

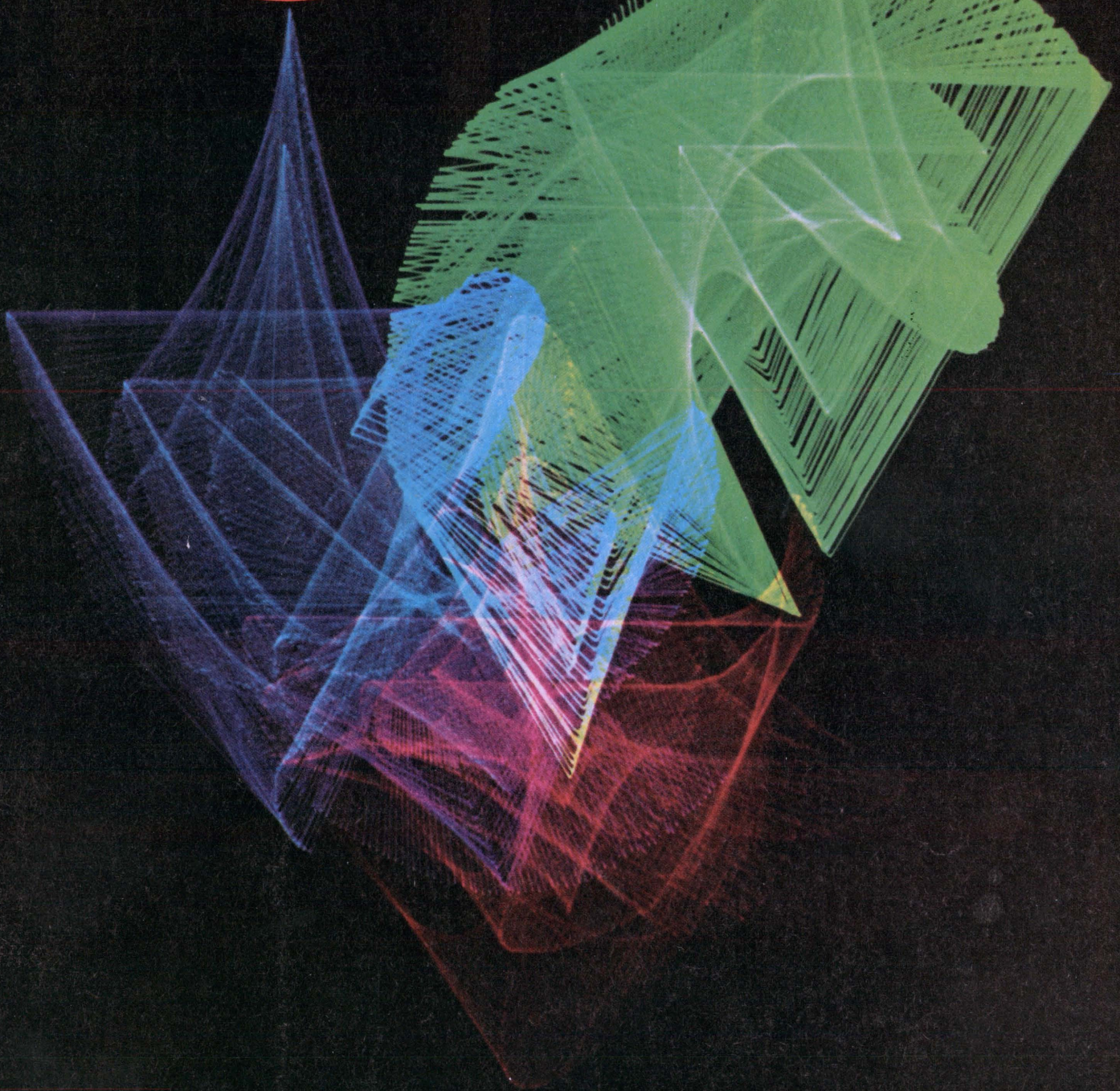


# software age

JULY 1970

DOCUMENTATION

3-DIMENSIONAL PLOTTING

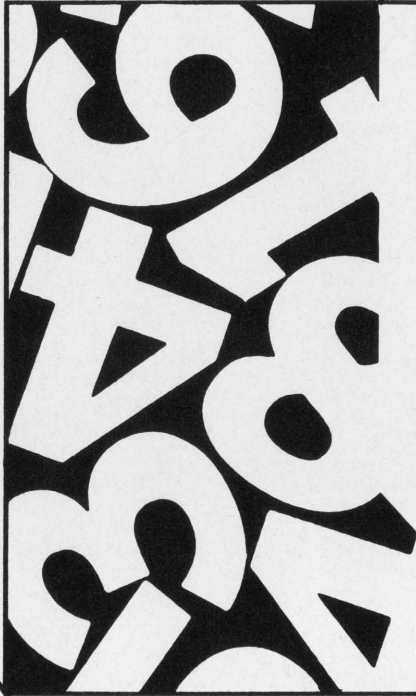


EDP MANAGEMENT . . . OPERATING TECHNOLOGY

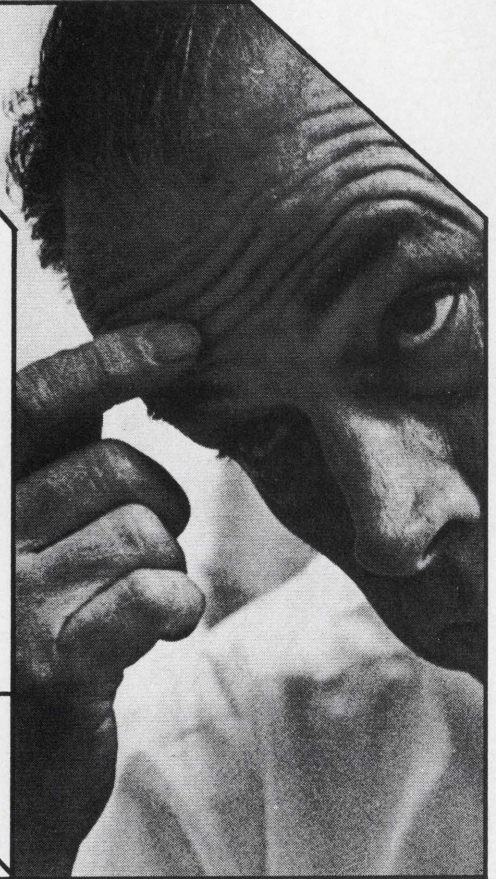
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# software age

JULY, 1970

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By GEORGE N. VASSILAKIS

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**software age**

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You can also profit by submitting PROBLEMS for this feature. If your problem in FORTRAN programming is selected for use in this feature, you will receive \$50.00

**TROUBLE-TRAN'S Objectives:**

1. To have fun.
2. To promote USA Standard FORTRAN by pointing out differences and inconsistencies of existing FORTRAN Compilers.
3. To alert programmers to the physical limitations of hardware.

**PROBLEM OF THE MONTH**

Here is an interesting problem submitted by Joseph S. Madachy, editor of "The Journal of Recreational Mathematics" and author of "Mathematics on Vacation".

**Problem 27: THE SIMMONS FACTORIAL CONJECTURE**

Only four factorials can be expressed as the product of three consecutive integers:

$$3! = (1) (2) (3) = 6$$

$$4! = (2) (3) (4) = 24$$

$$5! = (4) (5) (6) = 120$$

$$6! = (8) (9) (10) = 720$$

Perhaps a computer search could be extended to see if some fantastically large set of values produces a fifth factorial.

Note: There are two ways to attack this problem. Either you analyse it mathematically and prove there are no other solutions, or you rent a large computer for a weekend. Have your program debugged by Friday and start running it by Friday evening. If there is a solution, you should have it by Monday morning. And, if you would like to be notified immediately when a solution is found, I suggest you rig an alarm system to the printer and also make the proper arrangements with your local police.

**Answer to Problem 25:**

Once again, I am faced with the difficult task of awarding \$50.00 to the best solution. However, since I am on Jury Duty for the entire month of June and the deadline for entries is June 15, 1970, I hope to be a little more qualified when the time comes to make this decision. On second thought, why not disqualify myself and let the contest be decided by a Jury.

As of June 9, 1970, I have received correct solutions from about 50 readers. The number of correct solutions (different combinations of hexadecimal digits) is still undetermined. One reader has sent over 3,000 solutions (ascending order only), but these solutions need verification since I have spotted two mistakes. Does anyone have access to a hexadecimal adding machine? I sure could use one for a few days.

Here are some solutions:

$$1+2-3+4-5+6-7+8+9-A+B-C+D+EF=100$$

$$12+345-6+789-ABC-D+EF=100$$

$$123-4+5+6-78+9-AB-C+D+EF=100$$

$$1+23+45-67+8+9+A-B+C-D+EF=100$$

$$F+E+D+CB+A+9+8-7+6-5-4-3-2-1=100$$

$$FE-D+CBA-987+6-5-4-321=100$$

$$F-E-D+CB-A9+87-6+5+43+21=100$$

$$F+ED+CB+A-9+8-7-65-43-21=100$$

**Automorphic Numbers**

My statement in the May issue about "no solutions have been received as of April 8, 1970" upset many readers who had mailed their solutions during the first week of April. It also renewed the interest of other readers and generated another 100 replies. For those of you who do not know that I live in California I would like to mention that, even if you send your mail special delivery, it goes to Madison, Wisconsin, and from there it takes 8-10 days to come to me as third class mail.

Speaking of mail, Software Age and I would appreciate it if you do not mail computer output that weighs more than a few pounds. Last month I received a 13-pound solution to the Automorphic Numbers. A few days ago Software Age informed me that they had received a 30-pound solution from a reader who lives just a few miles away from me, and probably drives to work by my house. Think of the postage he could have saved.

P.S. Each month I receive about 10-15 letters which require personal attention. Unfortunately, I do not have secretarial support for this column, and my two-finger typing doesn't help much. If I have disappointed you by not answering your letter please forgive me.

XTRAN

SOFTWARE AGE



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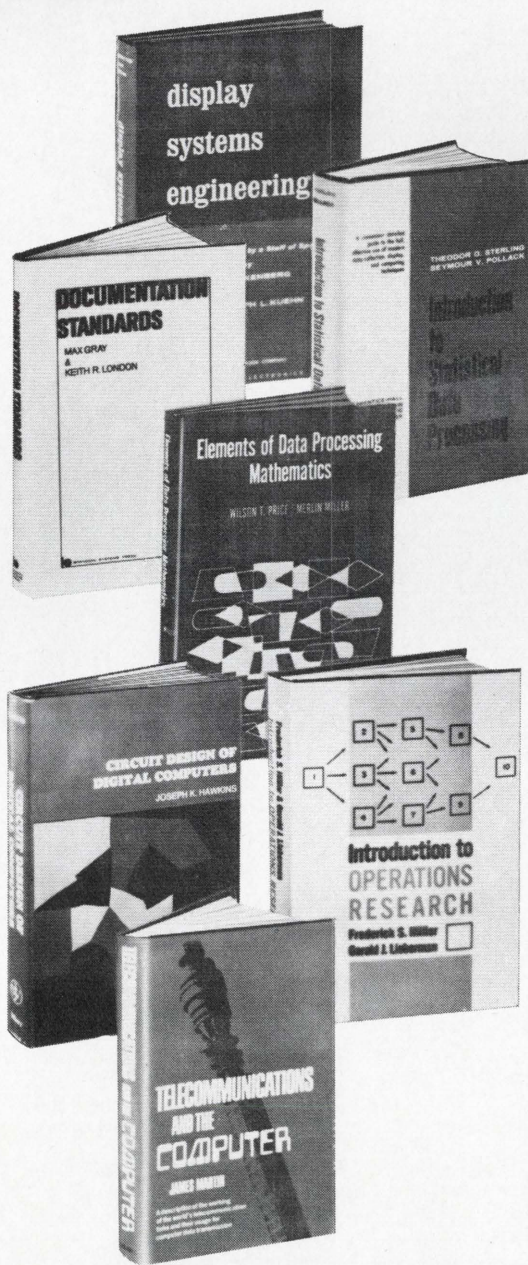
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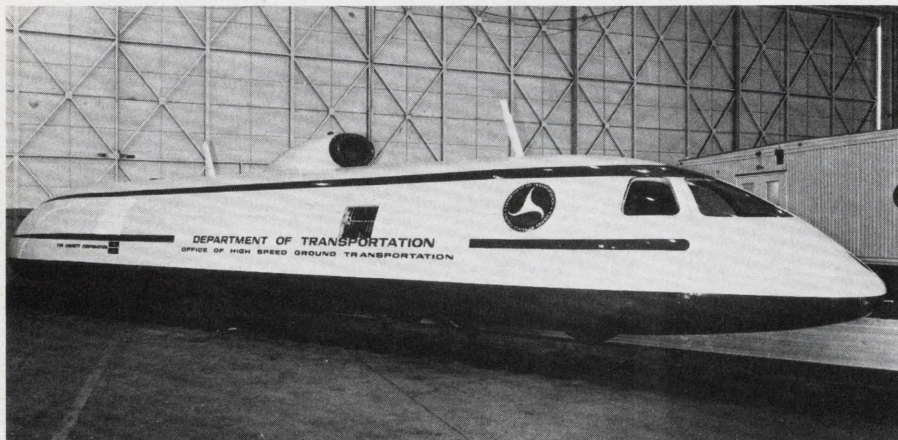
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# NEW APPLICATIONS



## Minicomputer in Motor Tests

Huge 25-ton electrically propelled test vehicle, capable of traveling 250 mph, is being tested by Garrett Corp., Torrance, Calif. on a low-speed test track. Telemetry trailer at right contains instrumentation equipment, heart of which is a Varian 620/i general purpose digital minicomputer with two buffers for regulating 32,000 data words per second between 127 sensors and magnetic storage tapes.



## Ultramodern Control Center

A highly-sophisticated computer complex that controls the world's only international stock and commodities quotation network was dedicated in Mount Laurel, N. J., recently by the Ultronic Systems subsidiary of Sylvania Electric Products Inc. Shown above is the control room of the Master Computer Control Center which is designed to meet, for years to come, the rapidly expanding communications needs of the investment and brokerage industry. A 100,000-mile global network provides a wide variety of stock information in the United States, Canada, United Kingdom, Western Europe, South Africa, Australia, Hong Kong, and Japan.

## Computer Program for Electrocardiograms

Availability of a new computer program designed to assist heart specialists analyze electrocardiographic data accurately and rapidly was announced by Xerox Corporations computer subsidiary, Xerox Data Systems. Dr. W. Lee Smith, XDS health care industry manager, said that HEARTS, the new 12-lead ECG analysis program, would permit hospitals, research institutions and computer service bureaus which serve the medical community to make rapid, consistent analyses of electrocardiograms. The program, he added, would augment the heart specialists' classical method of visually interpreting electrocardiograms.

ECG signals can be transferred over telephone lines to Xerox computers from data acquisitions carts or from storage media containing previously recorded information. Data can then be analyzed by the computer and a hard copy of the results made available in 15 to 20 seconds. In addition, all data can be stored in the computer for subsequent analysis, if desired.

## Hybrid Computer System for Self-Service Solutions

Trying to determine how to prevent a river from drying up, monitoring the electrical activity of the brain, and learning more about how the heart functions are but three of the variety of activities taking place in Carnegie-Mellon University's do-it-yourself hybrid computer laboratory in Pittsburgh. The laboratory serves as a self-service problem solving center for scientists from many disciplines. The computer system is a Digital Equipment Corporation PDP-9 medium-scale digital computer interfaced to a medium-scale Electronic Associates Incorporated analog computer.

Carnegie-Mellon researchers in electronics, medicine, chemistry, physics, civil engineering, and as many other disciplines as there are at the university make use of the laboratory at all hours of the day, according to the manager Joseph Johnston. In addition, university students, both undergraduate and graduate, undertake projects there.



# FINANCIAL CURRENTS

*Honeywell Inc.* has reached an agreement in principle with *General Electric Co.* to participate in the formation of a new Honeywell subsidiary to include the present Honeywell computer operations and General Electric's business computer equipment interests. Honeywell board chairman James H. Binger announced recently. Honeywell will own 81½ per cent and General Electric 18½ per cent of the subsidiary. The new company will be managed by Honeywell.

It is proposed that the transaction include both domestic and international computer equipment interests, including the transfer to the new company of the General Electric shares in the Bull-General Electric companies. Under the proposal General Electric would receive 1,500,000 shares of Honeywell common stock, together with notes totaling \$110 million. Negotiations are now proceeding toward final agreement. Any final agreement would be subject to the approval of the boards of directors of the affected companies and to the receipt of necessary government approvals.

Canada's largest independent computer services company is branching out into the United States. *EDP Industries Ltd.* of Vancouver plans to open its first consulting office this year in San Francisco.

President W. R. Wood said in the company's annual report, released today, that the business potential in San Francisco and other areas in the U. S. A. is excellent and he added: "We anticipate opening up other offices in that country upon further examination of the various markets." Wood said the "unbundling" by computer manufacturers of their products and services will directly benefit EDU as it will substantially broaden the market for the company's systems and consulting services.

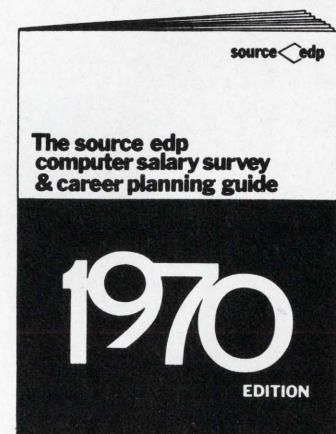
*May Co.*, California, announced it will lease and install a new credit authorization system, developed and produced by *TRW Data Systems*, at all of its 17 Southern California Stores. A May Co. official described the new system as offering the most advanced computerized retail credit service available today. Known as TRW's Credifier 3300 System, it is capable of storing and processing 600,000 customer account records from one central location.

The Board of Directors of *REDCOR Corp.*, Woodland Hills, California, and *Penta Computer Associates, Inc.*, New York, N. Y., jointly announced that an agreement in principle has been reached under which REDCOR would acquire the assets of Penta Computer Associates, Inc., on a pooling of interest basis. Under the terms of the proposed agreement, REDCOR would acquire the net assets of PCA for a minimum of 300,000 shares of common stock and up to 250,000 additional contingent shares based on the number of KeyLogic Systems installed over the next two years. The completion of the acquisition is subject to the approval of a definitive agreement and approval of PCA shareholders.

Accelerating its entry into the computer hardware products field, *Tracor, Inc.*, announced an affiliation with *Bright Industries, Inc.*, of San Francisco, designer and marketer of digital magnetic type recorders for computers and computer systems. Presidents of the two companies, Richard N. Lane of Tracor, and M. L. Bright of Bright Industries, said the agreement in principle reached by the companies involved the purchase by Tracor of 40 per cent of the stock of Bright Industries. Lane said Tracor will have options to purchase a larger percentage of Bright Industries in the future.


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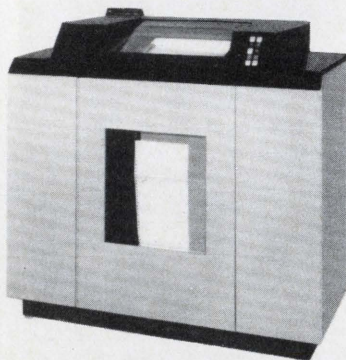


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*Computat Scientific Systems, Inc.* (OTC), a computer software company headquartered in New York, announced the acquisition of *Syntactics, Inc.* for stock. Syntactics is primarily engaged in developing computer software programs and furnishing computer consultation services to the securities and banking industries. Computat, a subsidiary of Camin Laboratories, Inc. (OTC), had been largely in computer software and technical programs for aerospace company applications.

*Information Systems Leasing Corp.* has notified its shareholders that the firm is experiencing serious financial difficulties and is engaged in merger/acquisition talks with two companies having compatible interests. In a letter to share- and warrant-holders, Mrs. Mary K. Hawes, president, said the company "has a critical cash flow problem, due in part to the general business environment, in that we have received acceptances of several outstanding proposals for the sale of our services, but have had the starting date on such proposals delayed a number of times."

The *Citizens and Southern National Bank*, Atlanta, and *Corporation S*, Dallas, have formed a new corporation, *C & S Optimization Services, Inc.* to provide automated optical reading services for corporations in the Southeast U. S. that have data input requirements. The new company is located in Atlanta's Executive Park and is equipped with an Electronic Retina\* Computing Reader ordered from Recognition Equipment Inc. Jack G. McIver, formerly with Service Bureau Corp., has been named president of C & S Optimization Services.

*IOA Data Corp.* (OTC), a major dealer in second user data processing and business machines, reported recently that it expects the future to bring increased volume as a result of a decision by IBM to exclude as a free item the integrated package of services it formerly offered to purchasers of its new equipment. This is in contrast to a somewhat slower rate of buying caused by tight money which has adversely affected a host of industries, including the data processing field.

*ITI Electronics, Inc.* (OTC), a manufacturer of electronic equipment, recently announced its entry into the video display-computer terminal market. Company officials stated that ITI's video display and monitoring equipment will be adaptable for use with Computer processing-terminal installations, closed circuit TV, and broadcast television. Harry B. Schwartz, Chairman of the Board, stated that this was a major step in ITI's program to introduce a line of new products which will more actively utilize the video technology ITI has developed over a twenty year span.

*Automatic Data Processing, Inc.* (ADP) of Clifton, N. J., a national computer services company, recently reported that it has reached an agreement in principle to acquire the Houston computer center and data processing operations of *Petro-Chem Computing, Inc.*, a wholly-owned subsidiary of *Duquesne Natural Gas Co.*, of Houston. In business for three years, Petro-Chem Computing's Houston operations presently provide a broad range of commercial data processing services to approximately 100 firms in the greater Houston area.

*Tab Products Co.* of Palo Alto, Calif., recently announced the sale of its Data Input Center division, effective June 1, 1970, to *United Financial Data Centers, Inc.*, of Detroit, Mich. Harry LeClaire, Tab president, said his company will receive \$402,000 in cash and notes for the assets of the division. The centers, established for the most part within the past year, are in Palo Alto, Seattle, Los Angeles, Chicago, Atlanta, Miami, New York and Detroit.

*Boole & Babbage* recently announced the acquisition of *Pacific Radionics* for an undisclosed amount of stock. The parent firm is a leading producer of systems measurement products and services used to evaluate and increase the efficiency of computer systems. Pacific Radionics, located in Campbell, California, is currently manufacturing electronic instruments such as the LP-1000, a unique type of interface for process control and analysis between multiple test environments and dedicated or time-share computers.



A new organization, the *Boeing Computer Services Division*, was announced today by T. A. Wilson, Boeing president. The new division will include all of the company's present computing capabilities, located in four major geographical locations—Philadelphia; Huntsville, Alabama; Wichita, Kansas; and Seattle. The combination of these under a single organization will permit both improved internal efficiency and sales of computer services to customers throughout the United States and Canada, Wilson said. Wilson also said studies leading to the announcement included market research, analysis of Boeing's computing capability, and actual test marketing of specific services in the United States and Canada.

*Computer Sciences Corp.* has received a contract to provide extensive services in systems analysis and computer programming to NASA's *Goddard Space Flight Center* at Greenbelt, Md., it was announced recently. Alvin E. Nashman, president of CSC's Systems Division, said the \$3 million contract covers a one-year period and contains options for two one-year extensions. Nashman estimated the value of the award at \$11 million if all contract options are exercised.

*KDI Corp.* has formed a new company called *KDI Graphic Inputs, Inc.* to specialize in the marketing of computer related products dealing with input to computerized graphic arts systems. The company is headquartered in Valley Forge Industrial Park, Norristown, Pa., with future offices planned for the New York, Massachusetts and California areas.

*Century Data Systems, Inc.*, Anaheim, California manufacturer of disk memory drives and related controllers, has announced that it has secured a \$5 million line of credit with the Orange County Regional Head Office of Union Bank. The funds are intended to meet working capital needs through 1971. Century Data Systems, formed in 1968, is a manufacturer of computer peripheral equipment. Century Data Systems is affiliated with *California Computer Products*, the nation's leading supplier of computer graphic output equipment.

Harry Schwedock, Vice President of Marketing for *Viatron Computer Systems Corp.*, recently announced that System 21 products will be available for sale only. The company will no longer rent its products. At the same time, he announced price increases for two products in the System 21 line. Schwedock noted that customer demand to purchase System 21 has been sufficiently large to absorb the company's production capacity for the foreseeable future. And, he added, the interest expressed in System 21 by third-party leasing companies as well as leasing arrangements provided by individual Viatron dealers should more than meet the demands of those customers wishing to lease System 21.

*The Telecontrol Division of Vogue Instrument Corp.* has entered into a joint manufacturing and marketing agreement with *Applied Data Research, Inc.*, Herbert Herz, chairman, Vogue Instrument Corp., and John R. Bennett, president, Applied Data Research, announced recently. Under the agreement, the two companies will combine their efforts to service the expanding field of computerized "manufacturing control systems" involving the operation and application of factory mass production methods. Applied Data Research will contribute systems analysis and software capabilities while Telecontrol will market the system and manufacture peripheral hardware.

*FAIM Information Services, Inc.* has assumed management responsibilities for *Geran Applied Systems, Inc.*, a computer time-sharing services firm, effective immediately. Robert Snoyer, FAIM president, has been elected Executive Vice President and a member of the Board of Directors of Geran. Geran supplies time-sharing computer services to small and medium sized businesses and institutions. It has exclusive rights in 45 states to a specially designed system used for service bureau operations. Geran intends to reactivate the four computer centers it had previously established in New York, Boston, San Francisco and Los Angeles. Each center can handle up to 600 customers with present equipment configuration.

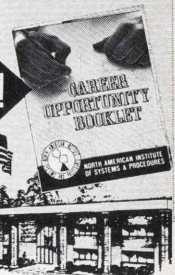
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# A CRASH DOCUMENTATION SYSTEM

**emergency documentation can result in an effective product when data build-up is scheduled, controlled**

by  
**JOEL R. POWER**

Although we have thrust ourselves into the space age, we still discover that documentation is its earthy foundation. In fact, documentation is the base for all technical activity. Nothing goes up, down, or anywhere without some dynamic document. In order to go from tape to print, pad to launch, millions of data sets must be captured and put on paper. Software is paper. Research is paper. Thought seeks paper, and that paper becomes documentation.

Information generators agree that data needs to be gathered and published. Here their similarity stops. For once documenting begins, technical men often become unbridled tyrants developing their own untested theories. Work philosophies, methods, and formatologies are developed which defy the natural laws of documentation.

Because language is the living tool of all men, many fall into the fallacy that documentation is an untutored skill and that almost anyone can produce it. This aberration creates publication problems from top management to the lowest assistant. The structure of documentation fractures, and its collapse is disastrous. No documents are produced. There is no communication, no customer, and no money.

The most dramatic documentation breakdown is "crash documentation." Crash documentation is the logical conclusion to inadequate publications planning and management. In-

stead of an orderly response to a data build-up (that is, the scheduled and regulated movement of quality documents written and published on time), there is a pressured reaction to what has developed into a data avalanche. In the ensuing panic, a short term, stop-gap solution is demanded. To meet the crisis a crash program is devised. Crash documentation is: *the emergency documentation produced by the crash program, the requirement for thousands of pages to be written and published within ninety days.*

Crash documentation, who is responsible for salvaging it? The new documentation manager is. What can he do? He can produce the crash documentation by seeking attainable solutions and attach the crash project like any other problem. What are the project constraints? Invariably, they can be recited by rote: 1. X; 2. Y; 3. Z; where X is the number of documents to be written and published, Y is the quality required, and Z is the data by which they must be delivered complete. Obviously, the previous documenting system must be changed. The fragmented documenting inherited by the new documentation manager has to be salvaged although it scuttled the original mission, that is, to document the data build-up on an orderly and scheduled basis. New strategy is needed and now.

The forte of the new manager is fresh strategy. Number one and two on his kill list are the operating standards and procedures. Which ones are sound? Which must be scraped? He minutely eyes the documenting system; this is a "red alert resuscitation" with his assistant and leads to save documentation. Among vital routines addressed are: the conditions for a rewrite, writing schedules, edit time per page, typing cycles, status reports, priorities, drafting specs, valid formats, use of duplicated material, routing, deviations from accepted editorial practice, style guides; . . . in capsule the major ponderables and minutiae of document making. These and the thousand others he rules upon. Unless new contractuals have been litigated, he streamlines the existing standards and procedures into a catalog of usable instructions with pertinent examples.

## **Document Work Flow Design**

With this step complete, the manager is ready to design his blueprint for Document Work Flow. He formulates a logical flow which will use his trained personnel and monitor their production. Each major documenting action is diagrammed into a flowchart and then explained so the work flow can be readily grasped in its entirety and in its in-



dividual parts. The manager then presents to staff: 1. The charted document work flow. 2. How it will accomplish the crash project. As an additional precaution, the manager should have his leads review the work flow as well. No changes may be made to this document work flow, or its attendant procedures and standards, without his approval. Bringing the document work flow into being is a time consuming duty. Before B, A must precede, before E; A, B, C, D, and so forth alphabetically, in order to span the completion abyss separating the A and Z of the crash project. First the manager must see this A, Z, cleavage and then bridge the gulf with his work flow.

Figure 1 is a diagram of a proven document work flow. Each station in the order of its sequence needs to be explained, the functions of each described, and the master plan of how the stations relate to one another and guide the document to completion analyzed.

The first step in the work flow is administrative; the receipt of the groupings of concepts and data from the technical projects into Station One, Management Control. This station permits the controlled entry of the document package to the work flow and initiates a series of tested steps which will produce a quality document on schedule. Here each package is assigned a document number, its title verified, the date recorded, and a file copy reproduced. Based upon reliable formulae, a clerk notates completion target dates for each station of the work flow and sends the package with a routing sheet to the manager.

Watching for possible work flow "ambush," he inspects the package and estimates its projected effort. At this stage he established target dates, keeping in mind the writing schedules, edit time per page, formats, all the safeguards to shield against work flow massacre. As necessary he notes the occasional packages requiring an impact statement, those with technical and structural inaccuracies beyond the pale of the project. Then the manager adjusts target dates and adds instructions for writing and steerage of the document. These orders transfer responsibility to his assistant to direct the day to day manufacture of the document. Then he routes the

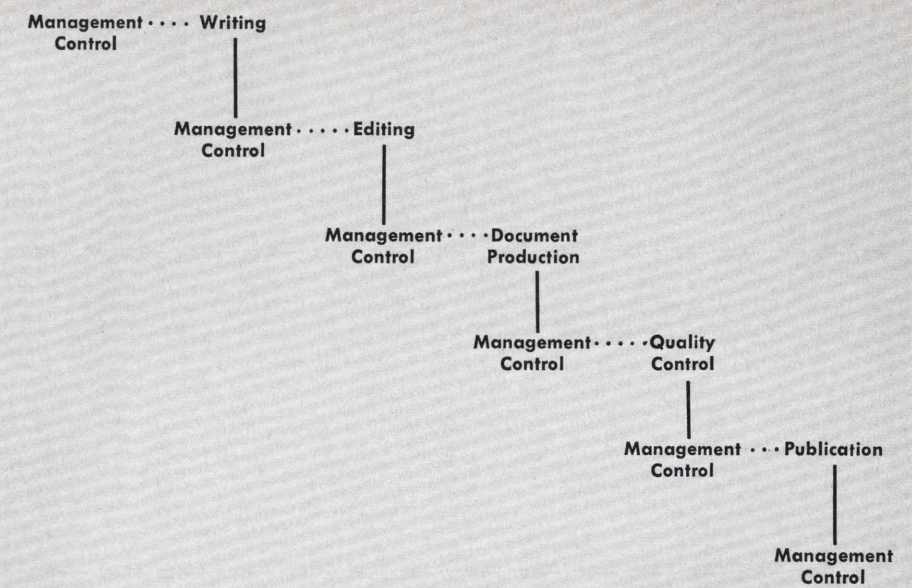


FIGURE 1  
DOCUMENT WORK FLOW

document package to the next station.

At Station Two, Writing, an actual writing of the document is performed. Mapping its course, the assistant manager and the lead writer steam out its flaws, with the advise and consent of the manager. After their strategy session, the writing lead delegates the package to the writer or writing team. By definition the lead must be highly skilled tying the technical words to page man, with proven ability to shape the peculiar writing of each document. Since there is lessening time in any crash project, and coordination is "coffee minutes," all points requiring technical light will be determined by the main writing coordinator. Whether these passages compel technical superknowledge, and what will and will not be written, remain his decision. He keeps a constant gauge of document movement. Only as he becomes an intimate of each writing family, will he be able to deliver the crash writing. Moreover, he must keep the assistant manager informed of work flow.

### Writers Are Key to Work Flow

Writing is documentation, and to hammer out crash documentation, writers will have to be "manhanded." There is no more important station in the document work flow than here; "What Is Or Is Not Done

*In Writing Hewns The Whole Document Making Process.*" If time must be spent, it should be bought here. If the entire written document demands a rewrite, here it should be written. Any blights in a document will show throughout the work flow and still have to be rewritten under even more time pressure, if they are not rewritten now. When the document is written, the lead writer criticizes it, has its deficiencies corrected, and when he is convinced that it is correctly written, he shelves a record copy and sends the writing draft to the next station.

Two things happen at Station Three, Management Control. First, the assistant manager reads the draft as a morning newspaper. Since the package has been transformed into a document, it can now be read as such. Latent problems may literally bounce out of its pages; and should immediately be eliminated by the lead writer. Second, the assistant manager scouts ahead for the document's mechanical production. With its typing, illustrating, reproduction and proofreading in mind, he forwards instructions to the lead editor for the draft's translation into masters. These are similar to the ones issued to the lead writer by the manager, but their purpose is to pilot the draft toward the harbor of finished masters. Then he sends the writing draft to the next station.

At Station Four, Editing, the lead editor receives the draft. His func-



## CRASH DOCUMENTATION . . .

tions are similar to the lead writer; he coordinates with the technical staff, work previews each document, removes document errors with the manager and his assistant, and then forwards the draft to an editor or editing team. Upon request, these leads should be able to switch assignments, although there is distinction between them. Primarily, the lead writer manufactures content, the lead editor, format; they are the two polarities of documentation. One assembles books, the other ideas.

force deadlines and keep the flow moving on target. Each document phase is quickened by the work flow. What is done once is best. If any process is repeated, the targets are delayed and the document flow is upset. During the crash project in this station in particular, repeats mean document "death." Typing, illustrating, reproduction, and proofreading are interdependent, a tightly geared manufacture which produces the document construction. Before they can be published, all documents must be typed, illustrated,

tegrity of the document. To guarantee this action, the assistant manager has the proofreaders signet the back of each proofread master. Major questions must be resolved by him. Blatant errors, inferior pages, missing narrative, outline gaps are the quality items which are enforced. After his product checks have been executed, he posts the masters to the next station.

### Quality Control Takes Over Masters

At Station Eight, Quality Control, the document masters must pass into the hands of the lead editor and senior editor for an objective, meticulous final review. Quality Control persons prepare the document for final publication. The lead editor gives the document to senior editors unfamiliar with it. Even though time may be threatening, cover, front matter, body, all the mandatory obvious are given a once over and again. This station is not a rewrite or reading "club", but rather a quick quality "savior." Decision pages are flagged by the quality controllers, and then approved for alteration by the lead editor and assistant manager. Next, the editors write instructions for the printer to store the camera ready masters in a book. With the lead editor's sanction, the document masters are then sent to the next station.

A review of the final masters' prior to printing is made at Station Nine, Management Control. By now, they should be ready to print and the manager should spot none but the most minute errors. Nevertheless, this station adds a valued last-minute precaution. If the print orders are sufficient, he sends the masters to the next station.

Station Ten, Publication, is the finale; the document appears in print between covers. While the document is at the printer's, the pages must be examined for sequence and print quality before binding. No single act of document making spells failure more than a "pock-marked" printing job. After this final security, the document is bound and sent to the next station.

Station Eleven, Management Control, concludes the whole process. The manager accepts the document; concepts, data, tabular sheets, and document are now tangible. A clerk

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**"As the strain of the crash project increases with each hour, control becomes everything held critical to the project."**

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To ensure the editing of a document, the lead editor instructs the editors to dress rough copy into typed, drawn, reduced, and proofread masters. Format mastery, page beauty, grammar are some of his job visions. Parallel to the lead writer, he becomes familiar with the documents and makes the daily editing decisions. He, too, communicates with the assistant manager on status renewals. When he has approved the edit, he sends the draft to the next station.

At Station Five, Management Control, the assistant manager notarizes the edit and confirms that its guidelines tell precisely how to make the document masters, how to insert tab A into slot B. He alerts the next station that the draft is being shipped.

When the document draft arrives at Station Six, Document Production, the documentation takes final shape in printed form. Typing, illustrating, reproduction and proofreading take place.

### Repeats Mean Document "Death"

As the draft is returned to each Document Production sub-station, its lead records and parcels the work to his staff. Each supplies his status stimulants to the assistant manager. As previously emphasized, every publication's lead must become governed by the document flow to

and proofed. The interdependency is illustrated by the example where an existing master is reused, but lacks a camera reduction.

By necessity, the sub-stations of Document Production must be in proper ratio, and their leads must mesh their activities. Because every page in a document has something typed on it, typing also requires management control. Close harmony of the document parts can be maintained by the assistant manager if he stays current with these leads and then uses typing as a clearing house. As quickly as the masters are made, they are batched and sent to proofreading as a sub-document package. Proofreading as the last relay of Document Production can puzzle the document together and begin preliminary closing checks, closely followed by the lead proofreader and assistant manager. The gathered document masters are then delivered to the next station.

Station Seven, Management Control, is the star chamber for Document Production. Two things are actualized. One, this is where the finished but prequality masters come for a quick judgment. Two, this station is the holding point for the masters. Before a document can be called a finished product, vital but rapid controls must be made; some only while the document is in Document Production, the rest after. All work must be proofed. Proofreading is the sentinel for the technical in-



issues the necessary paper work to deliver it to the customer.

Thus, the document has ended its transit through the work flow. Eleven stations on a surveyed path have been crossed, "outposts" on the manager's trade route through which thousands of pages must pass in the problem filled days of the crash project. Work flow means time. Despite crash expedient bravado, some maiming realities remain: The basic increments of time required for making the document never change (omniscient human birth still requires no less than nine months.) However, the document work flow fits the document making constants within the project framework.

### A Review of Work Stations

The work flow stations (see Figure 1) moduled by the manager are as follows: 1. Management Control, 2. Writing, 3. Management Control, 4. Editing, 5. Management Control, 6. Document Production, 7. Management Control, 8. Quality Control, 9. Management Control, 10. Publication, and 11. Management Control. Not only is there a Management Control station at the beginning and end of document making, but there are four such stations in its midst. Of the eleven document work flow stations blueprinted by the manager, six are Management Control. Why? The why is the rationale of the entire work flow.

In order for there to be a consistent flow of completed documents, the manager must be able to control their manufacture, and not in just one phase of their making, but all. Furthermore, he must be able to link each document-making action into a bridge which will span the time targets of the crash project. This is the A-B-C of crash documentation. For example, not only does the document have to be written, but it has to be written as timed and planned, and then checked before it can be forwarded to the editing stage. Before any document can be made, the document making framework must already be clearly defined and the individual document maneuvered and guided to have effective passage through its timetable.

Document work flow is the documentation bridge, and the work flow stations are its pilings. Management

Control supplied the cohesive which permits the coordinated union of crash documents with the customer.

As the strain of the crash project increases with each hour, control becomes everything held critical to the project. The manager must have a matrix which will give him control of all the crash documents. Management Control provides just that. Management Control stations have been buttressed at those very points of vulnerability where control becomes decisive. These stations are the "pressure valves" which the manager regulates, his flood gates to harness the kinetic moves of document making. Since the document work flow has been structured as a Detroit assembly line and the document making actions isolated into a series of controllable steps, the manager can control the crash documentation.

Management Control stations have been interspersed at those intersections where known obstacles have been charted. It is the operation of these stations which keeps the document on target for completion. Analysis of any crash documentation project will yield the number of Management Control stations called for. Regardless of number, these stations depend upon two premises. First, for effective staffing, the entire staff must be crafted in their given skill areas. Especially crucial is the "intensive care unit," the working relationship between the manager and his assistant manager and leads. Equally important is the second premise, effective status reporting. Rapid assessment of document objectives and the use of skilled personnel can not be achieved unless the status of every document and every work station can be known at any moment. Problems to be solved must be spotted and anticipated.

Eleven work flow stations have been studied in this paper. These eleven have been tempered in crisis situations. They work and will work again and again just like the wheel. Document work flow is the Alpha train, the method, technique, the process which couples all of the piecemeal scurryings of document making together. Management Control engineers the "Big A" through the pandemonium and wastelands of the crash project to the Omega depot, the completion of the crash documentation. ■



**You too . . .  
may be eaten alive by old software unless proper documentation exists.**



# DOCUMENTATION OF A COMPUTER SYSTEM

by

ROBERT C. EHLE

Scientific Control Corp.

## Introduction

Due to the many different types of applications, a computer system probably requires more user oriented documentation than any other type of electronic equipment. Each and every type of problem which may be solved by the system requires some documentation in the form of instructions to the intended user. In addition, each level of user, from the computer operator to upper management, requires a document oriented to his particular applications and problems. Finally, maintenance of a computer system requires an extensive set of documentation just as does any other electronic system. In addition, marketing departments may have special requirements for data in order to effectively sell a computer.

The following outline details the data required to document a computer system. It is divided into three categories according to user; these categories are engineering, software (or programming), and marketing.

## Engineering Manuals

*Computer Reference Manual* . . . This manual must present anything and everything the programmer needs to know about the computer. It should also present a thorough description of the capabilities of the computer from a systems point of view that may be used in applications engineering discussions.

A minimum content for the reference manual would be:

1. Introduction—brief description of the complete system written in non-technical terms.
2. System Architecture—description of the machine, its speed, capabilities, operation, etc., written in technical terms.
3. Programming and Operation—information on the specifics needed to program the machine. This section includes topics such as:
  - A. Formats
  - B. Addressing
  - C. Memory Mapping
  - D. Memory Protection Registers
4. Instructions—detailed description of every machine instruction available with optional and standard instructions distinguished.
5. Control Console and Operation (if applicable)

—description of the function and operation of each operator control and indicator.

6. Input/Output—description on the ways I/O may be performed by the computer.
7. Interrupt System—description of the operation of the interrupt system including the various interrupt commands available.
8. Peripherals—description of the peripheral equipment available with the system and how it is controlled by the system and from a program. Examples should be included.
9. Appendixes
  - A. Machine instructions listed by category (such as Load and Store, Arithmetic, Logical, etc.)—this list is normally placed on the inside front cover.
  - B. Conversion Tables such as Binary to Decimal, Octal (or Hexadecimal) to Decimal, etc.
  - C. Math Tables such as Powers of Two, Math Constants in Decimal and Octal (or Hexadecimal), etc.
  - D. Character Codes for Peripherals.
  - E. Machine Instructions listed alphabetically by mnemonic.
  - F. Machine Instructions listed numerically by operation code.



*Computer Maintenance Manual . . .* This can be as large or as small as required. The optimum situation would include the following:

1. Detailed Theory of Operation
  - A. Analysis of each CPU Instruction
  - B. Microcode and timing diagrams as applicable
  - C. Mapping, memory protection
  - D. Flow charts if applicable
2. Description and use of Logic Documentation
  - A. Types of documentation included
  - B. Recommended uses and troubleshooting procedures
3. Drawings
  - A. Logic Diagrams
  - B. Circuit diagrams (power supplies)
4. Listings
  - A. Wiring lists
  - B. Engineer's lists
  - C. Cable definitions
  - D. Locations lists
5. Automatic Hardware Diagnostics
  - A. Use of each program
6. Mnemonics Glossary
7. Parts lists

*Peripheral Equipment Reference Manuals . . .* This manual lists the operation of the device including detailed descriptions of program control when the device is attached to the computer. One manual should be written for each peripheral device available.

1. General description
2. Functional description
3. Program interface
4. Operations
5. Appendixes
  - A. Codes
  - B. Replaceable parts lists
  - C. Applicable documents

*Engineering Reports . . .* Interim documents written primarily by engineering for the purpose of design coordination. Some of these documents may be used in preliminary reports and should include topics such as product control specifications, design information, contract specifications, etc., on each hardware item.

*Peripheral Maintenance . . .* Theory of operation and maintenance of the specific piece of equipment should be covered in detail. Much of this information is available in vendors manuals if equipment is purchased and modified.

*Computer Operator's Manual . . .* This manual is written primarily for computer operators and provides instructions for the following operations:

1. Control console operation and function
2. Initializing the system
3. Punching a tape
4. Updating a tape
5. Assembling a tape
6. Source and object tapes

7. Source and object card decks
8. Breakpoint settings
9. Sample programs
10. Emergency shut down procedures, etc.

*Interface Manual . . .* A detailed description (written on an engineering level) of timing, interfacing, controlling and other information needed to interface the computer to non-standard equipment.

1. Introduction and general information
2. Multiplexor channel interface
  - A. Introduction
  - B. Device controllers
  - C. Input/Output sequence
  - D. Interface description
  - E. Interface functions
3. Selector channel interface
  - A. Introduction
  - B. Device controllers
  - C. Input/Output sequence
  - D. Interface description
  - E. Interface functions
4. Parallel Input/Output interface
  - A. Introduction
  - B. Interface description
  - C. Basic instructions
5. Digital multiplexor
  - A. Introduction
  - B. Interface description
  - C. Interface functions
6. Memory gates interface
  - A. Introduction
  - B. Memory communication
  - C. Interface description
  - D. Interface functions
7. Priority interrupt subsystem
  - A. Introduction
  - B. Interface description
  - C. Interface function
8. Cabling
  - A. Cable characteristics
  - B. Cable signals
  - C. Cable location
9. Flow diagrams
10. Signal Mnemonic definition

### Software Manuals

*SPL Assembler . . .* This manual must present the complete vocabulary of the assembler language to be used with the specific computer. It must include detailed descriptions of the functions of each switch, control, etc., when used with the assembler, how the assembler is to be run, and the proper way for assembling programs on the computer.

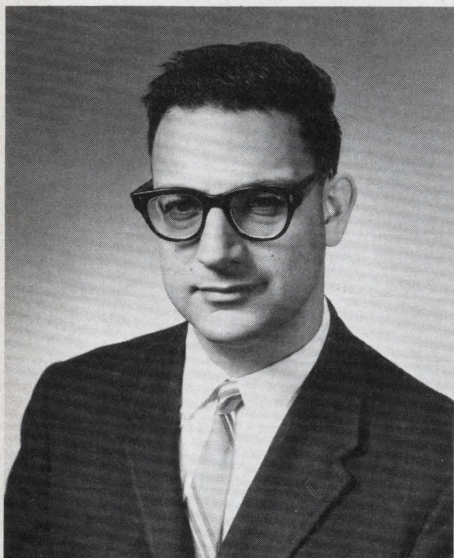
1. Assembly language syntax
2. Assembly listing
3. Assembler directives
4. Operate instructions
5. Assembler operation
6. Appendixes listing codes and mnemonics

(Continued on page 20)



# A PLANAR SOLUTION TO 3-DIMENSIONAL PLOTTING

**Computer-Plotter  
Software System  
An Aid to Design**



*Mr. Harvey N. Lerman currently is a Staff Engineer in the Computational Sciences-Digital Department of Martin Marietta's Orlando Division. He specializes in the fields of Design Automation and Graphics and was Arrangement Chairman of the 1969 Design Automation Workshop sponsored by SHARE, ACM, and IEEE. Mr. Lerman has written a paper entitled "MADS—A Machine Aided Drafting System." He previously was employed with the General Electric Company and has a BS degree in Mathematics from Trinity College in Connecticut.*

by

**HARVEY N. LERMAN**  
Martin Marietta Corp.

## **Introduction**

By the use of computers, designers have been able to increase their capabilities enormously. In all fields, designers are now able to use the computer as an aid in achieving their design objectives. No longer is it true that only Electronic Design is aided by the computer. Mechanical Design, Structural Design, and Graphics are now fully integrated into the Design Automation family.\* Now, while the ultimate is to eventually have all design within an interactive man-machine graphic atmosphere, it would be a mistake to assume that we are anywhere near this goal. Most designers do not have available the graphics hardware, and those who do often find it inadequate in scope or lacking in software. Very few people have passed the inactive design age of computers. For this reason the best tool for aiding the designer is still the mechanical plotter.

This paper will trace the development of a computer-plotter software system which can be used as an aid to design. From a two-dimensional beginning the system will be developed into a three-dimensional one from which the user is able to obtain perspective planar plots at any scale or orientation.

## **Perspective Plots**

In order to be able to produce perspective plots, transformation equations must be developed which when applied to a point in three-

\* These design areas are now firmly included in the format of the annual Design Automation Workshop sponsored by SHARE, ACM, and IEEE.



space will project it onto a plane. A detailed analysis of the development of these equations is given in Reference 1. A summary of this analysis is given here referring to Figure 1.

The observer's eye is at point  $O(O_x, O_y, O_z)$  and the line of sight,  $OP$ , makes angles  $a, b, c$ , with the 3-space  $X, Y, Z$  axis respectively.  $OD$  is the perpendicular distance from the observer to the plane onto which point  $P(P_x, P_y, P_z)$  is to be projected. If  $d$  is the distance  $OD$ , the coordinates of  $D$  are:

$$\begin{aligned} D_x &= O_x + d (\cos a), D_y = \\ &O_y + d (\cos b), D_z = O_z + \\ &d (\cos c) \end{aligned} \quad (1)$$

The coordinates of the projected point  $P'$  in three-space are:

$$\begin{aligned} P'_x &= O_x + F(P_x - O_x) \\ P'_y &= O_y + F(P_y - O_y) \end{aligned} \quad (2)$$

$$P'_z = O_z + F(P_z - O_z)$$

Where  $F = d / [(P_x - O_x) \cos a + (P_y - O_y) \cos b + (P_z - O_z) \cos c]$  (3)

The coordinates of  $P'$  on the new coordinate system then are:

$$X = [(P'_x - D_x) \cos b - (P'_y - D_y) \cos a] / \sin C + \Delta X \quad (4)$$

$$Y = (P'_z - D_z) / \sin c + \Delta Y$$

Where  $\Delta X, \Delta Y$  is the distance from  $D$  to the origin of the new coordinate system.

Equations (1), (2), (3), and (4) then can be used to project any point in three-space ( $P$ ) onto two-space ( $P'$ ).

One of the earlier projects which used perspective plotting techniques was the Sketchpad project at MIT (Reference 2). Many of the ideas and techniques developed in this project have paved the way for perspective plotting. The referenced article describes the original extension of Sketchpad from two to three dimensional graphics. The system at that time included the capabilities of rotating and scaling, but the hidden line problem was left to later versions.

The problem of scaling the object to be projected is readily solved by artificially moving the position of the observer's eye from point  $O$  to point  $O'$  such that  $O'D = d/f$  where  $f$  is the desired scale factor. Rotation can be accomplished similarly by rotating the observer's eye about the object.

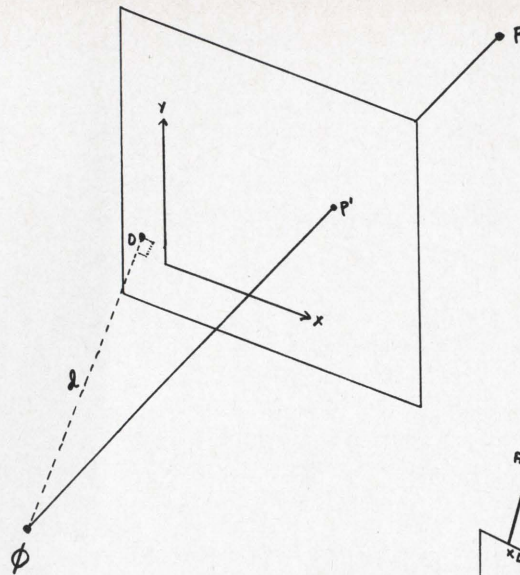


Figure 1—Geometry of Projection

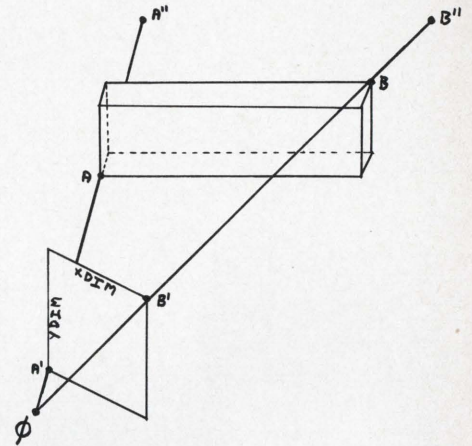


Figure 2—Geometry of Scaling

### Another Way to Accomplish Scaling

Another way to accomplish scaling is by moving the projection plane away from or toward the observer's eye which then can remain stationary. Referring to Figure 2, a rectangular solid is drawn around the three-dimensional object to be projected. The size of the solid is such, that, if  $A$  is the minimum corner of the solid and  $B$  is the maximum corner, then

$$\begin{aligned} A_x &\leq P_x \leq B_x, \\ A_y &\leq P_y \leq B_y, \text{ and} \\ A_z &\leq P_z \leq B_z \end{aligned} \quad (5)$$

Where  $P(P_x, P_y, P_z)$  is any arbitrary point within the object and  $A_x, A_y, A_z$  and  $B_x, B_y, B_z$  are the coordinates of  $A$  and  $B$  respectively. If  $O$  is the observer's eye, rays  $OA$  and  $OB$  are the projection rays of the three-dimensional object. If the object is to be projected onto a plane so that it will fill an area  $XDIM$  by  $YDIM$ , a rectangle of this size is moved perpendicular to  $O$  so that two of the rectangles diagonally opposite corners  $A'$  and  $B'$  will fall on the two projection rays,  $OA$  and  $OB$ , respectively. The farther the rectangle is moved from  $O$ , the larger the projection will be. If the rec-

tangle falls between the object and the observer, the projection will be scaled downward. But if the rectangle is moved to the far side of the object ( $A'', B''$ ), the projection will be scaled upward.

Windowing (viewing just part of the object) can be accomplished by requiring that the rectangular solid originally chosen enclose just the section of the object to be viewed. Then  $P(P_x, P_y, P_z)$  in equation (5) becomes any arbitrary point within the window. Then any other point,  $Q$ , within the object, but not the window, will be projected outside the projection rays and will not fall on the rectangle  $A'B'$ .

Once all the points in the object have been projected onto the plane, lines connecting these points can be drawn in the plane, and so doing, the whole object is projected. This is fine, but in so doing, the object is considered to be transparent, as all lines are drawn whether these lines can be seen by the observer or are actually hidden by some part of the object. The next important step then is to determine which line segments are hidden from view. Then these segments can either be eliminated from the drawing or show up as dashed.



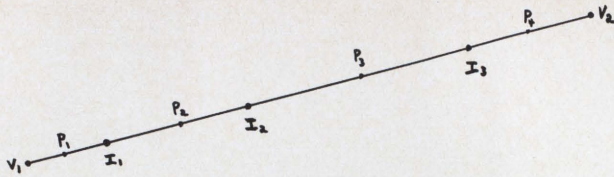


Figure 3—Edge Intersections

### Planar Solution

One way of solving this problem requires that all surfaces in the three-dimensional object be approximated by flat planes which are called faces. The object can contain any number of faces, the boundaries of which are called edges, and must be approximated by straight lines. Edge ends are called vertices, and edges and vertices may be common to several faces or to only one face, as in describing an object shell. Faces may contain inner edges as well as outer edges, where the inner edges can define a window. If several faces are coplaner, they can be combined into one face description.

Both P. Loutrel (Reference 4) and R. Galumberti, et al (Reference 5) present algorithms for solving the "polyhedra" problem where the faces must all be two-sided polygons. Their solution is based on the fact that an edge may be concave or convex. Neither of the referenced algorithms handle the window problem\* (except by breaking the face

\* Where the face has a "cutout" or a transparent section.

into several faces). The method described in this paper solves the polyhedra problem without requiring that the curvature of its edges be known, and without breaking the faces to solve the window problem.

Using equations (1) through (4) all the vertices in the object are projected onto the observation plane. By finding all edge intersections on this plane (Figure 3), the polyhedra problem can be simplified into the problem of determining whether or not a point is hidden by a face.

This simplification can readily be shown by observing that the edge connecting vertices  $V_1$  and  $V_2$  is composed of segments  $V_1I_1$ ,  $I_1I_2$ ,  $I_2I_3$ , and  $I_3V_2$ . Where the points  $I_1$  are all the intersection points between this edge and all other edges. Since the  $I_1$ 's are all the intersections, there can be no intersections on the individual segments. The visibility of segment  $j$  is equivalent to the visibility of any point in segment  $j$ , since visibility can change only at a point of intersection. Hence if  $P_j$  is visible, segment  $j$  is visible.

In order to determine the visibility of a point, I will first define the

property of being "covered." A point is said to be covered by a face if in the observer's plane, the point falls within the area enclosed by the edges of the face. This property is easily determined by drawing a horizontal line through and to the left of the point and counting the number of edges crossed. If an edge vertex is crossed it is counted only if the edge is below the point. If this number is odd, the point is covered, otherwise it is not. Figure 4 contains some examples of determining the coverage of a point. Points  $P_1$  and  $P_5$  are shown to be covered by faces 1 and 2 respectively, while the other points are not covered.

Since faces are closed polygons, it is easily seen that the total number of horizontal crossovers (to right as well as left) must be an even number (or zero). If there are an even number of crossovers on the left, there also must be an even number on the right. And if there are an odd number of crossovers on the left, there must be an odd number on the right. This property is observable as long as a face is described as a series of connected edge where the last vertex in the last edge is the same as the first vertex in the first edge (i.e., a closed figure). If face windows are described with this in mind, coverage is still observable.

In Figure 5 the face is described by this ordered set of points 1, 2, 3, 4, 5, 1, 6, 7, 8, 9, 6, 1. Note that like all faces, the last point must be the

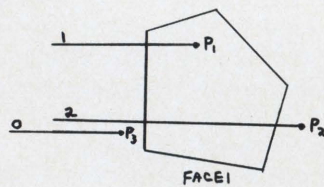


Figure 4—Coverage

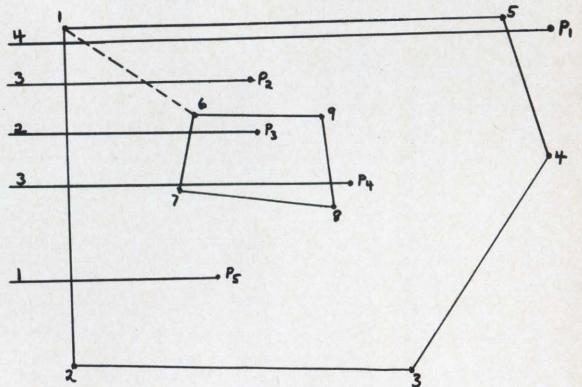
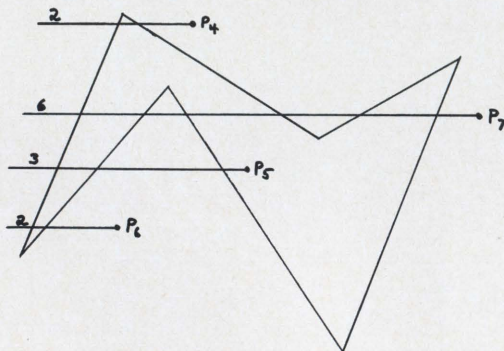


Figure 5—Window Coverage



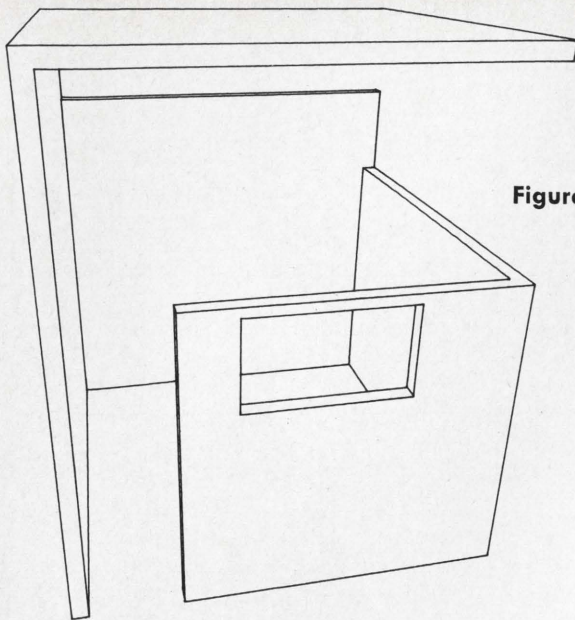


Figure 6

same as the first; and note that line 1, 6 is a double line 1, 6 and 6, 1 (when actually plotting these, pseudo-edges are ignored). These double lines can be thought of as a narrow cut allowing the window to be part of the outside. In this example, points  $P_2$ ,  $P_4$  and  $P_5$  are shown to be covered while points  $P_1$  and  $P_3$  are not. The algorithm allows the window point,  $P_3$ , to show through.

Once it has been determined that a point is covered by a face, the only property that the point must have to be visible is to be on the same side of the face as is the observer's eye. This can be determined by putting the coordinates of both the point,  $P_j$ , and the observer's eye,  $O$ , in the equation of the plane containing the face. The results,  $D_{Pj}$  and  $D_o$ , are the signed distance from the face to  $P_j$  and  $O$  respectively. If  $D_{Pj}$  and  $D_o$  have the same sign (i.e.,  $D_{Pj} * D_o > 0$ ), then the point is visible. Otherwise it is not.

The normal to the plane is determined by the cross product of the two of the edges in the plane. If  $P_1 (X_1, Y_1, Z_1)$ ,  $P_2 (X_2, Y_2, Z_2)$ , and  $P_3 (X_3, Y_3, Z_3)$  are three vertices of the face and  $V_1$  and  $V_2$  are the vectors connecting these points respectively, then

$$V_1 \times V_2 = A_i + B_j + C_k \quad (7)$$

where  $A = a_{12} a_{23} - a_{13} a_{22}$ ,

$B = a_{13} a_{21} - a_{11} a_{23}$

$C = a_{11} a_{22} - a_{12} a_{21}$

and,  $a =$

$$\begin{pmatrix} (X_1 - X_2) (Y_1 - Y_2) (Z_1 - Z_2) \\ (X_1 - X_3) (Y_1 - Y_3) (Z_1 - Z_3) \end{pmatrix}$$

The equation of the plane containing this face is

$$A_x + B_y + C_z + D = 0$$

where  $D$  is the distance from the origin to the plane. So

$$D = -(A_{x1} + B_{y1} + C_{z1})$$

The distance from the observer's eye to the plane is

$$D_o = A_{ox} + B_{oy} + C_{oz} + D$$

and the distance from point  $P_j$  to the plane is

$$D_{Pj} = A_{Pjx} + B_{Pjy} + C_{Pjz} + D$$

If  $D_o * D_{Pj} > 0$  the point is visible.

If  $D_o * D_{Pj} < 0$  the point is hidden.

And the visibility of  $P_j$  with respect to  $O$  is determined.

Since the visibility of  $P_j$  determines the visibility of segment  $j$ , the three-dimensional object can be drawn in perspective with the hidden lines identified and either eliminated or dashed.

Figures 6 through 8 contain some views of the Harris Cubicle.\*

\* Named after the office of a co-worker.

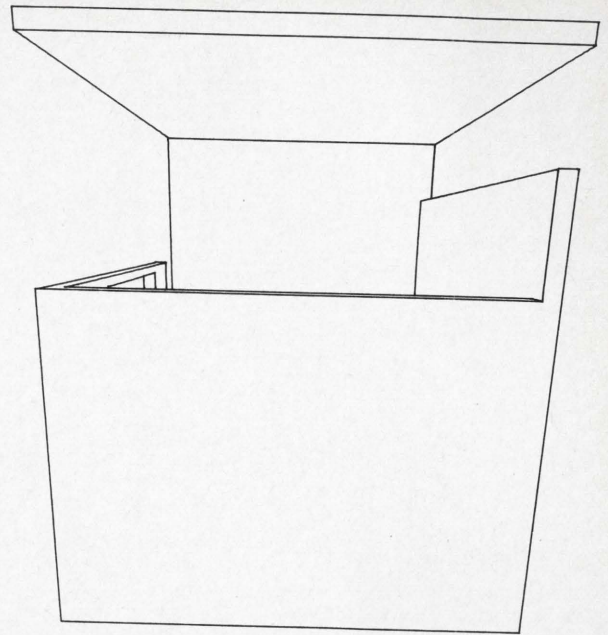


Figure 7

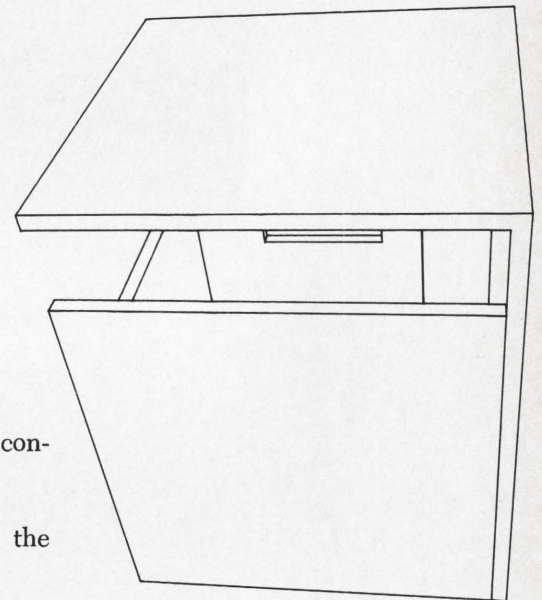


Figure 8

## References

1. Kubert, B., et al. "The Perspective Representation of Functions of Two Variables", *Journal of the Associations of Computing Machinery*, VI. 15, No. 2, April 1968.
2. Johnson, Timothy E. "Sketchpad III A Computer Program for Drawing in Three Dimensions", *Proceedings—Spring Joint Computer Conference*, 1963.
3. Schwalb, A. J., et al. "A System of Computer Programs to Calculate Aerodynamic Characteristics for Missiles, Re-entry Vehicles, and Spacecraft", *Sixth Space Congress, Cocoa Beach, Florida, March 1969*.
4. Loutrel, Phillipe, "A Solution to the 'Hidden-Line' Problem for Computer-Drawn Polyhedra", *Technical Report No. 400-167, New York University, Sept. 1967*.
5. Galimberti, R. and Montanari, U., "An Algorithm for Hidden Line Elimination," *Communications of the ACM*, Vol. 12, No. 4, April 1969.



## DOCUMENTATION

(Continued from page 15)

*Basic FORTRAN* . . . This manual describes the FORTRAN II available with the computer and must be specific in listing its limitations.

1. Introduction
2. Program form
3. Data
4. Specification statements
5. Expressions and assignments
6. Control statements
7. Input/Output statements
8. Programs and subprograms
9. Operating procedures

*FORTRAN IV* . . . This manual will describe standard FORTRAN and must include omissions or extensions available with the FORTRAN peculiar to the system. The basis for the manual should be ASA FORTRAN.

*Utility Routine Library* . . . This manual (or group of manuals) describes specific routines or subroutines available with the machine for performing special frequently occurring operations such as drum-disk-tape transfers. A section or manual should be available for every utility routine supplied with the computer.

*Math Library* . . . Similar to the utility routines, there should be a description of each math routine and subroutine available with the system.

*Basic Executive System* . . . Available only when the executive system is available for the computer, this manual describes the operation of the executive system. Included are discussions of batching, job control cards, accounting (if included) and other functions performed by the executive program.

*Software Users Manual* . . . This manual gives the program user instructions in the proper application of the program. Programs included here could be some of the following: DDT-program

verification system, CAL-conversational algebraic language, QED-symbolic text editor, LISP-list processor. One manual is written for each program available.

*Software Maintenance Manuals* . . . This manual details the constructions of the program for the purposes of maintenance or modification due to future needs, hardware changes, and correction of undiscovered errors at a future date. This manual should be supplied for each assembler, FORTRAN processor and all programs including special purpose programs.

*Real Time Monitor (Special Purpose)* . . . This manual describes the operation of the RTM program. Applicable to real time computer systems, this would be used with the interface manual to meet special requirements.

*Time-Sharing Monitor Manual (Special Purpose)* . . . For time-sharing systems, a description of the operation of the time-sharing monitor program.

*Time-Sharing Terminal Users Manual (Special Purpose)* . . . For time-sharing systems, this manual describes to the terminal subscriber how to best enter programs into the computer and how to carry on a real time interaction with the time-sharing machine.

*System Glossary* . . . Definitions of all terms used in systems manuals.

*Computer System Library Index* . . . This volume should provide cross-references to all pertinent volumes and should also outline the standards used in documenting the computer system. The glossary of terms could be included here. It would be desirable to list each manual with the level of user intended. An appendix could include outside reference sources applicable to each subject for those desiring further information not available in systems manuals.

*Computer Data Sheet* . . . This item presents an overall view of the complete system (hardware, software, peripherals, systems, etc.) in briefest form. Approximately four pages.

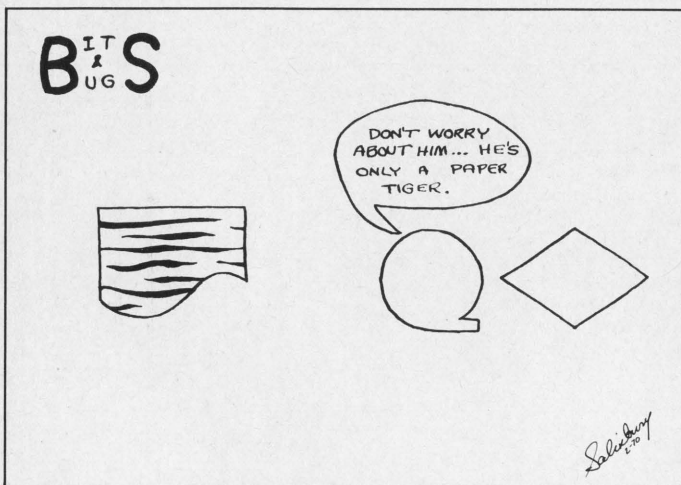
*Computer System Brochure (General Description)* . . . Marketing oriented, this document presents the basics of the computer system with pictures and block diagrams so as to be comprehensible by most customers. This is a sort of condensed reference manual (20-40 pages).

*Data Sheets on Peripherals* . . . There would, ideally, be a marketing data sheet (two pages) on each option or each peripheral unit available with the computer.

*Price List* . . . This gives current prices of each option or accessory available with the computer.

*Software Brochure* . . . This is a brief but concise description of all of the software available with the computer.

*Contract Specifications* . . . Legally correct descriptions of the system for the purpose of incorporation into contracts, proposals, etc. There should be one of these per unit offered. ■





## FREE PROGRAM LISTING PRACTICES AND PROCEDURES

**COST . . .** there is no charge for computer programs listed in SOFTWARE AGE.

**PUBLISHED . . .** the listings will appear in the first available monthly issue of the magazine.

**BROKERAGE . . .** SOFTWARE AGE does not broker computer programs nor act as an agent. As an unbiased third party, S/A is acting, solely, as a pipe-line of communications between buyers and sellers of computer programs.

**EVALUATION . . .** SOFTWARE AGE does not compare or evaluate computer programs. The degree of seller on-site support and the extent of buyer capability virtually make the evaluation of any program meaningless.

**PREREQUISITE . . .** all listings must be documented or supported to the extent of being operable by the buyer. The editors of S/A request that all forms be typed to ensure proper printing of your listing.

**ANONYMITY . . .** A cross-coded reference number will be assigned to any program whose originator wishes to remain anonymous. Buyer inquiries will be forwarded to the originator. If the originator still prefers anonymity, buyer will be notified by S/A.

**GROUPING . . .** listings will be grouped according to keyword, title, mainframe application and compatibility, industry, etc. As listings grow, more categories and definitions will be added.

**"N/A" DEFINED . . .** where price is either not available or not readily reported at the top right of each list, "N/A" or "Not Available" is listed instead.

## UTILITY

### ABREVI-8

\$75/Binary Copy

ABREVI-8 saves time and effort and reduces errors in preparing symbolic tapes for the PDP-8. Allows programmer to make up any abbreviations for frequently used character strings including entire lines, parts of lines, and multiple lines. Abbreviation is used in preparing the tapes then ABREVI-8 is used to replace every occurrence of the abbreviation with the full string it represents. Can be used to correct errors by substituting correct string for faulty string. When combining off-the-shelf subroutines duplicate uses of symbols may occur. ABREVI-8 can be used to replace every occurrence of a symbol with a new symbol. Can also be used to set or reset page control characters and many other useful operations. The number of different abbreviations that can be substituted on a single pass is quite large and is limited only by the buffer space available.

PDP-8, 4k, TTY, PAL-III

The Bedford Group  
P. O. Box 352  
Bedford, Mass. 01730

EG465

### CPACK/CUPACK

\$250

These programs provide packing and unpacking facilities for COBOL and PL/1 programs. By using a 6 bit representation for characters, up to 25% reduction in auxiliary storage and processing time can be realized. The packing process preserves the normal collating sequence, so that packed records can be sorted as usual. There is also provision for packing selected fields.

360, BAL

Four Pl, Inc.  
415 N. Scoville Avenue  
Oak Park, Ill. 60302

EG372

### ANLIZR

\$100

This is a series of three programs that will generate a cross reference listing and a listing of the lines that the entry appears in. The first program generates the index and calls in the second program which sets up the sort parameters and calls in the sort. The third program lists the programs. In its present form it will handle up to ten programs at a time. The program is currently working and has compiled without any diagnostics. The programs will accept COBOL or FORTRAN source decks. More information upon request.

H-200, H-120, 12K, COBOL (D Level)

Edward P. Faulk, Programmer  
UDP Data Center  
110 E. Travis  
San Antonio, Texas 78221

EG467

### CPU (COBOL PRINT UTILITY)

\$50

CPU is a general purpose utility print program that will afford the user, who does not possess manufacturer supplied software, the capability to generate report print tapes for subsequent printing rather than producing the listing(s) during the actual execution of a report program. Detail lines for multiple reports produced by a single program may be written in any sequence to one print tape. When CPU reads this tape, the various lines associated with each report are extracted and a listing is printed for each report segment. CPU may be modified to meet the standard COBOL requirements imposed by most manufacturers. Complete documentation and a copy of the program listing are available.

UNIVAC 9300, 32K, COBOL

Fritz M. Maier  
800 Devon Place  
Alexandria, Va. 22314

EG373

### CASRESO (COBOL (Deck Resequencing Program

\$35

Each card read is resequenced in columns 1-6 and an identifying name is gang punched into columns 73-80. The starting sequencing number and the incrementing amount are variable as well as the id to be ganged into the deck. Option of producing two output decks at the same time.

360/25 & up, BAL

Jack Sparks, Vice President  
Computer Applied Systems, Inc.  
18075 Ventura Boulevard  
Encino, Calif. 91316

EG468

### DOS BATCH JOB STREAM BUILD

N/A

This system builds a job stream on disk to be executed in a batch job partition on a DOS 360 system. The jobs to be executed are entered through the 1050 console and selected from a library of job control cards on disk. After the selection phase, the job stream is executed. When the job stream is completed, the monitor will accept requests for additional jobs. Other functions such as the allocation of core, stopping a partition, inserting additional control cards, etc., are also provided.

In addition to building complete job streams, this system has been found useful in executing single programs rather than using SPL when a large number of job control cards are needed and there is not an available card reader.

This system may be used in any or all DOS batch job partitions. The only requirement is that the supervisor must be generated with SYSFIL.

360 DOS, 24K & up, BAL & COBOL

% SOFTWARE AGE  
P.O. Box 2076  
2211 Fordem Avenue  
Madison, Wis. 53701

EG377



**EDITPG**

\$50 Lease

EDITPG is a general utility program designed to be used on any GE-400 series time-sharing computer system which is equipped with a standard FORTRAN IV compiler. The program reads any user disk file and edits the file contents into a standard 8 1/2 x 11 paged format output. Each page produced contains 50 lines or records of the file, 72 characters per line when printed on a standard teletype, and is printed with page cut lines at top and bottom. In addition, the file name is printed at the center of the top of each page, and a page number at the bottom center of each page. The program operates by editing the file and then storing the edited version in a second file named "PAGES" which is then listed by the user. Utilizing this method of operation, a typical 200 line FORTRAN source file can be edited in a total of four minutes of terminal time and 9.5 seconds of CPU time. The total time then required to list out the edited file, "PAGES", is approximately 12 minutes. EDITPG is completely conversational and self documenting, and is particularly useful for editing source and data files when preparing program user documentation.

**GE-400, FORTRAN IV**

% SOFTWARE AGE, P.O. Box 2076  
2211 Fordem Avenue  
Madison, Wis. 53701

**EG378****EMUCOMP EMULATOR COMPATIBILITY \$30**

When spooling 1443 printout/s to tape under emulation, the forms control used are Type A & D but, they are not compatible. While using the Utility, both types are made compatible without any loss of print lines and proper spacing is achieved.

**360/30 and up, BAL**

John Jaska, Systems Programmer  
St. Paul Federal Savings & Loan  
6700 W. North Avenue  
Chicago, Ill. 60635

**EG379****FILETAB—TABULATOR AND REPORT GENERATOR PACKAGE**

N/A

A simplified load-and-go system of producing reports with editing and summary facilities. Gives up to 16 levels of control and 32 totals at each control level. Any number of lines may be printed for each data record selected and mixed entry decision tables are used to define the selection and/or editing requirements. Descriptor look-up tables and summary file creation also available.

**ICL 1900, 360, ICL 4, BAL**

Mrs. M. Phillips, Head of Data Processing Techniques  
The National Computing Centre Ltd.  
Quay House, Quay Street  
Manchester M3 3HU, England

**EG380****FORTRAN OR COBOL CROSS REFERENCE LIST \$350-\$700**

This program takes a source desk and produces a listing of the source deck with statement sequence numbers added. A second listing gives all the variable or data names in alphabetical order with the sequence number of every statement containing the name. The Fortran version also produces a numerically sequenced list of the statement numbers used.

**FORTRAN or COBOL**

Michael Kulakofsky, President  
Data for Management Decisions, Inc.  
22335 Governors Highway  
Richton Park, Ill. 60471

**EG381****GETSET**

\$750

A program to select/delete records from sequential files, or replace specific data fields in selected records. A new file is written in the image and block size of the input file. GETSET requires two control cards: Lead card; contains the location and size of the fields to be matched or replaced, Data card; contains the constant data to be matched or replaced/placed.

**360 OS, BAL**

George Willette  
International Logic Corp.  
404 Ignacio Blvd.  
Novato, Calif. 94947

**EG382**

# SOFTWARE AGE FREE PROGRAM LISTING FORM

(PLEASE TYPE)

New Listing   
Revised Listing   
Program Wanted   
Broker Wanted

This program is: Utility  Systems  Scientific  Applications  Engineering  Management  Other

Title: \_\_\_\_\_ Additional Listing Forms Required \_\_\_\_\_

This program is: For Sale  Lease  Franchise  Price: \_\_\_\_\_

Description: (Use reverse side if necessary)

Hardware Configuration: \_\_\_\_\_

Programming Language: \_\_\_\_\_

Documentation Provided: \_\_\_\_\_

On-Site Support/Debugging Available? Yes  No  Hours  Guaranteed? Yes  No

Patent No. \_\_\_\_\_ Copyrighted? Yes  No  Number of Programs Distributed \_\_\_\_\_

Check Here for Cross-Coded Reference  Check Here for Cross-Coded Reference

Name and Address of Program Owner \_\_\_\_\_

Individual Contact \_\_\_\_\_ Title \_\_\_\_\_

Firm \_\_\_\_\_ Industry \_\_\_\_\_

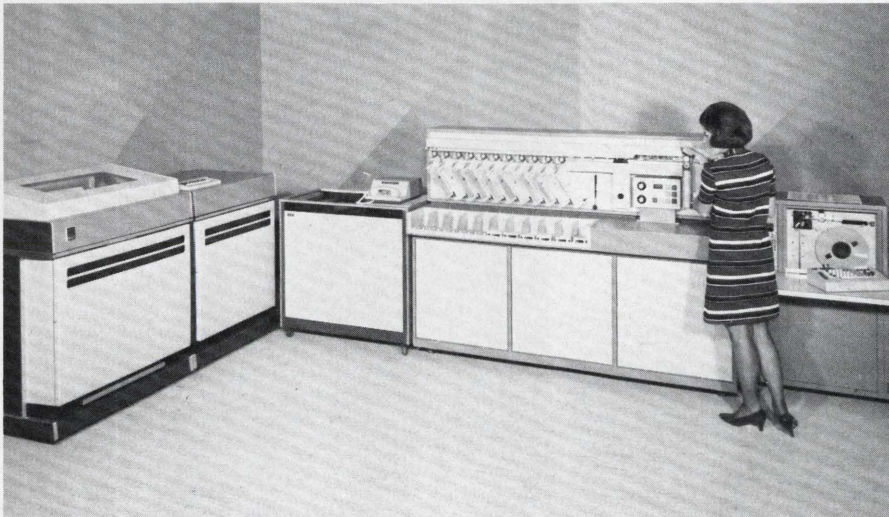
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City, State and Zip \_\_\_\_\_ Tel: (\_\_\_\_\_) \_\_\_\_\_

RETURN TO: PROGRAM LISTING EDITOR • SOFTWARE AGE • 2211 FORDEM AVE. • MADISON, WIS. 53701



# NEW PRODUCTS



## **NCR 720 System Decentralizes Paperwork, Eliminates Document Transportation**

A product which offers a new, partly-decentralized dimension to bank automation through use of data communication techniques was introduced in Los Angeles recently. The National Cash Register Company unveiled its NCR 720 Remote Bank System (as shown above) at the firm's Century City branch facility.

The equipment captures information from magnetically-encoded (MICR) bank documents locally and transmits it to large central computers. The system eliminates the physical transportation of banking documents—data moves between origin points and the computer center over telephone lines.

"This is more than a data-capturing system," explained C. L. Keenoy, Vice President and Group Executive, Marketing Division. "Its significance lies in the application of data transmission techniques to eliminate a long-time banking problem—the time-consuming and expensive transfer of documents from bank or branch to processing site." Keenoy explained that the NCR 720 is a means for handling paperwork in the local areas where branch or in-

dependent banks transact their business with the public. For the past seven or eight years, Keenoy indicated, the banking industry has followed a trend toward massive centralization in its automated procedures. Typically, checks, deposit slips, and other media are physically carried to large central facilities for processing.

*For more information, circle No. 9  
on the Reader Service Card*

## **Develops Intertran Data Set Series**

Computer Transmission Corp., a Los Angeles-based data distribution firm, has announced its second product line, the INTERTRAN series. INTERTRAN is a high-speed data set for half- or full-duplex, synchronous transmission over twisted pair four-wire facilities. Two models are available: Model 915 provides standard EIA RS 232-C low-speed interface, operating up to 20,000 bps; Model 916 provides high-speed current interface from 10,000 to 250,000 bps. Data rates can be changed in the field to meet changing user requirements.

*For more information, circle No. 10  
on the Reader Service Card*

## **Interdata Introduces Two New Computers**

Two new, small computers, both of which represent a significant achievement in state-of-the-art techniques, have been introduced by INTERDATA, Inc. According to Ronald A. Paterson, Vice President Marketing, for the company, the new Model 5 is a third generation general purpose Foreground-Background computer, "which produces more real-time programming power per dollar than any other computer available today." It is the most powerful INTERDATA computer made, he added.

Privileged instructions separate the supervising modes, and protect an unbugged background program from destroying an operating foreground. Additional features of the Model 5 include: autonomous programmable I/O channel to permit; noninterfering compute and I/O operations; Real-Time software including USASI Fortran and a real-time operating system; 114 instructions including floating point computation interrupt control, operating system linkages and list processing; 16 hardware priority interrupt levels, expandable in blocks of 16.

*For more information, circle No. 11  
on the Reader Service Card*

## **Inter-Computer Develops Multiplying D/A Converter**

A new 10-bit multiplying digital-to-analog converter with a conversion time of less than one microsecond, has been developed by Inter-Computer Electronics, Inc. The unit is said to be the fastest multiplying D/A now on the market. Designated Model IDA-1310X, the new unit incorporates the extremely fast-settling ICE digital-to-analog converter and a programable reference.

The unit functions as a digitally controlled attenuator; i.e., the output amplitude is a function of the digital number input. The 10-bit resolution provides for the 1024 outputs ranging from zero volts (all zeros in) to full scale (all ones in). By providing a constant input reference voltage, the IDA-1310X can be used as a conventional D/A.

*For more information, circle No. 12  
on the Reader Service Card*



## Path Introduces Tape-to-Print System

A new system for the high-speed, off-line conversion of data stored on magnetic tape into printed "hard" copy has been introduced by Path Computer Equipment, Inc. System 1200 increases computer capability by relieving the central processor of the printing function. Path claims that the purchase and/or leasing cost of System 1200—approximately \$33,000 or \$1,500 a month—is so low as to make the use of a central-processor-controlled line printer uneconomical for many applications.

System 1200 consists of a tape transport unit, a programmable computer/controller and a Path Model 1200 printer. The printer provides all 96 ASCII characters at a rate of 1200 lines a minute. The printer uses ordinary bond paper eliminating the need for more expensive coated paper. It will also prepare masters for offset duplicators directly. Paper is roll-fed and automatically cut into 11-inch lengths. Fanfold paper can also be accommodated.

For more information, circle No. 19  
on the Reader Service Card

## Atron's New Datamanager Reduces Programming Time

Atron Corporation, St. Paul-based computer manufacturer, is marketing a new kind of small computer that cuts programming dramatically. It's called the 501 Datamanager, because, unlike conventional minis, it's strictly a business-minded computer. It is designed to manipulate volumes of data with outstanding efficiency, in addition to normal business calculations. Atron is currently manufacturing and delivering the Datamanager.

"We examined the mundane repetitive things done billions of times in any computer center operation," said Atron president, Joseph Stoutenburgh, "and built extremely efficient hardware macro instructions to handle them. An additional benefit is minimum use of memory space for application programs. Datamanager's data structure and macro-instructions permit the user to design application programs with relative ease and modify such programs with minimum effort."

For more information, circle No. 20  
on the Reader Service Card



## Datamark Printer Designed for Optimum Print-Out

Datamark's 300 Line Per Minute Printer, shown above, features a patented precise impact mechanism—the Oscillating Bar. This unique innovation achieves unsurpassed print quality, offers an unlimited choice of fonts, exacts no premium for lower and upper case characters and provides perfect alignment at any speed.

The invention comprises a novel method for moving one or more linear type fonts etched on a metal strip and fastened to a motor-powered carrier with a lateral excursion. A yoke attached to the font is constrained along a horizontal path by guide rods. A drive roller rotating on a ballbearing shaft allows the yoke to move vertically in a slot. The entire shaft is molded to a drive belt powered by drive pulleys over which it passes. Thus, uniform rotation of the drive pulley results in constant font velocity during the horizontal phase of the drive roller motion and simple harmonic motion as the roller rounds the pulleys. Printing is accomplished during the constant velocity phases of the left and right bar excursions.

Character codes, space and time reference pulses are photoelectrically generated by reading the discontinuities in a code bar fastened to the font carrier. Phasing of the timing pulses required to fire the print hammers is controlled by a lead screw which positions the entire photoelectric pick-off assembly.

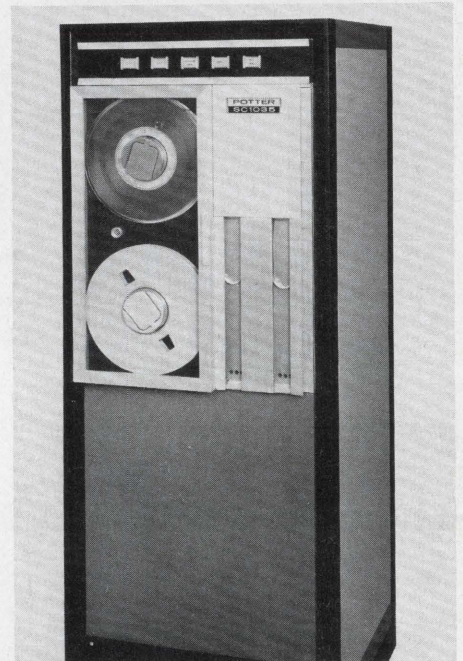
For more information, circle No. 21  
on the Reader Service Card



## Mark Computer Systems Announces DD-70 Data Display

Mark Computer Systems has announced the development of the DD-70 alphanumeric CRT display terminal for data entry and data communication systems. In addition to its Teletype and RS-232B I/O options, which allow the DD-70 to be substituted directly for Teletype equipment in applications, the DD-70 contains a 50K band serial I/O for in-plant data communication. It also offers a Mark Modem for multi-terminal, multi-plant tele-processing over standard leased telephone lines, requiring no additional interface equipment.

For more information, circle No. 22  
on the Reader Service Card



## New Tape Transport Introduced by Potter

Potter Instrument Company, Inc., of Plainview, New York has introduced a new low cost, single-capstan vacuum column digital tape transport specifically designed for low cost computer and data acquisition applications. Designated SC 1035, the new unit stresses low unit cost and optimum performance, without sacrificing data reliability, ease of servicing, or operator convenience. The unit provides bi-directional tape speeds to 45 ips and incorporates all the important data reliability features of Potter's high performance SC-series transports.

For more information, circle No. 23  
on the Reader Service Card



## Product Helps Improve Disk Head-Movement

A new Systems Measurement Software™ product designed to optimize the placement of data sets on disks has been announced by Boole & Babbage. Called the Data Set Optimizer (DSO), the new product operates under OS and enables users to see exactly how efficiently the present data sets are organized on a disk, how to improve that organization for increased throughput, and the amount of improvement that may be expected after reorganization. "The Data Set Optimizer is an ideal tool for those IBM 360 installations who need to reduce wait time resulting from data sets inefficiently arranged on disk," said William J. Brian, Marketing Vice President.

For more information, circle No. 31 on the Reader Service Card

## Develop System Independent Computer Language Translators

It was announced by William P. Burke, Chief Executive Officer of Information Resources, Inc. that a major breakthrough had been accomplished by the Company in the field of computer programming linguistics with the development of a capability to produce translators for any programming language which will run on any selected group of computer systems. Translators may be produced for existing, common languages such as FORTRAN, COBOL, PL/I, for user specified procedure or problem oriented languages or for languages developed by the Company for a client's special requirements.

One significant effect of this development is that it is now both



## OCR for Small Scale Applications

A new OCR document reader which offers a significant price/performance ratio in medium scale handling of turn-around documents, has been developed by Orbital Systems, Inc. The basic Orbit I unit includes a document handler, camera, video processing electronics, recognition logic, electronics for control of the document handler and (optionally) a mark reader. Designed for reading a single line with up to 70 numeric characters, Orbit I will read at 108 characters per second and up to 130 cards per minute.

For more information, circle No. 32 on the Reader Service Card

technically and economically feasible for any single programming language to be accepted on more than one kind of machine. By using IRI developed translators, a client may develop computer programs (software) that will be operable not only on his current computer system, but also on almost any future system he may select.

For more information, circle No. 33 on the Reader Service Card

## Free Sample Lesson in Systems & Procedures

North American School of Systems & Procedures is offering an actual free sample lesson, taken from its home-study course in Systems & Procedures so that prospective students may "preview" the course before actually purchasing it.

The lesson—which is one of fifty contained in the comprehensive course which is sponsored by the Association for Systems Management. The course is designed for personnel presently in Systems Departments who want to "brush up" or broaden their knowledge of the subject, as well as for companies—both large and small—who want to train their own personnel in Systems & Procedures.

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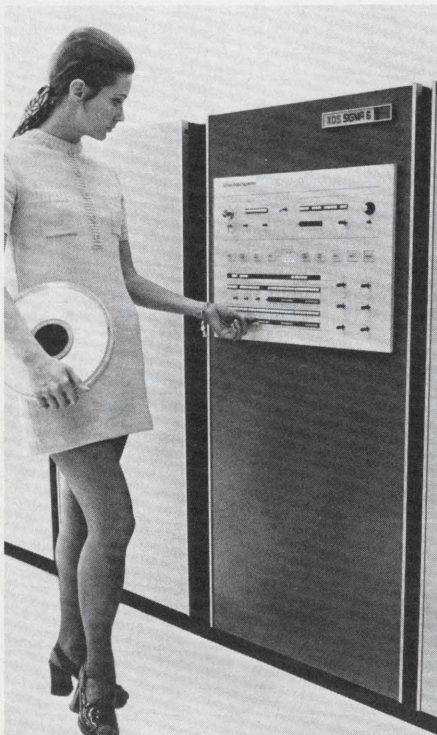




### 3-Minute Copy by Telephone

The new Copyphone 300D facsimile system by Telautograph transmits essential documents over the direct-dial public telephone network. An 8½" x 11" copy can be sent to anyone, anywhere, in 3 minutes—conveniently and economically. Copyphone 300D accepts graphics of all sorts, whether typed, drawn, handwritten, or photographed. Transmitter and receiver work automatically—insertion of copy into transmitter turns on both units—unattended reception is standard.

For more information, circle No. 13 on the Reader Service Card



### Xerox Announces Sigma 6 Computer

Sigma 6, a new computer designed for the specialized needs of business, was announced recently by Xerox Corporation's computer subsidiary, Xerox Data Systems. Sigma 6 is the company's first computer designed primarily for the commercial data processing marketplace. The computer leases for \$12,000 to \$18,000 per month depending on configuration.

For more information, circle No. 14 on the Reader Service Card

### EX\*PRESS Data Offers Compression System

The EX\*PRESS System, developed by AGS Computers, Inc. a New York City based consulting firm, is an advanced software system of computer programs, operating on today's third generation computers, that will dramatically reduce the amount of peripheral storage required for any type of data base—by as much as 80%. Through a combination of cryptographic, linguistic and mathematical techniques, the EX\*PRESS System analyzes each data base and assigns to it a coding structure that will reduce the amount of peripheral storage required, while maintaining absolute data base integrity. The EX\*PRESS System is made up of several modular subsystems, operates on most IBM System/360s, under either OS or DOS, for just about any type of data structure that is supported by the operating systems.

For more information, circle No. 15 on the Reader Service Card

### Control Data Announces New 7600 Computers

Reinforcing its business policy that very large machines offer the most economical means of using computer power, Control Data Corporation recently announced new 7600 models, software systems and separate prices for its 7600 family of super-scale computers. The announcement covered three additional 7600 models, two versions of its 7600 SCOPE software operating system and a new operator station for the Company's 7600 systems.

"Now, customers will have far greater flexibility in matching their computer requirements with Control Data's proven super-scale systems, supporting software, peripheral equipment and services," explained W. R. Keye, CDC executive vice-president and chairman of the executive committee. "Today, in a world of separate pricing, Control Data will meet user's super-scale computer requirements with four 7600 central processors ranging in price from \$4.1 million to \$6.2 million," Keye said.

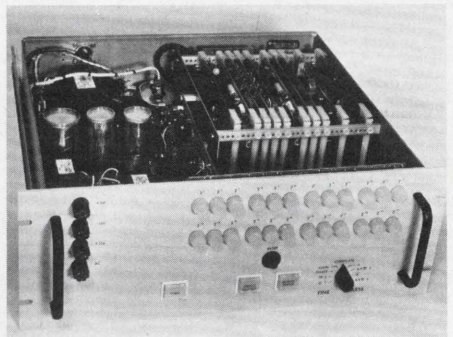
For more information, circle No. 16 on the Reader Service Card

### Data 100 Announces CRT Terminal Unit

A new desktop display terminal, designed to be plug interchangeable with Model 33 and 35 Teletypes<sup>(R)</sup>, has been introduced by DATA 100 Corp., Minneapolis-based manufacturer of remote terminal equipment for batch and real time applications. Called the Seventy Series Model 73 Interactive Display Terminal, the unit consists of a CRT display and keyboard and is interfaced to a communications line. It uses the ANSI character code and displays the 64-character upper case 1968 ANSI standard graphic subset. The Model 73-1 has 12 lines of 5x7 matrix characters, the Model 73-2 24 lines. Characters are displayed either white on a black background or black on a white background.

The keyboard has three sections: an alphanumeric keyboard duplicating the Teletype layout and including shift and control keys for generation of special codes; terminal control and edit keys to move the entry marker, repeat other key actions, clear and display, initiate printout on the optional hard copy printer, and start transmission in the block/edit mode; and an optional numeric keyboard in adding machine configuration. Storage is provided to refresh the display and to buffer storage for the optional hard copy printer.

For more information, circle No. 17 on the Reader Service Card



### Precision Angle Encoder

New, all-electronic angle encoder by Owens-Illinois' Fecker Systems Division, Pittsburgh, Pa., resolves up to ten times better than best optical encoders now available, according to the manufacturer. New instrument, which employs double-angle encoding technique, can resolve to 24 bits or 0.00002 degree in conversion of angular motion to computer-compatible digital information. Format is suitable for numerical indication, data recording, and closed loop control system applications.

For more information, circle No. 18 on the Reader Service Card



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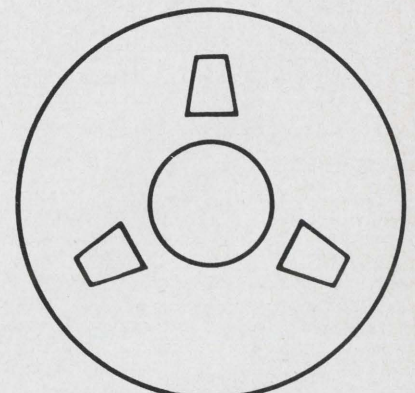
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