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IMPROVEMENTS IN THE CHART D RADIATION-HYDRODYNAMIC CODE IV: USER AID PROGRAMS

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Abstract

Several user aid programs concerning the CHART D radiation-hydrodynamic code are discussed. Input instructions and sample card decks are included. Both the CDC 6600 and the PDP 10 are employed.

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I. INTRODUCTION

The CHART D radiation flow-hydrodynamic code has been described in two previous reports[1,2] (hereafter referred to as R1 and R2). The purpose of the present paper is to present several related user aid programs and give some suggested forms for employment. The available CDC 6600 programs are MASPLT, CKEOS, and ZCHART with EOS and ZONER for the PDP 10 time-sharing system. All of the codes have been in existence for some time but have only been detailed in limited distribution letters.

MASPLT is an all purpose plot program. ZCHART is a small program employed for automatic resetting of maximum dimensions in CHART D and MASPLT. The codes CKEOS and EOS are equation of state test programs. The zoning test program ZONER is available on the time-sharing system for rapid determination of optimal zoning. The last four of these are designed to improve usage of the CDC 6600.

In the following sections, the input parameters, storage requirements, and limitations of each of the CDC 6600 programs are given. Sample card decks are found in Appendix C. The PDP 10 programs contain built-in instructions and require little explanation. The sections in this report concerning these codes are mainly to point out their existence.

Anyone interested in using any of these programs should contact the authors for tape number, user identifications, etc.

II. MASPLT - AN ALL PURPOSE PLOT PROGRAM

MASPLT is an all purpose plot program for CHART D. This code reads the tape dumps generated by CHART D on either output units 2 or 3 and, with some additional input information, produces data for the SC-4020. The CDC 6600 SCORS package[3] is employed. As a result, MASPLT is subject to all of the quirks and limitations of SCORS.

Movies, slides and hard-copy plots can be made. In most cases the input data required is much the same as would be necessary to draw the graphs by hand. For example inputs define scale sizes and indicate whether log or linear scales are desired.

The types of plots produced can be divided into two general classes. In the first, two variables are plotted against each other at a fixed time. Stress versus position is an example. In the other type, the time is a parameter. Examples are stress versus time at a fixed position or peak stress versus position.

Insofar as the coding is concerned, the former type is much easier to produce since the tape dumps are of this form. Only one or two complete dumps are required in storage to generate a complete plot. In the latter type the desired information must be picked out of many tape dumps in order to produce a single plot. In this case the user must supply a simple subroutine to collect the desired data. The structure of this subroutine is discussed below.

A listing of the program is given in Appendix A. Tape units 1, 2, 3, and 4 are data input units for output produced by CHART D on units 2 or 3. Each unit is designed for the entire output of a CHART D run and not continuation tapes from a single run. For example unit 1 could contain the

data from the first run of a series and units 2 and 3 the information generated during restart runs. It is also possible that all units could have data from different problems.

During some problems it is necessary to read to the end of file on the input tape, then rewind and reread it. This causes a difficulty when continuation tapes are employed as only the last continuation tape is rewound. For proper operation it is necessary to copy the data from tape to disk before execution. In general it is always advisable to copy the tapes since more efficient use of the computer facilities will result by freeing the tape drives. Example 5 in Appendix C illustrates this point.

Units 39 and 40 are the program output units. Unit 40 is the standard hard-copy output unit (using the SCORS subroutine HDCOPY). The user does not have to supply a physical tape but there are limitations on the total number of plots that can be generated in a single run in this manner (see Reference 3 and related newsletters). The user must supply a physical tape for output on unit 39 and submit a peripheral request card to send the tape to the SC-4020.

All input and output modes can be used in a single run. Typical output can be found in Section V of R1.

II-1. TIMEVA - A User Supplied Subroutine

The subroutine TIMEVA selects the proper data for plotting when various points on the graph correspond to different times, i.e., different tape dumps. An example of such a routine is included in the listing in Appendix A. This example calculation can produce plots of either peak

stress versus position or stress X versus time at fixed position. The proper structure of the subroutine is obvious from the example.

II-2. MASPLT Input Instructions

MASPLT requires 100000 (octal) central memory locations on the CDC 6600 with the FUN compiler. Remember that the SCORS package is employed.

TABLE II-1. Variable Selection Code for Parameters 1 and 2 on Card 1.

N(1),N(2)	variable	standard unit
1	I = zone or boundary number	--
2	position (boundary)	cm
3	position (zone center)	cm
4	velocity (boundary)	cm/sec
5	velocity (zone center)	cm/sec
6	temperature	eV
7	density	gm/cc
8	pressure	dynes/cm^2
9	stress X	dynes/cm^2
10	pressure + artificial viscosity	dynes/cm^2
11	stress X + artificial viscosity	dynes/cm^2
12	X stress deviator	dynes/cm^2
13	stress Y	dynes/cm^2
14	stress Z	dynes/cm^2
15	Z stress deviator	dynes/cm^2
16	specific entropy	ergs/gm eV
17	specific internal energy	ergs/gm
18	distention ratio	--
19	momentum summed from front†	taps
20	mass depth from front†	gm
21	solid density (distention ratio x density)	gm/cc

†for plane geometry problems only

Card 1 Format (16I5)

(1-5) N(1) = X variable code (see Table II-1).
Not used if N(16) = 1.

(6-10) N(2) = Y variable code (see Table II-1).
Not used if N(16) = 1.

(11-15) N(3) = 0 for hard-copy output.
= 1 for output on tape unit 39.

(16-20) N(4) = 0 plot frequency determined by record number.
= 1 plot frequency determined by time inputs.
See card set 8. Not used if N(16) = 1.

(21-25) N(5) = 0 for linear X scale.
= 1 for log X scale.

(26-30) N(6) = 0 for linear Y scale.
= 1 for log Y scale.

(31-35) N(7) = 0 no plot grid is shown on graph.
= 1 plot grid is shown on graph.

(36-40) N(8) determines number of title and The End frames.
If $N(8) > 0$, N(8) is the number of frames of each.
If $N(8) = 0$, no title or The End frames.
If $-1000 \leq N(8) < 0$, no The End frames but -N(8) title frames.
If $N(8) < -1000$, no title frames but -(N(8) + 1000) The End frames.

The options with $N(8) \leq 0$ are useful in making continuous movies from several data tapes.

(41-45) N(9) = number of frames of each plot except the first in a given interval.

(46-50) N(10) = number of frames of the first plot in a given interval. This is useful in freezing the action in a movie to adjust to scale changes.

(51-55) N(11) = 0. Join points with lines.
= 1. Do not join points with lines.
= 2. Join points with lines except across spalls.

(56-60) N(12) = 0 for small size frame. This must be used for movies or any 16 mm plot because of frame overlap.
= 1 for large size frame. Plot grid is always shown.

(61-65) N(13) = number of data packages in card set 8.
If N(16) = 0 then $0 < N(13) \leq 10$
If N(16) = 1 then N(13) = 0

(66-70) N(14) = number of plot symbols in card set 6.
$1 \leq N(14) \leq 50$

(71-75) N(15) = input tape number (1,2,3, or 4).

(76-80) N(16) = 0 for plot of variables at a given time.
= 1 for a single plot of variable as a function of time or with time as a parameter. User must supply subroutine TIMEVA.

Card 2 Format (3A10)

(1-30) Input label 1 (for first title frame, should be centered).

Card 3 Format (3A10)

(1-30) Input label 2 (for first title frame, should be centered).

Card 4 Format (3A10)

(1-30) Input label 3 (for second title frame, should be centered).

Card 5 Format (3A10)

(1-30) Input label 4 (for second title frame, should be centered).

Card 6 Format (8(I5,A1,4X))

There are N(14) sets of the following variables.
I = 1,N(14)

Variable odd — NBDY(I) = last point to be plotted with the symbol NSD(I).

Variable even — NSD(I) = plot symbol (can be blank)

Note: NBDY(N(14)) is set to the last point to be plotted.

Card 7 Format (5E10.3)

(1-10) SCALX = a scale factor for the X variable when N(16) = 0.
SCALX is used to change units.
If SCALX = 0, code sets SCALX = 1.
If N(16) = 1, SCALX can be used as an input parameter to TIMEVA.

(11-20) SCALY = same as SCALX except for the Y variable.

(21-30) DLABX = 0 – for MASPLT to supply X label.
= 1 – input X label in card set 8 or 9 (must be used if N(16) = 1 or SCALX ≠ 0 or 1).

(31-40) DLABY = same as DLABX except for Y label.

(41-50) EXTR = the number of data points pairs to be read in card set 10.
$0 \leq EXTR \leq 90$

Card Set 8 Present only if N(16) = 0.
There are N(13) sets of these cards.
I = 1,N(13)

Card 8.1 Format (2I10,6E10.3)

(1-10) ICY(I) = tape record number to start plotting with dump frequency ICYD(I).
Not used if N(4) = 1.

(11-20) ICYD(I) = tape record frequency for plots between record ICY(I) and ICY(I+1).
Not used if N(4) = 1.

(21-30) TM(I) = time to start plotting at time intervals of TMD(I).
Not used if N(4) = 0.

(31-40) TMD(I) = time interval for plots between time TM(I) and TM(I+1).
Not used if N(4) = 0.

(41-50) XMIN(I) = smallest X value to be plotted in this interval.

(51-60) XMAX(I) = largest X value to be plotted in this interval.

(61-70) YMIN(I) = same as XMIN(I) except for Y.

(71-80) YMAX(I) = same as XMAX(I) except for Y.

Notes: Points outside of minimum-maximum range are dropped. If N(13) > 1, plotting will start at first record ≥ ICY(1) and stop when record number > ICY(N(13)) if N(4) = 0 or start at first time ≥ TM(1) and stop when time > TM(N(13)) if N(4) = 1. In the case that N(13) = 1, the program will plot until the tape end of file.

Card 8.2 Format (5A10)

Present only if DLABX = 1 (card 7)

(1-50) X label for this interval.
Should be centered.

Card 8.3 Format (5A10)

Present only if DLABY = 1 (card 7)

(1-50) Y label for this interval.
Should be centered.

Card Set 9 Present only if N(16) = 1.

Card 9.1 Format (2I10,6E10.3)

(1-10) Blank

(11-20) Blank

(21-30) TSTART = time to begin plot.

(31-40) TSTOP = time to stop plot.

(41-50) XMIN(1) = same as on card 8.1

(51-60) XMAX(1) = same as on card 8.1

(61-70) YMIN(1) = same as on card 8.1

(71-80) YMAX(1) = same as on card 8.1

Note: Only tape dumps between TSTART and TSTOP are employed.

Card 9.2 – Same as 8.2 (must be present)

Card 9.3 – Same as 8.3 (must be present)

Card Set 10 Format (2E10.3)

Present only if EXTR > 0 (card 7)

There are EXTR sets of the following variables.
I = 1,EXTR

(1-10) EXTRX(I)

(11-20) EXTRY(I)

This set of variables is plotted on each frame with lines connecting the points.

Card 11 Format (8A10)

Present only if N(16) = 1

(1-80) Top label for graph. Only 1-50 are used for small size frame.

If more plots are desired, go back to card 1.

If finished, insert a blank card to stop.

III. CKEOS - AN EQUATION OF STATE TEST PROGRAM FOR THE CDC 6600

The program CKEOS can be used to test both analytic and tabular equations of state. The main body of the code is the same as the equation of state section in CHART D. Both plotted and printed output is produced. The SCORS package[3] and three-dimensional plot routine, supplied by D. C. Jones,[4] are employed.

The program can produce both one and two-wave Hugoniots. A high explosive test section is also available. The relations for both computations have been developed in a previous paper[1] and will not be repeated here.

There is no limitation on the number of independent equations of state that can be considered in a single run except that of the maximum number of hard-copy plots produced.[3] However, because of data storage arrangements, tabular forms must follow any analytic ones.

When tabular data is considered, the master EOS tape must be requested on tape unit 12. This tape is not required when only analytic forms are employed.

Samples of the output of this program can be found in Section V of R1 and Appendix D of R2. Example 6 in Appendix C of this report illustrates a typical card deck.

III-1. CKEOS Input Instructions

CKEOS requires 170000 (octal) central memory locations on the CDC 6600 with the FUN compiler. Remember that the SCORS package is employed and that the master EOS file must be requested on unit 12 for tabular data.

Card 1 Format (3I10,4E10.3,A10)

(1-10) NEOS = EOS number; -1 to -20 for analytic and > 0 for tabular. This variable has the same meaning as IES, variable 7, card 11.1 in R1.

(11-20) NPLS = number of constant density plots on each graph (see card 6).
Normally a large number

(21-30) IOVER = switch to control constant density calculations.

> 0, input data on cards 4, 5 and 6.

= 0 and NEOS > 0, tabular mesh points determine mesh.

Skip cards 4, 5 and 6

= 0 and NEOS < 0, code sets IOVER = 1

< 0, no constant density calculation, skip cards 4, 5 and 6.

(31-40) T_{min} = minimum temperature for 3-D plot.

(41-50) T_{max} = maximum temperature for 3-D plot.

(51-60) ρ_{min} = minimum density for 3-D plot.

(61-70) ρ_{max} = maximum density for 3-D plot.

(71-80) Any BCD information used for plot identification.

Note: If any of T_{min}, T_{max}, ρ_{min}, or $\rho_{max} \leq 0$, no 3-D plots are produced. If the plot is generated, a 60 x 60 mesh is used with equal log spacing.

Card 2 Format (5E10.3)

Produces one and two-wave Hugoniots

(1-10) RHG = initial density for Hugoniot calculation. If RHG < 0, calculation is skipped.

(11-20) THG = initial temperature.
If THG < 0, code sets THG = .02567789.

(21-30) RORUS = initial density for two-wave Hugoniot. If RORUS $\leq$ 0, calculation is skipped.

(31-40) PORUS = elastic yield stress.

(41-50) CORUS = elastic wave velocity.

Note: A single-wave solution is computed using only RHG and THG. If the two-wave calculation is desired, RHG should define the initial solid material density and RORUS the initial foam density for porous materials, i.e.,

$$\frac{\text{RHG}}{\text{RORUS}} = \text{distention ratio.}$$

The two-wave calculation is good only for pressures in excess of initial yield.

No plots are produced by this section.

Card Set 3

Present only for analytic equations of state (NEOS < 0 on card 1). Insert the standard analytic EOS data card set described in Appendix A of R2 or Appendix I of R1.

Card 4 Format (2I5,4E10.3)

Present only if IOVER > 0 on card 1.

(1-5) NTUP defines the number of test temperatures in card set 5.

(6-10) NRHUP = number of test densities in card set 6.

Note: The next 4 variables are used only for testing high explosives; otherwise leave blank. See Section X in R1.

(11-20) TOHE = initial temperature before start of burn. If TOHE $\leq$ 0, code sets TOHE = .02967795.

(21-30) ROHE = initial density.

(31-40) DHE = detonation velocity.

(41-50) EHE = chemical energy release per unit mass or - Chapman-Jouguet detonation pressure (same as variable 6, card 13.6 in Appendix II of R1).

Card Set 5 Format (E20.10)

Present only if IOVER > 0 on card 1.

There are two possible forms depending on NTUP on card 4.

If NTUP > 0, input NTUP ordered temperatures.

If NTUP < 0, input 2 temperatures. The code will put in |NTUP| values between them equally spaced on log scale.

Card Set 6 Format (E20.10)

Present only if IOVER > 0 on card 1.

Input NRHUP ordered densities.

Insert a blank card to stop or return to card 1 for another EOS.

IV. ZCHART - A REDIMENSIONING PROGRAM

The standard versions of CHART D and MASPLT are limited to a maximum of 400 and 500 zones respectively. With the CDC 6600 there is sufficient storage available to vary the maximum anywhere up to about 1800 zones. The program ZCHART has been written to modify the necessary dimension statements so that other size problems can be considered without the user having to repunch any cards. Wise use of this program can increase turn around by decreasing storage requirements for small problems and, when desired, increase resolution.

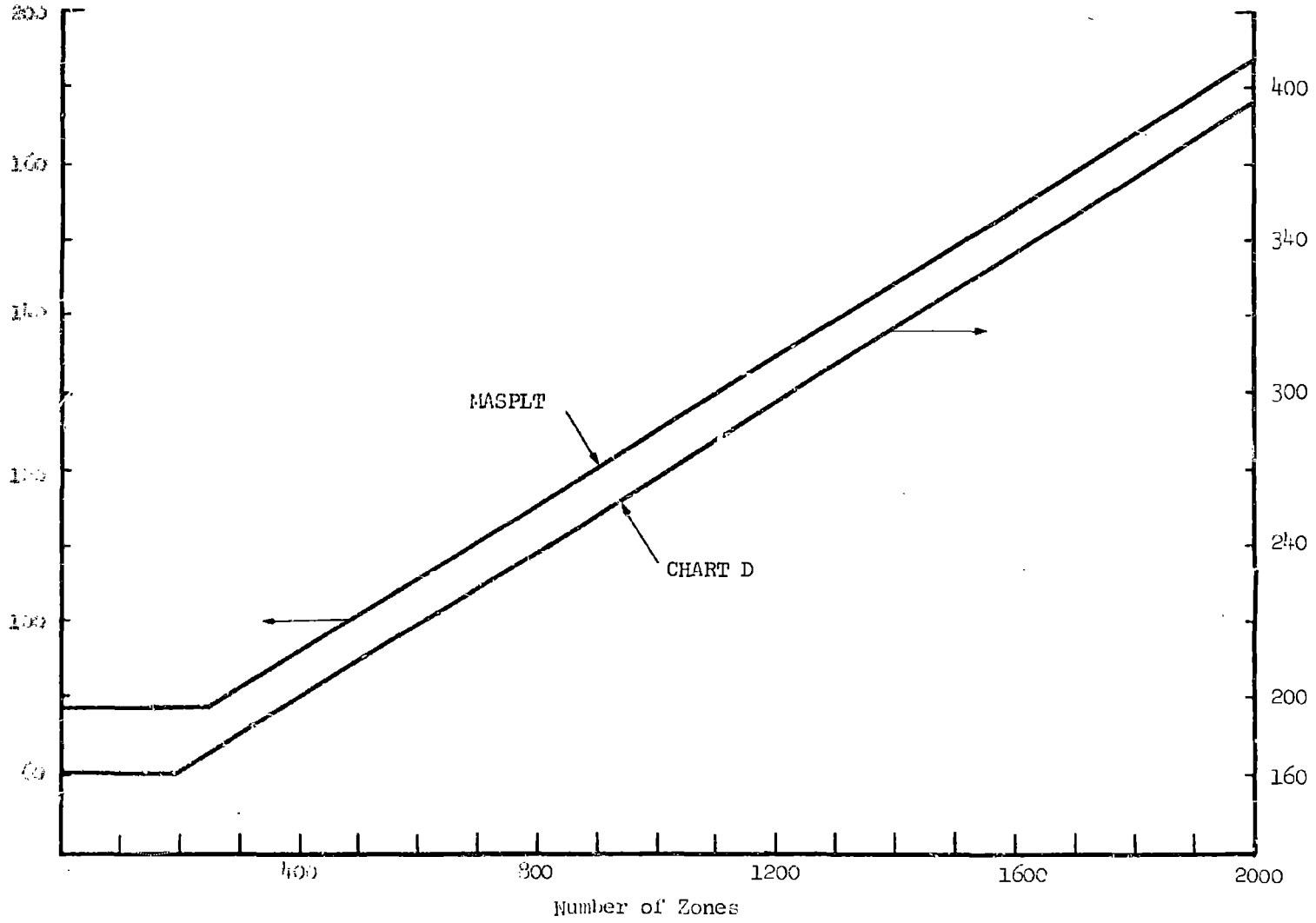
In this program the update features of the CDC 6600 are employed to generate a correction set using either card or disk output. Using the latter option, it is possible to run ZCHART under the same job card as CHART D or MASPLT. The update information is transmitted from ZCHART to the update processor by a disk file called INFILE. Examples 7 to 11 in Appendix C illustrate the four main modes of operation.

The central memory required for CHART D and MASPLT for various dimensions is shown in Figure IV-1. Note that octal numbers are shown.

CHART D also employs the CDC 6600 extended core storage (ECS). The modifications required for machines without this feature are given in Appendix C of R1. The amount of ECS necessary depends mainly on the number of tabular equations of state but also varies slightly with the maximum dimensions. As a result, ZCHART produces an ECS table during each run. An example is given in Appendix A of R1.

The ZCHART processor should not be used on an update file which was created by ZCHART as the card numbering is altered. Because of the relatively long time required for compilation of CHART 7 (~ 3 minutes), it

FIGURE IV-1. REQUIRED MEMORY (1000 OCTAL)



is suggested that a LGO tape be saved if several problems requiring the same dimensions are to be run.

IV-1. ZCHART Input Instructions

ZCHART requires 60000 (octal) central memory locations on the CDC 6600 with the FUN compiler. There is only one input card for ZCHART.

Format (3I5)

(1-5) MAXZONE = maximum number of zones.
MAXZONE ≥ 100

(6-10) IFLAGC = switch for CHART D update.
See following table.

(11-15) IFLAGM = switch for MASPLT update.
See following table.

The IFLAG options are

0. no update

1. INFILE output

2. punch card output

3. both punch card and INFILE output

-1. same as 1 with listing

-2. same as 2 with listing

-3. same as 3 with listing.

V. BUCKL/CHART D

The deposition code BUCKL[5,6] can be employed to generate energy source data for CHART D. The coupling formats and input details are given in R1 and Reference 6. The purpose of the present section is to demonstrate a method of running both codes under a single job card.

Example 3 in Appendix C gives the required control cards. The transfer of information from BUCKL to CHART D is through logical unit 7 (a disk file). Under normal conditions the central memory requirements are those of CHART D as BUCKL is slightly smaller. If a ZCHART modified CHART D is employed, it is required that the number of mesh points in any BUCKL material layer is not larger than the maximum number of zones available in CHART D. Note that the standard versions of BUCKL are limited to 400 mesh points.

VI. PDP 10 TEST PROGRAMS

Two test programs are available for the PDP 10 time-sharing system. These codes are designed to quickly determine optional input parameters for two possibly troublesome sections in CHART D.

Both programs contain built-in input instructions. When the code requires a number, it prints a description of the desired quantity. The notation is the same as is used in R1 and R2. However there are some problems. One difficulty common to both is the word length differences between the PDP 10 and the CDC 6600. This forced extensive modification of some sections. Iterations which presented no problems on the CDC 6600 were extremely difficult on the PDP 10 even in double precision.

Both are FORTRAN programs.

VI-1. EOS - An Equation of State Test Program for the PDP 10

EOS is a test program for the analytic equation of state package as described in R2. The tabular form is not considered. This code is very useful in making minor adjustments to fit some desired physical property. For example modification of vapor pressure curves, positions of critical points, and solid-solid phase transitions are much easier with the interactive computer system than with the CDC 6600.

Because of storage limitations it was not possible to get the entire ANEOS package into the PDP 10. As a result EOS does not contain the thermal electronic components subroutines as described in Section VI of R2. However no difficulty has ever been experienced with this section so there is little reason to test its results. All other calculations

are included. This means that EOS results are valid only at relatively low temperatures ($T \lesssim 2$ eV). On the other hand this is where most of the problems with the ANEOS package are found.

VI-2. ZONER - A Zoning Test Program for the PDP 10

The program ZONER is essentially the same as that section associated with card set 11 in Appendix H in R1 and uses the same notation. Due to storage limitations, the code is only able to treat a maximum of 500 zones.

REFERENCES

1. Thompson, S. L., and Lauson, H. S., Improvements in the CHART D Radiation-Hydrodynamic Code II: A Revised Program, SC-RR-710713, Sandia Laboratories, Albuquerque, New Mexico, February 1972.

2. Thompson, S. L., and Lauson, H. S., Improvements in the CHART D Radiation-Hydrodynamic Code III: Revised Analytic Equations of State, SC-RR-710714, Sandia Laboratories, Albuquerque, New Mexico, to be published.

3. SC-4020 Usage with IBM-7090/7094, CDC 3600, UNIVAC-1107/1108, CDC 6600, Prepared by: Advanced Techniques Division, SC-M-70-68, Sandia Laboratories, Albuquerque, New Mexico, March 1970.

4. Jones, D. C., Three-Dimensional Plot Routines, SC-TM-68-614, Sandia Laboratories, Albuquerque, New Mexico, November 1968.

5. Cole, R. K., Jr., BUCKL: A Program for Rapid Calculation of X-Ray Deposition, SC-RR-69-855, Sandia Laboratories, Albuquerque, New Mexico, July 1970.

6. Cole, R. K., Jr., A Modified BBAY Impulse Routine for BUCKL (U), SC-RR-710038, Sandia Laboratories, Albuquerque, New Mexico, February 1971 (CFRD). The inputs are described in this report for direct coupling to CHART D.

7. Smith, M. A., Scope User's Manual for the CDC 6600, SC-M-70-189, Sandia Laboratories, Albuquerque, New Mexico, February 1970.

APPENDIX A

MASPLT Fortran Listing

FUN Compiler Version

```
      PROGRAM MASPLT(INPUT,OUTPUT,TAPE1,TAPE2,TAPE3,TAPE4,TAPE39,TAPE40)MAS     1
C     A PLOT PROGRAM FOR CHARTD          9/71                            MAS     2
      COMMON X(501),V(501),XL(501),VL(501),ISPALL(501),T(501),D(501),F(5MAS     3
     101),Q(501),E(501),S(501),SXD(501),SZD(501),DRATIO(501)             MAS     4
      COMMON /SLC/ SCALX,SCALY,SCALL                                     MAS     5
      DIMENSION XXL(501), XXU(501), YYL(501), YYU(501), XX(501), YY(501)MAS     6
      DIMENSION ICY(10), ICYD(10), TM(10), TMD(10), N(16), NBDY(50)      MAS     7
      DIMENSION NSD(50)                                                  MAS     8
      DIMENSION XMIN(10), XMAX(10), YMIN(10), YMAX(10)                   MAS     9
      DIMENSION LF1(3), LF2(3), LF3(3), LF4(3)                           MAS    10
      DIMENSION LLT(8), LBX(8), LBY(8), LLX(10,5), LLY(10,5)             MAS    11
      DIMENSION EXTRX(90), EXTRY(90)                                     MAS    12
      DIMENSION KFRMS(2), ANAME(8)                                       MAS    13
      EXTERNAL TABL1V                                                    MAS    14
      NOFTH=NOFTF=KFRMS(1)=KFRMS(2)=0                                    MAS    15
   10 READ 1140, N                                                       MAS    16
      IF (N(15).EQ.0) GO TO 1020                                         MAS    17
      PRINT 1170                                                         MAS    18
      PRINT 1200, (I,N(I),I=1,16)                                        MAS    19
      READ 1160, LF1                                                     MAS    20
      READ 1160, LF2                                                     MAS    21
      READ 1160, LF3                                                     MAS    22
      READ 1160, LF4                                                     MAS    23
      DO 20 I=1,4                                                        MAS    24
      II=3*(I-1)+1                                                       MAS    25
      III=II+2                                                           MAS    26
   20 PRINT 1180, I,(LF1(K),K=II,III)                                    MAS    27
      SWTIT=SWEND=N(8)                                                   MAS    28
      IF (N(8).GE.0) GO TO 40                                            MAS    29
      IF (N(8).LT.-1000) GO TO 30                                        MAS    30
      SWTIT=-N(8)                                                        MAS    31
      SWEND=0.                                                           MAS    32
      GO TO 40                                                           MAS    33
   30 SWTIT=0.                                                           MAS    34
      SWEND=-(N(8)+1000)                                                 MAS    35
   40 ITOUT=40                                                           MAS    36
      IF (N(3).NE.0) ITOUT=39                                            MAS    37
      PRINT 1190, ITOUT                                                  MAS    38
      IF (N(14).LE.0) N(14)=1                                            MAS    39
      NN=N(14)                                                           MAS    40
      READ 1210, (NBDY(I),NSD(I),I=1,NN)                                 MAS    41
      PRINT 1220, (I,NBDY(I),I,NSD(I),I=1,NN)                            MAS    42
C     CENTER ANY PERIODS                                                 MAS    43
      DO 50 I=1,NN                                                       MAS    44
      IF (NSD(I).EQ.1H.) NSD(I)=42                                       MAS    45
   50 CONTINUE                                                           MAS    46
      READ 1150, SCALX,SCALY,DLABX,DLABY,EXTR                            MAS    47
      PRINT 1070, SCALX,SCALY,DLABX,DLABY,EXTR                           MAS    48
      NEXTR=EXTR                                                         MAS    49
      IF (SCALX.EQ.0.) SCALX=1.                                          MAS    50
      IF (SCALY.EQ.0.) SCALY=1.                                          MAS    51
      IF (N(13).LE.0) N(13)=1                                            MAS    52
      IF (N(16).EQ.0) GO TO 60                                           MAS    53
      DLABX=DLABY=N(13)=1                                                MAS    54
   60 NN=N(13)                                                           MAS    55
```

```
      DO 140 I=1,NN                                                    MAS   56
      READ 1230, ICY(I),ICYD(I),TM(I),TMD(I),XMIN(I),XMAX(I),YMIN(I),YMAMAS   57
     1X(I)                                                             MAS   58
      IF (DLABX.EQ.0.) GO TO 70                                        MAS   59
      READ 1160, (LLX(I,K),K=1,5)                                      MAS   60
      GO TO 90                                                         MAS   61
   70 CALL LSORT (N(1),LBX)                                            MAS   62
      DO 80 K=1,5                                                      MAS   63
   80 LLX(I,K)=LBX(K)                                                  MAS   64
   90 IF (DLABY.EQ.0.) GO TO 100                                       MAS   65
      READ 1160, (LLY(I,K),K=1,5)                                      MAS   66
      GO TO 120                                                        MAS   67
  100 CALL LSORT (N(2),LBY)                                            MAS   68
      DO 110 K=1,5                                                     MAS   69
  110 LLY(I,K)=LBY(K)                                                  MAS   70
  120 IF (N(16).EQ.1) GO TO 130                                        MAS   71
      PRINT 1250, I,ICY(I),I,ICYD(I),I,TM(I),I,TMD(I)                  MAS   72
      GO TO 140                                                        MAS   73
  130 PRINT 1270, TM(I),TMD(I)                                         MAS   74
  140 PRINT 1260, I,XMIN(I),I,XMAX(I),I,YMIN(I),I,YMAX(I),(LLX(I,K),K=1,MAS   75
     15),(LLY(I,K),K=1,5)                                              MAS   76
      IF (EXTR) 160,160,150                                            MAS   77
  150 READ 1080, (EXTRX(I),EXTRY(I),I=1,NEXTR)                         MAS   78
      PRINT 1090, (I,EXTRX(I),I,EXTRY(I),I=1,NEXTR)                    MAS   79
  160 IF (NN.EQ.1) ICY(2)=90000                                        MAS   80
      IF (N(16).NE.0) PRINT 1050                                       MAS   81
      IF (NN.EQ.1) TM(2)=1.E10                                         MAS   82
      IF (NN.LE.1) N(13)=2                                             MAS   83
      NN10=N(10)                                                       MAS   84
      LQ=115                                                           MAS   85
      IF (N(7).EQ.1) LQ=76                                             MAS   86
      IT=N(15)                                                         MAS   87
      REWIND IT                                                        MAS   88
      READ (IT) (X(I),I=1,13)                                          MAS   89
      PRINT 1240, (X(I),I=1,13)                                        MAS   90
      ENCODE (80,1100,ANAME) (X(I),I=1,13)                             MAS   91
      IF (NOFTH+NOFTF.GT.0) CALL EXTFLM (1)                            MAS   92
      IF (N(3)) 180,170,180                                            MAS   93
  170 N(6)=N(9)=N(10)=1                                                MAS   94
      NOFTH=NOFTH+1                                                    MAS   95
      IF (NOFTH.EQ.1) CALL HDCOPY (ITOUT)                              MAS   96
      IF (NOFTH-1) 200,190,200                                         MAS   97
  180 NOFTF=NOFTF+1                                                    MAS   98
      IF (NOFTF-1) 200,190,200                                         MAS   99
  190 CALL ENTFLM (ITOUT)                                              MAS  100
      GO TO 210                                                        MAS  101
  200 CALL ENTFLM (-ITOUT)                                             MAS  102
  210 IF (SWTIT.LE.0.) GO TO 270                                       MAS  103
      NN=SWTIT                                                         MAS  104
      DO 230 NM=1,NN                                                   MAS  105
      CALL FRAMEV (3)                                                  MAS  106
      KFRMS(ITOUT-38)=KFRMS(ITOUT-38)+1                                MAS  107
      DO 220 KK3=1,2                                                   MAS  108
      CALL LINEV (80,833,973,833)                                      MAS  109
      CALL LINEV (80,833,80,205)                                       MAS  110
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    CALL LINEV (80,205,973,205)                                          MAS  111
220 CALL LINEV (973,833,973,205)                                         MAS  112
    LVW=15                                                               MAS  113
    LVH=9                                                                MAS  114
    CALL CHSIZV (LVW,LVH)                                                MAS  115
    CALL RITSTV (5*LVW+3,7*LVH+5,TABL1V)                                 MAS  116
    CALL RITE2V (230,650,880,90,3,7,1,7HCHART D,NLAST)                   MAS  117
    LVW=LVH=3                                                            MAS  118
    CALL CHSIZV (LVW,LVH)                                                MAS  119
    CALL RITSTV (5*LVW+3,7*LVH+5,TABL1V)                                 MAS  120
    DO 230 KK3=1,2                                                       MAS  121
    CALL RITE2V (255,500,1000,90,1,30,1,LF1,NLAST)                       MAS  122
230 CALL RITE2V (255,400,1000,90,1,30,1,LF2,NLAST)                       MAS  123
    DO 260 NM=1,NN                                                       MAS  124
    CALL FRAMEV (3)                                                      MAS  125
    KFRMS(ITOUT-38)=KFRMS(ITOUT-38)+1                                    MAS  126
    DO 240 KK3=1,2                                                       MAS  127
    CALL LINEV (80,833,973,833)                                          MAS  128
    CALL LINEV (80,833,80,205)                                           MAS  129
    CALL LINEV (80,205,973,205)                                          MAS  130
240 CALL LINEV (973,833,973,205)                                         MAS  131
    LVW=LVH=2                                                            MAS  132
    CALL CHSIZV (LVW,LVH)                                                MAS  133
    CALL RITSTV (5*LVW+3,7*LVH+5,TABL1V)                                 MAS  134
    DO 250 I=1,2                                                         MAS  135
250 CALL PRINTV (80,ANAME,320,230)                                       MAS  136
    LVW=LVH=3                                                            MAS  137
    CALL CHSIZV (LVW,LVH)                                                MAS  138
    CALL RITSTV (5*LVW+3,7*LVH+5,TABL1V)                                 MAS  139
    DO 260 KK3=1,2                                                       MAS  140
    CALL RITE2V (255,600,1000,90,1,30,1,LF3,NLAST)                       MAS  141
260 CALL RITE2V (255,500,1000,90,1,30,1,LF4,NLAST)                       MAS  142
270 DO 280 I=1,8                                                         MAS  143
280 LLT(I)=LBX(I)=LBY(I)=1H                                              MAS  144
    NFRAME=0                                                             MAS  145
    NKK=0                                                                MAS  146
    IF (N(12).EQ.1) GO TO 290                                            MAS  147
    CALL SMXYV (N(5),N(6))                                               MAS  148
    CALL SETMIV (80,50,205,190)                                          MAS  149
290 IF (N(16).NE.0) GO TO 980                                            MAS  150
    ICMF=0                                                               MAS  151
300 READ (IT) NZ,NZP,ICYCLE,NCOUNT,TIME,X(NZP),V(NZP),(X(I),V(I),XL(I)   MAS  152
   1,VL(I),ISPALL(I),T(I),D(I),F(I),Q(I),E(I),S(I),SXD(I),SZD(I),DRATI   MAS  153
   20(I),I=1,NZ)                                                         MAS  154
    IF (EOF,IT) 310,320                                                  MAS  155
310 PRINT 1110                                                           MAS  156
    IF (ICMF) 930,960,990                                                MAS  157
320 NCYCLE=ICYCLE                                                        MAS  158
    IF (ICMF.NE.0) GO TO 1000                                            MAS  159
    FCYCLE=ICYCLE                                                        MAS  160
    ICYCLE=NCOUNT                                                        MAS  161
    PRINT 1120, ICYCLE,NCYCLE,TIME                                       MAS  162
    SCALL=SCALX                                                          MAS  163
    CALL SORT (N(1),NZP,XX)                                              MAS  164
    SCALL=SCALY                                                          MAS  165
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      CALL SORT (N(2),NZP,YY)                                          MAS  166
      NZP=NZP-1                                                        MAS  167
      IF (N(1).EQ.1) GO TO 330                                         MAS  168
      IF (N(1).EQ.2) GO TO 330                                         MAS  169
      IF (N(1).EQ.4) GO TO 330                                         MAS  170
      GO TO 350                                                        MAS  171
  330 IF (N(2).EQ.1) GO TO 340                                         MAS  172
      IF (N(2).EQ.2) GO TO 340                                         MAS  173
      IF (N(2).EQ.4) GO TO 340                                         MAS  174
      GO TO 350                                                        MAS  175
  340 NZP=NZP+1                                                        MAS  176
  350 IF (N(4)) 360,430,360                                            MAS  177
  360 IF (NKK) 370,370,390                                             MAS  178
  370 TIMEU=TIME                                                       MAS  179
      TTO=TIME                                                         MAS  180
      IF (TTO.LT.TM(1)) TTO=TM(1)                                      MAS  181
      FCYCU=FCYCLE                                                     MAS  182
      NKK=1                                                            MAS  183
      DO 380 I=1,NZP                                                   MAS  184
      XXU(I)=XX(I)                                                     MAS  185
  380 YYU(I)=YY(I)                                                     MAS  186
      GO TO 290                                                        MAS  187
  390 TIMEL=TIMEU                                                      MAS  188
      TIMEU=TIME                                                       MAS  189
      FCYCL=FCYCU                                                      MAS  190
      FCYCU=FCYCLE                                                     MAS  191
      DO 400 I=1,NZP                                                   MAS  192
      XXL(I)=XXU(I)                                                    MAS  193
      XXU(I)=XX(I)                                                     MAS  194
      YYL(I)=YYU(I)                                                    MAS  195
  400 YYU(I)=YY(I)                                                     MAS  196
  410 IF (TTO.GT.TIMEU) GO TO 290                                      MAS  197
      TIME=TTO                                                         MAS  198
      DL1=(TIME-TIMEL)/(TIMEU-TIMEL)                                   MAS  199
      DL2=(TIMEU-TIME)/(TIMEU-TIMEL)                                   MAS  200
      DO 420 I=1,NZP                                                   MAS  201
      XX(I)=DL1*XXU(I)+DL2*XXL(I)                                      MAS  202
  420 YY(I)=DL1*YYU(I)+DL2*YYL(I)                                      MAS  203
      FCYCLE=DL1*FCYCU+DL2*FCYCL                                       MAS  204
      GO TO 460                                                        MAS  205
  430 IF (NKK) 470,440,450                                             MAS  206
  440 NKK=1                                                            MAS  207
      NIC=ICYCLE                                                       MAS  208
      IF (NIC.LT.ICY(1)) NIC=ICY(1)                                    MAS  209
  450 IF (NIC-ICYCLE) 290,460,290                                      MAS  210
  460 NFRAME=NFRAME+1                                                  MAS  211
      PRINT 1130, NFRAME,TIME,ICYCLE,NCYCLE,FCYCLE                     MAS  212
      ENCODE (50,1280,LLT) TIME,FCYCLE                                 MAS  213
  470 CONTINUE                                                         MAS  214
      NN=N(14)                                                         MAS  215
      NBDY(NN)=NZP                                                     MAS  216
      DO 480 I=1,5                                                     MAS  217
      LBX(I)=LLX(NKK,I)                                                MAS  218
  480 LBY(I)=LLY(NKK,I)                                                MAS  219
      XL=XMIN(NKK)                                                     MAS  220
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      XR=XMAX(NKK)                                                      MAS  221
      YB=YMIN(NKK)                                                      MAS  222
      YT=YMAX(NKK)                                                      MAS  223
      IF (N(7)) 490,510,490                                             MAS  224
  490 IF (N(5)) 500,510,500                                             MAS  225
  500 DX=1.                                                             MAS  226
      NXB=-1                                                            MAS  227
      NB=1                                                              MAS  228
      IB=0                                                              MAS  229
      GO TO 550                                                         MAS  230
  510 DCB=20.                                                           MAS  231
      CALL DXDYV (1,XL,XR,DX,NB,IB,NXB,DCB,NLAST)                       MAS  232
      IF (NLAST.EQ.1) STOP 204                                          MAS  233
      IF (ABS(XR).GT.100.) GO TO 530                                    MAS  234
      IF (ABS(XL).GT.100.) GO TO 530                                    MAS  235
      IF (XL.EQ.0.) GO TO 520                                           MAS  236
      IF (ABS(XL).LT..1) GO TO 530                                      MAS  237
  520 IF (XR.EQ.0.) GO TO 540                                           MAS  238
      IF (ABS(XR).GE..1) GO TO 540                                      MAS  239
  530 NXB=-2                                                            MAS  240
  540 CONTINUE                                                          MAS  241
      IB=-IABS(IB)                                                      MAS  242
  550 IF (N(6)) 560,570,560                                             MAS  243
  560 DY=1.                                                             MAS  244
      NYB=-1                                                            MAS  245
      MB=1                                                              MAS  246
      JB=0                                                              MAS  247
      GO TO 670                                                         MAS  248
  570 DCB=20.                                                           MAS  249
      CALL DXDYV (2,YB,YT,DY,MB,JB,NYB,DCB,NLAST)                       MAS  250
      IF (NLAST.EQ.1) STOP 214                                          MAS  251
      IF (ABS(YT).GT.100.) GO TO 590                                    MAS  252
      IF (ABS(YB).GT.100.) GO TO 590                                    MAS  253
      IF (YB.EQ.0.) GO TO 580                                           MAS  254
      IF (ABS(YB).LT..1) GO TO 590                                      MAS  255
  580 IF (YT.EQ.0.) GO TO 600                                           MAS  256
      IF (ABS(YT).GE..1) GO TO 600                                      MAS  257
  590 NYB=-2                                                            MAS  258
  600 CONTINUE                                                          MAS  259
      JB=-IABS(JB)                                                      MAS  260
      GO TO 670                                                         MAS  261
  610 IF (N(5)) 620,630,620                                             MAS  262
  620 DX=2.                                                             MAS  263
      NXB=-1                                                            MAS  264
      NB=1                                                              MAS  265
      IB=0                                                              MAS  266
      GO TO 640                                                         MAS  267
  630 DX=0.                                                             MAS  268
      NXB=-1                                                            MAS  269
      NB=5                                                              MAS  270
      IB=5                                                              MAS  271
  640 IF (N(6)) 650,660,650                                             MAS  272
  650 DY=2.                                                             MAS  273
      NYB=-1                                                            MAS  274
      MB=1                                                              MAS  275
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      J8=0                                                              MAS  275
      GO TO 670                                                         MAS  277
  660 DY=0.                                                             MAS  278
      NY8=-1                                                            MAS  279
      M8=5                                                              MAS  280
      J8=5                                                              MAS  281
  670 NM=NN10                                                           MAS  282
      NN10=N(9)                                                         MAS  283
      DO 930 NN=1,NM                                                    MAS  284
      KFRMS(ITOUT-38)=KFRMS(ITOUT-38)+1                                 MAS  285
      IF (N(12).EQ.1) GO TO 760                                         MAS  286
      CALL GRID1V (4,XL,XR,YB,YT,DX,DY,N8,M8,I8,J8,NX8,NY8)             MAS  287
      DO 680 KK3=1,2                                                    MAS  288
      LVW=LVH=2                                                         MAS  289
      CALL CHSIZV (LVW,LVH)                                             MAS  290
      CALL RITSTV (5*LVW+3,7*LVH+5,TABL1V)                              MAS  291
      CALL RITE2V (250,830,1000,90,1,50,1,LLT,NLAST)                    MAS  292
      CALL RITE2V (L3,192,1000,180,1,50,1,LBY,NLAST)                    MAS  293
      LVW=LVH=2                                                         MAS  294
      CALL CHSIZV (LVW,LVH)                                             MAS  295
      CALL RITSTV (5*LVW+6,7*LVH+5,TABL1V)                              MAS  296
  680 CALL RITE2V (157,189,1000,90,1,50,1,LBX,NLAST)                    MAS  297
      IUP=0                                                             MAS  298
      NUMT=N(14)                                                        MAS  299
      DO 700 JJ=1,NUMT                                                  MAS  300
      ILOW=IUP+1                                                        MAS  301
      IUP=N8DY(JJ)                                                      MAS  302
      IF (NSD(JJ).EQ.1H ) GO TO 700                                     MAS  303
      DO 690 I=ILOW,IUP                                                 MAS  304
      II=I-ILOW+1                                                       MAS  305
      X(II)=XX(I)                                                       MAS  306
  690 V(II)=YY(I)                                                       MAS  307
      CALL OFF (II,X,V,XL,XR,YB,YT)                                     MAS  308
      IF (II.LT.1) GO TO 700                                            MAS  309
      CALL APLOTV (II,X,V,1,1,1,NSD(JJ),NLAST)                          MAS  310
  700 CONTINUE                                                          MAS  311
      IF (N(11)) 740,710,740                                            MAS  312
  710 DO 720 I=1,NZP                                                    MAS  313
      X(I)=XX(I)                                                        MAS  314
  720 V(I)=YY(I)                                                        MAS  315
      II=NZP                                                            MAS  316
      CALL OFF (II,X,V,XL,XR,YB,YT)                                     MAS  317
      IF (II.LE.1) GO TO 740                                            MAS  318
      III=II-1                                                          MAS  319
      DO 730 KK3=1,2                                                    MAS  320
      DO 730 I=1,III                                                    MAS  321
      II=I+1                                                            MAS  322
      XS1=X(I)                                                          MAS  323
      XS2=X(II)                                                         MAS  324
      YS1=V(I)                                                          MAS  325
      YS2=V(II)                                                         MAS  326
      CALL LINEV (NXV(XS1),NYV(YS1),NXV(XS2),NYV(YS2))                  MAS  327
  730 CONTINUE                                                          MAS  328
  740 CONTINUE                                                          MAS  329
      IF (N(7).EQ.1) GO TO 820                                          MAS  330
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      DO 790 KK3=1,2                                                    MAS  351
      CALL LINEV (NXV(XL),NYV(YB),NXV(XR),NYV(YB))                      MAS  352
      CALL LINEV (NXV(XR),NYV(YB),NXV(XR),NYV(YT))                      MAS  353
      CALL LINEV (NXV(XL),NYV(YT),NXV(XR),NYV(YT))                      MAS  354
  790 CALL LINEV (NXV(XL),NYV(YB),NXV(XL),NYV(YT))                      MAS  355
      GO TO 820                                                         MAS  356
  800 CONTINUE                                                          MAS  357
      N8=1                                                              MAS  358
      IUP=0                                                             MAS  359
      NUMT=N(14)                                                        MAS  360
      DO 810 JJ=1,NUMT                                                  MAS  361
      ILOW=IUP+1                                                        MAS  362
      IUP=N8DY(JJ)                                                      MAS  363
      DO 770 I=ILOW,IUP                                                 MAS  364
      II=I-ILOW+1                                                       MAS  365
      X(II)=XX(I)                                                       MAS  366
  770 V(II)=YY(I)                                                       MAS  367
      CALL OFF (II,X,V,XL,XR,YB,YT)                                     MAS  368
      N8=1                                                              MAS  369
      IF (N(11).EQ.0) N8=2                                              MAS  370
      IF (II-1) 800,780,790                                             MAS  371
  780 N8=1                                                              MAS  372
  790 CALL AICRT3 (N(5),N(6),X,V,II,1,N8,1,N5D(JJ),LLT,LBX,LBY,N8,1,16.,MAS  373
     116.,2,XL,XR,2,YB,YT)                                              MAS  374
      N8=2                                                              MAS  375
  800 CONTINUE                                                          MAS  376
  810 CONTINUE                                                          MAS  377
  820 CONTINUE                                                          MAS  378
      IF (N(11).NE.2) GO TO 890                                         MAS  379
      IUP=0                                                             MAS  380
  830 ILOW=IUP+1                                                        MAS  381
      DO 840 I=ILOW,NZP                                                 MAS  382
      IUP=IUP+1                                                         MAS  383
      IF (ISPALL(I).EQ.1) GO TO 850                                     MAS  384
  840 CONTINUE                                                          MAS  385
  850 III=0                                                             MAS  386
      DO 860 I=ILOW,IUP                                                 MAS  387
      III=III+1                                                         MAS  388
      X(III)=XX(I)                                                      MAS  389
  860 V(III)=YY(I)                                                      MAS  390
      CALL OFF (III,X,V,XL,XR,YB,YT)                                    MAS  391
      IF (III.LE.1) GO TO 880                                           MAS  392
      III=III-1                                                         MAS  393
      DO 870 I=1,III                                                    MAS  394
      II=I+1                                                            MAS  395
      DO 870 KK3=1,2                                                    MAS  396
  870 CALL LINEV (NXV(X(I)),NYV(V(I)),NXV(X(II)),NYV(V(II)))            MAS  397
  880 IF (IUP.LT.NZP) GO TO 830                                         MAS  398
  890 CONTINUE                                                          MAS  399
      IF (EXTR) 930,930,900                                             MAS  400
  900 DO 910 I=1,NEXTR                                                  MAS  401
      X(I)=EXTRX(I)                                                     MAS  402
  910 V(I)=EXTRY(I)                                                     MAS  403
      II=NEXTR                                                          MAS  404
      CALL OFF (II,X,V,XL,XR,YB,YT)                                     MAS  405
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      IF (II.LE.1) GO TO 930                                              MAS  385
      III=II-1                                                            MAS  386
      DO 920 I=1,III                                                      MAS  387
      II=I+1                                                              MAS  388
  910 CALL LINEV (NXV(X(I)),NYV(Y(I)),NXV(X(II)),NYV(Y(II)))              MAS  389
  920 CONTINUE                                                            MAS  390
      IF (N(4)) 950,940,950                                               MAS  391
  940 NIC=ICYCLE-ICY(NKK)                                                 MAS  392
      II=N(13)                                                            MAS  393
      IF (NIC.GT.ICY(II)) GO TO 960                                       MAS  394
      IF (NIC.LT.ICY(NKK+1)) GO TO 290                                    MAS  395
      NKK=NKK+1                                                           MAS  396
      NIC=ICY(NKK)                                                        MAS  397
      NN10=N(10)                                                          MAS  398
      GO TO 290                                                           MAS  399
  950 TTO=TTO-TMO(NKK)                                                    MAS  400
      II=N(13)                                                            MAS  401
      IF (TTO.GT.TM(II)) GO TO 960                                        MAS  402
      IF (TTO.LT.TM(NKK+1)) GO TO 410                                     MAS  403
      NKK=NKK+1                                                           MAS  404
      TTO=TM(NKK)                                                         MAS  405
      NN10=N(10)                                                          MAS  406
      GO TO 410                                                           MAS  407
  960 NN=N(8)                                                             MAS  408
      LVW=15                                                              MAS  409
      LVH=9                                                               MAS  410
      IF (SWEND.LE.0.) GO TO 10                                           MAS  411
      NN=SWEND                                                            MAS  412
      CALL CHSIZV (LVW,LVH)                                               MAS  413
      CALL RITSTV (5*LVW+3,7*LVH+5,TABLIV)                                MAS  414
      LF1(1)=10HTHIS END                                                  MAS  415
      DO 970 I=1,NN                                                       MAS  416
      KFRMS(ITOUT-39)=KFRMS(ITOUT-38)+1                                   MAS  417
      CALL FRAMEV (3)                                                     MAS  418
      DO 970 KK3=1,2                                                      MAS  419
      CALL LINEV (80,833,973,833)                                         MAS  420
      CALL LINEV (80,833,80,205)                                          MAS  421
      CALL LINEV (80,205,973,205)                                         MAS  422
      CALL LINEV (973,833,973,205)                                        MAS  423
  970 CALL RITE2V (290,500,1000,90,1,10,1,LF1,NLAST)                      MAS  424
      GO TO 10                                                            MAS  425
C     PLOT SOMETHING VERSUS SOMETHING AS FUNCTION OF TIME                 MAS  426
C     USER MUST SUPPLY SUBROUTINE TIMEVA                                  MAS  427
  980 READ 1160, LLT                                                      MAS  428
      PRINT 1060, LLT                                                     MAS  429
      II=0                                                                MAS  430
      ICHF=1                                                              MAS  431
      GO TO 300                                                           MAS  432
C     EOF                                                                 MAS  433
  990 CONTINUE                                                            MAS  434
      GO TO 1010                                                          MAS  435
 1000 PRINT 1120, NCOUNT,ICYCLE,TIME                                      MAS  436
      IF (TIME.LT.TM(1)) GO TO 300                                        MAS  437
      II=II+1                                                             MAS  438
      CALL TIMEVA (II,NZ,NZP,ICYCLE,NCOUNT,TIME,XX,YY)                    MAS  439
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      IF (TIME.LT.TMD(1)) GO TO 300                                     MAS  441
 1010 NZP=II                                                            MAS  442
      N(13)=2                                                           MAS  443
      TM(2)=-1.                                                         MAS  444
      TTC=TMD(2)=NFRAME=N(4)=NKK=1                                      MAS  445
      IF (N(11).EQ.2) N(11)=0                                           MAS  446
      GO TO 470                                                         MAS  447
 1020 IF (NOFTH.EQ.0) GO TO 1030                                        MAS  448
      CALL ENTFLM (-40)                                                 MAS  449
      CALL EXTFLM (0)                                                   MAS  450
 1030 IF (NOFTF.EQ.0) GO TO 1040                                        MAS  451
      CALL ENTFLM (-39)                                                 MAS  452
      CALL EXTFLM (0)                                                   MAS  453
 1040 I=40                                                              MAS  454
      II=39                                                             MAS  455
      PRINT 1290, I,KFRMS(2),II,KFRMS(1)                               MAS  456
C                                                                       MAS  457
 1050 FORMAT (///,36H  USER MUST SUPPLY SUBROUTINE TIMEVA)              MAS  458
 1060 FORMAT (11H1 TIME PLOT,//,15H  TOF LABEL IS ,8A10)                MAS  459
 1070 FORMAT (8H0 SCALX=,E12.5,30X,6HSCALY=,E12.5,/,8H0 OLABX=,E12.5,30(MAS  460
     1,6HOLABY=,E12.5,/,7H0 EXTR=,E12.5)                                MAS  461
 1080 FORMAT (2E10.3)                                                   MAS  462
 1090 FORMAT (24H1 FIXED INPUT PLOT CURVE,//,(,8H  EXTRX(,I2,2H)=,E12.4,MAS  463
     15X,6HEXTRY(,I2,2H)=,E12.4))                                       MAS  464
 1100 FORMAT (13A6)                                                     MAS  465
 1110 FORMAT (13H0 EOF ON TAPE)                                         MAS  466
 1120 FORMAT (21H0 TAPE READ   RECORD=,I7,5X,6HCYCLE=,I7,5X,5HTIME=,E12.MAS  467
     14)                                                                MAS  468
 1130 FORMAT (7H0 FRAME,I7,3X,5HTIME=,E11.4,4X,3HIC=,I7,4X,3HNC=,I7,4X,3MAS  469
     1HFC=,E12.4)                                                       MAS  470
 1140 FORMAT (16I5)                                                     MAS  471
 1150 FORMAT (8E10.3)                                                   MAS  472
 1160 FORMAT (8A10)                                                     MAS  473
 1170 FORMAT (32H1 MASPLT   A CHARTO PLOT PROGRAM,/,(2X,3A10))          MAS  474
 1180 FORMAT (/,8H  LABEL(,I1,6H) IS (,3A10,1H))                        MAS  475
 1190 FORMAT (///,16H  OUTPUT UNIT IS,I3)                               MAS  476
 1200 FORMAT (///,(,4H  N(,I2,2H)=,I6))                                 MAS  477
 1210 FORMAT (8(I5,A1,4X))                                              MAS  478
 1220 FORMAT (///,(,7H  NBDY(,I2,2H)=,I5,5X,4HNSD(,I2,2H)=,A2))         MAS  479
 1230 FORMAT (2I10,6E10.3)                                              MAS  480
 1240 FORMAT (23H1 CHARTO TAPE LABEL IS ,13A6)                          MAS  481
 1250 FORMAT (///,6H  ICY(,I2,2H)=,I10,30X,5HICYJ(,I2,2H)=,I10,/,5H  TM(,MAS  482
     1I2,2H)=,E15.6,25X,4HTMD(,I2,2H)=,E15.8)                           MAS  483
 1260 FORMAT (7H  XMIN(,I2,2H)=,E15.8,24X,5HXMAX(,I2,2H)=,E15.8,/,7H  YMMAS  484
     1IN(,I2,2H)=,E15.8,24X,5HYMAX(,I2,2H)=,E15.8,/,11H  X LABEL (,5A10,MAS  485
     21H),/,11H  Y LABEL (,5A10,1H),/)                                  MAS  486
 1270 FORMAT (///,9H  TSTART=,E15.6,26X,6HTSTOP=,E15.8)                 MAS  487
 1280 FORMAT (2X,5HTIME=,E9.2,5X,6HCYCLE=,F9.1)                         MAS  488
 1290 FORMAT (///,44H  THE TOTAL NUMBER OF SC 4020 FRAMES IN FILE,I3,3H IMAS  489
     1S,I6)                                                             MAS  490
      END                                                               MAS  491
```

```
      SUBROUTINE OFF (I,X,Y,XL,XR,YB,YT)                                MAS
      DIMENSION X(1), Y(1)                                              MAS
      M=0                                                               MAS
      DO 10 J=1,I                                                       MAS
      IF (X(J).GT.XR) GO TO 10                                          MAS
      IF (X(J).LT.XL) GO TO 10                                          MAS
      IF (Y(J).GT.YT) GO TO 10                                          MAS
      IF (Y(J).LT.YB) GO TO 10                                          MAS
      M=M+1                                                             MAS
      X(M)=X(J)                                                         MAS
      Y(M)=Y(J)                                                         MAS
   10 CONTINUE                                                          MAS
      I=M                                                               MAS
      RETURN                                                            MAS
      END                                                               MAS
```

```
      SUBROUTINE SORT (K,NUM,A)                                          MAS   507
      COMMON X(501),V(501),XL(501),VL(501),ISPALL(501),T(501),D(501),P(5MAS   508
     1)1),Q(501),E(501),S(501),SXD(501),SZD(501),DRATIO(501)             MAS   509
      COMMON /SLC/ SCALX,SCALY,SCALL                                     MAS   510
      DIMENSION A(1)                                                     MAS   511
      NK=NUM-1                                                           MAS   512
      GO TO (10,30,50,70,90,110,130,150,170,190,210,230,250,270,290,310,MAS   513
     1330,350,370,410,430,450), K                                        MAS   514
   10 DO 20 I=1,NUM                                                      MAS   515
   20 A(I)=I                                                             MAS   516
      GO TO 470                                                          MAS   517
   30 DO 40 I=1,NUM                                                      MAS   518
   40 A(I)=X(I)                                                          MAS   519
      GO TO 470                                                          MAS   520
   50 DO 60 I=1,NK                                                       MAS   521
      RR=X(I+1)                                                          MAS   522
      IF (ISPALL(I).EQ.1) RR=XL(I)                                       MAS   523
   60 A(I)=.5*(X(I)+RR)                                                  MAS   524
      GO TO 460                                                          MAS   525
   70 DO 80 I=1,NUM                                                      MAS   526
   80 A(I)=V(I)                                                          MAS   527
      GO TO 470                                                          MAS   528
   90 DO 100 I=1,NK                                                      MAS   529
      RR=V(I+1)                                                          MAS   530
      IF (ISPALL(I).EQ.1) RR=VL(I)                                       MAS   531
  100 A(I)=.5*(V(I)+RR)                                                  MAS   532
      GO TO 460                                                          MAS   533
  110 DO 120 I=1,NK                                                      MAS   534
  120 A(I)=T(I)                                                          MAS   535
      GO TO 460                                                          MAS   536
  130 DO 140 I=1,NK                                                      MAS   537
  140 A(I)=D(I)                                                          MAS   538
      GO TO 460                                                          MAS   539
  150 DO 160 I=1,NK                                                      MAS   540
  160 A(I)=P(I)                                                          MAS   541
      GO TO 460                                                          MAS   542
  170 DO 180 I=1,NK                                                      MAS   543
  180 A(I)=P(I)-SXD(I)                                                   MAS   544
      GO TO 460                                                          MAS   545
  190 DO 200 I=1,NK                                                      MAS   546
  200 A(I)=P(I)+Q(I)                                                     MAS   547
      GO TO 460                                                          MAS   548
  210 DO 220 I=1,NK                                                      MAS   549
  220 A(I)=P(I)+Q(I)-SXD(I)                                              MAS   550
      GO TO 460                                                          MAS   551
  230 DO 240 I=1,NK                                                      MAS   552
  240 A(I)=SXD(I)                                                        MAS   553
      GO TO 460                                                          MAS   554
  250 DO 260 I=1,NK                                                      MAS   555
  260 A(I)=P(I)-SZD(I)                                                   MAS   556
      GO TO 460                                                          MAS   557
  270 DO 280 I=1,NK                                                      MAS   558
  280 A(I)=P(I)+SXD(I)+SZD(I)                                            MAS   559
      GO TO 460                                                          MAS   560
  290 DO 300 I=1,NK                                                      MAS   561
```

```
300 A(I)=SZO(I)                                                    MAS  562
    GO TO 460                                                      MAS  563
310 DO 320 I=1,NK                                                  MAS  564
320 A(I)=S(I)                                                      MAS  565
    GO TO 460                                                      MAS  566
330 DO 340 I=1,NK                                                  MAS  567
340 A(I)=E(I)                                                      MAS  568
    GO TO 460                                                      MAS  569
350 DO 360 I=1,NK                                                  MAS  570
    IF (DRATIO(I)..T.1.) DRATIO(I)=1.                              MAS  571
360 A(I)=DRATIO(I)                                                 MAS  572
    GO TO 460                                                      MAS  573
370 DO 400 I=1,NK                                                  MAS  574
    IF (ISPALL(I).EQ.1) GO TO 380                                  MAS  575
    RR=X(I+1)                                                      MAS  576
    VR=V(I+1)                                                      MAS  577
    GO TO 390                                                      MAS  578
380 RR=XL(I)                                                       MAS  579
    VR=VL(I)                                                       MAS  580
390 A(I)=.5*D(I)*(VR+V(I))*(X(I)-RR)                               MAS  581
    IF (I.GT.1) A(I)=A(I)+A(I-1)                                   MAS  582
400 CONTINUE                                                       MAS  583
    GO TO 460                                                      MAS  584
410 VR=0.                                                          MAS  585
    DO 420 I=1,NK                                                  MAS  586
    RR=X(I+1)                                                      MAS  587
    IF (ISPALL(I).EQ.1) RR=XL(I)                                   MAS  588
    RR=J(I)*(X(I)-RR)                                              MAS  589
    A(I)=.5*(RR+VR)                                                MAS  590
    VR=RR                                                          MAS  591
    IF (I.GT.1) A(I)=A(I)+A(I-1)                                   MAS  592
420 CONTINUE                                                       MAS  593
    GO TO 460                                                      MAS  594
430 DO 440 I=1,NK                                                  MAS  595
    IF (DRATIO(I)..T.1.) DRATIO(I)=1.                              MAS  596
440 A(I)=DRATIO(I)*D(I)                                            MAS  597
    GO TO 460                                                      MAS  598
450 STOP 1010                                                      MAS  599
460 A(NUM)=A(NK)                                                   MAS  600
470 CONTINUE                                                       MAS  601
    IF (SCALL.EQ.1.) RETURN                                        MAS  602
    DO 480 I=1,NUM                                                 MAS  603
480 A(I)=SCALL*A(I)                                                MAS  604
    RETURN                                                         MAS  605
    END                                                            MAS  606
```

```
      SUBROUTINE LSORT (K,LAB)                                          MAS   607
      DIMENSION LAB(5)                                                  MAS   608
      GO TO (10,20,30,40,50,60,70,80,90,100,110,120,130,140,150,160,170,MAS   609
     1180,190,200,210), K                                               MAS   610
   10 ENCODE (50,230,LAB)                                               MAS   611
      GO TO 220                                                         MAS   612
   20 ENCODE (50,240,LAB)                                               MAS   613
      GO TO 220                                                         MAS   614
   30 ENCODE (50,250,LAB)                                               MAS   615
      GO TO 220                                                         MAS   616
   40 ENCODE (50,260,LAB)                                               MAS   617
      GO TO 220                                                         MAS   618
   50 ENCODE (50,270,LAB)                                               MAS   619
      GO TO 220                                                         MAS   620
   60 ENCODE (50,280,LAB)                                               MAS   621
      GO TO 220                                                         MAS   622
   70 ENCODE (50,290,LAB)                                               MAS   623
      GO TO 220                                                         MAS   624
   80 ENCODE (50,300,LAB)                                               MAS   625
      GO TO 220                                                         MAS   626
   90 ENCODE (50,310,LAB)                                               MAS   627
      GO TO 220                                                         MAS   628
  100 ENCODE (50,320,LAB)                                               MAS   629
      GO TO 220                                                         MAS   630
  110 ENCODE (50,330,LAB)                                               MAS   631
      GO TO 220                                                         MAS   632
  120 ENCODE (50,340,LAB)                                               MAS   633
      GO TO 220                                                         MAS   634
  130 ENCODE (50,350,LAB)                                               MAS   635
      GO TO 220                                                         MAS   636
  140 ENCODE (50,360,LAB)                                               MAS   637
      GO TO 220                                                         MAS   638
  150 ENCODE (50,370,LAB)                                               MAS   639
      GO TO 220                                                         MAS   640
  160 ENCODE (50,380,LAB)                                               MAS   641
      GO TO 220                                                         MAS   642
  170 ENCODE (50,390,LAB)                                               MAS   643
      GO TO 220                                                         MAS   644
  180 ENCODE (50,400,LAB)                                               MAS   645
      GO TO 220                                                         MAS   646
  190 ENCODE (50,410,LAB)                                               MAS   647
      GO TO 220                                                         MAS   648
  200 ENCODE (50,420,LAB)                                               MAS   649
      GO TO 220                                                         MAS   650
  210 ENCODE (50,430,LAB)                                               MAS   651
  220 RETURN                                                            MAS   652
C                                                                       MAS   653
  230 FORMAT (50H                ZONE  NUMBER                    )      MAS   654
  240 FORMAT (50H              POSITION  (CM)                    )      MAS   655
  250 FORMAT (50H              POSITION  (CM)                    )      MAS   656
  260 FORMAT (50H            VELOCITY  (CM/SEC)                  )      MAS   657
  270 FORMAT (50H            VELOCITY  (CM/SEC)                  )      MAS   658
  280 FORMAT (50H             TEMPERATURE (EV)                   )      MAS   659
  290 FORMAT (50H             DENSITY  (GM/CC)                   )      MAS   660
  300 FORMAT (50H           PRESSURE (DYNES/CM2)                 )      MAS   661
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```
310 FORMAT (50H                STRESS X (DYNES/CM2)                )     MAS  662
320 FORMAT (50H              PRESSURE + Q (DYNES/CM2)              )     MAS  663
330 FORMAT (50H              STRESS X + Q (DYNES/CM2)              )     MAS  664
340 FORMAT (50H           DEVIATOR STRESS X  (DYNES/CM2)           )     MAS  665
350 FORMAT (50H                STRESS Z (DYNES/CM2)                )     MAS  666
360 FORMAT (50H                STRESS Y (DYNES/CM2)                )     MAS  667
370 FORMAT (50H           DEVIATOR STRESS Z  (DYNES/CM2)           )     MAS  668
380 FORMAT (50H                ENTROPY (ERGS/GM-EV)                )     MAS  669
390 FORMAT (50H                  ENERGY (ERGS/GM)                  )     MAS  670
400 FORMAT (50H                  DISTENTION RATIO                  )     MAS  671
410 FORMAT (50H                  MOMENTUM  (TAPS)                  )     MAS  672
420 FORMAT (50H                  MASS DEPTH  (GM)                  )     MAS   73
430 FORMAT (50H               SOLID DENSITY  (GM/CC)               )     MAS  674
    END                                                                   MAS  675
```

```
      SUBROUTINE TIMEVA (II,NZ,NZP,ICYCLE,NCOUNT,TIME,XX,YY)                MAS  675
C     DETERMINES VARIABLES FOR TIME PLOTS                                   MAS  677
C     USER MUST SUPPLY ROUTINE                                              MAS  678
C     SET XX(II) TO THE X VALUE AND YY(II) TO THE Y VALUE.                  MAS  679
C     SCALX AND SCALY MAY BE USED FOR INPUT PARAMETERS.                     MAS  680
      COMMON X(501),V(501),XL(501),VL(501),ISPALL(501),T(501),D(501),P(5MAS  681
     101),Q(501),E(501),S(501),SXD(501),SZD(501),DRATIO(501)               MAS  682
      DIMENSION XX(1), YY(1)                                               MAS  683
      DATA MAXZONE/500/                                                    MAS  684
      COMMON /SLC/ SCALX,SCALY,SCALL                                       MAS  685
C     *    *    *    *    *    *    *    *    *    *    *    *    *    *MAS  686
      IF (II.GT.MAXZONE) GO TO 40                                          MAS  687
      IF (SCALX.GT.0.) GO TO 60                                            MAS  688
C     THIS IS AN EXAMPLE WHICH DETERMINES PEAK STRESS X VERSUS X           MAS  689
C     SET SCALX TO A NEGATIVE NUMBER FOR THIS SET OF VARIABLES             MAS  690
      PEAK=0.                                                              MAS  691
      DO 20 I=1,NZ                                                         MAS  692
      STRESS=P(I)-SXD(I)                                                   MAS  693
      IF (STRESS.LE.PEAK) GO TO 20                                         MAS  694
      PEAK=STRESS                                                          MAS  695
      IF (ISPALL(I).EQ.0) GO TO 10                                         MAS  696
      XX(II)=.5*(X(I)+XL(I))                                               MAS  697
      GO TO 20                                                             MAS  698
   10 XX(II)=.5*(X(I)+X(I+1))                                              MAS  699
   20 CONTINUE                                                             MAS  700
      IF (PEAK-1.E6) 40,40,30                                              MAS  701
   30 YY(II)=PEAK                                                          MAS  702
      GO TO 50                                                             MAS  703
   40 II=II-1                                                              MAS  704
   50 CONTINUE                                                             MAS  705
      RETURN                                                               MAS  706
C                                                                          MAS  707
C     THIS IS AN EXAMPLE WHICH PLOTS THE STRESS IN A GIVEN ZONE            MAS  708
C     AGAINST TIME.  SET SCALX TO THE ZONE NUMBER.                         MAS  709
   60 I=SCALX                                                              MAS  710
      XX(II)=TIME                                                          MAS  711
      YY(II)=P(I)-SXD(I)                                                   MAS  712
C     *    *    *    *    *    *    *    *    *    *    *    *    *    *MAS  713
      RETURN                                                               MAS  714
      END                                                                  MAS  715
```

APPENDIX B

ZCHART Fortran Listing

FUN Compiler Version

```
      PROGRAM ZCHART(INPUT,OUTPUT,PUNCH,INFILE,TAPE21=INFILE,TAPE22=PUNCZCH     1
     1H)                                                                ZCH     2
C     ADJUST DIMENSIONS IN CHART0 AND MASPLT                           ZCH     3
      COMMON /Z/ KSTATS(5)                                             ZCH     4
      DATA KSTATS/1HO,9,10H ZONE DECK,10H CREATED  ,1H /               ZCH     5
      DIMENSION IOUTC(3), IOUTM(3)                                     ZCH     6
      DATA IOUTC,IOUTM/6*0/                                            ZCH     7
C     MAX=MAXZONE                                                      ZCH     8
C     IFLAGC=1, NOTHING                                                ZCH     9
C     IFLAGC=2, WRITE UPDATE CARDS ON INFILE                           ZCH    10
C     IFLAGC=3, PUNCH UPDATE CARDS                                     ZCH    11
C     IFLAGC=4, PUNCH AND WRITE ON INFILE                              ZCH    12
C     IFLAGC.LT.0, LIST UPDATE CARDS                                   ZCH    13
      READ 21, MAX,IFLAGC,IFLAGM                                       ZCH    14
      IF (MAX.LT.100) MAX=110                                          ZCH    15
      PRINT 21, MAX,IFLAGC,IFLAGM                                      ZCH    16
      CALL MOVLOC (X,I,J)                                              ZCH    17
      KSTATS(1)=J                                                      ZCH    18
      KSTATS(2)=MAX                                                    ZCH    19
      IF (IFLAGC.LT.0) IOUTC(3)=3                                      ZCH    20
      IFLAGC=IABS(IFLAGC)                                              ZCH    21
      IF (IFLAGC.EQ.1.OR.IFLAGC.EQ.3) IOUTC(1)=1                       ZCH    22
      IF (IFLAGC.EQ.2.OR.IFLAGC.EQ.3) IOUTC(2)=2                       ZCH    23
      IF (IFLAGM.LT.0) IOUTM(3)=3                                      ZCH    24
      IFLAGM=IABS(IFLAGM)                                              ZCH    25
      IF (IFLAGM.EQ.1.OR.IFLAGM.EQ.3) IOUTM(1)=1                       ZCH    26
      IF (IFLAGM.EQ.2.OR.IFLAGM.EQ.3) IOUTM(2)=2                       ZCH    27
      REWIND 21                                                        ZCH    28
      CALL ZCHRT (MAX,IOUTC)                                           ZCH    29
      CALL ZMASP (MAX,IOUTM)                                           ZCH    30
      IF (IOUTC(1)+IOUTM(1).LE.0) GO TO 10                             ZCH    31
      END FILE 21                                                      ZCH    32
      REWIND 21                                                        ZCH    33
   10 PRINT 40                                                         ZCH    34
C                                                                      ZCH    35
   21 FORMAT (8I6)                                                     ZCH    36
   30 FORMAT (15H1 ZCHART REZONE,////,10H0 MAXZONE=,I5,/,4H0 IFLAGC=,I5,ZCH    37
     1/,3H0 IFLAGM=,I5)                                               ZCH    38
   40 FORMAT (////,25H0  ZCHART UPDATE COMPLETE)                       ZCH    39
      END                                                              ZCH    40
```

```
      SUBROUTINE ZCHRT (MAX,IOUT)                                                ZCH    41
      COMMON /D/ KDATS(5)                                                        ZCH    42
      DIMENSION KAB(18), KEE(4), IOUT(3)                                         ZCH    43
      DATA KEE,NDATA,NEOS/4H0043,4H2267,4H2611,4H3099,4H0057,4H3112/             ZCH    44
      DATA KAB/4H0024,4H003B,4H2268,4H2242,4H2480,4H2494,4H2592,4H2606,4ZCH    45
     1H2664,4H2678,4H2417,4H2931,4H2992,4H3006,4H3040,4H3094,4H6736,4H67ZCH    46
     2D/                                                                         ZCH    47
      KK=0                                                                       ZCH    48
      MAP=MAX+1                                                                  ZCH    49
      KOMMONA=5*MAX+46                                                           ZCH    50
      KOMMONB=33*MAX+641                                                         ZCH    51
      NNNIZE=MAX+188                                                             ZCH    52
      DO 80 KJ=1,3                                                               ZCH    53
      IJ=IOUT(KJ)                                                                ZCH    54
      IF (IJ) 80,50,10                                                           ZCH    55
   10 IF (IJ-2) 20,20,50                                                         ZCH    56
   20 IJ=IJ+20                                                                   ZCH    57
      WRITE (IJ,130)                                                             ZCH    58
      WRITE (IJ,310)                                                             ZCH    59
      WRITE (IJ,330) KDATS                                                       ZCH    60
      DO 30 K=1,17,2                                                             ZCH    61
      KK=K+1                                                                     ZCH    62
      WRITE (IJ,150) KAB(K),KAB(KK)                                              ZCH    63
      WRITE (IJ,190) MAX,MAX,MAX,MAX,MAP,MAX                                     ZCH    64
   30 WRITE (IJ,210) (MAX,I=1,6),(MAP,I=1,5),(MAX,I=1,3),MAP,(MAX,I=1,5)ZCH    65
     1,MAP,(MAX,I=1,3),MAP,MAX,MAX                                               ZCH    66
      DO 40 K=1,4                                                                ZCH    67
      WRITE (IJ,170) KEE(K)                                                      ZCH    68
   40 WRITE (IJ,230) MAX                                                         ZCH    69
      WRITE (IJ,170) NDATA                                                       ZCH    70
      WRITE (IJ,250) KOMMONA,KOMMONB,MAX                                         ZCH    71
      WRITE (IJ,170) NEOS                                                        ZCH    72
      WRITE (IJ,270) NNNIZE,MAX                                                  ZCH    73
      GO TO 80                                                                   ZCH    74
   50 PRINT 140                                                                  ZCH    75
      PRINT 320                                                                  ZCH    76
      PRINT 340, KDATS                                                           ZCH    77
      DO 60 K=1,17,2                                                             ZCH    78
      KK=K+1                                                                     ZCH    79
      PRINT 160, KAB(K),KAB(KK)                                                  ZCH    80
      PRINT 200, MAX,MAX,MAX,MAX,MAP,MAX                                         ZCH    81
   60 PRINT 220, (MAX,I=1,6),(MAP,I=1,5),(MAX,I=1,3),MAP,(MAX,I=1,5),MAPZCH    82
     1,(MAX,I=1,3),MAP,MAX,MAX                                                   ZCH    83
      DO 70 K=1,4                                                                ZCH    84
      PRINT 180, KEE(K)                                                          ZCH    85
   70 PRINT 240, MAX                                                             ZCH    86
      PRINT 180, NDATA                                                           ZCH    87
      PRINT 260, KOMMONA,KOMMONB,MAX                                             ZCH    88
      PRINT 180, NEOS                                                            ZCH    89
      PRINT 280, NNNIZE,MAX                                                      ZCH    90
   80 CONTINUE                                                                   ZCH    91
      IF (KK.EQ.0) RETURN                                                        ZCH    92
      KK=40*MAX+49536                                                            ZCH    93
      IF (KK.LT.56704) KK=56704                                                  ZCH    94
      PRINT 290, KK,KK                                                           ZCH    95
```

```
      KK=12*MAX+6                                                       ZCH   96
      DO 120 I=1,21                                                     ZCH   97
      IJ=I-1                                                            ZCH   98
      IF (IJ-2) 110,30,100                                              ZCH   99
   30 KK=KK+6*F1                                                        ZCH  100
  101 KK=KK+6351                                                        ZCH  101
  110 PRINT 300, IJ,KK,KK                                               ZCH  102
  120 CONTINUE                                                          ZCH  103
      RETURN                                                            ZCH  104
C                                                                       ZCH  105
  130 FORMAT (11H*IDENT,ZCH2)                                           ZCH  106
  140 FORMAT (12H1*IDENT,ZCH2)                                          ZCH  107
  150 FORMAT (15H*DELETE,CHARTD.,A4,3H,CHARTD.,A4)                      ZCH  108
  160 FORMAT (15H *DELETE,CHARTD.,A4,3H,CHARTD.,A4)                     ZCH  109
  170 FORMAT (15H*DELETE,CHARTD.,A4)                                    ZCH  110
  180 FORMAT (15H *DELETE,CHARTD.,A4)                                   ZCH  111
  190 FORMAT (6X,27HCOMMON /A/ JBND(21),ITRIED(,I4,4H),IZPTL(,I4,8H),IZPZCH  112
     1PL(,I4,2H),,/,6X,8H1KPHASE(,I4,7H),KACT(,I4,9H),ISPALL(,I4,24H),NSZCH  113
     2PALL,DDS,IBS,ICYCLE,,/,6X,66H2IDTMAX,IDTMIN,JPRIN,NCOUNT,NMTRLS,NZZCH  114
     3N,NZ,NZP,NOJMP,NBPRES,NOSOUR,,/,6X,54H3NACTION,NORAD,IGM,NRADCK,NOZCH  115
     4VIS,IMPEXP,IMPA,KPO4,NOHYD)                                       ZCH  116
  200 FORMAT (7X,27HCOMMON /A/ JBND(21),ITRIED(,I4,4H),IZPTL(,I4,8H),IZPZCH  117
     1PL(,I4,2H),,/,6X,8H1KPHASE(,I4,7H),KACT(,I4,9H),ISPALL(,I4,24H),NSZCH  118
     2PALL,DDS,IBS,ICYCLE,,/,6X,66H2IDTMAX,IDTMIN,JPRIN,NCOUNT,NMTRLS,NZZCH  119
     3N,NZ,NZP,NOJMP,NBPRES,NOSOUR,,/,6X,54H3NACTION,NORAD,IGM,NRADCK,NOZCH  120
     4VIS,IMPEXP,IMPA,KPO4,NOHYD)                                       ZCH  121
  210 FORMAT (6X,9HCOMMON D(,I4,5H),DD(,I4,4H),T(,I4,5H),TO(,I4,4H),P(,IZCH  122
     14,5H),XM(,I4,2H),,/,6X,5H1XM2(,I4,4H),X(,I4,5H),XO(,I4,4H),V(,I4,5ZCH  123
     2H),VO(,I4,5H),XL(,I4,5H),XLO(,I4,2H),,/,6X,4H2VL(,I4,6H),VLO(,I4,7ZCH  124
     3H),CSOO(,I4,4H),Q(,I4,6H),SXO(,I4,6H),SZO(,I4,2H),,/,6X,7H3EPATH(,ZCH  125
     4I4,7H),FLUX(,I4,4H),E(,I4,7H),PPPT(,I4,9H),PEPTIN(,I4,2H),,/,6X,8HZCH  126
     5ASPALL(,I4,5H),SO(,I4,7H),TEMP(,I4,8H),TSAVE(,I4,8H),PSAVE(,I4,2HZCH  127
     6),,/,6X,7H5ESAVE(,I4,3H),TEMPR(,I4,29H),TMSPALL(20),DT,DTMAX,DTMINZCH  128
     7,,/,6X,53H6DTTEMP,DTRAD,TIME,TPN,TEND,DTRADT,BL,BQ,DTIMEP(25),DLTTZCH  129
     8MX(25),,/,6X,67H7DTMINN(25),TIMEP(25),TDTMINN(25),TIMES(25),WORKF,ZCH  130
     9WORKB,END,ESOURS,/,6X,63H8TBPRES(25),PINNER(25),POUTER(25),XMATUP(ZCH  131
     $21),DTDS,DTP,TITH(25),,/,6X,62H9TEINTH(25),TEOUTH(25),FLINF,FLINFOZCH  132
     $,FLINB,FLINBO,FLOUF,FLOUFO,,/,6X,67HAFLOUB,FLOUBO,RADEB,RADEF,SCRAZCH  133
     $OF,SCRADB,SPLA(20),SPLB(20),SPLC(20),,/,6X,154HSPLD(20),ENTSV(,I4,ZCH  134
     $4H),TMOV(10),DTMOV(10),TRADOFF,SWEP,YIELD(20,8),,/,5X,8HCORATIO(,ZCH  135
     $I4,7H),SWPOP)                                                     ZCH  136
  220 FORMAT (7X,9HCOMMON D(,I4,5H),DD(,I4,4H),T(,I4,5H),TO(,I4,4H),P(,IZCH  137
     14,5H),XM(,I4,2H),,/,6X,5H1XM2(,I4,4H),X(,I4,5H),XO(,I4,4H),V(,I4,5ZCH  138
     2H),VO(,I4,5H),XL(,I4,5H),XLO(,I4,2H),,/,6X,4H2VL(,I4,6H),VLO(,I4,7ZCH  139
     3H),CSOO(,I4,4H),Q(,I4,6H),SXO(,I4,6H),SZO(,I4,2H),,/,6X,7H3EPATH(,ZCH  140
     4I4,7H),FLUX(,I4,4H),E(,I4,7H),PPPT(,I4,9H),PEPTIN(,I4,2H),,/,6X,8HZCH  141
     5ASPALL(,I4,5H),SO(,I4,7H),TEMP(,I4,8H),TSAVE(,I4,8H),PSAVE(,I4,2HZCH  142
     6),,/,6X,7H5ESAVE(,I4,3H),TEMPR(,I4,29H),TMSPALL(20),DT,DTMAX,DTMINZCH  143
     7,,/,6X,53H6DTTEMP,DTRAD,TIME,TPN,TEND,DTRADT,BL,BQ,DTIMEP(25),DLTTZCH  144
     8MX(25),,/,6X,67H7DTMINN(25),TIMEP(25),TDTMINN(25),TIMES(25),WORKF,ZCH  145
     9WORKB,END,ESOURS,/,6X,63H8TBPRES(25),PINNER(25),POUTER(25),XMATUP(ZCH  146
     $21),DTDS,DTP,TITH(25),,/,6X,62H9TEINTH(25),TEOUTH(25),FLINF,FLINFOZCH  147
     $,FLINB,FLINBO,FLOUF,FLOUFO,,/,6X,67HAFLOUB,FLOUBO,RADEB,RADEF,SCRAZCH  148
     $OF,SCRADB,SPLA(20),SPLB(20),SPLC(20),,/,6X,154HSPLD(20),ENTSV(,I4,ZCH  149
     $4H),TMOV(10),DTMOV(10),TRADOFF,SWEP,YIELD(20,8),,/,6X,8HCORATIO(,ZCH  150
```

```
     3I4,7H),3H/OR)                                                    ZOH  151
230  FORMAT (6X,51HCOMMON /E/IZETL(21),IZERL(21),ITL(21),IRL(21),IEOS(,ZOH  152
     1I4,11H),IEOSS(20))                                               ZOH  153
240  FORMAT (7X,51HCOMMON /E/IZETL(21),IZERL(21),ITL(21),IRL(21),IEOS(,ZOH  154
     1I4,11H),IEOSS(20))                                               ZOH  155
250  FORMAT (6X,36HDATA KOMMONA,KOMMONB,MAXZONE,MAXNMT/,3(I6,1H,),3H/3/ZOH  156
     1)                                                                ZOH  157
260  FORMAT (7X,36HDATA KOMMONA,KOMMONB,MAXZONE,MAXNMT/,3(I6,1H,),3H/3/ZOH  158
     1)                                                                ZOH  159
270  FORMAT (6X,37HDATA NMNIZE,NNNTTB,NISEOS,NECSA,IEOS/,I4,13H,7751,1,ZOH  160
     16451,,I4,3H*0/)                                                  ZOH  161
280  FORMAT (7X,37HDATA NMNIZE,NNNTTB,NISEOS,NECSA,IEOS/,I4,13H,7751,1,ZOH  162
     16451,,I4,3H*0/)                                                  ZOH  163
290  FORMAT (1HL,4X,27HCHARTD UPDATE DECK COMPLETE,//,5X,19HREQUIRED ST/ZOH  164
     1ORAGE I5,I4,12H (DECIMAL), .09,24H (OCTAL)  CENTRAL MEMORY.//,10X,ZOH  165
     244HECS,3X,11HECS STORAGE,/,3X,8H(TABLES),4X,15HDECIMAL   OCTAL)   ZOH  166
300  FORMAT (10X,I3,I13,2X,09)                                         ZOH  167
310  FORMAT (16H*INSERT,CHARTD,5)                                      ZOH  168
320  FORMAT (17H *INSERT,CHARTD,3)                                     ZOH  169
330  FORMAT (A1,I9,3A10)                                               ZOH  170
340  FORMAT (1X,A1,I9,3A10)                                            ZOH  171
     END)                                                              ZOH  172
```

```
      SUBROUTINE ZMASP (MAX,IOUT)                                       ZCH  173
      COMMON /BK/ KDATS(6)                                              ZCH  174
      DIMENSION IOUT(3), KPL(8)                                         ZCH  175
      DATA KPL/3H004,3H005,3H509,3H510,3H682,3H683,3H007,3H685/         ZCH  176
      KK=0                                                              ZCH  177
      MX=MAX+1                                                          ZCH  178
      DO 40 JK=1,3                                                      ZCH  179
      IK=IOUT(JK)                                                       ZCH  180
      IF (IK) 50,50,10                                                  ZCH  181
   10 IF (IK-2) 20,20,40                                                ZCH  182
   20 IK=IK+20                                                          ZCH  183
      WRITE (IK,70)                                                     ZCH  184
      WRITE (IK,200)                                                    ZCH  185
      WRITE (IK,220) KDATS                                              ZCH  186
      DO 30 K=1,5,2                                                     ZCH  187
      KK=K+1                                                            ZCH  188
      WRITE (IK,90) KPL(K),KPL(KK)                                      ZCH  189
   30 WRITE (IK,130) (MX,I=1,14)                                        ZCH  190
      WRITE (IK,110) KPL(7)                                             ZCH  191
      WRITE (IK,150) (MX,I=1,6)                                         ZCH  192
      WRITE (IK,117) KPL(8)                                             ZCH  193
      WRITE (IK,170) MAX                                                ZCH  194
      GO TO 50                                                          ZCH  195
   40 PRINT 80                                                          ZCH  196
      PRINT 210                                                         ZCH  197
      PRINT 230, KDATS                                                  ZCH  198
      DO 60 K=1,5,2                                                     ZCH  199
      KK=K+1                                                            ZCH  200
      PRINT 100, KPL(K),KPL(KK)                                         ZCH  201
   50 PRINT 140, (MX,I=1,14)                                            ZCH  202
      PRINT 120, KPL(7)                                                 ZCH  203
      PRINT 160, (MX,I=1,6)                                             ZCH  204
      PRINT 120, KPL(8)                                                 ZCH  205
      PRINT 180, MAX                                                    ZCH  206
   60 CONTINUE                                                          ZCH  207
      IK=22748+20*MX                                                    ZCH  208
      IF (IK.LT.27136) IK=27136                                         ZCH  209
      IF (KK.GT.0) PRINT 190, IK,IK                                     ZCH  210
      RETURN                                                            ZCH  211
C                                                                       ZCH  212
   70 FORMAT (12H*IDENT,ZMASP)                                          ZCH  213
   80 FORMAT (1H1,/,1X,12H*IDENT,ZMASP)                                 ZCH  214
   90 FORMAT (15H*DELETE,MASPLT.,A3,8H,MASPLT.,A3)                      ZCH  215
  100 FORMAT (1X,15H*DELETE,MASPLT.,A3,8H,MASPLT.,A3)                   ZCH  216
  110 FORMAT (15H*DELETE,MASPLT.,A3)                                    ZCH  217
  120 FORMAT (1X,15H*DELETE,MASPLT.,A3)                                 ZCH  218
  130 FORMAT (6X,9HCOMMON X(,I4,4H),V(,I4,5H),XL(,I4,5H),VL(,I4,9H),ISPAZCH  219
     1LL(,I4,4H),T(,I4,2H),/,5X,3H1D(,I4,4H),P(,I4,4H),Q(,I4,4H),E(,I4,4ZCH  220
     2H),S(,I4,6H),SXD(,I4,6H),SZD(,I4,2H),,/,5X,8H2DRATIO(,I4,1H))     ZCH  221
  140 FORMAT (7X,9HCOMMON X(,I4,4H),V(,I4,5H),XL(,I4,5H),VL(,I4,9H),ISPAZCH  222
     1LL(,I4,4H),T(,I4,2H),/,6X,3H1D(,I4,4H),P(,I4,4H),Q(,I4,4H),E(,I4,4ZCH  223
     2H),S(,I4,6H),SXD(,I4,6H),SZD(,I4,2H),,/,6X,8H2DRATIO(,I4,1H))     ZCH  224
  150 FORMAT (6X,13HDIMENSIONXXL(,I4,6H),XXU(,I4,6H),YYL(,I4,6H),YYU(,I4ZCH  225
     1,5H),XX(,I4,5H),YY(,I4,1H))                                       ZCH  226
  160 FORMAT (7X,13HDIMENSIONXXL(,I4,6H),XXU(,I4,6H),YYL(,I4,6H),YYU(,I4ZCH  227
```

```
     1,5H),XX(,I4,5H),YY(,I4,1H))                                                    ZOM  224
170  FORMAT (6X,14HDATA MAXZONE /,I4,1H/)                                            ZOM  225
180  FORMAT (7X,14HDATA MAXZONE /,I4,1H/)                                            ZOM  230
190  FORMAT (///,6X,29HMASPLT UPDATE DECK GENERATED,//,6X,19HREQUIRED SIZEOM  231
     1ORIGF IS,I7,14H (DECIMAL),   ,O8,8H (OCTAL))                                   ZOM  232
200  FORMAT (14H*INSERT,MASPLT,3)                                                    ZOM  233
210  FORMAT (17H *INSERT,MASPLT,5)                                                   ZOM  234
220  FORMAT (A1,I1,3A10)                                                             ZOM  235
230  FORMAT (1X,A1,I3,3A10)                                                          ZOM  236
     END                                                                             ZOM  237
```

APPENDIX C

Sample Card Decks

In this section sample control card decks for the four programs under consideration are given. All are for the CDC 6600 SCOPE 3.3 system and employ the FUN compiler as it exists at Sandia Albuquerque.[7] These examples are by no means the only methods of running the programs. However, as with most codes of this type, the user must be careful to select the most efficient manner to avoid wasting computer resources. Special care should be used with tape drives and central memory. The authors strongly suggest the use of ZCHART for the latter purpose.

For illustrative purposes it is assumed that three CDC 6600 tape files exist. The four programs CHARTD, CKEOS, MASPLT, and ZCHART are included in the update file called MASTER UPDATE FILE. Four separate LGO files are found on MASTER LGO FILE. The records are separated by end-of-file marks and are ordered as CHARTD, CKEOS, MASPLT, and ZCHART. Finally, the library of tabular EOS and opacity data exist on MASTER EOS FILE. All three are written at HI density (556 BPI). The first two are binary files while the last is a coded file.

```
CHARTD,CM200000,T$$$$,EC$$$,MT1.          NAME AND BOX
ACCOUNT CARD.
REQUEST,OLDPL,HI.    VRN=MASTER UPDATE FILE
UPDATE.
RETURN,OLDPL.
FUN,S,,,COMPILE,,,377770.
LGO.
(7-8-9)
*COMPILE CHARTD
(7-8-9)
DATA CARDS FOR CHARTD
(6-7-8-9)
```

Example 1: Card deck to compile and execute a short problem with CHART D.

No restart or EOS files are employed.

```
CHARTD,CM200000,T$$$$,EC$$$,MT2.          NAME AND BOX
ACCOUNT CARD.
REQUEST,CHARTD,HI.    VRN=MASTER LGO FILE
REWIND,CHARTD.
COPYBF,CHARTD,CHART.
UNLOAD,CHARTD.
REWIND,CHART.
REQUEST,EOS,HI.       VRN=MASTER ECS FILE
REWIND,EOS.
COPYCF,EOS,TAPE12.
UNLOAD,EOS.
REWIND,TAPE12.
REQUEST,TAPE3,HY.     VRN=(TAPE FOR MOVIE DUMP FILE)
REWIND,TAPE3.
REQUEST,TAPE10,HI.    VRN=(TAPE FOR RESTART FILE)
REWIND,TAPE10.
CHART.
(7-8-9)
DATA CARDS FOR CHARTD
(6-7-8-9)
```

Example 2: Card deck to execute a long problem with CHART D. Movie, EOS, and restart files are present.

```
BUKCH,CM200000,T$$$$,EC$$$,MT1.          NAME AND BOX
ACCOUNT CARD.
REQUEST,BUCKL,HI.    VRN=(BUCKL LGO FILE)
REWIND,BUCKL.
COLLECT,BUCKL,SCORS.
ATTACH,TAPE16,CROSSX.
REWIND,TAPE16.
REDUCE,OFF.
BUCKL.
UNLOAD,BUCKL.
REWIND,TAPE7.
REQUEST,CHARTD,HI.   VRN=MASTER LGO FILE
REWIND,CHARTD.
COPYBF,CHARTD,CHART.
UNLOAD,CHARTD.
REWIND,CHART.
REQUEST,EOS,HI.      VRN=MASTER EOS FILE
REWIND,EOS.
COPYCF,EOS,TAPE12.
UNLOAD,EOS.
REWIND,TAPE12.
REQUEST,TAPE10,HI.   VRN=(TAPE FOR RESTART FILE)
REWIND,TAPE10.
CHART.
RFL,12000.
UNLOAD,TAPE10.
REQUEST,FILM,HI,S.   VRN=(OUTPUT FILE FOR SC-4020)
REWIND,OUTPUT.
REWIND,FILM.
COPYCS,OUTPUT,FILM.
RETURN,FILM.
(7-8-9)
DATA CARDS FOR BUCKL
(7-8-9)
DATA CARDS FOR CHARTD
(6-7-8-9)
```

Example 3: Card deck to execute both BUCKL and CHART D as a single job. File 7 contains the output data from BUCKL for input to CHART D. Note that the classified spectrum file is not included in this example.

The control cards starting with RFL, 12000. are optional. As explained in Appendix J of R1, this set of cards will save the entire printed output on film.

```
MASPLT,CM100000,T$$$$,MT2.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,OLDPL,HT.    VRN=MASTER UPDATE FILE
REQUEST,TAPE1,HY.    VRN=(CHARTD OUTPUT FILE)
UPDATE.
RETURN,OLDPL.
FUN,S...COMPILE.
COLLECT,LGO,SCOPS.
LGO.
(7-8-9)
*COMPILE MASPLT
(7-8-9)
DATA CARDS FOR MASPLT
(6-7-8-9)
```

Example 4: Card deck to compile and execute a short problem with MASPLT. Tape 1 was produced by CHART D. Only hard-copy plots may be produced with this example.

```
MASPLT,CM100000,T$$$$,MT1.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,MASPL,HI.    VRN=MASTER LGO FILE
REWIND,MASPL.
COPYBF,MASPL,DUMMY,2.
COPYBF,MASPL,MASPLT.
UNLOAD,MASPL.
REWIND,MASPLT.
COLLECT,MASPLT,SCORS.
REQUEST,CFILE1,HY.   VRN=(CHARTD OUTPUT FILE 1)
REWIND,CFILE1.
COPYBF,CFILE1,TAPE1.
UNLOAD,CFILE1.
REWIND,TAPE1.
REQUEST,CFILE2,HY.   VRN=(CHARTD OUTPUT FILE 2)
REWIND,CFILE2.
COPYBF,CFILE2,TAPE2.
UNLOAD,CFILE2.
REWIND,TAPE2.
REQUEST,TAPE39,HI,S.   VRN=(OUTPUT FILE FOR SC-4020)
REWIND,TAPE39.
MASPLT.
(7-8-9)
(DATA CARDS FOR MASPLT
(6-7-8-9)
```

Example 5: Card deck to execute a long problem with MASPLT. CFILE1 and CFILE2 were produced by CHART D. This deck could be used to produce a movie.

```
CKEOS,CM170000,T5555,MT1.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,CKEOST,HI.  VRN=MASTER LGO FILE
REWIND,CKEOST.
COPYBF,CKEOST,DUMMY.
COPYBF,CKEOST,CKEOS.
UNLOAD,CKEOST.
REWIND,CKEOS.
COLLECT,CKEOS,SCORS.
REQUEST,EOS,HI.     VRN=MASTER EOS FILE
REWIND,EOS.
COPYCF,EOS,TAPE12.
RETURN,EOS.
REWIND,TAPE12.
CKEOS.
(7-8-9)
        .6        100          10.02567785       100.       0.001       5.4ALUMINUM
       2.7         0.        2.       5.E8      4.2E5
 -6    6 4 ALUMINUM                                                      -1.        -1.
  -70   10         0.         0.         0.         0.
0.02567785
2000.
0.0027
0.027
0.1
0.27
0.54
1.6
2.16
2.7
5.4
13.5
(BLANK CARD)
(6-7-8-9)
```

Example 6: Card deck to execute CKEOS. The input data would produce output similar to that in Section V of R1 and Appendix D of R2. The master EOS file is required only if tabular data is considered.

```
ZCHART,CM60000,T100,MT1.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,Z,HI.        VRN=MASTER LGO FILE
REWIND,Z.
COPYBF,Z,DUMMY,3.
COPYBF,Z,ZCHART.
RETURN,Z.
REWIND,ZCHART.
ZCHART.
(7-8-9)
DATA CARD FOR ZCHART
(6-7-8-9)
```

Example 7: Card deck to generate an update card set for CHART D and/or MASPLT.

IFLAGC = 0, ±2

IFLAGM = 0, ±2

```
NEWUP,CM60000,T100,MT2.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,OLDPL,HI.    VRN=MASTER UPDATE FILE
REQUEST,NEWPL,HI.    VRN=(TAPE FOR NEW UPDATE FILE)
UPDATE.
FUN,S,,,COMPILE.
LGO.
UPDATE,I=INFILE,N.
(7-8-9)
*COMPILE ZCHART
(7-8-9)
DATA CARD FOR ZCHART
(6-7-8-9)
```

Example 8: Card deck to generate a new update file containing CHART D and MASPLT with modified dimensions.

IFLAGC = ±1

IFLAGM = ±1

```
CHARTD,CM$$$$$$,T$$$$,EC$$$,MTS,          NAME AND BOX
ACCOUNT CARD.
REQUEST,OLDPL,HI.    VRN=MASTER UPDATE FILE
UPDATE.
FUN,S,,,COMPILE.
REDUCE,OFF.
LGO.
UPDATE,I=INFILE.
UNLOAD,OLDPL.
FUN,S,,,COMPILE,,CHART,377770.
REWIND,CHART.
REQUEST,SAVE,HI.     VRN=(TAPE FOR NEW LGO FILE)
REWIND,SAVE.
COPYBF,CHART,SAVE.
UNLOAD,SAVE.
REWIND,CHART.
REQUEST TAPES FOR CHARTD HERE
CHART.
(7-8-9)
*COMPILE ZCHART
(7-8-9)
DATA CARD FOR ZCHART
(7-8-9)
DATA CARDS FOR CHARTD
(6-7-8-9)
```

Example 9: Card deck to execute CHART D with modified dimensions. LGO file is saved.

IFLAGC = ±1, ±3

IFLAGM = 0, ±2

```
MASPLT,CM######,T#####,MT#.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,OLDPL,HI.    VRN=MASTER UPDATE FILE
UPDATE.
REDUCE,OFF.
FUN,G,,,COMPILE.
UPDATE,I=INFILE.
UNLOAD,OLDPL.
REWIND,LGO.
FUN,S,,,COMPILE.
COLLECT,LGO,SCORS.
REQUEST TAPES FOR MASPLT HERE
LGO.
(7-8-9)
*COMPILE ZCHART
(7-8-9)
DATA CARD FOR ZCHART
(7-8-9)
DATA CARDS FOR MASPLT
(6-7-8-9)
```

Example 10: Card deck to execute MASPLT with modified dimensions.

IFLAGC = 0, ±2

IFLAGM = ±1, ±3

```
MASPLT,CM[$$$###,T$$$#,MT#.                    NAME AND BOX
ACCOUNT CARD.
REQUEST,OLDPL,HI.    VRN=MASTER UPDATE FILE
UPDATE.
REDUCE,OFF.
FUN,G,,,COMPILE.
UPDATE.
UNLOAD,OLDPL.
REWIND,LGO.
FUN,S,,,COMPILE.
COLLECT,LGO,SCORS.
REQUEST TAPES FOR MASPLT HERE
LGO.
(7-8-9)
*COMPILE ZCHART
(7-8-9)
DATA CARD FOR ZCHART
(7-8-9)
*READ INFILE
ADD ADDITIONAL CORRECTIONS TO MASPLT HERE
(7-8-9)
DATA CARDS FOR MASPLT
(6-7-8-9)
```

Example 11: Card deck to execute MASPLT with modified dimensions and additional changes. Note differences from Example 10.