DECUSCOPE

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY

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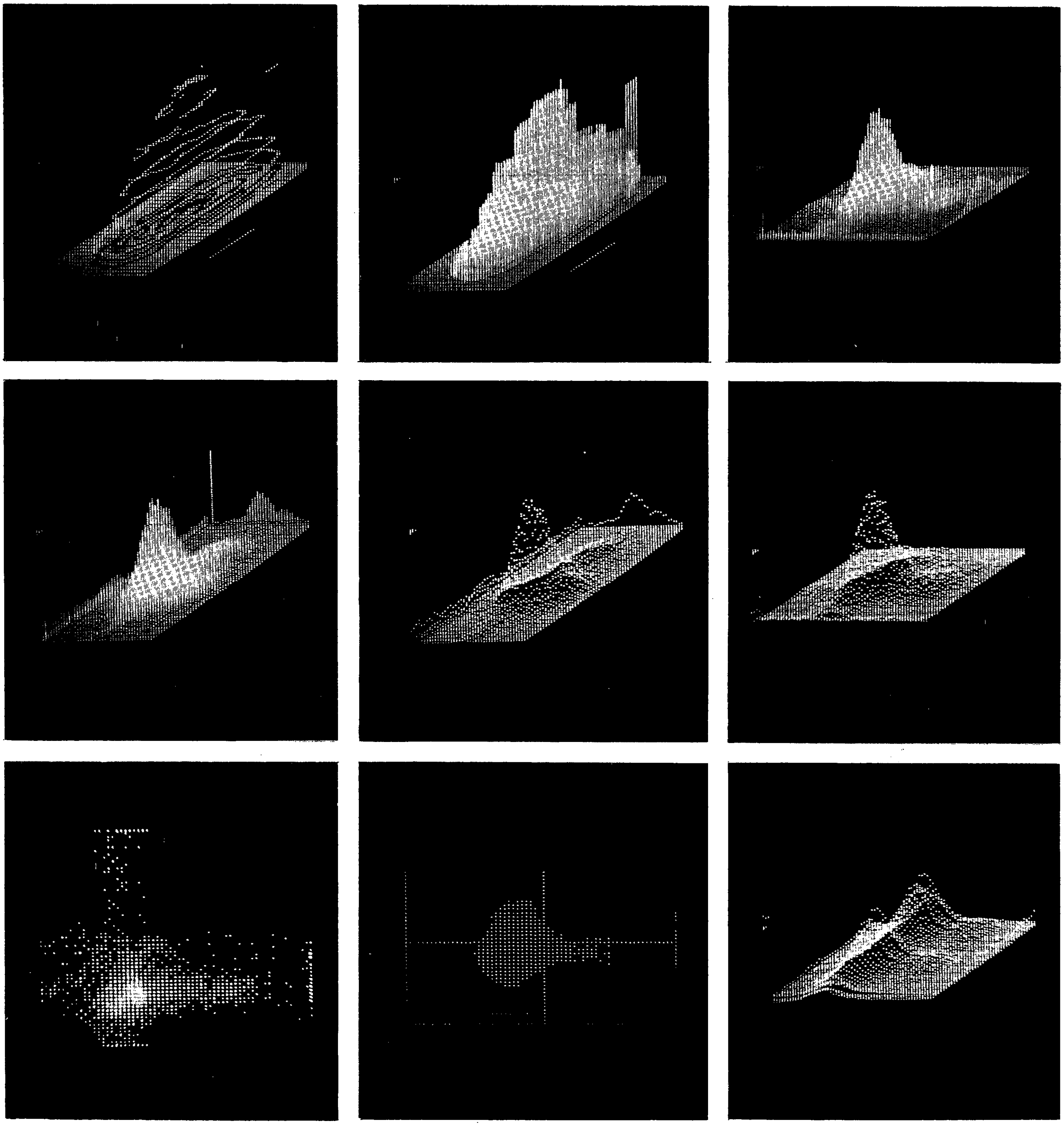

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COVER

The cover photos illustrate the displays allowed by the LINC-8 Multianalyzer program discussed on Page 8. The are (from left to right):

Top Row - 1. Point Display
2. 3-D Histogram
3. 3-D Data Display

Middle - 1 - 3. 3-D Data Display

Bottom - 1. Data Acquisition
2. Contour from No. 1
3. Data Surface

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"SOME LINC-8 APPLICATIONS"

EMORY UNIVERSITY
ATLANTA, GEORGIA

"The LINC-8 is part of the Laboratory of Neurophysiology of the Yerkes Regional Primate Research Center at Emory University. Though we intend using the computer on-line' in the laboratory, the Ampex SP 300 recorder is at present being used to collect raw data.

The computer will be used to record and analyze social behavior of primates. Some of the subjects' behavior will be evoked by telestimulation, and we hope to have the LINC-8 help make on-line decisions, such as the time of on-set of a stimulation. At present, in order to record the behavior, each key on the teletype is used to represent a particular behavior, but we are considering devising an English-type language that will give the observers more flexibility when describing more complicated interactions.

Another series of experiments involves the recording of single cell activity deep in the brain of a monkey. The computer will be used initially for such simple jobs as time-interval histograms, but we hope eventually to use it on-line to monitor the experiment and make accessible to the investigators much more information during the experiment.

The LINC-8 will be used to digitize impedance measurements made from the brain and will use this data to map brain structures on a CRT. The results will be visually similar to photographs of chemically stained sections of brain. Since the data will be in digital form, it will be possible to begin to generate some form o. three-dimensional plot of these structures."

William Bouris

DREXEL INSTITUTE OF TECHNOLOGY
PHILADELPHIA, PENNSYLVANIA

"The LINC-8 computer at Drexel will be a general-purpose computer serving the Biomedical Engineering & Science Program.

The computer will have three major functions: (1) Research, (2) Teaching, (3) Control of Experiments.

Research

Specifically, the research will center on the analysis, synthesis, and process identification of biological signals. We are undertaking work on the extraction of fetal EKG complexes from the maternal plus fetal. The computer will be programmed to act as an active, adapting filter to facilitate this extraction.

In addition, we are concerned with the propagation of information along the cortico-spinal tract. The computer will be used first as a computer of average transients to store the significant data and, secondly, as a programmed, adaptive correlator to compute the correlation at various points along the CS tract.

Research is being conducted on the properties of blood flow. The computer will be programmed to solve some of the peripheral problems to reduce the complexity of the problem for processing on a large computer.

There are many other problems that will be put on the computer but the above three are representative.

Teaching

For many years Drexel has accepted people whose primary training was in the life sciences for intensive remedial work in the physical sciences. These students are generally M. D.'s who feel that their research is stalemated for lack of new techniques. The LINC-8 computer will be used as a training tool for them as an example of the technique of modern data processing.

In addition, many of the engineers in our Program need experience in working on an on-line computer although they might be quite proficient at programming in artificial languages.

Control of Experiments

We envision the computer sensing the state of an experiment through the A-D converter, reacting through program control and effecting a change in the experiment through the relays or other output device. This use is in the future but the class of experiments for which we see the primary advantages are those involving animals and continuous monitoring of physiological situations."

B. A. Eisenstein

STANFORD RESEARCH INSTITUTE
MENLO PARK, CALIFORNIA

"The LINC-8 will be used by the Bioinformation Systems Group of the Control Systems Laboratory at Stanford Research Institute.

Members of this group are currently working in a variety of areas concerning the sensory systems of both human and subhuman organisms. For example, tactile perception has been explored by presenting air puffs to different sections of subjects' fingertips and analyzing the accuracy of the subjects' reports. This type of experiment previously had been run by a CDC 8090 computer. The computer timed the experiment, presented the stimuli, and analyzed the data. A specially built rack was designed to connect to the computer; this rack actually presented the stimuli to the subjects. It is hoped that the faster cycle speed of the LINC-8 will provide more flexibility in designing experiments in this field.

The LINC-8 will also be used in various vision experiments. On-line tracking experiments, for example, will be planned where the subjects' performance will be analyzed while the experiment is in progress. Here, especially, we are hoping that the speed of the LINC-8 will expand the possibilities of experimentation. Visual reaction time experiments are also being planned. Previously we had difficulty in running an experiment in which the computer was to measure reaction time as well as distinguish voluntary from involuntary eye movements, for our computer was not fast enough to do this while the experiment was in progress.

In the area of neurophysiology we are investigating the optomotor response in invertebrates. The computer will play a large role in this investigation. We intend to use an analog-to-digital transformer to enter nerve-signal data into the computer and then to have the data analyzed in various ways. The scope attachment to the computer will be used to display the results of the analyses, and these results will be photographed. Previously we had to plot all of the results by hand."

James C. Bliss

NOTE: Applications here were quoted from letters sent to Mr. Stephen Bowers, Product Information Manager of Digital Equipment Corporation, with permission of the authors.

PDP-8 Plays Major Role In Teaching Program

An ambitious teaching program, designed to provide every boy in a 215-member student body with a basic knowledge of computer operation and programming, has been successfully conducted at the Pomfret School in Connecticut with the assistance of a newly acquired PDP-8 computer.

PDP-8 Part of Curriculum

The PDP-8 was installed at the private high school last August. According to William Hrasky, chairman of the school's Science Department, the PDP-8 was "treated like another teacher, and computer time was woven into the curriculum. Assignments were given in all the science and math courses to be carried out on the computer. Not just computer exercises," he emphasized, "but problems teachers would have ordinarily hesitated to assign because of the amount of time required. Our objective was to give every boy a thorough knowledge of computer techniques by the time he graduated. We believe such a program to be unique in this scholastic level." He added that students were also encouraged to use the system as part of their extracurricular work.

When Pomfret's program began, only five or six boys in the school had any knowledge of computer operation. They consisted mostly of seniors who developed their interest during various phases of summer employment and extracurricular courses held informally every year.

Thirty-four physics students were selected for the initial training program. Their qualifications consisted of two years of science and one year of algebra and geometry. A week (six class meetings) was taken from the physics schedule and devoted to instruction on computer fundamentals, programming techniques, and FORTRAN. The students were then given a qualifying problem and "turned loose on the computer."

As a final and qualifying assignment, the students were asked to program the solution (the value of X) of the quadratic equation, $AX^2 + BX + C = 0$, for all possible values of A, B, and C. This program was considered a quiz, and students were marked according to program success.

The boys were left on their own with little help or guidance from an instructor. When allowed free acess to the computer, students derived more knowledge and skill as well as insight into the problems.

Mr. Hrasky stated that much of the time on the computer had been inefficiently used; however, allowing the boys to solve their own problems with their own program turned out to be a better teaching method than course demonstration. Although Symbolic Editor software had not been discussed, the boys soon learned about it and quickly achieved a skill in using it to correct symbolic tapes.

FORTRAN Programming

The week of instruction was based on Digital's PDP-8 FORTRAN Programming Manual. Input/output statements were covered early in the course to facilitate time actually spent programming problems which would be run on the computer for demonstration. Both programming techniques and machine operation procedure were covered during a single class period. Time economy was achieved by reading in the FORTRAN Compiler prior to class time. Regular assignments on programming which stressed the newly introduced FORTRAN statements were assigned each day.

Working Programs in Two Weeks

Two weeks after the course ended, 28 of the 34 original boys had developed a working program for the quadratic equation. Using the approach developed with the first training group, over 90% of the school was given a short computer course according to their level of mathematical maturity and were considered trained by Christmas. In the future, each new freshman class will be indoctrinated in the program.

The biggest problem the school encountered was in finding computer time for instructors to prepare programs and check-out student programs. The computer course became almost as important as football to the students, and they used the computer at every opportunity. At the present time, the students are working on programs dealing with such topics as electronic circuit analysis, a new triple precision floating point package, and refraction of light in the atmosphere. Some of the boys are already programming with the MACRO-8 assembly language, as well as using the CALCULATOR system for homework and laboratory calculations.

Invite Other Users

Pomfret hopes to expand its program, and plans are currently under way to move the PDP-8 from its present location (a small science lab) to a larger room designed as a computer lab-classroom complex. The school also hopes to initiate a program in which other secondary schools in the area without computer facilities will be able to use Pomfret's computer for similar training ventures.

The PDP-8 at Pomfret includes 4096 words of core memory, two keyboard printers, reader-punch, eight auto-index registers, an analog-to-digital converter, program interrupt, data break, and indirect addressing.

NEWS ITEMS

TAPES OF FALL '66 SYMPOSIUM

Tapes of the recording made of the presentations at the DECUS Fall Symposium at Lawrence Radiation Laboratory, Berkeley, are available and copies may be obtained from:

Mr. Anthony Schaeffer
Lawrence Radiation Laboratory
Building 50A, Room 1119
Berkeley, California 94720

FALL '66 PROCEEDINGS

DECUS Fall Symposium

The proceedings of the DECUS Fall Symposium have been distributed to all delegate members. Individual members and non-members may obtain copies by writing the DECUS office, attention: Executive Secretary.

Second European Seminar

Proceedings of the Second European DECUS Seminar are also available from the DECUS Office upon request.

NEW DECUS BROCHURES

New brochures describing DECUS and its activities have been printed. These brochures serve as an introduction to the users group and will be sent to new users of DEC equipment. Anyone interested in obtaining copies of the brochure should contact the Executive Secretary.

DECUS STATISTICS FOR YEAR 1966

Below are the statistics of DECUS activity for the year 1966 and a comparison to 1965:

MEMBERSHIP	YEAR	AMOUNT
Number of members:	1966	850 (385 delegates, 465 individual)
	1965	426 (211 delegates, 215 individual)
DECUSCOPE		
Circulation at end of year:	1966	1,975
	1965	1,400
Number of individuals on mailing list at end of year:	1966	1,010
	1965	575
PROGRAM LIBRARY		
Number of programs submitted:	1966	58
	1965	44
Total number of programs in DECUS Library:	1966	198
Programs issued to requestors:	1966	1,692
	1965	644
Number of program tapes involved in completing requests:	1966	3,460
	1965	1,735
PROCEEDINGS ISSUED		
Spring and Fall issues:	1966	2,000
European:	1966	450 (Approx. 400 by DEC in Reading)
	1965	900 (Approx.)

NEWS ITEM

A paper titled On-Line Computers for Nuclear Research given by J. A. Jones, DEC, at the 13th Nuclear Science Symposium (IEEE) has also been printed in the January issue of Nucleonics.

Preprints of the paper are available from the DECUS office.

WANTED

DOUBLE PRECISION DIVIDE FOR PDP-8

We would appreciate any information as to the availability of a 48-bit by 24-bit Double Precision Divide Routine for a PDP-8 which includes the 182 Extended Arithmetic Element.

L. P. Goodstein
AEK Research Establishment
RISOE
Roskilde
DENMARK

NEW LITERATURE AVAILABLE

The following Option Bulletins have been issued and are available from DEC sales offices:

PHA Interface Bulletin
PHA Interface Types and Descriptions
Analog to Digital Converter Type AD8S
PT08 Teletype Control

CONSOLE MANUAL FOR PDP-8
(DEC 08-NGCA-D)

A quick-reference document with pertinent facts on PDP-8 software, such as Loaders, Editors, Assemblers, DDT FORTRAN, subroutines and operational information.

This will be a handy document for PDP-8 users to keep at the console and will save considerable time normally spent in thumbing through larger manuals.

New PDP-8 and 8/S users will receive a copy upon delivery of their computer. Present 8 users may request a copy from the DECUS office.

Programs Available From Authors

Computer: PDP-5, -8, -8/S

Title: Double Precision Binary Coded Decimal Arithmetic Package

Available from: Richard M. Merrill
Digital Equipment Corporation
Maynard, Massachusetts 01754

Consists of the following routines:

BCDADD - The single precision BCD addition routine is the basic component of the BCD arithmetic package. This routine functions simply by masking out and adding together corresponding BCD digits (i.e., four bits) and checking for carry (i.e., when the sum of two four-bit numbers is greater than 9(1001)).

MPYBCD - This routine multiplies a single precision (three digit) number times a double precision one to produce another double precision number. Overflow is indicated in the link; the arguments are not affected.

SUBBCD - One double precision BCD number is subtracted from a second by this routine. It uses a 9's complement routine and the double precision add routine.

DOLOUT - special formats: ("$XXXX·YY ") ; ("XXXXXX "); (3-non printing data codes); ("XXX ").

Computer: PDP-8

Programs listed below are available from:

Dr. I. E. Bush
Worcester Foundation for
Experimental Biology
Shrewsbury, Massachusetts 01545

Exponential Decay Curves

This program carries out the common laboratory procedure of constructing a semi-log plot from data consisting of changes in concentration (or another intensive parameter in an experiment) over time. The program will handle up to ten pairs of values (of time and the dependent variable) and outputs the slope, the standard error of the slope of the linear regression by least squares of the semi-log plot, the intercept and standard error of same, residual sum of squares of deviations, the standard error of the estimate, and the half time and its standard error. Up to 2047 sets of data can be handled by the program. Execution time after reading in the data is approximately 36 seconds per set.

This is an extremely common laboratory calculation in a very wide range of fields and is an adaptation of the general linear regression program.

Student's T-Test

This program will take in two sets of variables and outputs the mean and standard deviation of each group, the combined standard deviation, and the value of student's T. Each group can consist of up to 40 variables and this number need not be the same for both groups. Execution time after reading in the data is approximately 20 seconds.

Calculation of Chromatogram Data

Input to this program consists of the distance moved by a substance on a paper or other form of thin-media chromotogram, the distance moved by the solvent front or a standard substance whose R_f value (distance moved by substance/distance moved by solvent front) is known, and outputs the R_f value and the R_m value. (The R_m value is a useful function of R_f which, within limitations, is a linear additive function of the partial R_m contribution of the constituent groups of the molecule of the substance.) The R_m values are stored (up to 500) and can then be manipulated by two other sections of the program so as to derive ΔR_m values. (e.g., The ΔR_m values of particular functional groups in the molecule, or those caused by making more complex changes in the molecule.) A special feature of the program is that each section of the program and the arithmetic calculations within each section are called by two simple code numbers. This means that any number can be used in title headings and in the names of chemical substances. This is of considerable convenience in formatting chemical input of this sort. Execution time is negligible.

Chromatogram Peak Calculations

A program based on the vector storage program for regression. The program will take in typical data from chromatogram records for up to five standard substances, calculate the best regression coefficient for the calibration curves and their standard errors, followed by the confidence limits of the estimate for each quantity of standard that was used. The sums of the squares of residuals and the deviations of X are also printed out for inspection and further use if necessary. It will then take in the data from unkown chromatograms, the data for each peak being preceeded by the index number corresponding to the particular standard to be used for calibration, calculate the area of the peak, and estimate the quantity and standard error of that quantity.

General Linear Regression

Carries out conventional least-squares calculation and outputs, slope, SE of slope, intercept, SE of intercept, sum of weights, sums of squares of deviations and products of deviations, means of X and Y, sum of squares of residuals, and correlation coefficient. It takes in two limits of X, a dummy (1.0 for standard errors, the appropriate value of student's T for per cent confidence limits) and a number. It then prints out a table of X,Y calculated from the regression coefficients, and the error or confidence limits for Y at each particular X over the range specified by the limits of X and intervals determined by the last number.

This program is designed so that it can be "fitted" with a variety of input conversions and weighting functions in symbolic form (e.g., semi-log conversion for analysis of exponentional decay curves); is provided with three potential useful weighting functions and is set by an intercept number in the input to handle either the general case or the special case where the regression is known to pass through 0,0. It is particularly useful for plotting calibration curves.

With Storage

This program is based upon General Linear Regression, but stores the pairs of X and Y of the data in a vector limited to ten pairs (capable of modification without too much difficulty). This enables a more precise calculation of sums of squares of deviations, etc., but has a smaller range of uses than General Linear Regression.

Enzyme Kinetics

The above program has been fitted with input and output sections which provide for the intake of raw data from typical enzyme kinetic experiments with print-out of the transformed variables for velocity and substrate concentration. By inserting an index figure in the data, it will derive and print out K_m and V_{max} and their standard errors in the form of a Lineweaver-Burk plot (1/v versus 1/c) in the form of an Eadie plot (V versus v/c) or will carry out both in succession. The input format is designed for typical experiments using optical density changes, but by the insertion of an appropriate constant can also be used for gasometric or other methods without modification of the program.

Computer: LINC-8

Title: LINC-8 Multianalyzer
(Adapted to the LINC-8 from the Pulse Height Analysis Program - J-5260)

Author: Richard M. Merrill
Digital Equipment Corporation
Maynard, Massachusetts 01754

The analysis facilities for high-speed data input and display have been adapted to the LINC-8 computer and several extra features have been added.

The basic program allows display of a complete three-dimensional data matrix as a 2D projection or as a contour display. Vertical or horizontal cross-sections of the data may also be displayed. The third basic mode, the Twinkle Display, shows dynamically the X and Y coordinates of only the current data points.

Additional features: (All numbers indicated below are octal.)

I. Display
   a. Histograms (including three-dimensional histograms) may be plotted as an option via sense switch zero.

   b. The data matrix is 100 x 53; the Twinkle Display is 100 x 100.

   c. For one-dimensional analysis, the X or Y coordinate may be changed via a control knob for selection of the data region. (Max: 53 (Y) sets of 100 (X) values of Z.)

II. Z-Coordinate
   a. The Z-coordinate may also be an analog signal instead of a count.

   b. X, Y, or Z coordinates may be taken from any of 16 built-in A-D converters. The value of Z for a given X, Y will be the last one taken.

   c. If the signal to noise ratio is small, then Z may be taken as a running average over 2^N samples; plus N is read from the left switches.

III. Miscellaneous
   a. A built-in variable timer is used and may be calibrated.

   b. Qualitative audio indications of $\pm X$ and $\pm Z$ are available.

   c. The LINC-8 Library System and data storage via DECtape may be used.

DECUS PROGRAM LIBRARY

PDP-5/8 PROGRAM LIBRARY ADDITIONS

DECUS No. 5/8-54

Title: Tic-Tac-Toe Learning Program - T^3

Author: Michael Green, Stevens Institute of Technology, Hoboken, New Jersey

Source Language: FORTRAN and PAL II

This program plays Tic-Tac-Toe basing its moves on stored descriptions of previously lost games. The main program is written in FORTRAN. There is a short subroutine written in PAL II used to print out the Tic-Tac-Toe board. The program comes already educated with about 32 lost games stored.

Minimum Hardware:	4K PDP-5/8, ASR 33
Other Programs Needed:	FORTRAN Object Time System
Storage Requirement:	$0001\text{-}7577_8$ (Including Object Time System)

DECUS No. 5/8-55

Title: PALEX, An On-Line Debugging Program for PDP-5 and PDP-8

Author: Robert I. Berger, Bell Telephone Laboratories, Inc., Holmdel, New York

One problem with programs written in Program Assembly Language (PAL) for operation on a PDP-5/8 computer is the danger of an untested program being self-destructive, running wild, or destroying other programs residing in memory such as loading programs. PALEX prevents any of the above unwanted operations from occurring while it gives the operator/programmer valuable debugging information and enables him to make changes in his program and test the modified program. Once running, PALEX cannot be destroyed by any program or instruction in memory, the operator need not touch any manual console controls, and all required information is printed in easy-to-read format on the Teletype console.

Minimum Hardware:	1K or 4K memory
Storage Requirement:	Four pages
Execution Time:	90 times instruction time

DECUS No. 5/8-56

Title: Fixed Point Trace No. 1

Author: B. J. Biavati, Columbia University, New York, New York

A minimum-size monitor program which executes the users' program one instruction at a time and reports the contents of the program counter, the octal instruction, the contents of the accumulator and link, and the contents of the effective address by means of the ASR-33 Teletype.

Since this program is of minimum size (two pages of memory), virtually no decisions can be made by it and once the trace mode is initiated, it will continue until the computer is stopped or a HLT instruction is encountered in the user's program.

The symbolic tape provided has a single origin setting instruction (6400). Any two consecutive pages of memory can be used, with the exception of page zero, by changing this one instruction.

DECUS No. 8-57

Title: Fixed Point Trace No. 2

Author: B. J. Biavati, Columbia University New York, New York

Similar to Fixed Point No. 2 except that the symbolic tape provided has a single origin setting instruction of (6000). Any four consecutive memory pages can be used, with the exception of page zero, by changing this one instruction.

DECUS No. 8-58

Title: One-Page DECtape Routines

Author: George Friedman, M. I. T. Cambridge, Massachusetts

A general-purpose program for reading, writing, and searching of magnetic tape. This program was written for the Type 552 Control. It has many advantages over both the standard DEC routines and also over DECUS No. 5-40. The routines are one page long and can be operated with the interrupt on or off. The DEC program delays the calling program while waiting for the unit and movement delays to time-out, this routine returns control to the calling program. This saves one-quarter second every time the tape searches forward and half that time when it reverses. In addition, it will read and write block 0.

This program is an advantage over the previous one-page routines in that it allows interrupt operation, doesn't overflow by one location, interrupts the end zone correctly and not as an error, and provides a calling sequence identical to the DEC program.

DECUS No. 8-59

Title: PALDT - PAL Modified for DECtape

Author: George Friedman, M. I. T. Cambridge, Massachusetts

When assembling programs, PALDT requires that the symbolic tape be read in only once. The program writes on the library tape itself after finding the next available block from the directory. During pass 0 the tape is read in using the entire user's symbol table. During passes 1, 2, 3 as much of the symbol table is used as possible. This means the fewest tape passes as possible. As an added advantage, pass 0 ignores blank tape, leader-trailer, line feeds, form feeds, and rub outs, saving space. The whole program decreases the users symbol table by only three pages: one for the DECtape program above, one for pass 0, and one for the minimal length read-in buffer.

DECUS No. 8-60

Title: Square Root Function by Subtraction Reduction

Author: George Friedman, M. I. T. Cambridge, Massachusetts

A single precision square root routine using EAE. This routine is usually faster than DEC routine and can easily be modified for double precision calculations at only twice the computation time.

DECUS No. 8-61

Title: Improvement to Digital 8-9-F Square Root

Author: George Friedman, M. I. T. Cambridge, Massachusetts

An improved version of the DEC Single Precision Square Root Routine (without EAE). Saves a few words of storage, and execution is speeded up 12 per cent.

PDP-6 PROGRAM LIBRARY ADDITIONS

DECUS No. 6-6

Title: DTADIR

Author: I. D. Pugsley, University of Western Australia, Nedlands, Western Australia

DTADIR is a 1K program which may manipulate DECtape directories. The program may perform several functions:

- Zeroize a DECtape directory.
- List a DECtape directory.
- Save a DECtape directory as a file.
- Get a saved file and write-up as a DECtape directory.

DECUS No. 6-7

Title: DTALST Alias PIP3

Author: I. D. Pugsley, University of Western Australia, Nedlands, Western Australia

DTALST is a program for listing DECtape data with minimal processing. Output format is controlled by switches included in the command string. DTALST can be used for:

Debugging programs with DECtape output,
Reading data with parity errors on the tape,
Teaching, and
General program listing.

DECUS No. 6-8

Title: BELL STAR

Author: C. B. Horan, University of Western Australia, Nedlands, Western Australia

This program contains two subroutines. These operate in the DDT submode on the user's TTY. Bell outputs two teletype bells. Star outputs a carriage return and an asterisk, thus enabling FORTRAN programs to be written to accept input in the standard CUSP command manner.

DECUS No. 6-9

Title: LININV

Author: D.W.G. Moore, University of Western Australia, Nedlands, Western Australia

This routine is a matrix inversion and/or linear equation solver. All I/O is from the user's teletype. The routine is self-explanatory on starting.

Subroutines Needed: STAR, MATIN1, MINLIB

DECUS No. 6-10

Title: DATE

Author: I. D. Pugsley, University of Western Australia, Nedlands, Western Australia

Source Language: MACRO

Returns today's date in form suitable for output from a FORTRAN program.

DECUS No. 6-11

Title: MATINV

Submitted By: University of Western Australia, Nedlands, Western Australia

Gauss-Jordan Total Pivotal Elimination Subroutine for matrix inversion, solution of linear equations with multiple right-hand sides, and determinant evaluation.

DECUS No. 6-12

Title: PDP-8 Assembler for Use on PDP-6

Author: Henry Burkhardt, Digital Equipment Corporation, Maynard, Massachusetts

This program will assemble PDP-8 programs written in PAL on a PDP-6 using any I/O devices.

NOTE: Please send in a DECtape when requesting DECUS programs which are supplied on DECtape. Your request will be processed quicker.

PDP-7 PROGRAM LIBRARY ADDITIONS

DECUS No. 7-17

This program was inadvertently omitted from the announcement of new programs in DECUSCOPE, Vol. 5, No. 6.

Title: CREASE

Author: Philip R. Bevington, Stanford University, Stanford, California

CREASE is a program written in symbolic language for the PDP-4/7 to control a card reader for card-to-paper tape transfers of FORTRAN programs, symbolic programs, and data decks. It has provisions for translating common card notations for FORTRAN source programs. The program is written for use with an NCR reader, but may be easily modified for other readers.

DECUS No. 7-26

Title: Normalize Instruction Test

Author: R. Law, Foxboro Company, Foxboro, Massachusetts

This program lacs a number, puts it in the MQ, normalizes the number, returns the number to original form, then checks it against the original number. If ok, increments the number and repeats the process. If in error, the original number and normalized-un-normalized numbers are printed out. It checks all numbers 1-37777. It also checks certain rotate hardware not tested in any maindeck program.

Minimum Hardware:	PDP-4 or 7 with EAE and Mod 28 or 35 teleprinter
Storage Requirement:	Locations 20 through 475

NEW DECUS MEMBERS

PDP- 4 DELEGATE

John F. Buckley
Wheeling Steel Corporation
Wheeling, West Virginia
(Replaces James C. Taliano)

PDP-5 DELEGATES

Theodore Bowen
University of Arizona
Department of Physics
Tucson, Arizona

B. A. Bowen
Nova Scotia Technical College
Hallifax, Nova Scotia

PDP-6 DELEGATE

Jonathan A. Singer
Artificial Intelligence Project
Stanford University
Stanford, California

PDP-7 DELEGATES

K. W. Bixby (PDP-7 and 9)
Aeronutronic Division
Philco-Ford Corporation
Newport Beach, California

Dr. G. I. Crawford
University of Glasgow
Department of Natural Philosophy
Glasgow, Scotland

William S. Jewell
College of Engineering
University of California
Berkeley, California

John R. Kosorok
Battelle-Northwest
Richland, Washington

PDP-8 DELEGATES

Laverne O. Amunds
Atomic Energy of Canada Ltd.
Design Engineering Division
Chalk River, Ontario Canada

G. R. Andrews
Canadian General Electric Co. Ltd.
Atomic Power Department
Peterborough, Ontario Canada

E. W. Blackmore
University of British Columbia
Physics Department
Vancouver 8, B.C. Canada

D. H. Bundy
E G & G
Las Vegas, Nevada

R. Frank Castorf
National Research Council
Division of Pure Physics
Ottawa 2, Ontario Canada

D. E. Damouth
Xerox Corporation
Rochester, New York

R. W. P. Drever
Department of Natural Philosophy
Glasgow University
Glasgow, W. 2., Scotland

Donald L. Frazer
Lawrence Radiation Laboratory
General Chemistry Division
Livermore, California

Donald A. George
Carleton University
Faculty of Engineering
Ottawa, Canada

David E. Lawrence
Oxford University
Department of Nuclear Physics
Oxford, England

George Lauer
North American Aviation Science Center
Thousand Oaks, California

PDP-8 DELEGATES (Continued)

George E. MacDonald
Medusa Portland Cement Company
Cleveland, Ohio

E. J. C. Read
Physics Department
University of Liverpool
Liverpool 3, England

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Parsippany, New York

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Columbia University
Nevis Laboratory
Irvington-on-Hudson, New York

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RCA Victor Aerospace
Montreal, Canada

J. R. Wormald
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PDP-8/S DELEGATE

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Department of Physiology
University of Virginia Medical School
Charlottesville, Virginia

LINC-8 DELEGATE

Professor Dr. med. W. D. Keidel
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Universitat Erlangen
852 Erlangen, West Germany

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Manchester University
Manchester, England

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Dept. of Communication
Keele University
Keele, Straffordshire, England

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Department of Physics
University of Arizona
Tucson, Arizona

V6 N1

"LETTERS"

Letters of general interest will be published as a standard insert to each issue of DECUSCOPE. Letters written between users, to DEC personnel, and to the DECUS office will be included. Submissions to this section, "Letters Insert," should be sent to: Angela J. Cossette, DECUS Executive Secretary, DECUS, Maynard, Massachusetts 01754.

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY

TRINITY COLLEGE
HARTFORD 6, CONNECTICUT

DEPARTMENT OF ENGINEERING

February 3, 1967

Mrs. Angela J. Cassette
Digital Equipment Computer Users Society
Main Street
Maynard, Massachusetts 01754

Dear Mrs. Cassette,

I am sending you two items that may be of interest for publication in DECUS, or for discussion at the Spring Symposium.

* The first involves a program modification one of our students worked up that allows the PDP-8 Fortran compiler to read source tape through the high-speed reader, and punch on the ASR 33. This program is loaded in over the compiler. We have punched it on an extension of the compiler tape so that by depressing the CONTINUE key it is read in immediatly following the compiler. We have found it to cut compiling time in half. No cases of improper compilation have arisen as yet because of this change.

**The second item is a short paper I have written primarily for my colleagues in biology, psychology, and economics who are interested in statistics. The results I have obtained can be compared to similar ones published for the IBM 7094. This paper shows well the effectiveness of the Fortran system for the PDP-8. Furthermore a little-known algorithm is presented which has superior computation properties over standard methods for computing standard deviations. You have my permission to publish this. I shall be glad to edit it as necessary.

I would be willing to participate in discussion sessions regarding the use of the PDP-8 as Fortran computer at the Spring Symposium if there is interest in this. Our use is nearly 100% Fortran, primarily for teaching undergraduates. We have found the 8 to be an excellent machine for this, and are quite enthusiastic about it.

Sincerely yours,

A E Sapega

August E. Sapega,
Assoc. Professor

Editor's Note: * Entered into the DECUS Library as DECUS No. 8-62
** To be published in the next issue of DECUSCOPE.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LABORATORY FOR NUCLEAR SCIENCE
CAMBRIDGE, MASSACHUSETTS 02139

Massachusetts Institute of Technology
575 Technology Square
4th floor - Bldg. Alpha
Cambridge, Mass. 02139 U. S. A.

February 8, 1967

Mrs. A. J. Cossette
DECUS
Maynard, Mass.

Dear Angela,

At the last two DECUS Symposia, discussion sessions were organized for PDP-6 users. On both occasions these sessions were quite profitable. I would like to suggest another PDP-6 Discussion Session at the Spring Symposium. With the large number of PDP-6 installations in the East, there should be considerable interest in such a meeting. I would be happy to receive suggestions of topics for discussion, and I look forward to another interesting session.

Best regards,

Dave Friesen

Dave Friesen

DF/re

GENERAL DYNAMICS
Convair Division

Lindbergh Field Plant, P. O. Box 1950, San Diego, California 92112 · 714-296-6611
M/Z 506-50 LF

16 December 1966

Mrs. Angela J. Cossette
DECUS Executive Secretary
Digital Equipment Corp.
Maynard, Mass. 01754

Dear Angela:

Thank you for sending the list of oceanographic-application DECUS members. As I indicated to you in Berkeley, a workshop for these members at the next DECUS meeting should be mutually beneficial, and of especial interest to me.

Enclosed find a request form for specified library programs.

In reviewing my DECUS literature, I cannot find the "Abstract of Programs". I have the "Addendum No. 1 Abstracts". I do not recall ever having received the original DECUS binder.

I recently found a bug in the multiply subroutine 8-11-F. The symbolic tape contains a "JMP MPSN-2" at location MPA-6. This results in a nonzero product for a multiplication of a negative value by zero. It should be corrected to "JMP MPSN+2". Perhaps you could pass this along to the proper individual at DEC.

Best regards,

Ted

Ted R. Shelor

TRS:dek

DECUSCOPE

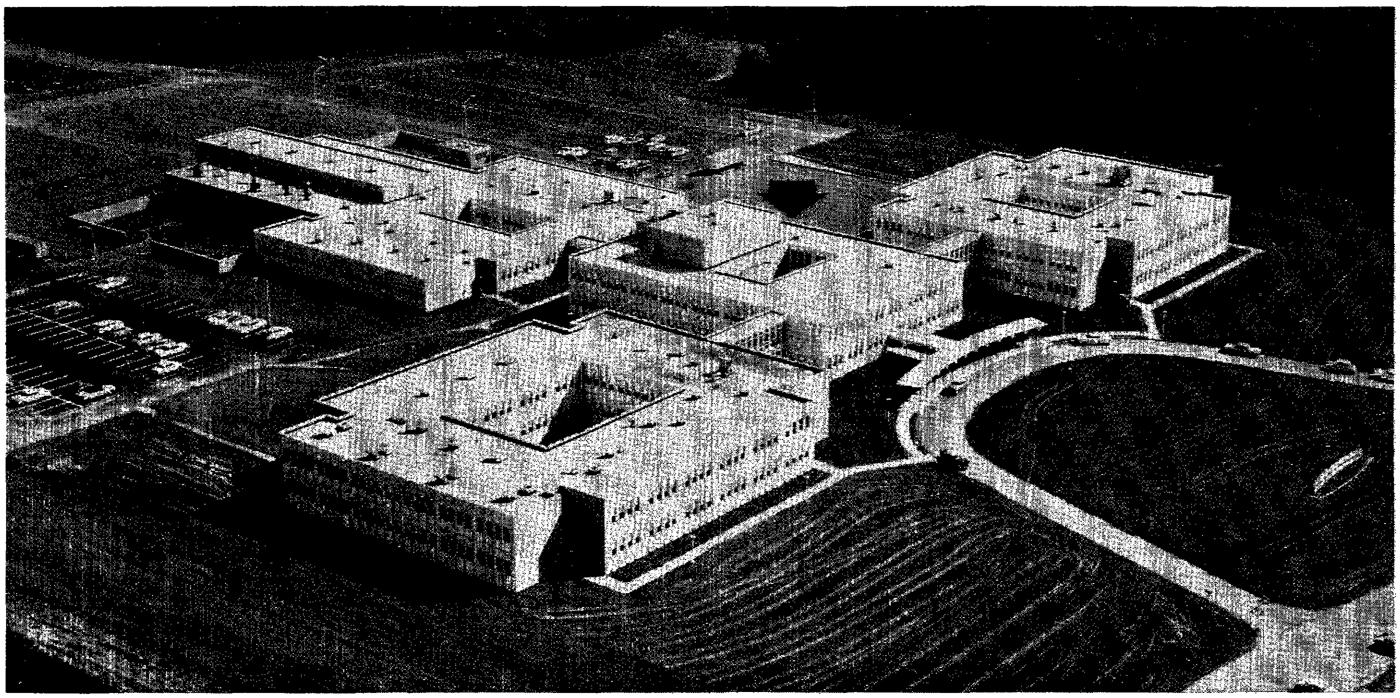
DIGITAL EQUIPMENT COMPUTER USERS SOCIETY

1967
Vol. 6 No. 2
Special Meeting Issue

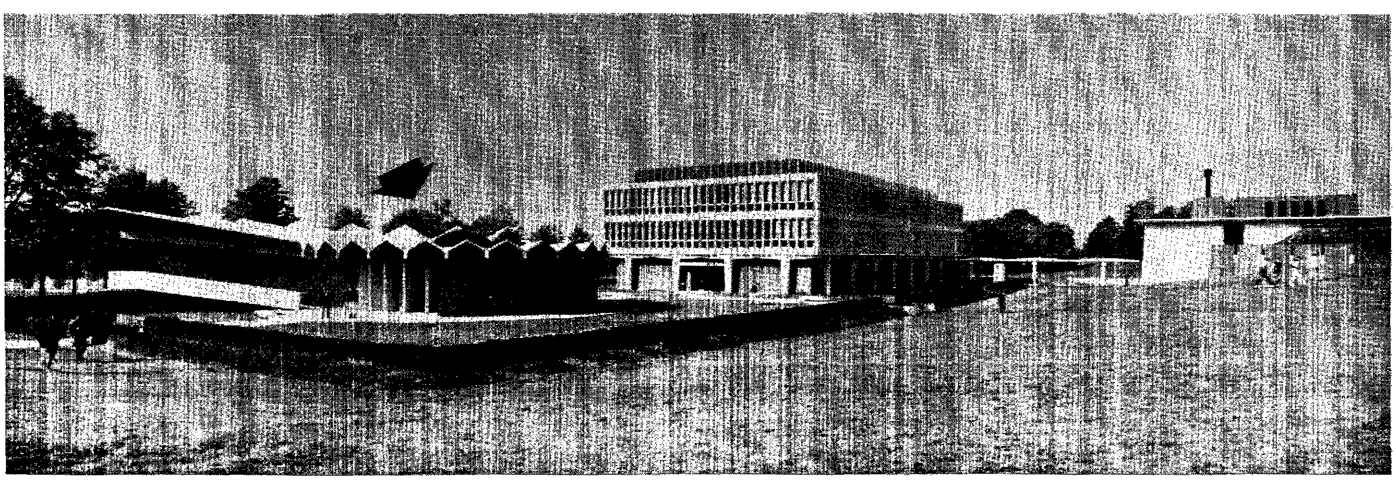
DECUS SPRING SYMPOSIUM

Rutgers University

April 14, 15, 1967



RUTGERS ENGINEERING CENTER - FRIDAY'S SESSIONS



RUTGERS PHYSICS COMPLEX - SATURDAY'S SESSIONS

DECUS KEYNOTE SPEAKER

Ivan E. Sutherland

Keynote speaker at the Spring DECUS Meeting will be Ivan E. Sutherland, Associate Professor of Electrical Engineering at Harvard University. Dr. Sutherland was formerly associated with MIT Lincoln Laboratory as an employee and consultant. His thesis "Sketchpad, A Man Machine Graphical Communication System" was completed with the help of the Lincoln Laboratory TX-2 computer.

After leaving MIT, Dr. Sutherland served in the U. S. Army Signal Corps where he had a number of engineering and research assignments. During this period, he specified a special display system for research applications. The "subroutining" feature of the DEC 340 display is a direct result of this work.

From 1964 to August, 1966, Dr. Sutherland served as Director for Information Processing Techniques at the Advanced Research Projects Agency of the Department of Defense. Dr. Sutherland was responsible for formulating, managing, and defending a $17 million a year program of advanced computer research. This program, one of the Government's largest, has achieved considerable respect as the leading computer research program now under way.

Dr. Sutherland came to Harvard as Associate Professor of Electrical Engineering in September, 1966. At Harvard, he is pursuing research aimed at making computers better able to bring understanding to people through pictures. He is a member of IEEE, ASME, and ACM.

Dr. Sutherland received his B.M. in Electrical Engineering at Carnegie Institute of Technology, M.S. in Electrical Engineering at California Institute of Technology and his Ph.D. in Electrical Engineering at Massachusetts Institute of Technology.

AGENDA

Friday - April 14

8:30 - 9:50	Registration - Lobby of Engineering Building, University Heights Campus
10:00	Opening - Professor Donald A. Molony, Chairman Welcome - Professor J. L. Potter, Chairman, Department of Electrical Engineering, Rutgers University
10:15	Review of Display Activity - Representative from Digital Equipment Corporation, Display Marketing Department
10:30	Software Support for a PDP-4/340 Display Configuration H. Quintin Foster, Jr., Department of Defense
11:00	Displays for Studying Signal Detection and Pattern Recognition Taylor L. Booth, Robert Glorioso, Robert Levy, James Walter, and Herbert Kaufman University of Connecticut
11:30	Coffee
11:45	A Status Report on the Application of Processor Controlled Color Displays in Signal Analysis - 1957 to 1967 Charlton M. Walter, Air Force Cambridge Research Laboratories
12:30	Systems Analysis of DEC 338 Programmed Buffered Display Stephen F. Lundstrom, University of Michigan
1:15	Lunch - University Commons Faculty Dining Room
2:30	Graphic Part Programming for Numerical Control Machine Tools James A. Snow, The Boeing Company
3:10	Enhancements to a Time-Shared Operating System R. N. Freedman, Massachusetts Institute of Technology

3:40	The Computer Display in a Time-Sharing Environment Thomas P. Skinner, Massachusetts Institute of Technology, Project MAC
4:10	X-Y Graph Production and Manipulation J. W. Brackett and R. Kaplow, Massachusetts Institute of Technology
4:45	Discussion Sessions Computer-Aided Design PDP-6 General Discussion Session
6:30	Cocktail Hour* - Brunswick Inn
7:30	Dinner* - Brunswick Inn

*Guests are welcome. Please notify secretary at registration desk that you will be bringing a guest and also of their meal choice if attending the Dinner.

Saturday - April 15

9:00 - 9:30	Registration (for those who did not register on Friday)
9:30	Opening - Saturday Session
9:35	Guest Speaker - Ivan E. Sutherland, Harvard University
10:00	Image Processing of Biological Specimens Stephen Lorch, Mass. General Hospital
10:30	High Precision CRT Scanning System C. A. Bordner, Jr., A. E. Brenner, P. de Bruyne, B. J. Reuter, and D. Rudnick, Harvard University
11:00	Coffee
11:15	An Electronic Speech Recognition System Morton M. Traum and Edward Della Torre, American Radiator and Standard Sanitary Corporation
11:45	General Procedures for Accomplishing Efficient Display Software J. Richard Wright, Wolf Research and Development Corporation
12:15	Lunch - University Commons Faculty Dining Room
1:30	TRACD - An Experimental Display Programming Language Barry Wessler, Digital Equipment Corporation and M. I. T.
2:00	HELP - An Integrated Display System for Program Development D. Friesen and J. Taylor, Massachusetts Institute of Technology
2:30	Displaying the Characteristics of Speech with a PDP-8 Morton M. Traum and Edward Della Torre, American Radiator and Standard Sanitary Corporation
3:00	Coffee
3:15	Discussion Sessions Topics to be Announced. (See Registration Form for suggested sessions.)

Tours and Demonstrations

Physics Department, Rutgers - PDP-6

Applied Data Research Corporation
Princeton, New Jersey
PDP-7, PDP-8, and 338 Display

Applied Logic Corporation - PDP-6 and 340 Display
Princeton, New Jersey

Transportation to Princeton will be provided.

NOTE: All new members who were notified that their names would be published in Vol. 6, No. 2, will have them published in Vol. 6, No. 3, because this issue is a special meeting issue.

ABSTRACTS

SOFTWARE SUPPORT FOR A PDP-4/340 DISPLAY CONFIGURATION

H. Quintin Foster, Jr.
Department of Defense
Fort George G. Meade, Maryland

This paper will discuss a library structure on a PDP-4 modified 340 display configuration. The library consists of two parts: an absolute library of service routines for the user and a relocatable library of subroutines for the PDP-4 and the 340. The power of MIDAS, an assembly language, will show how the relocatable library was made possible. The method of editing both sections of the library will be discussed.

A movie will attempt to demonstrate the method of retrieving programs from both sections of the library and the use of some of the service routines.

SYSTEMS ANALYSIS OF DEC 338 PROGRAMMED BUFFERED DISPLAY

Stephen F. Lundstrom
University of Michigan
Ann Arbor, Michigan

A semi-Markov chain model of the major states of the DEC 338 Programmed Buffered Display is developed. The use of the model in determining best policies for graphics programming is described. In addition, the means for use of the model for comparison of effectiveness of various deflection logic hardware configurations is developed.

A PDP-8 Simulator on the PDP-7, which provides a supporting role in gathering statistics on 338 programs, is presented and discussed.

THE COMPUTER DISPLAY IN A TIME-SHARING ENVIRONMENT

Thomas P. Skinner
Massachusetts Institute of Technology
Cambridge, Massachusetts

Current trends in the computer field seem to indicate that in the future we will have very sophisticated graphical display consoles and much more powerful time-sharing systems. This paper discusses the numerous basic display configurations that are possible in a time-sharing environment. The display console itself, as well as the various communications systems available, are integrated in the discussion of possible software systems. Finally, a system is discussed which is a preliminary attempt at developing a terminal using the DEC 338 Display Computer connected to the MULTICS Time-Sharing System now in development at Project MAC. Connection is made by means of a 2400-bit per second full duplex dataphone.

DISPLAYS FOR STUDYING SIGNAL DETECTION AND PATTERN RECOGNITION

T. Booth, R. Glorioso, R. Levy, J. Walter, and H. Kaufman
University of Connecticut
Storrs, Connecticut

The use of a unique computer-controlled (PDP-5) CRT display system with light pen facility in the study of a wide range of signal detection and pattern recognition problems is described.

The displays used to study the capabilities of the human operator to detect signals embedded in noise are described and illustrated. In addition to illustrating displays to study the effects of various signal and display parameters, pre-processing and real-time, operator-directed (via light pen) processing are also shown.

The use of this system for tachistoscopic stimulus presentations to study basic human information processing capacities is also described.

A STATUS REPORT ON THE APPLICATION OF PROCESSOR-CONTROLLED COLOR DISPLAYS IN SIGNAL ANALYSIS - 1957 to 1967

Charlton M. Walter
Air Force Cambridge Research Laboratories
Bedford, Massachusetts

The use of a processor-driven color display in the investigation of several radar signal analysis techniques will be described by showing excerpts from a movie made in 1957, using an RCA prototype color tube. More recent

work on a variety of on-line signal processing schemes, using the DEC color display at AFCRL, will be described. The potential of color in visualizing the behavior of pattern recognition schemes and of complex sensor data processing operations will be illustrated. Particular emphasis is placed on mistakes made and lessons learned, both with regard to hardware design and modes of control required for the effective use of color.

GRAPHIC PART PROGRAMMING FOR NUMERICAL CONTROL MACHINE TOOLS

James A. Snow
The Boeing Company
Seattle, Washington

A research project at The Boeing Company was established to explore the feasibility of using a computer with a CRT display to generate machining instructions for numerically controlled machine tools. The part programmer would input part geometry and observe a display of the input on the CRT. From the displayed part geometry, a cutter path would be generated, displayed, and then processed and transformed into a punched mylar tape.

The results of this project showed that an accurate part could be machined from information generated on a CRT coupled to a computer. This research also showed that there was a significant reduction of flow time from part definition to control tape by using a graphic part programming system compared to the processing of an identical part through the APT system.

ENHANCEMENTS TO A TIME-SHARED OPERATING SYSTEM

R. N. Freedman
Massachusetts Institute of Technology
Cambridge, Massachusetts

Some modifications have been implemented in the PDP-6 operating system at LNS/MIT to facilitate time-shared operations and to aid in the development of large application programs. These new features are available to the user in standard FORTRAN or assembly language coding and as CUSP programs. These features include a new device to permit flexible I/O operations, several FORTRAN library subroutines to permit full usage of the time-shared system, and some CUSP programs for a large magnetic-tape program filing system. Design goals and methods of implementation are explained.

X-Y GRAPH PRODUCTION AND MANIPULATION*

J. Brackett and R. Kaplow
Massachusetts Institute of Technology
Cambridge, Massachusetts

A number of user-oriented programs have been developed for forming x-y graph displays on the M.I.T. Compatible Time-Sharing System. A text input which describes the graph produces output on either the Project MAC interactive display facilities[1] or remote storage oscilloscope displays, depending on the user's location. Both axes of the graph may be either logarithmic or linear; production of annotated graph "paper" is automatic as is scaling unless range are set by the user. Up to three single- or multi-valued functions can be displayed simultaneously with a single request; any of which may be either point or line-connected plots. A user specification of precision, if given, is used to select data points for line-connected curves to minimize buffer requirements and/or transmission time, the default option being based on display hardware resolution. A light pen, if available, may be used to reference and manipulate any one of the curves on a multi-curve plot. The subsystem is conversational and will request any necessary information which the user omits or supplies incorrectly.

1. The Electronic Systems Laboratory Display Console and PDP-7 Computer.

* This work was supported, in part, by Project MAC, an M.I.T. research program sponsored by the Advanced Research Projects Agency, Department of Defense, under Office of Naval Research Contract Number Nonr-4102(02).

IMAGE PROCESSING OF BIOLOGICAL SPECIMENS

Stephen Lorch
Massachusetts General Hospital
Boston, Massachusetts

A flying spot scanner has been interfaced to a PDP-7 to process biological images. This paper discusses our approach to scanning as well as the importance of image processing to medicine and biology. Materials worked with thus far have been chromosomes, X rays and brain tissue. Examples of work in progress in the area of neuro-anatomy, neuro-surgery and pathology are shown. Future plans including 3-D processing of neuro-anatomical information are briefly developed at the conclusion.

HIGH PRECISION CRT SCANNING SYSTEM

C. A. Bordner, Jr., A. E. Brenner, P. deBruyne,
B. J. Reuter, and D. Rudnick
Harvard University
Cambridge, Massachusetts

A high-precision, relatively inexpensive CRT scanning system controlled by a PDP-1 computer with a resolution capability of approximately 1 part in 30,000 has been developed. Although primarily designed for the automatic scanning and measuring of photographs taken of spark chambers used in high-energy physics experiments, it has wide range capabilities.

The method and details of electronic implementation, test measurements, and the software required will be described.

TRACD - AN EXPERIMENTAL DISPLAY PROGRAMMING LANGUAGE

Barry Wessler
Digital Equipment Corporation and M.I.T.
Maynard, Massachusetts

A display programming language was developed by extending TRAC (Test Recognizing & Compiling) to include graphic input and output primitives. TRAC is a compact, interpretive string processor that is used to create and modify a textual representation of the displayed information. The representation is stated in the TRAC functional form and produces the display file as the value of the function when it is executed. Modifications to the displayed picture are made by changing the representation and then re-executing the representation to produce the new display file.

There are presently four types of display elements available: POINT, LINE, TEXT, and SYMBOL. The symbol element is user defined as some combination of the four display elements. A symbol may call other symbols to virtually unlimited depth. There are also input functions to accept coordinate information from a tracking cross, pointing information from the light pen, and the state of the console push buttons.

TRACD runs in a free standing 338 but was designed to be able to communicate with a larger computer, either through a data phone or an interprocessor interface. The graphic problem is formulated on the 338 and then the data base is transmitted to the large computer for processing; the data base being the textual representation created with TRAC.

GENERAL PROCEDURES FOR ACCOMPLISHING EFFICIENT DISPLAY SOFTWARE

J. Richard Wright
Wolf Research and Development Corporation
West Concord, Massachusetts

A specific design requirement will be used which will illustrate efficient procedures in the development of each phase of display software. These will be developed in the areas of data structure, on-line analysis of display codes, and improved methods for debugging display programs. The following additional subjects will also be touched upon: program storage, display storage, display area and timing, and display timing (for flicker-free displays). All are applicable to color, or black and white displays. The research for this paper was performed at AFCRL, and the equipment consisted of two PDP-1 processors and drum-driven displays.

AN ELECTRONIC SPEECH RECOGNITION SYSTEM

Morton M. Traum and Edward Della Torre
American Radiator and Standard Sanitary Corporation
New Brunswick, New Jersey

A Speech Recognition System for arbitrary vocabulary and speaker has been constructed using an Audio Spectral Analyzer interfaced with a PDP-8. The speaker enunciates a vocabulary of arbitrarily chosen words into the microphone while the operator types an identification of each at the keyboard. The computer automatically recognizes the subsequent enunciation of any vocabulary word and displays its previously inserted identification at the teletypewriter.

Using only 4K memory, a satisfying accuracy of recognition has been achieved. The software resulting from this initial research is subject to optimization which, it is felt, will render the system highly comparable to the far more elaborate systems common today.

HELP - AN INTEGRATED DISPLAY SYSTEM FOR PROGRAM DEVELOPMENT

D. Friesen and J. Taylor
Massachusetts Institute of Technology
Cambridge, Massachusetts

A set of display programs has been written as an integral part of the PEPR film scanning and measuring project. This display system, HELP, serves as a major tool in the development of other programs for the film scanning project. Included in HELP are real-time displays of program operations, and graphic displays of numerical data resulting from operations. Programmer interaction via light pen and teletype permits direct investigation and control of operating programs.

DISPLAYING THE CHARACTERISTICS OF SPEECH WITH A PDP-8

Morton M. Traum and Edward Della Torre
American Radiator and Standard Sanitary Corporation
New Brunswick, New Jersey

The frequency and amplitude characteristics of live or recorded speech are displayed as digital patterns at the teletypewriter. By interfacing an Audio Spectral Analyzer with the PDP-8, digital data produced while speaking into a microphone is loaded under program control into the computer memory.

A direct visual display at the teletypewriter of the stored data is possible, or reduction and calculation of the data according to software instruction may be performed prior to print out. The patterns produced serve as an important research tool for the analysis of speech.

Brunswick Inn

MOTEL HEADQUARTERS - DECUS SYMPOSIUM

DECUSCOPE is published monthly for Digital Equipment Computer Users Society (DECUS).

Material for publication should be sent to: Angela J. Cossette, DECUS, Maynard, Massachusetts 01754. Telephone: AC 617 897-8821, TWX 710 347-0212

Publications Chairman: Joseph Lundy, Inforonics, Inc.

Circulation: 2,000 copies per issue.

DECUS acknowledges the assistance of Digital's Technical Publications Department in the preparation of this newsletter.

DECUS

V6 N2

"LETTERS"

Letters of general interest will be published as a standard insert to each issue of DECUSCOPE. Letters written between users, to DEC personnel, and to the DECUS office will be included. Submissions to this section, "Letters Insert," should be sent to: Angela J. Cossette, DECUS Executive Secretary, DECUS, Maynard, Massachusetts 01754.

648-8550

PHILIP HANKINS & COMPANY, INC.
Computing Consultants
800 MASSACHUSETTS AVENUE
ARLINGTON, MASSACHUSETTS 02174

February 7, 1967

Mrs. Angela Cassette
DECUS Secretary
Digital Equipment Corporation
Main Street
Maynard, Massachusetts 01754

Dear Angela:

My recent change in positions breaks any direct ties with DEC computers and therefore I must regretfully resign from the DECUS board. I have enjoyed working with you and the rest of the board over the past few years. Your good work on DECUSCOPE has made my job on the Publications Committee quite easy.

Sincerely yours,

Joseph T. Lundy

JTL:ls

March 31, 1967

Mr. Michael S. Wolfberg
Moore School of Electrical Engineering
University of Pennsylvania
Philadelphia, Pennsylvania 19104

Dear Mr. Wolfberg:

I am happy to announce that at the DECUS Executive Board Meeting held on March 17 you were appointed to complete the term of office for Mr. Joseph Lundy as Publications Chairman.

We sincerely hope that you will accept this appointment, as we are certain you will do your best to fulfill the duties of this office.

Sincerely,

John Goodenough
DECUS President

JG:rml

Yale University *New Haven, Connecticut 06520*

MAR 24 1967

PHYSICS DEPARTMENT
217 Prospect Street

March 22, 1967

Mrs. Angela J. Cossette
DECUS
Maynard, Mass.

Dear Mrs. Cossette

Enclosed is a listing of a Macro - 6 subroutine for the PDP - 6 which we at Yale have found of great use. It allows one to enter DDT from program control and to return to ones program from DDT without having to set breakpoints, etc. in advance. Anyone who runs a large system program such as PEPR here at Yale will recognize the usefulness of this user program - DDT interface. One simply includes a standard 'CALL PRODDT' FORTRAN statement in his deck when compiling. This calls our program in the usual F4 fashion. To return to ones user program from DDT one types XCT GOBACK$X. We are sure that variations of this program would be applicable to any PDP language.

Sincerely yours,

O. C. Hansen   V. D. Bogert

```
        TITLE PRODDT
M1:       HRRM 16,LOC
           SOS LOC
          MOVEI 1,P10
         OUT. 1,4
          DATA. 0,LOC
          FIN. 0,0
P10:      JRST M2
          ASCII /(' PR/
          ASCII /ODDT./
          ASCII / CALL/
          ASCII /ED FR/
          ASCII /OM ',/
          ASCII /06,' /
          ASCII /XCT G/
          ASCII /OBACK/
          ASCII /$X TO/
          ASCII / RETU/
          ASCII /RN ' /
          ASCII .,/)  .
M2:       MOVE 1,JOBDDT
          HRRM 1,.+1
          JRST 0
RESTOR:   MOVEI 1,P20
          OUT. 1,777777
          FIN.
P20:      JRST M4
          ASCII /(' BA/
          ASCII .CK',/.
          ASCII /)    /
PRODDT:   BLOCK 1
         MOVEI 00,TEMP.
          BLT 0,TEMP.+16
          JRST M1
M4:       MOVSI 16,TEMP.
          BLT 16,16
          MOVE 3,PRODDT
          JRA 16,0(16)
GOBACK:   JRST RESTOR
LOC: BLOCK 1
TEMP.: BLOCK 20
          OPDEF OUT. [17B8]
          OPDEF DATA. [20B8]
          OPDEF FIN.  [21B8]
ENTRY PRODDT
INTERNAL GOBACK
EXTERNAL JOBDDT
EXTERNAL OCTO.
          END
```

*

DEMERS, HOMA, BABY
INGÉNIEURS-CONSEILS • CONSULTING ENGINEERS

4815 AVENUE CARLTON, MONTRÉAL 26, QUÉBEC
TÉL. 739-2208

PIERRE DEMERS
DAVID M. HOMA
JEAN BABY

MAY 1 1967

April 26, 1967

Our file: 31.507

Mrs. A.J. Cossette,
Decus Executive Secretary,
Digital Equipment Corporation,
Main Street,
Maynard, Mass. 01754.

Dear Mrs. Cossette:

PDP-8 FORTRAN

The following are a few comments on the use of PDP-8 FORTRAN which you may pass on to other members if they do not duplicate previously published instructions.

1. Compatibility of Output Data Tapes

With all the operating systems we have tried, the fixed-point output data generated by a FORTRAN program is not usable as an input to another program. After much time wasted because of the incorrect assumption that "obviously" the original operating system programmer would have provided for compatibility of the coding, the cause of the trouble was traced by our Mr. Ménard to incorrect coding of the '+' and '-' signs.

Correction:

Alter location 0074 from 0053 → 0253.

2. Echoing of Input Data

Even when using high-speed paper tape input/output, all data input to a FORTRAN program is either printed or punched out as it is entered. With something like a statistical analysis program, the effect is to have the input data and results intermixed on the output tape instead of only the reduced data. In other words, the ACCEPT statement acts as if it included a TYPE statement for everything read in, with a consequent reduction in input speed and duplication of all data.

Correction:

Alter locations 1503 → 7000
1504 → 7000.

3. SR Control with FORTRAN

A simple technique for incorporating a short machine language program with a FORTRAN program is illustrated in the following statements. Use of the technique avoids separate assembly of the machine language program, or of its insertion in direct binary form. The FORTRAN statements must always be placed at the start of any program to ensure their being allocated the same locations by the compiler.

Example:

```
DIMENSION MACH(9)

MACH(9)  =   0
MACH(8)  =   0
MACH(7)  =   7
MACH(6)  =   -1034
MACH(5)  =   1790
MACH(4)  =   252
MACH(3)  =   -124
MACH(2)  =   -254
MACH(1)  =   0
    '
    '        /Main program
    '
    '
PAUSE 3958

IF (MACH(9)) 1,1,2
    '
    '        /Main program
    '
```

The program is equivalent to:

```
7566     0000
7567     HLT
7570     LAS
7571     AND      7574
7572     DCA      7576
7573     JMP I    7566
7574     0007
7575     0000              /Spare
7576     0000              /MACH(9)
```

which halts; transfers the contents of the SR to the accumulator when continue is pressed; eliminates all but the rightmost 3 bits by blanking with the contents of 7574 (which may be made other than 7 to accomodate more options); deposits the result in 7576 which is the same as MACH(9); and jumps out of the subroutine.

The subroutine is reached by the PAUSE 3958 statement in FORTRAN, and the SR contents are checked by an IF(MACH(9)) as shown for 0 or >0, or by an IF(MACH(9) - TEST) if more optional branches are required in the FORTRAN program.

As given here, the subroutine permits branches in a FORTRAN program at the operator's option by using the SR. Further developments of the idea are obviously possible.

While we have used these modifications and subroutines in a number of programs without any problems, I do not guarantee results.

We would appreciate some definitive statements from DEC as to whether the given modifications of the operating system can disrupt any other functions (i.e. that the same values are not used as constants or indirect references by some other routine). The same applies to information on which parts of the operating system can be over-written with impunity, e.g. can the DEC-tape control routines be replaced by machine language programs of FORTRAN subroutines if the system does not have DEC-tape, etc. I mean definitive, not "why don't you try it and see"!

We have found FORTRAN to be quite useful for secondary analysis of statistical data generated by the PDP-8 in an experimental set-up. There are presumably others who are willing to use machine language processing where speed is essential, but who would like to avail themselves of easier programming once the volume of data has been reduced. I would therefore suggest that DEC or DECUS prepare a compendium of the FORTRAN techniques which have been suggested for the PDP-8, useful modifications to the operating system, etc., and perhaps - dare we suggest it - an improved version.

Yours very truly,

DEMERS, HOMA, BABY
Consulting Engineers

K. I. Gordon
....
K.I. Gordon, Eng.

P. Ménard
....
P. Ménard, Eng.

KIG:rz

Reply to letter from DEMERS, HOMA, BABY:

1. The revised Operating System dated March 2, 1967, has corrected the punching of exponential and integer + and - signs (see PDP-8 Newsletter).

2. The above mentioned Operating System has also suppressed the echoing of high-speed input data. If location 1504 is NOPed, echoing of data from the Teletype will also be suppressed (see PDP-8 Newsletter). The changes were made to the routine at 1500, IXCH, and to DTFMR which follows it.

3. The constant at location 74 is used in other operations and should remain 0053. NOP's to 1503 and 1504 will suppress all echoing in the September '65 Operating System and both are necessary. In the revised Operating System the echoing of high-speed input data is automatically suppressed. The NOP's will suppress echoing of Teletype input but will not harm anything.

There is a switch option in the Operating System which tells it whether or not DECtape is used. If DECtape is not used, the coding may be written over since it is not used.

Mrs. Evelyn Dow
Software Quality Control
Digital Equipment Corporation
Maynard, Massachusetts

1967 - Volume 6, Number 3

DECUSCOPE

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY

$$M_1 = \Sigma X_i / N \quad M_2 = m_n; \quad m_i = \frac{i-1}{i} m_{i-1} + \frac{1}{i} X_i$$

$$6_2 = \sqrt{\frac{S_{2n}}{N-1}}; \quad S_{2n} = \frac{N \Sigma X_i^2 - (\Sigma X_i)^2}{N}$$

$$_{-1})^2$$

$$P_1 = \frac{\Sigma XY - \frac{\Sigma X \cdot \Sigma Y}{N}}{S_{2n}}; \quad S_{2n} = \frac{N \Sigma X_i^2 - (\Sigma X_i)^2}{N}$$

THE PDP-8 AS A FORTRAN COMPUTER !

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DECUS Publications Chairman: Michael Wolfberg, Moore School of Electrical Engineering, University of Pennsylvania.

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A SURVEY OF METHODS FOR COMPUTING MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENTS ON THE PDP-8 COMPUTER

August E. Sapega
Trinity College
Hartford, Connecticut

INTRODUCTION

The use of the PDP-8 for calculation of means, standard deviations, and correlation coefficients, provides an excellent example of the application of this computer to an important type of data processing. Programming these calculations in FORTRAN makes this computation readily programmable by individuals in such fashion as best to serve their specific needs. However, these programs need to be written to reflect the capabilities and limitations of the computer. Principally, these involve the number of significant places to which the data is carried in the computer, and the limited storage available when using the FORTRAN system. Limited storage makes the use of one-pass methods of calculation mandatory for large amounts of data, hence one-pass methods of calculation are stressed in this article.

Three areas of general interest to the user of the PDP-8 are discussed: (1) some properties of the FORTRAN language used, (2) the number of significant places carried in calculations in the machine, and (3) the effect of various computational schemes on the accuracy of the results.

EFFECT OF LANGUAGE

Programs written in FORTRAN are handled in the PDP-8 through a one-pass compiler which produces a punched paper tape program. This must in turn be read back into the computer at object time to be interpreted by the operating system program. Because of the limited repertory of instructions for the basic PDP-8 computer, the operating system must supply many algorithms for even the least calculation. For example, to add two floating point numbers requires a programmed subroutine which calls out the mantissa and exponent of each, carries out the calculation is a psuedo-accumulator, and returns the result to the proper storage location. Reading in decimal numbers, converting to appropriate binary form for storage, then later reconverting for print out, is also under the control of the operating system. In addition, the compiler/operating system must also encode the calculation described in FORTRAN so that it is carried out in the sequence specified.

The results reported here indicate that the compile/operate system supplied by Digital carries out its functions excellently. Perhaps the only comment of interest in this regard is that programming calculations involving squaring a number are best carried out by specifying that the variables be multiplied together rather than using the exponentiation operation available in the FORTRAN system. The exponentiation operation involves calculation using natural logarithms. Negative numbers are not handled by this routine. Multiplying out the variables to be squared will not be affected by the sign of the numbers. Furthermore, this procedure has proved to be more accurate than using the exponentiation routine.

SIGNIFICANCE OF CALCULATION

Floating point data in the PDP-8 FORTRAN system is stored in the form of an eleven-bit binary exponent, and a twenty-three bit binary mantissa. The mantissa portion therefore can represent a value as large as 8,388,607, or $(2^{23} - 1)$, which means seven places of significance in decimal form. The exponent is program limited to a maximum value of 617 (i.e. 10^{617}). Data input is not inherently limited to seven decimal places, but clearly only the seven most significant digits will be stored accurately. Data output of this system is a fixed six-digit format, reflecting the degree of significance of the stored data.

Input/output routines, and some calculation routines, do not round off data, but truncate it. Thus a systematic error on the low side can be expected when handling data with significance to six or seven places. The results presented verify that as data become significant in the fifth or sixth decimal place such a systematic error is noted. Data with fewer significant places is handled most accurately.

EFFECTS OF VARIOUS COMPUTATIONAL SCHEMES

Proper programming of calculations is as important when using digital computers as when calculating by hand or by mechanical calculators. Having established that the FORTRAN system is adequate to handle data of six significant digits, it is the responsibility of the programmer to manipulate this data so as to minimize accumulation of errors involved in the calculation.

As examples of programming methods, three different algorithms for calculating means and standard deviations were carried out along with two methods for calculating correlation coefficients. The general scheme of testing algorithms follows that of a paper recently published by Neely[1]. This paper reports similar results of calculations carried out on an IBM 7094 computer.

Data to test the algorithms was generated by a program which produced values according to the following scheme:

$$X_i = \text{BASE VALUE} + i$$

Base values used were 0, 10, 100, 1000, 10,000, and 100,000. The base value was specified at the start of each calculation. Larger base values impose more stringent demands in carrying out calculations in terms of the number of significant places of data storage. Index i was determined by a DO loop in the program, and was specified for each calculation. Sample sizes were 10, 100, or 1000. Tests involving 10 or 100 values of X were programmed so that these values could be stored internally as generated, thus avoiding any input/output handling.

Runs using 1000 data values required the numbers to be stored on a paper tape to be read in during the calculation. When using this tape the base value was specified prior to read-in or data, and this was added to each term before the calculation proceeded further. Similar tapes containing 10 entries, and 100 entries, were also used, both to check the one-pass calculations and to provide comparison with those calculations which used internally stored data throughout. One would expect that the calculations which used internally stored data would be more accurate, and this did indeed turn out to be true, but the differences were mainly in the fifth or sixth significant digit.

CALCULATIONS OF MEANS

Two different computational schemes were programmed.

Method 1: $M_1 = \Sigma X_i / N$

Method 2: $M_2 = m_n \; ; \; m_i = \frac{i-1}{i} m_{i-1} + \frac{1}{i} X_i$

The first method was used two different ways. First was to use the internally stored data to calculate the total, which was then divided by the number of terms stored. Second was to accumulate a running sum as data values were read in from the tapes, and then to divide this sum by the number of entries. Thus, the second way was a one-pass calculation on external data.

Method 2, attributed by Neely to Welford, provides a one-pass calculation which in effect up-dates the previously calculated mean each time a new value is read in. For calculation of means it offers no special advantage over the definition, but it it an essential part of a calculational scheme for providing standard deviations and correlation coefficients which proved to be best suited to this computer.

Results of this computation of means is shown in Table I, where each is seen to be sufficiently accurate for all purposes. Note in sample size 1000 the mean is consistently under-valued, reflecting truncation of data, presumably in the input/output routines.

CALCULATION OF STANDARD DEVIATIONS

Three different computational schemes were programmed.

Method 1: $\sigma_1 = \sqrt{\frac{S_{1n}}{N-1}}$; $S_{1i} = \Sigma(X_i - \overline{X})^2$

Method 2: $\sigma_2 = \sqrt{\frac{S_{2n}}{N-1}}$; $S_{2n} = \frac{N\Sigma X_i^2 - (\Sigma X_i)^2}{N}$

Method 3: $\sigma_3 = \sqrt{\frac{S_{3n}}{N-1}}$; $S_{3i} = S_{i-1} + \frac{i-1}{i}(X_i - m_{i-1})^2$

$$m_i = \frac{i-1}{i} m_{i-1} + \frac{1}{i} X_i$$

Method 1 is simply calculation using the definition of standard deviation. This required the mean of the data to be calculated prior to calculating the individual values required to obtain the standard deviation. Thus, this method required either stored data, or two-passes on the data. Only the scheme using stored data was carried out in these tests, and the sample sizes were limited to 10 and 100. Inspection of the results of this calculation, presented in Table II, shows that this is a very accurate calculation, little affected by number of significant digits carried in the data. It is the preferred method for obtaining highest accuracy if the program is capable of storing the amount of data required.

Methods 2 and 3 are true one-pass calculations. Method 2 is simply a rearrangement of the definition of standard deviation organized in a convenient fashion for computation by hand calculating machines. Table II shows this to be a satisfactory method when the data does not carry greater than three significant digits, but to be very poor beyond this. The problem here is that upon forming X_i^2, and $(\Sigma X_i)^2$ the significant digits needed to preserve accuracy are greater than the capacity of the floating point number storage allocation, and upon taking the difference of these two terms, a great deal of significance is lost. The error is most serious in smaller sample sizes. Discussion of these types of errors, and methods to reduce their effects, are developed in the book by Dwyer[2]. In larger samples averaging of errors results in better accuracy, but clearly this method is unstable for values requiring more than four significant digits. (It should be noted that the data used to test the computation imposes more severe demands on the computational scheme than most data normally used.)

Method 3 for calculating the standard deviation is the analog of Method 2 for calculating the mean, and depends upon the mean calculation. This method involved only one calculation in a squared term, and this result is weighted according to the number of terms previously calculated. Table II shows this method to be quite accurate for any sample size and any number of significant digits handled in this machine.

CALCULATING OF CORRELATION COEFFICIENTS

Two methods of calculating correlation coefficients were programmed. The data were correlated with the digits, and should result in correlation coefficients equal to one.

Method 1:

$$P_1 = \frac{\Sigma XY - \frac{\Sigma X \cdot \Sigma Y}{N}}{S_{2n}} \quad ; \quad S_{2n} = \frac{N\Sigma X_i^2 - (\Sigma X_i)^2}{N}$$

Method 2:

$$P_2 = \frac{P_n}{S_n} \quad ; \quad P_i = P_{i-1} + \left(\frac{i-1}{i}\right)(X_i - \overline{X}_{i-1})(Y_i - \overline{Y}_{i-1})$$

$$S_i = S_{i-1} + \left(\frac{i-1}{i}\right)(X_i - \overline{X}_{i-1})^2$$

$$\overline{X}_i = \left(\frac{i-1}{i}\right)\overline{X}_{i-1} + \frac{1}{i} X_i$$

$$\overline{Y}_i = \left(\frac{i-1}{i}\right)\overline{Y}_{i-1} + \frac{1}{i} Y_i$$

Both methods are one-pass types. Method 1 is clearly analogous to Method 2 of calculating standard deviations while Method 2 is analogous to Method 3 of calculating standard deviations, and to Method 2 of calculating means, and depends on them for values needed to carry out the calculation.

Results of these computations are given in Table III. In general, the results are excellent except where the standard deviation calculations are inaccurate.

CONCLUSIONS

Highly accurate calculation of means, standard deviations, and correlation coefficients, is possible on the PDP-8 computer using appropriate one-pass methods. In general, data of three-digit significance or less can be handled by well-known methods suitable for desk calculators. Data with a greater number of significant digits is better handled by using the "up-dating" schemes presented.

As these results show, computations carried out in the PDP-8 will have an accuracy limited by the word length. Calculations involving subtractions should be programmed so as to minimize loss of significance. Reference should be made to standard discussions of such techniques, such as those in Dwyer.

References:

1. Neely, P. M., Comparison of Several Algorithms for Computation of Means, Standard Deviations and Cor-

relation Coefficients. Communications of ACM, Vol. 9, No. 7 (1966).

2. Dwyer, P. S., Linear Computations. John Wiley (1951).

TABLE I

COMPUTATION OF MEAN

Base	Mean	COMPUTATION USING: Method 1 — Internally Stored Data	Method 1 — Accumulative Summing	Method 2
		n = 10		
0	5.50000	5.50000	5.50000	5.49998
10	15.5000	15.5000	15.5000	15.4999
100	105.500	105.500	105.500	105.499
1,000	1,005.50	1,005.49	1,005.49	1,005.49
10,000	10,005.5	10,005.4	10,005.4	10,005.4
100,000	100,005.	100,005.	100,005.	100,005.
		n = 100		
0	50.5000	50.5000	50.4999	50.4986
10	60.5000	60.5000	60.4999	60.4986
100	150.500	150.499	150.499	150.495
1,000	1,050.50	1,050.50	1,050.49	1,050.46
10,000	10,050.5	10,050.4	10,050.4	10,050.1
100,000	100,050.	100,049.	100,049.	100,047.
		n = 1000		
0	500.500		500.489	500.381
10	510.500		510.489	510.403
100	600.500		600.485	600.358
1,000	1,500.50		1,500.45	1,500.10
10,000	10,500.5		10,499.8	10,497.3
100,000	100,500.		100,492.	100,474.

TABLE II

COMPUTATION OF STANDARD DEVIATION

Base	Std. Dev.	COMPUTATION USING METHOD: 1	2	3
		n = 10		
0	3.02765	3.02765	3.02765	3.02765
10	3.02765	3.02765	3.02765	3.02766
100	3.02765	3.02765	3.02765	3.02777
1,000	3.02765	3.02765	2.92118	3.02863
10,000	3.02765	3.02765	9.54055	3.03983
100,000	3.02765	3.02765	132.197	3.14588
		n = 100		
0	29.0114	29.0114	29.0115	29.0119
10	29.0114	29.0114	29.0115	29.0121
100	29.0114	29.0114	29.0117	29.0136
1,000	29.0114	29,0114	28.9665	29.0289
10,000	29.0114	29.0114	10.2915	29.1874
100,000	29.0114	29.0152	100.836	30.5734
		n = 1000		
0	288.819		288.818	288.867
10	288.819		288.817	288.857
100	288.819		288.820	288.873
1,000	288.819		288.803	289.039
10,000	288.819		296.139	290.612
100,000	288.819		947.916	303.568

TABLE III

COMPUTATION OF CORRELATION COEFFICIENT

Base	Correlation Coefficient	COMPUTATION USING METHOD: 1	2
		n = 10	
0	1.00000	1.00000	1.00000
10	1.00000	1.00000	0.999996
100	1.00000	1.00000	0.999960
1,000	1.00000	1.07421	0.999675
10,000	1.00000	-1.00708	0.995990
100,000	1.00000	0.00052	0.962383
		n = 100	
0	1.00000	1.00000	1.00000
10	1.00000	0.999994	0.999997
100	1.00000	0.999982	0.999943
1,000	1.00000	1.00311	0.999415
10,000	1.00000	7.94220	0.993988
100,000	1.00000	0.0832875	0.948925
		n = 1000	
0	1.00000	0.999940	1.00000
10	1.00000	0.999896	1.00003
100	1.00000	0.999862	0.999980
1,000	1.00000	0.999878	0.999408
10,000	1.00000	0.951410	0.993998
100,000	1.00000	0.0942358	0.951576

PROGRAMMING NOTES

PROGRAMMING NOTE FOR USERS OF PDP-8 FORTRAN (BASIC PDP-8 WITH ASR-33)

Gerald A. Sabin
Underwater Sound Reference Division
Naval Research Laboratory
Orlando, Florida

Users of PDP-8 FORTRAN may find it desirable to call for suppression (and subsequent restoration) of the typewritten ECHO in the execution of an ACCEPT statement. This is particularly true when the punched paper tape output of one program is used as input to another program. The following brief program (written into the last page of memory in the area left vacant by the Binary Loader (of 2/23/65) and RIM Loader) will change the contents of location 1504 from 4315 to 7000 and vice versa to accomplish control of the typewritten ECHO in the FORTRAN Operating System:

```
7600,0000     7611,5217
7601,2207     7617,1223
7602,4204     7620,3207
7603,5600     7621,5604
7604,0000     7622,1504
7605,7440     7623,1224
7606,7402     7624,4315
7607,1224     7625,7000
7610,3622
```

Notice the gap from 7612 to 7616 inclusive. These locations are used by the Binary Loader.

ECHO suppression is called by the FORTRAN statement: PAUSE 3968.

ECHO restoration is called by: PAUSE 3972.

The numbers 3968 and 3972 are the decimal equivalents of octal 7600 and 7604 respectively.

It is assumed that the accumulator is clear when entering into this program; in case the accumulator is not clear, the program will halt at 7606 to alert the operator.

The program is intended for use with the Operating System of 8/13/65. If it is to be used with the Operàting System of 3/2/67, then C(7622) = 1507 and C(7624) = 4317.

RE: INSTRUCTION MANUALS

We have found one little snag in the instruction manuals, even recent ones, concerning certain hardware flags. Referencing, for example, page 131 of the "Small Computer Handbook" we find a recommended sequence of instructions:

```
FREE, TSF
      JMP  FREE
      TLS
```

The trouble with this sequence is that if the flag is cleared by powering down, or by another program, the above sequence will hang up until a TLS is inserted manually or otherwise.

The above trouble can be obviated by using the following sequence:

```
      TLS
FREE, TSF
      JMP  FREE
```

This will work whether the flag is cleared or not.

C. G. Donahoe
Electrochemistry Section
San Francisco Bay Naval Shipyard
Vallejo, California

SOME CHANGES IN PAL III

1. To generate a longer leader for easier use of tapes on a high-speed reader, change location 1306 from 7700 to 7500. The listing is:

```
1306    7500    KONS, 0-300
```

2. To save time in punching leaders and trailers on passes 1 and 3 when preparing tapes on a ASR-33, it is possible to suppress leader/trailer punch out except on pass 2 by changing location 1272 from 7604 to 5664. The listing becomes:

```
1272    5665    JMP I LDTR
```

R. F. Templeman
Daresbury Nuclear Physics Laboratory
England

SHADOW LOADER FOR PDP-6

I. Pugsley and R. Reid
The University of Western Australia

The following is a program used for 16K or 32K machines with DECtape based systems. It resides permanently in the first 16 words of slow memory and can never be referenced except by use of manual switches. This program differs from previous versions in that it includes a block transfer so that at execution time the program itself cannot be permanently destroyed. This would happen, for example, if the first word from a DECtape would destroy an accumulator in slow memory.

```
                            PHASE 36ØØØ

ØØ    7ØØ2ØØ   63555Ø   CONO APR,  63555Ø    ;I/O RESET
Ø1    7ØØ6ØØ   Ø11577   CONO PI,   11577     ;CLEAR PI
Ø2    2Ø17ØØ   Ø36ØØØ   MOVEI 16, 36ØØØ      ;SET FOR BLOCK TRANSFER
Ø3    2517ØØ   036017   BLT 16,  36Ø17       ;TRANSFER WHOLE PROGRAM
Ø4    7212ØØ   233ØØØ   CONO DTC, 233ØØØ     ;DTAØ BACKWARDS
Ø5    72714Ø   ØØØØØ2   CONSO DTC, 2         ;LOOK FOR END-ZONE FLAG
Ø6    254ØØØ   Ø36ØØ5   JRST .-1             ;KEEP LOOKING
Ø7    721200   2223ØØ   CONO DTC, 2223ØØ     ;TO READ DATA FORWARDS
1Ø    72Ø2ØØ   ØØ4Ø1Ø   CONO DC, 4Ø1Ø        ;DATA CONTROL TO READ
11    72Ø34Ø   ØØ1ØØØ   CONSO DC, 1ØØØ       ;LOOK FOR DONE FLAG
12    254ØØØ   Ø36Ø11   JRST .-1             ;KEEP LOOKING
13    72ØØ4Ø   Ø36Ø16   DATAI DC, .+3        ;READ BOOTSTRAP WORD
14    72Ø34Ø   ØØ1ØØØ   CONSO DC, 1ØØØ       ;NEXT DONE FLAG?
15    254ØØØ   Ø36Ø14   JRST .-1             ;WAIT
16    ØØØØØØ   Ø36ØØØ   Ø,36ØØØ              ;WORKING SPACE
17    254ØØØ   Ø36Ø11   JRST .-6             ;GET NEXT BOOTSTRAP WORD
                            END
```

A PDP-8 - KLEINSCHMIDT INTERFACE

Terrel L. Miedaner and Dr. John F. McNall
University of Wisconsin, Space Astronomy Laboratory
Madison, Wisconsin

An early application of our PDP-8 faced us with the problem of handling an output requirement intermediate between line printer and Teletype capabilities. We needed several pages of hard copy data within five to ten minutes, and a highly reliable output device. The ASR-33 was both too slow and too undependable, but we could not justify even a low-speed line printer. This output requirement was solved nicely by the addition of a KLEINSCHMIDT Model M-311 printer.

This device is a heavy-duty teleprinter, operating at an average speed of 40 characters per second. The mechanism employs a rotating character drum of the type used in line printers, and a double print hammer. The solid state control electronics includes a ready-busy line, requiring only a six-bit parallel input buffer and strobe pulse to be supplied by the user. This particular model is equipped for on-line output only.

The performance of this machine has been very satisfactory. It has solved our output problems and increased our capabilities at a cost slightly less than that of an ASR-35. We have a programming package available, consisting of ASCII code conversion routines and a modified Phoenix assembler operating 3.1 times as fast as normal PAL. Any user faced with a similar problem may find it advantageous to investigate this printer.

NEWS ITEMS

LETTER TO THE EDITOR

From: Keith Nelson
DEC Diagnostic Programming Group
Maynard, Massachusetts

Reference: DECUSCOPE, Volume 6, Number 1
DECUS No. 7-26 Normalize Instruction Test

MAINDEC 722 Part 1 fully tests all of the PDP-7 EAE setup and shift logic including Normalize. Apparently, Mr. Law was not aware of the existence of the latest EAE MAINDECs.

MAINDEC 722 Part 1 was originally submitted to the PDP-7 Program Library March, 1966, and was revised October, 1966. Part 2 (MUL/DIV) was submitted to the library September, 1966.

Any user with knowledge of a specific deficiency in a MAINDEC program should pass this information on to their DEC Sales Representative.

DECUS BIOMEDICAL MEETING SET

The DECUS Biomedical Meeting has been definitely set for June 12 at the New York Medical College. Dr. Daniel Ruchkin, Brain Research Laboratory, will host the meeting. Dr. Josiah Macy of the Albert Einstein School of Medicine, Yeshiva University, will be the keynote speaker.

An agenda along with abstracts of papers for presentation will be sent with registration forms shortly. If you are interested in attending the meeting and do not receive the before mentioned material, please contact the DECUS Office.

WANTED

Information as to the availability of:

1. Self-contained three word floating point subroutines for PDP-8 with EAE.
2. File maintenance system for PDP-8 580 tape unit.
3. Combined editor and assembler for 8K PDP-8.
4. Fast two-word reduced accuracy floating point subroutines for PDP-8 with EAE.
5. FORTRAN compiler for 8K PDP-8.
6. Short numeric only character generator for PDP-8 type 34 display.

Contact: Mr. Walter R. Burrus
Neutron Physics Division
Oak Ridge National Laboratory
Post Office Box X
Oak Ridge, Tennessee 37830

WANTED

We are interested in acquiring any literature on, or actual program print-outs of, statistical analysis and evaluation of neuron "spike-trains," i.e., trains of spike potentials recorded intracellularly from single nerve or muscle cells. We wish to know of algorithms used in evaluating this type of data using such statistical procedures as frequency-interval histograms, autocorrelograms and cross-correlation histograms.

Contact: Mr. Lewis F. McLean (PDP-6 user)
Department of Neurology
Hospital of the University of Pennsylvania
Philadelphia, Pennsylvania 19104

DEC PROGRAM LIBRARY NEWS

In cooperation with the DEC Program Library, DECUS will be inserting copies of PDP-8 and 7/9 newsletters in this as well as future issues of DECUSCOPE.

This publication is designed to provide information concerning the software supplied by the DEC Program Library for the PDP-5, PDP-7/9, PDP-8, and PDP-8/S computers. The newsletter will be published on a bi-monthly basis unless a more frequent distribution seems warranted and will include the following information:

1. Software Errors
2. Program Corrections
3. Documentation Errors
4. Announcements of New and Revised Software
5. Programming and Operation Hints

All requests for program manuals, program listings, tapes, and write-ups from the DEC Library should be addressed to:

Mrs. Bonnie Korsman
Program Library
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts 01754
Telephone: AC 617 897-8821 Ext. 245

All problems encountered with either the DEC software or documentation should be addressed to:

Mrs. Evelyn Dow
Software Services Group, Quality Control
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts 01754
Telephone: AC 617 897-8821 Ext. 283

The DEC Library and the DECUS Library are two separate organizations. Please note that procedures for requesting DECUS Library material remain the same.

DECUS AND MODULE USERS

Introduction

This age is called by some people: The Age of the Information Explosion. Sometimes when one sees programmers carrying huge bundles of output, or one sees WESCON visiting engineers eagerly filling their briefcases with all available literature within eyesight, one just cannot believe that it will all be read. It must be the underlying fear to miss out on something, anything, that makes all of us at one time or another play a role in this "Information Craze." This craze may be the single biggest reason why an affluent society like ours needs so many machines to process the often redundant information over and over again.

Still, one needs information and everybody spends a good deal of time searching for it in all kinds of ways, trying to avoid the effects of information pollution and hoping to stumble onto that rare gem of quality. There is an enormous amount of experience all around us, a little of it well documented. To help people get access to it, many institutions are set up and many magazines are being published. The trouble with these institutions (like the giant computer conferences) is, that due to their ambition to do things on a nation wide or world wide scale, they lose out on that important channel of communication, namely, the communication between individuals. It is rather ironical that the otherwise most interesting get-togethers like Spring and Fall JCC's bear the label of Conference; by far, most of the participants are listening, looking around, and filling their briefcases with folders and lecture notes, while only a happy few in the misty top perhaps confer.

It may therefore be stimulating and helpful to participate in meetings of this sort on a smaller scale and to form small, simple institutions that enable participants to really confer with one another. A helpful ingredient for the process is to select an involvement common to all or most conferences, like, for instance, the habit of using DEC modules, Flip-Chips or DEC computers, leaving the software to the care of other institutions.

Why not just another "Hardware" section in DECUSCOPE and let it go at that? Well, it seems that people prefer by far to chat about a subject rather than to document it all. Once a NASA study showed that the staff in one research laboratory spent about half their time in "communication"; that is, anything from telephone conversations, meetings, visits, coffee chats to reading and dictating mail. They devoted only from 6 to 9 percent of their time on searching for and studying literature. This should not give the impression that documentation is relatively unimportant, but it may be worth considering how important conferring is. If that is how we work, we may as well face it.

When the first "Module Users Group" came into being (all by themselves!) it was clear that the time was ripe to make more people aware of this new version of agreeable communication. In the article that follows below, it is explained what has happened and what is planned. DEC Sales Offices will offer their time and effort to help people to get a Module User Group started, if the module users feel such an activity would be useful and enjoyable. Nobody needs to feel they are now going to be approached with another sales gimmick to further the sale of DEC modules. Just remember that the first groups started out of a need felt by the module users themselves, and we intend to help develop new groups in that same way. Naturally, DEC is interested in cooperating in this new venture, but it will be on a modest scale and mostly in the first phases of each budding group.

We hope that also in your area you soon will have an opportunity to happily shop around in your new Module Users Group; we wish all of you to get to know some more interesting people and more interesting ideas, of which you undoubtedly will forget many, thus affording you to feel that in your next design you thought of it all by yourself.

Sypko W. Andreae
DECUS Equipment Chairman

MINUTES OF MEETING RE: ESTABLISHING A MODULE USERS GROUP

A meeting to "start the wheels turning" in regard to organizing a module users group (MUG) as a sub-group to DECUS was held in January at Digital Equipment Corporation, Maynard, Massachusetts. The following attended:

John Storey, Defense Research Board
(Representing Canadian Module Users)
Frank Ollie, Defense Research Board
Bob Jones, DEC Pittsburgh
(Representing Pittsburgh Module Users
Al Devault, DEC Module Sales Manager
Marty Gordan, DEC Module Applications Engineering
Russ Doane, DEC Module Slow-Circuits Engineering
Angela Cossette, DECUS Executive Secretary

The meeting's main objective was to formally set up and establish the function and operation of a module users group.

A summary of decisions made during the meeting follows:

Module users would be organized regionally with the initial assistance of the DEC Sales Office in each area. Canada and Pittsburgh have already held seminars at which a module users group was discussed favorably and a committee elected.

(more)

MUG (Continued)

The executive structure of the group will be as follows:

1. Each group would organize regionally and elect a committee and chairman.

2. This chairman, in turn, would be a member of the present DECUS Equipment Committee of which Sypko Andreae of Lawrence Radiation Laboratory is chairman.

3. The Equipment Committee Chairman would be the representative or voice of the module users on the DECUS Executive Board.

Responsibilities of the Regional Group

1. Elect committee and chairman.

2. Hold seminars and/or other meetings in their area. Number of these meetings would be up to each group.

3. Publish a user directory of users in their region.

4. Submit application notes to DECUS for publication.

5. Provide feedback on applications, meetings, members to DECUS.

Responsibilities of DECUS

1. Initially contact module users informing them of the existence of the module group, advise them on how they can organize a group in their area, and provide forms for membership.

2. Publish a combined user directory.

3. Publish a section in each issue of DECUSCOPE regarding module users' news.

4. Publish an index of available Digital application notes and literature.

5. Provide clerical and mailing services.

6. Arrange sessions for hardware presentations at DECUS symposia.

7. Keep records of members, meetings, applications, etc.

8. DECUSCOPE, which would be the main news medium for the present, would contain:

a. application notes
b. abstracts of large systems built
c. user directories
d. DEC module personnel
e. communications, meeting information, etc.

9. Publish any proceedings from meetings.

****

Application forms for MUG will soon be sent to all DEC module customers. Membership in MUG is equal to individual membership in DECUS. If one is already a member of DECUS there is no need to rejoin; however, it is desirable that members indicate they are also module users and are interested in the activities of the Module Users Group.

Please note that it is not necessary that one be a member of an established regional group to join MUG. Regional groups may be initialized when there is a sufficient number of users in a particular area. A meeting at which a regional committee is elected can either be set up by a DEC sales office in the area of by the users with the assistance of DECUS.

If you do not receive information about joining MUG within the next two or three weeks, please contact the DECUS office for application forms.

Angela Cossette (Mrs.)
Executive Secretary

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Atomic Weapons Research Establishment

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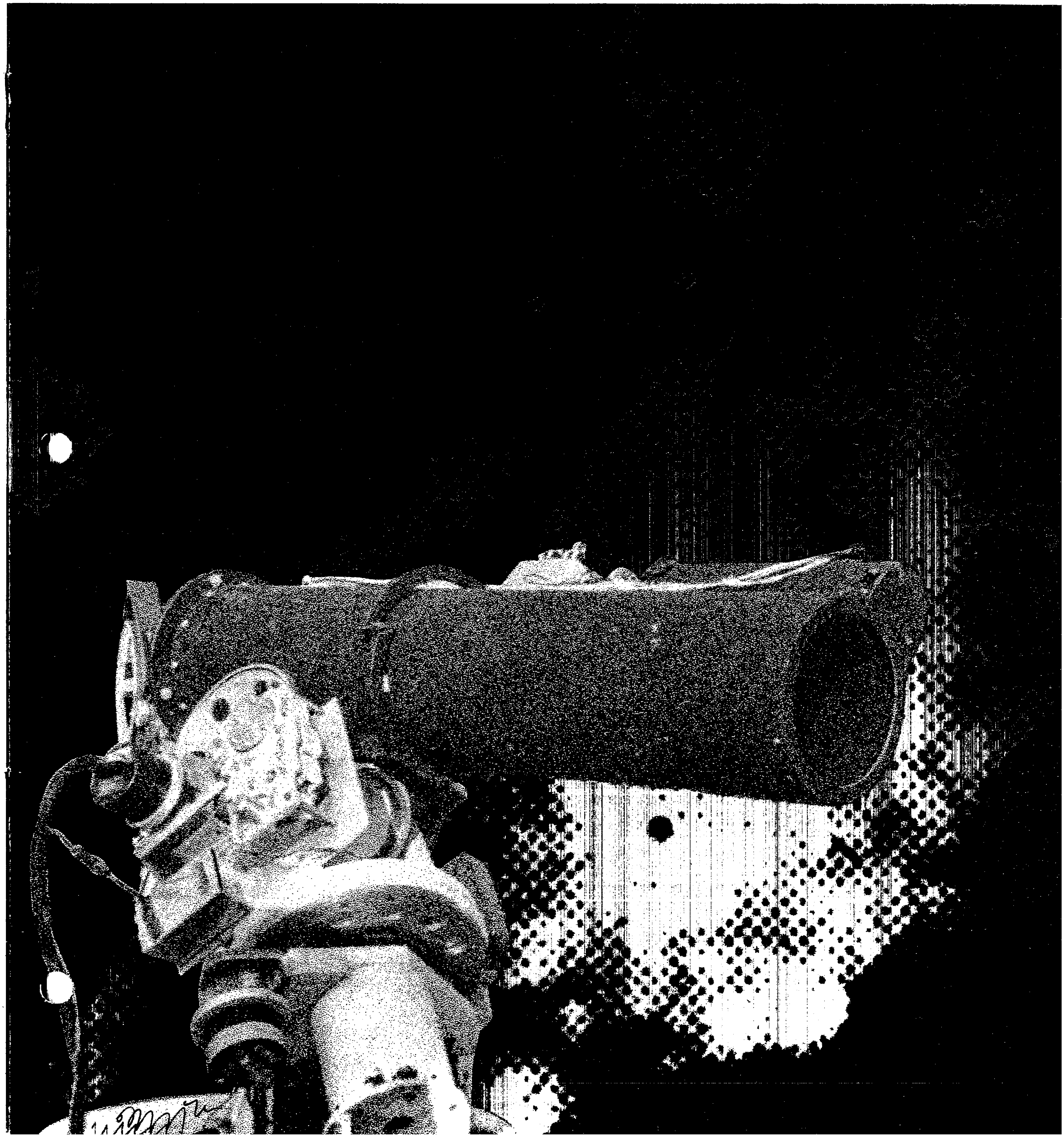
DECUSCOPE

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY



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DECUS Publications Chairman: Michael Wolfberg, Moore School of Electrical Engineering, University of Pennsylvania.

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A COMPUTER CONTROLLED TELESCOPE

Terrel L. Miedaner
John F. McNall
Space Astronomy Laboratory
University of Wisconsin
Madison, Wisconsin

The Space Astronomy Laboratory of the University of Wisconsin has recently installed a computer controlled telescope system at the University's Pine Bluff Observatory. Although not the first remote controlled system, it is the first such system which operates effectively with no human observer present during the entire observing evening.

Using a PDP-8 computer, surplus parts, and electronics designed by undergraduate students; the arrangement is noteworthy for its simplicity and economy as well as its originality.

Normal astronomical observing requires the presence of at least one highly trained observer. Stars must be sighted visually, and the equipment must be set up and operated by hand. Normal observing is night work, and is therefore performed at lowered human efficiency. If the evening clouds up, the observer must sit and wait. With this automatic system, the astronomer need only set up the equipment and provide a list of stars. Data will be collected automatically during the evening and the system will shut itself down in the morning or if the weather turns foul.

The addition of a computer into such a system also allows real-time data reduction. Normal observing is limited to data collection, with the reduction done later; whereas, a computer in the control system allows a certain amount of data to be analyzed immediately. Perhaps the nicest advantage of an automatic system is its weather independence. To eliminate air shimmering, the interior of a telescope dome must remain at the outside temperature. As the best observing in Wisconsin occurs in the winter when a zero degree night is normal, a computer at the controls instead of a man can eliminate a lot of foot stomping and shivering.

As this system is a prototype, the equipment used is somewhat non-standard. The telescope is an eight-inch reflector with a photomultiplier tube to measure light and a set of filters to limit observing to various wavelength bands. It incorporates two aperture sizes and can vary the exposure to adjust for different star brightnesses. This instrument is an offshoot of the NASA OAO satellite program and was specifically designed to be remotely operated. It is driven by two small stepper motors on the north-south and east-west axes, and its position is read by two encoders on the same axes.

The instrument is mounted in a small metal shed a few hundred feet from the main observatory and is connected to the PDP-8 in the observatory basement via a tunnel. The shed itself is fixed with a movable roof and sides which are also operated by the computer. The entire system is driven by the PDP-8 through a rack of control electronics also located in the basement, most of which was designed and built by students.

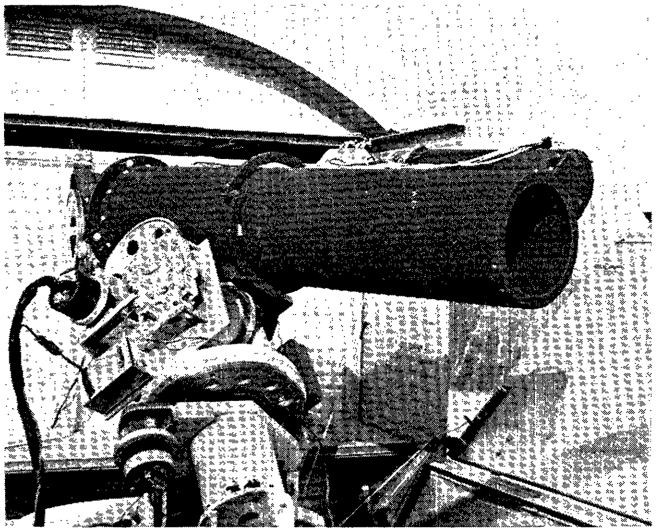


Fig. 1. The automatically controlled eight-inch telescope in normal rest position. The photomultiplier tube is in the housing on top of the instrument; the telescope control electronics is behind this. North-south drive train is clearly visible. The shed enclosing the telescope is in its open position with roof back and side flaps lowered.

The computer used is a basic 4K PDP-8. The only exotic features added are an A-D converter, power interrupt and auto restart, digital multiplexers, special purpose commands, and a loudspeaker on the link bit. Output is through a Kleinschmidt 40 cps teleprinter, input is standard ASR-33.

The PDP-8 has proven to be quite flexible for this purpose, performing a wide variety of functions. It maintains and searches a sequential star list of up to twelve stars, checking to see if the star is above the horizon, and slewing the telescope to the supposed star position if it is available. As the total gear slop of almost half a degree generally precludes finding the star in the aperture immediately, the computer can search a preset area of sky to find it. Once found, the star is centered in the aperture, and actual photometric observing takes place. Once this is done, a partial data reduction which includes expected errors for each data point is calculated and printed, and the system then proceeds to the next star in the list. Upon completion of each cycle through the list, a more detailed reduction is computed and printed.

During the observing sequence, the machine also checks for rain, wind, sudden barometric pressure changes, and sky brightness. If any of these factors exceed limits, the observing will stop, the telescope will be lowered, and the shed will be automatically closed. The computer will also shut off power to the instrument and will turn off the teleprinters. If desired, it can be set to restart observing again automatically at next nightfall, or if conditions become favorable again. The system does not shut down for cloudiness, but waits a half hour and then attempts to continue observing in hopes that the sky might clear up.

The power of the computer in a system such as this is perhaps best illustrated by the problems encountered in moving the telescope. Motion is accomplished by four instructions which move the appropriate motor one step in either direction, so that there is a command to step once east, west, etc. The speed of motion can then be varied by adjusting the intervals between issuing the motion instruction. In practice, however, the motors would not run in the range of about 100 to 200 cycles; so that although an optimum running speed was 500 cycles, the inertia of the system required that they be started at 250 cycles and gradually speeded up. It was also discovered that they would occasionally stall, and on starting would often go in the opposite direction from that commanded. This presented some programming problems.

One of the two position encoders also became troublesome, so that it was regularly giving an incorrect position reading whenever the instrument was moving south. This made it quite difficult for any general routine to figure out where the telescope was pointed at a given instant.

These problems, which at first seemed quite formidable, were solved by making full use of the machine's capabilities. A dynamic slewing method was adopted, in which each single motor step was followed by a complete position recomputation. This recomputation checks for stalled or reversed motors, probable encoder errors, and adjusts motor speed as well. In spite of the fact that most of these computations are double precision, there is relatively little slowdown in slew speed because of the extra work. This technique has proven so flexible that it is being extended to dynamic star searching. Rather than stop the telescope to see if there is a star present, the star will be caught as it appears in the aperture while the telescope is moving.

Because of the limited size of the telescope, the system has been used for only two purposes to date: to determine the amount of junk in the atmosphere, and in a search for variable stars. The first use requires repeated observations on a set of standard stars to calculate the amount of light lost through the atmosphere; this data is then used in reducing data from the larger manual instruments. The other use is more interesting and is particularly adaptable to automatic control. There are a number of stars which fluctuate in brightness over a period of a few hours, but with a variation of only two or three percent. Since atmospheric variation alone can easily cause a five percent change in apparent brightness, these small but real variations are difficult to catch. To find them, it is necessary to repeatedly alternate observations on the variable and on a non-varying standard star over the course of an evening using the standard star to check on sky variations. This requires rapid moving from one star to the other all night long, a difficult job for a person but a simple task for a computer.

Future developments to the system might incorporate a data-phone link to larger machines for more detailed reduction, or a tie-in to a larger machine at the observatory which might control the main telescopes as well. The usefulness of a small computer in this application is certainly proven.

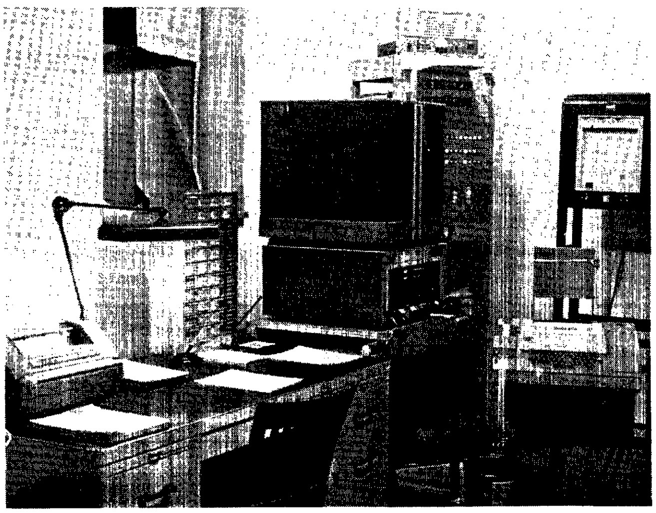


Fig. 2. The telescope control room, showing from left to right: Kleinschmidt Teleprinter on desk, PDP-8 computer, system electronics, ASR-33, and chart recorder.

This work was accomplished with the support of NASA Contracts NAS5-1348 and NSG-618.

DECUS PUBLICATIONS

Library Catalog - A new issue of the library catalog has recently been published. Copies have been sent to all DECUS members. Non-members may request copies from the DECUS Office, Maynard, Massachusetts.

Spring 1967 Proceedings - The proceedings of the "Display Symposium" held at Rutgers University in April are now available. Copies are being sent to all delegate members and meeting attendees. Others may request copies from the DECUS Office.

TABLE SORTS FOR THE PDP-8'S

Richard M. Merrill
Digital Equipment Corporation
Maynard, Massachusetts

The Table Sort and Branch is a powerful and flexible programming tool. If a program must contend with a number of different characters (or up to 11-bit items) each of which can initiate different responses, the program must look up the addresses of the action that corresponds to a given symbol or bit pattern. If the symbols do not form a continuum, the programmer must find the most efficient method for determining the corresponding address.

The method that was used in the new editor and in the new octal debugging program is that of the Table Sort and Branch. This uses a simple subroutine to match up an input character with one member of a list of characters. The call to the subroutine is followed by: (1) the address of the list and (2) the difference between that list and a second list. The latter list contains the corresponding addresses. Thus, if a match is found in the first list, the difference (2) is added to the address of that match to compute the address in the second list which itself points to the action to be performed.

In addition to being simple and concise, although perhaps somewhat more time consumming than other methods, this technique has another advantage that is especially useful in a PDP-8: The tables may be placed at page boundaries to take up the slack that often occurs at the end of a page. This quickly results in an efficient use of all available core storage.

```
SORTB,   Ø              /Sort and Branch Routine.
         SZA
         DCA CHAR       /CHAR is assumed or set.
         TAD I SORTB
         ISZ SORTB
         DCA AXTEM
         TAD I AXTEM
         SPA
         JMP SEX
         CIA
         TAD CHAR
         SZA CLA
         JMP .-6
         TAD AXTEM      /Match found.
         TAD I SORTB
         DCA SORTB
         TAD I SORTB
         DCA SORTB
         JMP I SORTB
/////
SEX,     ISZ SORTB      /Match not found.
         CLA
         JMP I SORTB
```

FUNCTION GENERATOR FOR A SMALL COMPUTER*

J. Levin[1] and E. Malamud[2]
Physics Department, University of Arizona
Tucson, Arizona

A program for a PDP-5 computer is described which allows scientific functions to be quickly set up and evaluated without necessity for compilation.

A problem commonly encountered in a scientific laboratory is how to quickly evaluate a function z = f(x,y) for a series of values of x and y, where the function may include trigonometric and logarithmic operations.

A program called FUNGEN (function generator) has been written for a PDP-5 computer having 4096 words of 12 bit storage and a Teletype which allows users to set up various functions quickly and easily by keying in codes for the operations desired. Whereas the details are particular to the computer used, the method should be applicable to any small computer. FUNGEN is written in PAL, the PDP-5 Assembly Language.

The program is set up so that complex functions of one or two variables can be programmed, evaluated, and reprogrammed all in one pass and without compilation. It allows for storing eight different functions in the computer simultaneously, with a maximum of 126 operations per function. These operations can refer to either of the two arguments x and y, or either of two temporary storage locations t_1 and t_2. These four operands and the result, z, which resides in a floating accumulator, are all three computer words long, i.e., 24 bits for the mantissa and 12 bits for the characteristic, which on the PDP-5 corresponds to about seven decimal digits of precision and a range of ±2048 for the exponent.

The operations and functions available and their corresponding Teletype code are summarized in Table I. Any of these codes can be combined in any order to form a large variety of functions.

Table I. Codes for Function Generator

Operation	X	Y	T1	T2
load	A	F	K	Q
add	B	G	L	R
subtract	C	H	M	S
multiply	D	I	N	T
divide	E	J	O	U
store			P	V

Function	Code
sq. root	W
sine	X
cosine	Y
arc tan	Z
exp(nat.)	\
log(nat.)	↑
evaluate	=

Two features make the program more convenient to use. If an error is made in composing the function, it may be corrected by typing "←" and then typing the correct letter. Secondly, the arguments may be typed in integer, fixed point, or exponential form and are converted to exponential form by the program.

The program operates in two phases. In the first phase, the functions are composed and the Teletype codes for the letter instructions are stored, one per word, in one of the eight 128-word pages reserved in core for the eight function channels, which are labelled A through H. The first word of a page indicates how many arguments are used (1 or 2) and the second word indicates how many instructions are in the function.

In phase two, the program determines which function channel is being called for and accepts data. The instruction library consists of a series of word pairs, the first word in each pair is the Teletype code of a symbol.

* This work was supported by the National Science Foundation.

1. Present address: Harvard University.

2. Temporary address: University of California, Los Angeles.

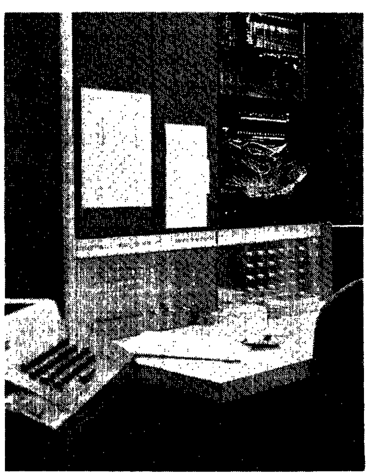
The second word is an instruction (if the Teletype symbol is A through V, which numerically corresponds to ≤ 326) or an address (if the letter corresponds to a code > 326). Each symbol comprising the function is evaluated sequentially working from left to right. If the corresponding code is ≤ 326, the program searches the library for the equivalent instruction, deposits the instruction into the program, and executes it. If the corresponding code is > 326, it searches the library for an address which is the location of one of the arithmetic library functions. When all the instructions have been executed in this manner, the contents of the floating accumulator are typed out, and the program returns to the beginning of phase two.

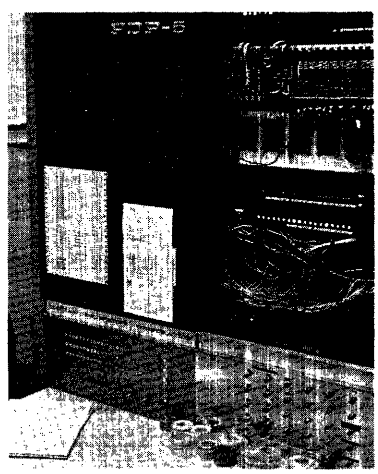
A few illustrations of the use of the program are given in Table II.

Table II. Examples Illustrating the Use of FUNGEN

	Program in Phase I	Meaning
enter	A1	function in channel A will have 1 argument
enter	ABBBPABBDLPABBBDDM=	sets up $f(x) = 5x^3 - (3x^2 + 4x)$ in channed A
typed back	ABBBPABBDLPABBBDDM	for verification--if the function is wrong it can be recomposed at this time.
enter	C2	function in channel C will have 2 arguments
enter	AYPFYN=	sets up $f(x,y) = \cos(x)\cos(y)$ in channel C
typed back	AYPFYN	for verification
enter	D2	function in channel D will have 2 arguments
enter	AIW=	sets up $f(x,y) = \sqrt{xy}$ in channel D
typed back	AIW	for verification
enter	%	go to Phase II

	Program in Phase II	Meaning
enter	A 2?	the argument x = 2 is entered into channel A. The argument is terminated by any non-numeric character, in this case "?"
typed back	.1999999+02	f(x) = 20 for x = 2. Shows the round off error.
enter	D 3.?12.?	the arguments x = 3 and y = 12 are entered into channel D.
typed back	.6000000+01	f(x,y) = 6 for the above arguments.





The interface shown mounted to the right of the PDP-5 is for use with an array of six liquid scintillator counters in an experiment designed by Doctor T. Bowen and Mr. E.P. Krider of the University Physics Department to try to determine the presence of fractionally charged particles (quarks) in cosmic rays.

DECUS/DEC SUPPORT AGREEMENT

On April 14, 1967, the DECUS Executive Board approved an agreement with Digital Equipment Corporation that describes the support to be given to DECUS. This agreement is printed below. In effect, the agreement states that established DECUS activities will be fully supported by DEC as well as any expansion of DECUS activity that is required by the growth of DECUS. Note that the nature of DECUS activities is not limited by the agreement, but DEC is only obligated to support the kind of activity that is described.

The provisions in Section 2 describe appropriate potential sources of income for DECUS; but the Board has no intention at present of charging for copies of proceedings or advertising in DECUSCOPE.

DECUS/DEC Support Agreement

1. DECUS shall have a treasury to provide funds for services not provided by DEC. Responsibility for the treasury rests with the DECUS President.

2. The DECUS Executive Board may seek income from appropriate sources, such as members or conference attendees. These funds are for services rendered by DECUS in accordance with the DECUS bylaws. The expenditure of such funds will be at the Board's discretion:

Income to that treasury could be from:

a. Meeting registration fees
b. Sale of proceedings
c. Advertisements in DECUSCOPE

Income probably should not come from annual dues, as most member organizations are not set up to provide funding for such purposes.

3. Services and material to be provided to DECUS by Digital Equipment Corporation:

a. Services of DECUS Secretary and support personnel as required (including office expenses and travel to two DECUS meetings per year).

b. Printing, reproduction and mailing services for up to 12 issues per year of DECUSCOPE, DECUS Proceedings and other material for DECUS members.

c. Program library cataloguing, reproduction and distribution to members.

d. Office space and equipment for above.

e. Services and expenses incidental to DECUS meetings (signs, shipping costs for DECUS material, etc.). However, any expenses for refreshments, meeting space, or entertainment are not included and would be borne by the individual participants of the meetings, the organizational host, or the DECUS treasury.

4. It is understood that as the DECUS group grows, the support outlined above must also grow.

5. DEC cannot provide support in the following areas. Funding for these activities should come from the DECUS treasury.

a. Out-of-pocket expenses of DECUS officers and members.

b. Costs associated with travel by the DECUS Secretary to DECUS installations.

6. DEC and DECUS realize that there may be expenditures that are not detailed in Sections 3 or 5, and they should be individually negotiated as they arise.

7. The DECUS President will make an annual report detailing significant events of the preceding year, outlook, and fiscal activity. The first report is to be submitted December 30, 1967.

8. This support agreement shall be reviewed annually by both parties. The first review shall be completed by December 30, 1967.

John Allen Jones
DEC Representative
To the DECUS Executive
Board

DECUS BYLAW CHANGES

The existence and growing activity of DEC users in Europe has led to the formation of a regional group called DECUS-EUROPE. This group has requested amendment of the DECUS Bylaws in order that they may be recognized under the Bylaws.

It is reasonable to expect that other groups may be formed in the future. Rather than amend the Bylaws to give each group separate rights and privileges, the Executive Board has proposed a new Bylaw article that establishes a category of Special User Groups (SUGs). It is the Executive Board's intention that the DECUS-EUROPE organization will be the first Special User Group recognized under the proposed article.

Subsection D-2 of the proposed article is especially important. DECUS exists to "promote the free interchange of information concerning the use of DEC computers and peripheral equipment." To achieve this goal, we feel that information about SUG activities should be available to the membership at large. It seems reasonable to expect that non-members of Special User Groups might also be interested in some of the information directed primarily to SUG members. Publication in any way other than through DECUSCOPE does not ensure sufficiently wide distribution of this information and thwarts a primary purpose of DECUS.

John Goodenough
DECUS President

ARTICLE VI-SPECIAL USER GROUPS WITHIN DECUS

Section A - Purpose of Special User Groups

Special User Groups (SUGs) may be formed to conduct meetings that are regional in character or specialized in technical scope and to promote interchange of specialized information.

Section B - Formation of Special User Groups

A group of users must petition the Executive Board for recognition as a Special User Group. The group must have a Chairman, but its organization is otherwise at the discretion of the SUG and Executive Board.

Section C - Restrictions of Special User Groups

1. A chairman and other officers (if any) must be elected by members of the Special User Group at least once every two years.

2. The Special User Group must hold at least one meeting a year.

3. Monies may be collected and spent only for meetings sponsored by the Special User Group. A report of monies collected and spent shall be presented to the Executive Board and published in DECUSCOPE at least once a year.

4. All members of SUGs must be members of DECUS.

Section D - Services to be Provided by DECUS to Special User Groups

1. Proceedings of SUG meetings will be published and distributed by DECUS. Distribution may be made to membership of the SUG or to DECUS at large, at the discretion of the Executive Board.

2. Notices of interest to the membership of the Special User Group shall ordinarily be published in a special column in DECUSCOPE. Such notices shall not be distributed to less than the entire DECUS membership except under special circumstances determined by the Executive Board.

3. DECUS will provide clerical services and help coordinate a SUG's activities to an extent determined by the Executive Board.

Section E - Representation on the Executive Board

The Chairman of a Special User Group will have a vote in matters concerning the application of Sections C, D, and F with respect to said Special User Group.

Section F - Dissolution of Special User Groups

1. A SUG may be dissolved by petition of its membership to the Executive Board. A notice of dissolution will be published in DECUSCOPE, and the Executive Board may effect dissolution no sooner than one month after such notice has appeared.

2. A SUG may be dissolved by vote of the Executive Board if Section C is violated. A notice of dissolution will be published in DECUSCOPE and the dissolution will take effect after the next business meeting of DECUS, provided that this business meeting is held at least three months after notice of dissolution has appeared in DECUSCOPE. At this meeting, the Executive Board's action may be overruled by the membership. If the Group appeals the Executive Board's action, reasonable publication will be allowed to any member of the SUG.

3. Any funds existing in a SUG's treasury after dissolution will revert to the DECUS treasury.

AMENDMENT TO ARTICLE III, SECTION A, NO. 1

"Qualification for Installation Membership shall be automatic unless in the judgment of the Executive Board that membership would not be consonant with the spirit of the Society."

The above sentence is to be added to No. 1.

FINANCIAL REPORT
DECUS SPRING 1967 SYMPOSIUM

Total Attendees - 197

Income from Registration Fee	$ 814.00	
Income for Meals	1237.07	
Total Income		$2051.07
Expenses (Registration)	$ 809.42	
Expenses (Meals)	1423.12	
Total Expenses		2232.54
Total Deficit		$ 181.47

NOMINATIONS FOR DECUS OFFICE

The following have been nominated for DECUS office for 1968. Official ballots will be sent out in August to all DECUS delegates. Any additional nominations should reach the DECUS office by July 31.

President - Richard McQuillin, Inforonics, Inc.
Cambridge, Massachusetts

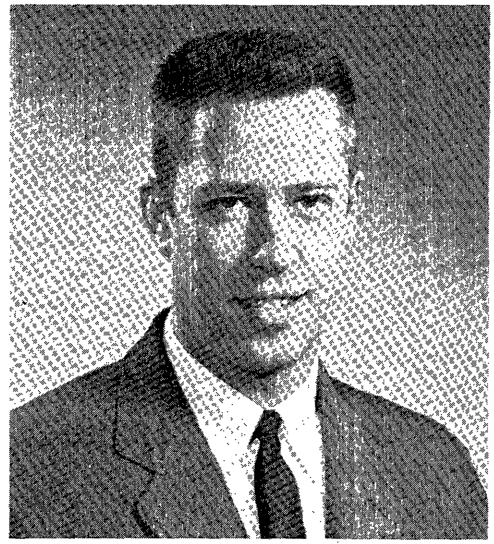
Mr. McQuillin earned a B.S.C. (1955) at the University of Puget Sound, and a M.S.C. (1959) at Brown University. His major fields were Mathematics and Physics.

He joined the staff of Bolt Beranek and Newman, Inc., in 1958, specializing in physical acoustics. His earliest computer experience was with an LGP-30, where his work involved writing a compiler to process complex algebraic statements. When BBN acquired the first PDP-1 computer, Mr. McQuillin's interests turned to this machine. Major computer activities included work on the Floating Point Package (DECUS No. 10), and on DECAL-BBN (DECUS No. 39). He headed the work on the DECAL-BBN Project.

Since June, 1964, Mr. McQuillin has been associated with Inforonics, Incorporated, where he is presently director of programming systems. His major interests include computer-aided publishing as well as computer languages. In addition to his current work on the specifications and implementation of programming languages, Mr. McQuillin is working on the development of a typesetting language for the computer composition of complex structures, such as mathematical displays and chemical ring structures.

He has been an active member of DECUS for five years, serving as Programming Chairman for the past four years. During that time he has been active in the Joint Users Group, JUG, the association of all user groups. In 1966 he served as chairman of the JUG/DECUS Workshop.

Mr. McQuillin is presently chairman of the JUG Program Library Committee. This committee has been very active in setting up a program library interchange service whereby users in one group can obtain program documentation from other user groups. The forthcoming JUG Program Library Catalog will serve as a communication medium for the interchange service.



Meetings Chairman - Philip R. Bevington, Stanford University, Stanford, California

Presently associated with the Physics Department of Stanford University, Stanford, California, Professor Bevington has been an active member of DECUS for the past few years. He has made many contributions to the DECUS PDP-7 Program Library. His experience and education follows:

Undergraduate Work:
- Harvard College, 1950-1954
- A.B. (Mathematics), cum laude, 1954

Graduate Work:
- Duke University, 1954-1960
- Ph.D, (Nuclear Physics), 1960
  - Teaching Assistant
  - Research Assistant
  - Research Associate and Instructor

Post-Graduate Work:
- Duke University, 1960-1963
  - Instructor and Research Associate
  - Asst. Professor and Research Associate
- Stanford University, 1963-1968
  - Assistant Professor

Honors:
- National Science Foundation Honorable Mention (Physics), 1954
- Sigma Xi, 1958
- Phi Beta Kappa, 1960

Teaching Experience: 1958 -
- Undergraduate:
  - Introductory Physics for Non-Science Majors
  - General Physics (Discussion Sections Only)
  - Modern Physics
  - Electronics
- Laboratory:
  - Freshman Laboratory
  - Intermediate (Junior) Laboratory
  - Electronics Laboratory
  - Advanced Laboratory (Teaching Asst.)
- Graduate:
  - Advanced Electronics
  - Nuclear Physics

Recording Secretary - Nancy Lambert, Inforonics, Inc.
Cambridge, Massachusetts

Miss Lambert joined the Systems Programming group at Digital Equipment Corporation in 1962. She worked on the design and implementation of basic software for the PDP-4 and PDP-5.

In 1964, she joined the Medical Information Technology Division at Bolt Beranek and Newman, Inc., to work on their time-sharing system. She presented a paper at the Fall 1966 DECUS Meeting describing some of her work there. After the founding of GE-Medinet, she was a consultant to them from BBN on programming teaching methods. Miss Lambert was the PDP-1 delegate for the Medical Information Technology Division.

Miss Lambert is presently at Inforonics where she is working on an on-line information retrieval system for bibliographic information in a large-scale library system.

DECUS PROGRAM LIBRARY

PROGRAM LIBRARY NOTES

CORRECTIONS

DECUS No. 8-44 - "Modifications to the Fixed Point Output in the PDP-8 Floating Point Package"

A pair of instructions have been erroneously duplicated. The following change should be made:

From	To
7220 1324	7220 7000
7221 3044	7221 7000

DECUS No. 5/8-9 - "Analysis of Variance" (Write-up)

1. Digital's Floating Point Interpretive Package (DEC-8-5C-S) must be used with the program. All arithmetic calculations are carried out by the package and it is not included in the Analysis of Variance program.

2. In order to terminate input data, the control character must be given twice.

DECUS No. 5/8-28(a) - "Phoenix Assembler"

When using the Phoenix Assembler the programmer must include a space between the operation code mnemonic and a period (e.g., "JMS."). Although the latest version of PAL III does not require the space character, the Phoenix Assembler is a set of modifications to an earlier version of PAL III which did require the space.

RE: DECUS No. 5/8-55 - "PALEX"

Due to the problem in duplicating the symbolic tape of PALEX, as a result of its size, it is desirable that users request the symbolic tape only when absolutely necessary.

Thank you,
DECUS Program Librarian

REVISIONS

DECUS No. 7/9-2(a)

Title: FAST 7 START and FAST 9 START

Author: Philip Bevington, Stanford University
Stanford, California

FAST 7 and FAST 9 are system program monitors (Fast Acquisition of System Tapes) for the PDP-7 and PDP-9 which retrieve programs from DECtape and are compatible with each other and with most DEC programs, including: FORTRAN, the Symbolic Assembler, and DDT. They are not compatible with, but replace, earlier versions of FAST START.

Minimum Hardware: 4K, 1 DECtape unit

Storage: 17600-17761

DECUS No. 7-4(c)

Title: PTSCOPE, PTPEN, PTPLOT, CALIBRATE, and LISTEN

Author: Philip Bevington, Stanford University
Stanford, California

PTSCOPE, PTPEN, PTPLOT, CALIBRATE, and LISTEN are five FORTRAN subroutines for the PDP-7/9 which provide oscilloscope displays and X-Y plots of single parameter spectra using the Type 34 Display. These are revised versions (9/66) of subroutines submitted earlier.

Minimum Hardware: 4K memory, Extended Arithmetic Element, Type 34 Display, X-Y Plotter, Type 370 Light Pen

Source Language: FORTRAN (ASCII) + PDP-4/7/9 Symbolic

Storage: 245, 265, 201, 22, 77 (octal)

Execution Time: 20/15 ms+85/65 us/pt, 20/15 ms (octal) for the PDP-7/9

Restrictions: Plotter assumes 0 yields full-scale deflection.

DECUS No. 7-8(a)

Title: FPTSCOPE, FPTPEN, and FPTPLOT (rev. 2/67)

Author: Philip Bevington, Stanford University
Stanford, California

FPTSCOPE, FPTPEN, and FPTPLOT are three FORTRAN subroutines for the PDP-7/9 which provide oscilloscope displays and X-Y plots of single parameter spectra using the Type 34 Display. These are revised versions (2/67) of subroutines submitted earlier.

Minimum Hardware: 4K memory, Extended Arithmetic Element, Type 34 Display, X-Y Plotter, Type 370 Light Pen

Other Programs Needed: LISTEN and CALIBRATE (included in tapes and write-up)

Source Language: FORTRAN (ASCII) + PDP-4/7/9 Symbolic

DECUS No. 8-19(a)

Title: DDT-UP Octal Symbolic Debugging Program

Author: Michael S. Wolfberg
Moore School of Electrical Engineering
University of Pennsylvania
Philadelphia, Pennsylvania

DDT-UP is an octal-symbolic debugging program for the PDP-8 which occupies locations 5600 through 7677. It is able to read a symbol table punched by PDPSYM and stores symbols, 4 locations per symbol, from 5577 down towards 0000. The mnemonics for the eight basic instructions and standard OPR and IOT group instructions are initially defined (the same as in the PDP-8 MAP Assembler), and the highest available location for the user is initially 5363.

From the Teletype, the user can symbolically examine and modify the contents of any memory location. DDT-UP allows the user to punch a corrected program in CBL format.

DDT-UP has a breakpoint facility to help the user run sections of his program. When this facility is used, the debugger also uses location 0005.

DECUS No. 8-26(a)

Title: Compressed Binary Loader (CBL)

Author: Michael S. Wolfberg

CBL (Compressed Binary Loader) binary paper tape format utilizes all eight information channels of the tape. The BIN format, which is the DEC standard, uses only six information channels. Nearly a 25 percent time saving can be achieved by using the CBL system.

Whereas BIN tapes include only one checksum at the end of the tape, CBL tapes are divided into many independent blocks, each of which includes its own checksum. Each block has an initial loading address for the block and a word count of the number of words to be loaded.

The CBL loader occupies locations 7700 through 7777.

DECUS No. 8-26(b)

Title: CBC (BIN to CBL) and CONV (CBL to BIN)

Author: Michael S. Wolfberg

CBC and CONV are two conversion programs which use the PDP-8 on-line Teletype to read a binary tape in one format and punch a binary tape in the other format. The conversion programs both ignore memory field characters so that the output is a tape for memory field 0.

DECUS No. 8-26(c)

Title: XCBL - Extended Memory CBL Loader

Author: Michael S. Wolfberg

XCBL, the Extended Memory CBL Loader, is used to load binary tapes punched in CBL format into a PDP-8 with more than the standard 4K Memory. The XCBL loader occupies locations 7670 through 7777 of any memory field.

DECUS No. 8-26(d)

Title: XCBL PUNCH Program

Author: Michael S. Wolfberg

This program permits a user to prepare an XCBL tape of portions of a PDP-8 extended memory through the control of the on-line Teletype keyboard.

There are two versions of the program so that any section of memory may be punched:

LOW XCBL occupies 00000 - 00377
HIGH XCBL occupies 17200 - 17577

DECUS PROGRAM LIBRARY ADDITIONS

The following programs have not been announced previously but are included in the latest version of the DECUS Program Library Catalog.

PDP-5/8 Library

DECUS No. 8-62

Title: High Speed Reader Option for PDP-8 FORTRAN Compiler

Author: R. W. Tuttle, Trinity College
Hartford, Connecticut

A program modification to the FORTRAN Compiler which allows the PDP-8 to read source tapes through the high-speed reader and punch on the ASR-33. This program is loaded in over the compiler. It can be punched on an extension of the compiler tape, so that by depressing the CONTINUE key, it is read in immediately following the compiler.

DECUS No. 8-62(a)

A revision of the above incorporates a new feature--a switch option which allows the compiler to scan FORTRAN statements without punching an object tape, but which will type out diagnostics in the usual way following reading of the tape. Using this option, the longest FORTRAN programs will be scanned for diagnostics in less than 20 seconds.

DECUS No. 5-63

Title: SBUG-4

Author: Robert Lafore
Lawrence Radiation Laboratory
Berkeley, California

SBUG-4 allows the PDP-5 to execute one instruction of any given program at a time, returning to SBUG-4 following each instruction and printing out the contents of various registers. This permits following the path of a program which has gone astray, or examining some defective operation.

Memory Space: 2-3, 6000-6176

DECUS No. 8-64

Title: DECtape Programming System

Author: John Fitzgerald (Submitted by DEC Software Services Group)

This program provides rapid access to DEC software and utility routines through the use of DECtapes. Programs may be stored, edited, assembled, listed, or executed without reliance upon paper tape.

May be used with both TCØ1 and 552 DECtape Controls.

The system DECtape consists of the following programs:

- ESCAPE--standard tape system program
- UPDATE--standard tape system program
- DELETE--standard tape system program
- GETSYS--standard tape system program
- XRDCT--new system internal programs
- XWDCT--new system internal programs
- XBUF--new system internal programs
- XEDIT--symbolic editor, modified 8-1-S
- XPAL--assembler, modified 8-3-S
- XLIST--symbolic lister
- XLOAD--binary loader
- XDUP--utility duplicating program
- XSYM--symbol loader for DDT
- XMACRO--assembler, modified 8-8-S
- DDT--standard debugging routine, 8-4-S

PDP-7 Library

DECUS No. 7-27

Title: Paper Tape Verifier Without EAE Instructions

Author: A. C. Kilgour, University of Edinburgh
Edinburgh, Scotland

This program is an amended version of DECUS No. 7-18 in which all EAE instructions have been replaced by calls to subroutine. The specification is the same as for DECUS No. 7-18 except that storage for the program has gone up to $(411)_8$, and EAE is not required.

Minimum Hardware: PDP-7 with 8K memory, Paper Tape Reader, Punch, and Teletype Teleprinter

Storage: $(411)_8$ - program $(412)_8$ - $(17713)_8$ - data

PDP-9 Library

DECUS No. 9-1

Title: DECtape Copy Routine

Author: James D. Pitts III
Digital Equipment Corporation
Maynard, Massachusetts

This program will reproduce and verify data information using verified DECtape.

A verified DECtape is one on which timing and mark tracks have been written. It will reproduce the data information from one reel (master) to a second (copy) and verify such information.

The complete tape of 576 blocks may be copied, or any number of blocks can be reproduced as designated by the operator through the AC SWS. Data can be copied in multiples of one block only. The blocks indicated in the AC SWS will be copied from the master reel to the corresponding blocks of the copy reel.

Minimum Hardware: Teleprinter and DECtape Control TCØ2 and two TU55 DECtapes

LINC/LINC-8 Library

DECUS No. L-3

Title: Off-Line LABCOM* System

Authors: G. P. Hicks, M. M. Gieschen, and R. W. Carr
University of Wisconsin Hospitals
Madison, Wisconsin

This program was developed to assist the staff in hospital clinical laboratories to perform routine calculations and to store laboratory data for administrative reports and quality control. It also includes an experimental program for on-line monitoring by the computer of a single automatic laboratory analyzing device.

The system also includes a selection of the following programs:

- Electrophoresis
- Catecholamines
- Creatinine Clearance
- Iron Binding Capacity
- 17 Keto Steroids
- 17 Hydroxy Steroids
- Type Out Steroid Reports
- Porphyrins (COPRO and URO)
- Single Channel On-Line Monitor (Channel 10 Only)

System Users' Manual, Master Tape, and Manuscript available.

(Continued)

Minimum Hardware:	Classic LINC (slight modification to teletype programs required on LINC-8)
Source Language:	LAP4
Storage Requirement:	2048 words - programming is overlapped
Restrictions:	Full capability requires four LINC tape drives

* Laboratory Aided By COMputer

DECUS PROGRAM LIBRARY ADDITIONS

The following are additions to the DECUS library but are not included in the present library catalog. Below, we have listed the number, title, and author of each. The abstract of each program is included in the insert, "Library Catalog Additions." In the future, we will continue this procedure of announcing new programs as an insert. This insert will be in the form of changes and additions to the catalog. Programs will be repeated occasionally in the insert due to the fact that we will be including the new programs on page replacements for the catalog. We will, however, indicate which are new programs in the text of the DECUSCOPE as shown below. Periodically, the category index and numerical indexes for the catalog will be updated.

DECUS No. 7-28

Title: .IODEC REVISION

Author: Phylis F. Niccolai
Carnegie Institute of Technology
Saxonburg, Pennsylvania

DECUS No. 7-29

Title: A Non-FORTRAN DECtape System

Author: K. W. Bixby, Aeronutronic Division
Philco-Ford Corporation
Newport Beach, California

DECUS No. 7/9-30

Title: GRASP: Gaussian Reduction and Analysis of Spectrum Peaks

Author: Albert Anderson, Stanford University
Stanford, California

DECUS No. 7-31

Title: Display N Letter Word

Author: Allen M. Cohen, New York University
Bronx, New York

DECUS No. 7-32

Title: Extended Memory and Interrupt Test

Author: Richard E. Law, Foxboro Company
Foxboro, Massachusetts

DECUS No. 8-65

Title: A Programmed Associative Multichannel Analyser

Author: G. C. Best
Atomic Energy Research Establishment
Harwell, England

DECUS No. 8-66

Title: Editor Modified for DECtape

Author: Robin B. Wadleigh
Johns Hopkins University
Baltimore, Maryland

DECUS No. 8-67

Title: PAL Modified for DECtape Input

Author: Robin B. Wadleigh
Johns Hopkins University
Baltimore, Maryland

DECUS No. 8-68

Title: ALP Program

Author: Charles Kapps
Moore School of Electrical Engineering
University of Pennsylvania
Philadelphia, Pennsylvania

EDITOR'S NOTE

Due to the large increase in the number of users joining DECUS each month, we can no longer publish the names of new individual members. Beginning this issue, only new installation delegates will be announced.

NEW DECUS MEMBERS

PDP-6 DELEGATES

Anthony J. Stracciolini
Medical School Computer Facility
University of Pennsylvania

PDP-7 DELEGATES

Dr. Enoch Callaway
Langley Porter Neuropsychiatric Institute

Clifford E. Carter
Department of Computer Science
University of Illinois

Alfred D. Ford
Department of Defense

O. J. Gossett
USNOTS

Dale Hurliman
Princeton-Pennsylvania Accelerator
Princeton University

James P. Mills
Department of Defense

PDP-8 DELEGATES

Peter Andrews
Fairchild R & D

J. W. Brahan
National Research Council
(Canada)

John G. Campbell
Department of Defense

Kathleen L. Cole
Bubble Chamber Group
Physics Department
State University of New York

Dr. Malcolm F. Collins
AERE Harwell
(England)

Ian F. Croall
AERE Harwell
(England)

PDP-8 DELEGATES (Continued)

Clauzel Dominique
I. M. A. G.
(France)

Roger Alan Due
N. A. D. Crane

Domenico Ferrari
Instituto Di Elettrotecnica
Ed Elettronica
(Italy)

Alan S. Fields
Naval Ship Reasearch and
Development Center
Annapolis Division

Adolf Futterweit
Applied Logic Corp.

Andrew A. Goba
General Electric Corporation
X-Ray Division

Earl D. Hergert, Jr.
Lockheed Electronics Corporation

Dale Hurliman
Princeton-Pennsylvania Accelerator
Princeton University

I. N. Hooton
Electronics and Applied
Physics Division
AERE
(England)

Cecil Kelsey
Daily News-Tribune
La Salle, Illinois

Brian T. Knight
Standard Telephones and
Cables Ltd.
(England)

J. W. Knowles
Atomic Energy of Canada Ltd.

M. Morris Mano
California State College at L. A.

Jack L. McClendon
J. P. Stevens & Co. Inc.

PDP-8 DELEGATES (Continued)

Gert Meisel
University Bonn (Germany)

Dr. Masanori Mishina
Institute for Nuclear Study
University of Tokyo

Robert F. Nickerson
Lawrence Radiation Laboratory
Livermore California

Dr. Edward A. Patrick
School of Electrical Engineering
Purdue University

Maxine L.Paulsen
Instrumentation Field Station
Washington

T. B. Pierce
AERE Harwell
(England)

Arthur M. Poskanzer
Lawrence Radiation Laboratory
Berkley, California

Jack Quade
Mackay School of Mines
University of Nevada, (Reno)

Fontaine K. Richardson
Department of Computer Science
University of Illinois

M. P. Ruffle
AERE Harwell
(England)

John H. Scarborough
Sun Oil Company

K.D. Smith
General Instruments Corp.
Micro Electronics R&D Center

William C. Stebbins
Kresge Hearing Research Institute
University of Michigan Medical School

Sydney Peter Spragg
Department of Chemistry
The University (Birmington,England)

PDP-8 DELEGATES (Continued)

Terry C. Tessein
The Foxboro Company

Rudolph E. Vogeli
Western Electric Company

C. H. West
Physics Department
University of Pennsylvania

Reinhard Wodick
Institute of Physiology
Marburg, Lahn (Germany)

PDP-8/S DELEGATES

David C. Barton
Eastman Kodak Company

George Lewis Helgeson
Helgeson Nuclear Services Inc.

Ronald E Medei
Western Electric Company

Richard B Millward
Walter S. Hunter
Laboratory of Psychology

Paul R. Morel
Parametrics Incorporated

R. Newton
Research Council of Alberta
(Canada)

William B. Packard
Raytheon Company
Submarine Signal Division (R. I.)

Walter M. Pawley
Oceanography Department
Oregon State University

D Polyzoes
Xerox Corporation

D. W. Roberts
The Strand Hotel Ltd (England)

Brian Schaefer
University of Waterloo

PDP-8/S DELEGATES (Continued)

Mr. Herbert R. Seal
Spacelabs, Incorporated

J. S. Waugh
Department of Chemistry
M. I. T.

Dr. H. R. Ziel
Department of Industrial
& Vocational Education
University of Alberta
(Canada)

PDP-9 DELEGATES

James G. Bever
M. I. T. Instrumentation Lab.
Longspur Group

Prof. Philip R. Bevington
Physics Department
Stanford University

Marcello Cresti
Instituto di Fisica Nucleare
(Italy)

Ercolino Ferretti
Ferretti-Lay Inc.

John L. Muerle
Cornell Aeronautical Laboratory, Inc.

Donald A. Norman
Psychology Department
University of California (San Diego)

Lloyd J. Ostiguy
Inforonics Incorporated

Ronald G. Ragsdale
The Ontario Institute for Studies
in Education (Canada)

LINC-8

James P. Berneski
Woman's Medical College,
Hospital (Philadelphia)

Robert Dolceamore
Frankford Arsenal
Computer Systems Laboratory

LINC-8 (Continued)

Joel Ellder
Chalmers Technical University
(Sweden)

Dr. Henry Gluck
Western Reserve University

Prof. Peter Ladefoged
University of Rochester
Center for Brain Research

George H. Stewart
Radiology-Physiology Research Group
Temple University Medical School

Michael Wilber
Stanford Research Institute

Richard V. Wolf
Eye and Ear Hospital
(Pittsburgh)

V6 N4

Last insert not complete

DECUS

"LETTERS"

Letters of general interest will be published as a standard insert to each issue of DECUSCOPE. Letters written between users, to DEC personnel, and to the DECUS office will be included. Submissions to this section, "Letters Insert," should be sent to: Angela J. Cossette, DECUS Executive Secretary, DECUS, Maynard, Massachusetts 01754.

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY

MAY 25 1967

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
LABORATORY FOR NUCLEAR SCIENCE
CAMBRIDGE. MASSACHUSETTS 02139

MAY 24, 1967

MR. DON WITCRAFT
DIGITAL EQUIPMENT CORP.
MAYNARD, MASSACHUSETTS

DEAR DON:

AT THE SPRING DECUS SYMPOSIUM THERE WAS SOME DISCUSSION OF THE CURRENT STATUS OF THE PDP-6 MPS MONITOR, AND OF POSSIBLE FUTURE ADDITIONS AND MODIFICATIONS TO IT. WE HAVE SOME SPECIFIC COMMENTS WHICH MAY BE OF INTEREST TO YOU. THESE COMMENTS REFER TO VERSION 2.8 (WITHOUT SWAPPING).

JOB IN MONITOR COMMAND MODE

WHEN A JOB IS RUNNING IN MONITOR COMMAND MODE, AS AFTER A CSTART OR CCONT COMMAND, INCONSISTENT THINGS MAY HAPPEN AFTER A SUBSEQUENT COMMAND WHICH TRIES TO CHANGE THE PROGRAM COUNTER. THE DDT COMMAND, FOR EXAMPLE, STORES THE DDT ADDRESS IN JOBPC. BUT THIS CHANGE OCCURS IN COMCON WHEN A CLOCK INTERRUPT IS IN PROGRESS. IF THE JOB AFFECTED IS CURRENTLY IN A QUEUE AND NOT RUNNING, THE JOBPC WILL BE USED NEXT TIME IT IS SCHEDULED, AND CONTROL WILL GO TO DDT. BUT IF THE JOB IS CURRENTLY RUNNING, THE CHANGE IN JOBPC HAS NO EFFECT, FOR THE CONTENTS OF USRPC ARE USED WHEN THE JOB RESUMES.

CORE SHUFFLER

ASSUME A 48K INSTALLATION WITH A 7K MONITOR. JOB 1 IS RUNNING PIP2 IN 10K IN LOWER CORE. JOB 2 IS RUNNING F4 IN 20K JUST ABOVE IT. JOB 1 MAY ATTEMPT R TECO 20 AND GET THE MESSAGE 3K CORE NEEDED. ASIDE FROM THE MISLEADING NATURE OF THIS ERROR COMMENT, THE PROBLEM REMAINS THAT 20K IS AVAILABLE AND YET THE REQUEST IS REFUSED.

THE SHUFFLER LOOKS FOR A 20K BLOCK OF CORE, AND DOES NOT RELEASE THE ORIGINAL 10K UNLESS THE REQUEST IS SATISFIED, BECAUSE IT WANTS TO BE ABLE TO GIVE BACK THE ORIGINAL CORE IF THE REQUEST CANNOT BE SATISFIED.

IT SHOULD BE POSSIBLE TO HANDLE ALL SUCH CASES BY THE FOLLOWING STRATAGEM: WHEN A JOB REQUESTS ADDITIONAL CORE IN THE AMOUNT OF N 1K BLOCKS, TO GIVE IT A TOTAL OF M+N 1K BLOCKS, THE SHUFFLER SHOULD LOOK FOR A HOLE OF SIZE N, RATHER THAN M+N. IF THIS IS FOUND ABOVE THE ORIGINAL BLOCK, THE INTERVENING USERS CAN BE SHUFFLED UPWARDS TO CREATE

A CONTIGUOUS BLOCK. IF THE HOLE IS FOUND BELOW THE ORIGINAL BLOCK, INTERVENING PROGRAMS CAN BE SHUFFLED DOWNWARDS.

JOB DATA AREA

PERHAPS THE CONTENTS OF AT LEAST JOBSA, JOBREN, AND JOBDDT SHOULD BE CLEARED WHEN THE JOB TO WHICH THEY REFER IS KILLED, INITIALIZED, OR SHUFFLED INTO A NEW AREA. CURRENTLY A USER MAY INITIALIZE A JOB AND TYPE START OR DDT. INSTEAD OF THE DESIRED ERROR RESPONSE, THIS ACTION CAUSES A TRANSFER TO THE FORMER STARTING ADDRESS OR DDT, WITH POSSIBLY UNDESIREABLE RESULTS.

OBJECTION TO IMPLICIT "RUN" COMMAND

WE UNDERSTAND THAT THERE IS SOME POSSIBILITY THAT NAME BE CONSIDERED EQUIVALENT TO RUN SYS:NAME. THIS WOULD PROBABLY BE ACCOMPLISHED BY HAVING ALL UNRECOGNIZED COMMANDS FALL THROUGH TO THE R COMMAND HANDLER. BUT IF A MISTAKE IS MADE IN A COMMAND, FOR EXAMPLE CONTINUE INSTEAD OF CONT, THE MANY THINGS THAT HAPPEN BEFORE THE LOOKUP FAILS IN SAVGET WOULD RENDER THE ERROR IRRECOVERABLE. THE CHANCE OF SUCH AN ERROR MAY BE SLIGHT, BUT THE MAGNITUDE OF THE LOSS IS SO GREAT, AND THE ADVANTAGE OF PIP2 INSTEAD OF R PIP2 SO SLIGHT, THAT IT SEEMS TO US THE EXPECTATION OF SUCH A CHANGE WOULD BE NEGATIVE.

WE HOPE THESE COMMENTS MAY BE OF SOME USE TO YOU, AND WE WOULD APPRECIATE ANY THOUGHTS YOU MIGHT HAVE ABOUT THEM.

SINCERELY YOURS,

Richard Freedman
RICHARD FREEDMAN

Dave Friesen
DAVE FRIESEN

CC: EVELYN DOW - DEC
ANGELA COSSETTE - DECUS

NEW YORK UNIVERSITY
School of Engineering and Science
UNIVERSITY HEIGHTS, NEW YORK, N.Y. 10453
AREA 212 584-0700

Department of Electrical Engineering

MAY 15 1967

April 27, 1967

P.2

Mrs. Angela J. Cossette
DECUS Executive Secretary
Digital Equipment Corporation
Main Street
Maynard, Massachusetts 01754

Dear Mrs. Cossette:

With reference to your telephone call of a few days ago, I am enclosing program dumps of our FORPLOT and GENPLOT programs.

Both of these programs are in frequent use here and have been very thoroughly tested. There should be no difficulty at all as far as using them on a PDP-5 computer. FORPLOT does use a routine "which was prepared by DEC" in which the program counter is addressed directly. This is possible in the PDP-5 but not in the PDP-8, and could account for the difficulties that a PDP-8 user would have. In the case of GENPLOT however, this is not the case and we can think of no reason why GENPLOT would not work very well with a PDP-8 computer.

Please feel free to give our name and adress to anyone who is interested in FORPLOT or GENPLOT. If he has difficulties with it or with either of these and will let us know what these are, we will try to advise him how he might correct these difficulties.

Sincerely yours,

H. Freeman
Professor of
Electrical Engineering

HF:ec
Encl.

JUN 8 1967

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ENGINEERING DEPARTMENT

June 7, 1967

Mrs. Angela J. Cossette
DECUS
Maynard, Massachusetts 01754

Dear Mrs. Cossette:

In "Programming Notes" of Decuscope, Vol. 6, No. 3, Mr. G. C. Donahue advocates using a print routine of the form:

```
        TLS
        TSF
        JMP .-1
```

to avoid problems with accidental clearing of the printer flag. While this will certainly work, it is wasteful of computer time, as the computer could be performing other tasks while the teletype is printing.

As a solution, I have used a routine:

```
A,      TSF
        JMP TEST
B,      TLS
        JMP ...    (exit)
TEST,   ISZ C
        JMP A
        JMP B
C,      Ø
```

which waits for the printer for a maximum of one-half second with the PDP-8/s (a loop nesting two ISZ's might be used with the faster PDP-8) before printing.

Yours very truly,

Matthew L. Fichtenbaum
Development Engineer

MLF:JPH

JUN 10 1967

STANFORD UNIVERSITY
STANFORD, CALIFORNIA

DEPARTMENT OF PHYSICS

June 8, 1967

Mrs. Angela J. Cossette
Executive Secretary/Editor
Digital Equipment Computer Users Society
Maynard, Massachusetts 01754

Dear Angela:

Thanks for your note. I'm glad to hear of the profusion of contributions to the DECUS program library.

Sorry about the confusion concerning SCANS Memo No. 20. It is not yet written and will not be available for general distribution for some time. This program (revised I/O library for the PDP-7/9) belongs in the category of _caveat emptor_ programs. We are now using preliminary versions of these library routines, but they are still undergoing revision. Copies are available for any interested persons, and I would hope DECUS might advertise this fact, but a documented SCANS memo for inclusion in the DECUS library will not be forthcoming until the routines are fully debugged.

The following is a preliminary abstract:

Fortran II I/O Library for the PDP-7/9: Revised versions of the library subroutines for FSWMIO Fortran II: .IO1, .IO2, .IO3, .IO4, .IO5, .IODEC, NARITH and EARITH. These routines are considerably shorter than the versions supplied by DEC, and they are compatible with programs utilizing the program interrupt facilities.

The DECtape routine is fully compatible with both the PDP-7 and the PDP-9 DECtape hardware, and can read and write tape on the PDP-7 in either format for checksums.

Sincerely,

Phip

Philip R. Bevington
Assistant Professor

PRB/ph

May 19, 1967

Mrs. Angela Cossette
DECUS Office
Digital Equipment Corporation
Maynard, Massachusetts 01754

Dear Angela:

As DECUS representative to JUG, I would like to take this opportunity to report on JUG activities to the membership of DECUS. Enclosed with this letter is a copy of the minutes of the last JUG meeting in Atlantic City. Of particular interest to DECUS members would be the operation of the JUG representative on the USASI Standards organization and the JUG Program Library Interchange Service.

Our representative to the standards organization has furnished a report, which is also attached to this letter. In this report he proposes a new organization within JUG and the JUG unit members to effect better user participation in the standards committees. What he is asking is that each unit member form its own standards committee. The chairman of that committee would be the representative to the JUG Standards Committee. This would provide a medium for better user participation, as well as providing a channel for the JUG Standards Committee to pass information to the users. In the past the JUG Standards Committee chairman has had to vote negatively on issues without benefit of a united front within JUG. These issues, such as the ASCII character set, can be very important to all of us.

Therefore, I would like to solicit the DECUS membership for interest to serve on a DECUS Standards Committee, should this JUG proposal be accepted. I would also like to find a chairman of the DECUS committee. As you can see by the enclosure the JUG Standards chairman must attend many meetings. I do not think this would have to be true for our chairman.

The other thing of importance to the DECUS membership is the proposed JUG Program Library Interchange Service. Under this plan users in one user group will be able to obtain documentation about programs in another user group program library. The key to this venture is the JUG Program Library Catalog. This effort was accepted by the ACM Council as a project worthy of support. Currently we are trying to raise funding to support the

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146 MAIN STREET, MAYNARD, MASSACHUSETTS 01754, TEL. (617) 897-8815
927 15TH STREET, N. W., WASHINGTON, D. C. 20005, TEL. (202) 638-6862

catalog effort. We are also in the process of getting JUG unit members committed to a trial period of this project. Thus far DECUS and SHARE have committed, but we anticipate more members soon. We estimate that the initial JUG Program Library Catalog will contain some 2,000-3,000 programs, and it will be updated quarterly. The project is being carried on by the JUG Program Library Committee. Its membership is:

Dick McQuillin - DECUS, Chairman
Angela Cossette - DECUS
Ben Faden - SHARE, Membership Chairman
Bob Chambers - SHARE
Elinor Burns - CAP (Computer Control)
Ken Brown - SDS Users
Walt DeLegall - COMMON

Our proposal to the ACM to sponsor this project is quite long - too long for this mailing. Anyone wishing a copy should write to you at DECUS Headquarters.

The only other item that came up in the JUG Workshop was the formation of an ad hoc committee to look into publication of a JUG newsletter. J. B. Person of SWAP (CDC 3000 users) is heading up this committee. More information should be available when the next workshop is held in the fall.

I would be glad to answer any questions the membership might have concerning DECUS activities in JUG.

Sincerely

Richard J. McQuillin
DECUS Representative to JUG

jmm

ASSOCIATION FOR COMPUTING MACHINERY 211 EAST 43 STREET, NEW YORK, N.Y. 10017

Joint Users Group

Minutes of Joint Users Group (JUG) Meeting, April 17, 1967, Atlantic City, New Jersey

The meeting was called to order at 4:20 p.m. by the Chairman, M. Klerer, at the Holiday Inn. The attendance is reflected in Appendix A "Attendance". The following agenda was approved.

AGENDA

1. Attendance
2. Approval of Agenda
3. Minutes of Previous Meeting
4. Secretary's Report
5. Committee Reports
    a. Programming Languages
    b. ASA Standards
    c. Education
    d. Applications Digest
    e. Program Library
6. Old Business
7. New Business
8. Next Meeting Plans
9. Adjournment

3. MINUTES OF PREVIOUS MEETING

The minutes of the previous meeting were approved.

4. SECRETARY'S REPORT

No Report.

5. COMMITTEE REPORTS

a. Programming Languages

No Report.

b. USASI Standards

Utman was unable to attend the meeting. His report and notes he planned to use are attached as Appendix "B" these minutes.

Steel commented that JUG's negative vote on the "Recorded Magnetic Tape" (800 CPI, NRZI) standard had been questioned at the last X3 meeting. The question was raised at X3 as to what balloting procedures JUG employed.

Davidson stated that he had discussed past issues at the COMMON meetings and also had balloted the membership on occasion.

Steel said that SHARE had a Standards Committee which considered proposals and made recommendations to an Executive Board.

Klerer remarked that he had received a letter from Bromberg concerning JUG's X3 activities. Klerer said that Bromberg suggesting something be done to keep JUG's members better informed on X3 ballots.

There was a general discussion on the subject of the number of levels JUG members are removed from X3 issues.

Steel suggested X3 alert JUG members on the issues involved.

Rountree said it appeared that Utman had to cast the JUG vote on how he thought JUG members felt about an issue rather than instructions from the members.

After considerable discussion on how best to distribute and collect comments on X3 ballots, Steel moved:

"That the JUG X3 representative be directed to make available to the unit members of JUG, on a timely basis, all ballots to be taken by X3, with accompanying explanation and a date by which a response must be received by the JUG X3 representative."

Davidson seconded.

The motion passed unanimously.

Steel said he would draft a letter for the JUG Executive Board to send to all Unit Members to inform them of their responsibilities on X3 issues.

There was a general discussion on carrying X3 issues in a JUG newsletter.

c. Education

Klerer read a letter from Naftaly in which he reported that he had distributed an education survey questionnaire. Naftaly said he had received only three responses, none of which contained any significant information. In view of the apparent lack of interest in this activity, Naftaly submitted his resignation and suggested that JUG could better expend its efforts in some other area.

The secretary was instructed to inform Naftaly of the acceptance of his resignation and to express the appreciation of the membership for his efforts.

Klerer stated that the education activity was suspended for the time being.

d. Application Digest

No Report. There was a general discussion in which it was concluded that there were not enough interested and competent people to warrant continuation of the activity.

Klerer commented that Bob Bemer (GE) had expressed an interest at the last meeting but that he had not heard from him since. He said he would call Bemer to see if there was any interest on Bemer's part to head up this activity.

e. Program Library

McQuillin reported that ACM had returned their proposal (Appendix "C", minutes of San Francisco meeting) for rewriting. The Program Library had rewritten it and it was ready for resubmission (Appendix "C", these minutes). McQuillin said that the Committee would meet after the JUG meeting to discuss the proposal and the Program Library Catalog (Appendix "D", these minutes).

6. OLD BUSINESS

Faden remarked that JUG should take a formal position on workshops.

There was a general discussion on future workshops and the large amount of work involved in conducting them.

Linda Ferguson said she would see if she could chair a workshop in conjunction with the FJCC. Klerer said if Ferguson was unable to chair a workshop he would poll the executive committee for a course of action to be taken in the future.

7. NEW BUSINESS

Klerer read a letter from the secretary of VIM requesting JUG to designate an individual to act as recipient of all regular VIM distributions.

Following a general discussion on the VIM request it was agreed that:

1. The JUG secretary would be the VIM contact, informing VIM that JUG did not want to receive regular mailings.

2. Workshop chairmen would request (probably through the JUG secretary) material from VIM on an as required basis.

Albright asked if JUG had any plans to organize a group to investigate making "applications programs machine independent". He stated that he felt there was a need for more widespread use of generalized programming languages. Also, through the use of such languages, applications could be made to be more machine independent.

The subject was discussed with the point made that the USASI standardization efforts were responsive to this issue. Nothing was resolved.

Klerer reported that there was a need for JUG to have a Treasurer. Klerer said he would act as temporary treasurer pending amendment of the bylaws. The secretary was instructed to prepare an amendment notice and have it circulated prior to and for consideration at the next meeting.

8. NEXT MEETING PLANS

The next meeting is scheduled for Monday, August 28, 1967, at 8:00 p.m. The meeting is in conjunction with the Annual National ACM Conference being held in Washington, D.C.

9. ADJOURNMENT

The meeting adjourned at 6:15 p.m.

Respectfully submitted,

Robert E. Rountree, Jr.
Secretary, JUG

5-2-67

Appendix B 1967 April 17

JUG IN INDUSTRY STANDARDIZATION

REPORT

From: R. E. Utman

As Chairman of the JUG Standardization Committee I have been representing the interests of users of computers and information systems in the name of the Joint Users Group as a member in the following standardization and related organizations:

USA Secretariat of ISO/TC 97 - Computers and Information Processing

USA Secretariat of ISO/TC 97/SC 5 - Common Programming Languages

USASI IPSSB - Information Processing Systems Standards Board (for ACM-JUG)

USASI Standards Committee X3 - Computers and Information Processing

USASI X3-IAC - International Advisory Committee

USASI X3.2 - Character Sets, Codes and I/O Media

USASI X3.4 - Common Programming Languages
X3.4.2 - Language Specifications
X3.4.5 - USA in ISO/TC 97/SC 5

USASI X3.6 - Problem Analysis and Definition

USASI Standards Committee X6 - Process Control Systems

IFIP/TC 2 - Programming Languages

ACM Standards Committee

In carrying out this representational responsibility I have officially participated in the following meetings in the name of JUG since 1966 January 1:

Appendix B   1967 April 17

PRELIMINARY PROPOSAL FOR JUG STANDARDS ORGANIZATION AND PROCEDURE

JUG Standards Organization

1. Each JUG Group Member appoints a Standards Chairman and organizes an internal Standards Committee in support.

2. Group Member Standards Chairmen comprise the JUG Standards Committee as a standing body representative of the membership.

3. The JUG President with approval of the Council appoints the JUG Standards Chairman, who shall preside in the Committee.

JUG Standards Operation

1. The JUG Council and Officers represent the ultimate authority within JUG in matters related to standards.

2. A Group Member Standards Chairman, and/or his designee, is responsible to his group authority for activity and representation, in the name of his group, in matters related to standards.

3. The JUG Standards Chairman, and/or his designee, is responsible to the JUG Council and Officers for keeping them and the membership informed, and for activity and representation, in the name of JUG, in matters related to standards.

4. Group Member needs and interests relative to standards, that are appropriate to collective JUG consideration or representation, are communicated to the JUG Standards Chairman and/or Committee through the Group Member Standards Chairmen.

5. Activity and representation by the JUG Standards Chairman and Committee, in the name of JUG, is communicated to the JUG Council and Officers by the JUG Standards Chairman, and to the Group Members and their membership through the Group Member Standards Chairmen.

6. The following are particular examples of lines of authority, responsibility, communication and representation:

   a. JUG is represented in USASI X3 activity by the JUG's Standards Chairman, his Alternate and/or his designees.

   b. JUG's formal positions in USASI X3 activity are represented by the JUG Standards Chairman with the advice of the Standards Committee.

For example, USASI X3 Letter Ballots are promptly referred by the JUG Standards Chairman to the JUG Standards Committee for due consideration. The JUG Standards Chairman is responsible within the Committee for making every reasonable effort to develop a JUG concensus position. In any case, he is to be guided by the Committee in his eventual responsibility to formulate the JUG position, and to inform the Council for ultimate review as appropriate.

c. Industry standardization activity in which JUG is represented is to be reported in writing periodically (at least three times a year) to the JUG Officers and Council, the Group Member Standards Chairmen and the Group Member Presidents by the JUG Standards Chairman.

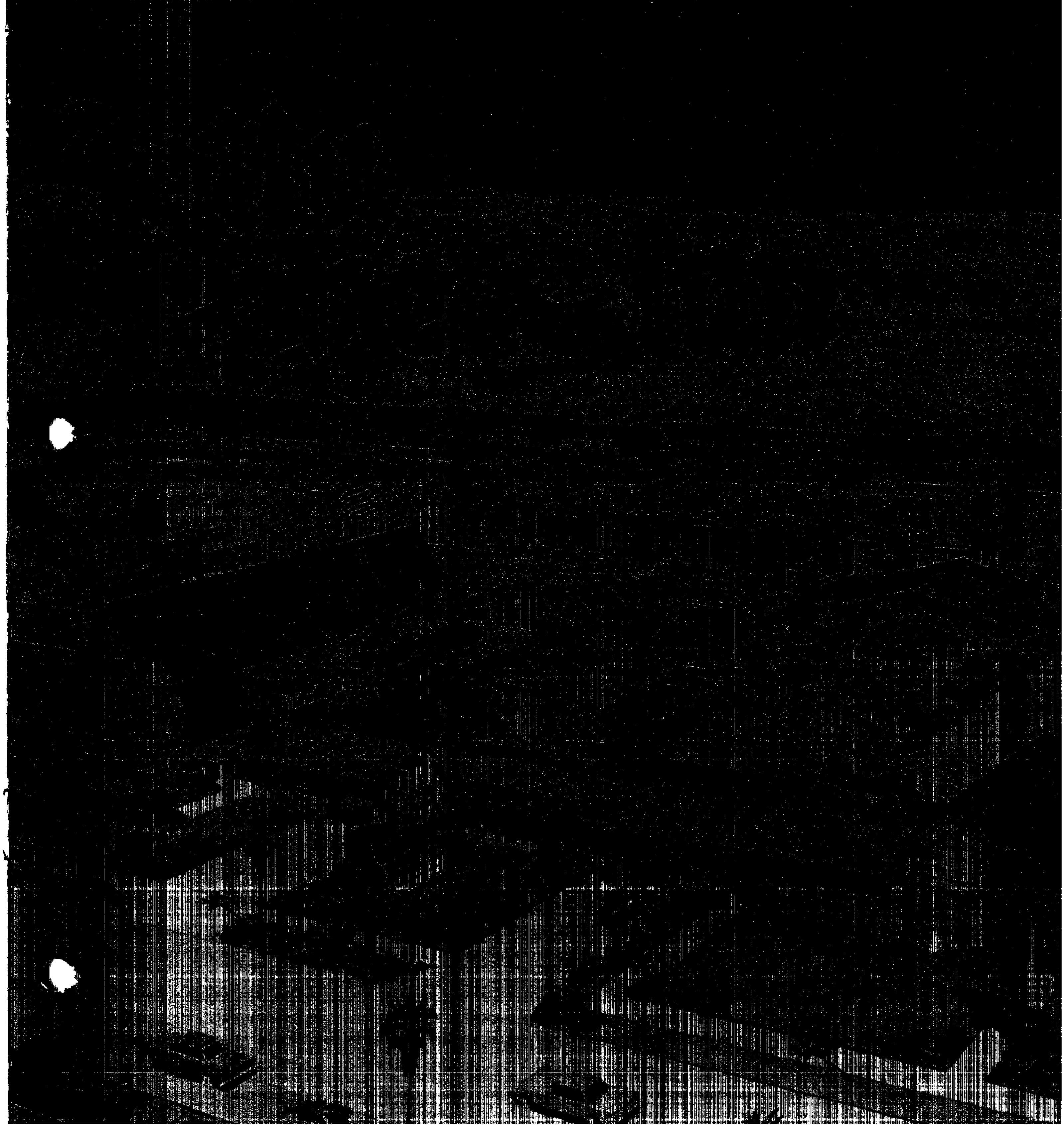
d. Periodic reports on JUG Standards activity will be submitted to the Communications of the ACM for publication.

e. The JUG Standards Chairman personally reports activity, status and problems to all formal meetings of the Council.

1967 - Volume 6, Number 5

DECUSCOPE

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY



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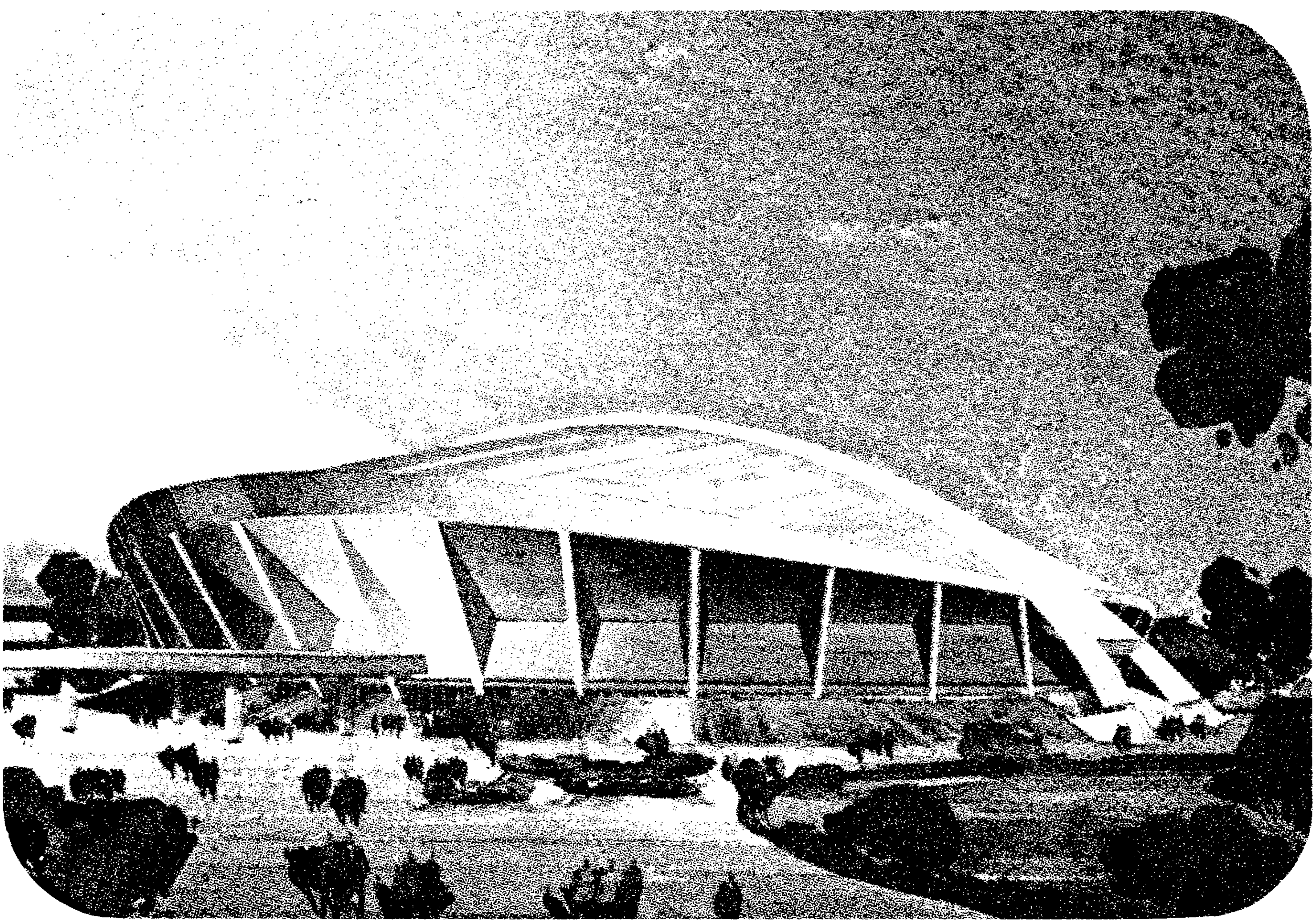

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DECUSCOPE has been published since April 1962 and is the official newsletter for Digital Equipment Computer Users Society.

It is published periodically at the DECUS Office, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Telephone: AC 617, 897-8821, ext. 414

Editor: Angela J. Cossette, DECUS

DECUS Publications Chairman: Michael Wolfberg, Moore School of Electrical Engineering, University of Pennsylvania

Circulation: 2,800 copies per issue

DECUS FALL SYMPOSIUM

The DECUS Fall Symposium will be held at the Jolly Roger Inn, Anaheim, California, on November 10 and 11. This year's meeting promises to be one of the best yet, as it is packed full with papers, workshops and tutorials.

The final agenda of the meeting will be available within the next few days along with registration and hotel information. This material will be sent automatically to all people on the DECUS mailing list. Anyone not on the DECUS mailing list may obtain information by contacting Mrs. Angela Cossette, DECUS, Maynard, Massachusetts 01754.

Meetings Chairman, Donald Molony of Rutgers, invites all members as well as interested individuals to attend the sessions. A banquet and cocktail party will be held for all attendees on Friday evening (guests welcome).

IT IS HOPED THAT AS MANY DECUS MEMBERS AS POSSIBLE PLAN TO ATTEND THE MEETING.

Abstracts of the papers for presentation along with outlines of the tutorials and workshops follow.

ABSTRACTS

A COMPUTER BASED ELECTROCHEMICAL CONTROL AND DATA ACQUISITION SYSTEM

George Lauer
North American Aviation Science Center
Thousand Oaks, California

We have assembled an electrochemical control and data acquisition system using a PDP-8 as the basic control element. The system consists of the PDP-8 equipped with EAE, high-speed punch and reader, a 32K disc, a 138-E Analog to Digital Converter, two Digital to Analog Converters, and a real-time clock with one microsecond resolution.

The system is tied to an analog control circuit which is connected to the electrochemical cell. In operation, the computer is programmed to control the voltages, apply pulses at the correct time and in the correct sequence, acquire the desired data and then fit the data to the particular model.

A variety of electrochemical procedures have been programmed. In practice, the system has been found to be extremely valuable. Experiments have been performed with great reduction in time required and a marked increase in precision. By using the computer to generate the pulses, we have also decreased costs which would normally be incurred for specialized pulse generating equipment.

A COMPUTER CONTROLLED DIFFRACTOMETER

Howard A. Cohodas
Picker Instruments
Cleveland, Ohio

In recent years X ray diffraction has become an important tool for the investigation of crystal structure. At the same time, the small computer has gained popularity in a systems control environment. Together they provide a powerful tool for scientific investigation.

One such system is the Picker diffractometer controlled by either the PDP-8 or PDP-8/S. Discussion will center around its hardware and software development, including examples of some useful programming techniques implemented on this system.

ANALYSIS OF MULTICHANNEL ANALYZER DATA WITH LIGHT PEN TECHNIQUES

C. Wendell Richardson
Phillips Petroleum Company
Idaho Falls, Idaho

Due to data formatting problems and long turn-around times experienced on large computers, a program package has been developed for a 4K PDP-8 computer using a stepping recorder and DECtape to readily access and store 4096 channel data from a multichannel analyzer. An inexpensive 21-inch display console, light pen, and function box are used to study the data, make fast preliminary calculations to determine parameters, and obtain final results. The need for listings and plots has been eliminated, and an analysis can be completed immediately after the data are taken.

AUTOMOBILE EXHAUST ANALYSIS SYSTEM

Robert Jahncke
Beckman Instruments, Inc.
Fullerton, California

Government standards have specified a procedure for measuring the carbon monoxide and hydrocarbons emitted from the tailpipe of an automobile. The procedures require the use of non-dispersive infrared analyzers and a series of computations to be applied to the response as measured to yield a final answer.

The operation is automated by the use of a PDP-8/S general-purpose computer to compute the results on-line. The analyzer data is presented to the computer via a 10-channel relay scanner and a 10-bit analog to digital converter. The computer then performs linearization of the ADC data, weighting, and correcting the data to meet government requirements.

A REAL-TIME AIR POLLUTION ANALYSIS SYSTEM

Carter L. Cole
Automatic Information Management, Inc.
Encino, California

Chemical analyzers are placed on-line to the PDP-8/S in this micrometeorology application. Scanning the sensors at many remote stations, the PDP-8/S determines instantaneous readings for the following parameters: carbon monoxide, sulfur dioxide, temperature, smog, wind speed, and wind direction. Printouts may be obtained either by an integration of readings over a report cycle of up to four hours, or by a demand log of the readings taken during the present scan. Readings may be calibrated by using known samples. Also, they may be checked against program limits to permit alarm signals to be generated at predetermined danger levels.

A PROGRAMMED DISTRIBUTION GENERATOR

David N. Samsky
Booz-Allen Applied Research, Inc.*
Albuquerque, New Mexico

Hardware additions to a PDP-8 analyzer system have made it possible to form a poisson weighted sum of the n-fold convolutions of any distribution. The associated program, consisting of a generator and a monitor, uses as an input any initial spectrum and pulses from a random pulse generator. The hardware and program have been used successfully to generate poisson statistics and spectra from the stochastic process of dark current from a photomultiplier tube. In the field of radiation dosimetry, it can be used to generate the distribution of expected dose in a cell, knowing only the single event energy deposition spectrum and the average number of events per cell.

* Work performed at: Battelle Northwest, Richland, Washington.

TAPE RECORDER I/O OPERATION IN A PDP-8 CONTROLLED BETA-RAY SPECTROMETER SYSTEM

J.J.H. Park and J. Ohkuma
Applied Physics Division, National Research Council
Ottawa, Ontario, Canada

A $\pi\sqrt{2}$ iron free beta-ray spectrometer system is being interfaced with a PDP-8 computer. While various interfacing is being designed and installed, an efficient use of the computer is made for general purpose by speeding up I/O operation by the use of a tape recorder I/O device. The new I/O system is simpler and more reliable than that described in the paper given at the Canadian DECUS Symposium in April. Detailed description will be given of the present system and of the modification of programs, Symbolic Tape Editor and PAL III for this high-speed operation.

AUTOMATIC CALIBRATION AND EVALUATION OF MULTICHANNEL ANALYZERS USING A PDP-8

W. W. Black
Idaho Nuclear Corporation
Idaho Falls, Idaho

A complete package of PDP-8 programs have been developed for automatic evaluation and calibration of multichannel analyzer systems. These programs require a basic PDP-8, a specially designed computer-controlled pulser, and a DEC Type 160B Interface for dual analog-to-digital converters (ADC's). The programs permit the following parameters to be measured: Stability of the ADC zero reference level, stability of the system gain, deviation of the system from a linear response, and ADC channel profiles. These parameters can be measured for any ADC ramp length up to 4096 channels with an accuracy of 5 parts in 100,000.

THE INTEGRATOR-COMPUTER SYSTEM FOR GAS CHROMATOGRAPHY DATA AUTOMATION

Tom Barrett
INFOTRONICS Corporation
Houston, Texas

The advent of the electronic digital integrator and the small inexpensive general-purpose computer makes possible a highly accurate and flexible automatic analysis system for gas chromatography.

The integrator performs the tasks of filtering, baseline drift correction, timing, and integration which are normally done by a computer in the conventional A-D system. Therefore, the need for a fast, expensive computer with additional memory or bulk storage and sophisticated programming is eliminated. In its place, a small inexpensive computer with a comparatively simple program may be used to perform the data acquisition, normalization, identification and reporting.

The integrator-computer systems modular configuration thus provides ease of expansion coupled with reliable performance and minimum effects due to subsystem failures.

DEDICATED COMPUTERS FOR INSTRUMENT CONTROL*

Roger E. Anderson
Chemistry Department, Lawrence Radiation Laboratory
Livermore, California

The low-cost control computer can be readily interfaced to laboratory instruments using breadboard circuitry. This paper will describe several such applications using the PDP-8/S. Emphasis will include software techniques, system capability and versatility, and experimenter interaction. These systems will be discussed as an alternate to a larger time-shared system. Specific examples will be used to illustrate this philosophy.

* This work was performed under the auspices of the U.S. Atomic Energy Commission. (UCRL-70638)

DATA ACQUISITION AND ANALYSIS OF HIGH RESOLUTION MASS SPECTRA IN REAL TIME

M. L. Cramer and D. J. Waks
Applied Data Research, Inc.
Princeton, New Jersey

A multi-phase computer program operational on a minimum configuration PDP-8 performs data collection, compression, mass measurement and chemical composition determination while connected on-line to a high resolution mass spectrometer. An analog-digital converter, variable oscillator, adjustable threshold, bias control, and error detection logic are employed in a low-cost data acquisition interface specially designed for this application.

Considerable variation in adjustment and parameterization is permitted from run to run enabling the application of automatic measurement and analysis to a wide range of mass spectral data. The operator/experimentor is encouraged to control and steer the process in an on-line interactive fashion through the selection of run parameters, standard measurement criteria, composition and error limits, and final report format.

ADAPTATIONS OF PDP-8 FORTRAN FOR LABORATORY COMPUTING

Russell B. Ham and Christopher B. Nelson
U. S. Public Health Service
NE Radiological Health Laboratory
Winchester, Massachusetts

The PDP-8 FORTRAN system provides a higher-level language for short but moderately complex computations. In addition, the system programs are sufficiently modular that it is possible to alter specific routines to accomplish a desired objective much more easily than writing an entire assembly language program.

We have made several modifications to the FORTRAN system in order to assist our basic project of X-ray and gamma-ray spectroscopy. Most significant of these modifications are DECtape routines for the TC$\emptyset$1 control, incremental DECtape reading and writing in order to access entire blocks, a mechanism for appending an argument list to a PAUSE-type subroutine call, and graphical output.

AN INTEGRATED DISK-TAPE OPERATING SYSTEM FOR THE 338 BUFFERED DISPLAY COMPUTER

Jerrold M. Grochow and Thomas P. Skinner
Project MAC, Massachusetts Institute of Technology
Cambridge, Massachusetts

A user oriented operating system allowing both the convenience of temporary mass storage and the availability of permanent secondary storage is described. The entire operating system is resident on the disk and accessible through bootstrap routines stored in a single core page. The user's program may use all 8K or core memory (except for the bootstrap page) and yet have immediate access to the "invisible" operating system. Programs may utilize system primitives for I/O buffering and creation of binary and symbolic tape files. System primitives also handle such activities as updating file directories, saving core images, loading binary-image tape files, and resuming user programs.

LINC-8 TEXT-HANDLING SOFTWARE FOR ON-LINE PSYCHOPHYSICAL EXPERIMENTS

B. Michael Wilber
Stanford Research Institute
Menlo Park, California

A complete text-handling system (LUCIFER) has been developed for the LINC-8. All communication between LUCIFER and mortal man is carried on through a Teletype medium so that hard copy is always produced, and one need never invoke scope, switches, and lights. Along with LUCIFER have appeared subroutines by which experiment-running programs can do input and output of data with text files or the Teletype. This paper discusses the philosophy of LUCIFER and includes examples of the use of LUCIFER and the running of a typical experiment.

THE LINC-8 IN RESEARCH ON SPEECH

Richard Harshman and Peter Ladefoged
Department of English, University of California
Los Angeles, California

Two applications of the LINC-8 computer to research on the analysis and synthesis of speech are described. "AVG 1" is a program which averages and processes acoustic and electromyographic data. "TALK" is a program which facilitates creation and manipulation of sets of speech parameter curves. It displays and stores these curves and generates from the curves coordinated varying voltage outputs which are used to control a terminal analog speech synthesizer. The role of such programs in phonetic research is discussed briefly.

PRE-PROCESSING PHYSIOLOGICAL SIGNALS

(Miss) Maxine L. Paulsen
Medical Systems Development Laboratory
Washington, D. C.

A PDP-8 program has been developed to receive and pre-process as many as eight physiological signals simultaneously from a monitored patient (or signals from eight patients). Input to the multiple channels is analog signals, which are sampled 500 times/second and digitized. The program performs a code recognition of each signal and stores this and the subsequent data values temporarily on a drum until the number points required for the analysis has been accumulated. Concurrently with other instructions, the data break facility allows short blocks of data to be written on the drum or long blocks read back into core. This long-block data, needed to do the analysis, is relayed via an interface to a second computer (CDC-8090), which transfers it to magnetic tapes. These tapes can be used as input to a third computer (CDC-160A), which consolidates, analyzes, and interprets the signals for each patient. The operations performed by these three computers can be carried on simultaneously once the first input tape has been written.

DEVELOPMENT OF CARDIOVASCULAR PULMONARY PATIENT CARE TECHNIQUES

Jerome A. G. Russell
Research Data Facility
San Francisco, California

The Research Data Facility employs a DEC PDP-7 to develop physiological monitoring and modeling techniques in their cardiovascular and cardiopulmonary clinically-oriented research activities. The PDP-7 is connected to several transducers which monitor patients during the course of open-heart surgery. Once these techniques have been developed, they are included in a standard library of programs which monitor the recovering patient on a 24-hour-a-day basis. Many of the computer techniques employ a combination of analog pre-processing under control of the digital computer. Several of these patient care development efforts will be described.

COMPUTERS IN THE LABORATORY: EDUCATION

Ronald G. Ragsdale
Department of Computer Applications
The Ontario Institute for Studies in Education
Toronto, Ontario, Canada

The PDP-9 facility of the Department of Computer Applications is designed to serve all nine departments of the Ontario Institute for Studies in Education. In addition to

the research and development work of the nine departments, the PDP-9 will also be a part of the Regional Data Processing Center (RDPC), through a link to the RDPC's 360/40. The RDPC is a prototype educational data center which at some time may be linked to school districts through computers like the PDP-9.

This paper describes the PDP-9 and 360/40 configurations and the applications of the PDP-9 system.

REAL-TIME DATA ANALYSIS WITH FORTRAN

Albert Anderson
Department of Physics, Stanford University
Stanford, California

The effectiveness of FORTRAN programs to implement real-time reduction and analysis of nuclear physics data is discussed, and two typical programs for the PDP-7/9 are described. The Gaussian Reduction and Analysis of Spectrum Peaks (GRASP) program makes Gaussian fits to experimental data peaks in multichannel pulse-height spectra, with provision for background fitting and subtraction. Fitting the peaks analytically provides a consistent method for extracting meaningful parameters (area, centroid) from the data. The DIrect REaction Cross Sections (DIRECS) program calculates theoretical angular distribution curves that may be compared with their experimental counterparts. Even under FORTRAN, these programs provide optimum interaction in real time between the experimenter and the analysis. The experimenter may monitor and control both programs with the Teletype, IDIOT panel switches, scope display, and light pen by means of general-purpose, FORTRAN-compatible, symbolic subroutines.

A NON-LINEAR LEAST-SQUARES SEARCH ROUTINE FOR SMALL COMPUTERS

Thornton R. Fisher
Department of Physics, Stanford University
Stanford, California

A technique is developed for performing a non-linear least-squares search which has not previously received wide application. The first and second partial derivatives of X^2 with respect to the parameters are computed, and a set of linear equations is solved to obtain new estimates for the parameters. The technique is particularly well-adapted to a small computer where storage is limited but maximum external control can be exercised by the operator. Examples are given of the application of the method to line-shape fitting of Doppler-shifted gamma ray lines for the purpose of extracting nuclear lifetimes.

GAMMA RAY SPECTRUM STRIPPING

Friedrich Riess
Physics Department, Stanford University
Stanford, California

A FORTRAN program is described which analyzes multichannel pulse-height spectra of gamma rays by a least-square fitting method. A fit spectrum is generated from two reference lineshapes which are input to the program. Up to five gamma ray lines can be analyzed simultaneously. A background of arbitrary shape can be included in the fit. The amplitudes of these components are calculated by solving a set of homogeneous equations which minimize chi-square. A search for the best position of each line is made. The variation can be controlled via the switches of the computer console and an IDIOT panel and monitored with an oscilloscope.

USE OF A PDP-9 FOR REAL-TIME OFF-LINE ANALYSIS OF SPECTRA FROM AN AERIAL SURVEY FOR RADIOACTIVE MINERALS

C. J. Thompson
Atomic Energy of Canada Limited
Ottawa, Ontario, Canada

A PDP-9 is being used here to process data in real time from an airborne γ-ray spectrometer being used to detect deposits of radioactive minerals. A pulse height to width converter in the helicopter records pulse widths proportional to γ-ray energies on magnetic tape. The pulse widths are digitized into 1024 channels by an interface to the PDP-9. A program examines the spectrum as a function of real time and records the ratios of the counts due Uranium and Throium to natural Potassium. The updated results are displayed using an interface designed to make full use of a variable persistance oscilloscope.

PDP-9 SYSTEM AT THE UNIVERSITY OF MANITOBA CYCLOTRON

L. W. Funk, J. V. Jovanovich, R. Kawchuck, R. King, J. McKeown, C. A. Miller, D. Peterson, and D. Reimer
Department of Physics, University of Manitoba
Winnipeg, Manitoba, Canada

A PDP-9 system and its on-line uses in the following experiments will be described: (1) Measurement of pp bremsstrahlung cross sections using wire chambers with magnetic core readout. A data link to the University IBM 360/65 computer will allow on-line event by event kinematics calculations to be made. (2) A mass spectrometer has been interfaced for rapid data acquisition and analyses. (3) PDP-9 is being used as a pulse height analyser for simultaneous recording of two 64 x 64 channel spectra using only one Nuclear Data 160F ADC.

TIME-SHARED COMPUTER CONTROL IN ANALYTICAL CHEMISTRY*

Jack W. Frazer
Chemistry Department, Lawrence Radiation Laboratory
Livermore, California

The PDP-7 system in Analytical Chemistry at the Lawrence Radiation Laboratory illustrates the real-time, time-shared instrument control application. The monitor program to allow multiple-asynchronous operations to function without interaction will be described. Various analytical applications that are in current use will be abstracted. In addition, future concepts will be described and anticipated limitations discussed.

* This work was performed under the auspices of the U.S. Atomic Energy Commission. (UCRL-70639)

THE PDP-9T: COMPATIBLE TIME SHARING FOR THE REAL-TIME LABORATORY

M. M. Taylor[1], D. M. Forsyth[2], and L. Seligman[3]

Modifications have been made to a PDP-9 to permit real-time control of laboratory apparatus in a time-sharing environment. The system is designed to accommodate 4-8 independent real-time users, providing each with device service latencies of under 100 microseconds and response latencies of a few milliseconds. At the same time, a similar number of interactive or background jobs may be sustained by the system (e.g. editing, assembling, FORTRAN jobs).

A paging system provides each user with a virtual memory space of 32K words. Physical core of the PDP-9T may be expanded to as much as 256K words. The virtual machine looks like an ordinary PDP-9 except that: (1) A few instructions trap to the monitor (i.e. HLT, OAS); (2) An IOT instruction is decoded into one of 256 possible calls to the system monitor; (3) Programs written to capitalize on the nature of the environment will run more efficiently than those which pretend to be in an ordinary machine.

1. Defense Research Establishment, Downsview, Ontario, Canada.

2. Psychology Department, Harvard University, Cambridge, Massachusetts.

3. Digital Equipment Corporation, Maynard, Massachusetts.

A DATA-LINK BETWEEN SMALL COMPUTER AND A CDC 6600

Sypko W. Andreae
Lawrence Radiation Laboratory, University of California
Berkeley, California

At LRL small computers are used ON-LINE with high energy physics experiments. When the experimenter desires to estimate the relative value of the experimental data, the necessary analysis can only be performed on a large computer. Hence the need arose for a fast two-way DATA-LINK between one or more small computers and one large computer.

The main components of the DATA-LINK are interfaces for the two computers, a buffering and error correcting system and a transceiver system using one-mile long telephone lines. A unique demand and response system both maintains synchronization and supports a highly accurate error correcting system.

ORGANIZATION OF THE DATA-LINK SYSTEM

Robert W. Lafore
Lawrence Radiation Laboratory, University of California
Berkeley, California

This paper describes the major system components of the LINK and the flow of data and control words between them. For example, four registers, two at each end of the phone lines, constitute a "carousel," which permits a data word to be echoed back to the transmitter for a comparison check.

Control words communicate word count, transfer direction, etc. between the computer programs. Special high reliability pulse train signals transmit critical information, such as "error" and "end of record" between the interfaces.

The logic used to implement the system will be described briefly along with state diagrams showing the flow of control during operation.

Reference paper by S. Andreae

TRANSMITTER OF LINK DATA OVER TELEPHONE LINES

Alan E. Oakes
Lawrence Radiation Laboratory, University of California
Berkeley, California

A technique is described for transmitting computer data over twisted-pair telephone lines at a rate limited only by the round-trip propagation delay.

The LINK method of signal generation and detection is presented along with a discussion of the effects of telephone line distortion, attenuation, and noise.

TRACK FOLLOWER - A SYSTEM FOR BUBBLE CHAMBER TRACK RECOGNITION

James P. Taylor
Massachusetts Institute of Technology
Cambridge, Massachusetts

Track following is a major pattern recognition problem in the automatic scanning of bubble chamber film. With the PEPR device controlled by a PDP-6, track following is done in real time. Both the film and the computer are used as storage for track data. Each track is followed one view at a time and the resulting data must meet certain requirements (e.g. continuity) to be accepted. Pattern recognition problems arise from close lying tracks, and from small angle-crossing tracks.

A TUTORIAL ON NUMERICAL ANALYSIS WITH AN EMPHASIS ON ERROR ANALYSIS AND PREDICTION

Wayne A. Muth and Bruce C. Davis
Southern Illinois University
Carbondale, Illinois

A tutorial is presented pertaining to the selection and use of certain numerical techniques. Key topics (illustrated by accompanying numerical examples) include error analysis in numerical integration (illustrated with Simpson's Rule), matrix manipulation error analysis (illustrated by the inversion of an ill-conditioned matrix), and error analysis in the design of certain elementary function routines (illustrated with newly-developed routines for square root and arcsin on the PDP-8).

The relative merits of several candidate numerical techniques are discussed. The inter-relations between level of desired accuracy, numerical method, type of computer, size of word, and computation speed are considered.

A TUTORIAL ON SORTING TECHNIQUES

John B. Goodenough
Electronic Systems Division, Air Force Systems Command
L. G. Hanscom Field, Bedford, Massachusetts

This session will describe some basic sorting algorithms. Flowcharts will be distributed and timing relations will be discussed. Methods suited for internal sorting (where the items to be sorted are held entirely in core) and methods for tape sorting will be presented. Three basic sorting methods will be described: bubble sorts, merge sorts, and ranking sorts.

PDP-9 OPERATING SYSTEM WORKSHOP (2-3 hours)

Chairmen: James Murphy and David Leney
Digital Equipment Corporation

This lecture and informal discussion period is directed towards the design philosophy of the PDP-9 ADVANCED SOFTWARE Operating System which centers on user convenience and optimum core utilization.

The sub topics will be:

1. The comprehensive, device independent, input/output programming system which includes handlers for all the standard peripheral devices.

2. The expansion and specialization capabilities of the system to utilize all central processor and standard or non-standard peripheral options.

3. The keyboard control for automatic storage, retrieval, loading execution of all system and user programs.

4. Complete error analysis at monitor, input/output and system program levels.

It is advised that the attendees prepare for this Workshop by reading the MONITORS Manual (DEC-9A-MAAØ-D) of the ADVANCED SOFTWARE System. Copies may be obtained by contacting your local DEC sales office.

PDP-8 (DISC) OPERATING SYSTEM WORKSHOP

Chairman: Roger Pyle, Digital Equipment Corporation

This lecture and discussion session is devoted to a presentation of the design philosophy of the PDP-8 Disc software. The primary features exhibited are ease of use, increased thru-put and user liberation from operator panel switch dependency.

The following topics will be discussed:

1. The philosophy behind the monitor development and the benefits to the user.

2. The user monitor commands and internal structure of the monitor, including the core requirements, limitations, extensions, and I/O device handling.

3. The standard system programs attached to the disc system, both for 4K memory and extended memory. A complete discussion will be given describing the way programs are saved on the disc, the general usage of the disc as a program storage and data file storage device.

It is advised that the attendees prepare for the workshop by reading the PDP-8 Disc Software (Basic) Manual (DEC-08-SBAA-D). Copies may be obtained by contacting the local DEC sales office.

MODULE WORKSHOP

Chairman: Sypko Andreae, Lawrence Radiation Laboratory

NEW MODULES FOR THE M-SERIES

Frederick W. Macondray
Lawrence Radiation Laboratory
Berkeley, California

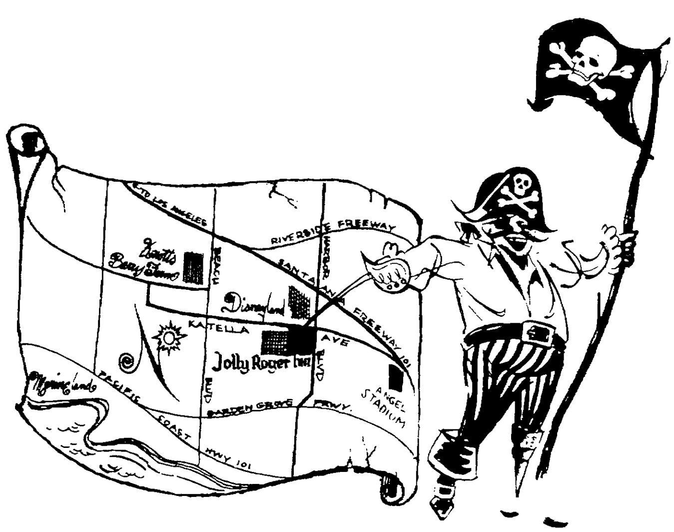
Computer interfacing using the recently introduced M-series (integrated circuit) modules is being persued at the Lawrence Radiation Laboratory in Berkeley. Additional general purpose and functional modules are needed for this endeavor. LRL, in cooperation with DEC has been developing a number of new modules including PDP-8 I/O buffer and interface cards.

The presentation will, if necessary, introduce the M-series modules. Open discussion on what would be the most useful types of new modules will follow.

DISCUSSION ON COMMUNICATION BETWEEN HARDWARE USERS AND DEC

T. R. Sarbin
University of California
Berkeley, California

In many cases it appears to the user that communication with the company is a problem. This has been particularly noticeable when difficulties are encountered with equipment and software. Similarly, customer suggestions for changes in I/O instruction sets do not seem to reach the proper people at Maynard. It is suggested that under the auspices of DECUS, the company be encouraged to respond more completely to the above and similarly that users be provided a channel of communication with one another to share a knowledge not only of problems encountered but of locally devised solutions.



NEWS ITEMS

THIRD DECUS EUROPEAN SYMPOSIUM

The Third DECUS European Symposium will be held at Ijmuiden, Holland, on October 19 and 20, 1967. Sixteen papers will be presented during the two-day session. For detailed information regarding the meeting, contact:

Mr. L. P. Goodstein
Electronics Department
AEK Research Establishment RISÖ
Roskilde, Denmark

or

Dr. Brian Macefield
Nuclear Physics Department
University of Oxford
21 Banbury Road
Oxford, England

BIOMEDICAL AND CANADIAN PROCEEDINGS

Asked for 11-10-67

The proceedings of the Biomedical Symposium held at the New York Medical College in June and the Canadian Symposium held in Ottawa in April are now available. Copies may be obtained by contacting the DECUS Office in Maynard or your nearest DEC sales office.

DECUSCOPE MAILING

With this issue, DECUS has adopted a new procedure for mailing DECUSCOPE within the continental United States. It is being mailed under U. S. Post Office "bulk" status; thus, eliminating envelopes and the mailing of multiple copies to an individual (saving considerable man hours).

Members who were receiving more than one copy were notified several weeks ago of the new procedure, and were advised to notify the DECUS office of the people to whom they were isssuing copies. These people will be placed on our mailing list and copies will be mailed directly to them in the future.

This new procedure, also, does not allow us to insert material loose (such as DEC Library Newsletter, "Letters", etc.) We still are including this material, bound, but arranged so that one can remove them easily for transfer to catalogs or notebooks.

We hope the newsletter is reaching you in good condition and without too much delay. Any reactions you might have to this new procedure would certainly be appreciated.

PROGRAMMING NOTES

MODIFIED BINARY LOADER FOR BASIC PDP-8

Upon delivery of a PDP-8, usually one of the first things to do is to copy all library tapes. With a basic PDP-8 configuration this is time-consuming and dull.

After making a few changes in Binary Loader (Digital-8-2-U), the High-Speed Reader option may be used instructing the loader to simultaneously load and copy a tape in binary format. Thus, by using this option, the first time a binary tape is read in, a copy of it will be produced for future use.

The changes are as follows:

7661, 6031	7702, 6046
7662, 5261	7707, 7710
7663, 6036	7712, 3266
7664, 3214	7752, 5267
7665, 1214	7753, 0003
7666, 0000	
7667, 6041	
7670, 5267	
7671, 6046	
7672, 5660	
7673, 7000	
7674, 7000	

After the changes have been inserted through the switch register, the modified loader may be punched out using Read-In-Mode Punch (Digital-8-4-U-Rim).

Start up and Entry:

1. Starting address (7777) in the switch register.
2. Press Load Address key.
3. Switch settings

   All switches up (7777): Normal loading.

   Switch 0 down (3777): Loading with simultaneous copying.
4. Press Start key.

Mats E. Hellstrom
Systems Analysis Section
ASEA
Vasteras, SWEDEN

CORRECTION TO PDP-8 ODT-LO

Digital-8-12-S, ODT, is distributed in a high-end version (7000 to 7577) and a low-end version (1000 to 1577). The low version seems to be a simple reassembly of the high version with the origin at 1000. Because of a programming trick, the punch command on the low version will not work. An attempt to execute it results in a jump to 7200 from 1044. This is because the high version wanted to go to 7200 and used a CLA as a pointer, which of course was not changed when assembled low. There is no space on the page for a proper pointer, so a patch is another programming trick.

Change the contents of 1044 from 5702 to 5377.

This jumps to 1177 where the pointer resident there is executed as a TAD. The next instruction at 1200 is where we wanted to go and since it is a CLA, the effect of the TAD is eliminated.

Note that this is not a general solution. If ODT is reassembled at 5000 for example, the pointer at 5177 will execute as a jump.

Jack Harvey

Program Wanted

The writer is interested in hearing from organizations having programs and/or hardware for copying from DECtape to IBM format 7 or 9 channel tape.

Jack Harvey
Communication Systems, Inc.
60 South, Highway 17
Paramus, New Jersey 07652

CORRECTIONS TO DEC-338 MANUAL (DEC-08-G61C-D)

A list of corrections to Version C of the Programmed Buffered Display 338 Programming Manual has been received by the DECUS Office. These corrections were made by Michael S. Wolfberg, Moore School of Electrical Engineering, University of Pennsylvania. Due to the lack of space in this issue, we cannot include all the corrections here. Copies of these corrections can be obtained by contacting Mrs. Angela Cossette, DECUS Executive Secretary, Digital Equipment Corporation, Maynard, Massachusetts 01754.

WANTED

Double Precision Subroutines for PDP-8 with Type 182 EAE

1. Signed Divide
2. Logarithm
3. Input/Output

Fast Fourier (Cooley-Tookey) program for an 8K PDP-7 with EAE.

Please contact the DECUS office if you are aware of the existence of the above programs.

FOR SALE

Teletype Receiver-Transmitter
33 each 4706
33 each 4707
Available in August - Make offer.

Contact: Dow Brian
Stanford University
Stanford, California

PROGRAMS AVAILABLE FROM AUTHORS

Title: Wire List Package

Author: C. W. Peck
Synchrotron Laboratory
California Institute of Technology
Pasadena, California

Computer: PDP-5, 8, 8/S. Minimum Hardware

This is a group of four routines used to prepare wire lists for Flip Chip modules to be installed in, at most, two DEC TYPE 1943 Mounting Panels (128 modules). With the wire lists and associated redundancy checks provided by the program, the author has had mounting panels hand-wired with no errors. The four programs are:

1. WIRE LIST ORGANIZE (50-1777, 6400-6777, Connection List 2000-6377)

This program accepts paper tape input of a wire list taken from the engineering drawings and generates a connection list in core. It outputs an ordered wire list in which each connection terminal used is referred to only once. The connection sequence generated does not necessarily result in minimum wire length, but usually does. The three subsequent programs assume that a connection list such as generated by this program is in core.

2. TERMINAL USE PRINT (50-1777, Connection List 2000-6377)

This program generates a table indicating which cards are used and the number of connections on each terminal (0, 1, or 2).

3. Editor (50-1777, Connection List 2000-6377)

This program allows the user to edit a connection list. It checks for elementary wiring errors in the editing.

4. BUS INCLUDE (50-1777, 6400-6777, Connection List 2000-6377)

This program includes all bussing into the connection list. It allows the designer to make a complete check of signal loading.

Material available from author:

1. IBM compatible magnetic tape (200) density. Upon request, binary paper tapes could be created.

2. Operating instructions.

Title: LINC Computer User-Interactive Programs and MACRO Instructions

Authors: Walter E. Reynolds
Robert B. Tucker
Timothy B. Coburn
James C. Bridges

This report describes four program packages for use on the LINC computer.

A program package which enables the LINC and a Teletype to be used as a very sophisticated desk calculator including graphical output with a Calcomp Plotter.

2. A general-purpose double-precision floating point subroutine package for the LINC.

3. A set of input-output routines providing for the communication of octal, decimal and alphanumeric information via a Teletype.

4. Also included is additional information on the LOSS system (see "An Operating System for the LINC Computer,"

R. K. Moore, NASA Technical Report No. IRL-1038) under which the above packages may be used.

The first program described, CALCULATOR III, is a complete program that enables the LINC and a Teletype to perform in a manner quite comparable to the most sophisticated electronic calculators on the market today. In addition, vector or single dimension array operations are included, direct communication with data blocks on LINC tape is permitted, and if a Calcomp Plotter is available, output may be graphically displayed.

The second package is a set of floating-point routines. They also exist in CALCULATOR III, but here in a form more suitable for inclusion in any LINC program where double-precision floating point arithmetic is desired. They occupy two quarters of LINC memory and when so included, become a comprehensive set of floating point macro instructions.

The third package contains numerous general-purpose routines in source code form invaluable to any LINC program where conversational input-output is desired. These may be inserted into LINC programs as desired to allow octal, decimal or alphanumeric communication with the LINC using a Model 33 Teletype in half-duplex mode.

These packages are presently utilized under the LOSS system, a general description of which is contained in this report.

Documentation for the above is available from:

Mr. Timothy Coburn
Stanford University School of Medicine
Stanford Medical Center
Palo Alto, California 94304

PROGRAMS IN PROGRESS

DECTAPE SYMBOLIC FORMAT GENERATOR, PDP-8

Two experimental DECtape versions of the Symbolic Tape Format Generator, Digital-8-21-U, have been prepared and are being tested. They operate under DECtape Programming System, DECUS No. 5/8-64. This note describes their use and limitations.

XPFORM

This version reads a symbolic tape from DECtape and punches it on the ASR-33 paper tape punch. Bit 11 of the switch register controls the format, as in the original DEC-8-21-U, as follows:

Bit 11 = 0, spaces are generated between tags, instructions and comments.

Bit 11 = 1, tabs, followed by rubouts, are generated.

Pages, as defined by XEDIT are separated by form feed and sections of leader to enable easy reentry to a symbolic editor program. The program returns to INDEX on encountering a dollar sign anywhere in the text. Leader and trailer are punched before and after the text. If no dollar sign is encountered before the end of the file, a file error message will issue followed by return to INDEX.

XTFORM

This version formats DECtape file-to-file, analogous to XPAL or XEDIT. Bit 11 in the switch register controls format as in XPFORM. On completion, the decimal number of blocks used in the output file is given, followed by return to INDEX. The output file is acceptable as input to XPAL, XLIST, XPFORM, and XTFORM. It has not been tested with XMACRO.

CAUTION: The output of XTFORM is not acceptable as input to XEDIT. If you want to format a source program for further editing, use XPFORM and then reenter the paper tape via XEDIT using the "G" command. A revised version whose DECtape output will be acceptable as input to XEDIT is planned.

Jack Harvey
Communication Systems, Inc.
60 South, Highway 17
Paramus, New Jersey 07652

* Users with 552 Controllers should be able to modify the symbolic version for their use.

Editor's Note: This program has just recently been submitted to DECUS and should be available shortly.

DECUS LIBRARY CATALOG ADDITIONS

THE LATEST ADDITIONS TO THE DECUS LIBRARY ARE INCLUDED IN THIS ISSUE AS PAGE REVISIONS TO THE CATALOG. THESE PAGES SHOULD BE REMOVED FROM THE DECUSCOPE AND INSERTED IN THE CATALOG.

REVISED PROGRAMS

DECUS No. 5-31(a)

Title: FORPLOT - FORTRAN Plotting Program for PDP-5 (Revised)

Author: Jerome Feder, New York University, Bronx, New York

The program has been revised to include data input on 80-column cards as well as paper tape.

Minimum Hardware: 4K PDP-5, High-Speed Reader, CALCOMP Plotter

Storage: Locations ØØØØ to 4577

MODIFICATIONS TO PROGRAM "XCOPY", TCØ1 VERSION (DECUS No. 5/8-64)

PROBLEM

XCOPY is part of the PDP-8 DECtape Programming System, DECUS No. 5/8-64. It is used to copy any file from tape unit 8 onto any file (existing or not) on tape unit x which may be tape unit 8.

The problem occurs only when XCOPY is used to reproduce a file onto a tape unit other than 8. After completing the transfer, the program prints out "DONE RETURN TO INDEX." Following this, tape unit x is rewound to block zero, followed by a jump to location 7600. This is the start of the DECtape bootstrap routine.

The problem invariably occurs immediately after the jump back to the bootstrap routine. The contents of portions of core are destroyed. This usually includes the bootstrap and occasionally includes the binary loader.

The apparent cause of this problem is the short time between commands for control of tape unit x and commands from the bootstrap routine for control of tape unit 8. By introducing a delay immediately before the jump to the bootstrap routine, this problem is eliminated.

CORRECTION OF PROBLEM

A simple way of introducing a delay for jumping to the bootstrap routine is shown below:

```
                            /REWIND TAPES, EXIT BACK TO SYSTEM

 Ø1Ø7        1Ø4Ø          DONE, TAD ADMS8
 Ø11Ø        4421          JMS I  TYPSI       /"DONE"
 Ø111        1Ø41          ERROUT, TAD ADMS1Ø
 Ø112        4421          JMS I TYPSI    /", RETURN TO SYSTEM."  CR
 Ø113        1Ø42          TAD UNIT       /REWIND TAPE, ON UNIT X
 Ø114        1Ø74          TAD NØ2ØØ
 Ø115        3117          DCA .+2
 Ø116        442Ø          JMS I RWTPI
 Ø117        ØØØØ          Ø
 Ø12Ø        ØØØØ          Ø
 Ø121        ØØØØ          Ø
*Ø122        2125          ISZ + 125
*Ø123        5122          JMP + 122
*Ø124        5473          JMP I +73
*Ø125        ØØØØ          Ø
```

*Changed instructions

An alternate way of introducing delay between rewind of tape unit x and the jump to the bootstrap can be provided by rearranging the last few words of printout performed in the program. This rearranged program is:

```
                                      /REWIND TAPES, EXIT BACK TO SYSTEM

 Ø1Ø7     1Ø4Ø                        DONE, TAD ADMS8
 Ø11Ø     4421                        JMS I TYPSI      /"DONE"
*Ø111     1Ø42                        ERROUT, TAD UNIT      /REWIND TAPE ON UNIT X
*Ø112     1Ø74                        TAD NØ2ØØ
*Ø113     3115                        DCA .+2
*Ø114     442Ø                        JMS I RWTPI
*Ø115     ØØØØ                        Ø
*Ø116     ØØØØ                        Ø
*Ø117     ØØØØ                        Ø
*Ø12Ø     1Ø41                        TAD ADMS1Ø
*Ø121     4421                        JMS I TYPSI      /", RETURN TO SYSTEM." CR
 Ø122     5473                        JMP I LC76ØØ     /EXIT BACK TO SYSTEM
```

PROCEDURE FOR INTRODUCING MODIFICATIONS TO XCOPY

A seven-step procedure for making modifications to program "XCOPY" is described below:

1. In the Index Mode, load XCOPY. The XCOPY program will type "COPY FILE :"

2. Stop, Restart at 7600 and load DDT.

3. After the DECtape Operating System has loaded and entered DDT, make the appropriate corrections as listed above.

4. After corrections have been made to the program in core, restart at 7600.

5. Load "UPDATE" and type the following data for the appropriate questions:

```
UPDATE

PROGRAM NAME          : YCOPY

SA  (OCTAL)           : Ø2ØØ

PAGE LOCATIONS        : <1, 1777>;
```

6. Check the correction to the program by exercising YCOPY to copy any program onto another tape unit.

7. After being satisfied of the performance of YCOPY, execute YCOPY to copy "YCOPY" onto tape unit 8, changing the name to "XCOPY" with the following appropriate instructions:

```
COPY FILE                 : YCOPY

ONTO UNIT #               : 8

RENAME FILE?              : Y

NEW FILE NAME             : XCOPY

FILE IN DIRECTORY, OVERLAY?   : Y

DONE, RETURN TO INDEX.
```

The above sequence will permit the modification of XCOPY without losing its location in the directory on the tape. After the modification of "XCOPY", may be deleted.

C. M. Jansky
Communications Systems,
Inc., Paramus, N. J.

DEC LIBRARY NEWS

NOTE: Due to the extremely favorable response of the users, the DEC Library Newsletter will now be a standard section in each issue of DECUSCOPE. It is suggested that you save this newsletter for future reference since it is of a continuing series.

A. PDP-5, 8, 8/S

I. ERROR LIST

PROGRAM: MACRO-8 (high-speed version)

PROBLEM: Extreme slowness and violent jerking of tape in high speed reader causing excessive wear and tear on reader.

SOLUTION: Overlay tape available (MACRO-8 High-Speed PATCH, Binary, PC02) which creates a small buffer. This will considerably decrease assembly time when using PDP-8/S with PC02 reader. It is also worthwhile to any 5-8-8/S high speed MACRO assembly since it benefits the reader. This is a temporary solution available on a limited basis from the Program Library.

Operating Instructions:

1. Put the MACRO-8 tape (high speed version) in the reader.

2. Put 7777 in the Switch Register and press LOAD ADDRESS.

3. Put bit Ø down and press START on the console.

4. Put the enclosed overlay tape in the reader and press CONTINUE on the console.

5. If using PDP-8, replace the HLT (7402) in location 3767 with an NOP (7000). This is done by setting 3767 in SR; pressing Load Address Key; setting 7000 in SR; pressing Deposit Key.

6. Put the starting address (200) of MACRO-8 in the Switch Register and press LOAD ADDRESS.

7. Continue with normal operating procedure of MACRO-8 as defined by the MACRO-8 Manual.

PDP-8 USER'S HANDBOOK & SMALL COMPUTER HANDBOOK

PROBLEM: 680 Data Communications System description contains a misprint.

SOLUTION: In the PDP-8 USER'S HANDBOOK, pp 140-141, change the octal code for Turn On Clock 1 (TTXON) from 6422 to 6424, and change the octal code for Turn Off Clock 1 (TTXOFF) from 6424 to 6422.

The same change should be made in the Small Computer Handbook on p. 201.

II. PROGRAMMING NOTES

PDP-8 FORTRAN

A. Source Restrictions

Please note the following list of restrictions to FORTRAN (also to be found in FORTRAN manual):

1. Not more than 1000 data cells. This includes all dimensioned variables, user-defined variables, constants, and all constants generated by the usage of a DO loop.

2. Not more than 20 undefined forward references to unique statement numbers per program. An undefined forward reference is a reference to any statement label that has not previously occurred in the program. Multiple references to the same undefined statement numbers are considered as one reference.

3. Not more than 52 decimal (64 octal) different variable names per program.

4. Not more than 128 characters per input statement. (When using the DECtape Compiler, the input statement size is reduced to 100 characters).

5. Not more than 40 numbered statements per program.

B. GO TO clarification.

One method of branching is to use a COMPUTED GO TO statement

GO TO ($n, n_2, \ldots, n_m$), i

where $n, n_2, \ldots, n_m$ are statement numbers and i is an integer variable reference whose value is greater than or equal to 1 and less than or equal to the number of statements enclosed in parentheses. If the value of i is out of this range, the statement is effectively a CONTINUE statement.

C. Linking Programs

In using a FORTRAN program with DIMENSION statements, the Compiler assigns storage at the top of core. These registers are not cleared at the end of the run. Therefore, if the user wishes to run another FORTRAN program using the results of the first program as data, he may put the same dimension statements at the beginning of the second program and gain immediate access to the results of the first program.

FORTRAN MANUAL

The PDP-8 FORTRAN Manual has been revised to clarify a number of previously hazy areas such as core limits, etc. The Manual also provides step by step instructions on usage indicating all switch options and error conditions and explaining the use of symbol print and the writing and running of FORTRAN programs using DECtape. This Manual is available from the Program Library.

PDP-8 COMPILER AND OPERATING SYSTEM CORE MAP

The Compiler occupies the following core locations:

3 - 7600 Compiler itself plus tables
7200 - 7600 Compiler tables (undefined forward reference table, etc.)

The Operating System occupies locations:

0 - 5200 Operating System for Paper Tape I/O
0 - 6000 Operating System for DECtape I/O

Locations 5200 - 7576 are available for the user's program when using paper tape input/output or locations 6000 - 7576 when using DECtape.

NOTE: The 1000 data word restriction applies.

FORTRAN OPERATING SYSTEM

A. Reloading OP SYS

It may not have been made clear in the FORTRAN Manual that it is not necessary to reload the OP SYS itself in order to run a second or third program . . .

The following should clarify this point: Load the OP SYS. Start at 200 and load the interpretive code tape of the program (the compiler output tape). When this has been loaded, press CONTINUE to execute the program. To re-execute this program, start at 201 (Load ADDR & START or for PDP-8/S user STOP, LOAD ADDR & START). To execute a different program, start at 200. Load your new interpretive code tape and press CONTINUE as explained above.

B. Reducing Execution Time

Run time can be reduced by nearly 50% if the user will, after loading the OP SYS change location 404 to a 7000 (NOP).

CAUTION: The OP SYS contains a checking routine which essentially serves to protect it from being destroyed by any self-contained user program. Replacing the contents of 404 with an NOP disables the checking routine reducing run time, but leaving the OP SYS vulnerable to destruction. We advise that the only programs run under this condition be programs which have been previously run and are known to operate properly.

C. Suppressing Input Echo

If it is desirable that teletype input to the OP SYS not echo on the teletype keyboard, place an NOP (7000) in location 1504 after loading the OP SYS.

TELETYPE OUTPUT

It has been brought to our attention that the PDP-8-8/S User's Handbooks and the Small Computer Handbook do not sufficiently explain the process of typing/punching a character. The sequence of instruction shown in the manuals was chosen because it makes the best use of computer time. It does, however require that the program initialize the teleprinter flag before a character can be typed. This can be done by including a TLS as one of the first instructions of the program.

```
        TLS          /initialize teleprinter flag
         .
         .
         .
Type,   Ø            /subroutine to test flag and
        TSF          /type character when flag is
        JMP .-1      /found to be a 1
        TLS
        JMP I TYPE
```

The routine may also be inverted which eliminates the necessity of initializing the flag, but also wastes 100 milliseconds of computer time waiting for each character to finish typing/punching.

```
Type,   Ø
        TLS          /send character to TTO
        TSF          /wait for it to be printed
        JMP .-1      / . . .
        JMP I TYPE
```

PAL III PROGRAMMING

A. Page Boundaries

In a PDP-5, 8 or 8/S there is a great deal of emphasis on "pages" of core memory. The user must always keep in mind that he may not directly reference anything that is not on the current page or page zero. This may tend to over-shadow the fact that control may flow over a page boundary just as it flows from one instruction to the next on the same page. The following is an example:

```
Location  Instruction

Ø375      TAD LOW
Ø376      JMS KILL      /KILL is at location Ø334
Ø377      TAD COMM      /COMM is at location Ø227
        /BEGINNING OF NEW PAGE
Ø4ØØ      DCA COUNT     /COM is at location Ø423
Ø4Ø1      ISZ MCR       /MCR is at location Ø517
Ø4Ø2      SPA
Ø4Ø3      JMP OUT       /OUT is at location Ø42Ø
```

B. MICRO PROGRAMMING

Constants which can be formed in the accumulator in one step include:

+2 by CLA CLL CML RTL,
-2 by CLA CLL CMA RAL,
-3 by CLA CLL CMA RTL.

Note:

In the 8/S complement and rotate instructions cannot be combined.

TC01 DECTAPE CONTROL INSTRUCTIONS

Note that the two read instructions:

DTRA (6761): Read Status Register A,
DTRB (6772): Read Status Register B,

do not clear the AC before the read-in. Since the read is accomplished by an OR transfer, the program should clear the AC beforehand.

III. NEW & REVISED PROGRAMS & MANUALS

(a) REVISED:

DEC-08-NAAA-D
Application Notes 801, 802 and 804 combined into a single document.

DEC-08-SUAØ-D
DECtape Manual, updates to include TCØ1 data.

DEC-08-ASB1-PB and
DEC-08-ASB2-PA
PAL III, tapes revised to allow ASCII extended Symbol Definition Table for standard peripheral devices. Full explanation available in revised PAL III Manual DEC-08-ASAB-D.

DEC-08-COAB-D
ODT: revised ODT High & Low tapes. Also ODT source tape to allow user to place ODT on any three core pages. Also allows a Breakpoint on a JMS with arguments, and allows High Speed output.

DEC-08-G61C-D
Programmed Buffer Display 338 Program Manual.

DEC-08-LBAA-D
Binary Loader, revised so it will not be destroyed by DECtape I/O routines.

MAINDEC-801-2B
Instruction Test Part 2B, revised.

MAINDEC-801-2C
JMP and JMP Test, revised.

MAINDEC-08-D60B
338 Visual Buffered Display, revised.

(b) NEW:

MAINDEC-08-D71A-PB
680 Data Communication System, Extended Static Test.

MAINDEC-08-D72A-PB
680 DCS, Data and Control Test

MAINDEC-08-D26A-D
PDP-8 type 645A Line Printer test.

MAINDEC-08-D23A-D
8/S High Speed Reader test.

MAINDEC-08-D5CA-D
DF32 DISC DATA: Mini-Disc, Interface, Address, Data Test. A complete test of the DISC System.

MAINDEC-08-D5BA-D
DF32 Discless, Logic Test, Mini-Disc. A test of the disc logic and its computer interface. Does not test the disc, nor associated analog interface circuits.

MAINDEC-08-DO3A-D
Basic JMP JMS Test.

MAINDEC-08-DO4A-D
Random JMP Test.

MAINDEC-08-DO5A-D
Random JMP

MAINDEC-08-DO7A-D
Random ISZ Test.

B. PDP-7, 9

1. ERROR LIST

FORTRAN II

PROBLEM: Mathematical problems such as $Y=A^X$ may result in a slight error.

EXAMPLE: When A=3; 6; 7; 9 and X>1 or A=5 and X>3 slight discrepancies will occur.
e.g., 3^2=8.999999

SOLUTION: No solution at present - will advise when solution found.

PROBLEM: OTS (Object Time System) occasionally returns erroneous result in case of simple input and output on the Teletype.

EXAMPLE: When values for the variable X are input from the Teletype and simply written back on the Teletype, as illustrated in the following program -

```
11 READ 1, 10, X
   WRITE 2, 10, X
10 FORMAT (E6.2)
   GO TO 11
```

Some values of X are subject to erroneous interpretation:

The values are:

INPUT		OUTPUT
X = 0.04	⟶	X = 0.03
0.05		0.04
0.07		0.06
0.08		0.07
0.09		0.08

The results indicate that the in put value was incorrectly inter preted.

SOLUTION: No solution at present - will ac vise when solution found.

2. NEW & REVISED PROGRAMS & MANUALS

EDITOR REVISIONS

1. Y command-delay between character prin out made uniform (Ø.7 sec), rather than depen ent on the cycle time of the particular machin

2. register PUNTEM, previously used for sto age in punch interrupt routine, changed PUNTE, since PUNTEM is also used outside the interrupt. This had caused bad characte to be punched randomly.

3. KILL command - now clears the used p of the storage buffer, besides resetting the buff pointers.

4. 9 advanced software compatibility - i structions have been added to the reader inte rupt routine to enable the Editor to accept p ity ASCII tapes, output by the PDP-9 Advanc Software. This section has also been modifi so that the 7/9 Editor will consider ASCII c riage returns, rather than line feeds, as li delimiters, since the Advanced Software d not guarantee that the last line will be tern nated by a line feed.

5. Extraneous interrupts - the interrupt dis patch routine has been modified to clear all ex traneous interrupts for which there is no servic routine. Thus, for example, an interrupt fro the line printer will not cause the editor to hal waiting for the operator to clear it manually.

6. Semicolons & Colons - the teletype inp routine, TTI, has been corrected so that the "double" characters will not be lost when the are typed in on the keyboard after an upper ca character.

7. Question Marks - ASCII to baudot conve sion code has been corrected for question mar so that they are now input correctly from KSR3

Corrections to Source Listing follow:

Revised PDP-7/9
Editor Code

Editor 7/27/66 / **Revised Editor 8/21/67**

(1) Y command

Editor 7/27/66:

```
DLYSWT,     NOP
            JMP   DSUBA
            TTQ
            LAC   (-1ØØØØØ)
            703341
            SKP
            LAC   (-377777)
            DAC   TXCNT#
            ISZ   TXCNT
            JMP   .-1
```

Revised Editor 8/21/67:

```
DLYSWT,     NOP
            JMP   DSUBA
            TTQ
            LAC   (-52)
            DAC   7
            CLON
            JMP   .
```

(2) PUNTEM

Editor 7/27/66:

```
OPBM1       DAC PUNTEM
            IORS
              .
              .
              .
            JMP   .-6
            LAC PUNTEM
```

Revised Editor 8/21/67:

```
OPBM1,      DAC PUNTE#
            IORS
              .
              .
              .
            JMP   .-6
            LAC PUNTE
```

(3) KILL command

Editor 7/27/66:

```
KILL,       Ø
            LAC BUFBEG#
            DAC BUFFER
              :
            JMP I KILL







            ADD  (1ØØ
            DAC BUFEND#

GOI,        LAC (JMP INTRP
            DAC 1
              :
            JMP CONTROL
```

Revised Editor 8/21/67:

```
KILL,       Ø
            LAC BUFFER
            CMA
            TAD BUFBEG
            DAC BUFFER
            LAC BUFBEG
            DAC X1
            DAC X2
            DZM I X1
            DZM I X2
            ISZ BUFFER
            JMP   .-3
            LAC BUFBEG#
            DAC BUFFER
              :
            JMP I KILL
            ADD (1ØØ
            DAC BUFEND#
            DAC BUFFER
GOI,        LAC (JMP INTRP
            DAC 1
              :
            JMP CONTROL
```

(4) Advanced Software Compatibility

Editor 7/27/66:

```
TAPASC,     SAD  (212)
            JMP  TAPSTP
              :
```

Revised Editor 8/21/67:

```
TAPASC,     AND (177)
            ADD (2ØØ
            SAD (215
            JMP TAPSTP
              :
```

```
DIT,        Ø
            SNA
            JMP I DIT
            SAD (377
            JMP  .TFEED
            SAD (212
            JMP  .LFEED
            SAD  (214
            JMP  .STOP
            SAD  (2ØØ
            JMP  .TFEED
            SAD  (211
            JMP  .TAB
            SAD  (215
            JMP  .TFEED
            AND (77
              :
```

```
DIT,        Ø
            SNA
            JMP I DIT
            SAD (377
            JMP  .TFEED
            SAD (215
            JMP  .LFEED
            SAD (214
            JMP  .STOP
            SAD (2ØØ
            JMP  .TFEED
            SAD  (211
            JMP  .TAB
            SAD  (212
            JMP  .TFEED
            AND (77
              :
```

(5) Extraneous Interrupts

```
INTRP,      DAC SV#AC
            TSF...
            KSF...
            RSF...
            PSF...
            IORS
            HLT
            LAS
            AND (17777
            ADD  (IOT
            DAC  CLRINT
            SKP'.  HLT
            JMP  .-7
CLRINT,     XX
```

```
INTRP,      DAC SVAC
            TSF...
            KSF...
            RSF...
            PSF...
       CLSF  JMP   .+3 ISZ Ø
       CLOF MTAF      RCLD
       LPCF   DCF     IDCF
       GCL   PLCF     DRCF
```

(6) Semi Colons, Colons

```
FOTC,       SNL
            JMP CASEOK
            LAC (72
            DAC FOCS#
            LAC (JMP FOXT
            DAC TISW
            LAC FOCS
            JMP CASEOF

FOXT,       LAC (NOP
```

```
FOTC,       SNL
            JMP CASEDK
            LAC (72
            DAC FOCS#
            LAC TISW
            DAC TISWSV#
            LAC (JMP FOXT
            DAC TISW
            LAC FOCS
            JMP CASEOK

FOXT,       LAC TISWSV
```

(7) Question Marks

```
ASCT,       467
             :
ASCT+17/   453062
           457030
             :
```

```
ASCT,       467
             :
ASCT+17/    453063
            457030
              :
```

"LETTERS"

Technological University of Delft
Julianalaan 134
Delft, Holland.

Delft, 13th of July, 1967

Mrs. Angela J. Cossette
DECUSCOPE
Digital Equipment Co.
M A Y N A R D Mass. 01754

Dear Mrs. Cossette,

The small remark of Mr. C.G. Donahoe in DECUSCOPE Vol 6,nr 3 p. 7 on a "little snag in the instruction manuals" prompts me to write this letter (which you may by all means publish in DECUSCOPE).
Mr. Donahoe does not seem to realise the advantages of first testing on the flag and then doing the printing. Of course in the first case all time between printing is available for calculation, while in the case of Mr. Donahoe's example all time for printing a single character is fully wasted.

A much better solution, which works while the interrupt will stay on is the following:

```
OUT, 0
     DCA TEMP
     TAD FLAG
     SNA CLA   /FLAG
     JMP .-2   /PRESENT?
     DCA FLAG  /CLEAR FLAG
     TAD TEMP
     TLS
     JMP I OUT
TEMP,0
FLAG,0
```

```
          *1
          JMP I 2
          INTERRUPT

INTERRUPT,     :
               :
          TSF
          JMP ETC
     TTY, CLA IAC
          DCA FLAG    /SET PROGR FLAG
          TCF         /CLEAR REAL FLAG
     ETC,      :
               :      /HANDLE OTHER INTERRUPTS
```

The preparation in the beginning should read as:

```
     TCF
     CLA IAC
     DCA FLAG
```

The same remarks hold for the input routines, which can all be modelled along the same pattern.

A still better solution is a fully buffered input/output in which the user can deliver his characters to be printed at very high speed up to the capacity of the buffer and which will slowly empty the buffer onto the printer with the help of the interrupt system. The same hold for input where the interrupt system will steadily try to fill the input buffer and where the programmer can get a burst of characters at high speed. This program increases the speed of operation significantly. We have applied it to PAL III where it now can do reading and printing at the same time in pass 3. The program has three entrances: IN for getting a character from keyboard or tapereader, OUT for printing/punching a character, and CLBUF for clearing the buffers and initialising the system. Only the teleprinter is included in the system so that it can run on a basic PDP-8 or PDP-8/S but it is easy to include any other I/O devices. The buffers have been chosen to contain 32 characters each. This can be changed to any power of 2. The three components are called with JMS IN, JMS OUT, and JMS CLBUF respectively. It is advisable not to use HLT at the end of the program as in that case the output buffer will perhaps not be fully emptied. It is better to end with X, JMP X or go back to a supervisor routine. It is possible to connect the buffered I/O to a supervisor routine so that waiting time for an empty buffer (on input) or a full buffer (on output) can be spent in another useful program.

```
          *1
          JMP I 2
          INTRPT            /JUMP TO INTERRUPT PROGRAM
          *xxx
INTRPT,   DCA AC            /SAVE ACCUMULATOR
          TSF               /TEST PRINTER FLAG
          JMP READ          /IF NOT PRINTER THEN IT MUST BE READER
IN2,      TAD I W1          /LOOK IF BUFFER STILL CONTAINS SYMBOL
          SPA               /YES IF POS
          JMP EMPTY         /ELSE GO TO EMPTY
          TLS               /OUTPUT SYMBOL FROM BUFFER
          CLA CMA           /TAKE -1
          DCA I W1          /PUT -1 IN PLACE JUST EMPTIED
          TAD W1
          IAC               /INCREASE POINTER W1
          AND MASK          /CYCLICALLY
          TAD PBUFF
          DCA W1
EXIT,     TAD AC            /RESTORE ACCUMULATOR
          ION               /INTERRUPT ON
          JMP I 0
EMPTY,    CLA CMA
          DCA EMPTYFLAG     /PUT -1 IN EMPTYFLAG TO REMEMBER PUNCH IS READY
          TCF               /CLEAR PRINTER FLAG
          TAD I W2          /LOOK AT FILL POINTER OF INPUT
          SMA CLA           /IF NEG: THERE IS STILL SPACE
          JMP FULL          /ELSE INPUT BUFFER FULL
          KSF               /TEST INPUT FLAG
          JMP EXIT          /NO FLAG
          JMP L1
READ,     TAD I W2          /STILL SPACE
          SMA CLA
          JMP EXIT          /NO INPUT SPACE BUT LEAVE INTERRUPT ON FOR OUTPUT
L1,       KRB               /READ NEXT CHARACTER
          DCA I W2          /PLACE CHARACTER IN BUFFER
          TAD W2            /INCREASE FILL BUFFER POINTER OF INPUT
          IAC               /CYCLICALLY
          AND MASK
          TAD RBUFF
          DCA W2
          JMP EXIT
FULL,     TAD AC            /IF INPUT BUFFER FULL AND NO OUTPUT TO BE DONE
          JMP I 0           /RETURN BUT DO NOT TURN ON INTERRUPT
```

```
OUT,        0                   /OUTPUT SUBROUTINE
            DCA SYM             /KEEP SYMBOL TEMPORARILY
            TAD I W3            /LOOK IN OUTPUT BUFFER
            SMA CLA             /IF POS THERE IS NO PLACE
            JMP .-2             /CYCLE UNTIL THERE IS PLACE (OR DO ANOTHER PROG)
            TAD SYM
            DCA I W3            /PLACE CHARACTER IN OUTPUT BUFFER
            ISZ EMPTYFLAG       /TEST EMPTYFLAG
            JMP RET             /IF NOT EMPTY THEN RETURN AND INCREASE POINTER
            IOF                 /TURN INTERRUPT OFF! TO MAKE EXTERNAL USE OF
            TAD RETT            /INTERRUPT ROUTINE. ARTIFICIALLY STORE RET IN 0
            DCA 0
            DCA EMPTYFLAG       /CLEAR EMPTYFLAG
            DCA AC              /CLEAR AC
            JMP IN2             /BORROW INTERRUPT ROUTINE FOR BRINGING PRINTER
RET,        TAD W3                      /TO LIFE
            IAC                 /INCREASE FILLING POINTER CYCLICALLY
            AND MASK
            TAD PBUFF
            DCA W3
            JMP I OUT           /RETURN

IN,         0                   /INPUT SUBROUTINE
            CLA
            TAD I W4            /LOOK IF THERE IS STILL A CHARACTER IN BUFFER
            SPA
            JMP .-3             /IF NEG CYCLE UNTIL THERE IS CHAR (OR DO SOMETHING
            DCA SYM                     /ELSE)
            CLA CMA             /PLACE -1 IN BUFFER PLACE JUST EMPTIED
            DCA I W4
            ION                 /INTERRUPT ON AND LOOK FOR NEXT CHAR READY
            TAD W4                      /(INTERRUPT COULD BE OFF)
            IAC
            AND MASK            /INCREASE EMPTYING POINTER OF READ BUFFER
            TAD RBUFF
            DCA W4
            TAD SYM             /TAKE CHARACTER READ
            JMP I IN            /RETURN
RBUFF,      RBUF                /READ BUFFER ADDRESS
PBUFF,      PBUF                /PRINT BUFFER ADDRESS
W1,         0
W2,         0                   /POINTERS
W3,         0
W4,         0
AC,         0                   /PLACE TO SAVE AC
SYM,        0                   /SYMBOL READ
MASK,       37                  /MASK FOR COUNTING CYCLICALLY IN LAST 5 BITS
RETT,       RET
EMPTYFLAG,  -1

CLBUF,      0                   /INITIALISING ROUTINE TO CLEAR BUFFERS ETC
            TAD RBUFF
            DCA AC              /RUNNING ADDRESS TO BE CLEARED
            TAD MASK
            CMA
            CLL RAL
            DCA SYM             /-64(10) IN SYM AS COUNTER
            CMA                 /-1
            DCA I AC
            ISZ AC              /CLEAR BOTH BUFFERS
            ISZ SYM
            JMP .-4             /CYCLE
            TAD PBUFF
            DCA W1
```

```
            TAD PBUFF
            DCA W3              /SET POINTERS W1 AND W3 TO PBUF
            TAD RBUFF
            DCA W2
            TAD RBUFF
            DCA W4              /SET W2 AND W4 TO RBUF
            CMA
            DCA EMPTYFLAG       /SET EMPTYFLAG ON EMPTY
            KCC                 /CLEAR KEYBOARD FLAG AND SET GOING
            TCF                 /CLEAR PRINTER FLAG
            ION
            JMP I CLBUF         /RETURN
            *INTRPT+200
RBUF,       0                   /START OF RBUF MUST BE 32-FOLD
            *.+37
PBUF,       0                   /SAME FOR PBUF
            *.+37
LLLL,                           /LOCATION AFTER LAST IN USE
```

The total number of places is 300_8 with a few spares left over for the inclusion of other flags.

The careful reader will see from this program that a big mistake is present in the design of the PDP-8. As soon as the input buffer is full one cannot turn off the reader flag without initiating the next symbol to be read. Still one does not want to lose that symbol. The only thing one can do (and which has been done in the program above) is to turn off all interrupts as soon as nothing is to be expected any more (i.e. when the output buffer is empty. This is indeed a very crude method. The output does not suffer from this design error.

Signalling an error in the design without telling how to cure it would be a bad thing. The cure is very simple and does not involve a single extra component in the machine. Furthermore it leaves intact all existing coding. It requires, however, another device select code. We have chosen device number 13. This has no other standard applications as far as I know. 6131, 6132 and 6134 have now the same action as 6031, 6032 and 6034 except that the tape reader is not stepped. Hence the only instruction needed is 6132 for turning off the flag of the reader without commanding the next step. The changes are:
Disconnect ME18D. Select code 03 and 13 now both select keyboard.
Disconnect earth from ME21V. Connect signal MB5(1) to pin ME21V. (Can be found on ME36D).

The interrupt routine can now be adapted to turn off the reader flag as soon as the read buffer is full. The machine then does not have to indulge in continuous reader interrupts when there is still printing to be done. The changes are left to the reader. (Hint: a FULLFLAG is now needed and an artificial going to the interrupt routine for starting the reader is necessary).

Yours sincerely,

Prof. Dr. W.L. van der Poel
Department of Mathematics
Technological University of Delft
Delft, Holland.

Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources
CANADA

Bedford Institute of Oceanography
Institut océanographique de Bedford
P.O. Box 1006
Dartmouth, N.S., Canada
File Number
N° à rappeler 546-3

August 3, 1967

noted

Mrs. Angela Cossette,
DECUS Executive Secretary
Digital Equipment Computer Users Society

Dear Mrs. Cossette:

I would like to point out an error in Digital 8-20-F Four-Word Floating Point Package.

The pseudo-instruction FSUB is accomplished by negation (subroutine OPNEG) followed by addition (subroutine FLAD). Upon exiting from the floating point interpreter, the return address 5656 is stored at the origin of subroutine FLSU. After subroutines OPNEG and FLAD have been executed, control attempts to return to the interpreter through the origin of FLAD. This will only be successful if 5656 has been stored there by the previous use of the instruction FADD. I assume the Four Word Floating Point Package instruction was tested only when it was proceeded by the instruction FADD.

The following changes will remedy the problem:

```
6026  0000  FLSU,0
6027  4706  JMS I OPMINS
6030  5364  JMP FLSUX

6164  4200  FLSUX, JMS FLAD
6165  5626  JMP I FLSU
```

Yours sincerely,

D. A. Dalby

D. A. Dalby

---

agree

UNIVERSITY OF SASKATCHEWAN

DEPARTMENT OF
ELECTRICAL ENGINEERING

SASKATOON, CANADA

August 24, 1967

Mrs. Angela J. Cossette
Digital Equipment Corporation
MAYNARD, Massachusetts
U.S.A.

Dear Mrs. Cossette:

For any systems designer using DEC modules a full range of associated hardware available makes the job indeed easier and pleasant. However, as you can appreciate, a considerable amount of time is put in making the necessary drawings.

On my part, to be consistant with other DEC units and because of their clarity, I prefer using DEC standard symbols for all the documentation of the units developed and built by us. Now, if some drafting aids such as templates or stick on symbols on a transparent paper are available, I am sure at least our draftsman will be happy. As far as I am aware DEC product line does not seem to include anything in this direction.

I will be happy to hear other DEC module user's views in this matter.

Yours faithfully,

R. Krishna

R. Krishna

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Lawrence Radiation Laboratory

Dr. Jerry A. Sovka
Atomic Energy of Canada Limited

John W. Spencer
Chrysler Corporation Space Division

PDP-7 DELEGATES

Lawrence H. Gerhardstein
Battelle Memorial Institute
Pacific Northwest Laboratory

Sonya R. Shapiro
Bolt, Beranek and Newman, Inc

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Fairchild Semiconductor

Steven L. Bard
U. S. Army Nuclear Defense Lab
Edgewood Arsenal

Dr. George W. Barton
Lawrence Radiation Laboratory

R. M. Bolton
U. S. Naval Oceanographic Office

Richard Burfeind
Cognitronics Corporation

David L. Carson
Texas Institute for Rehabilitation
and Research

George S. Cooper
LOGIC, Incorporated

Mrs. Phyllis Cove
Harvard Medical School

Bruce C. Davis
School of Technology
Southern Illinois University

Paul A. Dennis
United Geophysical Corporation

Charles Grzenda
USAECOM, COM/ADP Laboratory

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Kresge Hearing Research Institute
University of Michigan

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(England)

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Serendipity Associates

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General Precision, Incorporated

Oscar Schoo Lastra
The Boeing Company

Hans P. Lie
Bell Telephone Laboratories

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Albert Einstein College of Medicine

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International Harvester Company

A. H. Read
Atomic Energy Authority
(England)

Robert F. Richart
Western Electric Company

Ronald C. Schuman
Department of Defense

Dr. Dan W. Scott
University Computing Company

Harry Scott
University Computing Company

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Bolt, Beranek and Newman, Inc

Ingvar E. Sodal
University of Colorado Medical Center

Roy S. Taylor
Department of Defense

Leroy Towell
University Computing Company

Donald S. Tracy
ITEK Corporation

Charles R. Wagner
Fairchild Semiconductor

Kenneth B. Wiberg
Yale University

A. Williams
National Physical Laboratory
(England)

David L. Zemel
Cognitronics Corporation

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E. I. duPont de Nemours

M. Arouette
Technique et Produits
(France)

Glenn L. Booman
Idaho Nuclear Corporation

Athanasios H. Canatsoulis
Sprague Electric Company

Dr. B. J. Cohon
C. N. Burman Company

C. Douglas Creelman
University of Toronto
(Canada)

Robert J. Donovan
University of Western Australia

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(England)

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St. Bartholomew's Hospital
Medical College (England)

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Electro-Optical Systems, Incorporated

Allen Green
Aerojet-General Corporation

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Motorola Incorporated,
Aerospace Center

Martin S. Itzkowitz
University of California at Berkeley

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Datacraft, Incorporated

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Princeton University

G. B. Lomax
Leigh Instruments
(Canada)

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A.E.R.E. Harwell
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Williamson Free School of
Mechanical Trades

Glenn S. Mills
Sandia Corporation

Hans E. Nicolaysen
Teleteknisk Forskningslaboratorium
(Denmark)

John F. Pauls
Smith, Kline & French Laboratories

Kenneth C. Perkins
Hampshire Engineering Company

Dr. Zenon W. Pylyshyn
University of Western Ontario
(Canada)

Ralph W. Riddle
Amelco Semiconductor

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University of Mississippi Medical Center

Lyndon A. Thomas
Research and Productivity Council
(Canada)

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(England)

Harold R. Buchanan
Bell Telephone Laboratories

Dr. I. L. Fairweather
University of Ottawa
(Canada)

Dr. Daniel M. Forsyth
Harvard University

George E. Friend
University Computing Company

C. M. Fritsch
Data Trends, Incorporated

Prof. W. Henke
Massachusetts Institute of Technology

Dr. Peter T. Kirstein
Institute of Computer Science
(England)

K. G. Standing
University of Manitoba
(Canada)

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U.S. Veterans Administration
Hospital

Roger Dann
University of Miami

Alfred G. Delker
Pennsylvania Hospital

Thomas J. Downing
U.S. Army Frankford Arsenal

F. H. Hellmuth
Manitoba Cancer Foundation
(Canada)

Dr. Edward M. Huff
NASA, Ames Research Center

Dr. Irene Martin
Institute of Psychiatry
(England)

Norman Milkman
Rockerfeller University

Barry F. Smith
Clarke Institute of Psychiatry
(Canada)

Charles F. Stroebel
Institute of Living

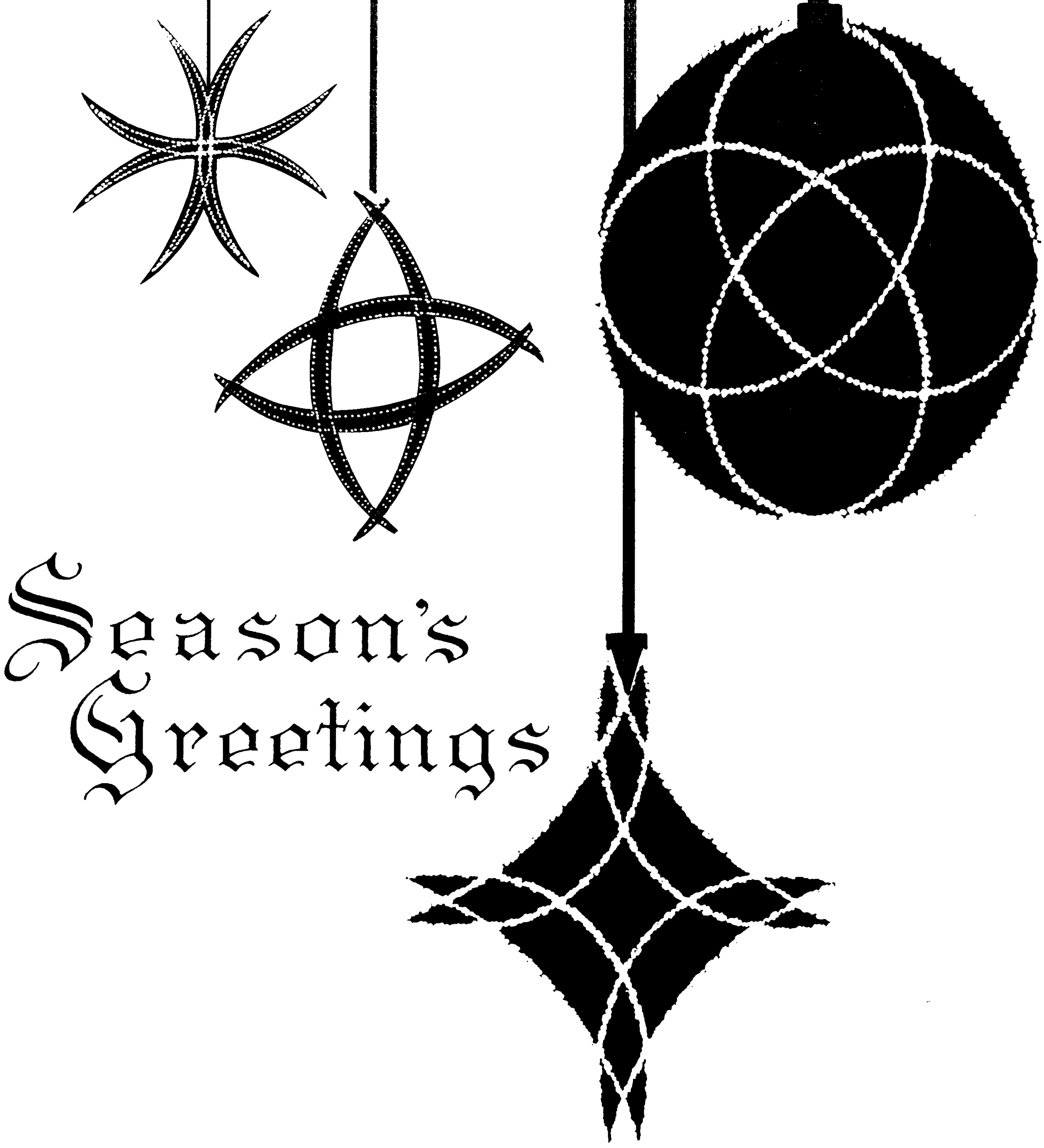
Dr. T. D. Williams
University of Bristol
(England)

OPPOSITE
ENTRANCE TO
Disneyland

DECUSCOPE

DIGITAL EQUIPMENT COMPUTER USERS SOCIETY

1967 V6 N6



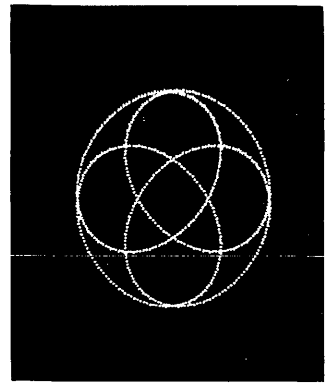
The Season's best wishes

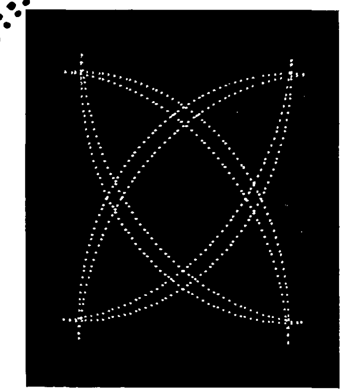
AND A

Happy New Year

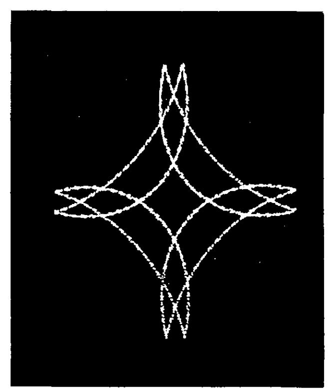
FROM THE DECUS STAFF

Angela J. Cassette
Rita M. Fryatt
Susan M. Charney
Jeanne M. Galdosk
Mary Ann Colombo





恭祝圣誕



MERRY CHRISTMAS AND HAPPY NEW YEAR

WIR WÜNCHEN IHNEN EIN FROHES FEST

JOYEUX NOËL ET BONNE ANNÉE

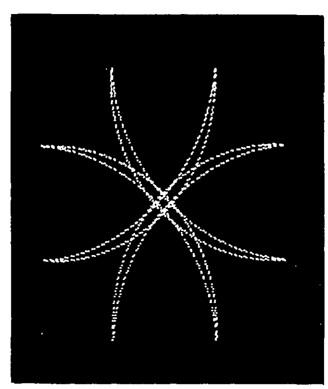
クリスマス　おめでとう

新年　おめでとう

AUGURI PER UN BUON NATALE E UN FELICE ANNO NUOVO

FELIZ NAVIDAD Y FELIZ NUEVO AÑO

GLADELIG JUL OG GODT NUT AAR



Cover: Designs shown on the cover were produced by the Kaleidoscope described on page 35-S , DECUS program number 8-99.

Table of Contents

DECUS TO PUBLISH INFORMATION ON SOFTWARE FOR SALE

Traditionally DECUS has not announced programs for sale or lease, partly because DECUS exists to promote the free interchange of programs. But DECUS also exists to help users of DEC computers, and questionnaires returned last year indicated that members would like to know about programs that can be purchased. The DECUS Board has now adopted guidelines for announcing programs for sale.

Despite the lure of money, we expect that the free DECUS library will continue to grow since DECUS will only announce programs sold by corporations (not by individuals). Other safeguards have also been provided, and these are spelled out below. In this issue, we announce the first program accepted under these guidelines and invite the submission of more. Comments on the new policy would be welcomed.

John B. Goodenough
President

DECUS POLICY ON PROGRAMS FOR SALE OR LEASE

1. Programs will only be accepted if they are submitted on behalf of corporations. Programs submitted on behalf of individuals must be available free of charge to any DECUS member.

2. DECUS reserves the right to reject any program without liability or stating cause.

3. No program will be announced unless the request is formally submitted to DECUS for this purpose.

4. Programs which are accepted under these guidelines will be announced in DECUSCOPE and in the DECUS Library Catalog.

5. Programs will be removed from the DECUS catalog when they are withdrawn by the sponsoring company or otherwise become unavailable to the general membership of DECUS.

6. DECUS will act as a repository for complaints presented by users of programs announced in DECUSCOPE. The complaint file may be inspected on request by any DECUS member. DECUS will not ordinarily investigate such complaints in any way.

7. DECUS may terminate this service at any time without prior announcement.

The programs listed below may be purchased or leased. Pricing information should be obtained directly from the supplier. DECUS makes no charge for announcing these programs and reserves the right to discontinue this service at any time. DECUS cannot guarantee the accuracy of these announcements. A complaint file will be maintained at the DECUS office for each offering and this file may be inspected by any DECUS member.

Programs will be announced for sale or lease only if they are submitted on behalf of corporations; no individual person may offer a program for sale or lease through DECUS.

Submitted by Information Control Systems Inc.

Information Control Systems is leasing its 4K version of extended FORTRAN II and ALICS II programming systems. These systems bring to the 4K PDP-8 family a capability that is not available with existing software.

USA FORTRAN II programs compile into ALICS II assembly code in a single pass. ALICS II assembles this FORTRAN output or directly coded ALICS in a single pass. It produces relocatable binary object programs.

A linking loader automatically loads and links the main program and all subroutines. These programs and subroutines may be coded in ALICS or FORTRAN. Standard subroutines may be added from the user or ICS Library.

The system has been especially useful for real-time applications due to the building block structure and the compatability between the machine level ALICS language and the high level FORTRAN language. The system is equally effective for scientific programming and small scale data processing. Important system features include:

Extended FORTRAN II

1. Large Capacity - A true compiler concept eliminates interpretive execution time systems. Programs up to 200 FORTRAN statements. May be fitted into a 4K memory.

2. Subroutines - Full provisions are made for either FORTRAN or ALICS II assembly language subroutines and external functions.

3. Precision - Floating point numbers are accurate to 8 significant digits, making the system suitable for accounting applications.

4. Speed - Object programs execute up to 4 times as fast as those processed with other compilers available for the PDP-8 family.

5. Relocation - Object programs are relocatable. They are automatically linked by the loader.

ALICS II Assembler

1. Relocatable - Binary object programs are produced which can be relocated without reassembling. A linking loader automatically establishes linkages between your program and subroutines and fits them into the available core.

2. Automatic Paging - Allows the programmer to directly reference all of core without considering page boundaries.

3. Single Pass Assembly

4. Powerful Diagnostics - To help you find errors quickly.

5. Easily Learned - People with no previous language experience will find ALICS easy to master.

ICS Library

1. Floating Point - Features 27 bit mantissa, 8 bit exponent, and sign. All operations fit on 3 pages.

2. Format Interpreter - Features full A, E, F, H, I, and X format term specifications for formatted I/O with conversion. I/O is device independent.

3. Integer MUL/DIV two's complement single precision.

4. Subscripts - One and two dimensional for FORTRAN arrays.

5. Mathematical functions - includes ABS, IABS, SQRT, SIN, COS, TAN, EXP, ELOG, ATAN, and IRDSW for reading the console switches.

For more information contact:

Mr. John Wyman, Sales Manager
Information Control Systems, Inc.
327 South Fourth Avenue
Ann Arbor, Michigan 48104

EDUCATIONAL SUBGROUP PROPOSED

Interest has been expressed by educators on both the high school and university levels in establishing a DECUS Educational Subgroup. An educational Subgroup would facilitate an application exchange and encourage added participation in the DECUS program exchange.

Meetings and seminars initially would be organized to convene during the Spring and Fall DECUS Meetings. The Spring DECUS meeting, scheduled for April 26 and 27 in Philadelphia, Pennsylvania, tentatively has a quarter of the proceedings reserved for education. (Contact Mrs. Angela J. Cossette if you wish to present a paper.) Separate user groups are currently operating in the areas of Modules, Biomedicine, Canadian Users, and European Users.

As our users in education increase, communication becomes more difficult but remains important. No charge is made for the subgroup or DECUS membership. The usual registration fee to cover expenses for DECUS meetings would, in most cases, also cover the subgroup's meetings. If you are interested in this group, please fill out and return the reply form (last page).

Joan Fine
Education Applications
Digital Equipment Corporation
Maynard, Massachusetts

THE PDP-8 PLAYS FOOTBALL

Every Sunday during the football season, football scouts from colleges all over the country sit down at their desks to analyze the information they got at Saturday's games. At Trinity College, Hartford, Connecticut, the scouts can sleep in and let a computer do the work.

Looking for tendencies in the offensive tactics of Trinity's opponents, the computer prints out a play-by-play report of the game with 19 separate pieces of information on each play in the game. It then runs through nine master programs to identify tendencies the Bantams will look for in future games.

Coach Terry Herr wouldn't say exactly what the top-secret programs were looking for, but he did say it took Trinity graduate Tom Ripley hundreds of hours to write them up. Ripley, a fifth-year engineering major, spent the summer working on the programs which cut the time in making scouting reports in half.

Coach Herr indicated that, generally, he was looking for the favorite plays of strong teams. Weaker teams, he said, tend to change their tactics more often. "That doesn't mean we're only prepared for those strong plays," he cautioned. "It just means we have an idea of what kind of defensive adjustments to make in certain cases."

The computerized football scouting report programs developed by Thomas Ripley interpret seventy-five offensive plays (one full game). Each play consists of nineteen data components and is sorted into seven predetermined groupings. In order to accomplish this task using Digital's PDP-8 and the FORTRAN II language, the nineteen data input components are numerically represented. After the seventy-five plays are sorted, the output is translated into a designated football code. The result is a clear, concise picture of an opponent's offensive strengths, weaknesses, and tendencies.

The nineteen data components indicate such information as down, yardage needed for first down, field position, formation, type of play, hole number, backfield motion, receiver, pass pattern, passing zone, play result, etc. Each component is represented by a numerical value, and the entire seventy-five by nineteen array is stored in core. This data is operated upon by six sorting programs (sorters), which group similar plays, formations, and situations together. For instance, one sorter groups all the passing plays by formation, line variation, and backfield motion, and the print-out indicates the above plus the pass receiver, pass pattern, passing zone, result of pass, and yardage gained or lost. The remaining five sorters list plays according to field position, formation and hole number, down and yardage needed for first down, and so on.

The sorters have a set of given conditions which they attempt to match with the components of each play. If such a match occurs as the sorter scans the seventy-five plays, the entire nineteen components of the matched play are punched on a tape. The conditions of each sorter are incremented after each scanning, and the process is repeated until the entire list is complete.

The punched tapes, therefore, contain the sorted lists in numeric form. By transferring this data into core and using the "Master Translator" program, a concise, readable output in the desired football code is printed. This information is obtained in about four hours of computer time.

The computerized scouting report was in operation this past fall, and the coaches were quite pleased with the output format. Incidentally, Trinity's football team finished this season with a 6-1-1 record.

A PDP-8 AND PDP-8/S DRIVEN DIGITAL-TO-SYNCHRO CONVERTER

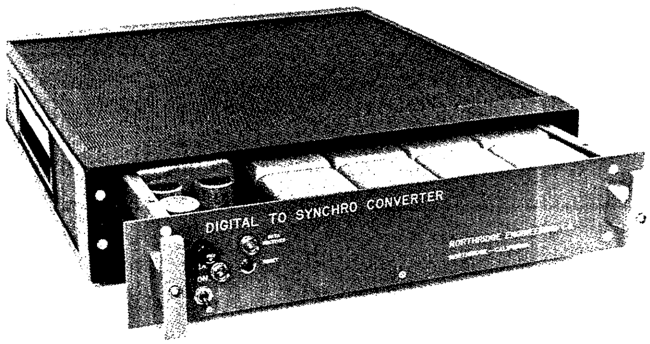
Paul K. Harris
Northridge Engineering Company
Northridge, California

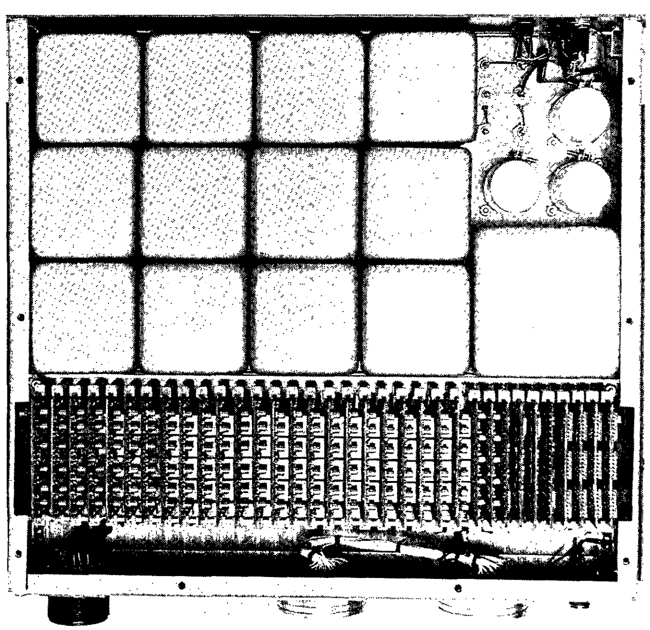
Northridge Engineering Company has recently delivered a four channel Digital-to-Synchro Converter designed to be directly driven by a PDP-8/S computer. The unit is presently undergoing feasibility demonstrations in conjunction with a classified Navy shipboard project. Outputs from the unit directly drive a large analog computer.

The NEC converter (figures 1 and 2) is a standard unit, model 4DS-101-400-12 and consists of four separate 12 bit converters, complete computer interface, and power supplies, all within a 3 1/2 x 19 x 17 rack mountable chassis. Data from the computer is accepted in the normal parallel buss fashion and each converter is assigned a unique device code. By utilizing the unique micro-programmed I/O instruction set of the PDP-8 family, a single instruction effects a 12 bit data output to a specific channel of the converter.

All four channels operate in a "Continuous Ready-Non Interrupt" status; there are no flags or interrupt busses required. After receipt of data, the synchro outputs are held at the appropriate value indefinitely or until new data is received. As conversion time is 400 microseconds maximum for any magnitude angular change, extremely high angular rates can be accommodated.

This system is considered to be unique on several counts. Data input to the converter is in Binary Angular Measurement System (BAMS) units, instead of sine and cosine functions as normally used. This results in a faster and simpler program with no sine/cosine subroutines required. Additionally, the converter is purely electronic, utilizing integrated circuits throughout. Using Northridge Engineering's IC module units, the entire computer interface, including device-selection decoding, is contained on two 2" x 3 1/4" plug-in cards. In keeping with DEC's own reliability principles, the converter has no controls or adjustments, and achieves a mean time between failure of approximately 4000 hours.





A MAINTENANCE NOTE REGARDING ALIGNMENT OF THE TYPE 189 ADC

D. B. Francis and J. P. Brown
Medical Systems Engineering Laboratory
Electrical Engineering Department
Carnegie-Mellon University
Pittsburgh, Pennsylvania

The instructions for alignment of the 12 bit Digital to Analog Converter (DAC), which is part of the Type 189 ADC, are incomplete and incorrect as given in the machine maintenance manual. The procedure outlined below is straightforward.

Only the six most significant bits (A6Ø4 modules) are adjustable. This procedure will test the lower six bits, but they cannot be aligned.

Equipment Required

DEC Module Extender
Oscilloscope (preferably with differential preamp)
having a sensitivity of 1 MV./CM., AC coupled

Basic Setup

Isolate the oscilloscope from line ground and connect the plus input to the DAC output at PE11N; ground the minus input to PE11C. Use the shortest possible leads. Load and start the program described below.

Program

The program does the following:

1. Loads the accumulator from the switch register.
2. Holds for two time units.
3. Subtracts one.
4. Holds for one time unit.
5. Iterates.

The effect is to produce square waves equal in amplitude to one significant bit (2.4 MV.). The square waves are asymmetrical as shown in Figure 1.

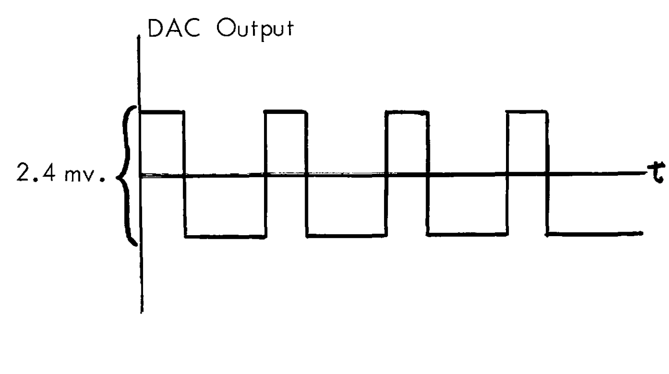


Figure 1.

Program Listing

```
Ø2ØØ  76Ø4  START,  LAS          /FETCH PATTERN
Ø2Ø1  2211          ISZ CTR      /WAIT
Ø2Ø2  52Ø1          JMP .-1
Ø2Ø3  2211          ISZ CTR      /WAIT
Ø2Ø4  52Ø3          JMP .-1
Ø2Ø5  1212          TAD M1       /SUBTRACT 1
Ø2Ø6  2211          ISZ CTR      /WAIT
Ø2Ø7  52Ø6          JMP .-1
Ø21Ø  52ØØ          JMP START    /LOOP
Ø211  ØØØØ  CTR,
Ø212  7777  M1,                  /MINUS ONE
```

Detailed Procedure

1. Turn the machine off and extend the module being aligned. Turn the machine on.

2. Start the program and set the appropriate pattern in the switch register.

3. Check the scope for 2.4 MV. Square waves as shown in Figure 1. If the amplitude is incorrect, adjust the appropriate potentiometer.*

4. Repeat 2 and 3 for the other bit associated with this module.

5. Repeat 1 thru 4 for the next module and pair of bits.

6. When alignment is complete, an overall check may be made using the check sequence below; each pattern in the sequence should give the same square wave.

*Be certain that the scope trace is not inverted. Overzealous adjustment can produce this inversion in the higher bits.

Use the following chart with the procedure above.

Bit	Module	Pot	Pattern
5	PF13	Upper	Ø1ØØ
4	PF13	Lower	Ø2ØØ
3	PF12	Upper	Ø4ØØ
2	PF12	Lower	1ØØØ
1	PF11	Upper	2ØØØ
Ø	PF11	Lower	4ØØØ

Perform these in the indicated order; the check sequence is:

7777, 7776, 7774, 777Ø, 776Ø, 774Ø, 77ØØ, 76ØØ, 74ØØ, 7ØØØ, 6ØØØ, 4ØØØ

EDITORIAL
SYNOPSIS OF DECUS FALL MEETINGS

Fall 1967 Symposium

The Jolly Roger Inn and the Anaheim Convention Center were the settings for the sixth DECUS Fall Symposium in Anaheim, California, on November 10 and 11. Approximately 200 users attended the two-day sessions on Computers in the Laboratory which included 30 papers, 5 workshops, and a tutorial on numerical analysis. The meeting opened with a keynote address by Digital's President, Kenneth H. Olsen, during which he commented on the growth of DECUS and reiterated Digital's support of the Society.

A new concept of tutorial workshops based around a software package and application area was well received. The workshops held on the PDP-9 Advanced Software and the PDP-8 Disc Software were ably presented by DEC people. Both included a question-and-answer session following the presentation.

The first module workshop was held on Friday afternoon. Approximately 24 people were in attendance. Sypko Andreae, Chairman of the Module Users Group (MUG), gave a short introduction reviewing the reasons and goals behind the establishment of a module group. This was followed by two users presenting several suggestions for new products in the M series and stronger lines of communication between users and DEC. An open discussion session followed.

The overall feeling was that these workshops should be continued at future DECUS meetings.

Proceedings of the meeting are in the process of publication and should be available by the end of January.

A financial statement on the meeting will be published in our next issue.

Spring 1967 Symposium

The Spring Symposium will be held in Philadelphia on April 26 and 27.

European Meeting

The European meeting was lavishly hosted by Hoogovens in Ijmuiden, Netherlands, on October 19 and 20. The 110 people in attendance reflected the increasing use of DEC computers in Europe. Papers in the nuclear physics area dominated the subject matter of the meeting. Highlight of the meeting, however, was the paper by D. W Roberts, Strand Hotel, on "A Stimulus-Response Program for Hotel Room Inventories."

The discussion session with DEC people on Friday morning resulted in the feeling that the similar session held a year ago paved the way for better communications between the European users and DEC in that there seemed to be fewer problems this year. Thus indicating the importance of such sessions. New officers for the European Committee were appointed (next col.), and the meeting for 1968 was set for September in Edinburgh, Scotland. The proceedings of the meeting will be available by the end of December.

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CANADIAN MEETING PLANNED

Due to the success of the Canadian Meeting held in April of this year, plans are now underway to hold another meeting in Ottawa for Canadian users on February 23, 1968. It will be a one-day meeting at the Talisman Motor Inn. Papers will be presented as well as workshops on the PDP-9 software system and PDP-8 Disc System with a possible session for module users. These workshops will be similar in concept to the ones held in Anaheim to enable the Canadian users to also benefit from these workshops. Anyone interested in presenting a paper during this meeting should contact Mrs. Angela Cossette at the DECUS office. Official notice of the meeting will be sent to all Canadian members as soon as more details have been finalized.

PROGRAMMING NOTES

It has been noted by one of our users that, contrary to the definitions in the supporting literature, the LINC-8 LAP 4 assembler program does not correctly define the mnemonic SKP. As it currently stands, the mnemonic SKP is treated as the mnemonic for the skip class instructions, which include the internal processors skip tests and the sense switch tests instructions. Therefore, SKP is assembled as 440.

For users who have a large group of programming in which they do not want to change this skip to a jump P+2, I would suggest the following changes to the LAP 4 assembler.

The following locations in Block 326 (Assembly Pass 1) should be changed:

Location 265 is 4346, it should be 4646
Location 326 is 4646, it should be 4346
Location 360 is 440, it should be 446

Richard Clayton
LINC-8
Digital Equipment Corporation
Maynard, Massachusetts

WANTED

Information regarding solutions to more complex classifications for Analysis of Variance for the PDP-8/S computer.

Contact: Alonza C. Johnson, M.D.
Chief of Research
Department of Mental Hygiene
NAPA State Hospital
Imola, California 94558

THE PDPMAP ASSEMBLY SYSTEM

Thomas H. Johnson, Michael S. Wolfberg
Moore School of Electrical Engineering
University of Pennsylvania
Philadelphia, Pennsylvania 19104

This report describes the use of the powerful assembler of a large computer (IBM 7040 MAP Assembler) for the quick assembly of symbolic programs written for a PDP-8 or DEC-338 with up to 16-K memory locations. The ideas presented can be used to produce a PDP-8 assembly system on any machine which has a sophisticated assembler. A group in the Physics Department of the University of Pennsylvania has applied these ideas to develop a similar system for the assembly of PDP-9 programs on the IBM 7040.

Copies of this report are available from the DECUS office.

CORRECTION

To abstract published in DECUSCOPE, Vol. 6, No. 5 "A Digital Electrochemical Control and Data Acquisition System"

This paper was co-authored by:

George Lauer and R. H. Osteryoung
Science Center
North American Rockwell Corporation
Thousand Oaks, California

DECUS PROGRAM LIBRARY NOTE

The program previously announced as DECUS No. 6/10-27 On-Line Algebraic Interpreter (JOSS in the Index) will no longer be available through the DECUS office. AID (for Algebraic Interpretive Dialogue) the PDP-10 version of JOSS* will be made available by Digital Equipment Corporation in the very near future. All inquiries regarding this program should be directed to the Programming Department, Digital Equipment Corporation, Maynard, Massachusetts 01754.

*JOSS is the trademark and service mark of the RAND Corporation for its computer program and services using that program.

REVISIONS

DECUS No. 5/8-15

A.T.E.P.O. - Automatic Test in Elementary Programming and Operation of PDP-5/8 Computer

Revised for use on a PDP-8 and 8/S as well as PDP-5.

DECUS No. 5/8-18(b)

Binary Tape Disassembler

Revision by Roger Due, N.A.D. Crane

An extension of the Disassembler which enables double spacing and paging of output.

The following revisions were submitted for DECUS No. 5/8-27a - Absolute Memory Clear.

From: Michael Wolfberg
Moore School of Electrical Engineering
University of Pennsylvania
Philadelphia, Pennsylvania 19104

The following eight-location PDP-8 program clears an entire 4K memory (including itself). The START key should be used to start the program at location 2772. Credit is due to J. E. Gorman, author of DECUS No. 5/8-27a for some of the ideas behind the program.

Location	Octal	Symbolic
ØØØØ	3ØØØ	3ØØØ
2772	2ØØØ	ISZ Ø
2773	34ØØ	DCA I Ø
2774	1372	TAD 2772
2775	764Ø	SZA CLA
2776	5372	JMP 2772
2777	3376	DCA 2776
3ØØØ	34ØØ	DCA I Ø

From: Willard Crittenden
Ann Arbor Computer Corporation
Ann Arbor, Michigan 48103

The following changes to "Absolute Memory Clear" (DECUS No. 5/8-27a) are necessary.

2765 / 2376 ← 1363
2766 / 1363 ← 2376

With the ISZ instruction in location 2765, overflow is fatal.

MEMORY CLEAR

The following program clears all of PDP-8 core (4K) so that the machine continually cycles memory executing AND Ø instructions.

An effective jump to location 277Ø with the accumulator clear starts the loaded program. Locations 3ØØ1 through 7777 are sequentially cleared by depositing indirect through a pointer, advancing the pointer, etc. When the pointer overflows, the SZA CLA instruction is skipped and 277Ø is deposited in location Ø. Locations 1 through 2767 are then cleared via the pointer.

Having cleared all of core except for itself and location Ø, the program falls through the SZA CLA instruction. The jump instruction and pointer are cleared in order to provide a harmless path through the program to the DCA I Ø instruction. This instruction, via the self-advancing pointer now in location Ø, proceeds to clear locations 277Ø through 3ØØØ, location 3ØØØ being the address of the DCA I Ø instruction. At this time, location Ø has a 3ØØØ and is the sole remaining non-zero core location. The self-advancing pointer is also self-destroying and does so the next time around.

MEMORY CLEAR

Starting Address 277Ø

2767 / 277Ø	C277Ø,	277Ø
277Ø / 3777	LOOP,	DCA I POINT
2771 / 1367		TAD C277Ø
2772 / 2377		ISZ POINT
2773 / 764Ø		SZA CLA
2774 / 537Ø		JMP LOOP
2775 / 3374		DCA .-1
2776 / 3377		DCA POINT
2777 / 3ØØ1	POINT,	3ØØ1
3ØØØ / 34ØØ		DCA I Ø

WANTED

THE DECUS OFFICE NEEDS COPIES OF DECUS PROCEEDINGS FOR 1963 AND 1964. ANYONE WHO HAS EXTRA COPIES OR WILLING TO PART WITH THEIR PERSONAL COPY, IS REQUESTED TO SEND THEM TO THE DECUS OFFICE AS SOON AS POSSIBLE.

"LETTERS"

Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources
CANADA

Bedford Institute of Oceanography
Institut océanographique de Bedford
P.O. Box 1006
Dartmouth, N.S., Canada
File Number
Nº à rappeler 4546-3

November 6, 1967

Mrs. Angela Cossette,
DECUS Executive Secretary,
Digital Equipment Computer Users Society,
Maynard, Massachusetts.

Dear Mrs. Cossette:

Prof. Dr. W.L. van der Poel's simple and economical solution of the Teletype reader interface problem (DECUSCOPE 6 no. 5 p. 21) was most timely -- I for one had been deterred by the mistaken belief that considerable rewiring would be required. For our computer (PDP-8 #902), the changes are not exactly as given by Prof. van der Poel but should read:

"Disconnect ME 17D. Select code 03 and 13 now both select keyboard.

Disconnect ground from ME 21V. Connect signal MB5(1) to pin ME 21V. (Can be found on ME 36E.)"

Prof. van der Poel's buffered routines raise a couple of points. For complete safety, the 'OUT' routine should start with an AND instruction to make sure the output character is positive. Secondly, again in the 'OUT' routine, "EMPTYFLAG" needs to be cleared not after the test ISZ EMPTYFLAG has succeeded but after it fails. The test must now be carried out with IOF because of the (exceedingly remote) possibility of a combination of interrupts setting EMPTYFLAG between the times the ISZ test shows it to be clear and the DCA EMPTYFLAG reclears it. A possible sequence is:

```
     DCA I W3          / PLACE CHARACTER IN OUTPUT BUFFER
     IOF
     ISZ EMPTYFLAG     / TEST EMPTYFLAG
     JMP RET-2         / IF NOT EMPTY RETURN AND INCREASE PTR
     TAD RETT          / PREPARE TO USE INTERRUPT ROUTINE
     DCA 0
     DCA AC            / CLEAR AC
     JMP IN2           / GO TO INTERRUPT ROUTINE
     DCA EMPTYFLAG     /
     ION
RET, TAD W3            / INCREASE FILLING POINTER CYCLICALLY
     etc.
```

Yours sincerely,

A.S. Bennett

A.S. Bennett,
for Director,
Bedford Institute of Oceanography.

ASB/law

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ENGINEERING DEPARTMENT

September 1, 1967

Mrs. Angela Cossette
DECUS
146 Main Street
Maynard, Massachusetts 01754

Dear Mrs. Cossette:

The article "Table Sorts for the PDP-8's" in the [redacted] Decuscope (Vol. 6 No. 4) seems to omit mention of a few important points. The table of allowed characters against which the argument is compared must end with a negative number (4000-7777) and must contain no other such entries, or the terminate-search test will fail. The register AXTEM must be incremented each time through the search loop; this may be done with an appropriate ISZ AXTEM instruction or by use of an auto-index register for AXTEM (in this case the register after the calling JMS should contain the address of the comparison list - 1, rather than the address alone as specified by the article).

While the program and its errors are simple enough that no grievous errors should result, I add these notes for the sake of completeness. Please feel free to include this letter in DECUSCOPE if you wish.

Sincerely,

Matthew L. Fichtenbaum

MLF:JB

Author's Comments - The original documentation was not intended to give the actual coding, just the concept.

R. Merrill

SWEDA

SWEDA INTERNATIONAL • SALES REGISTER SYSTEMS • A DIVISION OF LITTON INDUSTRIES
GENERAL OFFICES • 550 CENTRAL AVENUE, ORANGE, N. J. 07051 • (201) 673-6600

September 13, 1967

DECUS, Secretary
c/o Digital Equipment Corporation
Maynard
Massachusetts

Dear Miss Cosette:

We are planning to use a PDP8/S system with the photo-electric reader on a system for data reduction on high volumes of unfanfolded paper tape. We would appreciate hearing from any users who have been involved with tape spooling and related problems.

Thanks.

Very truly yours,

Harris Hyman

Harris Hyman
Senior Systems Engineer

HH:ra

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516 belt line road • richardson, texas 75080 • (214) ad 5-5286

September 26, 1967

Mrs. Angela J. Cossetle
DECUS Executive Secretary
Digital Equipment Corp.
Main Street
Maynard, Mass. 01754

Dear Mrs. Cossetle:

We are interested in obtaining a program for Analog Simulation for use of the PDP-8. This type of program allows the user to attack analog problems such as differential equations, control system simulation, etc., on a digital computer. Such programs now available for large computers are MIDAS, MIMIC, and DIANA.

If you know of anyone working in this field on the PDP-8, please let me know.

Very truly yours,

OMEGA-T SYSTEMS, INC.

H. H. Reed
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Engineering

HHR/cw

systems engineers and communications consultants

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DECUSCOPE has been published since April 1962 and is the official newsletter for Digital Equipment Computer Users Society.

It is published periodically at the DECUS Office, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Telephone: AC 617, 897-8821, ext. 414

Editor: Angela J. Cossette, DECUS

DECUS Publications Chairman: Michael Wolfberg, Moore School of Electrical Engineering, University of Pennsylvania

Circulation: 2,800 copies per issue

DEC LIBRARY NEWS

SMALL COMPUTER NEWSLETTER

This newsletter is intended for PDP-5/8, 8/S, LINC-8, 7, and 9 users. It is compiled and published by the Software Maintenance Group and contains information about the following:

1. Software Problems and corrections. Various problems with Digital's standard library programs and manuals are discussed and solutions given. In the case where no corrections are available at the time of publication, they will be included in a later newsletter.

2. Programming Notes. Various programming aids are discussed, generally in response to customer questions. An attempt is made to supplement the manuals where necessary. Suggestions for subject material of these notes should be directed to the Software Maintenence Group (address below).

3. A list and brief description of new and/or revised software which is available from the Program Library.

The Software Maintenence Group is responsible for the maintenence of Digital's standard library programs. There is a Software Support person at most of the regional sales offices and initial reports should be made to them. In the case where they are unavailable, reports should be directed to:

Software Maintenance Group
Digital Equipment Corporation
146 Main Street
Building 12 Second Floor
Maynard, Massachusetts 01754

It is strongly suggested that all problems referred to this group be sent on Software Trouble Report Forms, which are available from the Program Library (address below). A sample of the form is included at the end of this newsletter. For more efficient service, the following information should be included:

1. Type and configuration of machine.

2. Brief but concise description of problem, including the name and date of the Digital library program in use at the time of problem.

3. Listing of user program in use at time of problem.

4. Listing of erroneous results and/or error messages.

5. Contents of AC and PC where applicable.

New and revised software and manuals and Software Trouble Report forms are available from the Program Library. When ordering, include the document number and a brief description of the program or manual desired. At this time there is not automatic updating of revised programs and manuals. Revisions and notifications of updates will be published in this newsletter, which will continue to be a part of DECUSCOPE. They will be shipped only on request. Direct all inquiries and requests to:

Program Library
Digital Equipment Corporation
146 Main Street
Building 12 First Floor
Maynard, Massachusetts 01754

A. PDP-8

I. ERROR LIST

PROGRAM: Double Precision Sine Subroutine (formerly Digital-8-16-F) now distributed as DEC-08-FMFB-PA (11/20/67) and described in the MATH Routines Manual, DEC-08-FFAB-D.

PROBLEM: The argument to this subroutine is given in radians. If this argument is a very small number and its sine needs to be rounded, the subroutine ROUND which does this may fail since its exit consists of the following sequence and there is a possibility of the ISZ causing a skip:

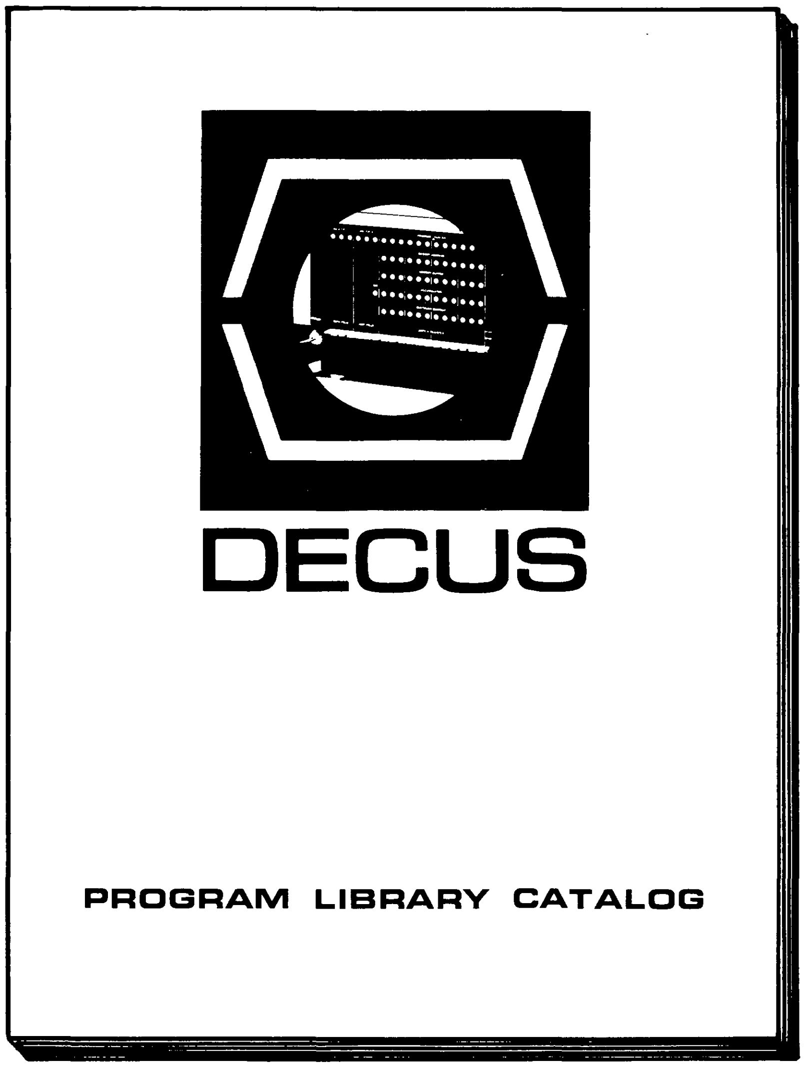
```
0733 ISZ...
0734 JMP I ROUND
```

SOLUTION: Inserting a NOP between the ISZ and the JMP will insure that control will not be lost if the ISZ should cause a skip. The addition of this instruction requires another change in order not to relocate ARG which is referenced by other programs. This change consists of exchanging the two symbols X and PNT as follows:

```
          PNT, 0
0736     XSQR, 0
0737           0
0740      ARG, 0
0741           0
0742        X, 0
0743           0
0744      CHK, 0
```

CONTINUED ON PAGE 20
FOLLOWING DECUS ADDITIONS
LIBRARY CATALOG

ADDITIONS



PLEASE REPLACE PAGES IN YOUR DECUS LIBRARY CATALOG WITH THE ATTACHED.

DECUS NO.	TITLE	TAPES AVAILABLE	LISTING
72	OLD DECUS LIBRARY III		
	BBN-3 Binary Punch and Load Package	R	
	BBN-46 Binary Punchoff	R	
73	MADCAP; MAmmonth DeCimal Arithmetic Program for the PDP-1 Computer	B, S	
74	Tapelibrary Program	S, L	
75	SEETAPE - A Magnetic Tape Dump Program	B, S	
76	A 28-Bit Floating Point Package for the PDP-1	B, S	
77	DSL Sort Routines-Sort 2, Sort 3	S	
78	TAPE 52 Magnetic Tape Control Subroutines	S	
79	Extended Memory Punch and Loader Routines (EXPCH1 and EXPCH0)	B, S	
80	DEXTER, A Magnetic Tape Executive Routine	R, S	
81	Calcomp Plotter Software	B, S	X
82.3	FORTRAN for the PDP-1 (Version 3)	B, S	
83	340 Assembly Language and 340 DDT	B, S	
84	M.I.T. Floating Point Arithmetic Package	S	
85	LISP for the PDP-1	B, S	X
86	Precision Hypotenuse/Square Root Subroutine	R, S	X
87	Buffered DECtape Read and Write Routines	L, S	
88	Typewriter Time Test	B, S	
89	Cube Display	B, S	X
89a	Matchbox Display	B	
90	Color Debugger	S	X
91	DECtape Duplicate/Verify	B, S, L	X

DECUS No. 82.3

FORTRAN for the PDP-1 - Version 3

The FORTRAN Compiler for the PDP-1 is not intended to be a replacement language for the other compiler and assembly languages already in use on the PDP-1; however, it is useful for short programs which may easily be coded in FORTRAN. Version 3 is for machines with multi-div hardware.

DECUS No. 83

340 Assembly Language and 340 DDT

This program resembles ordinary DDT in that it allows the bit patterns of the 340 Scope instructions to be inspected and changed, on-line, in a symbolic language. The symbols used are identical to the symbols used when compiling programs for the scope.

In addition registers may be inspected and changed using ordinary machine language.

The action operator tape, which defines the 340 Assembly Language, can be compiled only with the 2-core DECAL of November 1964 (or with versions of DECAL derived from the Skeletal DECAL of November 1964). After compilation, DECAL can be punched off to obtain a permanent copy of DECAL with the 340 definitions.

Following the action operators is a test program which can be compiled and loaded to check that the compiler is using the definitions correctly. The pattern produced by the test program is described in the 340 DDT write-up.

DECUS No. 84

M. I. T. Floating Point Arithmetic Package

The Floating Package is a group of arithmetic subroutines in which numbers are represented in the form $f \times 2^e$. f is a 1's complement 18-bit fraction with the binary point between bits 0 and 1. e is a 1's complement 18-bit integer exponent of 2. The largest magnitude numbers that can be represented are $\simeq 10^{,39,000}$.

A number is normalized when $\frac{1}{2} \leq |f| < 1$. All the floating point routines, except the two floating unnormalized adds, return a normalized answer. The fraction appears in the AC, the exponent in the I/O. Routines include:

- Floating Add - jda fad
- Floating Multiply - jda fmp
- Floating Divide - jda fdv
- Floating Square Root - jda fsq
- Floating Log, base 2 - jda log
- Floating Reciprocal - jda rcp
- Floating Input - jda fip
- Floating Output - jda fop
- Floating Unnormalized add - jda fua
- Floating Unnormalized add and Round - jda fur
- Floating Exponentiation - jda f2x

DECUS No. 85

LISP for the PDP-1

LISP (for LISt Processing) is a language designed primarily for processing data consisting of lists of symbols. It has been used for symbolic calculations in differential and integral calculus, electrical circuit theory, mathematical logic, game playing, and other fields of intelligent handling of symbols.

LISP for the PDP-1 uses, from the basic function, about 1500 registers, and for working storage from about 500 to 14000 registers (the latter in a four-core PDP-1) as may be chosen. It is flexible, permits much investigation, and the correction of preliminary expressions.

DECUS No. 86

Precision Hypotenuse/Square Root Subroutine

Precision Hypotenuse is used to form the 34-bit sum of the squares of two 17-bit one's complement deltas and takes the square root. Precision Square Root, indicated by coding within the comments, will calculate the 17-bit square root of a 34-bit number.

The symbolic version of the subroutine is in Drum FRAP but will assemble with ordinary FRAP. The subroutine occupies 34_{10} registers, using automatic multiply and divide hardware, and requires a constant of 200000_8.

DECUS No. 87

Buffered DECtape Read and Write Routines

These routines simulate paper tape on DECtape. When characters are written (punched) onto DECtape, they are packed two per word. Therefore, it is possible to put 776_8 characters on one DECtape block.

Minimum Hardware: 4K, DECtape Dual Transport

Source Language: DECAL

Storage: 100-557 plus rest of memory for buffer

DECUS No. 88

Typewriter Time Test

Indicates time ratios between key strokes on a typewriter.

DECUS No. 89 and 89a

Cube Display and Matchbox Display

Demonstration programs displaying a cube or matchbox for use with the PDP-1 and Type 30 Display.

DECUS No. 90

Color Debugger

Provides on-line debugging in octal using PDP-1 with color display and pushbuttons. It has two basic modes: examine/modify and program trace. Requires PDP-1 with memory extension control and a color display console, or black and white display Type 30 (preferably with pushbuttons connected to computer test-word).

DECUS No. 91

DECtape Duplicate/Verify

Richard McQuillin, Inforonics, Inc., Cambridge, Massachusetts

This program copies DECtape on the PDP-1. When a DECtape is copied, it is automatically verified. An operation that will only verify one tape against another is also included. The user has control over how much of the tape is duplicated and verified. He may also adjust the internal buffer size to any core configuration.

DECUS No.	TITLE	TAPES AVAILABLE	LISTING
7-41	Two-Pass Assembler	R	X
7-42	The ML/I Macro Processor	B, S	X
7-43	A PDP-7 Music System	B, S	X
7-44	An Interrupt Compatible DDT	B	

DECUS No. 7-41

Two-Pass Assembler

P. Fleck, M.I.T., Lincoln Laboratory, Lexington, Massachusetts

I. General

The FLAP two-pass assembler uses a source program prepared in ASCII code on paper tape, or in Hollerith code on punched cards, or in packed Hollerith code on magnetic tape. This source program is read in two passes and produces an assembly listing and a binary object paper tape in absolute (Read In Mode), RIM, or relocatable format. If 16K memory is used, the binary program is assembled in core memory ready to run.

The minimum requirements for the assembler are: a PDP-7 with EAE and 8K of memory, tape reader and punch and a Teletype. The assembler was designed to operate on a PDP-7 with a card reader, line printer, and one magnetic tape unit; and this extra equipment reduces the assembly time. If cards or paper tape are input, an option allows for writing the source program in packed Hollerith on magnetic tape (unit Ø) during the first pass. This collating tape will be used for the second pass (to reduce the assembly time) or it can be used as input to the assembly program (e.g. if the magnetic tape is prepared off-line by pre-storing cards onto tape).

The optional listing can be on the Teletype or line printer. The listing includes the complete octal code, the location of this word in memory and the symbolic source statement which was assembled into this octal code.

The binary output is optionally punched on paper tape. If 16K memory is available, the binary output will be stored in the upper bank where it can optionally be moved to the lower bank at the end of the assembly for immediate execution.

The FLAP assembler can also be used as a card or paper tape (ASCII) or mag tape (FLAP format) lister. Since the assembler is not used, any format can be used on the input, with the qualification that for paper tape anything after the 80th character after each carriage return will be listed on a new line, and only the symbols for which characters exist in Hollerith will be listed (i.e., characters like ![]" :\↑← are illegal and will be incorrectly listed as ↑).

DECUS No. 7-42

The ML/I Macro Processor

P. J. Brown, University Mathematical Laboratory, Cambridge, England

ML/I is a general Macro processor. It is general in the sense that it can be used to process any kind of text. The text may be in any programming language or natural language, or it may be numerical data. The most important use of ML/I is to provide the user with a simple means of adding extra statements (or other syntactic forms) to an existing programming language in order to make the language more suitable for his own field of application. This process of extension may be carried to the level where the extended language could be regarded as a new language in its own right. Other uses of ML/I are program parameterization (e.g. a parameter might determine whether debugging statements are to be included in a program) and various applications in text editing or correction and data format conversion. ML/I is also suitable for use as the final pass of a compiler.

Minimum Hardware: Basic PDP-7

Storage Requirement: 8K

DECUS No. 7-43

A PDP-7 Music System

Ronald F. Brender, Logic of Computers Group, The University of Michigan, Ann Arbor, Michigan

This is a pair of programs concerned with producing four-part music on the PDP-7. One program "performs" the music, while the other translates from symbolic musical text to the form required by the music player program. Four independent simultaneous parts in the frequency range 1 to 2000 hz are produced.

Complete instructions and examples include a concert of seven pieces from Bach to The Loving Spoonfuls. These programs are easily adapted to PDP-4 or PDP-9.

Minimum Hardware: 4K and EAE

DECUS No. 7-44

An Interrupt Compatible DDT

Ronald F. Brender, Logic of Computers Group, The University of Michigan, Ann Arbor, Michigan

A modified DDT is provided which facilitates the debugging of programs using the interrupt hardware of the PDP-7. Interrupt and teleprinter flag status are saved and optionally restored at breakpoints and can be specified when starting execution. Several additional commands are provided to control these features.

Minimum Hardware:	4K
Storage Requirement:	Approximately 1500 words plus user symbol table - about the same as Basic DDT

PDP-9 INDEX

Code

B - Binary
R - RIM
X - Listing Available

A-ASCII Source
L - Linking Loader
D - DECtape

S - Symbolic
H - High Binary Loader

Write-ups are available for all programs.

PDP-9 PROGRAM ABSTRACTS

DECUS No. 9-1

DECtape Copy Routine

This program will reproduce data information from one reel (master) to a second (copy), and verify information using verified DECtape on the PDP-9.

The complete tape of 576 blocks may be copied or any number of blocks can be reproduced as designated by the operator through the AC SWS. Data can be copied in multiples of one block only. The blocks indicated in the AC SWS will be copied from the master reel to the corresponding blocks of the copy reel.

DECUS No. 9-2

3D Draw for 339

Barry Wessler

This program is a demonstration of the capabilities of the 339 system. It allows the user to sketch three-dimensional objects on the scope and rotate them in real time. The equipment required consists of a basic 339.

DECUS NO.	TITLE	TAPES AVAILABLE	LISTING
8/8S-76	PDP NAVIG 2/2	B, S	
8/8S-77	PDP-8 Dual Process System	B, S	X
8-78	Diagnose: A Versatile Trace Routine for PDP-8 and EAE	B, A	X
8-79	Tic-Tac-Toe (Trinity College Version)	B, S	X
8-80	Determination of Real Eigenvalues of a Real Matrix	B, S	X
8-81	A BIN or RIM Format Data or Program Tape Generator	B, S	X
8-82	Library System for 580 Magnetic Tape Preliminary Version	B	X
8/8S-83	Octal Debugging Package (With and Without Floating Point)	B, A	X
8-84	One-Pass PAL III (8K PDP-8)	B, A	X
5/8-85	Set Memory Equal to Anything		X
8-86	High-Speed Reader Option for PDP-8 FORTRAN Compiler for use with DECtape-Stored Compiler	B, A	X
8-87	XMAP	D-B,S	X
8-88	DECtape Symbolic Format Generator	D-B,S	
8-89	XOD - Extended Octal Debugging Program	B	
5/8-90	Histogram on Teletype	S	X
8-91	Micro-8: An On-Line Assembler	B	
8-92	Analysis of Pulse-Height Analyzer Test Data With A Small Computer	B	X
8-93	CHEW - Convert Any BCD to Binary - Double Precision	S	X

DECUS No.	TITLE	TAPES AVAILABLE	LISTING
8-94	Blackjack	B,S	X
8-95	Trace for EAE	B,S	X
8-96	J Bessel Function (FORTRAN)	F,O	X
8-97	GOOF	S	X
8-98	3D DRAW	B,S	
8-99	Kaleidoscope	B,S	X
8-100	Double Precision Binary Coded Decimal Arithmetic Package	S	X
8-101	Symbolic Editor With View	B,S	

DECUS No. 8-87

XMAP

Curtis Jansky and Robert B. Brown, Communications Systems, Inc., Paramus, New Jersey

This program types on TTY keyboard the contents of the DECtape directory. The list includes the name of the program, its initial block number, the amount of blocks used, the starting address and the location(s) of the program in core. The above restriction is only a format restriction due to the line length on the TTY unit. At present, this program is operational only with the TCØ1 control; however, the symbolic version may be modified for use with the 552 control.

Storage:	ØØØØ-1232, 6ØØØ-6577 (directory)
Restrictions:	Each program on tape is assumed to occupy no more than three successive sequences of memory pages.

DECUS No. 8-88

DECtape Symbolic Format Generator

Jack Harvey, Communications Systems, Inc., Paramus, New Jersey

These are DECtape versions of the Symbolic Tape Format Generator, Digital 8-21-U, that operate under the DECtape Programming System, DECUS 5/8-64. They provide neat formats for symbolic files generated with XEDIT, and a means to get symbolic programs out on paper. They compact a program containing extra spaces and give the number of blocks actually used in the output file. The library tape is executable on TCØ1 equipment only, but the write-up gives instructions for altering it for 552 equipment.

Other programs needed:	XRDCT, XWDCT, XBUFF (DECUS 5/8-64)
Storage:	Ø-4777(8)

DECUS No. 8-89

XOD - Extended Octal Debugging Program

Michael S. Wolfberg, The Moore School of Electrical Engineering, Philadelphia, Pennsylvania

XOD is an octal debugging program for a PDP-8 with extended memory which preserves the status of program interrupt system at breakpoints. The program occupies locations 6430 through 7577 of any memory field.

From the on-line Teletype, the user can examine and modify the contents of any memory location. Positive and negative block searches with a mask may also be performed.

XOD includes an elaborate breakpoint facility to help the user run sections of his program. When this facility is used, the debugger also uses locations 0005, 0006, and 0007 of every memory field.

The ability to punch binary tapes is not included in XOD.

DECUS No. 5/8-90

Histogram on Teletype

J. B. Levin, University of Arizona, Tucson, Arizona

This routine provides a means of plotting histograms on the Teletype when there is no CRT display available, or of making a permanent copy of a CRT display. Input to the routine consists of a vertical scaling factor, the size of the table to be plotted (limited only by the size of the Teletype print line), the starting address of two core areas: one containing the data to be plotted, and one for use as temporary storage by the machine.

Storage:	128_{10} words plus tables

DECUS No. 8-91

MICRO-8: An On-Line Assembler

K. F. Kinsey, State University of New York, Geneseo, New York

M. E. Nordberg, Jr., Cornell University, Ithaca, New York

Micro-8 is a short assembler program for the PDP-8 that translates typed mnemonic instructions into the appropriate binary code and places them in specified memory locations immediately ready to function. It processes the typed instructions by a table-lookup procedure.

It is especially useful for programs of less than one page which are to be run immediately. Only octal (not symbolic) addresses may be specified, but the user has control of the zero page and indirect addressing bits. An octal typeout routine permits examination of any memory location.

Storage: 3200 - 4200

Restrictions: Micro-8 is quite capable of modifying itself.

DECUS No. 8-92

Analysis of Pulse-Height Analyzer Test Data With A Small Computer

E. McDaniel and J. W. Woody, Jr., Oak Ridge National Laboratory, Oak Ridge, Tennessee

This PDP-8 computer program is used in the evaluation of test data for multichannel pulse-height analyzers. The program determines integral and differential nonlinearities and examines smooth spectra of radioactive decay.

DECUS No. 8-93

CHEW - Convert Any BCD To Binary - Double Precision

Louis O. Cropp, Sandia Corporation, Albuquerque, New Mexico

This subroutine converts a double precision (6 digit) unsigned-integral-binary coded decimal (BCD) number with bit values of 4,2,2, and 1 to its integral-positive-binary equivalent in two computer words. It is possible to change the bit values to any desired values and thereby convert any BCD number to binary.

Storage: 0109_{10}

DECUS No. 8-94

BLACKJACK

Dennis J. Frailey, Ford Motor Company, Dearborn, Michigan

This program enables a person to play Blackjack with the computer. The computer acts as dealer and keeps track of bets, cards played, etc.

Storage: $0 - 3777_8$

DECUS No. 8-95

TRACE for EAE

Eberhard Werner, Scripps Institution of Oceanography, University of California, San Diego, California

Trace interpretively executes a PDP-8 program. At the same time a printout is provided of the contents of the program counter, the instruction, the link, accumulator, and multiplier-quotient registers, and where applicable, the effective address, and the contents of the effective address. This printout may be for all or a selected type of instruction within selected memory bounds. The program is capable of handling any PDP-8 instruction including IOT, two-word EAE, and interrupt instructions. Trace cannot be destroyed by the program being traced while Trace is in control.

Minimum Hardware: PDP-8 with Type 182 EAE, ASR-33 Teletype

Storage: 400_8 or 500_8 Locations

DECUS No. 8-96

J Bessel Function (FORTRAN)

J. A. Crawford, Communications Systems, Inc., Paramus, New Jersey

This program computes the J Bessel Function for a given argument and order. It is a complete PDP-8 FORTRAN program that operates in a conversational mode.

Other Programs Needed: FORTRAN Compiler/Operating System

DECUS No. 8-97

GOOF

Pete Andrews and Charles Wagner, Fairchild R & D, Palo Alto, California

A one-page program which allows insertion of instruction (xxxx) in location (nnnn) by means of the TTY keyboard. A feature of automatically incrementing the current address permits rapid insertion of blocks of data or instructions. Typing "RUB-OUT" reinitializes the program.

Storage: 175_8 locations (1 Page)

DECUS No. 8-98

3D DRAW for 338

Barry Wessler

This program is a demonstration of the capabilities of the 338 system. The program allows the user to sketch three dimensional objects on the scope and rotate them in real time. The equipment required consists of a basic 338.

DECUS No. 8-99

Kaleidoscope

The program creates pictures on the PDP-8 or PDP-8/S with 34D Display. They are varied by manipulating the sense switches (within the range 0000 - 0007). The program was submitted without comments by an anonymous donor.

DECUS No. 8-100

Double Precision Binary Coded Decimal Arithmetic Package

Richard M. Merrill, Digital Equipment Corporation, Maynard, Massachusetts

Consists of the following routines:

BCDADD - The single precision BCD addition routine is the basic component of the BCD arithmetic package. This routine functions simply by masking out and adding together corresponding BCD digits (i.e., four bits) and checking for carry (i.e., when the sum of two four-bit numbers is greater than 9(1001)).

MPYBCD - This routine multiplies a single precision (three digit) number times a double precision one to produce another double precision number. Overflow is indicated in the link; the arguments are not affected.

SUBBCD - One double precision BCD number is subtracted from a second by this routine. It uses a 9's complement routine and the double precision add routine.

DOLOUT - special formats: ("$XXXX·YY "); ("XXXXXX "); (3 non-printing data codes); ("XXX ").

DECUS No. 8-101

Symbolic Editor With View

Barry Wessler

This program is an extended version of the standard PDP-8 Symbolic Editor (high-speed I/O) program. One extra command has been added. "V" which takes the lines specified by the arguments and displays them on the CRT (338). The program, otherwise, operates in the same way as the Editor. The following pushbutton options are provided:

- Ø: Count Up Scale
- 1: Count Down Scale
- 2: Count Up Intensity
- 3: Count Down Intensity

PDP-6 INDEX

DECUS NO.	TITLE	TAPES AVAILABLE	LISTING
6-1	ALPHAS	A, D	X
6-2	LPFOL	A, D	X
6-3	PUNCH	A, D	X
6-4	NUMBER	A, D	X
6-5	TIMEF4	A, D	X
6-6	DTADIR	A, D	X
6-7	DTALST ALIAS - PIP -3	A, D	X
6-8	BELL STAR	A, D	X
6-9	LININV	A, D	X
6-10	DATE	A, D	X
6-11	MATINV	A, D	X
6/8-12	PDP-8 Assembler for PDP-6	A, D	
6-13	FORTRAN II Compiler	A,D	
6-14	The Dots Playing Program	A, D	X
6-15	DREDIT	A, D	
6/10-16	FILER	A, D	
6-17	FIT	A, D	X
6-18	DISUBS	A, D	X

Code

B-Binary
R-RIM
D-DECtape

A-ASCII Source
L-Linking Loader
X-Listing Available

S-Symbolic
H-High Binary Loader

Write-ups are available for all programs.

DECUS NO.	TITLE	TAPES AVAILABLE	LISTING
6-19	MXNOUT	A, D	X
6-20	DTADDT	A, D	X
6-21	Critical Path Analysis	A, D	X
6-22	MEM2 and MEM4	A, D	X
6-23	TSUM, DERIV and CONTROL	A, D	X
6-24	CHISQ	A, D	X
6-25	1KCLOK	A, D	X
6-26	WIRE	A, D	
6/10-27	Not available at this time.		
6/10-28	CMPSRC	A, D	
6/10-29	LISP 1.5 for PDP-6/10	A, D	
6/10-30	COBOL	A, D	
6-31	CARD	A, D	X
6-32	DISDAT	A, D	X
6-33	PLIST	A, D	X
6-34	IBYTE	A, D	X
6-35	CUBIC	A, D	X
6-36	RANDOM	A, D	X
6-37	PACK	A, D	X

DECUS No. 6-23

TSUM, DERIV and CONPOL

Mr. Boundy, C. L. Jarvis, and D. W. G. Moore, The University of Western Australia, Nedlands, Western Australia

Chebyshev polynomial subroutines:

TSUM

This function evaluates -
A(1)/2+A(2)*T(1)+.......A(N+1)*T(N)

DERIV

This subroutine calculates the derivative of the polynomial chebyshev coefficients at a point. i.e. The first derivative of A(1)/2+A(2)*T(1) ....A(N+1)*T(N)=C(1)/2+C(2)*T(1)+........ +C(N)*T(N-1) The C(I)'s overwrite the A(I)'s.

CONPOL

This subroutine converts -
A(1)/2*A(2)*T(1)+.....+A(N+1)*T(N) to C(1)+ c(2)*X+C(3)*X**2+.....+C(N+1)*X**N
(i.e. The equivalent polynomial)

In all cases, maximum order of polynomial is 25.

DECUS No. 6-24

CHISQ

N. S. Stenhouse, The University of Western Australia, Nedlands, Western Australia

This program calculates chi-squared up to order 6 x 12 on users TTY. Yates corrections are applied for 2 x 2 matrix.

Source Language: FORTRAN IV

Subroutines: STAR

DECUS No. 6-25

1KCLOK

R. L. Macmillan, The University of Western Australia, Nedlands, Western Australia

This is a demonstration program in which the date and time are converted from their number form into a clock face on the display. Display routines used are taken directly from DISUBS, (DECUS 6-18).

Note: Power line frequency must be 50CPS.

Source Language: MACRO-6

Equipment Needed: display, 1K core

DECUS No. 6-26

WIRE

Richard J. Plano, Rutgers - The State University, New Brunswick, New Jersey

WIRE is a program designed to help with the tedious and detailed bookkeeping involved in wiring digital circuits. It assumes the circuit is known with all module and pin assignments made. Given this information, it will optimize the wiring connections in the sense of making the wire lengths short, bussing where advantageous, and keeping wiring between rows to a minimum. It assumes 32 modules in a row with 15 possible connections on each (as for Digital Equipment Corporation Flip Chip modules neglecting pins A, B, C, which generally carry power and ground).

It can then produce a variety of output including a list of loops of connected points, a list of busses and grounds, a wiring list which contains the number of connections already on each pin to which a connection is about to be made, and the length of wire needed for the connection. A detailed map can also be printed out showing both ends of each connection as well as busses, grounds, and module names.

An updating or editing facility is also provided so that the map and loops can be kept up-to-date as the circuit is modified or debugged.

The program is written for a PDP-6 computer using the Digital Equipment Corporation multiprogramming system. It requires approximately (6 + N)*1000 decimal words of core, where N is the number of rows of modules. The storage is automatically expanded at run time. I/O equipment required is a user Teletype, one DECtape, and a line printer. Running time for a 20-row circuit, including all print out and optimizing but no editing, is approximately 20 minutes.

DECUS No. 6-27

The program originally announced as 6/10-27 has been temporarily removed from the DECUS Library. Further information will be available at a later date.

DECUS No. 6/10-28

CMPSRC

Joan Lechnor, Applied Logic Corporation, Princeton, New Jersey

This program compares two (MACRO-6 or similar) source files and prints list of differences in readable form. Insertions and deletions are handled. Program is run using DDT.

Storage Requirement: 5K and variable size buffer.

DECUS No. 6/10-29

PDP-6/10 LISP 1.5

T. Eggers, Digital Equipment Corporation, Maynard, Massachusetts

LISP is a general-purpose programming language which utilizes a list-structure storage scheme for both program and data. It is primarily suited for manipulation of symbolic quantities, although it offers complete fixed and floating point arithmetic as well. LISP functions may be recursive.

LISP is used effectively for arithmetic simplification and for symbolic differentiation and integration. It has been used extensively for studies in artificial intelligence, man-machine communication, and solution of game-playing problems.

On PDP-10 systems, the LISP interpreter runs under control of the system Monitor. It includes device-independent input/output capability, and the ability to process character-by-character input. The system also includes a large set of LISP functions as subroutines. All storage made available to LISP will be used for the data structure.

The documentation available is supplementary to the MIT Press LISP 1.5 Manual.

Minimum Hardware: 16K PDP-6/10 with DECtapes.

Source Language: MACRO-10

Storage Requirement: 9K or more

DECUS No. 6/10-30

COBOL

Applied Logic Corporation, Princeton, New Jersey

COBOL (Common Business-Oriented Language) enables a PDP-6/10 user to write a computer program in a language which reads as easily as if it were ordinary English. For example, the calculation of the price of an item after adding a four percent sales tax could be written as:

> Tax-calculation. Multiply net-price by 0.04 giving sales-tax. Add sales-tax to net-price giving total-price.

PDP-6/10 compact COBOL runs under the control of the PDP-6/10 Monitor Systems.

DECUS No. 6-31

CARD

C. B. Horan, University of Western Australia, Nedlands, Western Australia

This FORTRAN IV function returns a false answer

LINC and LINC-8 INDEX

DECUS NO.	TITLE	TAPES AVAILABLE	LISTING
L-1	MSCPNT-Manuscript Compressed Print	D, B	X
L-2	Clock 1 for LINC, Clock 8 for LINC-8	D, B	
L-3	Off-Line LABCOM System	D, B and Manuscript	
L-4	Interval Histogram	D, Sym paper tape	X
L-5	Tape Subroutine	D, Sym paper tape	X
L-6	TRIGGR	D	X
L-7	Modifications to PROGOFOP Version 2	D, B & A paper tapes	X
L-8	DECtape Interface for LINC-8	D, B & A paper tapes	X
L-9	LINC-Calcomp Plot Subroutine Package	D	X
L-10	LINC-8 Multianalyzer	B, S	X
L-11	DATUM8	D	X
L-12	READIT		X

Code

B - Binary
R - RIM
X - Listing Available

A - ASCII Source
L - Linking Loader
D - DECtape

S - Symbolic
H - High Binary Loader

Write-ups are available for all programs.

DECUS No. L-10

LINC-8 Multianalyzer
(Adapted to the LINC-8 from the Pulse Height Analysis Program - J-5260)

Richard M. Merrill, Digital Equipment Corporation, Maynard, Massachusetts

The analysis facilities for high-speed data input and display have been adapted to the LINC-8 computer and several extra features have been added.

The basic program allows display of a complete three-dimensional data matrix as a 2D projection or as a contour display. Vertical or horizontal cross-sections of the data may also be displayed. The third basic mode, the Twinkle Display, shows dynamically the X and Y coordinates of only the current data points.

Additional features: (All numbers indicated below are octal.)

I. Display

A. Histograms (including three-dimensional histograms) may be plotted as an option via sense switch zero.

B. The data matrix is 100 x 53; the Twinkle Display is 100 x 100.

C. For one-dimensional analysis, the X or Y coordinate may be changed via a control knob for selection of the data region. (Max: 53 (Y) sets of 100 (X) values of Z.)

II. Z-Coordinate

A. The Z-coordinate may also be an analog signal instead of a count.

B. X, Y, or Z coordinates may be taken from any of 16 built-in A-D converters. The value of Z for a given X, Y will be the last one taken.

C. If the signal to noise ratio is small, then Z may be taken as a running average over 2^N samples; plus N is read from the left switches.

III. Miscellaneous

A. A built-in variable timer is used and may be calibrated.

B. Qualitative audio indications of ±X and ±Z are available.

C. The LINC-8 Library System and data storage via DECtape may be used.

DECUS No. L-11

DATUM8

Richard W. Young (Submitted by: Walter H. Moran, Jr., M.D., West Virginia University, Morgantown, West Virginia)

DATUM8 is a revision of and an addition to DATAM by James Hance contained in the general library supplied with the LINC-8 computer. This program has retained all the features of DATAM. Some of the original routines have been changed in order to eliminate undesired features. In addition, DATUM8 has the ability to multiply, subtract, and display the data with two cursors. The data not included between the cursors can be suppressed allowing, for instance, integration between definite limits. The program has been recoded to facilitate future modifications.

Minimum Hardware:	LINC (2K) or LINC-8
Source Language:	LAP6
Storage:	$0\text{-}3777_8$

DECUS No. L-12

READIT

Dr. T. D. Williams, University of Bristol, England

READIT is a program for measuring data stored on LINC tape. The program will read the data into store and then display it.

PROGRAM: BINARY LOADER Digital-8-2-U March 23, 1966.

PROBLEM: This version of the BINARY LOADER uses location 7754 to store the constant 300 which it uses as a mask in testing for field settings and leader/trailer on the tape being read in. The Data Break locations for DECtape are 7754 and 7755. Therefore, any program which uses this Data Break destroys the constant which the Binary Loader expects to find there.

SOLUTION: The version of the Binary Loader labeled DEC-08-LBAA has been revised so that location 7754 is not used and therefore using the Data Break does not destroy Binary Loader. The write-up for this version, documents the changes and also includes instructions on using the Binary Loader in Memory Fields other than Field 0 and operational flow charts of same. This is available on request from the library.

PROGRAM: Any User Written 8/S Program

PROBLEM: On a PDP-8 it is possible to micro-program the Group 1 microinstruction RTL (rotate accumulator left two bits) and CMA (complement AC) into the same instruction. This type of combination is not legal on a PDP-8/S since the same logic circuits which complement the accumulator also rotate it. Example: CLL CML CMA RTL which is legal on the PDP-8 is not legal on the PDP-8/S.

SOLUTION: Every occurrence of one of the rotate microinstructions combined with a CMA, must be changed into two separate instructions. The above example would become:

```
CLL CMA
CML RTL
```

It is still possible to complement the link and rotate the accumulator in the same instruction on an 8/S.

II. PROGRAMMING NOTE USING INTERRUPT SELECTIV[illegible]Y

PROBLEM: A situation where the user would like to use the teletype for a short period of time and then use some other device (say high speed reader or DECtape) on the interrupt system, and would like to be able to stop the teletype from causing interrupts without turning off the interrupt.

SOLUTION: A. If characters are being read from the teletype reader, the flag is set to 1 each time there is a character assembled in the teletype buffer (TTI) and ready to be picked up by the computer (under program command). Clearing the flag will allow the teletype hardware to advance the tape and begin assembling the next character into the buffer. If there is no tape in the reader or if the reader is turned off, the flag will not be set, unless a key is struck. Therefore, the solution is to arrange the program so that either the tape is removed from the reader or the reader is turned off, and the keyboard flag is cleared before enabling the Interrupt System (ION).

B. If characters are being typed, after sending the last character to the teletype (TLS) wait for the flag to come up indicating that the teletype is ready for another character, then clear the flag using a TCF and the teletype will not cause interrupts. (A TLS must be issued when the teletype is to be used again for output.)

III. NEW AND REVISED PROGRAMS AND MANUALS

(a) NEW

PROGRAM: PDP-8 EDITOR DEC-08-ESAB

The PDP-8 EDITOR and its manual have been rewritten. There is no longer a separate tape for high speed reading and punching, this is now governed by switches 10 and 11. Among the other new features are the following:

1. It is no longer necessary to retype an entire line because of a mistake; the rubout key will remove one character from the line each time it is struck.

2. The line following the current line may be listed by typing line feed or ALTMODE. The line preceding the current line may be listed by typing the left angle bracket (<).

3. Using switches 0 and 1 it is possible to manipulate the formatting on a tape. A tape which is completely formatted with spaces to simulate tabs may be significantly longer than the same tape with tab characters to produce tabs. Until now there was no way to replace the spaces without retyping the tape. This is now easily done by reading in the tape with switch 0 up (set to 1). A shorter tape takes less time to assemble if the input is via teletype.

4. If the user has given an output command which is in error, he no longer has to wait for it to be completed; the editor now allows him to put switch 2 up (set to 1) and output is suppressed and command returned to the user.

5. Form Feeds and Leader/Trailer are now generated by EDIT-8 on command, the user need never turn the teletype off-line to manually generate some code.

6. EDIT-8 has three new commands. The first is the MOVE command which allows the user to move any line or group of lines from its current location and insert it (them) before any other line in the buffer.

7. The second is the ability to search through the buffer and stop at and list the next line beginning with a tag. This is the GET command.

8. The third and most powerful is the SEARCH command which allows the user to delete or insert characters in any portion of any line without disturbing the remainder of the line.

This Editor and its Manual are available from the Program Library under the code numbers DEC-08-ESAB-PB 8/4/67 for the binary tape and DEC-08-ESAB-D for the Manual.

PROGRAM: ODT DEC-08-COBO

ODT-II has been rewritten. Among the features offered by this new ODT DEC-08-COBO are the following:

1. This version makes leader/trailer on command making it unnecessary to turn the teletype off-line.

2. ODT uses essentially the same command set as DDT-8 but without the ALTMODE.

3. ODT has two new commands which will allow the user to trace through indirect references, etc.; one assumes the word to be an absolute address and opens the register at that address, the other assumes it to be a memory reference instruction and opens the register referenced.

4. The restriction which prevented a breakpoint from being placed on a JMS, if that JMS was followed by an argument rather than an executable instruction, has been removed. Breakpoints may now be placed anywhere except on a floating point instruction or on an argument to a subroutine. If the user places a breakpoint on an instruction referencing an auto-index register, he must remember to increment the auto-index register himself before requesting continuation of his program. The reason for this being that when the user requests a breakpoint, ODT removes the instruction at the breakpoint location and replaces it with an effective JMP to its breakpoint processor. After stopping at a breakpoint the user requests a continuation; ODT simulates execution of the instruction without replacing it by executing it indirectly from a page within ODT. It does not distinguish indirect references to auto-index registers on page zero from any other indirect references. It, therefore, treats them similarly with the result that the contents of the auto-index is not incremented before being used.

5. This version is completely page relocatable to any three pages in core. Standard locations are 1000 and 7000. Relocation is accomplished by requesting the ASCII source from the library and changing the value of the tag START which is the origin.

These binary tapes are available on request from the Program Library as:

ODT (LOW origin 1000) DEC-08-COB1-PB; ODT (HIGH origin 7000) DEC-08-COB2-PB;

ODT (SOURCE) DEC-08-COBO-PA;

ODT (WRITE UP) DEC-08-COBO-L(D).

PROGRAM: PDP-8 DISC SYSTEM BUILDER DEC-08-SBAB

This is a fast convenient keyboard oriented monitor which will enable the user to efficiently control the flow of programs between his disc and his PDP-8. The system is modular and open ended allowing the user to build the software components he requires.

PROGRAM: OVERLAY for 8/S to DISC BUILDER

Due to timing considerations on a PDP-8/S, DISC I/O must be handled in a slightly different manner than is possible on a PDP-8. There is an overlay tape which converts the DISC SYSTEM BUILDER (DEC-08-SBAB) to handle I/O on a PDP-8/S. This is DEC-08-NBAA and is available on request from the library.

PROGRAM: PROGRAMMED BUFFERED DISPLAY 338

There is now an ASCII tape which contains all the IOT DEFINITIONS necessary to assemble 338 display programming with PAL III. It reads into PAL III before the user program on pass 1 only, and is available on request from the Program Library as DEC-08-AEAA-PA. There is a short writeup which accompanies it as DEC-08-AEAA-D(L).

(b) REVISED

PROGRAM: PDP-8 FORTRAN

The FORTRAN COMPILER has been revised. Among the revisions are the following features:

1. The compiler will accept input from either the teletype or the high-speed reader as indicated by the position of switch 1.

2. The compiler will output the interpretive code tape to either the teletype or high-speed punch as indicated by the position of switch 2 with error diagnostics being sent to the teletype in either case.

3. There are no longer two starting addresses, one of which indicates DECtape I/O statements. If the program contains DECtape I/O statements (READ, WRITE) switch 0 should be set to 1; if not, leave it set to 0. Error diagnostic 24 indicates incorrect setting of switch 0.

The FORTRAN OPERATING SYSTEM has also been revised. The way in which it handles DECtape I/O is completely rewritten and allows much more efficient use of the DECtape as a storage device. The same procedure is used for both the TC01/TU55 and 552/555. The TC01 is considered standard with an overlay available on request for the 552.

The FORTRAN PROGRAMMING MANUAL has been revised to include instructions on DECtape I/O programming and a description of the switch options to the compiler.

These are all available on request from the Program Library. The binary tape of the COMPILER is DEC-08-AFC1-PB. The binary tape of the OP SYS with TC01 DECtape I/O is DEC-08-AFC3-PB. The binary tape of the overlay to convert the OP SYS to 552 DECtape I/O is DEC-08-AFC5-PB. The FORTRAN MANUAL is DEC-08-AFAC-D.

Change	DEC-08-FUA0 (previously 8-31-U)	TC01 DECtape Subroutines	6/20/67
Change	DEC-08-FMG3-PA (previously 8-18-F)	Double Precision Cosine Subroutine	8/26/67

NEW AND REVISED MAINDECS

New	MAINDEC-08-D71A-PB	680 DCS Expanded Static Test	5/15/67
New	MAINDEC-08-D72A-PB	680 DCS Data and Control Test	3/5/67
New	MAINDEC-08-D5CA	DF32 Mini Disc Data Test	3/7/67
New	MAINDEC-08-D5BA	Mini Disc Discless Logic Test	3/6/67
New	MAINDEC-8S-D23A	High-Speed Reader Test for 8/S	5/19/67
New	MAINDEC-08-D26A	PDP-8 Type 645A Line Printer Test	4/5/67
New	MAINDEC-8S-D8AA	KW08 Check	11/22/66
New	MAINDEC-08-D3EA-PB(L)	TC01 Extended Memory Exerciser	8/15/67
New	MAINDEC-08-D2NA	CR01C Card Reader Test (replaces MAINDEC-08-D201)	9/1/67
New	MAINDEC-08-D6GA	A/D Calibration Check (replaces MAINDEC-845 which was internal distribution only.) D6GA is available to customers on request.	7/7/67
New	MAINDEC-08-D601	338 Instruction Test	10/10/67
New	MAINDEC-08-D6IA	VF38 Search Mode Test	9/30/67
New	MAINDEC-08-D8IA	DB08A Test	9/15/67
New	MAINDEC-08-D11A	4K Memory Address Check	6/8/67
New	MAINDEC-08-D0RA	Automatic Recovery Option Check	10/16/67
Change	MAINDEC-08-D6CB	Calcomp Plotter Test	6/1/67
Change	MAINDEC-08-D02A (previously MAINDEC 801-2B)	Instruction Test Part B	3/13/67

B. PDP-7/9

I. PROGRAMMING PROBLEMS

BASIC FLOATING POINT PACKAGE

PROBLEM: The directions for assembling the system are misleading.

SOLUTION: PDP-9 Basic Software Manual (DEC-9B-GSAA-D), Mathematical Subroutines, page 3-28, Section 6.3.1.1, step d., second sentence should read: Repeat step d for tapes 2 through 5 and either tape 6 (Normal Arithmetic) or 7 (EAE) and 8 (600 Library) or 9 (900 Library), whichever is desired. (A total of 7 tapes, including the user title tape, should be assembled together.)

Same page, step g, should read:

Put PUNDEF Request Tape (tape 10) in reader, depress START.

BASIC FORTRAN II

PROBLEM: In the evaluation of LOG_e A, the FORTRAN II System returns a meaningless result if argument A is negative or zero.

SOLUTION: To avoid the situation, use an IF statement before the evaluation of the function, as follows:

```
10      READ 1, 20, B
        IF (B) 30, 40, 50
50      P = LOGF(B)
        .
        :
30      ERROR MESSAGE
        GO TO 10
40      ERROR MESSAGE
        GO TO 10
```

DECSYS

PROBLEM: DECtape search routines did not work correctly.

SOLUTION: MOD 3 is now available from the program library. The DECtape search routines have been updated and the keyboard routine has been modified to echo a line feed when it receives a carriage return and to output five spaces when it receives a tab.

MACRO-9

PROBLEM: When defining MACROs in MACRO-9, expansions involving arguments separated by, ␣ are not handled correctly.

SOLUTION: Leave no spaces between arguments in the list. Example:

SERVE A,␣B,␣C will give an incorrect expansion.
SERVE A,B,C will expand properly.

This problem will be remedied in subsequent versions of MACRO-9.

II. PROGRAMMING NOTES

Please note that the following mnemonics have not been included in MACRO-9's permanent symbol.

CLOCK

CLSF	700001	CLOF	700004	CLON	700044

TAPE READER

RSF	700101	RCF	700102	RSA	700104
RRB	700112	RSB	700144		

TAPE PUNCH

PSF	700201	PCF	700202	PSA	700204
PLS	700206	PSB	700244		

KEYBOARD

KSF	700301	KRB	700312

TELEPRINTER

TSF	700401	TCF	700402	TLS	700406
TTS	703301				

DISPLAY 30D

DXC	700502	DXL	700506	DXS	700546
DYC	700602	DYL	700606	DYS	700646
DLB	700706				

DISPLAY 340

IDVE	700501	IDRS	700504	IDRA	700512
IDSI	700601	IDLA	700606	IDRD	700614
IDSP	700701	IDCF	700704	IDRC	700712
IDHE	701001				

LIGHT PEN 370

DSF	700701	DCF	700702

SYMBOL GENERATOR 33

GCL	700641	GSF	701001	GPL	701002
GLF	701004	GPR	701042	GSP	701044

MULTIPLEXER 139

ADSM	701103	ADIM	701201

A TO D CONVERTER 138

ADSF	701301	ADSC	701304	ADRB	701312

SERIAL DRUM RM09

DRLR	706006	DRLW	706046	DRSF	706101
DRCF	706102	DRSS	706106	DRSN	706201
DRCS	706204				

LINE PRINTER

LSDF	706501	LPCB	706502	LPL2	706526
LPLD	706546	LPL1	706566	LSEF	706601
LPCF	706602	LPPB	706606	LPLS	706626
LPPS	706646				

CARD READER CR01E

RCSF	706701	RCSE	706704	RCRA	706712
RCSD	706721	RCLD	706724	RCSR	706741
RCRB	706752				

MAGNETIC TAPE TC59

MTSF	707301	MTVC	707302	MTGO	707304
MTRC	707312	MTCR	707321	MTAF	707322
MTCC	707324	MTLC	707326	MTTR	707341
MTVS	707342	MTRS	707352		

DECTAPE TC02

DTCA	707541	DTXA	707544	DTLA	707545
DTRA	707552	DTEF	707561	DTRB	707572
DTDF	707601				

MEMORY PROTECT KX09A

MPSK	701701	MPLU	701702	MPLD	701704
MPEU	701742				

MACRO-9

Field Delimiters: Because MACRO-9 is a field dependent assembler, an instruction cannot be the first item in a line. If no label is given, a field delimiter (space or tab) must be given to step the assembler across the label field. The combination of a space and a tab constitutes two field delimiters and therefore gives erroneous results.

Example:

↓LAC A
↓⟶|␣LAC A } illegal

↓⟶|LAC A
↓␣LAC A } proper

↓ = line feed
⟶| = tab
␣ = space
↲ = carriage return

Since spaces are used as field delimiters, they may not be used in lieu of plus signs, as JMP .␣1 for JMP .+1. Where addition is meant, it must be expressed.

To allow the coding of two or more entries on one line, the semicolon (;) has the same effect as a carriage return. RTL ; RTL is the same as

```
RTL↵
RTL
```

.ABS: The normal paper tape output from MACRO-9 is link-load binary, either absolute or relocatable. If desired, the pseudo-op .ABS may be used to generate absolute non-monitor system output. This is normally preceded by a loader which may be entered by hardware read-in, thus making the paper tape binary self-loading. The option NLD in the address field suppresses the output of this loader.

.FULL: The .FULL pseudo-op causes MACRO-9 to produce a binary paper tape in HRM mode. No loader is necessary; every word of the program is hardware loaded. There must be a word on the paper tape for every machine word included within the limits of the program. The following rules govern the organization of the program:

1. .LOC must appear only at the beginning.
2. .BLOCK should not be used.
3. If literals are used, variables and undefined symbols may not be present.
4. If variables or undefined symbols are present, literals must not be used.

Radix 50: The symbol table put out by the assembler for the linking loader and DDT purposes uses radix fifty notation. Each character is weighted with a value 0-47 (octal) and the total value for the symbol is determined by the formula:

1st word	$3100_8\, C_1 + 50_8\, C_2 + C_3$
2nd word	$3100_8\, C_4 + 50_8\, C_5 + C_6$

where C_1 = the first character, C_2 = the second character, etc.

Bit 0 of the first word is set to one to indicate the presence of a second word. If the symbol contains 3 characters or less, only one word will be used to store the symbol. The weights for the characters are:

space	0
A-Z	$1\text{-}32_8$
%	33_8
.	34_8
0-9	$35_8\text{-}46_8$
# or $	47_8

(# for MACRO-9 and $ for DDT)

Globals: Global symbols provide a convenient method of linking individually assembled routines. Any symbol in a program may be made a global by entering it in a .GLOBL statement. Reference to this symbol in a different program segment must be made indirectly. Note that the symbol must appear in a .GLOBL statement in each program segment in which it is used.

7-to-9 Converter (CONV):

Compatibility of MACRO-9 and PDP-7/9 Basic Symbolic Language.

Any source program written for the PDP-7/9 Basic Symbolic Assembler may be converted to the source language and statement format of the PDP-9 Advanced Software System Assembler, MACRO-9, by the 7-to-9 CONVERTER (CONV) program. A list of PDP-7 psuedo ops which cannot be converted can be found in the Converter Manual.

There are also a number of mnemonic codes, primarily I/O, which are not recognized by MACRO-9. They are not part of the Permanent Symbol Table because all I/O is done by the system and user's IOTs would be an exception.

After conversion, there are two convenient methods for compensating for the user IOTs.

1. Define the unlisted codes in a parameter assignment.

Example: The sequence

```
READ        KSF
            JMP .-1
            KRB
```

requires the following parameter assignments.

```
            KSF = 700301
            KRB = 700312
```

The parameter assignment can be achieved by using the "P" option in the MACRO-9 command string, where "P" indicates secondary input.

Secondary input must consist of direct assignments only, and a paper tape must terminate with →.EOT↵. If the secondary input is assigned to the Teletype, I/O Monitor Standard, the user must type an additional ↵ (for double buffering purposes) or may terminate with ↑D (Control D). The parameter tape will be inputted in Pass 1 only. After receiving an .EOT on the tape or ↑D from the keyboard, MACRO-9 outputs to the teletype:

```
EOT
↑P
```

The user types ↑P (Control P) to continue.

2. Rewrite the code in corresponding MACRO-9 language. Example:

```
.READ   a,m,l,w   where a = Data Slot
                        m = Data Mode
                        l = Line Buffer Address
                        w = Word Count
```

1's and 2's Complement: In the PDP-9 Advanced Software System, 2's complement arithmetic is assumed and all negative numbers are assembled accordingly. This marks a difference from the PDP-7 software, which assumed 1's complement.

When PDP-7 programs are converted by means of the 7-to-9 Converter, negative numbers are prefixed with a -1 to account for the change.

Internal ASCII Format: The PDP-9 Advanced Software System used 7-bit ASCII with parity in the 8th bit, whereas the PDP-7/9 Basic Software System uses 8-bit ASCII with no parity. It is, therefore, highly recommended that after a program is converted through the 7-to-9 Converter, ASCII literals should be changed to 7-bit to insure correct operation of the converted program.

Example:

PDP-7/9 Basic Software System:

SAD (215 /TEST FOR CARRIAGE RETURN

In the PDP-9 Advanced Software System, one should write:

SAD (015 /TEST FOR CARRIAGE RETURN

For output, the above has NO effect.

Core Fitting: When using the Linking Loader and DDT, problem of fitting programs into core sometimes arises. The following procedures will aid in alleviating the problem.

Device Handlers: Use the smallest handler that will do the job. For example, if DTB will handle your needs, do not use DTA.

Avoid excess handlers for the Loader. For example, if using DTB, and loading from DECtape, assign DTB to the Loader and system DAT slots (-4, -1), thus saving the space which would be taken by DTC (the standard handler used by the Loader). Please see the Monitor Manual, Section 4.6 for a summary of standard I/O handler features.

Memory Bank Boundaries:

In 16K systems (or larger), problems sometimes arise because no single program segment can be loaded across a bank boundary. The following loading sequence can help to make the best use of the Linking Loader's ability to fit programs into available space.

Main program	(must be first to insure
Largest subprogram	proper starting)
⋮	
Smallest subprogram	

Example - To load a program with 3 large subroutines, none of which call any library subroutines, into a 16K machine. The main program loads starting at 11K. The subroutines are:

SUB1	2K
SUB2	3K
SUB3	2.5K

Figure 1 shows the result of loading in numeric sequence.

Figure 2 shows all routines located, using the loading sequence described above.

If any library routines had been called, they would have been loaded in free core in any bank, starting with the highest bank.

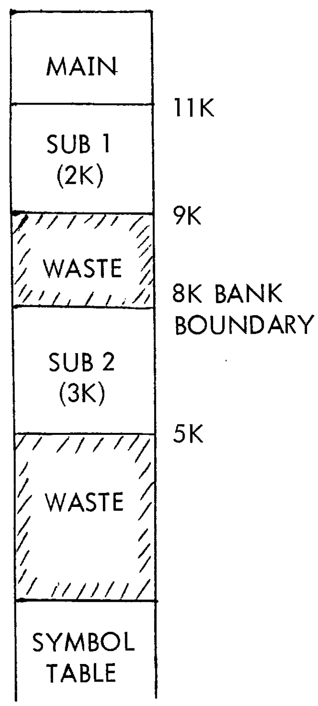


Figure 1

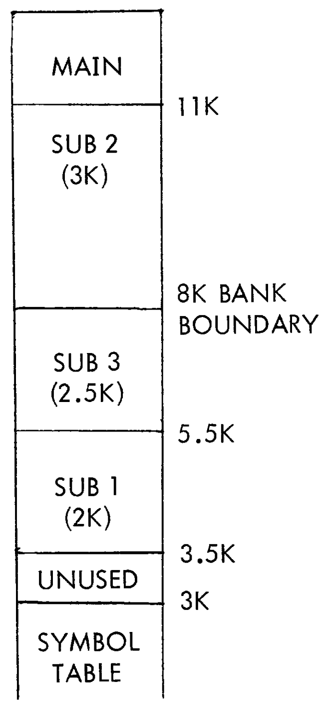


Figure 2

Symbol Table: There are basically two types of symbols: those needed by the Linking Loader and those needed by DDT. Linking Loader symbols include program names and globals, while DDT symbols include program names and user defined labels within the program segments.

When DDT receives control from the monitor, the symbol table built by the Linking Loader is transferred to DDT and contains both types of symbols. DDT condenses the table, removing those entries needed only by the Loader, to gain patch and table space. When loading programs, this entire symbol table must be considered.

A sizable amount of core can be saved by using DDTNS which suppresses loading of the user symbol table. The DDT permanent symbol table is maintained. After loading, the user may define a few key symbols to help him find his way around. These symbols overlay DDT's initialization, thus not requiring additional core space.

DDT with FORTRAN IV: To use DDT effectively with FORTRAN IV programs, the user must have an object listing showing the MACRO-9 type instructions generated by the FORTRAN IV Compiler. An understanding of the FORTRAN IV compiler's method of representing floating point numbers is also helpful.

When working with FORTRAN programs, which make great use of separate subroutines linked by globals, it is important to keep in mind the fashion that globals are entered in DDT's symbol table. (Simply stated, globals are symbols which provide linkage among separately compiled routines.) When DDT first takes control, it is primarily concerned with the main program. Any symbol defined within the segment currently under investigation may be referred to directly. Global symbols defined in a different segment (identified by indirect addressing), must be referred to indirectly. Requesting the contents of such a location by typing the symbol will cause the address of the requested register to be displayed. This address is referred to as a transfer vector which points to the requested register. The X (Control X) feature simplifies the operation by opening the register designated by the transfer vector.

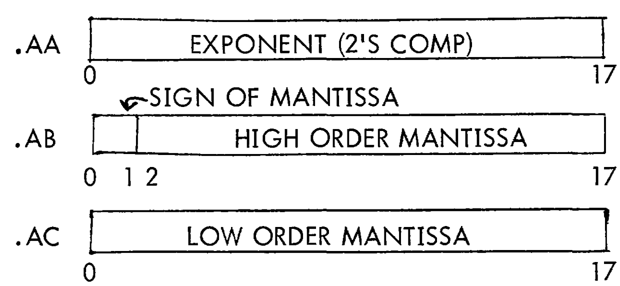
FORTRAN IV and MACRO-9

Linking MACRO-9 Programs with FORTRAN IV Library

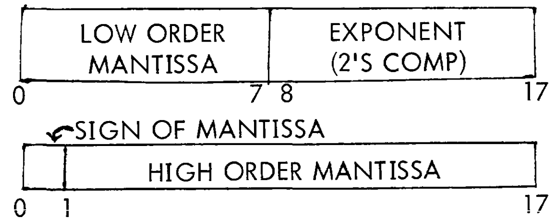
Routines: Calling sequences for each of the FORTRAN IV Library routines, which are in the MACRO-9 language, are given in the PDP-9 Scientific Library write-up. It is necessary to declare, in the MACRO-9 program, the name of the Library routine in a .GLOBL statement. The number and type (real, integer, double precision) of the arguments must agree from the calling program to the FORTRAN IV routine. The result is generally returned in the A-register (integer) or the floating accumulator (real and double precision). They must be stored on return to the calling program. This is most easily done with FORTRAN IV library routines: .AH to store real values and .AP for double precision. If used, these must be declared in a .GLOBL statement.

The A-register is the standard hardware accumulator. A DAC instruction serves to store values returned in this register.

The floating accumulator is a software accumulator in the REAL ARITHMETIC package. It consists of three words, the first labeled .AA, the second .AB and the third .AC. It has the following format:



Double precision numbers standardly use this format. Although they are processed in the floating accumulator format, single precision values have the following format:



In order to ensure this format in the calling program, use .AH to store single precision numbers.

The following example shows a section of a MACRO-9 program which uses the FORTRAN IV SIN Library function.

```
      .TITLE
      .GLOBL SIN, .AH
        .
        .
        .
      JMS*    SIN
      JMP     .+2     /JUMP AROUND ARGUMENT
      .DSA    A       /+400000 IF INDIRECT
      JMS*    .AH     /F4 STORE REAL
      .DSA    X
        .
        .
        .
X     .DSA    0
      .DSA    0
```

The names of the FORTRAN IV Library routines are listed as globals. When the MACRO-9 program is loaded, the Linking Loader will attempt to resolve these globals by searching the Library file. In this case, SIN and REAL ARITHMETIC will be loaded. The references to these routines in the MACRO-9 program must be indirect, as only the transfer vectors are given in the main program.

The actual calling sequence must be structured in this manner to ensure proper functioning of the FORTRAN IV routine.

Linking MACRO-9 Programs with FORTRAN IV Language Sub-programs: There are two forms of FORTRAN IV subprograms: subroutines and external functions. The main difference between the two is the method of returning arguments to the calling program. Subroutines return the argument directly to the calling program, while functions return arguments through the accumulators.

The form of a FORTRAN IV subroutine is given in the FORTRAN IV Manual (DEC-9A-AF40-D). The MACRO-9 program set-up is basically that described in the write-up on linkage with FORTRAN IV Library routines. The name of the subroutine to be called must be declared as a global, there must be a jump around the argument addresses, and the number and type (integer, real, double precision) of arguments must agree from the calling program to the subroutine.

An example of a calling routine:

```
.TITLE
.GLOBL   SUBROT
JMS*     SUBROT
JMP      .+N+1
.DSA     ADDR OF ARG1         /+400000 if indirect
.DSA     ADDR OF ARG2         /+400000 if indirect
  .
  .
.DSA     ADDR OF ARGN         /+400000 if indirect
  .
  .
```

When the FORTRAN IV subroutine is compiled, the compiler will generate code for .DA, the General Get Arguments from the MACRO-9 calling program to the FORTRAN IV subroutine. .DA expects to find the calling sequence just described for the calling program (see the FORTRAN Scientific Library write-up). The following is an example of an expansion of the beginning of a FORTRAN IV subroutine.

```
        C     TITLE SUBROT
              SUBROUTINE SUBROT (A,B)
  000000            CAL         0
  000001            JMS*        .DA
  000002            JMP         $000002
  000003            .DSA        A
  000004            .DSA        B
  $000002=000005
```

The simplest method of passing arguments between the main program and the subroutine is to use one of the calling arguments as output. For example, if the value of D is to be calculated in the subroutine, use D as one of the calling arguments. "D=" will generate a "DAC* D", which will put the value calculated for D in the subroutine in D in the calling program.

The form of a FORTRAN IV External Function is given in the FORTRAN IV Manual (DEC-9A-AF40-D). The MACRO-9 program set-up is identical to that for linkage with subroutines, except that some provision must be made for storage of the values upon return from the function. Functions return the value calculated in the accumulator. In the case of integers, the value is returned in the A-register, and in the floating accumulator for real and double precision numbers. The simplest method of storing the values is to use the FORTRAN IV routines furnished in the library for this purpose. .AH stores real values, and .AP stores double precision values. Since the A-register is the standard hardware accumulator, a DAC instruction will store integer values.

Linking FORTRAN IV Programs with MACRO-9 Subprograms: There are two essential elements of a Macro subprogram that is linked to FORTRAN IV. One is the declaration of the name of the subprogram (as used in the F4 program) in a .GLOBL statement within the subprogram. The second is leaving open registers in the subprogram for the transfer vectors of the arguments used in the F4 calling sequence. The number of open registers must agree with the number of arguments given in the calling sequence.

As an illustrative example, consider a F4 program and a MACRO-9 subprogram which read, negate and write a number. One positive single precision floating point (2 word) number is read by the F4 program, negated in the MACRO-9 subprogram, and written out from the F4 program.

FORTRAN IV PROGRAM:

```
C           TEST MACRO SUBPROGRAM
C           READ A NUMBER (A)
1           READ (1,100) A
100         FORMAT (E12.4)
C           NEGATE THE NUMBER AND PUT IT IN B
            CALL MIN (A,B)
C           WRITE OUT THE NUMBER (B)
            WRITE (2,100) B
            STOP
            END
```

MACRO-9 SUBPROGRAM

```
              .TITLE MIN
              .GLOBL MIN,.DA
MIN           0                  /ENTRY/EXIT
              JMS*    .DA        /USE THE F4 GENERAL GET ARGUMENT
                                 /SUBPROGRAM TO LOAD THE ARGUMENTS
              JMP     .+3        /JUMP AROUND REGISTERS LEFT FOR
                                 /ARGUMENT ADDRESSES
MIN1          .DSA    0          /ARG 1
MIN2          .DSA    0          /ARG 2
              LAC*    MIN1       /PICK UP FIRST WORD OF A
              DAC*    MIN2       /STORE IN FIRST WORD OF B
              ISZ     MIN1       /BUMP THE POINTER TO SECOND WORD
              ISZ     MIN2       /OF A AND B
              LAC*    MIN1       /PICK UP SECOND WORD OF A
              TAD     (400000    /SIGN BIT = 1
              DAC*    MIN2       /STORE IN SECOND WORD OF B
              JMP*    MIN        /EXIT
              .END
```

Since A is a single precision floating point number, machine words are required and must be accounted for in the subprogram. Thus MIN1 and MIN2 (which contain the addresses of A and B) must be incremented to get to the second word of each number. F4 expands the CALL statement as follows:

```
         CALL MIN (A,B)
00013       JMS*        MIN
00014       JMP         $00014
00015       .DSA        A
00016       .DSA        B
$00014=00017
```

When the program is loaded, the address (plus relocation factor) of A is put in location 00015 (plus relocation factor) and the address of B in 00016 (plus relocation factor). When .DA if called out of the MACRO-9 subprogram, it puts these addresses in MIN1 and MIN2 (plus relocation factor). MIN1 must be referenced indirectly to get the value of A (a direct reference would get the address of A).

.DA is the general get argument subroutine of the FORTRAN IV library. A detailed write-up of it can be found in the PDP-9 Scientific Library write-ups.

I/O Monitor

.DAT SLOT ASSIGNMENTS

Assignments for the entire system are given in the Monitor Manual, page 2-17. The following is a breakdown by program.

PIP-9

.DAT	DEVICE	USE
-3	TTA	CONTROL AND ERROR MESSAGES
-2	TTA	COMMAND STRING
1	TTA	INPUT/OUTPUT - SYSTEM DEVICE
2	TTA	INPUT/OUTPUT
3	PRA	INPUT/OUTPUT
4	TTA	INPUT/OUTPUT
5	PRA	INPUT/OUTPUT
6	PRA	INPUT/OUTPUT
7	PPA	INPUT/OUTPUT
10	PRA	INPUT/OUTPUT

EDIT-9

.DAT	DEVICE	USE
-15	PPA	OUTPUT
-14	PRA	INPUT
-10	PRA	SECONDARY INPUT
-3	TTA	TELEPRINTER OUTPUT AND ERRORS
-2	TTA	COMMAND STRING

CONV-9

.DAT	DEVICE	USE
-15	PPA	OUTPUT
-14	PRA	INPUT
-12	TTA	SECONDARY INPUT
-3	TTA	TELEPRINTER OUTPUT AND ERRORS
-2	TTA	COMMAND STRING

LOAD and GLOAD

.DAT	DEVICE	USE
-5	NONE	USER LIBRARY
-4	PRA	USER PROGRAM(S)
-3	TTA	CONTROL AND ERROR MESSAGES
-2	TTA	COMMAND STRING
-1	PRA	SYSTEM LIBRARY

MACRO-9

.DAT	DEVICE	USE
-13	PPB	OUTPUT
-12	TTA	LISTING
-11	PRB	INPUT
-10	TTA	SECONDARY INPUT
-3	TTA	COMMAND AND ERROR MESSAGES
-2	TTA	COMMAND STRING

DDT with PATCH FILE

.DAT	DEVICE	USE
-10	PRA	PATCH INPUT
-6	PPA	PATCH OUTPUT
-5	NONE	USER LIBRARY
-4	PRA	USER PROGRAM(S)
-3	TTA	TELEPRINTER OUTPUT AND ERRORS
-2	TTA	COMMAND STRING
-1	PRA	SYSTEM LIBRARY AND DDT

DDT without PATCH FILE

.DAT	DEVICE	USE
-10	NONE	PATCH INPUT
-6	NONE	PATCH OUTPUT
-5	NONE	USER LIBRARY
-4	PRA	USER PROGRAM(S)
-3	TTA	TELEPRINTER OUTPUT AND ERRORS
-2	TTA	COMMAND STRING
-1	PRA	SYSTEM LIBRARY AND DDT

FORTRAN IV

.DAT	DEVICE	USE
-13	PPC	OUTPUT
-12	TTA	LISTING
-11	PRB	INPUT
-3	TTA	COMMAND AND ERROR MESSAGES
-2	TTA	COMMAND STRING

See the Monitor Manual, Section 4.6, for a summary of each of the handlers.

FILE ORGANIZATION ON DECTAPE:

Non-File Oriented DECtape

The term "file oriented" and "non-file oriented" seem to evoke considerable confusion. A DECtape is said to be "non-file oriented" when it is treated as Magnetic Tape by issuing the MTAPE commands: REWIND, BACKSPACE followed by READ or WRITE. No directory or identifying information of any kind is recorded on the tape. A block of data (255_{10} word max.) exactly as presented by the user program is transferred into the handler buffer and recorded at each WRITE command where the final (256th) word is the "data link" to the next DECtape block of data. A CLOSE terminates recording with a simulated End-of-File consisting of two words: 1005, 76773. The data link of the EOF DECtape block is 777777. Note that the simulated End-of-File is identical whether executing a CLOSE in a "file oriented" or "non-file oriented" environment. (See Figure 2-2 in the PDP-9 Monitor Manual.)

Because braking on DECtape is such as to allow for tape roll, staggered recording of blocks is employed in the PDP-9 Advanced Software System to avoid the constant turnaround or time consuming back and forth motion of sequential block recording. When recorded as a "non-file oriented" DECtape, block 0 is the first recorded in the forward direction. Thereafter, every *4th block is recorded until the end of the tape is reached at which time recording, also staggered, begins in the reverse direction. Four passes over the tape are required to record 576_{10} blocks (0-1077_8).

File Oriented DECtape

Just as a REWIND or BACKSPACE command declares a DECtape to be "non-file oriented", a SEEK OR ENTER implies that a DECtape is to be considered as "file oriented." The term "file oriented" means simply that a directory exists on the DECtape to identify as to name and location the files which are recorded on this DECtape. A directory listing of any DECtape so recorded is available via the (L)ist command in PIP-9 or the (D)irect command in KM-9. A fresh directory may be recorded via the (N)ewdir in KM-9 or Z switch in PIP.

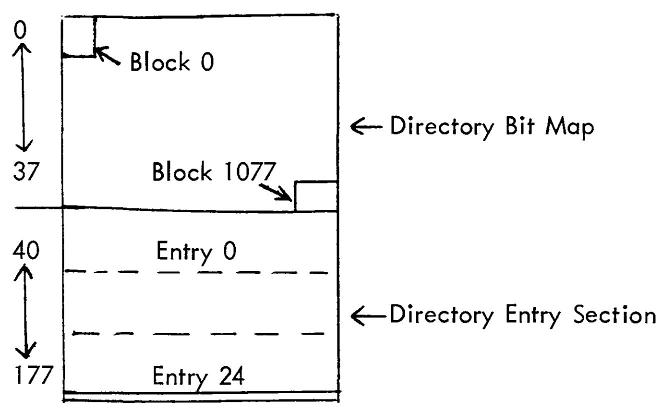
The directory occupies the first 200_8 locations of DECtape block 100_8. It is divided into two sections: (1) a 40_8 word Directory Bit Map; and (2) a 140_8 word Directory Entry Section.

*Early versions of the PDP-9 Advanced Software System stagger recording on every 5th block.

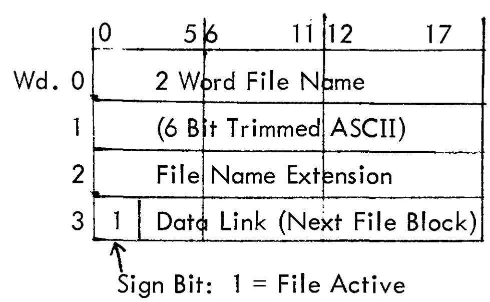
The Directory Bit Map defines block availability. One bit is allocated for each DECtape block (576_{10} bits = 32_{10} words). When set to 1, the bit indicates that the DECtape block is occupied and may not be used to record new information.

The Directory Entry Section provides for a maximum of 24_{10} files on a DECtape. A four word entry exists for each file on DECtape where each entry includes the 6 bit trimmed ASCII file name (6 characters max.) and file name extension (3 characters max.), a pointer to the first DECtape block of the file and a file active or present bit.

DECTAPE DIRECTORY



A DIRECTORY ENTRY



Note: Nulls (0) fill in short file names. A file name extension is not required.

The second 200_8 words of DECtape block 100_8 contain basic Directory information (blocks occupied by system programs) used by KM-9, PIP-9 and SGEN-9.

Additional file information is stored in blocks 71, 72 and 73 of every "file oriented" DECtape. These are the File Bit Map Blocks. For each file in the Directory a 40_8 word File Bit Map is reserved in block 71, 72 or 73 as a function of file name position in the Directory Entry Section of block 100. Each block (71, 72, 73) is divided into 8 File Bit Map Blocks. A File Bit Map specifies the blocks occupies by that particular file and provides a rapid convenient method to perform DECtape storage retrieval for deleted or replaced files. Note that a file is never deleted until the new one of the same name is completely recorded, i.e., on the CLOSE of the new file.

FILE BIT MAP BLOCKS

Block 71	File Bit Map for File 0
Block 72	File 8_{10}
Block 73	File 16_{10}
	File 23_{10}

When a fresh Directory is written on DECtape, blocks 100, 71, 72 and 73 are always indicated as occupied in the Directory Bit Map.

Staggered recording (at least every 4th block) is used on "file oriented" DECtapes where the first block to be recorded is determined by examination of the Directory Bit Map for a free block. The first block is always recorded in the forward direction. Thereafter, free blocks are chosen which are at least four beyond the last one recorded. When turnaround is necessary, recording proceeds in the same manner in the opposite direction. When reading, turnaround is determined by examining the data link. If reading has thus far been in the forward direction and the data link is smaller than the last block read, turnaround is required. If reverse, a block number greater than the last block read implies turnaround.

A simulated End-of-File terminates every file and consists of a two word header (1005, 776773) as the last line recorded. The data link of this find block is 777777.

Data Organization

Sections 2.1.1 and 2.1.2 of the PDP-9 Monitor Manual discusses IOPS data modes. Data organization for each I/O medium is a function of these data modes. On "file oriented" DECtape there are two forms in which data is recorded: (1) packed lines - IOPS ASCII, IOPS binary, Image ASCII and Image Binary; (2) dump mode data - Dump Mode.

In IOPS or image modes, each line (including header) is packed into the DECtape buffer. A 2's complement checksum is computed and stored for each line of information. When a line is encountered which will exceed the remaining buffer capacity the buffer is output after which the new line is placed in the empty buffer. No line may exceed 254_{10} words including header because of the data link and every word requirement of the header word pair count. An End-of-File is recorded on a CLOSE. It is packed in the same manner as any other line; i.e., if the buffer will contain it, fine. Otherwise, it gives into the next free block chosen.

In Dump Mode, the word count is always taken from the I/O Macro. If a word count is specified which is greater then 255_{10} (note that again space for the data link must be allowed for), the DECtape handler will transfer 255_{10} word increment into the DECtape buffer and from there to DECtape. If some number of words less than 255_{10} remain as the final element of the Dump Mode WRITE, they will be stored in the DECtape buffer which will then be filled on the next WRITE or with an EOF if the next command is CLOSE. DECtape storage use is thus optimized in DUMP Mode since data is stored back to back without headers.

III. REVISIONS AND ADDITIONS TO PROGRAM LIBRARY

PDP-7

DEC-07-SDAA	DECSYS-7 MOD 3
DEC-9B-ESAB	EDITOR (with addendum)
MAINDEC-07-DOBA	Add-Rotate Test

PDP-9

Additions:

DEC-9U-SA1-UC	DECtape advanced System
DEC-9T-CDA1-PH	DDT-9 without patch file
DEC-9T-CDF1-PH	DDT-9 with patch file
DEC-9T-PPA1-PH	PIP-9
DEC-9T-PCA1-PH	7-to-9 Converter
DEC-9T-AMA1-PH	MACRO-9 ASSEMBLER
DEC-9T-LLA1-PH	LINK LOADER
DEC-9T-ALAA-PR	I/O LIBRARY
DEC-9T-ALBA-PR	LIBRARY TAPE 2 of 3
DEC-9T-ALCA-PR	LIBRARY TAPE 3 of 3
DEC-9T-AFA1-PH	FORTRAN IV COMPILER
DEC-9T- EEA1 -PH	EDIT-9
DEC-9T-QFAA-PA	INTRIN (F4 Test)
DEC-9T-QMAA-PA	CANRUN9 (MACRO-9 Test)
DEC-9T-QCAA-PA	CANRUN7 (CONV Test)
DEC-9A-USA0	MULTIANALYZER Manual, Listings, Test
MAINDEC-9A-JMS-Y	INTERRUPT TEST
MAINDEC-9A-DDBA	ISZ TEST
MAINDEC-9A-DOIA	API TEST
MAINDEC-9A-DZBA	TTY TEST
MAINDEC-9A-EUFA	DECtape FORMAT GENERATOR
MAINDEC-9A-D6AA	34H, 30D, 370 DISPLAY (Preliminary)
MAINDEC-9A-D7IA-PB	DB98 TEST 8 SIDE
MAINDEC-9A-D7IB-PH	DB98 TEST 9 SIDE
MAINDEC-9A-D8AA-PB	DB97A DIAGNOSTIC
MAINDEC-9A-D8BA-PH	RELAY BUFFER TEST
MAINDEC-9A-D8IA-PB	DB098 TEST
MAINDEC-9A-DZEA	CR0Z BURROUGHS CARD READER TEST
MAINDEC-9A-D4AA	TC59 CONTROL (Preliminary)
MAINDEC-9A-D4BA	TC59 UTILITY (Preliminary)
MAINDEC-9A-D6CA	CALCOMP PLOTTER
MAINDEC-9A-D7AA	BASIC EXERCISER
MAINDEC-9A-D2FA	CR01E NCR CARD READER

MAINDEC-9A-DZLA-PB	647E LINE PRINTER TESTER
MAINDEC-9A-D5BA-PH	RM09 DRUM TEST and MAINTENANCE COMPILER
MAINDEC-9A-D5CA-PH	RM09 DATA PACKING DRUM TEST and MAINTENANCE COMPILER

Revisions:

DEC-9B-ABEA	EXTENDED ASSEMBLER
DEC-9B-CDEA	EXTENDED DDT
DEC-9B-ESAB	EDITOR (with addendum)
MAINDEC-9A-DZDB	PUNCH TEST
MAINDEC-9A-DOCA	MEMORY ADDRESS TEST
MAINDEC-9A-DODB	JMP SELF TEST
MAINDEC-9A-DOHA	EAE PART II
MAINDEC-9A-DOIA	API TEST
MAINDEC-9A-D1CB	EXTENDED MEMORY CONTROL
MAINDEC-9A-DZCB	HIGH SPEED READER TEST
MAINDEC-9A-D3BB	TC02 BASIC EXERCISER
MAINDEC-9A-D3RB	TC02 DECtape RANDOM EXERCISER

MANUALS, WRITEUPS AND LISTINGS:

F-95A	USER HANDBOOK SUPPLEMENT
DEC-9B-SUFA	FAST-9 MANUAL
DEC-9B-ABEA-LA	EXTENDED ASSEMBLER
DEC-9B-CDEA-LA	EXTENDED DDT
DEC-9A-MAA0-D	MONITOR
DEC-9A-AF40-D	FORTRAN IV
DEC-9A-GUAA-D	UTILITIES
DEC-9A-AM9A-D	MACRO
MAINDEC-9A-D710-D	DB98 TEST
MAINDEC-9A-D8BA-D	RELAY BUFFER TEST
MAINDEC-9A-D8IA-D	DB098 TEST

SOFTWARE TROUBLE REPORT

Name ______________________ Installation or Machine Nr. ______________________

Company Name ____

Program Name and Product Code ______________________________________

Program Date ______________________ Computer Type PDP- (   ) ☐
LINC-8 ☐

Monitor I.D. (Date, Size, ...) ______________________________________

SPECIAL OPTIONS (Scope, DECtape, ...) ______________________________

Description of Problem and Action Taken ______________________________

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Panel Indicators: ______________________ Program Counter ____________

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DEC-00-QR1A-D

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