote user terminals.

Every advance toward the efficient and effective union of computers and communications has occurred as the result of new technological innovation in these three areas.

The first such development occurred in the late 1950's as digital techniques for information transmission gradually replaced analog techniques. Although telegraph and teletype lines operated digitally, it was the development of digital telemetry systems for missile and space communications which produced the widespread development of digital communications systems.

Message Switching Systems

Since digital communications systems transmit information in binary form, and digital computers operate on information in binary form, computers were naturally used for control of digital communications systems. Computer-based message switching systems are one example. Besides completely automating the function of message control, the computer increased system capability by providing such features as automatic code conversion, format control, data compression, error detection with automatic retransmission, and maintenance of a message log from which messages could be recalled on demand. The buffering capability of the computer allowed message transmission between communication lines of different speeds; also, it could be used to store messages for later transmission to stations which were closed due to time-zone differences or equipment malfunction. Message priority structures, generation of line usage statistics, and computation of line charges with automatic billing, could all be easily handled by the computer.

The many advantages in using computers for communications control led to the development of multiplexing devices. These allowed a single computer to simultaneously communicate over a large number of communications lines. In most cases, however, the computers did little if any processing on the information content of the messages; they were concerned only with message header information for purposes of message identification and routing.

Time-Sharing

The advent of computer time-sharing technology was the most significant milestone in the integration of computers and communications. Now computers could not only control the flow of messages over communications lines, but information contained within these messages could be analyzed and processed by the computer, which then could generate an appropriate response message for transmission within the system. A user, then, could engage in a meaningful dialogue with the computer. The development of sophisticated time-sharing software (and supporting hardware) allowed the computer to switch its attention between a large number of users so rapidly that, for all each user knew, the complete resources of the computer system were his exclusively.

The development of time-sharing technology and the ability to connect computers to the communications facilities of common carriers provided two of the three primary elements of computer-communications systems. Up to this point, however, comparatively little work had been done in the area of remote computer terminals.

For some specialized applications, special terminals were developed. While they were useful in their narrow applications, these terminals were much too limited for generalized use. Teletype units, which had the advantages of being readily available and already connected to communications lines, were almost universally chosen as remote terminals on early time-sharing systems. Because of their low cost and the millions of dollars invested in teletype-based time-sharing software systems, they are still the most widely used remote computer terminals. But a teletype can operate at only 1/20 of the communications speed currently available over a standard switched voice-grade phone line. Users with applications dealing in large volumes of data or requiring higher speed transmission than a teletype can handle, have often used a small computer as the remote terminal. Most remote job entry systems still today use expensive computers as the control element at each remote site.

The full benefits of sophisticated and efficient time-sharing software and higher speed communications capabilities cannot be widely implemented without economical remote terminals designed within the context of a total computer-communications system environment.

"Distributed" Computer System

The basic function of a computer-communications system is to provide the proper information at the proper place at the proper time. In most present systems that just doesn't happen efficiently or economically. To a great extent, the reason is that all information is stored at the computer site, and this requires a communications connection whenever a user at a remote site wishes to store or retrieve information. A better distribution throughout the system is obtained by storing each item of information wherever it is used most often; this increases system efficiency while at the same time it reduces communications costs.

Terminals for this "distributed computer" system have come into existence only recently. Depending on system requirements, several types of storage, or input/output capability, can be made available at each terminal. The primary storage is completely addressable by the computer in a manner similar to addressing its own internal storage. In effect, a "page" of main computer memory is distributed to each remote terminal. All data communication between computer and remote terminal becomes a transmission from one memory to another at speeds which are limited only by the communications facility.

By means of a CRT, the user at each terminal is provided with a "window" for viewing information contained within his "page." With the addition of a keyboard (for data entry and operator control), storage units (such as drums and discs) and other peripheral devices (card readers, line printers), the terminal becomes extremely powerful. An unlimited number of pages can be stored locally. All data transfers between the peripheral storage units and the primary page of storage at the terminal are handled off-line, independent of the computer and the communications facilities. The initiation of all data transfers — whether between the primary page and peripheral storage at the terminal site, or between the computer and the terminal — are under either manual operator control or computer control.

In the "distributed computer" concept, the terminal recognizes and responds to control functions as if it were directly attached to the computer. In essence then, a portion of computer memory, input/output capabilities, and all associated controls are provided at each remote terminal.

With the broad implementation of this kind of computer-communications, the computer itself will be considerably more than a digital processor; it will be part of an interactive, automated, information processing *system* which provides swift and easy access to a really huge information base. ☐

COMMON CREATION AND OWNERSHIP OF MASSIVE DATA BANKS

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Data banks, in the present context, mean files of machine-readable information which may be manipulated by an electronic digital computer, generally for the purpose of retrieving part of the information and displaying it in man-readable form. *Massive* connotes that the data bank is of such size, that substantial investment is required to initially create the file. The information in many such data banks in existence may have been organized, abstracted or otherwise "structured," or it may exist in largely unorganized or "natural" form, such as natural language text. Thus the massive data bank of which we speak, may consist of many hundreds or thousands of reels of magnetic tape. Once created, these are relatively inexpensive to copy or to manipulate into other types of structural files according to pre-selected rules.

Three Ways of Creating A Data Bank

There are three known methods of creating a massive data bank. The first is through the accepted path of borrowed or equity risk capital provided by lenders and investors. This is effective, assuming that use of the data bank can be ascertained in advance with sufficient certainty to insure ultimate recovery of capital and profitable operation.

The second way is by compulsory extraction of information incident to some government activity. Examples are the taxation or licensing laws, or laws which directly authorize accumulation of information at taxpayers' expense. Such data banks include the Social Security data files and the Internal Revenue Service files.[1] In either case, the data bank is built through utilization of tax funds to organize information extracted by the Government from its citizens. Hopefully, the public purpose is sufficiently clear and useful in every such case.

A third, and most interesting, way to create a large file of information, with relatively little investment, might be termed the "mutual interest dichotomy." The method here is to find two diverse groups of individuals, each having an interest in finding information about the other, and willing to furnish data about themselves in order to obtain the desired information. Hundreds of service organizations utilize this principle; e.g., dating bureaus, realty-locating and employee-employer matching to name a few. The data bank feeds upon itself as it grows; however, it is subject to the proprietary interest of its creator.

When all of the foregoing methods are examined with a view toward establishing a massive data bank which is non-proprietary and fully responsive to the public interest, without costing the taxpayer, all fall short in one manner or another. A cooperative effort by major potential users to establish a common data bank in any given field appears to be one possible approach.

COMSAT

An unusual experiment was enacted into law in 1962.[2] A Congressional act established the Communications Satellite Corporation, whose purpose was to establish a worldwide commercial communications satellite system as an instrument of U.S. policy. To accomplish a task of such magnitude required an organization having some unusual features. First, the corporation was to be formed and operated under government scrutiny and thus had all of the regulated aspects of a public utility. More than that, the law provided for continuing supervision by an agency (FCC) insuring non-discriminatory use of and access to the system, and more vital and direct government assistance by another agency (NASA) on a reimbursable basis in launching the satellites. Ownership of stock in this new corporation was to be both by the investment community and by "authorized users," and was limited by law to prescribed percentages of outstanding stock. Revenue was to be obtained by leasing communication channels to authorized users and sometimes to outside users as well. Another unusual feature includes the management of the overall system for an international consortium of member nations.

Advantages of a Co-operative Data Bank

The overall impact of COMSAT which is pertinent to this article is that an enormously expensive and risky undertaking was enabled through a common effort of common owners which would have been too great for any one to undertake alone in view of the risks.

The COMSAT approach suggests yet a fourth way to create and to administer a data bank. Furthermore, it seems to solve a number of problems inherent in very large data

[1] "The Federal Data Center: Proposals and Reactions" by Robert L. Chartrand, Law and Computer Technology, Oct. 1968.

[2] Title 47 of USC Sec. 701-744.

"Complete government ownership and control of massive data banks is repugnant to some. Yet the obvious economic power which would reside in such files absolutely requires application of government control through well-known public utility concepts. Is some compromise possible?"

banks, high investment cost and risk being among the foremost. Some of the advantages seen to accrue from a co-operative data bank privately created, but administered under government agencies are: responsiveness to the public interest, spreading of the risk among the investor and the user community, and lack of commitment to any one proprietary approach to data usage or file structure for information retrieval.

Characteristics of a Co-op Data Bank

A few of the characteristics of such a co-op data bank and a few principles which should govern its inception and operation are enumerated below:

1. The corporate form of ownership would be employed with stock ownership limitations and classes of permissible owners specified in the charter. It is envisioned that there would be at least two classes of owners — these being investor-owners, and user-owners.
2. Other principles and public safeguards normally applying to public utilities are incorporated in the charter as well as additional features which are unique to the COMSAT approach.
3. The major, if not only, tangible property of such a co-op data bank is the information file itself; i.e., the reels of tape or whatever bulk data storage form is employed. The software is the major capital asset of the corporation.
4. The only significant service of the co-op data bank is to create and to maintain the file and to make it available for copying. The later file maintenance may be facilitated by agreements with user-owners. However, one of the basic principles is that the file continues to be maintained so that it is free to utilize later technological developments and new uses.
5. User-owners occupy a special status of privilege and responsibility in many respects. Among these are:
   a. In the initial creation of the file, they may contribute machine-readable data in prescribed form rather than cash in order to acquire ownership shares. (Thus a precalculated cost per unit record is necessary.)
   b. Subscription to purchase shares of stock by owner-users includes usage agreements designed to liquidate the initial cost of creating the file.
   c. Return of profits to user-owners by rentals to subsequent user-owners may take the form of reduced rates.
6. The principle of a "natural" file is to be adhered to. Often a data base is "structured" by rearranging, coding, supplementing or abstracting into a form representing the most currently popular approach to information retrieval. The inverted file is an example. Structuring can be an irreversible process involving loss of information. Therefore the machine-readable form should follow the man-readable form as closely as possible. Later techniques, not foreseen today, which may include use of syntax, probabilistic and other approaches may then be employed.
7. The copyright laws and rights of copyright owners must be recognized and resolved by appropriate agreements in advance. Rights to privacy of individual information are also recognized.
8. One interesting aspect of the foregoing is the possibility of government ownership of shares in partnership with private or corporate owners. The possible enabling of such government ownership arises under the "general welfare" clause[3] coupled with necessary legislation. Many legal problems apparently attaching to such government and private sharing of ownership may be alleviated by an intermediate U.S. corporation to hold and administer the government shares and to agree to be liable as any other stockholder.
9. A privately financed data bank of international scope becomes possible by using the international consortium management feature of COMSAT.

The nine principles above seem to flow from the concept of a co-op data bank and there may be others as well, depending upon the specific proposal.

A Patent Data Bank

One example of an immediate need for such a massive data bank created and administered through cooperative effort of the potential users is a common patent data bank. This would be used by both the U.S. Patent Office and the private patent community (law firms, corporations, and searching services) to advance the art of computer-assisted patent searching.

The mechanized patent searching problem has one costly aspect which looms large. The entire published art must be considered. As a practical matter, however, this involves some 3⅓ million U.S. patents averaging roughly 30,000

[3]U.S. Constitution, Art. 1, Section 8

alpha-numeric characters each, or 10^{11} characters, if full text information is to be stored. This is truly a potential massive data bank such as comprehended by this article.

Many organizations have attacked the problem in indirect fashion. The U.S. Patent Office has recently instituted a "data bank" program involving building a *future* data bank of machine-readable patents in full text. This becomes economic as an incident to typesetting by computer to reduce printing costs. Although there are plans to go back eventually and attack the mass of already existing patents, such plans are not aided by the aforesaid economic factors favoring printing of patents.

Another approach has been through ICREPAT, or the Committee for International Cooperation in Information Retrieval among Examining Patent Offices. This group, as the name suggests, is a multi government-sponsored international organization of patent offices, and its approach is to divide up the technical art, according to subject matter classification, among the world's patent offices. Only a small fraction of the field is covered and the program has been moving slowly since its inception in 1961.

Lastly, many private corporations have considered the problem from time to time and have made evaluations on small samples of data with some encouraging results.[4] No one organization, however, has been willing, thus far, to commit the necessary capital for such a speculative endeavor as building a machine-readable data bank for patent searching. Yet evidence is available that a great number of organizations are ready and willing to offer retrieval services if the patent file existed for copying for a reasonable fee.

Information Retrieval

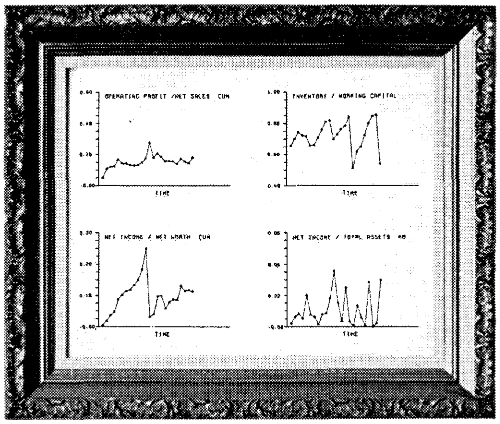
Information retrieval from massive files is yet in its infancy and it would be preposterous to assume that we will continue to use the same techniques and file structures employed today. Certainly some of the approaches utilizing probabilistic, heuristic or learned response show promise. Untrammeled use of a "natural" or uncommited file is necessary to continued development, yet the lack of demonstrative prediction of success demonstrates the inherent risk in the creation of such files.

Certainly the success of COMSAT attests to the willingness of the investor community to gamble on something as speculative (at the time) as the profit-making capacity of a series of orbiting satellites relaying messages and television pictures from one country to another. This gamble paid off in the form of a net profit of just under $1 million for 1968. It is believed that many opportunities and as yet unforeseeable techniques and uses will arise from massive machine-readable data bases after they are in existence.

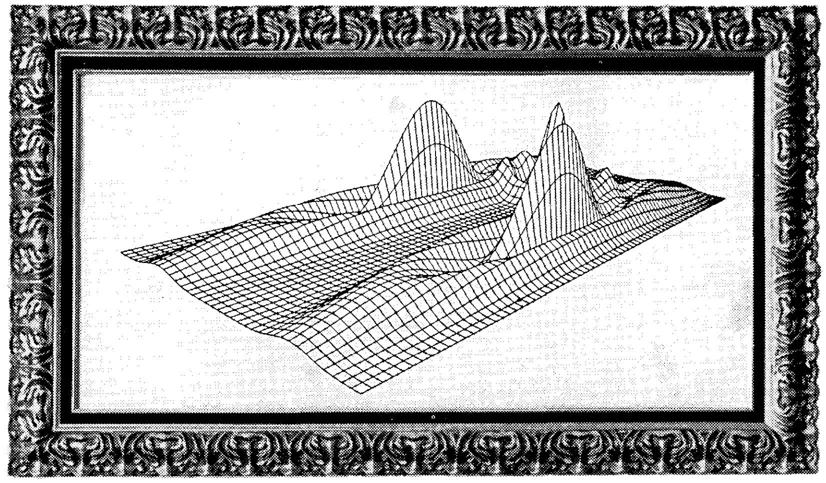
The specter of complete government ownership and control of such files of information is repugnant to some. Yet the obvious economic power which would reside in such files absolutely requires application of government control through well-known public utility concepts. Furthermore, the economics and new uses generated by natural competitive forces and private investment should be utilized. It is felt that the concept of co-op data bases offers a practical solution to these problems. ☐

[4] "Cybernetics as a Solution to the World's Patent Information Gap" by J. W. Birkenstock, Vice President IBM, given before Nat'l Assoc. of Mfgrs., Frankfurt, Germany, June 1967.

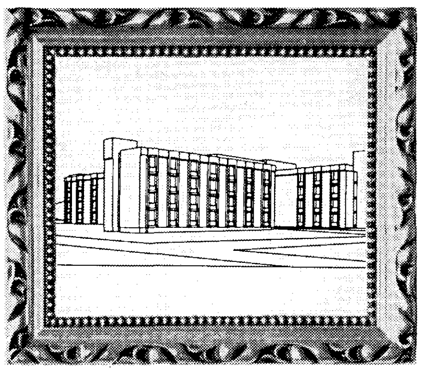
Teach your computer to draw



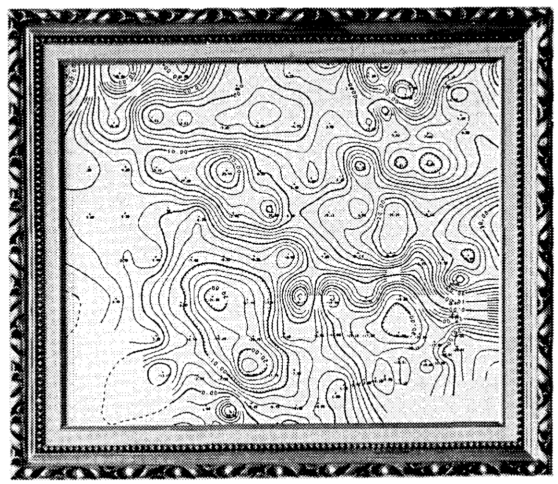
FINANCIAL TREND CHARTS



PERSPECTIVE DRAWINGS



ARCHITECTURAL DRAWINGS



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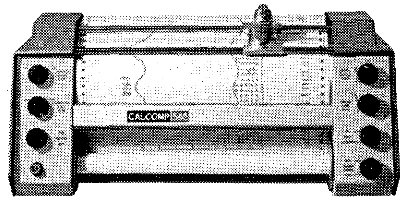

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NEW VARIABLES IN THE DATA PROCESSING EQUATION

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"Human operators of terminals will play a key role in the success of any communications-based information system. The designers of the system should recognize that these operators will have little orientation or motivation in data processing."

For many years it has been clear that there is a tremendous potential for the digital computer in jobs far more sophisticated than the traditional uses of routine accounting and record keeping. One broad classification of advanced application has been given the name "Information System" or "Management Information System" (MIS).

In an "Information System" the computer, utilizing communications facilities and remote input and output devices, extends and enhances the human being's ability to gather and evaluate large quantities of data. The system thus helps a manager to understand his business environment and permits him to function more efficiently; it permits him to base his decisions more on facts and less on intuition. The system may literally present a dynamic picture of his business and his business environment. The value of such a picture to a business manager is like the value of an oscilloscope trace to an electrical engineer. Just as the oscilloscope shows a pictorial representation of an electrical circuit's functioning, so a management information system can show to a businessman much of the environment in which his business exists.

The advantages of management information systems will become more and more evident to top level management; so data processing managers will feel greater and greater pressures to implement such systems. In order to implement an MIS, and realize its advantages, a complex set of new variable quantities must be introduced, disturbing a fairly stable and clearly understood data processing "equation".

Time for the System to Respond

Performing its new role as an information system, the computer must be keyed to the needs of the business environment, — not, as in the past, to the calendar or the clock. This fact implies that data will be processed not in a batch mode, dictated by convenience, but in a mode keyed to events or occurrences which produce the raw input data.

This leads us to identify "system response time". This is partly the elapsed time from the event through data recording, data collection, summarizing, processing and dissemination of results to the individuals who require this information. In addition, the systems response time includes the elapsed time required for human evaluation and definite feedback or action designed to influence subsequent events.

System response time varies according to application and purpose. Examples of varying response times can be demonstrated by some of the more common types of events in information systems. Inquiry, for example, would have a rather short response time, probably measured in seconds or at most minutes. This timeliness is dictated by the fact that the requirement for information is immediate, and long delays, by and large, cannot be tolerated. Order-entry, for another example, may have a wide variation of response times, depending upon the business enterprise and the market in which it functions. A dealer in small electronic components, for example, who has many competitors and who finds himself faced with a marketplace that demands 24-hour service, may require an extremely rapid response time. On the other hand, a manufacturer of large capital goods, may spend several months negotiating an order, and then custom-manufacture his product to meet the order; he would find an order-entry response time measured in minutes or even hours to be of almost no value.

Systems Balance

In merging a number of system-events needing different response times into a single information system, considerations relating to systems balance will become all-important. This can be best illustrated by a brief case study. About two years ago a manufacturer of a highly sophisticated technical product was experiencing severe problems in final assembly and product test due to parts shortages and defective components. In his effort to solve this problem, he spent a significant amount of money installing a highly sophisticated data-collection system in the areas of assembly and test. Briefly, this system tracked minute by minute the progress of assembly and test of each individual product. Any defects or deficiencies were to be recorded and noted instantly, thus seeking to overcome the problems of late delivery and poor quality. On installation of the system, it was discovered that the tree had concealed the forest. Final assembly and test of the product required approximately 3 days. Unfortunately, there was no input to the system from the key areas of inventory and receiving inspection. Therefore, once a defect was observed, the horse had, by that time, quite literally slipped from the barn and there was little that could be done to

recover in time from the difficulty. In this particular case, the system was clearly out of balance, since a great deal of time and effort had been taken to minutely scrutinize and control factors which, while related to the problem, were not the keys to its resolution.

Clearly, the factor of systems response time and the problem of systems balance can best be controlled through the development of long range plans for data processing. These should be based on studies of current and future applications, their interdependence, and information requirements of management. Always, the natural tendency of management to demand more and more information, in more and more detail, must be carefully balanced against a realistic appraisal of what can be accomplished with this information once it is gathered and evaluated, and the actual payoff to the organization.

Selection of Input/Output Devices and Their Location

Suppose that a long range plan for a management information system has been established. Suppose that the optimum system response time has been settled for each system-event. Then it will become obvious that often, in order to achieve the desired response time, the input/output devices must be located distant from the computer.

Two questions immediately arise. First, where should the device be located? Second, what is the best device to install there? Alternatives to be studied include: equipment speed; media used (such as cards, magnetic tape or paper tape); alternatives for media creation; and finally, requirements for communications or other transportation facilities needed to move the data from remote locations to the site of the central processing unit. Also the input/output device will need to be oriented to the job or the environment or both, suiting the human factors involved.

Organizations contemplating the implementation of information systems would be well advised to begin promptly to identify and define data sources by system-event. Then, the needs and the locations of the users of the system should be determined. From these two evaluations should emerge a determination of the problems that may be expected in data capture and distribution. Appropriate measures may then be taken to suit the hardware to the need.

The Involvement of Human Beings

The increased involvement of human beings, particularly in the input to an information system, offers one of the greatest challenges to its implementation.

Human operators of terminals will play a key role in the success of any information system. The designers of the system should recognize that these operators will have little orientation or motivation in data processing. In fact, they may have very little understanding of the system and of its importance to the organization. In addition, these operators will be remote from the computer site, and also from the usual authority of data processing management. In all probablity, they will be under different functional supervision, and this may pose organizational problems in systems implementation.

Human errors and the education of human beings are, therefore, two systems design factors which must receive significant attention. The systems designer must understand the chief motivations of the terminal operators. Wherever possible, he must design into the system factors which will lead to operator satisfaction as a result of successful operation of a terminal. Operator education, both at the start and on a continuing basis, must also be carefully planned. This is particularly true for systems which may expect a significant turn-over in terminal operators within a relatively short period (e.g., 6 months to a year) after the initial implementation of the system. Operator education must be recognized as a continuing system function. Wherever possible, means for providing education or guidance for operators should be designed into the terminal device or the system as a whole.

The efficiency of the terminals and the system, and the degree of intrusion introduced by the system into the regular jobs or occupations of the terminal operators, also must be considered. Many people in the organization will assume a second role as a result of the information system. In addition to their regular job, they will now also be expected to act as a recorder of data. As a result, human factors will be extremely important in the design of terminal devices. This will insure that the data recording operation is as simple and straightforward as possible, and requires a minimum effort from the terminal operator.

Also needed is a program of education for top-level management designed to impress on them the importance of a coordinated, well-supported effort. In several large on-line systems currently installed or in the process of installation, the key to success has been a top-level commitment to the system, and their recognition of the fact that any information system will force extensive changes in the way an organization does business.

Bringing into the data processing division people who have worked in areas of critical data sources can also pay large dividends.

New Vendors

A data processing manager contemplating the installation of an information system using terminals may well feel that he is drowning in an ocean of abundant choices. According to one spokesman for the data processing industry, more than 200 different firms today are manufacturing and marketing devices designed to capture, transmit, or display information at remote locations. In addition to this abundance, the common carriers offer a broad selection of communications facilities, and are continually striving to enhance and diversify these offerings. It is even harder to survey choices since many leading vendors of equipment are willing to customize or, in some cases, develop entire new devices for customers who are sufficiently perceptive and articulate to define their requirements and make them known. A systems study group needs an experienced, impartial overview of equipment. In addition, experience in the communications industry is a useful resource for a systems study group.

Summary

In conclusion, it is clear that communications-based information systems are on the way. They will bring with them significant changes for the total organization and particularly the data processing and systems divisions.

These changes imply both problems and opportunities. To minimize problems and ensure maximum exploitation of the opportunities will require careful long-range planning. These efforts should focus on isolating key dependencies in the capture and distribution of data, so that the organization's information needs are met with the best possible cost/effectiveness ratio.

Implementation of information systems will require extraordinary efforts both in staffing and education. People possessing the necessary skills and experience are in short supply; and efforts should be undertaken promptly to insure availability of these essential resources.

Finally, serious consideration should be given to education programs designed to prepare the whole organization for the new systems, secure support for their installation, and insure their successful operation. □

PREPARING FOR DATA COMMUNICATIONS

"The introduction of data communications to an established data processing operation is an essentially revolutionary development: it changes the lives of everyone concerned."

George O'Toole
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New York, N.Y. 10022

Mr. O'Toole is Director of the Education Division of Computer Methods Corp., and is currently producing a series of tutorial films for programmers and systems analysts. Prior to his present position, he served for several years with the Central Intelligence Agency. His earlier experience included the design and implementation of air traffic control, passenger reservations and military command and control systems.

Much of the communications technology used to transfer digital data between computers and remote terminals is not new; it was available in the era of the IBM 701 and the UNIVAC I. But it was the appearance of new developments in computer technology which gave rise to the new field of Data Communications.

The Programmer's World

Consider the world as seen by the computer programmer. It consists of two parts: — the central processing unit (CPU), and everything else. The programmer thinks of the CPU (together with its core storage) as the place in which his program resides. The program operates on data stored in core and is controlled by the registers of the CPU. "Everything else" includes all of the peripheral devices attached to the CPU. The programmer thinks of these as devices through which data are input to the CPU for processing, are stored from time to time (especially large masses of data), and are output as the final results of the processing carried out by his program. He is aware that these peripherals are connected to the CPU by cables and that data are exchanged between the peripherals and the CPU by means of electrical impulses, but the physical location of the peripherals is of no particular importance to him: it doesn't affect the way in which he writes his program.

However, the physical fact that electrical impulses are attenuated with distance in cables places a limit on how far a peripheral device may be located from a CPU. In practice this limitation is usually a few hundred feet.

Data, of course, are prepared and collected beyond this limiting radius for peripheral devices. Generally, the users of the results of the data processing function are also located beyond this limit. Traditionally, data have been exchanged between the user and the data processing system by mail, courier, or some equally leisurely medium. This has not usually been unacceptable, since this leisurely time required to transfer the data has been only a small part of the total cycle of accumulating the data for batch processing, the processing itself, and the dissemination of the results.

Remote Terminals

Recently, however, this cycle has shrunk. Direct-access storage devices and faster, interruptible CPU's have permitted the development of on-line systems. The remote user frequently wants to take advantage of this capability to process his data immediately. Wherever economy or operational necessity make this attractive, an effort has been made to replace the punch card and the printed listing with the remote terminal.

Suddenly, the programmer's world has acquired a third domain; "everything else" has been subdivided into two groups: peripherals within the radius of cable connection, and devices located beyond this radius, i.e., remote terminals. The physical connection of the remote terminal is not by cable but by some communications medium, usually provided by the common carriers, American Telephone & Telegraph or Western Union. This change requires the introduction of a new device — the communications controller.

The controller is basically a peripheral device which is used to interface the CPU or the remote terminal with the communications medium. Thus, the programmer must use a peripheral device to access another peripheral device, and between these two devices lies the *terra incognita* of Data Communications.

The introduction of Data Communications to an established data processing operation is an essentially revolutionary development: it changes the lives of everyone concerned. It places new demands on the manager, the systems analyst, the programmer, and the computer operator, and presents them with a new set of problems.

An Additional Vendor

First and foremost among the manager's new problems is his need to deal with an additional vendor, i.e., the common carrier. Presumably, he is already dealing with hardware manufacturers. He may also be contracting with an outside source for some of his software. The introduction of an additional vendor to provide communications presents a number of problems.[1] The first of these is the simple administrative burden which is added to the existing load. The second problem is linguistic — the manager may have mastered the jargon of EDP technology (it may, in fact, be his own jargon) but he is now forced to talk to people who speak a somewhat different dialect. Finally, the new vendor complicates a classical problem. He is, as are the software and hardware contractors, responsible for only a piece of the total system. The manager is responsible, when all the parts are put together, to insure that the totality works. Now, obviously, it is easier to determine that a system is not performing as required, than it is to say why. If things aren't working as they should, there is a natural human tendency to suspect that the trouble lies, not with one's own work, but elsewhere. This puts the manager in the conflicting and unenviable position of being both outraged customer and referee. To face this kind of problem the manager must have unusual personal technical resources, or a very competent staff.

Staff Problems

This introduces another thorny problem for the manager. His staff has suddenly become partially incompetent. They are generally ignorant of a new technological area of major importance to the system: Data Communications. There are two possible solutions to this problem: either to hire some more staff with a background in Data Communications or to retrain the present staff. The practical route is a combination of the two, with an emphasis on the latter. Even if it were desirable, it is certainly not feasible to fire all the programmers and systems analysts and replace them with EDP professionals who also have a background in Data Communications. In fact, the supply/demand ratio becomes even worse when the requirement for communications experience is added to the necessary qualification of EDP competence.

The most practical route seems to be to try to recruit one or two individuals with the required Data Communications background, either as in-house employees or as consultants (consultants, of course, represent yet another vendor for the manager to deal with). At the same time, the existing systems and programming personnel should be given intensive training in Data Communications. The objective of this procedure is to provide some people experienced in Data Communications against whose practical background the others can orient their newly acquired theoretical knowledge.

What and how much should be studied by the programming and systems staff? Data Communications is obviously a large subject. The EDP professional cannot expect to become an expert in it overnight or even after some weeks of training. The question reduces to: "Who needs to know what?"

The Manager

First, the manager is faced with acquiring some knowledge. As a minimum he needs a survey course on Data Communications which will orient him to the subject and permit him to converse intelligently on a general level with communications people.

The Systems Analyst

The systems analyst must get somewhat deeper into Data Communications than the data processing manager. He has to be able to talk to communications specialists and representatives of common carriers on a more detailed level. He must also be able to identify his specific communications requirements. He should be able to select from among the variety of communications services available to find the appropriate combination to meet his requirements. He must understand the sometimes complex cost factors associated with these different services. Finally, he must acquire some general understanding of the physical characteristics of remote terminals, the controller devices which interface with the communications medium, and even some features of the central processing unit with which he may not have had reason to become familiar in the past.

The Systems Programmer

The systems programmer has the greatest need for training in Data Communications. Most of what has been said of the systems analyst applies also to the systems programmer and to an even greater degree. He must have a very detailed understanding of the operational characteristics of the remote terminals and controller devices. He must master the art of exchanging data with this new third domain of his universe, peripherals beyond the reach of the old familiar (and simple) cable connection.

He must also adjust himself to a new kind of timing problem. Data are being "pushed" into the system through the communication links and must be processed if they are not to be lost or clog the system. This is different from the conventional system in which data are "pulled" in by the program when it is ready for further processing. This difference means that the systems programmer must pay a new kind of attention to program cycle times and buffer sizes.

The communications medium represents a new source of data error for the systems programmer; these errors must be handled in a new way. When a parity check fails on reading from a local peripheral device, an attempt to repeat the read operation can be made in the hope that the error is transient, before dumping error messages on the operator. In the data communications environment, error correction and recovery procedures must be different. They may include the transmission of a message to the remote

[1]These problems are treated at length in, D. C. McNelis, "The Common Carrier as a Second Vendor," *Principles of Data Communications for Professional Programmers and Systems Analysts,* Ernest Heau and Donald McNelis, Computer Methods Corp., 1968, p. 56.

terminal to request a retransmission of the lost data. However, if the CPU and the peripheral device are connected by a "store-and-forward" communications link — one or more relay points at which messages are temporarily held until a line becomes available for further transmission — then the erroneous data may have been generated some time ago, the request for retransmission may take a while to get back to the remote terminal, and the retransmission may also suffer similar delays.

All of this means that the program must include the "bookkeeping" necessary to keep track of error conditions over relatively long intervals. This is much more difficult to deal with than the relatively simple problems of data errors in local peripheral devices in which the program can attempt to read the data several times, notify the operator if it is still unsuccessful, and get on with the processing. Here is another dimension of complexity for the systems programmer which is introduced by the advent of Data Communications.

The Computer Operator

The applications programmer and the computer operator are probably the personnel least affected by the advent of Data Communications. Of course, if the applications programmer has only been exposed to batch processing applications and the new system into which Data Communications is introduced is on-line (as is likely), then he too has a major transition to make. However, this transition is not so much involved in familiarization with Data Communications technology. Instead, it is concerned with the use of direct access storage devices, and programming within the environment of an on-line executive operating system.

The computer operator must adjust to sharing his role with the user; everyone who operates a remote terminal is, in a sense, a computer operator, and, in most cases, an amateur one. The teleprocessing system may include some means for the remote user to talk to the computer operator to ask for assistance. The operator must learn to provide that assistance.

Scheduling

If the system includes remote terminals located in time zones different from that in which the CPU is located, problems from schedules of shifts may also be created. If the computer is in Los Angeles and the terminal is in New York, and if someone in New York wants to use the system at 8:00 a.m. Eastern Standard Time, then there must be a computer operator available in Los Angeles at 5:00 a.m. Pacific Standard Time. Some small consolation may be drawn from the fact that it is not a new headache — it is the recurrence of an old one.

Data Communications implies not only new equipment, but also new ideas. The latter are always the more difficult to integrate with an existing system, but the data processing profession is accustomed to making this kind of intellectual leap. The transition from card systems to tape systems, the introduction of higher order languages, direct access storage devices, ... , have all involved mind-stretching to absorb new ideas.

> "Well, in *our* country," said Alice, . . . "you'd generally get to somewhere else — if you ran very fast for as long a time as we've been doing."
>
> "A slow sort of country!" said the Queen. "Now, *here*, you see, it takes all the running *you* can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that."

Data Processing is not a slow sort of country and Data Communications *is* somewhere else. □

A GLIMPSE AT THE FUTURE OF DATA COMMUNICATIONS

Richard P. Rifenburgh
Exec. Vice Pres.
Mohawk Data Sciences Corp.
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"At the upper end of the equipment spectrum, we can expect small computers with a high degree of format flexibility, a low amount of computing power, and a fair degree of sophistication so that they would operate as terminal devices to transfer information back and forth from the central powerful computer."

Data communications appears increasingly to be one of the fastest-growing segments of the computer industry. Our experience at Mohawk Data Sicences certainly supports that contention. In less than two years, some 3000 Mohawk data terminals have been installed in the field, and a majority of these are now equipped with card readers and computer line printers.

Before I try to explore just how rapid the expansion can be, let me attempt to define the present data communications market. It really consists of three submarkets: message information; data information; and what I would term "hybrid" information, which is somewhat of a cross between the first two.

Richard P. Rifenburgh, is one of the four founders of Mohawk Data Sciences Corp., formed in August, 1964. Born in Syracuse, New York, he studied electrical engineering at Wayne University in Detroit and started his business career in 1955 with the UNIVAC Division of Sperry Rand Corp.

Message Information

In terms of technology, message information is generally considered in the simplest category, and consists of the typical teletype terminal: TWX, telex and private wire. Such media for message communications provide direct readable information, usually through a vast wire network. While there has been little technological advance in this area over the last two decades in terms of terminal devices, there has been substantial improvement in areas within the network which are far removed from the terminal, i.e. in equipments used to switch, store, and distribute this message information to these older and slower terminal units. Examples of high-speed switching and forwarding systems are to be found in government installations, in some of the common carriers, and in a few, very large manufacturing companies.

Data Information

The second major communications category, the transmission of information in digital form, on the other hand constitutes a relatively new technology, especially in terms of the terminal equipment employed. Punched card and punched paper tape systems are at the lower end of the equipment spectrum; yet in conjunction with a touch-tone telephone, they represent tremendous potential as communication devices. At the upper end is the large multipurpose terminal which can transfer information to and from the central processor and which permits a good deal of work to be done at a remote site with a high-speed printer, card punch, and so forth. Between the two extremes of complexity and cost, we have the batch data communications systems which transmit data information from magnetic tape over telephone lines.

"Hybrid" Information

The third major submarket for data communications consists of "hybrid" information systems. Examples of such

(Please turn to page 53)

THE IMPACT OF STANDARDS

Gilbert E. Jones, Sr. Vice Pres.
IBM Corp.
Armonk, N.Y.

"Standards should be a means of enhancing trade and not restricting it; of stimulating technical progress and innovation, and not inhibiting it."

In examining standards as they relate to data processing, I think we can reach the inevitable conclusion that:

— Management has the major responsibility for standards;
— Management cannot totally delegate this responsibility to engineering,
— Management had better accept fully that responsibility.

Let's consider some of the problems.

Broad Base of Applications

First, the broadening base of computer applications is calling forth a whole new array of standardization activities. Examples are:

— Credit card standards in merchandising;
— Character recognition standards in banking;
— Instrumentation standards in process control systems;
— Reliability standards in industrial systems;
— Drafting standards in engineering;
— The standardization of symbols within scientific disciplines;
— Noise level standards;
— Radiation standards; etc.

Many of these standards may vary not only by field of application, but also by country and, in the United States, even by state.

Second, all the arms of government — administrative, regulatory, defense, science technology, etc. — are deeply involved with data processing. As a result, we are experiencing a significant demand for standards within each of these major areas. In defense, for example, we are concerned with radiation standards and reliability criteria. In administration we are deeply involved in the need to interchange data, leading to standards for codes for data interchange. In government-related fields, such as telephone, cable, radio, and satellite facilities, we need to interface with standards in those fields.

The result of all this standardization activity is that the data processing manufacturers find themselves currently involved with over 600 technical committees worldwide, addressing at least 70 major subject areas of standardization with which the data processing industry is directly and vitally involved.

The current procedure presents several problems. In particular, the speed with which it operates is hardly commensurate with the rate of development taking place in the data processing industry — particularly, the pace at which users are finding new areas of application for EDP equipment.

Time

We are finding that it takes over 3½ years to develop a national standard, and over 5½ years for an international one.

To be sure, that is not bad when you are dealing with a standard for which the need has not been fully defined, justified, or agreed upon. Also, it is not bad when you are dealing with a standard which is really de facto in nature and only requires formalization. This slowness is bad, however, when the need is obvious and universal, and a solution is beneficial to the vast majority.

Expense

Another serious consideration is the expense of proper participation within the current framework. Much external time, much travel and much internal time are required to participate adequately in the many committee meetings required.

There appears to be no simple solutions. Even if there were, no single government, organization, manufacturer, or user could implement them. The problem is global. As such it is not controllable by any single group or manufacturer. Accordingly, we who are concerned must attack it together with understanding, patience, and common sense on all sides.

Duplication

First, in our current standards activities, we need to make every effort on a national and international scale to rid ourselves of unnecessary duplication of effort, and waste of resources.

Need

Second, in approaching an area of standardization, let us first demand a clear statement of need.

- — Exactly what purpose is the standard expected to serve?
- — Equally important, what is it *not* intended to serve?
- — By whom is it expected to be used?
- — Who is *not* expected to have any use for it?
- — Where is it intended that it be implemented?
- — Where is it *not* intended to apply?
- — What is the total scope of its effect on users, on manufacturers, on nations, and on mankind?
- — Most important, how will it stand the test of time?

These are never easy questions to answer; but to ponder them carefully may well be the best way to rid ourselves of much effort that is obsolescent, redundant, and even undesirable, in favor of effort which is timely, well-thought through, and truly beneficial.

The Role of Established Practices

Third, in the pursuit of altruistic goals in standardization, let us not overlook de facto practice and the many economic considerations associated with it. For example, many of us who live in the foot-pound world would grant the technical superiority of the meter-kilogram system. Those of us who drive on the left-hand side of the street may concede that the more worldwide de facto practice of the right-hand side makes greater sense. I expect that the naturally convergent trend will be towards driving on the right and working in metric units. I suspect that whichever way the standard goes will be decided largely by economic considerations and de facto practice. But it is almost impossible to imagine some world body seeking to force us all overnight to drive on the left-hand side because of the 3 following reasons:

1. Drivers would be able to keep their right-hand on the steering wheel while using the left to shift the gear lever on the floor.
2. Although the U.S. would have to make the biggest change, they can more easily afford it.
3. The change would give a great boost to the British export drive, and thereby help the pound sterling.

The point is that we need to observe natural convergence trends and established practices, and we need to avoid a great deal of redundant effort, and expense in time and money. There will be times when the de facto practice will have to yield. But that decision should be carefully considered by those who will have to pay the bill — both users and manufacturers. Such a decision should not leave the issue strictly to technical judgments which may be made without sufficient attention to the economic consequences.

Scope of a Standard

It is important to define the intended scope of a standard, so that everyone is clear as to its intended use. For example, a data processing system has many aspects. First, it is a system of many electronic and mechanical components; second, it is a system of several items of equipment or hardware; third, it is a system within another system such as an industrial process, a guided missile, a payroll department, a hospital, an airline reservation network, or a management information system. Thus, in approaching standardization in data processing the committee has to think very carefully in terms of all the aspects mentioned. If not, the committee runs the risk of imposing upon one segment of users the special standards requirements of another segment — and there may be no real need, but a very tangible cost and expense.

It is sometimes advantageous to have more than one standard cover a particular area; for example, the different densities for magnetic tape, or different programming languages to communicate with the computer. We now have a FORTRAN and COBOL programming standard; we are actively working on an APT and an ALGOL programming standard. Each of these programming languages is designed to help the programmer or user communicate with the machine. The tremendous diversity of data processing requirements by type of industry, nature of application, and scope of application makes it essential that a variety of approaches to standards be available; otherwise much of the progress and creativity which has characterized the EDP industry would be stifled. Standards must not become ceilings to our progress.

Standards should be a means of enhancing trade and not restricting it; of stimulating technical progress and innovation, and not inhibiting it. Thus those who would manage either international or corporate affairs should approach standardization as a means for moving forward, and not as a means of holding back change.

Basically there are two ways of developing standards. One is the voluntary procedure advocated by the United States of America Standards Institute. The other is by unilateral action by some authoritarian group, such as the government, or an industry segment like the bankers, the airlines, or the merchants.

The institute's approach is usually better, I believe, but its success requires deep participation by management, in order to assure that the best technical and business talent guide the development of the standard.

Consumer Interests

Management has the responsibility to protect the interests of the consumer, the user. If we use standards as a means of protecting our own professional, company or national interests, it is the user who pays the bill. Management's job is to demonstrate leadership to the standards fraternity at a high ethical level.

Management has the job of evaluating trade-offs between technical and business values, between groups of customers, between short-term profits and longer term industrial health.

Management has the job to ensure that well-meaning standards are not prematurely written and accepted which could constrain product development. At the same time management must make certain that standards needs are anticipated and that enough muscle is put behind the effort to develop them so the standard is done well and done on time.

The technical community makes changes at an ever increasing rate. Management has the job of managing that change.

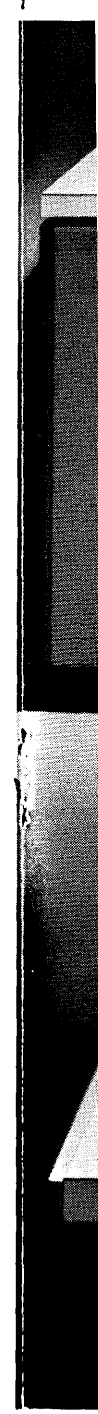
Standardization is in many ways like law making. In the case of laws, you want as little as possible written as well as possible, and written by and for the people who have to live with the law. In the case of law, the ultimate responsibility rests with government; in the case of standards, the responsibility rests with business management, the government, and all users. We need to live up to that responsibility. □

Hello, IBM?

About those 42 keypunches, 21 verifiers, the card reader and 4 tons of cards:

Please come and <u>take them all away</u>.

And...can you use a dozen extra operators? They're lovely girls, but we're installing a CMC KeyProcessing System.



Punching holes in a card, then running it through a card reader, is the standard way of getting new data into a computer. But as the flood of data continues to swell relentlessly, and as keypunch operators become harder and harder to find, many data processing managers are looking desperately for a better way.

— *Business Week*

Computer Machinery Corporation presents... a better way.

No cards. All data is recorded on one single reel of magnetic tape. And each $75-a-month keystation can be used for both keying and verifying. So you need far fewer operators and fewer units.

KeyProcessing works like this:

A special computer and a tape unit are contained in the supervisory console of each CMC KeyProcessing System.

Up to 32 keystations are controlled by the computer, which contains proprietary programs provided by CMC with the system.

Operators at individual keystations can enter or verify data independently and simultaneously, on multiple job formats.

The data is processed by the computer and stored on a magnetic disk.

When batches are complete, they are transferred on command to the single tape, which becomes clean input for your computer system. Done!

At a tenth of a cent apiece, punched cards may sound like a bargain. But a user of, say, 20-million cards a year—not an unlikely output for a 50-keypunch operation—can easily see where to get the first $20,000 for new, more productive equipment. The latest systems may trim by one-third the cost of running a 50-keypunch data center.

— *Business Week*

Check the reader card for information on the latest of the latest systems. A CMC KeyProcessing System makes your data preparation as modern as your data processing.

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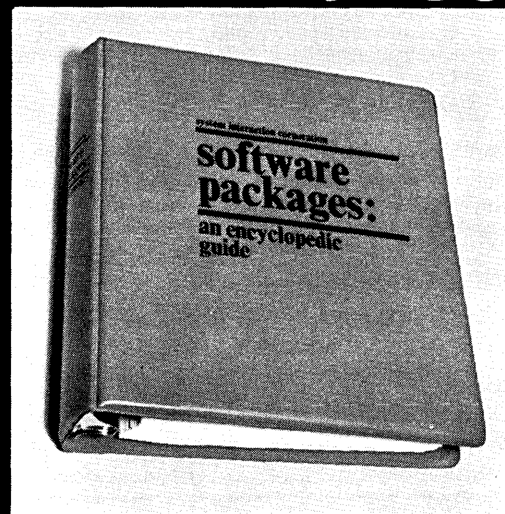

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C.a

COMPUTER MARKET REPORT

IBM's New Generation

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This is a report on IBM's "new generation" (NG) computers and other peripheral data processing equipment. The report is divided into three main parts. Part 1 covers the strategy and background behind the new equipment, Part 2 lists the characteristics of the new equipment, and Part 3 discusses the possible effect of the new equipment on the data processing marketplace and on other aspects of the data processing industry. The data for this report was compiled from various announcements and other announced developments about new data processing systems and peripheral equipment. Of course many other developments not included in this summary can be expected from IBM during the coming year.

Part I: Strategy and Background

It appears likely that some new equipment announcements regarding small card systems which incorporate a new input card may still possibly come in the second quarter of 1969. It is also likely that announcements dealing with large systems in the new generation computers will be scheduled near the start of the second half of 1969. One cannot discount the fact that IBM may change these expected announcement dates, as it has on previous occasions in the past five years. However, it is believed that the marketing strategy behind these announcements is unlikely to undergo any major changes.

We have named these expected machines new generation (NG) equipment, in preference to the term fourth generation, which may not be completely suitable. It is expected that the new equipment will use Metal-oxide-semiconductor (MOS) integrated circuits with several hundred elements. This new technology will assure the NG computers of several important advantages, including: substantially longer component life, far greater reliability, increased ease of diagnosis of reasons for equipment breakdowns, and repair in a fraction of the time it takes today. It is expected that ferrite-core memories will continue to be used, even though they will be made of smaller and smaller cores. These reductions in core size combined with other buffering technique innovations used on IBM's large computers (System 360/model 85) will assure substantially increased memory operating speeds.

Upwards Compatibility

The new generation systems will have between two to three times the capability (for example in terms of speed) for almost the current price. These computers will be as new in some respects as the system 360 line was when it was introduced in 1964. There will be important differences between the existing line of data processing systems and those to come in 1969. Certainly, it will not be possible to compare some of these new generation machines with any existing equipment. However, no matter how the new equipment is labelled, it will be able to use current programs and other software developed by users for System 360. It is believed that it will not be possible to use software specially produced for the new generation equipment on current IBM equipment. Most of the machines and systems will be upwards compatible. It is highly likely that the initial machines of the NG line will be one or more of the large systems in the line, and will be comparable to the IBM System 360/models 75 or 65 in price.

Initial deliveries of this new generation equipment are expected to be about nine to twelve months from the date of the 1969 announcement. This will be in line with the delivery schedules of other data processing equipment manufacturers, and will hopefully eliminate any problems with long delivery quotation as stated by some of IBM's competitors in their complaints to the anti-trust division of the Dept. of Justice.

Price

It is likely that although the prices of new systems equipment will be comparable to the existing machines, the relationships of rental charges to purchase prices and applicable maintenance agreement service rates will differ from existing IBM equipment. There are many reasons for this conclusion, some of these based on studies of the data processing marketplace conducted by DP Data Corp. during 1967 and 1968.

System 360

Far from making current system 360 equipment obsolete, the NG equipment will extend its life in many ways, so that current system 360 and other IBM users will be able to take advantage of the performance of the new equipment when they have outgrown their present equipment. It is likely that it will not be uncommon to mix the new generation equipment with the current system 360 and other equipment in a single system at a single location. In this sense, life of the system 360 machines will be extended into the 1970's.

Since the initial deliveries of a limited number of types of new generation equipment can be expected during the second quarter of 1970, 1971 and 1972 will be the years of volume deliveries to data processing users.

It is expected that the 1969 announcements (and later ones) by IBM will include a large number of machines and devices which go with the central processor. These peripheral units will proliferate over a period of time, making each computer installation virtually a custom-tailored job. This would be in line with increasing specialization at IBM in dealing with the needs of customers from different industries and even of those having different data processing needs and applications in the same industry.

Since the system 360 and new generation equipment life will extend into the mid-1970's, it is not unreasonable to expect a relaxation of IBM's past conservative depreciation practices, in line with the increasing maturity of the data processing industry. The evidence of this maturity, if not based on changes in technology, is based on the increased size that this industry will have attained in the 1970's.

Business Strategy

In coming out with the NG line of computers, IBM's business strategy is expected to undergo a drastic change from that of the past several years. Since it is expected that IBM will start its announcements of its NG line of computers with one of the large systems, the battle between IBM and Control Data Corp. for dominance of the large and very large sectors of the computer field will start with the NG announcements. The battle will be fought on Control Data's home grounds, the very large scale computer systems.

During the past several years, IBM has had trouble living up to the outmoded consent decree provisions which forced it to offer its equipment for sale, in addition to renting it as the corporation had done for over four decades. The consent decree was appropriate at a time when competition was almost nonexistent. Now, however, no one can realistically ignore the existence of competition in the data processing industry. Several large companies — General Electric, Honeywell, RCA, NCR, Burroughs, and Control Data — have entered the industry since that time. There is little doubt that there has been a dramatic increase in competition in this industry since the mid-1950's, almost fifteen years ago.

Growth of Leasing Companies

Over the years, many leasing companies have been established. These leasing companies did not sell any equipment to a user. They just took over the ownership of the data processing equipment from IBM with the consent of the equipment user in return for lower rental payments for the user than charged by IBM. In general, IBM took these leasing company actions gracefully. It looked forward to the day it could learn to live with these leasing companies so that both could cooperate in offering the equipment and services to the computer user. However, this independent leasing idea spread and really caught fire in the second half of 1967. In 1967 and 1968 several hundred million dollars worth of equipment was purchased each year by these financial intermediaries. It appears that from IBM's point of view all of these leasing companies took full advantage of IBM's inability to take any concrete actions, in view of the consent decree provisions. It seems that IBM would have liked to stop the disruption of its relationships with its customers caused by the independent leasing companies. The leasing companies did not service any of the purchased equipment or provide the data processing user with anything additional except the "lower than IBM rental," which was their initial appeal.

The leasing company side of the story, however, reads differently. They claim to have come to the rescue of the IBM equipment user. The companies lowered the cost of computer usage for their clients and at the same time kept some of the same conditions for the user, such as maintenance service by IBM. In addition, they claim to have created a more favorable climate for the user so that IBM would "treat them more fairly in the future".

Problems for Leasing Companies?

It seems likely that IBM's technological advances will cause severe problems for some, if not all, of these leasing companies. Innovation is the life blood of the current industrial scene; innovation will leave some indelible marks on those leasing companies not prepared for these changes, and on all others who do not attend to their homework in the little time that remains. We believe that IBM's strategy is to introduce large NG systems so as to offer its system 360/model 65 and 75 customers with far more power than they currently have for little, if any, more money. This will be a good bargain for these large system users. An analysis by DP Data Corporation of our file of Installed Data Processing Equipment shows that some of the leasing companies have concentrated their purchases of data processing systems in this part of the equipment spectrum. When current users desire to release their system 360/model 65 and 75 systems and go for the new IBM NG line of computers, there will be some problems in finding new customers for the released equipment belonging to the leasing houses.

It appears to us that in one move, IBM will try to compete with Control Data and regain its customers lost to the independent leasing companies. It is likely that IBM will experience some success in coming to terms with two of its recent problems — the competitive battle for the large system market, and a realistic adjustment of relations with the independent leasing companies.

Part 2: Equipment Characteristics

Some of the main characteristics of IBM's new generation (NG) equipment are new to the data processing marketplace. Others bring to the general computer user the equipment and techniques which have so far been used only by the so-called "advanced customers," all of them users of the large (and very large) computers.

The main characteristics of IBM's new generation equipment include:

1. **Stress on use of terminals.** These will enable the user to interact with the data, obtain data as needed from a data base, and assist in the updating of the data. In brief, these terminals will be used in several modes, some of these being time sharing and conversation, remote job entry, and entry and retrieval of data.
2. **Use of direct access storage devices.** Thus one can deal with data based systems on a random basis. Increased density disc drives and disc packs are a distinct possibility. Drums and mass storages should be an increasingly important part of a computer system, with stress on the improvement of access times. Newer technologies, such as the electron beam, may possibly be marketed at some point in the evolution of these new generation systems.
3. **Increased use of multiprogramming** — the concurrent operation of programs. This mode of operation will become progressively more important. Batch operations and batch and spool operations only will show a decline, while those including teleprocessing will increase.
4. **Differentiation between a uniprocessor, a multiprocessor, and a variation of the two.** A uniprocessor is a single processor system. A multiprocessor is a combination of two or more processors which share storage facilities, but which operate under a single control program. It is expected that for a multiprocessing two-process system, throughput would be, as far as possible, equal to twice that of a uniprocessor system.
5. **Greater stress on increased availability of the system.** This feature will emphasize reduction in the number and duration of interruptions to system functions, whether a uniprocessor or a multiprocessor.
6. **A design permitting changes in configuration of a system.** Thus it may be possible to include or eliminate control units, input and output devices, proces-

sors, memories and channels through either program control or manual operations.

7. **Increased performance and throughput.** This will be achieved through hardware capabilities which limit the negative effect of special features on total system performance, including those special features which are a part of shared storage systems.
8. **Many new CPU (central processing unit) characteristics.** Among these characteristics will be the possibility of operating the CPU in more than one mode. For example, two such modes could be "interruptable" and "non-interruptable". In the former move, a supervisor would be able to interrupt CPU operation for use on some other job. Another new CPU characteristic might be the provision of a console printer with keyboard for each system processor, so that any malfunctioning unit (a console or CPU) will not also cause the loss of the properly operating units in the system. In our opinion, some of these and other new features will make obsolete, in varying degrees, the existing CPU's in the hands of users.
9. **Many changes in the memory area, with the emergence of multiprocessor units.** For example, two memories may be asymmetrically combined. Shared memory storage may be provided which will enable more than one CPU to address one or more memory units. Detection and automatic correction of memory errors are also a possibility. It is likely that the system supervisor will be given the capability of assigning memory units for the use of a specific CPU. Although some of these changes may appear small, they will offer many alternatives to the user which are presently not available, in order to make possible a greater degree of utilization of the computer system's capabilities.
10. **A change in the multiplex and selector channel characteristics.** This will probably permit a reassignment of a specific job on one CPU to another CPU. In addition, to eliminate some of the problems with failing channels, alternate paths to any input-output control unit of the computer system may be provided. Also some provision for input-output load balancing may be available through the new (multiplex and selector) channel setup.
11. **Provision for the use of current and forthcoming new input-output devices.** This will extend the usefulness of existing devices and enable the new systems to operate with combinations of input and output equipment not presently possible.
12. **Equipment changes whereby a control unit will be accessible from any channel in the system.** This will permit easy switching of input-output devices and control units from one channel to another of the same or some other processor.
13. **Newly developed software will be used to introduce many new features.** One example is the on-line recording of error indications, so that maintenance personnel can obtain a history of events in order to locate a trouble or assist in preventing breakdowns in the future. Other examples are verification of all information written on the input-output storage devices, and the duplicate storage of certain critical control information by the supervisor. In essence, the emphasis in some of these software innovations is expected to be an effort to increase the reliability of the system and produce greater uptime of the computer (even though parts of it may be in the state of requiring corrective adjustments and maintenance).

Part 3: Changes in the Data Processing Marketplace

The changes expected in the DP marketplace in the U.S. and their effects on the data processing industry with the marketing of the new generation systems from IBM can be briefly stated as follows:

1. **Increased Competition for all Existing Companies.** The main battle will be for the business-oriented user of systems presently in the IBM range of 3630 to 3650, the largest segment of the current market. At this time, IBM holds the lion's share of this segment which we term the "intermediate range" systems.
2. **Imitation of IBM.** In order to reduce IBM's share of the total market, all the other companies will tend to imitate IBM. This apparent likeness will extend to their computer systems makeup, the stress on suitable software, the terms and conditions of doing business, and all the sales knowhow. In past years there has been some spreading of IBM sales know-how (an example is sales presentations) by the hiring of IBM salesmen and other personnel by its competitors. More of it will come in the days ahead.
3. **Increased Emphasis on Sales Efforts Directed Toward Specific Industries.** Although some of the other major manufacturers have recognized the benefits of selling by industry, they have to date not fully implemented even the small beginning in one or two specific industries. Specialized centers for dealing with each user industry's requirements will be increasingly in evidence, reflecting the desire of computer manufacturers to concentrate their expertise at one or more locations for each user industry. Operating from these specialized centers, they will be able to offer the user all the assistance needed with installations of the changed equipment expected in the 1970's. However, these specialized efforts organized along industry lines are likely to increase the marketing costs as a fraction of the rental (or sales) dollar.
4. **Greater Uniformity in Ways of Doing Business.** This will include firm list prices, emphasis on customer upgrading, elimination of overtime rentals (and plans for lower and higher basic numbers of hours of monthly usage), and many other operating policies now prevalent in the industry. Large commercial users will try to obtain the advantages accorded the Federal Government at this time. Other levels of government (state and local) which have been slow to catch up with computerization will also attempt to deal like BIG BROTHER, hoping they can operate in the style set by Washington.
5. **New Services.** Several other types of services at present not available separately from DP equipment rental (or purchase) contracts will be offered by independent companies. A few of these services are beginning to be offered by small firms. A lengthy list can be made of these specialized services if one begins to minutely examine the activities of the large computer manufacturing companies. We believe there will be many opportunities for entrepreneurs among the ranks of all large DP oriented and related companies, since many services can be best provided by small organizations. Several activities, such as programming and leasing, will attain a firm underpinning as the shakedown proceeds in the existing structure composed of new and unseasoned companies.

6. **Larger Used Equipment (and Computer) Market.** This is something many have expected prematurely in recent years. The erroneous expectations were that the used DP equipment (and computer) market would blossom with the installation of third generation machines by IBM (starting in 1965). Thus the used DP equipment market will come into being at long last while a new sector of the industry, the second (and later) user services is being developed. Some type of systematic definition of what is available from computer manufacturers and other independents can be expected. This in turn, will assist and sustain the DP used equipment market, including computers of previous (mostly third) generation vintage.
7. **IBM Equipment at Discounts.** Substantial amounts of almost all types of IBM DP equipment (including computers) will be available at large discounts from current IBM prices. This equipment will be available from both leasing companies and present owners of purchased equipment. By 1971-72, these rentals could be as low as 40% of current prices. Eventually, most of these price changes will seriously impact equipment available from all the computer manufacturers, including IBM. From information currently at hand, it appears that these developments will slow down the rate of growth of all companies in the industry, particularly large main frame manufacturers. However, by creating a broader market for data processing products generally, if additional marketing efforts are made, these changes may be moderated.
8. **Involvement of Financial Intermediaries.** Sooner or later the financial intermediaries (like banks and insurance companies) will become involved in the computer leasing industry. Some of the companies will become principals in the leasing industry; others will become integral parts of current industry participants. We believe the computer leasing industry is here to stay.
9. **Multiprocessing.** An increasing number of computer users will expect multiprocessing (especially in real time systems) and time sharing capabilities in their systems.
10. **Peripherals.** The computer peripheral equipment sector companies will seriously impact the mainframe system manufacturers at some date in the near future. Some of the peripheral equipment companies may emerge as full-fledged computer manufacturing companies. The price-performance relationship of input-output devices will become an increasingly important subject for the user and all manufacturers connected with the computer field.
11. **Higher Performance.** The user will demand greater performance and reliability (including uptime) from the equipment. He will become more familiar with systems and software techniques at present used by only a few of the so called advanced and large scale computer users. The role of consultants will filter down to users of small and intermediate size systems. There will be greater awareness and use of multiple suppliers of equipment, software and other services.
12. **More Understanding.** Top management of DP user companies will become more familiar and intimately connected with the goings-on in the computer and data processing field. This will be an outgrowth of the relative maturity of the computer industry. Many top managers will be drawn from those who came through the DP ranks in a company. With this top management involvement, users will upgrade equipment only after proof of availability of superior (and operating) software and substantially increased equipment performance for the rental (or purchase) dollar.
13. **Divisions.** Separate organizations (divisions or subsidiaries) will be formed within companies in the data processing industry (including IBM). As the different sectors of the industry (like leasing, software, supplies, and accessories) grow to a certain size, these separate organizations will become necessary in order to assure appropriate attention to these specific business activities. It appears that most of these new setups will include pricing separate from the equipment. One of the new sectors likely to emerge at an early date is maintenance (as IBM does through its Field Engineering Division now, but may do through a subsidiary company). ☐

c.a

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 695: SEARCH RESEARCH

"You just can't beat the good old binary split when you're searching for something, can you?" Al looked up from the program he was writing — a search program of course.

"Well," Bob replied, "when the total number of items is a power of 2 your best bet is certainly to halve the distribution at each step, but what if this isn't the case?"

"I can't see why dividing the data as nearly as possible in half at each step isn't still optimal."

"O.K., suppose you had a number of items that wasn't a power of 2, say 50, and you were able to split the distribution in two at every step and learn which of the two parts contained the target item. How would you go about finding it in the fewest steps?"

"I'd just break it up 25 and 25, then when I learned which set of 25 contained the item I was after I'd break up that group 12 and 13, and so on, always making the split as near 50-50 as possible." Al made a few calculations. "If I had to find every item once, using this procedure, there would be, let's see, 14 times when I'd find the target item in 5 steps and 36 times when 6 steps would be necessary. This would mean 5.72 steps on the average to find an item selected at random. I think any other way would lead to a higher average number of steps."

Is he right?

Solution to Problem 694: Bits and Pieces

If the number of all-zero vectors produced by applying the Majority Function to all N bit long vectors is denoted by F (N), we have $F(N)=F(N-1)+F(N-3)$. With initial values $F(3)=4$, $F(4)=6$, $F(5)=9$, we are able to continue to $F(15)=406$ (probability .01239) and $F(16)=595$ (probability .00908). Therefore 16 is the required length.

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

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1969, 366 pp., $15.00

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Difficult Fences in the Computer Field

(Based on a report by J. R. Birkle, A.S.A.P. Consultants Ltd., in the January 13, 1969 edition of The Times, *Printing House Square, London E-C-4, England)*

The high salaries at present paid to experienced computer programmers and systems analysts are no guide to their ability for anyone considering the recruitment of such people.

Data processing managers have a tremendous job trying to keep their teams together, and if salaries are not kept at or close to the market average, resignations are inevitable. Some will say they are inevitable anyway, but there is still no point in aggravating the situation.

Because demand is so great and the market is in general so indiscriminating, the salary range between the best and the worst in an installation tends not to be very great. For instance, programmer "A", who is only half as good as programmer "B" in terms of his output of tested instructions, may be paid $8500 compared with "B's" $10,000 because "A" has two years' experience and $8500 is the going rate for a programmer with two years' experience.

If the manager holds "A" back, "A" will find it far too easy to walk into another job, because the market is almost universally incapable of measuring the relative abilities of different programmers and analysts. Salary and years of experience are the usual guides for the inexperienced interviewer.

You might think that the loss of "A", an overpaid and below average programmer, was no great hardship, but to replace him may cost from $600 to $2000 in advertising and recruiting expenses. In addition, because of the shortage and lack of precision in evaluation techniques, the poor data processing manager may end up with a even worse programmer than "A".

The below average performers are thus carried along by the stream, paid more than they are worth and, because of the market conditions, sometimes changing jobs and moving to something well outside their capabilities. Here their stay is painfully short and they are pushed rather forcefully back into the job-hunting pool. This pool contains, along with the many who are genuinely seeking to improve themselves, three sorts of undesirables — the unsuitable, the unfortunate, and the unscrupulous.

The Unsuitables

The unsuitables are those with no aptitude for programming at all. They often enter the computer field because, quite by chance, they are on the spot when a computer is ordered and the new department is being chosen. They may, for instance, be clerks with a long experience in the accounting, stock or payroll department, and because of their familiarity with one aspect of the computer's proposed work, they are made part of the data processing team. They may be misfits whom the company would be pleased to relocate, or perhaps they are recruited from outside as trainees by a company ill-equipped to select them, and still less able to train them.

These people do a reasonable job in a not very demanding environment and, as explained above, may find it easy to change their jobs once or twice and increase their salaries substantially. Sooner or later they or their employers, probably both, discover the awful truth — that they have no ability to control the computer environment, or to analyze in detail a complex business system. Their apparent success earlier was far too rapid and in two or three years they have doubled or trebled their salaries.

Now, out of the environment with which they are familiar, they are, through no fault of their own other than a lack of awareness of their own capabilities and of the demands of computer work, stranded in a position from which there is no retreat. This is the fate of the unsuitables.

The Unfortunates

The unfortunates, the second category of undesirables, are those who have the ability to program but, without realizing it, have been in the wrong place. Having entered the computer field, they either immediately or eventually become specialists on some computer or computer application that no one else is interested in. Unfortunately for them, in a way, their salary rises in line with the rest of the market, but the skills they are acquiring are not at a premium. For instance, they may be the country's programming expert on a rare imported computer, or an obsolete "first generation" machine. Alternatively, they may be analysts with all their experience on a non-commercial system which was never implemented for one reason or another.

However brilliant they are, and however sound their work, they are going to suffer. The methods of assessing technical competence are so imprecise, that data processing managers want on the whole to recruit staff with directly relevant previous experience. The experience that really counts in the job market is time spent on commercial applications and third generation computers. Those without it are the unfortunates.

Of course some of the unfortunates may also be unsuitable, and most of the unsuitables are unfortunate. Because of their situation they must, if they wish to live in the manner to which they have become accustomed, eventually resort to some of the tactics of the unscrupulous.

The Unscrupulous

The unscrupulous hardly need definition. They are progressing their careers by the judicious use of verbal dexterity for the financial rewards which this brings in the short term. The demand for programmers is so great that the unscrupulous can talk their way into jobs past the screening processes of men unable to define what they are looking for, let alone recognize it when it comes along.

This type of job applicant is sometimes prepared to create titles, qualifications and salaries for himself. And he may get away with it. But he usually resorts to subtler methods. He soon discovers that the market is not looking for titles and qualifications and that a salary need only avoid looking suspiciously low. What he must have is experience in commercial applications on third generation computers; such things are easy to talk about and difficult to verify.

AUGMENTING MAN THROUGH TELEOPERATORS

This book surveys an emerging facet of control technology which, when adopted by industry, will have a profound effect upon the development of new products and new processes. The technology of sophisticated control — particularly the cybernetic interaction between man, computer and versatile machines — is important in the fields of nuclear energy, in our investigation and use of the ocean's resources, and in space exploration. Further applications of teleoperator systems will occur in industry, urban services, and even agriculture. Teleoperator control is becoming an essential part of our scientific-engineering-industrial basis for a more advanced society, one in which knowledge and technology — rather than nature and man — can be exploited.

The sources of teleoperator technology are found in recent work in biomechanics, computer science, and the remotely operated equipment used by the AEC and NASA. Teleoperator systems augment and extend man — they do not replace man. Man is always in the control loop, a characteristic that distinguishes the teleoperator system from automation. . . .

New approaches are needed if society is to fully realize the benefits of modern science. The virtually unlimited energy made available by nuclear science, the new level of sophistication being achieved by our chemistry and physics, our earth science and life sciences — all this coupled with the ability to augment man through teleoperators, will hopefully propel us toward a society in which man can at last have time and resources to think and act in new directions and new dimensions.

s/ Glenn T. Seaborg
— from page iii of "Teleoperator Controls"

A *teleoperator* is a general-purpose, dexterous, man-machine system that augments man by projecting his manipulatory and pedipulatory capabilities across distance and through physical barriers into hostile environments. A manipulator that fabricates radioactive fuel in a hot cell is a teleoperator because it transmits man's dexterity through the hot-cell wall into the lethal environment. Teleoperators can also extend man's hands to the Moon and planets before he can make the trip himself. An artificial limb is considered a teleoperator because it augments an amputee by restoring a part of his lost dexterity — the lost limb is in effect a barrier to normal operation.

Man is nearly always in the teleoperator control loop. In contrast, clock-radios and computer-controlled machine tools are preprogrammed machines, not teleoperators, because man is never in the loop on a real-time basis. Neither are robots teleoperators: robots operate autonomously and sometimes (in science fiction, at least) counter to man's interests. The man-machine relationship in the teleoperator is essentially *symbiotic;* that is, mutually beneficial. Man needs the machine's strength and resistance to hostile environments, while the machine depends upon man's brain and dexterity.

The adjective "dexterous" in the definition of the teleoperator excludes the great host of nondexterous man-machine systems that surround us. To illustrate, the automobile becomes a part of a man-machine system when the driver brings it to life with the ignition key; yet the automobile cannot manipulate anything for all its other attributes.

In metal-working plants or construction jobs, and on many production lines, one sees man-machine systems that pick up, position, and otherwise manipulate objects and materials. We prefer to exclude these single-purpose mechanical hands and fingers from the class of teleoperators by adding the adjective "general-purpose" to the definition. Teleoperators should be thought of as extenders and augmenters of man; and man is a general-purpose, versatile creation. . . .

— from "Teleoperator Controls", p. 1, by William R. Corliss and Edwin G. Johnsen, USAEC Div. of Technical Information Extension, Oak Ridge, Tenn., 1969

Separating The Undesirables from the Desirables

I would like to warn those whose task it may be to separate the sheep from the goats against two of the strategies devised by the unscrupulous, but often perforce resorted to by the unfortunate and the unsuitable.

Perhaps the commonest is the claim to have analyzed and designed a particular system when in fact this was the work of others. Acquaintance with the system may have been gained through helping to implement it, joining the team half-way through or even through writing the programs. Whatever the degree of exposure, claims to total responsibility for a project are hard to disprove.

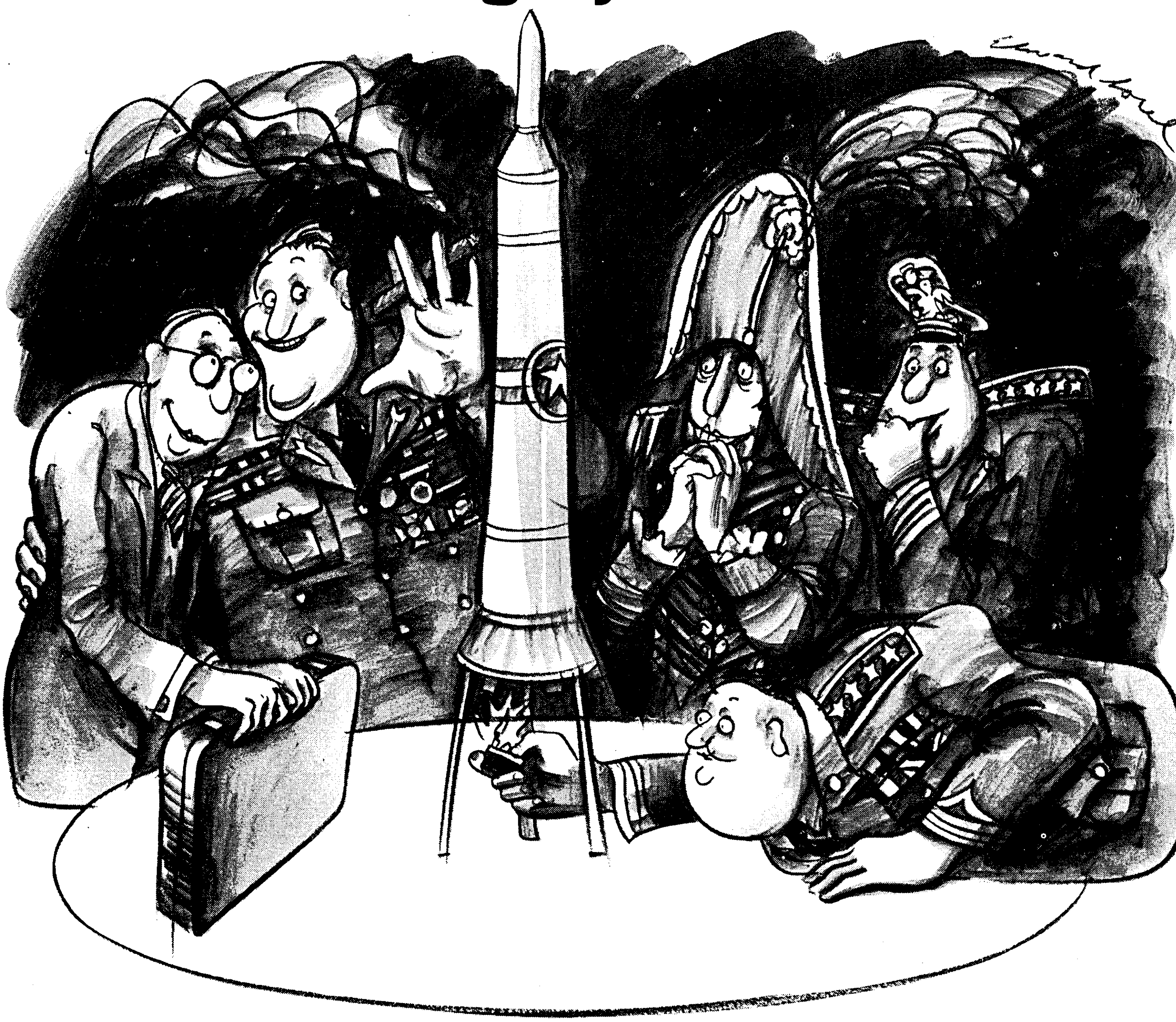
Second, claims to have worked on particular hardware may sometimes be made by those who have very little experience with that equipment at all. They may have programmed an earlier machine and taken a course for the new machine. They may have spent a few months converting a large number of COBOL programs from one machine to another. If they choose to maintain that all their programs were written for the new machine, and if they know just enough to talk through an interview, they may sound wonderfully convincing.

As a safeguard, when taking up references, request a brief summary of the projects a man has been working on, and the condition of these when he joined and left them. At least you have an indication then if you are buying an honest man.

Personnel selection is based on many factors. The question of compatibility, educational background, personality, mental ability, logical approach, etc. must all be resolved by well-established interviewing techniques. Technical competence must also be established, and this is not done by getting a man to relate his past experience. He must be asked technical questions by people who know the subject.

Programmers should be asked to write, or look for errors in, sections of coding. Systems analysts should be asked about their approach to problems other than those they are familiar with. Only by developing selection techniques like these can one avoid buying men with everything to learn and little to contribute. □

From the people who brought you Vietnam:



The anti ballistic missile system.

They're mad.

They're absolutely mad.

Everyone can see that things at home are getting worse all the time, and that little or nothing is being done about it.

The last thing in the world we need is to spend six or seven thousand million dollars for the down payment on an anti ballistic missile system.

But what can you expect from the type of mind that got us into Vietnam in the first place, and that keeps plunging us back in for one-last-victory-try every time it looks as though we might finally extricate ourselves.

Mr. Nixon and Secretary Laird and their advisors in the Pentagon seem to have lost touch with reality.

There are bombs going off in our cities, but they're not coming from China or the U.S.S.R.

The air we breathe is being poisoned, but it's not being done by enemy agents.

Many Americans no longer believe what the Government tells them, but it's not because they listen to Radio Moscow.

The gold in Fort Knox is, for all practical purposes, no longer our own–but the job wasn't done by Goldfinger or Smersh.

The war and weapons people have become so obsessed with International Communism, they fail to see that they themselves are laying the groundwork for a state of home-grown anarchy.

A few observations on the A.B.M.

The figure they use is six or seven billion dollars. But this is just the well-known foot in the door.

Experience with Pentagon procurement in the past indicates that actual costs run two or three times the original estimate.

Furthermore, there is every likelihood that the "light" ABM system will get heavier and heavier as it goes along, and would ultimately cost over fifty thousand million dollars.

All this for a "Maginot Line in the Sky" (as the N.Y. Times described it in a recent editorial), that would most likely be obsolete by the time it is operative, and wind up as surplus electronic junk on Canal Street.

Meanwhile, back in the U.S.S.R., do you think "their" hawks would be standing still for this?

What can we do about it?

Unfortunately, the Pentagon doesn't seem to be able to learn from experience, but we wouldn't give up hope for the U. S. Senate.

There are a lot of Senators–including conservative Republicans–who feel they were "had" by the infamous Gulf of Tonkin resolution, and this time they don't seem to be buying the Pentagon's big public relations campaign on the A.B.M.

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REPORT FROM GREAT BRITAIN

Ferranti Makes Inroads in Eastern Europe

Although computer companies in Britain have made remarkable inroads into the East European market during the past five years with total sales now not far off $40m, the sale of one single small, but advanced process control system to Czechoslovakia and a technical agreement concerning it may prove to be of far greater significance.

The machine is an Argus 500, built from the fastest DTL microcircuits produced in the western world, by the Ferranti company. This small, private organisation was the originator of the vast Atlas computers which were the first superscale machines to function satisfactorily.

Ferranti is breaking new ground in that it has agreed to make Inorga — the Czech Institute for Industrial Management and Automation — into a Technical Support and Sales Unit for the Argus computers, the first such pact in Eastern Europe.

Just to relate Ferranti performance to the World market — the company has sold nearly 250 process control systems, has 30 percent of the UK market for such equipment which, in turn, is now using over 15 percent of total world installations. Moreover, having set up its first time-sharing service in West Germany, Ferranti has captured 15 percent of that market through the GRA organisation in spite of bitter competition from Siemens and AEG. Its major users include Bayer and the German Steel Research Institute.

To come back to Czechoslovakia. Inorga, described as an independent consultancy, serves its own and several other Soviet Bloc countries. It has carried out production control systems for several steel and light alloy works and will use its first Argus 500 for simulation and program development with steel industry applications in view.

The agreement provides for active sales of this extremely fast machine and its even faster parallel-mode Argus 400 stable mate. With these machines goes a wide range of peripherals which make major use of fast integrated circuitry and are probably the most advanced available.

It has the blessing of the Ministry of Technology and somehow seems to have escaped the COCOM strategic embargo net, presumably because there is not a single imported component which the U.S. Department of Commerce could bar should it have a mind to.

Turning Machines Out Like "Hot Cakes"

Meanwhile, Ferranti has been developing the mass-production techniques required to turn out its machines like hot cakes and has been offering a stripped-down version of what is truly powerful equipment for around $20,000.

All the signs point to a possible quick break into a major market. It would be well deserved, for the company has worked on computer control for ten years and installed the world's first direct digital control scheme on a fertiliser plant for Imperial Chemical Industries as far back as 1962. ICI is using many Argus machines — and ICI is a name to conjure with, particularly in Russia.

Ferranti's giant UK rival, resulting from the regrouping of Elliott-Automation, AEI, and English Electric process control forces under the wing of the expanded British General Electric Company, claims more process control installations in the world than any other group, including IBM and GE. It also claims that the only correct way to go about process control is to offer "total packages" of computer plus instruments, valves, rectifiers and even actuating motors. This GEC-Elliott Automation can do since it is part of a $2,000m electrical/electronics group. But the argument is not always valid, particularly when bids are made in technologically advanced countries, though sometimes it applies when an East European or Far Eastern Country takes a package deal involving a complete steel mill or plastics plant. In all other cases Ferranti has a good look-in.

Computer-Controlled Tests of Concorde

Concorde is in the news following a successful maiden flight. Now come two years of the most exacting tests metallurgists, engine specialists and stress experts can devise. To monitor, control and analyse them will demand the installation at the Royal Aircraft Establishment of close on $1.5m of computers and loggers.

Suppliers will include Digital Equipment Corporation, the U.S.-based company which has set up a large assembly plant in Britain, and Kent Instruments which makes use of PDP central processors in some of its installations.

The system will be in control of fatigue testing which will simulate not only take-off and landing stresses, but also the slow cycling of the climb to operational altitude, passage to supersonic speeds, deceleration and landing. A second system, based on UK equipment and worth about the same, will control the pressure-testing, heating and cooling systems to be applied to the actual Concorde hull — worth nearly $7m — which will be tested without a stop throughout the service life of this advanced aircraft, which is likely still to be flying at the turn of the century.

A "Production Proletariat"?

The excellent results put up for 1968 by Honeywell in Britain have caused some raised eyebrows in ministerial circles. Pre-tax profits were over the $10m with a UK labour force of 7,000 and funds returned in the country.

Some underline that this has been achieved without massive Government support like that given to ICL. But this is not strictly true. Honeywell has received indirect support by using the facility provided by grants — very generous grants — given to companies which establish manufacturing in depressed areas.

RIFENBURGH, THE FUTURE OF COMMUNICATIONS

(Continued from page 36)

equipment today would be the inquiry-response systems employed in cathode ray tube displays for stock quotations and the teletype terminals used in computer time-sharing.

Over the next two to five years, I believe we will see many more "hybrid" systems. They will employ the relatively sophisticated switching equipment of the message communications industry and combine that with the high-speed, high-technology terminals of the computer industry. In the area of new peripherals and terminal devices, I think we will see an expansion of such equipments as the touch-tone telephone and lower cost, high speed printers. And finally, I expect we will see a proliferation of large communication networks in which both computer data and message systems will be handled completely through switching within the same large network.

The impact of the expansion of data communications could be enormous. Arthur D. Little, Inc., a highly respected research organization, estimates a three-fold increase in the dollar value of shipments of modems between 1968-1972, a five-fold increase in data terminals, and a nine-fold increase in concentrators and multiplexers.

Carterfone Decision

The Carterfone decision also will have a far-reaching impact on the development of this market. Since the user can now choose among alternative equipments, manufacturers have an incentive to develop and attach new devices to the switching network. As a result, I think improved technology in this area will provide us with some dramatic cost-breakthroughs in terms of throughput to and from the central processor.

At the low end of the scale, the touch-tone telephone, the acoustical coupler, a low-cost printer, and other such devices will facilitate low-cost entry into the central processor. At the upper end of the equipment spectrum, we can expect small computers with a high degree of format flexibility, a low amount of computing power, and a fair degree of sophistication. They would operate as terminal devices to transfer information back and forth from the central powerful computer.

Technology will have a major role in spurring the growth of the data communications market. Ultimately, however, the success of the supplier of devices for this market will depend — as it has in the past — on his ability to provide the end user with the kind of technical and maintenance support he has become accustomed to expect. And he must be prepared to supply that support wherever it is required to meet the mounting needs of data processing users throughout the world. □

At the same time there is a real danger when American companies concentrate manufacturing in Britain and keep development and research far away from these shores, recruiting the best they can as the opportunity occurs. This spells the development of a "production proletariat" dominated entirely by forces completely outside its control. No British Government, Socialist or Conservative can contemplate this without concern.

Ted Schoeters

Ted Schoeters
Stanmore, Middlesex
England

WHO'S WHO IN THE COMPUTER FIELD, 1968-1969 — ENTRIES

Who's Who in the Computer Field 1968-1969 (the Fifth Edition of our Who's Who) will be published by Computers and Automation during 1969. In this edition, we hope to include upwards of 10,000 capsule biographies, including as many persons as possible who have distinguished themselves in the field of computers and data processing.

If you wish to be considered for inclusion in the Who's Who, please complete the following form or provide us with the equivalent information. The deadline for receipt of entries in our office is Monday, June 30, 1969. (If you have already sent us a form some time during the past eighteen months, it is not necessary to send us another form unless there is a change of information.)

WHO'S WHO ENTRY FORM
(may be copied on any piece of paper)

1. Name? (Please print)________
2. Home Address (with Zip)?________
3. Organization?________
4. Its Address (with Zip)?________
5. Your Title?________
6. Your Main Interests?

Applications	( )	Mathematics	( )
Business	( )	Programming	( )
Construction	( )	Sales	( )
Design	( )	Systems	( )
Logic	( )	Other	( )
Management	( )	(Please specify)	

____
____

7. Year of Birth?________
8. Education and Degrees?________
9. Year Entered Computer Field?________
10. Occupation?________
11. Publications, Honors, Memberships, and other Distinctions?________
____
____
(attach paper if needed)
12. Do you have access to a computer? ( )Yes ( )No
    a. If yes, what kind of computer?
       Manufacturer?________
       Model________
    b. Where is it installed:
       Manufacturer?________
       Address?________
    c. Is your access: Batch? ( ) Time-shared? ( )
       Other? ( ) Please explain:________
    d. Any remarks?________
____
13. Associates or friends who should be sent Who's Who entry forms?

Name and Address

____
____
____
____

(attach paper if needed)

When completed, please send to:

Who's Who Editor, Computers and Automation,
815 Washington St., Newtonville, Mass. 02160

CALENDAR OF COMING EVENTS

May 13, 1969: Symposium on Extensible Languages sponsored by the ACM Special Interest Group on Programming Languages, Boston, Mass.; contact Carlos Christensen, Chairman, Massachusetts Computer Assoc., Inc., Lakeside Office Park, Wakefield, Mass. 01880

May 14-16, 1969: Spring Joint Computer Conference, War Memorial Auditorium, Boston, Mass.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645

May 14-28, 1969: International Exhibition, Automation-69 (Modern Equipment for Automation of Production), Moscow, USSR; contact Mikhail Nesterov, USSR Chamber of Commerce, Moscow, USSR.

May 18-21, 1969: Power Industry Computer Application Conference, Brown Palace Hotel, Denver, Colorado; contact W. D. Trudgen, General Electric Co., 2255 W. Desert Cove Rd., P.O. Box 2918, Phoenix, Ariz. 85002

May 19-21, 1969: National Automation Conference of the Automation Dept. of The American Bankers Assoc., Conrad Hilton Hotel, Chicago, Ill.; contact William P. Rust, American Bankers Assoc., 90 Park Ave., New York, N. Y. 10016

May 19-22, 1969: Seventh National Biomedical Sciences Instrumentation Symposium on "Imagery in Medicine", Chrysler Center, The Univ. of Mich., Ann Arbor, Mich.; contact 1969 BSIS, c/o Ernest E. Sellers, Box 618, Ann Arbor, Mich. 48107

May 21-22, 1969: ACUTE (Accountants Computer Users Technical Exchange), Palmer House, Chicago, Ill.; contact ACUTE, 947 Old York Rd., Abington, Pa. 19001

May 21-23, 1969: Seventh Annual Workshop Conference of Belvedere Hotel, Baltimore, Md.; contact E. T. Maguire, Avco/MSD IDEP Center, 201 Lowell St., Wilmington, Mass. 01887

May 26-28, 1969: Forum of Control Data Users (FOCUS I) Conference, St. Paul Hilton Hotel, St. Paul, Minn.; contact Douglas T. Berg, Electric Machinery Manufacturing Co., 800 Central Ave. N.E., Minneapolis, Minn.

May 27, 1969: Systems and Procedures Association 5th Annual Systems Seminar, Holiday Inn Town, Harrisburg, Pa.; contact Stan Kross, Publicity, 710 Elkwood Drive, New Cumberland, Pa. 17070

June 4-6, 1969: Technicon International Congress on Automated Analysis, Hilton Hotel, Chicago, Ill.; contact Jerome E. Golin, Technicon Corp., Tarrytown, N.Y. 10591

June 8-12, 1969: Sixth Annual Design Automation Workshop, Hotel Carillon, Miami Beach, Fla.; contact N. Garaffa, Jr., RCA ISD, Bldg. 13-2-8, Camden, N.J. 08101

June 9-11, 1969: IEEE International Communications Conference, University of Colorado, Boulder, Colo.; Dr. Martin Nesenbergs, Environmental Science Services Administration, Institute for Telecommunication Sciences, R614, Boulder, Colo. 80302

June 12-14, 1969: Assoc. for Computing Machinery, Eighth Annual Southeastern Regional Meeting, Carriage Inn, Huntsville, Ala.; contact Dr. Leland H. Williams, Computer Center, Auburn Univ., Auburn, Ala. 36830

June 16-19, 1969: Data Processing Management Association (DPMA) 1969 Internat'l Data Processing Conference and Business Exposition, Montreal, Quebec, Canada; contact Mrs. Margaret Rafferty, DPMA, 505 Busse Hwy., Park Ridge, Ill. 60068

June 16-21, 1969: Fourth Congress of the International Federation of Automatic Control (IFAC), Warsaw, Poland; contact Organizing Comm. of the 4th IFAC Congress, P.O. Box 903, Czackiego 3/5, Warsaw 1, Poland.

June 17-19, 1969: IEEE Computer Group Conference, Leamington Hotel, Minneapolis, Minn.; contact Scott Foster, The Sheffield Group, Inc., 1104 Currie Ave., Minneapolis, Minn. 55403

June 17-20, 1969: American Astronautic Society and the Operations Research Society of America, Brown Palace Hotel, Denver, Colo.; contact Dr. George W. Morgenthaler, General Program Chairman, Martin Marietta Corp., P.O. Box 179, Denver, Colo. 80201

June 19-20, 1969: American Society of Mechanical Engineers and Association for Computing Machinery Joint Computer Conference on "Computational Approaches in Applied Mechanics", Illinois Institute of Technology, Chicago, Ill.; contact E. Sevin, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616

June 19-20, 1969: Assoc. of Data Processing Service Organizations Management Conference, Sheraton Ritz Hotel, Minneapolis, Minn.; contact Jerome L. Dreyer, Assoc. of Data Processing Service Organizations, Inc., 420 Lexington Ave., New York, N.Y. 10017.

June 19-20, 1969: Seventh Annual Conference of the Special Interest Group, Computer Personnel Research of the Association of Computing Machinery, Univ. of Chicago, Chicago, Ill.; contact A. W. Stalmaker, School of Industrial Management, Georgia Tech., Atlanta, Ga. 30332

June 21-28, 1969: Second Conference on Management Science for Transportation, Transportation Center at Northwestern University, 1818 Hinman Ave., Evanston, Ill. 60204; contact Page Townsley, Asst. Dir., Management Programs, 1818 Hinman Ave., Evanston, Ill.

June 23-24, 1969: National Gaming Council Eighth Symposium, Sheraton-Elms Hotel, Excelsior Springs, Mo.; contact Dr. Richard L. Crawford, Booz, Allen Applied Research Inc., 911 Walnut St., Kansas City, Mo. 64114

June 30-July 1, 1969: ACM/IEEE/SHARE/SCi Conference on Applications of Continuous System Simulation Languages, Sheraton-Palace Hotel, San Francisco, Calif.; contact Robert Brennan, IBM Scientific Center, 2670 Hanover St., Palo Alto, Calif.

June 30-July 3, 1969: Institution of Electrical Engineers Conference on Computer Science and Technology, Univ. of Manchester Institute of Science and Technology, Manchester, England; contact Conference Secretariat, Institution of Electrical Engineers, Savoy Place, London, W.C.2, England.

July 8-11, 1969: IEEE Annual Conference on Nuclear and Space Radiation Effects, Penn State University, University Park, Pa.; contact D. K. Wilson, Bell Telephone Laboratories, Whippany, N.J. 07981.

July 19-22, 1969: 30th Annual Convention of the National Audio-Visual Association, Conrad Hilton Hotel, Chicago, Ill.; contact Harry R. McGee, National Audio-Visual Association, Inc., 3150 Spring St., Fairfax, Va. 22030

Aug. 6-8, 1969: Joint Automatic Control Conference, Univ. of Colorado, Boulder, Colorado; contact unknown at this time.

Aug. 11-15, 1969: Australian Computer Society, Fourth Australian Computer Conference, Adelaide Univ., Adelaide, South Australia; contact Dr. G. W. Hill, Prog. Comm. Chrmn., A.C.C.69, C/-C.S.I.R.O., Computing Science Bldg., Univ. of Adelaide, Adelaide, S. Australia 5000.

Aug. 25-29, 1969: Datafair 69 Symposium, Manchester, England; contact the British Computer Society, 23 Dorset Sq., London, N.W. 1, England

Sept. 8-12, 1969: International Symposium on Man-Machine Systems, St. John's College, Cambridge, England; contact Robert C. McLane, G-MMS Meetings Chairman, Honeywell Inc., 2345 Walnut St., St. Paul, Minn. 55113

Sept. 28-Oct. 1, 1969: Association for Systems Management International (formerly Systems and Procedures Association) International Systems Meeting, New York Hilton Hotel, New York City, N.Y.; contact Richard L. Irwin, Association for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138.

Oct. 1-5, 1969: American Society for Information Science, 32nd Annual Meeting, San Francisco Hilton Hotel, San Francisco, Calif.; contact Charles P. Bourne, Programming Services, Inc., 999 Commercial St., Palo Alto, Calif. 94303.

Oct. 6-10, 1969: Second International Congress on Project Planning by Network Analysis, INTERNET 1969, International Congress Centre RAI, Amsterdam, the Netherlands; contact Local Secretariat, c/o Holland Organizing Centre, 16 Lange Voorhout, The Hague, the Netherlands

c·a

NUMBLES

Number Puzzles for Nimble Minds — and Computers

Neil Macdonald
Assistant Editor

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away and a second one in the digit cipher. The problem is to solve for the digits.

Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, which is expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling uses puns or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions.

NUMBLE 695:

```
     W H E N           S O R R O W
+        I S     +   A S L E E P
=    H I W S     = T N I S P S E

                                  K P H = L R W

     8 5 8 7 9 6   1 1 0 3 1 1
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We have a computer program for the Digital Equipment Corporation PDP-9 computer which will solve addition Numbles such as Numble 695. The program was created by Stewart B. Nelson, Software Editor of *Computers and Automation.* A copy of the punched paper tapes for the symbolic program and the working binary program, and a copy of the operating instructions will be sent to any reader on request for the nominal price of $8.00. Please enclose this amount with your order, and send it to:

Computers and Automation
Numbles, Att'n Neil Macdonald
815 Washington St.
Newtonville, Mass. 02160

Solution to Numble 694

In Numble 694 in our April issue, the digits 0 through 9 are represented by letters as follows:

I=0	T=5
O=1	R=6
S=2	E=7
D=3	H=8
A=4	L,P=9

The full message is: The hardest step is o'er the threshold.

Our thanks to the following individuals for submitting their solutions to Numble 693: A. Sanford Brown, Dallas, Tex.; T. P. Finn, Indianapolis, Ind.; Richard Lynch, Sycamore, Ill.; T. J. McElreath, Weston, Mass.; G. P. Peterson, St. Petersburg, Fla.; D. F. Stevens, Berkeley, Calif.; and Robert Weden, Edina, Minn. — and to Robert C. Jensen, Endicott, N.Y., for his solution to Numble 692.

Oct. 9-11, 1969: DPMA Div. 3 Conference, Lafayette Hotel, Little Rock, Ark.; contact Robert Redus, 6901 Murray St., Little Rock, Ark.

Oct. 13-16, 1969: Association for Computing Machinery (ACM) Symposium on Data Communications, Calloway Gardens, Pine Mountain, Ga.; contact Edward Fuchs, Room 2C-518, Bell Telephone Laboratories, Inc., Holmdel, N. J. 07735; Walter J. Kosinski, Interactive Computing Corp., P.O. Box 447, Santa Ana, Calif. 92702

Oct. 13-16, 1969: 1969 International Visual Communications Congress, International Amphitheatre, Chicago, Ill.; contact Internat'l Assoc. of Visual Communications Management, Suite 610, 305 S. Andrews Ave., Fort Lauderdale, Fla. 33301

Oct. 15-17, 1969: IEEE Tenth Annual Symposium on Switching and Automata Theory, University of Waterloo, Waterloo, Ontario, Canada; contact Prof. J. A. Brzozowski, Dept. of Applied Analysis and Computer Science, University of Waterloo, Waterloo, Ontario, Canada

Oct. 22-24, 1969: IEEE 1969 Systems Science and Cybernetics Conference, Philadelphia, Pa.; contact C. Nelson Dorny, Moore School of Electrical Engineering, Univ. of Pa., Philadelphia, Pa. 19104.

Oct. 26-30, 1969: ACM/SIAM/IEEE Joint Conference on Mathematics and Computer Aided Design, Disneyland Hotel, Anaheim, Calif.; contact J. F. Traub, Program Chairman, Computing Science Research Center, Bell Telephone Laboratories, Inc., Murray Hill, N.J. 07974.

Oct. 27-31, 1969: Business Equipment Manufacturers Assoc. (BEMA) Annual Business Equipment Exposition and Management Conference, New York Coliseum, Columbus Circle, New York, N.Y. 10023; contact Laurance C. Messick, Business Equipment Manufacturers Assoc., 235 East 42nd St., New York, N.Y. 10017

Oct. 30-31, 1969: Assoc. of Data Processing Service Organizations Management Conference, Regency Hyatt Hotel, Atlanta, Ga.; contact Jerome L. Dreyer, Assoc. of Data Processing Service Organizations, Inc., 420 Lexington Ave., New York, N.Y. 10017.

Nov. 3-5, 1969: 5th Annual IEEE Symposium on Automatic Support Systems for Advanced Maintainability, Chase-Park Plaza Hotel, St. Louis, Mo.; contact Matthew F. Mayer, Program Chairman, P.O. Box 4124 Jennings Station, St. Louis, Mo. 63136

November 15-16, 1969: ACUTE (Accountants Computer Users Technical Exchange), Jack Tar, San Francisco, Calif.; contact ACUTE, 947 Old York Rd., Abington, Pa. 19001

Nov. 18-20, 1969: Fall Joint Computer Conference, Convention Hall, Las Vegas, Nev.; contact American Federation for Information Processing (AFIPS), 345 E. 47th St., New York, N.Y. 10017

Nov. 25-27, 1969: Digital Satellite Communication Conference, Savoy Place, London, England; contact IEE Joint Conference Secretariat, Savoy Place, London WC2, England. ☐

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

Table of Contents

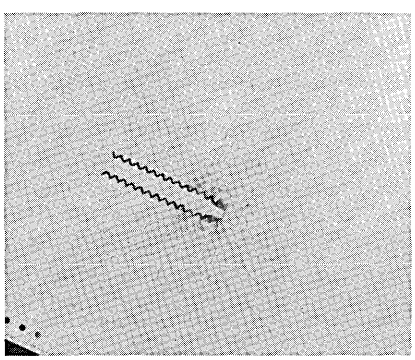
APPLICATIONS

"ELECTRONIC" EARTHQUAKES MAY UNLOCK SOME OF NATURE'S HIDDEN SECRETS

In an effort to understand more about the nature and causes of earthquakes, scientists at the New Mexico Institute of Mining and Technology are studying local earthquakes and simulating them on their IBM 360/44 computer. Among the mysteries the research group is trying to solve are: How and why do portions of the earth slide and what triggers the activity? How do earthquake waves travel through the complex and varied layers of the earth? What happens to the energy? During a quake, what are the directions of earth movement?

To simulate an earthquake, a numerical model of a piece of the earth's crust is created. A grid, or series of horizontal and vertical lines, represents a piece of earth. Each intersection of lines on the grid represents a specific point within that piece of earth.

At one or more intersections on the grid, the scientists create an external force, a disturbance, that would be equivalent to a real disturbance in the earth — the triggering action that produces an earthquake. The magnitude and direction of the induced force, and the grid location at which it is to occur, are represented mathematically and fed into the computer. The computer calculates the



effect upon each grid point, and plotting devices produce "synthetic seismographic patterns" like the one shown in the picture above. When a seismographic pattern thus created resembles one generated by a real earthquake, the research team concludes that the laboratory earthquake was a close approximation of the real quake. They can then draw conclusions about the activity below the earth's surface that triggered the actual jolt.

EDUCATORS CAN "CREATE" BOOKS WITH AID OF COMPUTERIZED TYPESETTING SYSTEM

Encyclopaedia Britannica's new reference series, "Annals of America", has been combined with an electronic retrieval and composition system to allow schools to choose the source materials for their text books.

The heart of the system is an RCA Videocomp 70/830 typesetter that sets Annals pages — complete with headlines, subheads, footnotes, folio numbers and even rules — at an average rate of one page every 25 seconds. It enables educators to select the particular material they want out of the more than 2200 articles in the Annals, and have it put in a book just for their use. The Annals cover the subject areas of history, social studies, and political science.

The cycle from receipt of an order to plate-ready film takes five days or less. When a school decides exactly what information it wants (in units as small as a single paragraph), an order is sent to Britannica's home office in Chicago. The request is first checked, and then keypunched and fed into a computer specifying what is to be printed and in what order. The information is then sorted to a master magnetic tape and sent to the Poole Clarinda Company for typesetting.

Proofs are checked by Annals editors, and then put on film by the Videocomp system, ready for platemaking and the press. An entire 400-page book of Annals selections can be composed in less than a day.

ALBUQUERQUE SCIENTISTS TURN THEIR COMPUTER INTO A STOCK BROKER

A group of scientists at the Dikewood Corp., Albuquerque, N.M., have developed a successful business and a new company by applying hard scientific principles to the ups and downs of Wall Street.

The principles they formulated are programmed into an IBM 360/44 computer, which keeps track of the recent and overall trends of each stock listed on the New York Stock Exchange. The system analyzes the historical prices of stocks, computes various slopes for each, sorts them and arranges a relative ranking by performance. The computer then applies the rules developed by the scientists, and automatically prints a weekly list of what stocks to buy, sell, or hold — and in what order.

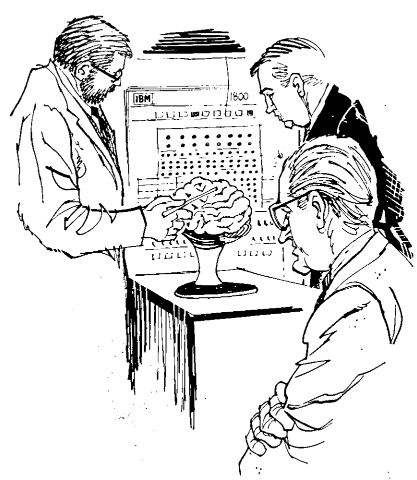
The computer analysis of stocks was started as a hobby by Dr. Sheldon Dike, Dikewood Corp. president, and his associates. When local brokers learned that Dikewood was applying its stock analysis techniques in managing its employee retirement funds, the brokers asked to see copies of the weekly stock analysis reports. So Dikewood began selling them on a subscription basis, and formed a new company, Edde Securities Corp., to handle the weekly "Dikewood Stock Report".

The reports are based on laws of science and mathematics rather than on conventional methods of speculation, such as acting on tips, market forecasts, or emotion. "We make no claim to understanding the stock market", Dr. Dike says. "Basically we believe that everything we need to know about a stock is reflected in its price and past performance."

To assess the value of their analyses, Edde Securities traces a hypothetical portfolio which is managed according to the weekly reports. The sample portfolio increased 87% in 1967 and 42% in 1968. It would appear that the scientific approach is resulting in better than average decisions.

ABNORMALITIES IN THE HUMAN BRAIN DETECTED BY COMPUTER

A computer linked directly to testing instruments at the Lafayette Clinic in Detroit, Mich., is being used to detect abnormalities in the human brain. The 120-bed clinic, which serves as the research and training institute of the Mich. Dept. of Mental Health, utilizes an IBM 1800 data acquisition and con-



trol system to evaluate information transmitted electrically from its biochemistry, psychopharmacology, psychophysiology, neurology, psychology, and psychobiology laboratories.

The computer is currently running a liquid scintillation counter which tracks radioactivity injected into biological systems; studying the human knee reflex by averaging responses to external stimuli; evaluating changes in the heart and breathing rates under different emotional conditions; and scoring and interpreting psychological tests.

A 16-channel electroencephalogram (EEG) machine is being used in conjunction with the computer. Responses of the brain to different stimuli are displayed in curve form on a cathode ray tube, and a curve plotter produces an average of the output. Each scan is also stored on tape for later detailed study, and computer-printed reports are made available to researchers for evaluation as experiments unfold.

NEW PRODUCTS

Digital

GE-615 COMPUTER / General Electric Company

A new member of the GE-600 systems, the GE-615 has been announced by General Electric Co., Phoenix, Ariz. The new system can perform three kinds of operations concurrently: multiprogrammed local batch processing; remote batch processing from terminals of various speeds; and reactive time sharing. All three operations have access to a common, fully-protected data base. The modular and expandable 2 microsecond main memory will add 244,000 numbers a second.

A typical GE-615 system may include a 64,000-word memory and central processor with console typewriter, magnetic tape handlers, card reader, card punch, printer, and fixed or removable disc storage. The extensive GE-600 software program library can be utilized without exception or modification.
(For more information, circle #47 on the Reader Service Card.)

MODEL 3200 COMPUTER / Honeywell Electronic Data Processing

The new Model 3200, the fourth Series 200 central processor to be announced in the past 18 months by Honeywell Inc., is designed to meet the growing market demand for fast medium-priced, communications-oriented computer systems.

The 3200, tenth member of the EDP Division's family of compatible computers, has main memory sizes ranging from 131,072 to 524,288 characters of information. Main memory cycle time is one microsecond for two characters with a maximum data transfer rate of 1.5 million characters per second.

Integrated circuit packaging on the 3200 central processor is similar to that used on Honeywell's newest equipment, the Model 110 and Honeywell Keytape data preparation units. Noteworthy among the advanced silicon circuit chips, used

— Janice M. O'Brien, of Honeywell, is shown holding an integrated circuit in one hand and a photographic enlargement of a circuit in the other. Flatpacks on circuit boards are shown in foreground.

exclusively on the 3200, is a four-bit binary full adder. This chip measures about 70 mils square and contains the equivalent of 172 discrete components. This adder chip is packaged in a 16-pin flatpack, instead of the traditional 14-pin flatpack. The new flatpack is the first of its kind to be used on a Series 200 central processor.
(For more information, circle #41 on the Reader Service Card.)

GA 18/30 INDUSTRIAL COMPUTER SYSTEM / General Automation, Inc.

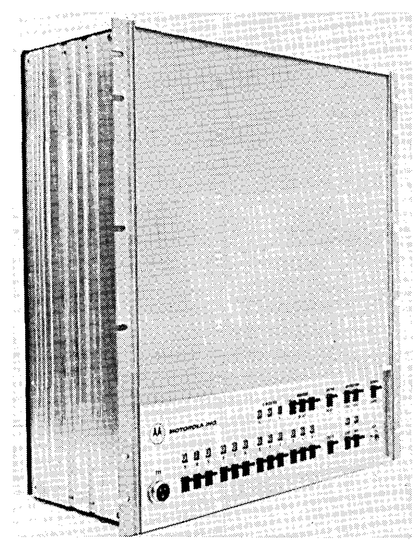
The new industrial computer system, GA 18/30, announced by General Automation, Inc. (Orange, Calif.), is aimed at the emerging industrial automation market. The 18/30 is fully compatible with the IBM 1800 and the IBM 1130, the two leaders in this field.

The new 18/30 has a 16-bit word length, hardware multiply and divide, plus parity and storage protection bits; the processor has a 960 nanosecond memory available in 4K increments to 32K. Direct addressing to the entire 32K memory is provided.

Since the GA 18/30 is intended to fill a supervisory industrial computer role, it has an extensive and flexible I/O system. Standard peripherals are available. The I/O system also includes 61 automatic priority interrupt levels, programmable interrupts, and direct-to-memory I/O channels. In addition to being program compatible with the IBM 1800 and 1130 systems, the GA 18/30 software includes assemblers, compilers, utility programs, real-time monitors and control programs.
(For more information, circle #42 on the Reader Service Card.)

PHASE II MDP-1000 COMPUTER / Motorola Instrumentation and Control Inc.

Phase II configuration of Motorola's MDP-1000 departs from the horizontal packaging techniques. The new unit, produced by Motorola Instrumentation and Control Inc., Phoenix, Ariz., is in a vertical configuration. The slim-line design solves the chronic space problem of industry users who need a rack-mountable package permitting



expansion of memory while maintaining minimum package depth. Phase II MDP-1000 has a maximum depth of 13". The systems oriented computer is available with memory capacities from 4K to 16K (in 4K increments). The upright configuration will be shown at the Spring Joint Computer Conference in booths 2201 and 2202. The machine will perform in excess of 400 commands of various types, and the single address memory has a cycle time of 2.15 microseconds.
(For more information, circle #44 on the Reader Service Card.)

UNIVAC 1106 COMPUTER / Univac Division, Sperry Rand Corp.

The UNIVAC 1106 is a new addition to Sperry Rand's family of 1100 series computers. The new system, announced by Sperry Rand's Univac Division (Philadelphia, Pa.) incorporates advanced hardware and software design concepts taken from the successful UNIVAC 1108. The 1106 is suitable for real-time, demand and high-volume batch processing, as well as precision scientific work in a multiprogrammed environment.

The basic 1106 has a 65,536 word memory. This can be expanded in increments of 98,034, 131,072, 196,608 or 262,144 words. Each word in the main memory is 36 bits in length. The complete read/restore memory cycle time is 1.5 microseconds.

The UNIVAC 1106 will have all of the software presently available with the 1108 including the current versions of the Executive II and Executive 8 Operating Systems. In addition, application packages such as APT III, MATH/STAT Pack, PERT/TIME and LP (Linear Programming will be available.
(For more information, circle #45 on the Reader Service Card.)

MIDI-RC 70 COMPUTER / Redcor Corporation

A new classification — the Midi-Computer (Midi-Computer: Submicrosecond, 16-bit computer, compactly packaged with megacycle throughout word rate for OEM and systems requirements) is being established with the introduction of the RC 70 computer by Redcor Corp., Canoga Park, Calif. The Midi-RC 70 is designed to bridge the gap between the high performance, high-priced 32-bit CPU's and the marginal capabilities of the mini-computers.

The Midi-RC 70 is an 860-nanosecond, 16-bit computer. It has an 8K memory (plug-in expandable to 32K), memory parity, memory protect, bi-directional index register, high-speed multiply and divide, direct memory access, priority interrupt and ASR 33. The new computer will be on display at booths 2401 and 2402 at the Spring Joint Computer Conference.
(For more information, circle #43 on the Reader Service Card.)

H-316 COMPUTER / Honeywell Computer Control Division

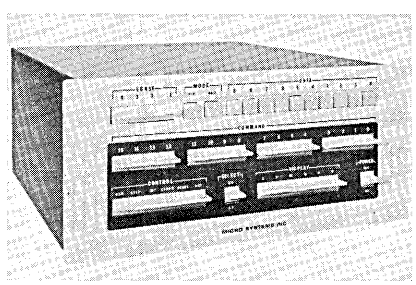
The newest member of the Series 16 family of digital computers manufactured by the Computer Control Division of Honeywell (Framingham, Mass.) is the H-316, the fourth in the division's series 16 line and the first very small computer announced by this major computer manufacturer. The H-316 is logically identical with the division's larger DDP-516 computer, the main differences being in the cycle time, memory expansion, and physical size.

The 115-pound computer, which can be as small as 19 by 24.5 by 14-inches, is available in three versions: pedestal, table-top and rack-mountable. The integrated circuit H-316 has a 72-instruction complement, 1.6 microsecond cycle time, and minimum 4,096 16-bit word memory, expandable to 16,384 words. All DDP-516 peripherals and interfaces are available to H-316 users. Over 500 field-proven programs are included in the software library.
(For more information, circle #48 on the Reader Service Card.)

MICRO 800 COMPUTER / Micro Systems, Inc.

The MICRO 800, now available from Micro Systems, Inc. (Santa Ana, Calif.), is a new digital computer based on highly flexible microprogrammed techniques. The MICRO 800 is designed for direct integration into control and processing system applications.

Microprogramming (firmware) allows adapting internal organization and instruction repertoire to achieve both speed and core memory efficiency impossible with conventional computers with fixed instructions. With microprogramming, I/O interface hardware is reduced to a minimum in any application.



The new machine has a 1.1 microsecond full cycle core memory with 220 nanosecond micro-command execution time; core memory is expandable from zero to 32,768 bytes (8, 9, or 10 bits) in 4096 byte increments to meet the configuration for any application. Read-only storage is expandable from 256 to 1024 words in modules of 256 words. File registers are a set of 16 general-purpose 8-bit registers.
(For more information, circle #46 on the Reader Service Card.)

Special Purpose Systems

LOW-COST DATA ACQUISITION AND CONTROL SYSTEM / Astrodata, Inc.

Astrodata, Inc. (Anaheim, Calif.) has developed a low-cost system for analog and digital acquisition and control. The new Series 2016, named ADAC for Astrodata Data Acquisition Control, acquires low-and/or high-level analog signals, enables the input of on-line functions such as data editing, and produces a digitized computer compatible output.

An analog input section, an intercoupler, a small general-purpose computer, and an ASR-33 Teletypewriter comprise the basic ADAC system. The system can be interfaced to all regular peripheral units by a "plug-in" intercoupler. Typical applications of the new ADAC include seismic studies, biomedical research, wind tunnel testing, nuclear reactor monitoring, petro-chemical process analysis, telecommunications control and spacecraft checkout.
(For more information, circle #51 on the Reader Service Card.)

COMMUNICATIONS CONTROL SYSTEMS / Comcet, Inc.

A new family of communications control systems for on-line computer networks has been introduced by Comcet, Inc., St. Paul, Minn. The new systems combine a computer, memory, interfacing units, monitoring equipment and software, all designed together as a single efficient way of handling the communications requirements of a multi-terminal system.

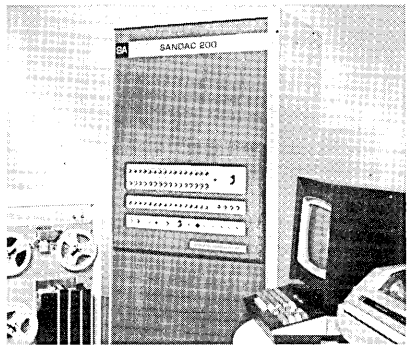
COMCET 60, the first system to be introduced, is compatible with computers in the size range of the IBM 360/50, 360/65, 360/85 and UNIVAC 1108. The COMCET 60 has a 32 bit parallel processor with a 900 nanosecond memory expandable from 32,768 bytes in three steps to 131,072 bytes. It has sixteen high-speed general, purpose registers, four general purpose I/O channels and 64 independent communications channels which can handle any type of line service at speeds ranging from 2,000 bits per second to 230,400 bps. A communications hardware transfer rate of more than 1,800,000 bps can be achieved.

The COMCET 60 interfaces directly to processors and peripheral units of the major computer manufacturers.
(For more information, circle #49 on the Reader Service Card.)

SANDAC 200 COMMUNICATIONS PROCESSOR / Sanders Associates, Inc.

A high-speed programmable communications processor has been developed by Sanders Associates, Inc., Nashua, N.H. The special purpose computer, designated the SANDAC® 200 Communications Processor, enables more than 250 communications terminals to talk to one another simultaneously in several different computer codes. Unlike conventional computers designed for computation and adapted for communications, the SANDAC 200 can stand alone as a system controller for all types of data traffic or can be used as a message concentrator, a pre-processor, or for message switching.

The SANDAC 200 has modular construction ranging from 4K or 8K words of memory (with a 16-channel buffer control unit and standard software) to a 65K word (131K bytes) memory and 256 input/output channel buffers. Sanders Associates will demonstrate the SANDAC 200 at the Spring Joint Computer Conference in Boston this month.
(For more information, circle #50 on the Reader Service Card.)



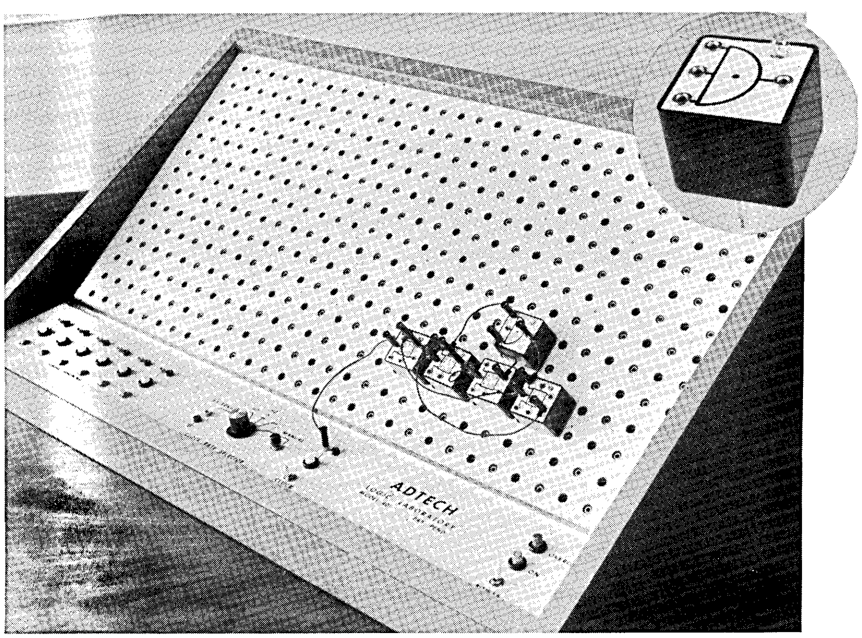
Teaching Devices

MODEL 401 LOGIC LABORATORY / Adtech, Inc.

Most presently available laboratories have fixed-position circuits. In the new Logic Laboratory, Model 401B, the circuits are moveable — systems can be made to have virtually the same form as their diagrams. This is an important conceptual aid to students of logic design and computer fundamentals. The new product, now available from Adtech, Inc., Honolulu, Hawaii, also is well suited to breadboarding applications where ease of assembly and troubleshooting save considerable time over conventional methods.

The Laboratory consists of a 32" x 18" Logicboard, a set of sixty 1.5" x 1.5" x 1.25" Logicubes (shown below) and <u>Elements of Computer Logic</u>, the laboratory workbook.

Power and ground are applied to the Logicubes when they are placed anywhere on the Logicboard with any one of four orientations. Each logic module performs a single function and is clearly labelled with a standard symbol for this function.
(For more information, circle #52 on the Reader Service Card.)



Memories

SMALLER, LOW-COST MAGNETIC CORE MEMORY / Ampex Corporation

The new Ampex 3DM-3000 modular-expandable core memory, available from Ampex Corporation, Culver City, Calif., measures at least 10 percent smaller than previous core memories of its type. Complete on one plug-in module, the new memory requires only one power supply voltage compared with the three usually needed for previous core memories.

The 3DM-3000, 1.2 inches high, 7 inches wide and 12 inches deep, has capacities up to approximately 100,000 bits. Access time is 1.2 microseconds, a half-cycle time of 1.5 microseconds and a full cycle time of 3 microseconds. The basic memory module accommodates 128, 256, 512 or 1,024 words by 4 to 12 bits. Maximum capacity, using all eight modules, is 8,192 words by 12 bits.

The new memory, which will be shown for the first time at the Spring Joint Computer Conference, is designed for use as a buffer memory in data terminals and acquisition systems, as a data-refresh memory for display devices, and in a wide variety of applications requiring a small, economical core memory.
(For more information, circle #56 on the Reader Service Card.)

NEW SERIES 7000 MEMORY SYSTEM / Information Storage, Inc.

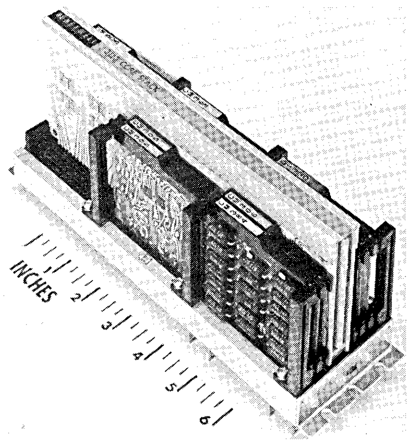
The storage capacity of Information Storage, Inc.'s 7000 series of standard production memory units has been increased with the addition of a new model — Model 7064 — which has a storage capacity of 2.0 million bits and an average access time of 16.5 milliseconds. The new memory, sixth in the series, maintains a packaging density of 1,000 bits per inch. Cost of the new model which includes integrated read/write/detection and selection electronics is less than .3¢ per bit.

The complete line of 7000 series memory systems have fixed non-positioning flying heads in a head-per-track configuration. ISI's 7000 series may be used to expand core storage on small and medium size general purpose computers, for buffer memory applications, as the main storage or as "extender" memories.
(For more information, circle #55 on the Reader Service Card.)

ICM-160 CORE MEMORY SYSTEM / Honeywell Computer Control Division

First of a new line of low-cost core memories, the ICM-160 (from Honeywell's Computer Control Division in Framingham, Mass.) is a 4,096-word memory available with 8, 12 or 16 bits per word. The system is field expandable to other word and bit sizes on a modular basis.

The ICM-160, said to be the smallest of its capacity currently available, measures only 2-3/4 by 5 by 9 inches. Full cycle time is 1.6 microseconds with access time of 550 nanoseconds. The system is self-contained and includes an address register, internal timing and control, sense amplifiers, and integrated circuit X-Y selection switches.



Applications include use in machine tool control, petroleum, chemical, steel and power process control systems, computer peripherals and data rate buffering; it is designed also for use as a mainframe memory in general purpose and special systems.
(For more information, circle #54 on the Reader Service Card.)

SYSTEM 360 COMPATIBLE BULK CORE MEMORY / Lockheed Electronics Co.

The Data Products Division of Lockheed Electronics Co., Los Angeles, Calif., has announced a multi-million byte core memory plug compatible with IBM System/360 Models 50, 65, or 75. Deliveries of the new bulk core memory, offered on sale or lease terms with maintenance options, are expected to begin in the first quarter of 1970. Details will be available at SJCC, Booth 2005-8.

Memory cycle time is 3.2 microseconds with access of 2.0 microseconds or less. Memory capacities are one-half, one and two million bytes for system 360 models.
(For more information, circle #53 on the Reader Service Card.)

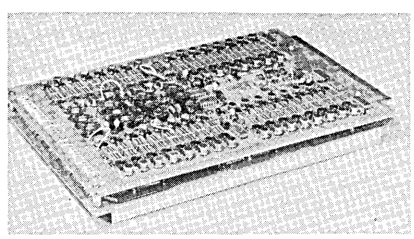
DSS-167 and DSS-170 DISC SYSTEMS / General Electric

General Electric (Phoenix, Ariz.) has added two new removable-disc designs to its family of random-access disc storage information subsystems. They are: the 90 million characters DSS-167, expandable to 120 million capacity; and the DSS-170, with 220 million character capacity. Access time for both systems is 75 milliseconds. The transfer rate for the DSS-167 is 208,000 characters per second; the DSS-170 has a rate of 416,000 cps. Both systems use the industry-standard eleven-high disc pack.

These systems, along with the existing DSS-160 (from 7.8 million to 60 million characters capacity) are expected to extend application of GE-developed automated management information filing and control technique, Integrated Data Store (I-D-S).
(For more information, circle #58 on the Reader Service Card.)

MODEL 140 CORE MEMORY / Micro Systems, Inc.

The core memory module, Model 140, from Micro Systems, Inc., Santa Ana, Calif., has a 900 nanosecond full cycle time and 300 nanosecond access time. The basic building block, of modular design, permits a wide range of word capacity/word size memory systems. Capacity of the module is 4096 words x 8, 9, 10 bits. Address and timing inputs are supplied by the user.



The Model 140 includes: full, half, and split cycle modes of operation; random address; party line data, address, and control line input/output; TTL integrated circuit interface; 40 watts average power consumption; and 0-50°C operating temperature range. The compact device measures 8-5/8" W by 1-7/8" H by 12'1/2" D, and weighs 3.5 lbs. The MSI-140 core memory may be ordered as a separate memory subassembly or as part of a complete system.
(For more information, circle #57 on the Reader Service Card.)

Software

SCIENTISTS DEVELOP SYSTEM FOR COMMUNICATING WITH COMPUTER IN THREE FOREIGN LANGUAGES

A system for communicating with a computer in three foreign languages — Spanish, French, and German — from inexpensive remote teletypewriter terminals, has been developed by computer scientists at Illinois Institute of Technology, Chicago, Ill. The three corresponding computer languages are known as SPANTRAN, GAULTRAN, and DEUTRAN. They employ translated words and sentences from the IITRAN system. (The IITRAN system is a language designed for communicating with computers which was developed at IIT for high school and college classroom computer use.)

Dr. Peter G. Lykos, director of the Computation Center at IIT, noted that prior to this time the computer has been used in other countries primarily by high-level professionals for whom English is an easy second language. The advent of SPANTRAN, GAULTRAN, and DEUTRAN now makes it possible for the computer to be utilized at the college, high school, and even elementary school level in other countries. Commands to the computer are given in the native language and messages from the computer to the programmer are returned in the same language. Also foreign students in the United States now can become familiar with the computer in their native language.

The new system can be adapted to any language which uses letters of the English alphabet. In the event that a translation is desired into a language using letters not found in the English alphabet, a simple adjustment can be made in the type fonts of the printing mechanism.

AUTODOC / Computer Time-Sharing Corp., Palo Alto, Calif. / An automated computer system which produces required documentation directly from source program decks. Autodoc is currently available for total documentation of systems written in COBOL or FORTRAN. User developed language modules will be implemented for Autodoc upon request. Since Autodoc is completely modular in design, product options can easily be added or changed. The system is written in COBOL and can be implemented easily on most computer systems.
(For more information, circle #59 on the Reader Service Card.)

CHARGE-SERV / Arthur S. Kranzley and Company, Cherry Hill, N.J. / Interrelated groups of computer programs facilitate credit control and perform charge card accounting functions. CHARGE-SERV programs are written in COBOL for an IBM System/360 (Model 30 and higher), but can run on other manufacturer's equipment as well. The systems are fully installed and guaranteed by the firm, which also provides a period of on-site guidance to each user at no charge. (For more information, circle #60 on the Reader Service Card.)

EXEC 16 / Honeywell Computer Control Division, Framingham, Mass. / A control package which performs scheduling, interrupt handling, core allocation, coordination of input-output devices and general supervisory functions. The software package provides DDP-516 users with a multiprogramming capability for real-time programs. (For more information, circle #61 on the Reader Service Card.)

FILS / Cullinane Corp., Boston, Mass. / Developed by The First National Bank of Boston, FILS provides a complete instalment loan accounting service for a bank and its correspondents. Distributed by Cullinane, the system requires an IBM 360/30 with 65K core and a minimum of four tapes or disks. The program is written in COBOL. Price is $15,000 and includes with the program tape a conversion manual, users' manual, operator's manual, computer operations control manual, installation, and training. (For more information, circle #62 on the Reader Service Card.)

FILEMAKE / Synergistic Software Systems, Inc., Houston, Texas / A debugging and testing aid. The software package gives application programmers the ability to automatically generate validating test data while reducing machine usage and program checkout time by using data subsets instead of entire "live" files. FILEMAKE is compatible with FORTRAN, COBOL, PL/I or ALC under DOS/OS. It requires 24K bytes. (For more information, circle #63 on the Reader Service Card.)

PAGE-I / RCA Graphic Systems Division, Dayton, N.J. / A computer language for instructing computers for electronic typesetting. Using PAGE-I, graphic arts personnel unskilled in computer programming, and programmers with a rudimentary knowledge of typesetting, to "tell" a computer exactly how to handle all aspects of composition. PAGE-I is used with an RCA Spectra 70 computer. (For more information, circle #64 on the Reader Service Card.)

SCADS (Supervisory Console Assembler Debugging System) / Mandate Systems Inc., New York, N.Y. / A system which enables IBM 360 DOS users to debug their programs directly from the 360 console typewriter. OOPS (On line Object Patching System), which is an adjunct of SCADS, simplifies machine language patching of object decks and saves a great deal of re-assembly time. The combination of SCADS and OOPS is available at $1,000 per installation plus $200 for each additional computer owned by the same company up to a maximum total of $2,000. (For more information, circle #65 on the Reader Service Card.)

XTRAN / Com-Share, Inc., Ann Arbor, Mich. / A time-sharing language which incorporates features of both FORTRAN II and FORTRAN IV, yet is an independent language. It can be either fully interactive or run in an almost batch-like mode. Com-Share has provided programs to convert existing Com-Share FORTRAN IV and FORTRAN II programs to XTRAN. (For more information, circle #66 on the Reader Service Card.)

XBUG / Mandate Systems Inc., New York, N.Y. / A utility program that enables users to debug 360 assembly language programs on-line. The package runs on any DOS configuration. The XBUG package is priced at $1,000 with additional copies at a lower price. (For more information, circle #67 on the Reader Service Card.)

Peripheral Equipment

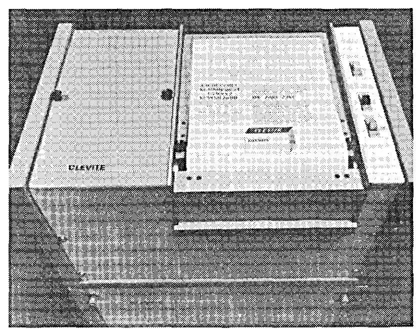
PLATEMAKER FOR GRAPHICS INDUSTRY / Datatronics, Inc.

The successful completion and demonstration of a computerized book platemaker for the graphics industry has been announced by Datatronics, Inc., Waltham, Mass. The computer operated platemaker will permit a programmer to lay out pages in position and then deliver a negative which can be exposed and etched onto the plate in a matter of seconds. Irvin Rachwal, President of Datatronics, Inc., indicated that the development of the platemaker involved the application of several new principles of electronics, including a new and rapid light source. (For more information, circle #76 on the Reader Service Card.)

HIGH-SPEED ELECTROGRAPHIC WRITER / Clevite Corp.

The Clevite 4800, a new electrostatic hard copy printer for computer systems, provides accurate printouts — including charts and drawings — as quickly as the computer supplies them. The electrographic recorder, developed by the Clevite Corp., Cleveland, Ohio, produces hard copy readout of computer solutions in less than 1 second for each 8½ x 11 page. It delivers 4,800 alphanumeric lines per minute (80 lines of 86 characters each per second) — a productivity rate of 412,000 characters a minute.

The Clevite 4800 produces a wide variety of fonts from the smallest matrix on up in an equally wide variety of weights, sizes and styles. It generates immediate dry and permanent copy. The machine prints directly from a computer, from a tape deck or duplicates the display on the CRT, depending on the application.



The Clevite 4800 cabinet, tailored specifically to customer needs, can be mounted on desk top or floor. It can be part of a computer terminal, part of a machine grouping or it can be mounted remotely. The application determines the ultimate configuration. (For more information, circle #84 on the Reader Service Card.)

HIGH SPEED PRINTER FOR IBM 1130 SYSTEMS / Hydrosystems, Inc.

The Model 3502-1130, announced by Hydrosystems, Inc., Farmingdale, N.Y., is a 400 lines per minute chain printer interfaced to operate from an IBM 1130 computer system. Up to 192 different characters are available including upper and lower case letters. The basic unit includes the line printer, the line printer controller, the interface enclosure assembly and associated cables. A complete software package is provided. (For more information, circle #77 on the Reader Service Card.)

DFC-10 TRANSMITTER / Dacom, Inc.

With the new DACOM DFC-10 Facsimile Bandwidth Compression Systems, available from Dacom, Inc., Palo Alto, Calif., facsimile transmission of page-sized documents requires less than two minutes over an ordinary voice circuit. The DACOM systems use digital transmission and operate with various types of facsimile and modem equipment.

These systems achieve notable reductions in communications costs by eliminating the transmission of redundancies normally present in graphic data, including typed and handwritten documents, maps, drawings, etc. DACOM DFC-10 systems also can be used with computers and data terminals to reduce storage, processing and communications costs for computer graphics.
(For more information, circle #78 on the Reader Service Card.)

DUAL ACCESS BUFFER (DAB) / Varian Data Machines

A high-speed buffer system, the Model 620/i-21 Dual Access Buffer (DAB), has been introduced by Varian Data Machines, Irvine, Calif. (a subsidiary of Varian Associates). The DAB option nearly triples the input/output capabilities of Varian Data's 620/i computer. DAB consists of one or more 1.0 microsecond memory banks, plus a control unit that allows direct access by either the computer or by high-speed peripheral devices.

Typical applications for the DAB option include real-time process control, graphic displays, simulation studies, and data acquisition.
(For more information, circle #75 on the Reader Service Card.)

INFORMATION RETRIEVAL SYSTEM / Data Corporation

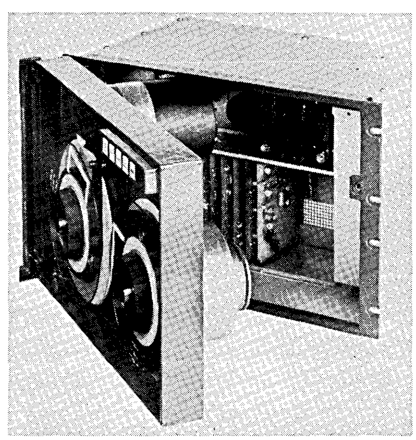
The new information storage and retrieval system, developed by Data Corp. of Dayton, Ohio (a subsidiary of the Mead Corp.), stores and retrieves in plain English, produces answers in seconds, builds its own keyword dictionary and permits direct access to the complete data base or any part of it. Mead Data Central, as the new system is called, can be used with any 64K or larger IBM System/360 or can be adapted to other similar size equipment.

Mead Data Central does not require use of special codes nor extract data based only on headings. Each word entered in the data base becomes a "handle" for extracting information, with the "dictionary" growing with every input to the system. Operating on a free text basis, the system searches every word in the data base for information requested. Once the MDC computer has been informed which and how much information is needed, the data is recorded on CRT, high-speed printer, magnetic tape or remote typewriter console.

Data Corp. is currently involved in a joint project with the Ohio Bar Association to file in a computer bank the entire body of Ohio case law, representing some 95 million words since 1810. When completed later this year, Ohio Bar Association members will be able to search out complicated legal precedents in seconds at a cost of less than $50 per search. Data Corp. also is working on assignments in the fields of research and development, chemistry, medicine, finance and personnel.
(For more information, circle #72 on the Reader Service Card.)

INCREMENTAL or CONTINUOUS MAGNETIC TAPE RECORDER / Bright Industries Inc.

The Model BI 830 tape transport, from Bright Industries, Inc. (San Francisco, Calif.), is designed for computer and data collection systems. The BI 830, a single-capstan recorder, records incrementally at 1,000 sps and continuously at 75 ips, a data transfer rate of 60 kHz. Data packing densities are available at 1600, 800 or 556 bpi. Continuous speeds are field adjustable. All tapes, on 8½" reels, are fully IBM compatible, 7 or 9 track, recorded with a high density ferrite recording head.

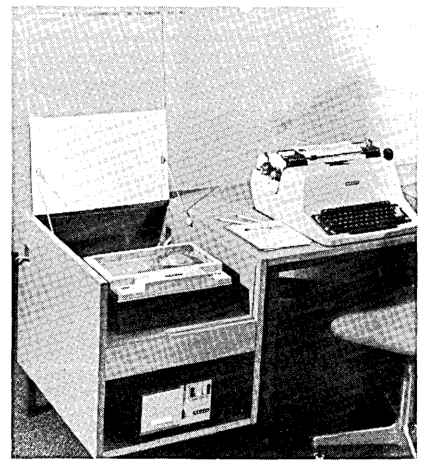


— Interior view of BI 830 showing vibration free front casting and heavy duty printed circuit motors

The recorder also is available with incremental read at 400 sps and continuous read at 75 ips; continuous only models also are available.
(For more information, circle #70 on the Reader Service Card.)

FACIT 6000 SERIES and 6200 SERIES DATA RECORDING SYSTEMS / Facit-Odhner, Inc.

Two modular data recording systems capable of producing hard copy simultaneously with magnetic computer tape are being introduced by Facit-Odhner, Inc., Secaucus, N.J. The two systems — the 6000 series and the 6200 series — offer a choice of four different input units. The systems are built around standard, easy to use office machines coupled with a control unit and an incremental magnetic tape recorder.



— Facit 6202 data recording system with modified Facit electric typewriter, control unit and incremental, magnetic tape recorder

In the Facit 6000 series, a choice of any of three standard 10-key adding or accounting machines can be used as the input unit for the simultaneous creation of numeric hard copy and magnetic computer tape. The Facit 6200 series uses a basic Facit Electric Typewriter as the input unit. A photoelectric read unit on the typewriter identifies each type bar as it travels to the platen by means of a pattern of binary coded holes in the upper end of the type bar.
(For more information, circle #79 on the Reader Service Card.)

CMC MODEL 3 KEYPROCESSING SYSTEM / Computer Machinery Corp.

The Model 3 CMC KeyProcessing System has been specifically designed for high volume keyboard input applications which do not require verification. The System includes: a supervisory console, a 1.6 microsecond computer, a synchronous magnetic tape unit and the associated system programs.

The Model 3 may be configured with up to 32 keystations which may independently and simultaneously utilize any one of up to 32 different record formats. Keyed data is stored in the computer's memory in 80 character blocks. As blocks are completed they are automatically transferred to the magnetic tape unit which is then ready for high speed input to the general computer system.

The new system, developed by Computer Machinery Corp. (Los Angeles, Calif.) may be readily upgraded to the Model 9 CMC KeyProcessing System which includes the verification feature.
(For more information, circle #80 on the Reader Service Card.)

MAGNETIC TAPE SYSTEM FOR NOVA COMPUTER / Peripheral Data Machines, Inc.

PerData (Peripheral Data Machines, Inc.), Hicksville, N.Y., has announced its Magnetic Tape System for Data General's new NOVA Computer. A dual gap head permits "read after write" checking, thus eliminating the necessity of reversing the tape and rerunning to check. The system is 9 track, 800 bpi, 25 ips, and IBM-compatible. It consists of a rack mountable controller and tape transport(s), cables, power supplies, basic software and documentation. Prerequisites are a NOVA equipped with the optional external I/O bus connector and one of the available interrupt levels.
(For more information, circle #74 on the Reader Service Card.)

2400 BPS DATA SETS / International Communications Corp.

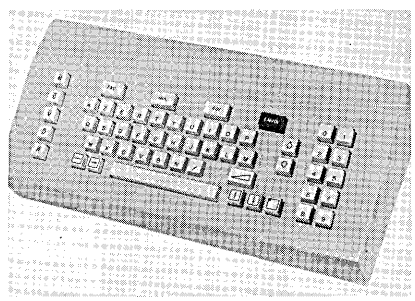
International Communications Corporation (Miami, Fla.), a subsidiary of Milgo Electronic Corp., has announced the Modem 2200/24 data set for transmitting 2400 bps data over either dial-up or dedicated leased telephone lines. The new data set is compatible with most existing four-phase units such as the Western Electric 201B. It is, however, a new type of four-phase modem, and includes circuit techniques formerly exclusive to ICC's eight-phase data sets, Modem 4400.

Users of the Modem 2200/24 may either communicate fully on a dial-up basis, or use dial-up as back-up to their dedicated leased lines through the telephone company's new Data Access Arrangement. The user requires only a single data set at each side as compared to two units per site generally furnished by the phone companies.

The Modem 2200/24 data set has been designed to meet the needs of international as well as domestic users. The new units will be shown in Booth No. E8 at the Spring Joint Computer Conference, May 14-16 in Boston.
(For more information, circle #73 on the Reader Service Card.)

CUSTOM-DESIGNED EXPANDED KEYBOARDS / Navcor, Inc.

Expanded keyboards remove the limitations on man-machine interface imposed by traditional typewriter-type keyboards. Designed to customer needs by NAVCOR, Inc., Norristown, Pa. (a division of KDI Corp.), all factors of the specific application are examined before making suggestions as to interface modes. Machine operators as well as programmers review the suggestions. The final expanded keyboard design can be made to encompass all the functional parameters of a specific customer requirement.



— Expanded keyboard designed and built for Air France by NAVCOR, Inc.

(For more information, circle #82 on the Reader Service Card.)

INTELLIGENT KEY ENTRY SYSTEM / Inforex, Inc.

The Intelligent Key Entry System, developed by Inforex, Inc., Burlington, Mass., combines the system processor, memory and tape drive in one control unit, thus eliminating the need to duplicate control and memory units at each keyboard. Cost-per-station is reduced and data entry functions available to each station are increased.

Up to eight keyboards may be linked to a single control unit. Information keyed at any station is stored in disc memory. Complete jobs are automatically pooled and transferred to seven or nine-channel magnetic tape.

Among the data entry functions standard with the new system are: automatic check digit computation; two levels of program control; full record display; recallable programs; simultaneous entry and verification.
(For more information, circle #81 on the Reader Service Card.)

DATANET-355 COMMUNICATIONS SYSTEM / General Electric

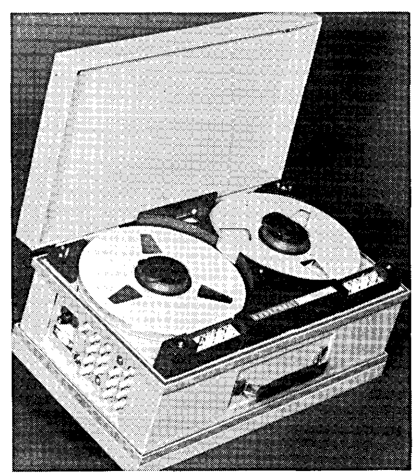
A versatile high-capacity data communications system, called the DATANET®-355, has been developed by General Electric, Phoenix, Ariz. While readily adaptable to many other advanced systems, it is especially designed to match the fast computing speeds and high-volume input-output requirements of the GE-600 information systems.

The DATA-355 acts as a system module in the GE-600 computer. It can serve up to 192 communications lines at the same time, and can accommodate as many as 400 users. Digital data is communicated directly to and from GE-600 memory.

The system processor has a 1-microsecond memory with a highly adaptable input-output multiplexer. Storage size is 16,384 or 32,768 18-bit words, with data handling in 6, 9, 18 or 36-bit word lengths. All word lengths are individually addressable, and data words of different lengths can be mixed and fully packed in storage.
(For more information, circle #71 on the Reader Service Card.)

PORTABLE MAGNETIC TAPE SYSTEM / Honeywell Test Instruments Division

A portable magnetic tape system, dubbed "jet pack" because of its comparatively small size, has been announced by Honeywell's Test Instruments Division. The Model 5600 data recording device weighs 65 pounds. It is described by the Denver-based firm as "a full 14-channel instrumentation-grade recorder that will handle virtually any tape recording requirement of the laboratory or field."



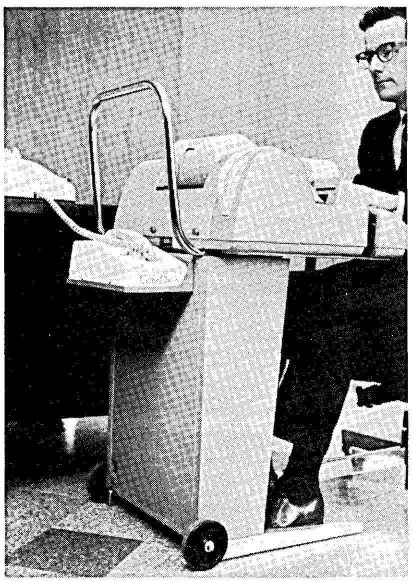
— Model 5600 dubbed "Jet Pack" because of small size

The ability of the Model 5600 to accommodate thin-base tape on 10½-inch reels gives it the record-

ing time capability of the larger systems. Built-in features of the Model 5600 permit easy, on-the-spot conversion of tape width, power source or recording technique to meet a variety of special requirements at remote locations.
(For more information, circle #69 on the Reader Service Card.)

MOBILE TERMINAL AND DATA SET / ComData, Inc.

ComData, Inc., Niles, Ill., has developed a completely portable modified Model 33 Teletype and acoustic data set. The mobile console unit can be rolled easily up and down stairs by a single person.



A large range of options include: paper tape input-output; automatic control of paper tape reader and/or punch; friction or sprocket feed; automatic form feed; 74 or 88 columns per line; mobile stand; and separate or built-in acoustic data set providing originate only or originate/answer mode. The portable units are available singly or in quantity lots.
(For more information, circle #68 on the Reader Service Card.)

LOW-SPEED DATA SET / Tel-Tech Corp.

Both small size and low price have been combined in the TT-103 Data Set developed by Tel-Tech Corp., Silver Spring, Md. The low-speed asynchronous modem is built on a single printed circuit card that transmits and receives data up to 300 bps. It is compatible with the Bell 103.

The Tel-Tech data set may be used to transmit data over either the switched telephone network or via dedicated 3 KHz type 3002 unconditioned telephone circuits. With either facility, the TT-103 provides full duplex data transmission over a two-wire circuit. To permit the transmission of data on a dial-up network, the TT-103 has been designed to operate with the Bell Data Access Arrangement.

Being a compact unit (4½" x 10"), it is well suited for use as an integral modem in a terminal. The same cards also can be packaged into a card file along with a power supply for use as a central modem in a communications network.
(For more information, circle #83 on the Reader Service Card.)

Data Processing Accessories

QUANTUM COMPUTER TAPE / Memorex Corporation

A totally new computer tape, called Quantum, has been developed by Memorex Corporation, Santa Clara, Calif. Quantum is designed to save processors the costs of reconstructing information lost by errors, the costs of checkpoint restarts on major processing and the lost time of "shuttling away" transient errors.

A new coating formulation resists thermal, oxidative and hydrolytic decomposition — even under extreme environmental conditions. This formulation also produces virtually no dropout-producing shed, considerable reducing transient errors and contributing to the tape's "start clean, stay clean" performance.

Actual shelf tests and accelerated aging tests reported by Memorex have proven the error-retardant quality of the new Quantum formulation. After ten months shelf storage, newly developed Quantum tape has only 4 to 5 transient errors — and on the average, less than 1 permanent error per reel. In accelerated aging tests, Quantum is 15 to 16 times more resistant to temporary errors, 2 to 3 times more resistant to permanent errors, than the two leading competitive brands.

The new Quantum tape is warranted for a full five years.
(For more information, circle #85 on the Reader Service Card.)

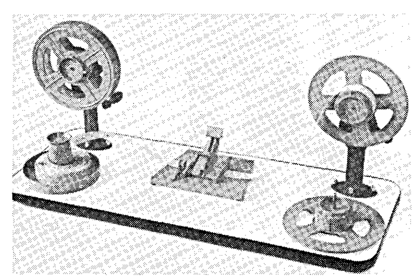
SYSTEMS UTILIZATION MONITOR / Computer Synectics Inc.

A new firm in Santa Clara, Calif., Computer Synectics Inc., has developed a device called the Systems Utilization Monitor (SUM). SUM simultaneously measures the activity and interaction of all system components: CPU, channels, control units and attached devices. In a multiprogramming environment, the SUM can measure each storage partition independently. Results are recorded on a 7- or 9-track tape in an IBM-compatible format. A data-reduction program is supplied by the company providing information to improve: system operating efficiency, hardware configuration balance, data set organization, and priority scheduling of major program segments.

No program modification or machine change is required in order to use the SUM. It attaches easily to any computing system via monitor probes. The connection provides complete electrical isolation from the host computer and has no effect on system operation.
(For more information, circle #86 on the Reader Service Card.)

PERFORATED TAPE WORK STATIONS / Data-Link Corp.

A new combined work station, called the Processor, for editing, splicing, repairing and rewinding all perforated tapes, has been announced by Data-link Corp., San Mateo, Calif. The device provides flexibility through the two D-L manual winders (both with adjustable brake tension), a D-L Splicer-Gauge-Punch, and a D-L Center-Feed Unwinder. Tapes can be shuttled between the two manual winders to locate the desired code level(s) and any code level can be corrected or changed with the Splicer-Gauge-



Punch. Tape direction (on a roll) can be changed by transferring from one manual winder to the other or tape direction can be maintained while splicing or editing by using the Center-Feed Unwinder. Data-link Processors are available in many configurations to fit the user's requirements.
(For more information, circle #87 on the Reader Service Card.)

TC-12 TAPE SPLICER / Tape-Stor Div., International Computer Appliances Corp.

The TC-12, developed by Tape-Stor Div., International Computer Appliances Corporation of Minneapolis, Minn., is both a Tape-Splicer and a Tape-Corrector. The splicer portion has an ever-sharpening blade for trimming the tape and a pressure pad for pressing patch securely. The corrector portion is designed for hand punching needed holes for correction or deletion. Guide pins have been located to provide for precision positioning of the tape. The splicer-corrector measures only 3" x 6" and weighs less than 2 lbs. (For more information, circle #88 on the Reader Service Card.)

COMPUTING/TIME-SHARING CENTERS

APL-MANHATTAN ANNOUNCES APL 360 TIME-SHARING SERVICES

APL-Manhattan, a division of Industrial Computer Systems, Inc., will provide APL 360 time-sharing services from the New York area, on or about June 9, 1969. APL, a language developed bt IBM's Iverson and Falkoff, speeds up programming by a large ratio. It is reported to be the fastest growing time-sharing language within IBM. APL implies "A Permanent Language".

An IBM System/360 Model 50 will provide initially for 30 simultaneously connected remote terminals. The modern "Selectric"® type terminal is used exclusively. A large library of applications programs has already been written by over a thousand users. A powerful text-editing program for secretarial use is available. Customer instruction will be included as part of the service.
(For more information, circle #89 on the Reader Service Card.)

IBM SYSTEM/360 MODEL 65/75 OPERATIONAL FOR COMMERCIAL USE AT McDONNELL AUTOMATION

An IBM System/360 Model 65/75 ASP (Attached Support Processor) system has begun processing data transmitted to it from more than three dozen smaller computers and terminals located throughout the nation. The new computer installation, at McDonnell Automation Co., St. Louis, Mo., gives the Automation Company's 1000 clients faster solutions to their problems than previously possible. It can compute solutions to 15 separate problems simultaneously and sweeps from task to task making some one-million calculations a second. It is the only one of its kind available for commercial use.

The system, valued at $7,750,000, consists of two computers joined by a unique software arrangement that permits the smaller Model 65 to drive the Model 75. By performing all the "housekeeping" functions, such as scheduling duties and printing the computer's solutions, the Model 65 can keep the Model 75 doing nothing but computing 24 hours a day, seven days a week. The Model 75 has a storage capacity of one million characters of information in its main memory. Additional disks and drums give the system a total storage capacity of 712-million characters.

Robert L. Harmon, vice president-general manager, said the computer is currently handling approximately 18,000 jobs each month, and it is expected to be computing nearly twice that many by late summer.
(For more information, circle #90 on the Reader Service Card.)

TRANS-CANADA NETWORK LINKS 23 IBM DATA CENTERS FROM BRITISH COLUMBIA TO NEWFOUNDLAND

Satellite computers and terminals in 23 IBM Data Center locations in Canada will be linked through a high-speed communications network, stretching from Victoria, B.C. to St. John's, Newfoundland. IBM Data Center users in those centers now will have access to IBM's complete Canadian program library, and its most powerful computers.

Three System/360 Model 65 computers, located in Toronto, Calgary and Montreal, now are within economical and "dial-up" reach of any Canadian user. Data may be submitted through a satellite center, routed to one of the three major computers, processed and returned. Or, a user can transmit punched card data from distant points in Canada to his central headquarters computer.
(For more information, circle #92 on the Reader Service Card.)

CYPHERNETICS CORPORATION, NEW NATIONAL COMPUTER SERVICE COMPLEX

Alan E. Schwartz, Detroit business executive and civic leader, and Charles W. Missler, formerly director of the Technical Computer Center of the Ford Motor Company, have announced the formation of The Cyphernetics Corp. (Ann Arbor, Mich.), a national computer service. The Cyphernetics Corporation is expected to be in full operation by the first of June and will serve business and industry through a time-sharing network.

The new firm will offer its clientele: an advanced time-sharing network; advanced software development; computer graphics; and computer management services.

The founders of the corporation include senior systems personnel from the original Dartmouth project (the GE-265 and GE-635 time-sharing systems) who, with Missler, established the Ford Motor Company world-wide time-sharing network. Alan E. Schwartz will serve as chairman of the board and chief financial officer of the new firm; Charles W. Missler will be president and chief operating officer.
(For more information, circle #91 on the Reader Service Card.)

RESEARCH FRONTIER

"BRAILLE MACHINE" WOULD MAKE INFORMATION STORED ON MAGNETIC TAPE AVAILABLE TO BLIND PERSONS

A device which may one day vastly increase the amount of literature available to blind people who read braille symbols is being developed by engineers and scientists at the Atomic Energy Commission's Argonne National Laboratory under a grant from the U.S. Office of Education to the Univ. of Chicago.

The new instrument is smaller than a portable typewriter. When perfected, it will take symbols recorded on ordinary magnetic tape and play them back as patterns of upraised dots — letters in the braille alphabet — on an endless plastic belt. A blind person will

read the information on the moving belt simply by touching the belt with his fingertips. He will be able to vary the speed of the plastic belt to suit his desired reading speed.

At the end of each pass, the moving belt will be "erased" and new dot patterns will be impressed on it. A special long-lived plastic being developed for this belt is capable of being used for weeks or months before replacement.

As part of their research, mathematicians at Argonne are perfecting computer programs which would enable the paper tape used for typesetting for an entire book to be "read" by a computer in a matter of minutes and translated into magnetic tape for the braille machine.

LIGHT BEAMS DEFLECTED AT SPEEDS SUITABLE FOR FUTURE OPTICAL MEMORIES

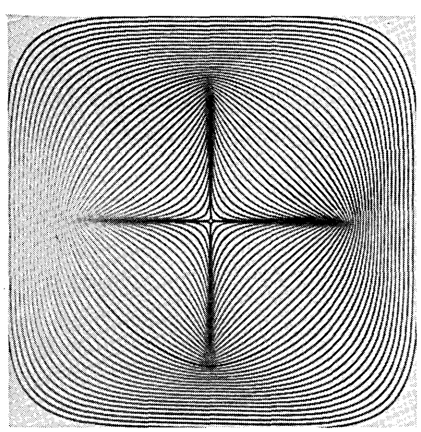
An experimental device that can switch the position of a light beam more than a thousand times faster than the blink of an eye could become an important part of computer memories of the future. The device, a digital light deflector, was developed at the IBM Systems Development Div. laboratory in San Jose, Calif.

The experimental deflector changes the location of a beam in 35 millionths of a second by a unique method of moving a glass plate in and out of contact with a prism.

High-speed deflectors of this type are potentially useful in future optical memories to randomly position a laser beam for data recording and reading. Such beam addressable memories are expected to be many times faster than present magnetic storage methods because of the relative speed of relocating a light beam in comparison to moving a bulky recording head.

MISCELLANY

WINNERS IN CALCOMP'S ART COMPETITION ANNOUNCED



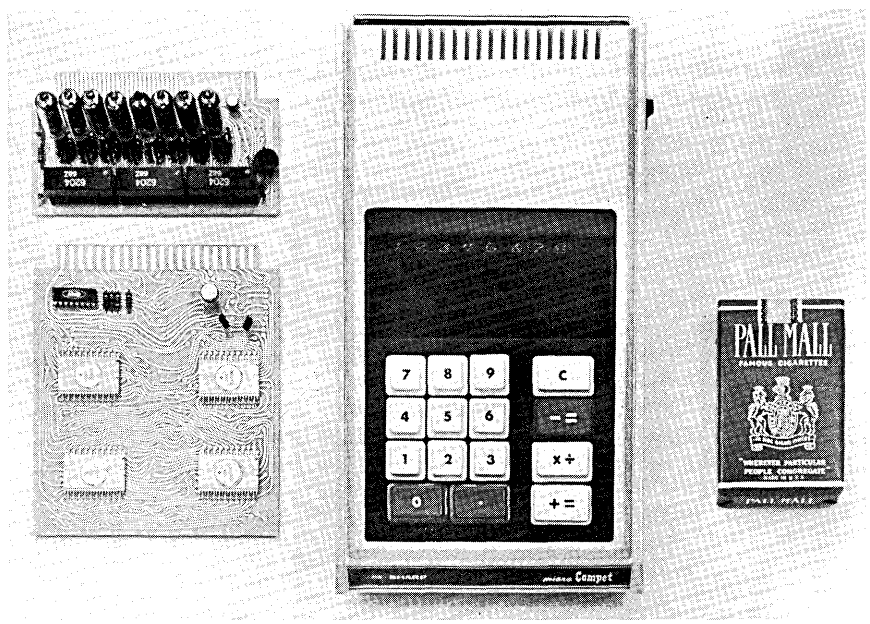
First prize was recently awarded to the entry titled "Cross" (above) in an international computer/plotter art competition sponsored by California Computer Products of Anaheim, Calif. The winner, Gordon Hines, a doctoral student at Queen's Univ., Kingston, Ontario, Can., received a cash award of $500, and a $5000 scholarship in his name was donated to Queen's Univ.

Second prize winner was Mrs. Linda Sue Lowery, a graduate student in painting at George Washington Univ., Washington, D.C. Third prize was awarded to George Olshevsky, Jr., a post graduate student in computer science at the Univ. of Toronto, Ontario, Can.

The contest was conducted over a period of nearly a year, and attracted entries from all over the world, including the countries of Japan, Germany, France, Holland, England, and Switzerland.

BREAKTHROUGH IN MICROELECTRONICS RESULTS IN MINIATURIZED ELECTRONIC ABACUS — WHILE THE ANCIENT ABACUS DEFEATS THE ELECTRONIC COMPUTER IN A CALCULATING CONTEST

The development of what they claim is the world's smallest full-functioning electronic calculator, the Sharp Micro QT-8D, was recently announced jointly by Hayakawa Electric Co., Ltd., of Osaka, Japan, and Autonetics, Div. of North American Rockwell, of Anaheim, Calif. The unusually compact size of the calculator, called an "electronic abacus" by its developers, was made possible through the use of Large Scale Integration. The unit weighs only 3-1/8 pounds, is completely silent, and performs addition, subtraction, multiplication, division, mixed calculations, and features automatic credit balance.



...A story in the March 19, 1969 Ottawa Journal, however, might lead one to believe that some of the marvelous inventions resulting from developments in microelectronics may not be needed — at least not by the contestants in a recent calculating contest held in Seoul, South Korea.

It seems that the ancient Oriental computing board, the abacus, is enjoying a new wave of popularity in Japan, Formosa, and South Korea. This inspired a calculating contest in which the abacus defeated the electronic computer and showed that adding, subtracting, and multiplying could be done faster by flipping beads on the board than by pressing computer keys.

A 10-year old Chinese boy from Taipei solved 10 mental arithmetic problems which involved multiplying two three-digit figures together in 37 seconds with no mistakes. The several hundred spectators who were present, including some American students, gasped at the incredible speed both in board calculating and in mental arithmetic demonstrated by the contestants.

Of course there's really no doubt that those who are not so mentally adept (and probably most of those who are) will continue to rely increasingly on the marvelous inventions of microelectronics. So if you would like more information on the new electronic abacus, the Sharp Micro QT-8D, please circle #93 on the Reader Service Card.

MEETING NEWS

SOFTWARE PROTECTION WORKSHOP ANNOUNCED BY THE GEORGE WASHINGTON UNIVERSITY'S COMPUTERS-IN-LAW INSTITUTE

Patent Resources Group, in cooperation with Professor Irving Kayton of The George Washington University's Computers-In-Law Institute, has announced a Software Protection Workshop, to be held June 2-4 at the Hotel America in Washington, D.C. The workshop will provide know-how and details for effective protection of computer programs by patent, trade secret agreement, and government and private contract.

The course is under the direction of Howard R. Popper of Bell Telephone Laboratories and Professor Irving Kayton. The workshop is oriented primarily toward lawyers serving computer users and software and hardware manufacturers. A course brochure may be obtained by writing Patent Resources Group, 2011 Eye St., N.W., Suite 800, Washington, D.C. 20006.

IFIP CONGRESS '71 — CHAIRMAN NAMED

Chairman of the U.S. Committee for IFIP Congress '71, to be held in Ljubljana, Yugoslavia during the last week of August 1971, is Dr. Herbert Freeman of New York University. The appointment was announced by Prof. Dr. Milan Osredkar, President of the Executive Committee for the IFIP Congress '71 and Director of the Nuclear Institute in Ljubljana.

IFIP — the International Federation for Information Processing — was formed in 1960 as a multinational organization of professional and technical societies concerned with information processing. IFIP's aim is to advance the interests of member societies through international cooperation in the field.

Dr. Freeman is Professor and Chairman of the Department of Electrical Engineering at NYU and a lecturer in graduate courses in systems analysis, optimum control and digital computer systems. He was Vice-Chairman of the U.S. Committee of IFIP Congress '68 in Edinburgh, Scotland and also has held a variety of posts in the IEEE, including his current chairmanship of the New York Chapter of the IEEE computer group.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Univac Federal Systems Div., Sperry Rand Corp., St. Paul, Minn.	U.S. Navy	Production of microminiature avionics computers for the U.S. Navy's P-3C Orion anti-submarine-warfare aircraft	$13.6 million
MAI Equipment Corp., New York, N.Y.	General Services Administration	A requirements contract for the rental and service of punch card machines with option to buy any or all of equipment covered by the award	$3.6 million (approximate)
CAE Electronics GmbH, Stolberg, Germany (a subsidiary of CAE Industries Ltd., Montreal)	NADGECO Ltd., London, England	Installation of ground-to-air and ground-to-ground communications equipment throughout Western Europe for the NATO Air Defence Ground Environment (NADGE) system	$1.8 million
Ampex Corp., Culver City Calif.	Badger Meter Mfg. Co., Milwaukee, Wis.	Model RG magnetic core memories which will be linked to PDP-10 computers; both will be incorporated into time-sharing systems developed and marketed by Badger Meter	$1.2 million
Platronics, Inc., Linden, N.J.	IBM Corporation, Endicott, N.Y.	Production of special gold plated contact pins	$1 million
Marshall Industries, San Marino, Calif.	Federal Reserve Bank, Chicago, Ill.	A dual M-1000 data communications system; contract provides for installation in 1969	$750,000
Computer Time-Sharing Corporation (CTC), Palo Alto, Calif.	Hospital Sciences of Northern California, Inc.	CTC computer systems for administrative and business office procedures	$500,000 (approximate)
Honeywell Electronic Data Processing, Wellesley Hills, Mass.	U.S. Dept. of Labor	Two-year grant to train 130 persons in computer production work; students will receive 13 weeks orientation and skill training at the Brighton facility before going to an EDP production line for on-the-job training	$396,000
MetaSystems Corp., Trenton, N.J.	U.S. Army Data Field Systems Command	Monitoring of the design and development of software for the Tactical Fire Direction (TACFIRE) System being developed for the Army by Litton Industries	$260,000
System Development Corp. (SDC), Santa Monica, Calif.	U.S. Office of Economic Opportunity	A study of the reading program given at Job Corps Centers; study will be done at Los Pinos Job Corps Ctr. near Elsinore, Calif.	$166,249
Com-Share, Inc., Ann Arbor, Mich.	U.S. Naval Research Laboratories	One year of time-sharing service to be used for wide range of activities by some four hundred engineering and scientific users	$50,000
Cambridge Computer Corp., New York, N.Y.	Drug Distribution Data, Inc., New York, N.Y.	A computerized data system which will give pharmaceutical manufacturers access to complete information on drug sales by geographical area	—
Control Data Corp., Minneapolis, Minn.	Greek Atomic Energy Commission (AEC), Athens, Greece	A multi-programming CDC model 3300 and a medium-scale CDC 1700 system; the CDC 1700 will be used to format and edit source data, mainly in the area of high energy physics, for processing on the larger CDC 3300	—
IBM Corporation, New York, N.Y.	Allegheny Airlines, Washington, D.C.	An IBM computer system, called PACER 360, which will be one of the largest real time data processing systems in the U.S. and by 1975 will represent a $12 million investment. PACER 360 will be built around two IBM System/360 Model 65's that will incorporate two IBM System/360's presently in use	—
General Dynamics, Electronics Div., Rochester, N.Y.	U.S. Army Electronics Command, Ft. Monmouth, N.J.	Design and development of a high speed Morse telegraph terminal for use by the U.S. Army Special Forces at bases in various parts of the world; the terminal will have the capacity of sending and receiving messages independently in a full duplex mode of operation	—
Planning Research Corp., Los Angeles, Calif.	U.S. Army Missile Command	Performing supplemental reliability and quality assurance studies on the SHILLELAGH Antitank Missiles; this follow-on award brings the total amount of awards to Planning Research for this project (over 7½ years) to over $1.3 million	—
Intertech Research Services, Inc., Huntsville, Ala.	Trans World Airlines	Computer services for TWA operations at the Cape Kennedy Space Center in Florida	
Executive Computer Systems, Inc., Oak Brook, Ill.	Scripture Press Publications, Wheaton, Ill.	Assuming the total data processing function for Scripture (five-year contract), including systems design, programming, operations, management and application development	—
Mauchly-Wood Systems Corp., Newport Beach, Calif.	Marshall and Stevens, Inc. Los Angeles, Calif.	Design and implementation of a computerized appraisal system	—
Delta Data Systems Inc., College Park, Md.	Mosler Information Systems Division of Mosler Safe Co.	Assisting Mosler in defining the Army Material Command's requirements for complete microfilming and data information systems in implementing Technical Data Centers	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B3500 system	Laclede Steel Co., St. Louis, Mo.	Reinforcing steel order entry system, maintenance and stores inventory control (to be on-line); and purchased scrap analysis, reinforcing steel estimating for structures, sales analysis, accounts payable, pensions and salaried payroll
Burroughs B5500 system	Joint Computer Center, Washington, D.C. (serving the International Monetary Fund and the World Bank)	Business management applications, operational research and statistical needs (system valued at $1.2 million)
Digital Equipment PDP-10	Computility, Inc., Boston, Mass.	A full range of time-sharing services to engineering, commercial, financial and educational organizations
	On-Line Systems, Inc., Pittsburgh, Pa.	Use by subscribers with remote terminals at area educational, industrial and engineering organizations
GE-430 system	Academy Computing Corp., Oklahoma City Computer Ctr., Oklahoma City, Okla.	Time-sharing services; Academy already has a GE-255 (Oklahoma City) and a GE-420 (Houston)
GE-635 system	University of Kansas, University Computation Ctr., Lawrence, Kan.	Educational, administrative and research computing for the institution
Honeywell Model 110 system	Glamorgan Pipe and Foundry, Lynchburg, Va.	Pipe production and foundry production analysis, monthly maintenance, accounts payable and receivable, payroll and inventory
	Mentor Exempted Village Board of Education, Mentro, Ohio	Handling attendance and grade reporting and the school system's payroll
	Stolper Industries Inc., Menomonee Falls, Wis.	Production scheduling and production floor loading
Honeywell Model 120 system	Chase Brass & Copper, Inc., Shaker Heights, Ohio	Payroll, finished goods inventory, stores inventory, accounts receivable and sales analysis
	Stevens Henager College, Salt Lake City, Utah	Student and administrative accounting; also as a teaching tool for electronic data processing courses
	Victor Equipment Co., Denton, Tex.	Cost accounting, general accounting, production control, manufacturing reports, sales analysis, inventory control, payroll and bill of materials
Honeywell Model 125 system	Pacific Valves Inc., Long Beach Calif.	Accounting functions and an inventory cost system
Honeywell Model 200 system	Board of Education of Howard County, Clarksville, Md.	A teaching tool in data processing courses
	Eastern Kentucky University, Richmond, Ky.	Wide range of applications from developing feed formulations for the agriculture department to general university accounting and hands-on training for electronic data processing courses
	Oak Creek-Franklin Joint City School District, Oak Creek, Wis.	Teaching data processing and handling student and administrative accounting; also services for the municipalities including poll lists and city payrolls
	School District 281, Robbinsdale, Minn.	A variety of administrative and student accounting operations for seven suburban communities
Honeywell Model 1200 system	Arizona State Univ., Tempe, Ariz.	Administrative data processing services for the entire 24,000-student university
	Waukesha Motor Co., Waukesha, Wis.	Inventory control, order entry, forecasting, labor reporting, purchasing, inventory costing, engine costing, and general accounting routines
Honeywell Model 2200 system	Supplementary Education Center of the Bossier Parish School Board, Louisiana	CAI field tests; the center is supported by Bossier Parish, Caddo Parish and 10 other school districts in northwest Louisiana
IBM System/360 Model 67	Rutgers University, New Brunswick, N.J.	A data processing network linking four other Rutgers campuses; research projects to be continued or initiated with the expanded facilities range from studies of zodiacal light to analyses of rent control legislation (system valued at $1.5 million)
NCR Century 100 system	Mervyn's, San Lorenzo, Calif.	Management information system; inventory, credit and merchandise management, general accounting routines
	U.S. House of Representatives, Washington, D.C.	Preparation of the House staff payroll involving some 6,000 persons; additional applications later
NCR Century 200 system	First Federal Savings and Loan Association of Wisconsin, Milwaukee, Wis.	Processing savings accounts, mortgage accounts, and various management reporting functions
UNIVAC 418-II system	MacDill Air Force Base, Tampa, Fla.	Providing the U.S. Air Force and U.S. STRIKE Command with an automated entry into the government's AUTODIN network
UNIVAC 494 system	Yasuda Trust and Banking Co., Tokyo, Japan	Processing savings accounts, loans, trust and administration business; will establish on-line, real-time banking system later (system valued at $1.4 million)
UNIVAC 1108 system	Agricultural Cooperatives Federation (Zenkyoren), Tokyo, Japan	Processing mutual insurance business of agricultural cooperatives, including accounting, finance and personnel affairs, and new contracts (system valued at $3.3 million)
	Fuji Bank, Tokyo, Japan	Supplementing another UNIVAC 1108 Multiprocessor System and three UNIVAC 418 Systems previously supplied to Fuji; bank handles an average of 150,000 customer transactions each day (system valued at $5.7 million)

COMPUTER CENSUS

This Computer Census is based on files which identify by each user, installation sites and information regarding digital computers, other data processing equipment, and software.

Part 1, information on the ten largest manufacturers in the U.S. market; Part 2, information on other manufacturers in the U.S. market; and Part 3a, information on non-U.S. controlled companies in the world market were published previously. Any company whose data is not included in our censuses is invited to send us the applicable figures for us to publish. Also, we invite any corrections or additions from informed readers.

PART 3B-U.S. CONTROLLED COMPANIES IN THE WORLD MARKET (EXCLUDING U.S.)
Data as of December 30, 1968 (except as noted)
*1 Data not available at press time

MANUFACTURER	COMPUTER TYPE	TYPICAL MONTHLY RENTAL $ (000)	NUMBER OF COMPUTERS INSTALLED LEASED & PURCHASED
Burroughs	205	4.6	2
	220	14.0	2
	B100	2.8	13
	B200	5.4	71
	B300	9.0	40
	B500	3.8	None
	B2500	5.0	12
	B3500	14.0	18
	B5500	25.0	7
	B6500	33.0	None
	B7500	44.0	None
	B8500	200.0	None
Control Data	G-15	1.6	*1
	G-20	15.5	*1
	LGP-21	0.7	*1
	LGP-30	1.3	*1
	RPC-4000	1.9	*1
	160/160A/160C	2.1;5.0;12.0	*1
	924/924A	11.0	*1
	1604/1604A	45.0	*1
	1700	3.8	41
	3100/3150	10.0	15
	3200	14.0	15
	3300	20.0	17
	3400	18.0	4
	3500	25.0	None
	3600	52.0	9
	3800	53.0	2
	6400/6500	56.0	14
	6600	115.0	11
	7600	235.0	None
Digital Equipment	PDP-1	3.4	1
	PDP-4	1.7	2
	PDP-5	0.9	8
	PDP-6	10.0	2
	PDP-7	1.3	15
	PDP-8	0.5	209
	PDP-9	1.1	71
	PDP-10	9.0	5
General Electric	105	1.4	None
	115	2.2	418
	130	4.5	None
	205	2.9	None
	210	16.0	None
	215	6.0	1
	225	8.3	16
	235	12.5	17
	405	6.0	3
	415	11.0	68
	425	18.0	20
	435	25.0	6
	625	50.0	3
	635	60.0	3
	645	90.0	None
	4020	5.0	8
	4040	3.0	8
	4050	7.0	None
	4060	8.5	1

MANUFACTURER	COMPUTER TYPE	TYPICAL MONTHLY RENTAL $ (000)	NUMBER OF COMPUTERS INSTALLED LEASED & PURCHASED
Honeywell	110	2.5	2
	120	4.0	145
	125	5.0	9
	200	8.5	208
	400	8.5	14
	800	28.0	10
	1200	10.0	31
	1250	12.0	2
	1400	14.0	None
	1800	50.0	3
	2200	16.0	21
	4200	21.0	None
	8200	50.0	None
IBM	1130	1.7	1227
	1401	5.4	1836
	1410	17.0	116
	1440	4.1	1174
	1460	9.6	63
	1620	4.1	186
	1800	5.0	148
	7010	26.0	14
	7040	25.0	27
	7044	36.5	13
	7070	27.0	7
	7074	35.0	26
	7080	60.0	2
	7090	63.5	4
	7094-I	75.0	2
	7094-II	83.0	4
	3620	2.8	3276
	3625	5.3	4
	3630	9.3	3144
	3640	19.0	498
	3644	15.0	13
	3650	33.0	109
	3665	70.0	31
	3667	69.0	4
	3675	81.5	3
	3685	115.0	None
	3690	150.0	None
NCR	304	14.0	1
	310	2.5	None
	315	8.7	142
	315 RMC	12.0	17
	390	1.9	68
	500	1.5	324
	100	2.7	None
	200	7.5	None
RCA	301	7.0	98
	501	18.0	1
	601	14.0	None
	3301	35.0	1
	70/15	4.1	34
	70/25	6.7	18
	70/35	8.0	20
	70/45	23.0	21
	70/46	33.5	None
	70/55	33.5	1
Scientific Data	92	1.5	2
	910	2.0	7
	920	2.9	3
	925	3.0	1
	930	3.4	14
	940	14.0	None
	9300	8.5	1
	Sigma 2	1.8	9
	Sigma 5	6.0	6
	Sigma 7	12.0	5
Sperry Rand	III	21.0	6
	418	11.0	36
	490 Series	30.0	11
	1004	1.9	628
	1005	2.4	299
	1050	8.5	62
	1107	57.0	3
	1108	68.0	18
	9200	1.5	48
	9300	3.4	38
	9400	7.0	None

BOOK REVIEWS

Neil Macdonald
Assistant Editor
Computers and Automation

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

Carter, Norman H. / Introduction to Business Data Processing / Dickenson Publishing Co., Inc., Belmont, Calif. / 1968, hardbound, 269 pp., $?

This book is intended for an individual who will *not* be a computer specialist. Thus, it does not dwell on the mechanics of "board-wiring" or programming. The book is meant to be used in introductory survey courses in business schools and is structured accordingly. Its organization reflects the management view of data processing. The seven parts include 16 chapters and six case studies, a glossary, a bibliography, and an index. Part I, The Field of Data Processing; Part II, Methods of Data Handling; Part III, The Stored Program Computer; Part IV, Using EDP in Business; Part V, Direct Access to the Computer; Part VI, The Relation of Business Data Processing and the Corporation; Part VII, Technical Case Studies. It includes an Instructor's Manual.

The author has been Vice President for Corporate Planning and Research, at the Union Bank, Los Angeles, Calif., and is now Vice President and General Manager of the Center for Educational Technology, Computer Sciences Corp., Los Angeles.

Wooldridge, Dean E. / Mechanical Man — The Physical Basis of Intelligent Life / McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036 / 1968, hardbound, 212 pp., $8.95

This book presents evidence from fields like biophysics, neurophysiology, and computer science, to prove that biology is a branch of physical science, and that man is only a complex kind of machine. The introduction, "The Nature of Physical Explanation" and the five parts: "The Physical Properties of Organisms", "Behavior", "Intelligence", "Consciousness", and "Implications of the Physical Explanation of Biology" comprise the book. There are nineteen chapters.

Reilly, E. D., Jr., and F. D. Federighi / The Elements of Digital Computer Programming / Holden-Day, Inc., 500 Sansome St., San Francisco, Calif. 94111 / 1968, hardbound, 222 pp., $?

This book seeks to teach the fundamental principles of digital computer programming in machine language to college and university students who have had no prior exposure to the subject, and who do not necessarily have any mathematical preparation beyond high school algebra. The 15 chapters include: "The Stored Program Digital Computer"; "Preparing Programs for Solution"; "Decision-Making"; "Input-Output Instructions"; "Job Sequencing and Error Control"; "Subroutines and Calling Sequences". There are two appendices, a glossary, and two indexes.

This book makes use of a fictitious computer, the MOHAC, but this "computer" is implemented on a number of real computers, and hence it is "real" and can actually be used. The book was first written by the Education Committee of the Hudson-Mohawk Chapter of the Association for Computing Machinery when one of the authors was the committee chairman.

The present book is written with a flair and with enjoyment, and is really useful.

Maurer, Ward Douglas / Programming — An Introduction to Computer Languages and Techniques / Holden-Day, Inc., 500 Sansone St., San Francisco, Calif. 94111 / 1968, hardbound, 306 pp., $?

The book seeks to present an introduction to computer programming techniques. It starts out by explaining machine (assembly) language, but then quickly delves into modern ways of pro-

C.a

PROOF GOOFS

Neil Macdonald
Assistant Editor

We print here actual proofreading errors in context as found in actual books; we print them concealed, as puzzles or problems. The correction that we think should have been made will be published in our next issue.

If you wish, send us a postcard stating what you think the correction should be.

We invite our readers to send in actual proofreading errors they find in books, *not* newspapers or magazines (for example, *Computers and Automation*), where the pressure of near-at-hand deadlines interferes with due care. Please send us: (1) the context for at least twenty lines before the error, then the error itself, then the context for at least twenty lines after the error; (2) the full citation of the book including edition and page of the error (for verification); and (3) on a separate sheet the correction that you propose.

We also invite discussion from our readers of how catching of proofreading errors could be practically programmed on a computer.

For more comment on this subject, see the editorial in the September 1968 issue of *Computers and Automation.*

Proof Goof 695

Find one or more proofreading errors.

Sometimes the indifference of the teacher to the presence of a pupil can destroy the effort to participate and the will to succeed. The ways in which teacher indifference is displayed are myriad. The tone of voice, the inflection in an exchange of speech between teacher and pupil, the faraway look when the pupil is speaking, the lift of an eyebrow at what to the teacher seems to be a stupid statement by the pupil, a quick change in facial expression as the teacher shifts his attention to a pupil whom he obviously respects — these are examples of the innumerable telltale signs of disrespect which may be communicated to the timid, insecure, inadequate youngster whose intuitive sensitivity to those symbols of communication is often far more sharp than is usually believed. The result is a degree of negative influence that is frightening in its total, irreducable, and continuing effect upon the pupil. In such ways even the teacher who does not wish to do so unconsciously demotivates the unsure and hestitant pupil. She not only destroys the wish to achieve, but implants the causes of negative behavior.

— from *The Amidon Elementary School* by Carl F. Hansen, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1962, page 93.

Solution to Proof Goof 694:

Paragraph 6, line 2: Replace "ones" with "one's".

Correction

The solution to Proof Goof 692 published on page 15 in the March, 1969 issue should have included one more goof: Paragraph 6, Line 12: Replace "exhorbitant" with "exorbitant".

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gramming. The 12 chapters include: Machine Language; The Assembler; Searching and Sorting; File Processing; Programming Systems. There are four appendices, and an index, but no glossary or bibliography.

A reader of this book is assumed to be familiar with some algebraic programming language such as ALGOL, FORTRAN, JOVIAL, MAD, or NELIAC.

The book is full of information and thought-provoking problems, and pays special attention to definitions. It could be a very useful book for many computer people.

Chapin, Ned, PhD / 360 Programming in Assembly Language / McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. / 1968, hardbound, 531 pp., $12.50

The objective of this book is to help the reader learn to program a "byte" computer (such as IBM 360, Univac 9000, or RCA Spectra 70) in assembly language. "The motive for writing this book has been to provide an easily understood, well-organized, and carefully graded text." The only mathematical knowledge assumed is the ability to add, subtract, multiply and divide. The book has been classroom tested with college freshmen. The twelve chapters in this book include: "Computer and Language Features"; "Data Representation"; "Program Control"; "Input, Output, and Job Control"; "Debugging"; "Problem Analysis"; "Tape and Disk Operations"; "Floating-Point Operations". There are seven technical appendices and an index.

This is an interesting, informative, and useful book by a very well informed and capable author.

Joslin, Edward O. / Computer Selection / Addison-Wesley Publ. Co., Inc., South St., Reading, Mass. / 1968, hardbound, 172 pp., $?

This book is written for computer users. It covers the system study needed to make a decision about acquiring a computer. The book describes how a computer is selected to meet a requirement for a large-scale system. Much of the material in the book was first prepared as a thesis for Boston College.

Part I. "The Selection Plan" contains 5 chapters: "Specifications for Computer Systems"; "Techniques of Evaluating Proposals for Computer Systems"; "Methods of Procuring Computer Systems"; "Preparing for Validation and Adjustments"; and "Interaction Between User and Vendor".

Part II consists of "An Abbreviated Selection Example". There is a bibliography and an index. The author participated in developing a course on "Specifications for Selection" for the Computer Institute of the Department of Defense. The author has a B.S. degree in Electrical Engineering from the Milwaukee School of Engineering and an M.B.A. degree from Boston College.

Englander, H. S., Englander, W. R., and Saxon, J. A. / System 360 Programming: A Self-Instructional Manual / Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632 / 1968, paperback, 231 pp., $5.75

This book is for self-study or a text in school. As a text, it should free the instructor from many routine chores. The book is designed to teach a course in the IBM System 360 assembly language. Among the 10 chapters are: "Necessary Basics"; "Fixed Point Binary Arithmetic"; "RX Instructions"; "Branching"; "Logical Instructions". There are 4 appendices, no glossary, no index. The book is typewritten (with elite type) and unjustified right-hand margins. The book is restricted to a single computer system made by one manufacturer. It is basically equivalent to computer manuals put out by a manufacturer.

CLASSIFIED ADVERTISEMENTS

NEW PATENTS

(Continued from page 12)

3,425,044 / Pierre Alfred Ferrier, Villebon, and Marc Charles Joseph Lesueur, Chaville, France / Compagnie des Machines Bull (Societe Anonyme), Paris, France / Selecting system for magnetic core stores.

February 4, 1969

3,426,328 / Robert O. Gunderson, Sidney L. Valentine, and Martin H. Jurick, Torrance, and Paul Higashi, Gardena, Calif. / The National Cash Register Co., Dayton, Ohio, a corporation of Maryland / Electronic data processing system.

3,426,329 / Hans B. Marx, Bromall, Edward W. Moll, King of Prussia, Bruce W. Nutting, West Chester, and Meyer Schilder, Plymouth Meeting, Pa. / Burroughs Corporation, Detroit, Mich., a corporation of Michigan / Central data processor for computer system having a divided memory.

3,426,330 / Hans B. Marx, Broomall, Edward W. Moll, King of Prussia, Bruce W. Nutting, West Chester, and Meyer Schilder, Plymouth Meeting, Pa. / Burroughs Corporation, Detroit, Mich., a corporation of Michigan / Central data processor.

3,426,334 / Edward Camp Dowling, Harrisburg, Pa. / AMP Incorporated, Harrisburg, Pa. / Continuous selective readout for magnetic core systems.

3,426,335 / Philip A. Lord, Vestal, and Mitchell P. Marcus, Binghamton, N. Y. / International Business Machines Corp., Armonk, N. Y., a corporation of New York / Thin film associative memory.

February 11, 1969

3,427,592 / Ralph J. Bahnsen, Brighton, Mass., and John Cocke, Mount Kisco, N.Y. / International Business Machines Corporation, New York, N. Y., a corporation of New York / Data processing system.

3,427,598 / James J. Kubinec, San Jose, Calif. / Fairchild Camera and Instrument Corporation, Syosset, N. Y., a corporation of Delaware / Emitter gated memory cell.

3,427,600 / Simon Middelhoek, Kilchberg, Zurich, Switzerland / International Business Machines Corporation, New York, N. Y., a corporation of New York / Magnetic film memory cell with angularly displaced easy axes.

3,427,601 / Vincent J. Korkowski, Minneapolis, Francis J. Belcourt, Shakopee, and Raymond H. James, Bloomington, Minn. / Sperry Rand Corporation, New York, N. Y., a corporation of Delaware / Detector system and device.

3,427,602 / Wilbert L. Shevel, Jr., Peekskill, N. Y. / International Business Machines Corporation, Armonk, N. Y., a corporation of New York / Magnetic systems with memory elements consisting of tubular magnetic members arranged in aperture form.

3,427,603 / Irving William Wolf and Andre A. Jaecklin, Palo Alto, Calif. / Ampex Corporation, Redwood City, Calif., a corporation of California / Magnetic thin film shift register.

3,427,605 / Andrew Gabor, Huntington, N. Y. / Potter Instrument Company, Inc. / Plainview, N. Y., a corporation of New York / Apparatus and method for recording control code between data blocks.

February 18, 1969

3,428,824 / Stathis G. Linardos and Richard F. Elmhurst, Clearwater, and William A. Elmhurst, Largo, Fla. / Lykes Bros., Inc., Tampa, Fla., a corporation of Florida / Logic circuits.

3,428,828 / Sam M. Korzekwa, Baldwinsville, and Hans R. Schindler, Syracuse, N. Y. / General Electric Co., a corporation of New York / Sample and hold circuit.

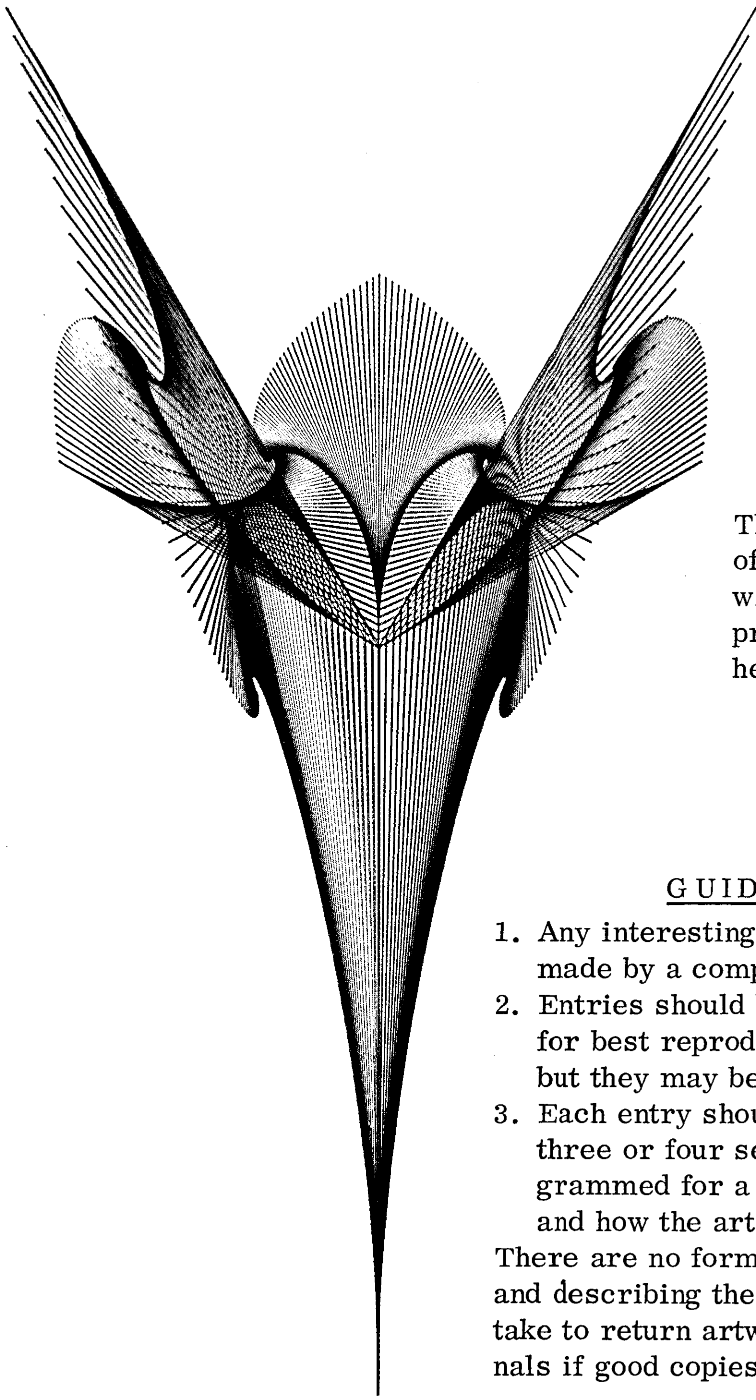
3,428,830 / John C. McEvoy, Livonia, Mich. / Burroughs Corporation, Detroit, Mich., a corporation of Michigan / Start-stop logical switching system.

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.

YOU ARE INVITED TO ENTER OUR

7th annual COMPUTER ART CONTEST



the special feature of the August, 1969 issue of

computers and automation

The winning entry will appear on the cover of our August issue — more than 25 entries will be published inside. The 1968 first prize winner, "Hummingbird", is shown here at the left.

GUIDELINES FOR ENTRY

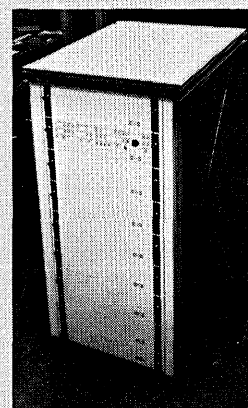
1. Any interesting and artistic drawing, design or sketch made by a computer (analog or digital) may be entered.
2. Entries should be submitted on white paper in black ink for best reproduction. Color entries are acceptable, but they may be published in black and white.
3. Each entry should be accompanied by an explanation in three or four sentences of how the drawing was programmed for a computer, the type of computer used, and how the art was produced by the computer.

There are no formal entry blanks; any letter submitting and describing the entry is acceptable. We cannot undertake to return artwork, and we ask that you not send orignals if good copies are available.

Deadline for receipt of entries in our office is July 3, 1969.

For information on how to obtain color reproductions of this and other computer art from our 1968 contest, designate No. 2 on the Reader Service Card.

With every Raytheon computer you get AID... plug-in interface for incompatibles.



It's one thing to match a systems computer like the 706 to standard peripherals. But what about non-standards? Pick analog and parallel interfaces, scopes, data acquisition systems, or something you happen to have on the shelf.

The AID concept, (Applications Interface Device) for the 706, handles them all. A series of functionally modular blocks lets you interface the 706 with your input or output conveniently, quickly and economically.

AID blocks go well with standard equipment too. They're compatible with our packaged system instruments like the MINIVERTER™ which combines multiplexing, sample-and-hold and a/d conversion. This means you can get an analog front end, interface, computer and your output devices from one place—RAYTHEON.

AID modules simplify timing, coding, buffering and control logic. Thus expensive systems, design and checkout time is dramatically reduced.

AID is just one more reason why the 706, with a basic price of $19,000, is becoming the systems designer's choice. Write or call today for Data File CB170. Raytheon Computer, 2700 S. Fairview, Santa Ana, California 92704. Telephone (714) 546-7160.

RAYTHEON