ZDRAFT-A GRAPHITE CODE FOR VTOL AIRCRAFT GROUND FOOTPRINT VISUAL-ETC(U)
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ZDRAFT - A GRAPHIC CODE FOR VTOL AIRCRAFT GROUND FOOTPRINT VISUALIZATION

J. J. Zanine and K. A. Green
Aircraft and Crew Systems Technology Directorate
NAVAL AIR DEVELOPMENT CENTER
Warminster, Pennsylvania 18974

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The computer program, entitled "ZDRAFT," generates a graphic display of VTOL aircraft and their associated ground flow fields. The actual flow field data is calculated by another computer program. The "ZDRAFT" computer code rapidly assimilates and displays this flow field data. The
display consists of pertinent flow field characteristics, such as stagnation lines, upwash flow and ground plane wall jet conditions, superimposed over a scaled aircraft planform. This visual form allows easy assessment of various configurations and operating conditions.
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This effort was performed during the period October 1978 to January 1980 and was sponsored by Mr. E. Lichtman of the Naval Air Systems Command under Air Task No. A33333/031C/940582331.

SUMMARY

This report documents a computer program, entitled "ZDRAFT", that generates a graphic display of VTOL aircraft and their associated ground flow fields. The actual flow field data is calculated by another computer program. The "ZDRAFT" computer code rapidly assimilates and displays this flow field data. The display consists of pertinent flow field characteristics, such as stagnation lines, upwash flow and ground plane wall jet conditions, superimposed over a scaled aircraft planform. This visual form allows easy assessment of various configurations and operating conditions.
1.0 DESCRIPTION

1.1 Background

The "ZDRAFT" computer graphics program, described in this report, was developed to complement a computer program that estimates the inlet temperature rise of VTOL aircraft operating in ground effect (Reference a). The "ZDRAFT" code was designed to display the ground plane flow fields and the stagnation lines calculated by the other program. This display is most useful in examining parametric variations of aircraft height, nozzle pressure ratios, nozzle vector and splay angles and nozzle aspect ratios. These parametric variations can produce drastic changes in the shape and the location of ground plane and/or undersurface stagnation lines. Hence, a rapid means for visualizing these changes is necessary, to efficiently evaluate conceptual designs. Although, flow field visualization was the primary reason for developing this graphics capability, "ZDRAFT" was constructed for use as a general graphics program. For example, drawings have been developed for aircraft spotting and engine installation studies.

1.2 Program Description and Capabilities

The "ZDRAFT" code is compiled in Fortran IV and uses the Tektronix PLOT10 library. Computer runs are made from a remote interactive graphics terminal on the Naval Air Development Center's (NAVAIRDEV CEN) Central Computer System. This computer system consists of two CDC 6600's and one CDC CYBER 170 Model 175. The "ZDRAFT" code exceeds the memory size limit of the NAVAIRDEV CEN interactive system. Therefore, it is necessary to run the program with segmentation loading. This uses less computer memory by loading only the program segments that are need at a given time.

The specific interactive hardware, necessary for running the code, are:
1. Tektronix 4010-series computer display terminal
2. Tektronix 4953/4954 graphics tablet
3. Tektronix 4631 hard copy unit

The interactive computer display terminal has a keyboard, similar to a conventional typewriter, and a direct storage cathode ray tube (DSCRT) display screen. It is via this keyboard and display screen that the operator communicates with the Central Computer System. The major components of the graphics tablet are a large (1.079 M x 0.864 M) flat writing surface (tablet) and writing pen or position cursor. The tablet is a magnetically prebiased surface on which paper (film, etc.) may be placed. Under the surface of the tablet is a X-Y grid of magneto-strictive wires, that sense the position of the cursor or writing pen. Hence, a point on the tablet can be converted to a digital position, and this information transmitted to the display terminal and/or the computer. The hard copy unit allows the operator to make a permanent high contrast copy of the display screen image. The copies are made on special dry silver paper. For specific information concerning this equipment, see References b, c and d.

An interactive computer terminal permits direct interplay between the operator and the computer. The "ZDRAFT" computer program utilizes this interactive capability. The program monitors and supervises the operator by writing directions and questions to the terminal display screen. The operator controls execution and responds to questions with inputs from the cueboard, the terminal keyboard and/or the the graphics tablet. The cueboard is a program generated operation menu which lists the individual program functions (see Figure 1). Selection of a cueboard command causes the specified function to execute. A command may be input to the computer in two ways. First, using the tablet cursor, a selection can be made from a cueboard mounted on the graphics tablet. Second, the cueboard code for the desired command can be typed from the terminal keyboard. The cueboard is the primary instrument for running the "ZDRAFT" program. Therefore, by selecting the appropriate cueboard commands and responding to questions and directions, all of the the following procedures can be duplicated.

Reproduction of a simple line drawing on the terminal display screen is a primary function of the "ZDRAFT" program. After loading the program and answering an initial set of questions, the operator can elect to construct a drawing. In response, the code requests the operator to secure a drawing
to the graphics tablet and to input position, size and scale. This information initializes the graphics tablet and the display screen. Now, the operator can attempt to represent the drawing with a series of line segments. A line segment is a set of points connected by straight lines or with a spline fit curve. For a specific line segment, the operator selects the type of fit and inputs the points from the tablet drawing. These line segments may be displayed as they are completed. For drawings symmetric about the x-axis, the operator can, at his or her option, construct half of the drawing and instruct the code to generate the mirror image. The code simply produces a negative y image of the drawing data and adds to the existing drawing data matrix. This capability is useful with scaled aircraft planforms.

When the drawing is complete, the boundaries of the drawing displayed on the screen can be changed. To accomplish this, the operator redefines the boundaries of the graphics tablet drawing. The operator can increase or decrease the area of the drawing shown on the display screen. The scale of the screen drawing will change to utilize the entire display screen. Any of these screen drawings can be saved and retrieved at another time. That is, the drawing data matrix is written to a specified local file, which can be made permanent after the program terminates. To revive a drawing, the data file must be local. At the operator's request, this local file is read into the program.

Additional "ZDRAFT" features include, drawing a border, drawing a x-y axis, calculating and drawing a scale legend, and adding a title. Drawing the border or axis only requires the operator to specify the cueboard command. When selecting the scale legend option, the operator positions or repositions the legend on the drawing. Once the position is fixed, the operator must input the command to draw the legend. The scaling is determined by the computer and will change, if the drawing size is altered. The legend's position, however, relative to the display screen is unaffected by a change in the drawing boundaries. Finally, requesting a title initiates a series of set questions which allows the operator to type in lines of a drawing title. The display screen drawing will resize to accommodate the title which is automatically centered over the drawing. This title is written on the screen at the operator's request.

Another basic function of "ZDRAFT" program is the superposition of a VTOL aircraft's ground plane and upwash flow field (i.e. stagnation lines and isocontour lines) over
an appropriate aircraft planform drawing. This stagnation and isocontour information is generated by the hot gas reingestion computer program, "REINGST" (see Reference a) and stored on permanenBefore loading "ZDRAFT" on the computer, the operator makes the specific data file a local file. When running "ZDRAFT" this data file is read by the program at the operator's request. With the planform drawn on the display screen, the operator can select to plot the stagnation lines and/or isocontour lines over the planform.

1.2 Program Structure

The graphics computer program, "ZDRAFT", consists of twenty one subroutines and functions. These subroutines are listed below in alphabetical order.

- CAPTION
- CUEBRD
- DRAFT
- DRAWCUE
- DRAWSIG
- ERASE
- FIT
- INPUT
- ISO
- LINES
- MESSAGE
- OPTION
- REVIVE
- SAVE
- SETCUE
- SETSCR
- SETTD
- STAGLN
- SYMEOL
- SYMMET
- VIEW

In addition, two computer libraries are accessed by "ZDRAFT". These are the Tektronix PLCT10 library and the in-house TEKLIB2 library (see Reference e). A simplified flow chart of the computer code is shown in Figure 3.
1.4 Subroutine Descriptions

**CAPTION** - handles the input, storage and writing of drawing titles. These titles are input from the terminal keyboard by the operator.

**CUEFDD** - transforms the operator's cueboard input into calls to the appropriate subroutine.

**DRAFT** - is the main program in "ZDRAFT". It initializes Tektronix PLCT10 and "ZDRAFT" routines and presets various variables, switches and matrices. Further, the operator is permitted to obtain a copy of cueboard and/or position the cueboard on the graphics tablet. Operational control of the program is switched to the cueboard.

**DRAWCUE** - draws a cueboard key on the terminal display screen and generates a hard copy.

**DRAWSO** - draws the ground plane isocontour lines (e.g., temperature, velocity, etc.) which can be superimposed over an aircraft planform.

**ERASE** - sets the matrices that contain line segment information to zero. This erases the drawing data from memory, but does not alter the present drawing size, coordinate system or scale.

**FIT** - controls and orders the spline fit of line segments that describe the aircraft planform.

**INPUT** - receives positional inputs from the terminal display screen or the graphics tablet and/or alpha-numeric information from the terminal keyboard. This information is transformed into digital data that is usable by other subroutines.

**ISC** - reads the isocontour data from a specified file and computes the necessary spline curves.

**LINES** - controls the input of line segments which describe an aircraft planform. These line segments are a series of points that are connected by a linear or spline curve fit.

**MESSAGE** - controls all program messages written to the terminal display screen.

**OPTION** - performs several drawing functions. These include drawing a border, drawing x-y axis and positioning and drawing...
a scale legend.

**FEVIVE** - reconstructs a previously generated planform configuration from data on a specified input file.

**SAVE** - allows the operator to place planform data on a local file. This local file can be made permanent or copied to a magnetic tape for long term storage.

**SETCUR** - permits the operator to position a copy of the cueboard key on the graphics tablet.

**SETSCR** - sets screen limits and scale factors necessary to generate a planform drawing on the terminal display screen.

**SETTD** - allows the operator to position a drawing on the graphics tablet and describe a specific coordinate system and scale factor.

**STAGLN** - reads stagnation line data from a specified file and draws the stagnation lines. These stagnation lines can be superimposed over an aircraft planform.

**SYFEOL** - generates the symbol used in plotting the stagnation line data points.

**SYMET** - duplicates existing line segments but with negative y values. These new segments are added to the existing segment producing an image which is symmetric about the x-axis.

**VIEP** - translates the line segment data into a line drawing on the terminal display screen.
2.0 Conclusions

The graphical code "ZDRAFT" is a useful conceptual design tool for visualizing the primary flow field characteristics of a VTOL aircraft hovering in ground effect. "ZDRAFT" can quickly construct a scaled computer drawing of an aircraft planform from a line drawing. Major flow field characteristics of the VTOL aircraft, such as stagnation lines, upwash flow and ground flow conditions can be rapidly superimposed over this scaled computer planform. Flow field conditions and stagnation line locations for input to the "ZDRAFT" code are generated from experimental data and/or computations from another computer code. "ZDRAFT" has been used extensively to compare experimental data, supplied by industry or taken from technical reports, with computer generated results.

Although this computer code was written specifically for VTOL aircraft ground footprint studies, it was designed to be easily modified for application to other tasks. To date, "ZDRAFT" has been used to scale aircraft planforms for spotting studies and to help analyze aircraft/engine interface problems, at the conceptual design stage.
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**FIGURE 1 - Tablet Cueboard Key**
Figure 3 - ZDRAFT Flow Diagram
3.0 References


APPENDIX A - User's Guide

The "ZDRAFT" computer program is not a computational computer code. The purpose of "ZDRAFT" is to facilitate the visualization of ground flow fields generated by VTOL aircraft. The flow field data is produced by another computer program, "REINGST" (Reference a). The output from "REINGST" is maintained on permanent file in a format acceptable to the "ZDRAFT" code. In describing the use and operation of "ZDRAFT", it will be assumed that the stagnation line and isocontour data stored on permanent files, will be retrieved to local files.

"ZDRAFT" is run from an interactive graphic computer terminal. The interactive capability allows the operator direct control over program execution. Further, this capability allows the computer code to monitor operator inputs and to veto improper requests. In "ZDRAFT", the operator controls the program through an operation cueboard and a question and answer format. The cueboard is a checkerboard drawing with key words and three digit alpha-numeric codes identifying the individual blocks (see Figure 1). This drawing is taped to the graphics tablet, and its position is input to the program with the tablet cursor. When control is switched to the cueboard, the operator can select a specific block with the tablet cursor. Alternately, control can be passed to the terminal keyboard and the corresponding alpha-numeric code can be entered via the keyboard. This will cause the computer to execute the specified action. Examples of these actions are clearing the display screen, drawing an aircraft planform, requesting the input of data points from the tablet, terminating the program, reading and plotting stagnation line data, generating an informative message on the display screen, etc. An explanation of each cueboard command is given in section (A.1).
(A.1) Explanation of Cueboard Commands

The following commands are available to the operator via the tablet cueboard or using the terminal keyboard codes shown in parenthesis:

MESSAGES (A01) - acts as an on/off switch for questions/instructions that normally would appear on the terminal display screen. Error messages, however, are not suppressed and will appear if something is done incorrectly by the operator.

SC/ON.CFF (A02) - switches control from the graphics tablet cueboard to the terminal keyboard and display screen, or vice versa.

DRAWCUE (A03) - clears the display screen and constructs a cueboard.

SETCUE (A04) - permits the operator to position or reposition the cueboard on the graphics tablet.

SETDRAWING (A05) - allows the operator to secure a drawing to the graphics tablet and to specify size, scale and axis system.

SETSSCREEN (A06) - sets screen limits and scale factors necessary to generate a drawing on the terminal display screen.

BOARDER (A07) - draws a border around the display screen drawing.

DRAWAXIS (A08) - draws the x-y axis on the display screen drawing. The axes are drawn with a dash-dot line.

CLEAR (A09) - clears the display screen. No information is cleared from memory.

HARDCOPY (A10) - produces a hard copy of current screen information.

NEWLINE (B01) - sets the program to create a line segment
unrelated to previous segments. Next, the operator must select the LINEAR or the SPLINE cue.

**SPLINE (BC2)** - permits a series of points from the drawing to be input and fitted with a spline curve. (NOTE: Values of X must be increasing.) Any other cueboard command ends the line segment.

**LINEAR (BC3)** - permits a series of points from the drawing to be input and fitted with straight lines. Any other cueboard command ends the line segment.

**DRAWALL (BC4)** - draws all existing line segments on the display screen.

**DRAW (BC5)** - draws line segments on display screen starting from the end of last line segment drawn.

**X-SYM (BC6)** - Causes the computer to symmetrically reproduce the drawing about the X-axis.

**TITLE (BC8)** - permits the operator to input, from the terminal keyboard, drawing titles. The title is input one line at a time, and the character size is specified for each line. There are four character sizes defined by the integers from 1 to 4. The largest size is 1 and the smallest is 4.

**WRITETITLE (BC9)** - causes the drawing title to be written on the display screen. The drawing will be resized and repositioned to accommodate the title. This is not automatic, however, and the drawing should be reconstructed after the title is written.

**SAVE (C01)** - writes the existing planform data to a local file. The operator must input the tape number which corresponds to the local file. Tape numbers from 5 to 15 are valid.

**REVIVE (C02)** - reads in a previously saved planform from a local file. The operator must input the tape number which corresponds to the local file. Tape numbers from 5 to 15 are valid.

**ERASE (C03)** - sets all line segment data to zero. This erases the line segment data from memory, but does not alter present drawing size, coordinate system, scale, or actual drawing already existing on the screen.
STAGTAPE (CC4) - allows the operator to specify the tape number which corresponds to a local file containing stagnation line data. Tape numbers from 5 to 15 are valid.

DRAWSTAG (CC5) - reads the stagnation line tape previously specified and plots the data to the same scale as the planform drawing.

POSITIONKEY (CC6) - allows operator to position the scale bar legend at a convenient location on the drawing.

DRAWKEY (CC7) - determines the proper size for the scale legend and draws it on the screen at the specified location.

ISOTAPE (CC8) - allows isocontour data to be read from a local file and performs the computations necessary to spline fit this data. The operator must input the tape number which corresponds to the local file. Tape numbers from 5 to 15 are valid.

DRAWISO (CC9) - draws the previously compiled isocontour lines on the screen drawing.

STOP (D10) - terminates the program.
(A.2) Drawing Planform Configuration

The "ZDRAFT" computer code has the capability of computerizing a simple line drawing. That is, the code allows the user to transform a line drawing into a set of variables and a matrix of points. Having transformed the drawing into numerical data, the code interprets the information and produces a line drawing on the terminal display screen. Further, the code can alter the size and scale, draw a border and a x-y axis, generate a scale legend, add titles, superimpose other drawings, etc. These features are used in the construction of an aircraft planform.

Assume the initial steps in running "ZDRAFT" are complete. The process of computerizing a scaled aircraft planform is initiated by selecting the cueboard command, SETDRAWING. The initial steps are predetermined and instructions are output to the display screen. First, the operator is directed to secure the drawing on the graphics tablet and using the tablet cursor, specify the lower left and upper right corners of the drawing. Next, the operator is requested to specify two points on the drawing and to input their x-y values. Finally, the operator must designate the units of linear dimensions. With this information the code sets scaling factors and initializes the display screen. At this point, control is returned to the operator and construction of planform drawing can start.

The aircraft planform is described by a series of line segments. These line segments are defined by a set of points which are connected by either straight lines or a spline fit curve. To begin construction of the planform drawing the cueboard command NEWLINE is selected. This primes the code for the input of in a new line segment. The operator is then requested to select the LINEAR or the SPLINE command. This determines the fit for the following set of drawing points. Using the tablet cursor, the operator selects points from the planform drawing. Selection of any cueboard block terminates this set of points. The LINEAR or SPLINE command selected after a set of points, will initiate another set of points. The first point of this second set is identical to the last point of the preceding set. To input a line segment unconnected to preceding segments, NEWLINE must be the first
command. When complete the drawing data can be written to a local file by specifying SAVE. This file can be made permanent after termination of the program.

The following information details the exact input and response to generate a computer drawing with a bar scale legend, title information, a border, and an axis system. Examples of the drawing partially complete are also given in Figures A1 through A5. Note, the symbol, "cr", indicates that a carriage return must be input from the terminal keyboard.

type.... CALL,PAES9. "cr"

(screen clears)

prompt.. do you wish a copy of the graphics tablet cueboard? type y(yes) or n(no), and "cr".

type.... Y "cr"

prompt.. is hard copier sufficiently warm? type y(yes) or n(no), and "cr".

type.... Y "cr"

(cueboard is drawn on the terminal display screen and a hardcopy is produced)

prompt.. do you wish to position the graphics tablet cueboard? type y(yes) or n(no), and "cr".

type.... Y "cr"

prompt.. input lower left and lower right corners of cueboard?

(secure copy cueboard on the graphics tablet and input points with tablet cursor)

(cueboard is now operative)
cuebrd.. SETDRAWING

( use the tablet cursor to make selection from cueboard)

prompt.. place drawing on the graphics tablet.

( secure drawing on graphics tablet)

prompt.. input lower left and upper right corners of drawing.

( input points with cursor)

prompt.. specify point on drawing
       and type in (x,y) coordinates.

( input point with cursor)

type.... 0.0 , 0.0 "cr"

prompt.. specify another point
       and type in (x,y) coordinates.

( input point with cursor)

type.... 1.2125 , 0.0 "cr"

prompt.. type unit of dimensions (20 characters or less)

type.... FEET "cr"

( construction of aircraft planform can now begin)

cuebrd.. NEWLINE

prompt.. new line started select linear or spline.

cuebrd.. SPLINE

( use tablet cursor to select points from drawing on tablet,
   points will be connected with a spline fit,
   points must have increasing values of x
   with a minimum of three points)

( for the present example, start at the aircraft nose,
   input points)
cuebrd.. SPLINE

(starts a new spline curve that is connected to the previous curve, input points)

cuebrd.. LINEAR

(select points to be connected with straight lines, lines connect with preceding curve, input points)

cuebrd.. SPLINE

(starts new spline fit that is connected to preceding curve, input points)

cuebrd.. LINEAR

(starts another series of straight lines, input points)

cuebrd.. DRAW

(draws all curves input, since last draw command)

cuebrd.. HARDCCPY

(see Figure A1)

cuebrd.. NEWLINE

prompt.. new line started select linear or spline.

cuebrd.. LINEAR

(starts a series of straight lines not connected to the preceding curve, input points)

cuebrd.. NEWLINE

prompt.. new line started select linear or spline.

cuebrd.. LINEAR

(input points)

cuebrd.. SPLINE

(input points)
NADC-80109-60

cuebrd.. DRAW

cuebrd.. HARDCCPY

(see Figure A2)

cuebrd.. X-SYM

(this generates a negative y image of the existing
drawing data, producing an image symmetric
about the x-axis)

cuebrd.. DRAW

cuebrd.. HARDCCPY

(see Figure A3)

cuebrd.. SAVE

type.... 5 "cr"

(places drawing data on tape5, this local file
can be made permanent)

cuebrd.. POSITIONKEY

prompt.. set scale position.

(using the tablet cursor, select a position on the drawing
for the scale legend)

cuebrd.. DRAWKEY

(the scale legend is drawn on the display screen)

cuebrd.. HARDCCPY

(see Figure A4)

cuebrd.. CLEAR

(screen clears)

cuebrd.. TITLE
prompt.. input title lines. character is preset to 3.

(four character sizes are available, 1 through 4,
larger numbers represent smaller character sizes)

prompt.. input character size.
eof default is previous character size.

type.... 1 "cr"
prompt.. type title line
type.... SAMPLE DRAWING "cr"
prompt.. sample drawing
prompt.. is this line correct?
type y(Yes) or n(no), and "cr".

type.... Y "cr"
prompt.. input character size.
eof default is previous character size.

type.... 2 "cr"
prompt.. type title line
type.... FLAT PLATE TEST MODEL "cr"
prompt.. flat plate test model
prompt.. is this line correct?
type y(Yes) or n(no), and "cr".

type.... Y "cr"
prompt.. input character size.
eof default is previous character size.

type.... 4 "cr"
prompt.. type title line
type.... 16 JANUARY 1980 "cr"
prompt.. 16 January 1980
prompt..  is this line correct?
type y(yes) or n(no), and "cr".

type....  Y "cr"

prompt..  input character size.
etd default is previous character size.

type....  "cr"

prompt..  type title line

type....  "cr"

(a return of carriage when a title line is requested,
ends title line inputs)

(screen clears and title is written)

cuebrd..  HARDCOPY

(see Figure A5)

cuebrd..  BORDER

(border is drawn)

cuebrd..  DRAWAXIS

(x-y axis is drawn)

cuebrd..  DRAWKEY

(scale legend is drawn)

cuebrd..  DRAWALL

(planform is drawn)

cuebrd..  HARDCOPY

(see Figure A6)
(A.3) Superimposing Stagnation and Isocontour Lines

This example demonstrates the superposition of stagnation lines over a specific aircraft planform (see Appendix B.1). The stagnation line data was previously generated by "FEINGST" (Reference a) and stored on permanent file or magnetic tape. The previously developed aircraft planform was also stored on permanent file or tape. To be read by the "ZDRAFT" program, these data files must be placed on local files. Appropriate local file names are TAPE5 through TAPE15. Assume the aircraft planform data is on TAPE5, the ground plane stagnation line data is on TAPE6 and the undersurface stagnation line data is on TAPE7. After repeating the initial inputs, the following commands will generate a drawing of the planform and the stagnation lines.

cuebrd.. STAGTAPE
prompt.. input tape number that contains stagnation line data.
type.... 6 "CR"
cuebrd.. CLEAR
(screen clears)
cuebrd.. BORDER
(border is drawn)
cuebrd.. DRAWALL
(aircraft planform is drawn)
cuebrd.. DRAWAXIS
(x-y axis is drawn)
cuebrd.. DRAWSTAG
Figure A7 illustrates the stagnation line data generated by the computer program, "REINGST" (Reference a). "REINGST" produces a stagnation line for each sequential pair of nozzles. For a simple two nozzle case, stagnation lines for nozzle pairs 1-2 and 2-1 are generated. These stagnation lines would be identical. In the complex six nozzle system, stagnation lines are calculated for nozzle pairs 1-2, 2-3, 3-4, 4-5, 5-6 and 6-1. Because "REINGST" does not compensate for the interference between stagnation lines, portions of the stagnation lines are imaginary. These imaginary sections can be determined by plotting the stagnation lines. The section of a stagnation line plotted before the intersection with another line is imaginary. Complex nozzle configurations may have a series of stagnation line intersections. Determining the governing intersection may be difficult.

In the present illustration the three stagnation lines intersect at a single point on the x-axis (see Figure A7). Hence, locating the non-existent portion of the stagnation lines is relatively simple. The stagnation line of nozzle pair 1-2 plots from top to bottom; therefore, the section above the x-axis is imaginary. Similarly, the section of the 3-1 stagnation line below the x-axis must be eliminated. For the nozzle pair 2-3, the segment to the left of the intersection should not exist. Figures A8 and A10 show a portion of the uncorrected data file for stagnation lines 1-2 and 2-3, respectively. Using the text editor, the imaginary sections can be deleted from the data files. The revised data files are shown in Figures A9 and A11.

This problem of imaginary stagnation line segments, also, occurs with the undersurface stagnation lines. Determination of the imaginary portions of these lines may prove more difficult than the ground plane lines. Therefore, the undersurface line data should be revised after the ground plane data. The ground plane revisions can then be used as a
guide in eliminating the non-existent undersurface sections.

The corrected stagnation line data is on local files TAPE6 and TAPE7. The isocontour data is taken from permanent file and placed on local file, TAPE10. Now, a final drawing of the aircraft planform with superposed stagnation lines and isocontour lines can be constructed. Note, the cueboard commands are now input from the terminal keyboard.

type.... CALL,PAES9. "cr"

(screen clears)

prompt.. do you wish a copy of the cueboard?
type y(yes) or n(no), and "cr".

type.... Y "cr"

prompt.. do you wish to position the cueboard?
type y(yes) or n(no), and "cr".

type.... N "cr"

prompt.. input cue codes from terminal keyboard.

(cue codes are shown on the cueboard)

type.... C2 "cr"

(cue - revive)

prompt.. input tape number that contains drawing data.

type.... 5 "cr"

type.... B8 "cr"

(cue - title)

prompt.. input title lines. character is preset to ?.

(four character sizes are available, 1 through 4, larger numbers represent smaller character sizes)

prompt.. input character size.
eof default is previous character size.

type.... 1 "cr"

prompt.. type title line.

type.... SAMPLE DRAWING "cr"

prompt.. sample drawing
is this line correct?
type y(yes) or n(no), and "cr".

prompt.. input character size.
eof default is previous character size.

prompt.. FLAT PLATE TEST MODEL "cr"

prompt.. flat plate test model

prompt.. is this line correct?
type y(yes) or n(no), and "cr".

prompt.. input character size.
eof default is previous character size.

prompt.. type title line.

type.... 16 JANUARY 1983 "cr"

prompt.. 16 January 1983

prompt.. is this line correct?
type y(yes) or n(no), and "cr".

prompt.. input character size.
eof default is previous character size.
type.... "cr"

prompt.. type title line.

(type.... "cr"

(a return of carriage when a title line is requested,
ends title line inputs)

(screen clear and title is written))

type.... A7 "cr"

(cue - border,
border is drawn)

type.... A8 "cr"

(cue - drawaxis,
 x-y axis is drawn)

type.... B4 "cr"

(cue - drawall,
aircraft planform is drawn)

type.... A1 "cr"

(cue - messages,
screen messages will not be printed,
except error messages)

type.... C4 "cr"

(cue - stagtape,
stagnation line data tape number is requested)

type.... 6 "cr"

type.... C5 "cr"

(cue - drawstag,
stagnation lines are printed)

type.... C4 "cr"

(cue - stagtape,
stagnation line data tape number is requested.

```plaintext
type....  7 "cr"
type....  C5 "cr"

(cue - drawstag, stagnation lines are plotted)

type....  C6 "cr"

(cue - positionkey, screen cursors appear, use screen cursors to position scale legend)

type....  P

(do not return carriage)

type....  C7 "cr"

(cue - drawkey, scale legend is drawn)

type....  A10 "cr"

(cue - hardcopy, see Figure A12)

type....  A9 "cr"

(cue - clear, screen clears)

type....  A1 "cr"

(cue - messages, screen messages are turned on)

type....  C8 "cr"

(cue - isotape)

prompt.. input tape number containing iso data.

prompt.. this is a test isocontour line tape
read this data?
type y(yes) or n(no), and "cr".

type....  Y "cr"

(type....  C4 "cr"
      (cue - stagtape)

prompt..  input tape number that contains stagnation
line data.

type....  6 "cr"

(type....  A9 "cr"
      (cue - clear,
screen clears)

(type....  A8 "cr"
      (cue - drawaxis,
  x-y axis is drawn)

(type....  A7 "CR"
      (cue - border,
border is drawn)

(type....  B9 "cr"
      (cue - writetitle,
title is written)

(type....  B4 "cr"
      (cue - drawall,
aircraft planform is drawn)

(type....  A1 "cr"
      (cue - messages,
screen messages will not be printed,
except error messages)

(type....  C5 "cr"
      (cue - drawstag,
stagnation lines are plotted)

type.... C9 "cr"

(cue - drawiso, isocontour lines are drawn)

type.... C6 "cr"

(cue - positionkey, screen cursors appear, use screen cursors to postion scale legend)

type.... P

(do not return carriage)

type.... C7 "cr"

(cue - drawkey, scale legend is drawn)

type.... A10 "cr"

(cue - hardcopy, see Figure A13)

type.... D10 "cr"

(cue - stop)

prompt... stop requested from cueboard

(execution is terminated)
FIGURE A7 - Planform drawing showing impingement points and all ground plane stagnation line data.
FIGURE A8 - Uncorrected ground plane stagnation line data.
Data for nozzles 1 and 2.
<table>
<thead>
<tr>
<th>DATA POINT</th>
<th>X VALUE</th>
<th>Y VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0.597700</td>
<td>6.000090</td>
</tr>
<tr>
<td>-2</td>
<td>0.537000</td>
<td>8.091709</td>
</tr>
<tr>
<td>-3</td>
<td>0.597700</td>
<td>6.091709</td>
</tr>
<tr>
<td>445</td>
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<td>-0.01799</td>
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<td>450</td>
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FIGURE A9 - Corrected ground plane stagnation line data. Data for nozzles 1 and 2.
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<th>Y VALUE</th>
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</thead>
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FIGURE A10 - Uncorrected ground plane stagnation line data.
Data for nozzles 2 and 3.

Drop all of these points.
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<th>Y VALUE</th>
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</thead>
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</table>

**FIGURE A11** - Corrected ground plane stagnation line data
Data for nozzles 2 and 3.
(B.1) Listing of Procedure Files

Various procedure files necessary to compile, segment, load and run the "ZDRAFT" code are listed below. Permanent file, ZDRAFT9, contains the fortran program "ZDRAFT". The following procedure file, FZE9, packs and compiles the fortran code. The fortran compiled version is saved on file, ZD9REL4, and the fortran listing is written to file, CUT.

FZE9
GET,ZDRAFT9.
PACK,ZDRAFT9.
FTN4(I=ZDRAFT9,R=3,L=OUT,E=ZD9REL4)
SAVE,ZD9REL4.

Next, the procedure file, PSEC9, segments the code and saves the absolute version on ZD9AES.

PSEC9
GET,SEGDIR9,ZD9REL4,XTAPE.
GET,SEGREF,PL1CLIE/UN=SYSTEM.
GET,TEKLIB2/UN=VT1781.
COPYEF,XTAPE,TAPE1.
COPYEF,XTAPE,TAPE2.
REWIND,TAPE1,TAPE2.
MAP, PART.
SEGREF,ZD9REL4,SEGOUT.
SEGLOAD(I=SEGDIR9)
LIBLOAD(PL1CLIE,CHECK)
LIBLCAD(PL1CLIB,LABEL)
LDSET(LIB=PL1CLIE/TEKLIB2/PL1CLIE/TEKLIB2,MAP=/MAP)
LCAD,ZD9REL4.
NGC,CZD9AES.

The following is the segmentation load directions, SEGDIR9.

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</thead>
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<td>ISO, SPLNC1, UPDATE</td>
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<td>CGLOBAL</td>
<td>BLKISO-SAVE</td>
</tr>
<tr>
<td>BR2</td>
<td>TREE</td>
<td>ERASE</td>
</tr>
<tr>
<td>ERASE</td>
<td>INCLUDE</td>
<td>FIT, LINES, REVIVE, SETTD, SPLNC1, SYM-MET, UPDATE, VIEW</td>
</tr>
</tbody>
</table>
Finally, the procedure file to run the segmented absolute version of the "ZDRAFT" computer code.

PAB9
GET,ZD9ABS,XTAPE.
COPYZBF,XTAPE,TAPE1.
COPYZBF,XTAPE,TAPE2.
REWIND,TAPE1,TAPE2.
MAP,PART.
ZD9ABS.
(E.2) Listing of the Input File

XTAPE is a multi-file permanent file that contains information input to the "ZDRAFT" code. The first file contains the messages that the code outputs to the terminal display screen. The second contains information pertaining to the structure of the cueboard.

**TAPE1**
12CC  BAUD, TRANSMISSION RATE - CHARACTERS PER SECOND
4C64 MAXRX, NUMBER OF ADDRESSABLE POINTS
1 ITEM, TERMINAL IDENTIFICATION NUMBER
1 ISIZE, CHARACTER SIZE (4C04/15 ONLY)
1 LCCDS, LOCAL DISPLAY OF TABLET POINT ON TERMINAL (C - NC)(1 - YES)
1 IFEN, TABLET MODE (C - PEN MODE) (1 - PRESENCE PCE)
C1 PC DO YOU WISH A COPY OF THE CUEBOARD? TYPE Y(YES) OR N(NC), AND "CR".
C2 PC IS HARDCOPIER ON AND SUFFICIENTLY WARM? TYPE Y(YES) OR N(NC), AND "CR".
C3 PC TURN ON HARDCOPIER. WHEN WARM TYPE Y AND "CR".
C4 PC IS COPY SATISFACTORY? TYPE Y(YES) OR N(NC), AND "CR".
C5 P
C6 P POINTER IMPROPERLY POSITIONED, TRY AGAIN.
C7 P INPUT LOWER LEFT AND LOWER RIGHT CORNERS OF CUEBOARD.
C8 P INPUT CODES FROM TERMINAL KEYPAD.
C9 P CUEBOARD DATA NOT FOUND ON TAPES.
C10 PC DO YOU WISH TO POSITION THE CUEBOARD? TYPE Y(YES) OR N(NC), AND "CR".
C11 INPUT TAPE NUMBER ON WHICH DRAWING DATA IS TO BE SAVED.
C12 PS TABLET CUEBOARD DATA NOT FOUND ON TAPES.
C13 PS NUMBER OF TABLET CUEBOARD ROWS EXCEEDS MATRIX DIMENSION.
C14 PS NUMBER OF TABLET CUEBOARD COLUMNS EXCEEDS MATRIX DIMENSION.
C15 PS NUMBER OF TABLET CUEBOARD A/N CHARACTERS EXCEEDS MATRIX DIMENSION.
C16 PS CAUTION: LOCN FOR TABLET CUECARD BLOCK.
C17 P BLANK CUE REQUESTED. TRY AGAIN.
C18 P PLACE DRAWING ON THE GRAPHICS TABLET.
C19 P INPUT LOWER LEFT AND UPPER RIGHT CORNERS OF THE DRAWING.
C20 PS SPECIFY POINT ON DRAWING AND TYPE IN (X,Y) COORDINATES.
C21 PS SPECIFY ANOTHER POINT AND TYPE IN (X,Y) COORDINATES.
C22 PS DISTANCE BETWEEN SELECTED POINTS CANNOT BE ZERO.
C23 P DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED.
C24 P INSUFFICIENT NUMBER OF POINTS FOR SPLINE.
C25 PC DO YOU WISH TO ABORT THIS LINE SEGMENT? TYPE Y(YES) OR N(NC), AND "CR".
C26 P CURRENT LINE SEGMENT ABORTED.
C27 P INPUT ADDITIONAL POINTS FOR SPLINE CURVE.
C28 NEW LINE SEGMENT STARTED SELECT LINEAR OR SPLINE.
30 P MAXIMUM NUMBER OF POINTS HAS BEEN EXCEEDED.
31 P MAXIMUM NUMBER OF SPLINES HAS BEEN EXCEEDED.
32 P TWO CONSECUTIVE NODES EQUAL 1.
33 P NODE IS NOT -5, -1, 0, 1, 5.
34 P NODE SHOULD BE EQUAL TO -5.
35 P VALUES OF X MUST BE INCREASING FOR SPLINE FIT.
36 P ERASE DRAWING? TYPE Y(YES) OR N(NO), AND "CR".
37 P THE CUECARD HAS NOT BEEN POSITIONED.
38 P INPUT TAPE NUMBER THAT CONTAINS DRAWING DATA.
39 P EOF ENCOUNTERED READING DRAWING DATA TAPE.
40 P INPUT TAPE NUMBER THAT CONTAINS STAGNATION LINE DATA.
41 P TAPE NUMBER CONTAINING STAGNATION DATA HAS NOT BEEN SPECIFIED.
42 P SCREEN SCALE IS LESS THAN 1.0E-10.
43 P SCREEN SCALE IS GREATER THAN 1.0E10.
44 P SET SCALE KEY POSITION.
45 P UNIT OF DIMENSIONS (2) CHARACTERS OR LESS).
46 P INPUT CHARACTER SIZE. EOF DEFAULT IS PREVIOUS CHARACTER SIZE.
47 P TYPE TITLE LINE.
48 P IS THIS LINE CORRECT? TYPE Y(YES) OR N(NO), AND "CR".
49 P CHANGE CHARACTER SIZE IF DESIRED.
50 P RETYPE LAST LINE.
51 P RETYPE TITLE LINES. CHARACTER IS PRESET TO 3.
52 P INPUT TITLE LINES. CHARACTER IS PRESET TO 3.
53 P INPUT TAPE NUMBER CONTAINING ISO DATA.
54 P EOF ENCOUNTERED READING ISO DATA TAPE.
55 P NUMBER OF VARIABLES EXCEEDS MAXIMUM LIMIT OF 20.
56 P NUMBER OF ANGLES EXCEEDS MAXIMUM LIMIT OF 20.
57 P NUMBER OF ISO CONTOUR LINES EXCEEDS MAXIMUM LIMIT OF 20.
58 P IMPROPER CODE. TRY AGAIN.

-EOF-

TAPE
  34 NUMBER CUECARD ROWS
  13 NUMBER CUECARD COLUMNS
  23 NUMBER OF CHARACTERS PER CAPTION
A01 MESSAGES CALL MESFLIP
A02 SC/CH, OFF CALL CUEFLIP
A03 DRANCUE CALL DRANCUE
A04 SETCUE CALL SETCUE
A05 SETDRAWING CALL SETTO
A06 SETSCREEN CALL SETSCR
A07 SCREER CALL SCREER
A08 DRAWAXIS CALL AXIS
A09 CLEAR CALL MESSAGE(J,NO)
A10 HARDCOPY CALL HCROCPY
B01 NEWLINE CALL NEWLINE
B02 SPLINE CALL SPLINE(THPLK),RETURNS(6))
B32  LINEAR
B34  DRAWALL
B35  DRAW
B36  X-SYM
B38  TITLE
B39  WRITETITLE
C31  SAVE
C32  REVIVE
C33  ERASE
C34  STAGTAPE
C35  DRAWSTAG
C36  POSITIONKEY
C37  DRAWKEY
C38  ISO TAPE
C39  DRAWISO
D13  STOP

CALL LINEAR(NTHETK),RETURNS(60)
CALL VIEWALL
CALL VIEW
CALL SYMMET
CALL CAPTION
CALL WITLE
CALL SAVE
CALL REVIVE
CALL ERASED
CALL STAGLN
CALL DRAWWTAG
CALL SETKEY
CALL KEY
CALL ISO
CALL DRAWISO
STOP"REQUESTED FROM CJSBCARD"

-ECF-
(E.?:) Listing of the "ZDRAFT" Computer Code
CZDRAFT

PRG0002 CZDRAFT(INPUT=121, OUTPUT=121, TAPE3=INPUT, TAPE4=OUTPUT,
   * TAPE7=101, TAPE8=101, TAPE9=101, TAPE10=101,
   * TAPE11=101, TAPE12=101, TAPE13=101, TAPE14=101,
   * TAPE15=101)

COMMON
* /BLK/
* /THORZ(4),
* /VERT(4),
* /IYSET,
* /MAXCCL,
* /MAXIX,
* /MAXIY,
* /MAXRCW,
* /MAXSR,
* /NF

COMMON
* /ELKCL/
* /HEIGHT,
* /LENGTH,
* /SIDE,
* /IQCERT,
* /IQRIG,
* /IQ1,
* /IVQERT,
* /IVQRIG,
* /IVQ1,
* /LEGEND(15,15,2)),
* /NCHARQ,
* /PHIC,
* /SIDEQ

COMMON
* /ELKJ/
* /CJ&,
* /DRAW,
* /MNESS,
* /JSCR,
* /JSTAG,
* /JTITLE

COMMON
* /ELKPTS/
* /ARRAY(500,2),
* /ASPIL(100,2),
* /NCODE(500),
* /NPTS,
* /NSPLS(500),
* /NSWITCH
COMMON
* /BLKSCALE/
* /LENSCAL,
* /NEWS,
* /SCALAST,
* /SCALES,
* /SCALET,
* /SCALSIZ
COMMON
* /ELKSD/
* IXRANGE,
* IXSTART,
* IX1,
* IYRANGE,
* IYSTART,
* IY1,
* NUNIT(2)),
* PHID,
* RATIO0,
* XRANGE,
* XSTART,
* XJ,
* YRANGE,
* YSTART,
* YJ
COMMON
* /ELKSD/
* IJDRW1,
* IJDRW2,
* IU3,
* IVORW1,
* IVORW2,
* IVJ
DATA
* (ARRAY=3333*3.3),
* (IJDRW10=6*9)),
* (IJG1=)),
* (IVQ1=)),
* (IX1=-1),
* (IY1=-1),
* (JCMZ=-1),
* (JDRM=3),
* (JMESS=1),
* (JSCR=3),
* (JSTAG=3),
* (JSTAG=3),
* (LEGEND=4550*55B),
* (NCCOE=104*),
* (SCALAST=3.0)
C THIS ROUTINE INITIALIZES VARIOUS PLOT10 AND ZDRAFT Routines
C
C VARIABLES READ FROM TAPE1
C IBAUD .... TRANSMISSION RATE (BAUD), CHARACTERS PER SECOND
C MAXSR .... NUMBER OF ADDRESSABLE POINTS ON THE TEKTRONIX TERMINAL
C ITERM .... TERMINAL IDENTIFICATION NUMBER
C 1 - 4300, 4310, 4312/13
C 2 - 4314/15
C 3 - 4314/15 ENHANCED GRAPHICS MODULE
C ISIZE .... CHARACTER SIZE, 4314/15 ONLY
C CHAR/S/LINE NUM LINES
C 1 - 74 35
C 2 - 81 38
C 3 - 121 58
C 4 - 133 64
C LOCDS .... SWITCH FOR LOCAL DISPLAY OF TABLET POINT ON TERMINAL
C 0 - NO
C 1 - YES
C IPEN ..... TABLET MODE
C 0 - PEN MODE
C 1 - PRESENCE MODE
C
C REWIND 1
READ(1,1300)
READ(1,1300) IBAUD, MAXSR, ITERM, ISIZE, LOCDS, IPEN
IF(EQF(1).NE.0) STOP"INITIALIZING VARIABLES FOR PLOT10 NOT FOUND ON TAPE1."
C
C INITT (PLOT10 ROUTINE) INITIALIZES TERMINAL
IBAUD=IBAUD/10
CALL INITT(IBAUD)
C
C TERM (PLOT10 ROUTINE) SPECIFIES TERMINAL TYPE
CALL TERM(ITERM, MAXSR)
IF(ITERM.EQ.1) GO TO 200
C
C THE FOLLOWING STORES ALPHA/NUMERIC CHARACTER DIMENSIONS
30 130 ISIZE=1,4
CALL CHRSIZ(ISIZE)
CALL CSIZE(IH,IV)
IHZ2(Z(ISIZE)=IHN
IVERT(ISIZE)=IV
130 CONTINUE
C
C TABINT (PLOT10 ROUTINE) INITIALIZES GRAPHICS TABLET
CALL TAPNT(ICCORD,LOC&S,IPRIM)

2) CALL MESSAGE(MAXSR,NOCM

THE FOLLOWING READS CUE BLOCK SPECIFICATIONS FROM TAPE2
AND INITIALIZES CUE BLOCK VARIABLES.

REWIND 2
READ(2,2233)

MESSAGE - "SCREEN CUE BOARD DATA NOT FOUND ON TAPE2"
IF(EOF(2).NE.3) CALL MESSAGE(9,NOCM)
READ(2,2133) MAXROW,MAXCOL,NCHARQ
IF(EOF(2).NE.3) CALL MESSAGE(9,NOCM)

MESSAGE - "NUMBER OF TABLET CUE BOARD ROWS EXCEEDS MATRIX DIMENSION"
IF(MAXROW.GT.15) CALL MESSAGE(13,NOCM)

MESSAGE - "NUMBER OF TABLET CUE BOARD COLUMNS EXCEEDS MATRIX DIMENSION"
IF(MAXCOL.GT.15) CALL MESSAGE(14,NOCM)

MESSAGE - "NUMBER OF SPECIFIED CUE BOARD A/N CHARACTERS EXCEEDS MATRIX DIMENSION"
IF(NCHARQ.GT.20) CALL MESSAGE(15,NOCM)
NF=MAXSR/1024
MAXIX=MAXSR - 1
MAXTY=NF*723
MAXBLK=MAXROW*MAXCOL
DO 430 NTBLK=1,MAXBLK
READ(2,2233) NROW,IICCL,(L-EGEM-DCNRCWd,NCOL-,N),N:,NllPCHAriC)
IF(EOF(2).NE.3) GO TO 423

CONTINUE
423 IXORIG=NF*510
IYORIG=NF*390
ISIDE=NF*(103/MAXCOL)
IJJMY=NF*(76)/MAXROW
IF(ISIDE.GT.IJJMY) ISIDE=IJJMY
ILENGTH=MAXCOL*ISIDE
IHEIGHT=MAXROW*ISIDE

MESSAGE - "DO YOU WISH A COPY OF THE GRAPHICS TABLET CUEBOARD ?
TYPE Y(YES) OR N(NO)"
CALL MESSAGE(1,NANS)
IF(NANS.EQ."Y") CALL DRAVCUE

MESSAGE - "DO YOU WISH TO POSITION THE GRAPHIC TABLET CUE BOARD ?
TYPE Y(YES) OR N(NO)"
483 CALL MESSAGE(13,NANS)
IF(NANS.EQ.1)H) GO TO 500
CALL SETCUE
GO TO 600
500 JCUE=1

C
MESSAGE - "INPUT CUE CODES FROM TERMINAL KEYBOARD."
CALL MESSAGE(8,NOJUM)
600 CALL CUEEND

C
FORMATS
1111) FORMAT(I5)
2111) FORMAT(F5.2)
1111) FORMAT(I5)
2211) FORMAT(R1,I2,2X,2,R1)
END
THE FOLLOWING STATEMENT CLEAR THE SCREEN, NO MESSAGE IS WRITTEN.
CALL MESSAGE(3, NOJM)

MESSAGE - "INPUT TITLE LINES. CHARACTER SIZE IS PRESET TO 3."
CALL MESSAGE(52, NOJM)
12) NLINE=NLINE + 1

MESSAGE - "INPUT CHARACTER SIZE." EOF DEFAULT IS PREVIOUS CHARACTER SIZE.
CALL MESSAGE(47, NOJM)
CALL ANMODE
READ(3, 113) ISIZEA
IF(EOF(3).EQ.3) ISIZE=ISIZEA

THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-1, NOJM)

MESSAGE - "TYPE TITLE LINE."
CALL MESSAGE(48, NOJM)
14) CALL ANMODE
READ(3,100) (NCAPT(J,NLINE),J=5,84)
IF(EOF(3).NE.3) GO TO 330
C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-1,NDUM)
NCHARS=80
C 220 J=1,80
IF(NCAPT(NCHARS+4,NLINE).NE.55B) GO TO 220
NCHARS=NCHARS - 1
230 CONTINUE
220 J=1CHARS + 4
CALL ANMODE
WRITE(4,1000) (NCAPT(J,NLINE),J=5,J2)
C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-1,NDUM)
C MESSAGE - "IS THIS LINE CORRECT? TYPE Y(YES) OR N(NO)"
CALL MESSAGE(49,NANS)
IF(NANS.EQ.1HN) GO TO 260
NCAPT(1,NLINE)=(MAXIX - NCHARS*2HORZ(ISIZE))/2
IY=IY - IVERT(ISIZE)
IF(NLINE.EQ.1) GO TO 240
ISIZE1=NCAPT(3,NLINE-1)
IY=IY - 1.25*( IVERT(ISIZE) + IVERT(ISIZE1))
240 NCAPT(2,NLINE)=IY
NCAPT(3,NLINE)=ISIZE
NCAPT(4,NLINE)=NCHARS
GO TO 120
C MESSAGE - "CHANGE CHARACTER SIZE, IF DESIRED."
260 CALL MESSAGE(50,NDUM)
CALL ANMODE
READ(3,113) ISIZEA
IF(EOF(3).EQ.3) ISIZE=ISIZEA
C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-1,NDUM)
C MESSAGE - "RETYPE LAST LINE"
CALL MESSAGE(51,NDUM)
GO TO 140
C THE FOLLOWING STATEMENT CLEARS THE SCREEN, NO MESSAGE IS WRITTEN.
330 CALL MESSAGE(J,NDUM)
IYSET=IY - 1*IVERT(ISIZE)
MAXLINE=NLINE
ENTRY WTITLE
IF(MAXLINE.EQ.0) GO TO 100
IF(JORAW.EQ.0 .OR. MAXIY.EQ.IYSET) GO TO 320
MAXIY=IYSET
CALL SETSCR
320 NLINE= )
340 NLINE=NLINE + 1
ISIZE=NCAPT(3,NLINE)
NCHARS=NCAPT(4,NLINE)
CALL CHRSIZ(ISIZE)
IX=NCAPT(1,NLINE)
IY=NCAPT(2,NLINE)
CALL MCVABS(IX,IY)
J2=NCHARS + 4
CALL ANMODE
WRITE(4,1000) (NCAPT(J,NLINE),J=5,J2)
IF(NLINE.LT.MAXLINE) GO TO 340
RETURN

C FORMATS
1000 FORMAT(8XR1)
1100 FORMAT(I1)
END
CCJEBRD

SUBROUTINE CCJEBRD
40 NTHBLK=3
   CALL INPIT(X,Y,NTHBLK)
60 IF(NTHBLK.GT.3) GO TO 83
   CALL MESSAGE(5,NOUM)
   GO TO 43
83 MAXBLK=43
   IF(NTHBLK.GT.MAXBLK) GO TO 9999
   GO TO (*133,135,113,115,123,125,133,135,143,145,150,155,163,165,170,175,
*9999,193,185,9999,193,195,233,235,213,215,223,225,233,9999,9999,
*9999,9999,9999,9999,9999,9999,9999,235
*) NTHBLK
100 CALL MESSFLIP
   GO TO 43
135 CALL CUEFLIP
   GO TO 43
113 CALL CRAWCUE
   GO TO 43
115 CALL SETCUE
   GO TO 43
120 CALL SETT
   GO TO 43
125 CALL SETSCR
   GO TO 43
130 CALL BORDER
   GO TO 43
125 CALL AXIS
   GO TO 43
140 CALL MESSAGE(6,NOUM)
   GO TO 43
145 CALL HXCOPY
   GO TO 43
150 CALL NEWLINE
   GO TO 43
155 CALL SPLINE(NTHBLK),RETURNS(6))
   GO TO 43
160 CALL LINEAR(NTHBLK),RETURNS(6))
   GO TO 43
165 CALL VIEWWALL
   GO TO 43
170 CALL VIEW
   GO TO 43
175 CALL SYMNET
   GO TO 43
180 CALL CAPTION
   GO TO 43
185 CALL WITLE
   GO TO 40
190 CALL SAVE
   GO TO 42
195 CALL REVIVE
   GO TO 43
200 CALL ERASED
   GO TO 43
205 CALL STAGLN
   GO TO 43
210 CALL CRMSTAG
   GO TO 43
215 CALL SETKEY
   GO TO 43
220 CALL KEY
   GO TO 43
225 CALL ISO
   GO TO 43
230 CALL CRWISO
   GO TO 43
235 STOP "REQUESTED FROM CUE BOARD"
   GO TO 4D
C
C MESSAGE - BLANK CUE REQUESTED. TRY AGAIN.
9999 CALL MESSAGE(17,NCJM)
   GO TO 43
END
COMMON
 */ELKISO/
 * ANGLE(20),
 * ARCMAx(20),
 * NTITLE(9),
 * MAXLINE,
 * RADIUS(20, 20),
 * VAR(20),
 * XISC(50, 20),
 * YISC(45, 20)
 COMMON
 */ELKPTS/
 * ARPTY(50, 20),
 * ASPL(10), 20),
 * NCODE(50),
 * NPTS,
 * NSPLS(50),
 * NSWITCH,
 * NTNSPL,
 * NVPTS,
 * JNT
 DC 303 'NTHLINE=1,MAXLINE
 ARCLen=1, 3
 203 X=SLN(1, XISC(1, NTHLINE), ARCLen)
 Y=SLN(1, YISC(1, NTHLINE), ARCLen)
 IF (ARCLen .LT. 3) CALL MCVEA(X, Y)
 CALL DRAWA(X, Y)
 ARCLen=ARCLen + 1
 IF (ARCLen .LT. ARCMAX(NTHLINE)) GO TO 203
 303 CONTINUE
 RETURN
 END
SUBROUTINE DRAWCUE

COMMON *ELK/
* IHCRZ(4),
* IVERT(4),
* IYSET,
* MAXCCL,
* MAXX,
* MAXY,
* MAXROW,
* MXOR,
* NF
COMMON
*/ELKCU/E/
* IHEIGHT,
* ILENGTH,
* ISIDE,
* IVCOELT,
* IXORIG,
* IY1,
* IVCOELT,
* IYORIG,
* IVC1,
* LEGEND(15,15,2)),
* NCHARQ,
* PHIC,
* SIDEX
DIMENSION
* NWCRDS(2)

C C MESSAGE - "IS HARDCOPIER ON AND SUFFICIENTLY WARM ? TYPE Y(YES) OR N(NO)
C CALL MESSAGE(2,NAM)
C C MESSAGE - "TURN ON HARDCOPIER, WHEN WARM TYPE Y."
C IF(NAMS.EQ.1HN) CALL MESSAGE(3,NAM)
C C THE FOLLOWING STATEMENT CLEARS THE SCREEN, NO MESSAGE IS WRITTEN.
21) CALL MESSAGE(0,NAM)
C CALL MCVABS(IXORIG,IVORIG)
C CALL MCVREL(-LENGTH/2,-HEIGHT/2)
C CALL DRWREL(3,HEIGHT)
C DO 33) MCCL=1,MAXCCL
C CALL MCVREL(ISIDE,-HEIGHT)
C CALL DRWREL(3,HEIGHT)
C 33) CONTINUE
C CALL DRWREL(-LENGTH,3)
C DO 36) NRWO=1,MAXROW
CALL MOVREL(ILength,-ISIDE)
CALL MOVREL(-ILength,1)
360 CONTINUE
CALL MOVREL(ILength,INHEIGHT)
DO 600 NRCW=1,MAXRCW
CALL MOVREL(-ILength,-ISIDE/2)
DO 500 NCCL=1,MAXCCL
CALL SEELOC(ix,iy)
NCAP=0
DO 400 N=1,NCHARC
IF(LEGEND(NRCW,NCCL,N),EQ.65B) GO TO 420
INCCRS(N)=LEGEND(NRCW,NCCL,N)
NCAP=N
410 CONTINUE
420 IF(NCHAR.LT.1) GO TO 480
DO 440 I=1,14
INCAP=NCAP*IMORZ(ISIZE)
IF(INCAP.LT.ISIDE) GO TO 460
440 CONTINUE
MESSAGE - "CAPTION TO LONG FOR CUE BLOCK"
CALL MESSAGE(16,4DUM)
460 CALL MOVREL((ISIDE-INCAP)/2,-IVERT(ISIZE)/2)
CALL CHRSIZ(ISIZE)
CALL ANMCE
WRITE(4,21100) (INCCRS(N),N=1,NCHAR)
CALL MVABS(ix,iy)
CALL MOVREL((ISIDE-3*IMORZ(3))/2,((ISIDE/2)-IVERT(3)))
CALL CHRSIZ(3)
CALL ANMCE
WRITE(4,21100) NRCW,NCCL
CALL MVABS(ix,iy)
480 CALL MOVREL(ISIDE,1)
500 CONTINUE
CALL MOVREL(1,-ISIDE/2)
600 CONTINUE
CALL MDCOPY
MESSAGE - "IS CPY SATISFACTORY ? TYPE Y(YES) OR N(NO)"
CALL MESSAGE(4,4HNS)
IF(NANS.EQ.14H1) GO TO 2100
RETURN
FORMAT
2100 FORMAT(2X,R1)
2110 FORMAT(R1,12.2)
SUBROUTINE ERASE
COMMON
* /BLKPTS/
* ARRAY(500,2),
* ASPL(100,20),
* NGCDE(500),
* NPTS,
* MSPLS(500),
* NSWITCH,
* NTHSPL,
* NVPTS,
* UNIT
ENTRY ERASED

C MESSAGE - "ERASE DRAWING ? TYPE Y(YES) OR N(NO)"
CALL MESSAGE(36,NANS)
IF(NANS.EQ.100) RETURN
DO 100 N=1,3000
ARRAY(N)=3.J
100 CONTINUE
DO 200 N=1,1004
NGCDE(N)=C
200 CONTINUE
RETURN
END
SUBROUTINE FIT(NFIRST)

COMMON */ELKPTS/
* ARRAY(5), 2),
* ASPL(1, 2),
* NCOE(5),
* NPTS,
* NSPLS(5),
* NSWICH,
* NTHSPL,
* NVPTS,
* JNIT
N1=NFIRST
N2=NPTS
DO 100 N=N1, N2
XSPL=ARRAY(N, 1)
YSPL=ARRAY(N, 2)
CALL UPDATE(ASPL(1, NTHSPL), XSPL, YSPL)
100 CONTINUE
RETURN
END
SUBROUTINE INPUT(X,Y,NTHBLK)
COMMON
*/ELK/
* IHRZ(4),
* IVERT(4),
* IYSET,
* MAXCL,
* MAXX,
* MAXY,
* MAXCM,
* MAXSR,
* NF
COMMON
*/ELKC'E/
* IHEIGHT,
* LENGTH,
* ISIDE,
* IJQDELT,
* IXORIG,
* IUQ1,
* IVQDELT,
* IVORIG,
* IVQ1,
* LEGEND(15,15,25),
* NCHARQ,
* PHIQ,
* SIDEQ
COMMON
*/ELKJ/
* JOE,
* JDRAW,
* JMESS,
* JSCR,
* JSTAG,
* JTITLE
COMMON
*/ELKSCAL/
* LENSCL,
* NXP,
* SCALAST,
* SCALES,
* SCALET,
* SCALSIZ
COMMON
*/ELKSIZ/
* IXRANGE,
* IXSTART,
* IX1,
* IYRANGE,
* IYSTART,
* IY1,
* NUNIT(2),
* PHIO,
* RATIOQ,
* XRANGE,
* XSTART,
* X1,
* YRANGE,
* YSTART,
* Y0

COMMON
*/ELKTO/
* IJDRW1,
* IJDRW2,
* IJ3,
* IVDRW1,
* IVDRW2,
* IV3

DIMENSION
* ICHARS(3)

IF(JCUE.EQ.1) GO TO 400

100 CALL BELL
   CALL ONEPNT(IJ,IV)
   IF(JDRAW.EQ.J.OR. NTHBLK.EQ.1) GO TO 200
   IF(JU.LT.IJDRW1 .OR. IJ.GT.IJDRW2)
   IF(JV.LT.IVDRW1 .OR. IV.GT.IVDRW2 ) GO TO 200
   IJDELT=IJ - IJ3
   IVDELT=IV - IV3
   X=SCALE-T*(IJDELT*CCS(PHIO) + IVDELT*SIN(PHIO))
   Y=SCALE-T*(IJDELT*CCS(PHIO) - IVDELT*SIN(PHIO))
   NTHBLK=1
   RETURN

200 IF(JUQ1.GT.) .AND. IVQ1.GT.) GO TO 240

C C MESSAGE - "GRAPHIC TABLET CUE BOARD HAS NOT BEEN POSICITIIONED."
   CALL MESSAGE(37,NQJM)

C C MESSAGE - "DO YOU WISH A COPY OF THE GRAPHICS TABLET CUE BOARD ?
   CALL MESSAGE(1,NAMS)
   IF(NAMS.EQ.1)HY) CALL DRAWCUE

C C MESSAGE - "DO YOU WISH TO POSITION THE GRAPHIC TABLET CUE BOARD ?"
   CALL MESSAGE(1,NAMS)
 IF(NAMS.EQ.IHY) GO TO 220
 JCJ=1

 C MESSAGE - "INPUT CUE CODES FROM TERMINAL KEYBOARD"
 CALL MESSAGE(?1,IOJN)
 GO TO 420
 220 CALL SETCJE
 NTHBLK=1
 RETURN
 240 IJDELT=IJ - IJC1
 IVDLT=IV - IVQ1
 JPRIME=IJDELT*CCS(PHIQ) + IVDLT*SIN(PHIQ)
 VPRIME=IJDELT*CCS(PHIQ) - IVDLT*SIN(PHIQ)
 IF( JPRIME.LE.0.0 ) CR. JPRIME.GE.IJDELT
 * .CR.
 * VPRIME.LE.0.0 CR. VPRIME.GE.IVDELT ) GO TO 330
 NTHCCL=(JPRIME/SIDEQ) + 1
 NTHROW=VPRIME/SIDEQ
 NTHROW=MATCHROW - NTHROW
 GO TO 730

 C MESSAGE - "POINTER IMPROPERLY POSITIONED, TRY AGAIN."
 330 CALL MESSAGE(5,IOJN)
 GO TO 133
 430 IF(JDRAW.EQ.) CR. NTHBLK.EQ.0) GO TO 530
 420 CALL BELL
 CALL SCURSP(ICHAR,IX,II)
 IF(ICHAR.EQ.81) GO TO 533
 "G"
 IF(IX.LT.IXSTART .CR.
 * IX.GT.(IXSTART + IXRANGE) .CR.
 * IX.GT.IYSTART .CR.
 * IX.GT.(IYSTART + IYRANGE ) ) GO TO 430
 IXD=IX - IXSTART
 IYD=IY - IYSTART
 X=SCALES*IXDELT + XSTART
 Y=SCALES*IYDELT + YSTART
 NTHBLK=1
 RETURN
 530 NTHROW=1
 NTHCCL=1
 CALL HCMZ
 CALL BAKSP
 CALL CHRSIZ(3)
 CALL CAXIS(2)
 CALL BELL
 CALL AIMCQE
 READ(3,2333)) ICARS
CALL CZAXIS(1)
NTHROW=ICHARS(1)
IF(NTHROW.LT.1 .OR. NTHROW.GT.MAXROW) GO TO 600
IF(ICHARS(2).GE.33B .AND. ICHARS(2).LE.44B)
  NTHCOL=ICHARS(2) - 33B
IF(ICHARS(3).GE.33B .AND. ICHARS(3).LE.44B)
  NTHCOL=10*NTHCOL + (ICHARS(3) - 33B)
IF(NTHCOL.GE.1 .OR. NTHCOL.LE.MAXCOL) GO TO 700
C      MESSAGE - "IMPROPER CJE CODE. TRY AGAIN."
  600  CALL MESSAGE(59,NOJM)
        GO TO 500
  700  NTHFLK=(NTHROW - 1)*MAXCOL + NTHCOL
        RETURN
C      FORMATS
C
  2000  FORMAT(?R1)
        END
SUBROUTINE ISO
COMMON
*/FLKISO/,
* ANGLE(2),
* ARCMAX(2),
* NTITLE(9),
* MAXLINE,
* RADIUS(2,2),
* VAR(2),
* XISC(6,2),
* YISC(6,2)
DIMENSION
* X(2),
* Y(2),
PI=3.14159265359
R0=PI/180.3
C MESSAGE - "INPUT TAPE NUMBER CONTAINING ISO DATA."
CALL MESSAGE(53,NO,JM)
READ(3,*) NTAPE
IF(NTAPE.EQ.3) RETURN
RESEND NTAPE
READ(NTAPE,133) NTITLE
IF(EOF(NTAPE).NE.0) GO TO 99
WRITE(4,1030) NTITLE
C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-2,NO,JM)
C MESSAGE - "READ THIS DATA? TYPE Y(YES) OR N(NO)"
CALL MESSAGE(54, NANS)
IF(NANS.EQ.1) IHN) RETURN
NHLINE=3
DO 12 N=1, 2
DO 12 M=1, 63
XISC(N,M)=3.
YISC(N,M)=3.
12) CONTINUE
DO 14 N=1, 2
DO 14 M=1, 23
RADIUS(N,M)=1.
14) CONTINUE
DO 16 N=1, 2
DO 16 M=1, 23
RADIUS(N,M)=1.
16) CONTINUE
READ(NTAPE,136) XGEN
IF(EOF(NTAPE).NE.0) GO TO 99
READ(NTAPE,136) YGEN
IF(EOF(NTAPE).NE.0) GO TO 99)
READ(NTAPE, 136) XPT
IF(EOF(NTAPE).NE.0) GO TO 99)
READ(NTAPE, 136) YPT
IF(EOF(NTAPE).NE.0) GO TO 99)
Xcen=-Xcen
Ycen=-Ycen
Xpt=-Xpt
Ypt=-Ypt
Argx=Xpt - Xcen
Argy=Ypt - Ycen
EPSLN=ATAN2 (Argy, Argx)
READ(NTAPE, 134) NVAR
IF(EOF(NTAPE).NE.0) GO TO 99)
IF(NVAR.LE.2) GO TO 22)
MESSAGE - "NUMBER OF VARIABLES EXCEEDS MAXIMUM LIMIT OF 20."
CALL MESSAGE(56, NDUM)
RETURN
223 READ(NTAPE, 138) (VAR(N), N=1, NVAR)
IF(EOF(NTAPE).NE.0) GO TO 99)
READ(NTAPE, 134) NANG
IF(EOF(NTAPE).NE.0) GO TO 99)
IF(NANG.LE.2) GO TO 24)
MESSAGE - "NUMBER OF ANGLES EXCEEDS MAXIMUM LIMIT OF 20."
CALL MESSAGE(57, NDUM)
RETURN
243 READ(NTAPE, 138) (ANGLE(N), N=1, NANG)
IF(EOF(NTAPE).NE.0) GO TO 99)
CC 2E N=1, NANG
ANGLE(N)=RD*ANGLE(N)
CONTINUE
READ(NTAPE, 133)
IF(EOF(NTAPE).NE.0) GO TO 99)
333 READ(NTAPE, 1120) NTHANG, NTHVAR, RAD
IF(EOF(NTAPE).NE.0) GO TO 99)
IF(NTHANG.EQ.99 .OR. NTHVAR.EQ.99) GO TO 332)
RAD=AS(NTHANG, NTHVAR)=RAD
GO TO 333)
332 CC 5J) NTHVAR=1, NVAR
ARGLEN=3,)
NTRIP=3)
NTH=3)
GO "4) NTHANG=1, NANG
IF(NTRIP.EQ.1) GO TO 56)
IF(RADIUS(NTHANG, NTHVAR).LT.2.0) GO TO 44)
NTRIP=1
NTHLINE=NTHLINE+1
IF(NTHLINE.LE.2) GO TO 380
C
C MESSAGE - "NUMBER OF ISO CONTOUR LINES EXCEEDS MAXIMUM LIMIT OF 20."
CALL MESSAGE(58,NOJM)
RETURN
360 IF(RADIUS(NTHANG,NTHVAR).GT.3.3) GO TO 380
ARCMMX(NTHLINE)=ARCLEN
ARCLEN=3.3
NTRIP=3
NTH=3
GO TO 440
380 NTH=NTH+1
R=RADIUS(NTHANG,NTHVAR)
XPRIM=R*COS(ANGLE(NTHANG))
YPRIM=R*SIN(ANGLE(NTHANG))
X(NTHANG)=XPRIM*COS(EPSLN) - YPRIM*SIN(EPSLN) + XCEN
Y(NTHANG)=XPRIM*SIN(EPSLN) + YPRIM*COS(EPSLN) + YCEN
IF(NTH.EQ.1) GO TO 420
ARGX=X(NTHANG) - X(NTHANG-1)
ARY=Y(NTHANG) - Y(NTHANG-1)
SEGLEN=SQRT(ARGX**2 + ARGY**2)
ARCLEN=ARCLEN + SEGLEN
420 CALL UPDATE(XISO(1,NTHLINE),ARCLEN,X(NTHANG))
CALL UPDATE(YISO(1,NTHLINE),ARCLEN,Y(NTHANG))
440 CONTINUE
IF(RADIUS(NTHANG,NTHVAR).LT.3.3) GO TO 530
N2=ANG
GO 460 NTHANG=1,3
ARGX=X(NTHANG) - X(N2)
ARY=Y(NTHANG) - Y(N2)
SEGLEN=SQRT(ARGX**2 + ARGY**2)
ARCLEN=ARCLEN + SEGLEN
CALL UPDATE(XISO(1,NTHLINE),ARCLEN,X(NTHANG))
CALL UPDATE(YISO(1,NTHLINE),ARCLEN,Y(NTHANG))
N2=NTHANG
460 CONTINUE
ARCMMX(NTHLINE)=ARCLEN
530 CONTINUE
MAXLINE=NTHLINE
READ(NTAPE,1360) XCEN
IF(EOF(NTAPE).EC.)) GO TO 200
RETURN
C
C MESSAGE - EOF ENCOUNTERED READING ISO DATA TAPE."
999 CALL MESSAGE(55,NOJM)
RETURN
C FORMATS
134) FORMAT(3X, I2)
136) FORMAT(2X, 6G12.5)
138) FORMAT(6E12.5)
112) FORMAT(I2, 8X, I2, 8X, G12.5)
END
CLINES
SUBROUTINE LINES(NTHBLK),RETURNS(NS6)
COMMON *
* BLKJ/
* JOE,
* JDRAW,
* JMESS,
* JSCR,
* JSTAG,
* JTITL
COMMON
*/PLKPTS/
* ARRAY(530,2),
* ASPL(100,2)),
* NCCDE(530),
* NPTS,
* NSPLS(530),
* NSWITCH,
* NTHSPL,
* NVPTS,
* JNIT
ENTRY NEWLINE
6) IF(JDRAW.NE.9) GO TO 99
C
C MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
CALL MESSAGE(23,NDJM)
RETURN
99 IF(NSWITCH.EQ.1) GO TO 113
NPTS=NPTS + 1
NTHPT=NPTS
NSWITCH=1
NCCDE(NTHPT)=0
C
C MESSAGE - "NEW LINE SEGMENT STARTED SELECT LINEAR OR SPLINE."
113 CALL MESSAGE(29,NDJM)
RETURN
ENTRY LINEAR
IF(NPTS.EQ.0) GO TO 60
NTHPT=NPTS
NPLS=1
GO TO 211
ENTRY SLINE
IF(NPTS.EQ.0) GO TO 60
NTHSPL=NTHSPL + 1
IF(NTHSPL.LE.2) GO TO 120
C
C MESSAGE - "MAXIMUM NUMBER OF SPLINES HAS BEEN EXCEEDED."
CALL MESSAGE(31,NDJM)
GO TO 41)
12) NFIRST=NPTS
   NSPLS(NFIRST)=NTHSPL
   NPLUS=4
20) CALL INPJIT(X,Y,NTHBLK)
   IF(NTHBLK.NE.-1) GO TO 26)
   IF(NCOE(NTHPT).EQ.0) .AND. NSWITCH.EQ.1) GO TO 24)
   IF(NPLUS.NE.4 . OR. X.GT.ARRAY(NTHPT,1)) GO TO 22)
C   MESSAGE = "VALUES OF X MUST BE INCREASING FOR A SPLINE FIT."
   CALL MESSAGE(25,NOJM)
   GO TO 36)
22) NTHPT=NTHPT+1
   IF(NTHPT.LE.500) GO TO 23)
C   MESSAGE = "MAXIMUM NUMBER OF POINTS HAS BEEN EXCEEDED."
   CALL MESSAGE(33,NOJM)
   GO TO 40)
23) NCOE(NTHPT)=1 + NPLUS
24) ARRAY(NTHPT,1)=X
    ARRAY(NTHPT,2)=Y
    NSWITCH=)
    GO TO 25)
26) IF(NCOE(NTHPT).GT.0) GO TO 30)
    IF(NCOE(NTHPT).EQ.0) NTHPT=NTHPT - 1
    IF(NPLUS.EQ.4) GO TO 25)
    GO TO 40)
30) IF(NCOE(NTHPT).LE.5 .AND. (NTHPT - NFIRST).LT.2) GO TO 24)
    NCOE(NTHPT)=NCOE(NTHPT)
    NPTS=NTHPT
    IF(NCOE(NTHPT).EQ.-5) CALL FIT(NFIRST)
    RETURN NS6)
C   MESSAGE = "INSUFFICIENT NUMBER OF POINTS FOR SPLINE CURVE."
34) CALL MESSAGE(25,NOJM)
C   MESSAGE = "DO YOU WISH TO ABORT THIS LINE SEGMENT ? TYPE Y(YES) OR N(NO)"
36) CALL MESSAGE(26,NOJM)
   IF(YAMS.EQ.1) GO TO 42)
30) NTHSPL=NTHSPL - 1
    NTHPT=NFIRST
C   MESSAGE = "CURRENT LINE SEGMENT ABORTED."
41) CALL MESSAGE(27,NOJM)
   RETURN NS6)
C   MESSAGE = "INPJIT ADDITIONAL POINT(S)."
42) CALL MESSAGE(29,NOJM)
SUBROUTINE MESSAGE(NUM,NAMS)
C THIS SUBROUTINE WRITES MESSAGES TO THE SCREEN
COMMON
*/ELK/,
* H Horz(4),
* IVERT(4),
* IYSET,
* MAXCOL,
* MAXIX,
* MAXY,
* MAXXC,
* MAXXR,
* NF
COMMON
*/ELKJ/,
* JC E,
* JDRW,
* JMESS,
* JSCR,
* JSTAG,
* JTITLE
DIMENSION
* NCHARS(PS,66)
DATA
* (NCHARS=480*55B),
* (NTOTAL=65),
* (N55=1941)
ISIZE=2
CALL CHRBSIZ(ISIZE)
IF(NUM.LT.1)) GO TO 233
NLIN=2*IVERT(ISIZE)
C SETTING THE CHARACTER SIZE AND LINE SPACING FOR MESSAGES.
C THIS SECTION READS THE MESSAGES STORED ON TAPE1
M55=M55.AND..NCT.MASK(5)
GO 12) I=1,NTOTAL
READ(1,1)) NTH,(NCHARS(J,NTH),J=1),$)
IF(EOF(1).NE.)) RETURN
12) CONTINUE
STOP"EOF NOT ENCOUNTERED READING MESSAGES FROM TAPE1."
233) CALL BELL
IF(NUM.GT.NTOTAL) STOP"MESSAGE I) NUMBER EXCEEDS MATRIX DIMENSION"
IF(NUM.GT.)) GO TO 244
IF(NUM.LT.)) GO TO 222
NLIN=2*IVERT(ISIZE)
CALL NEWPAG
RETURN
22) NL=NUM
    NLINE=NLINEx+NL*IVERT(ISIZE)
RETURN
24) NCHK1=(NCHARS(1,NUM).AND.MASK(6)) .CR. N55
    NCHK2=(SHIFT(NCHARS(1,NUM),6).AND. MASK(6)) .CR. N55
    IF(NCHK1.NE.1HP .AND.
      * NCHK2.ME.1HS .AND.
      * JMESS.NE.1) GO TO 33)
26) NLINEx=NLINEx+IVERT(ISIZE)
    CALL HOME
    CALL MVCVRL(3.-NLINEx)
    CALL ANMODE
    WRITE(4,0000) NCHARS(1,NUM),(NCHARS(J,NUM),J=2,8)
    IF(NCHK2.EQ.1HS) CALL FINITT(3,3)
33) IF(NCHK2.NE.1HG) RETURN
34) CALL HOME
    CALL BAKSP
    CALL CZAXIS(2)
    CALL BELL
    CALL ANMODE
    READ(3,3333) NANS
    CALL CZAXIS(3)
    IF(NANS.EQ.1HM .CR. NANS.EQ.1HY) RETURN
    GO TO 26)
ENTRY MESFLIP
JMESS=-JMESS
RETURN
C FORMATs
133) FORMAT(I2,1X,2R10)
333) FORMAT(A1)
993) FORMAT(R8,7R10)
END
CCOPTCN
SUBROUTINE OPTION
COMMON
/*ELK/
* IHORZ(4),
* IVERT(4),
* IYSET,
* MAXCCL,
* MAXIX,
* MAXY,
* MAXRCN,
* MAXSR,
* MF
COMMON
*/ELKJ/
* ICJE,
* JDRAW,
* JMESS,
* JSER,
* JSTAG,
* JTITLE
COMMON
*/ELKSCAL/
* LENSCAL,
* NEXP,
* SCALAST,
* SCALEP,
* SCALET,
* SCALSIZ
COMMON
*/ELKCD/
* IXRANGE,
* IXSTART,
* IY1,
* IYRANGE,
* IYSTART,
* IY1,
* NNUMIT(2)),
* PHD,
* RATIO,
* XRANGE,
* XSTART,
* XJ,
* YRANGE,
* YSTART,
* YJ
C
C******************************************************************************
C.C  CALCULATES AND DRAWS SCALE KEY ON TERMINAL SCREEN
ENTRY KEY
    IF(JDRAW.NE.1) GO TO 370
130 IF(JSCR.NE.1) CALL SETSCR
    IF(SCALAST.EQ.SCALES) GO TO 410
    SCALAST=SCALES
    SCALSIZ=1
    NEXP=3
    STEP=0.125*MAXR*SCALES
230 IF(STEP.GE.1.) GO TO 240
    STEP=1.0*STEP
    NEXP=NEXP+1
    IF(NEXP.GE.10) GO TO 230
C C    MESSAGE - "SCREEN SCALE IS LESS THAN 1.0*E-10."
    CALL MESSAGE(42,NCJM)
    RETURN
240 IF(SCALSZ.GE.STEP) GO TO 230
    IF(SCALSZ.T.11.9) GO TO 260
    SCALSZ=11.9*SCALSZ
    GO TO 240
260 NEXP=NEXP+1
    STEP=0.1*STEP
    IF(NEXP.EQ.7) GO TO 240
C C    MESSAGE - "SCREEN SCALE IS GREATER THAN 1.0*E10."
    CALL MESSAGE(43,NCJM)
    RETURN
330 IF(FATOR.GT.3.7) GO TO 240
    SCALSZ=3.5*SCALSZ
    IF(SCALSZ.GT.1.0) GO TO 230
    CALL MESSAGE(44,NCJM)
    RETURN
340 LENSCL=(SCALSZ*(1.0**NEXP))/SCALES
430 IF(IY.LT.0) OR (IY.LT.0) GO TO 630
    IF((IX1+1.2*LENSCAL).GT.(IXSTART+IXRANGE))
        * IX1=IXSTART+IXRANGE-1.2*LENSCAL
    CALL MOVABS(IX1,IY1)
    CALL DRWRPL(LENSCAL,IY)
    TY=1.0*LENSCAL
    CALL DRWRPL(TY,IY)
    IX=0.5*LENSCAL
    CALL DRWRPL(-IX,IY)
    CALL DRWRPL(-IX,ITY)
    CALL DRWRPL(-IX,IY)
    CALL DRWRPL(IX,ITY)
    CALL DRWRPL(IX,IY)
IY = IY/2
CALL MCVREL(IY,-IY)
CALL DRAWREL(LENSCAL,IY)
CALL MOVABS(IYI,1)
CALL CHRTZ(3)
CALL CSIZE(IH,IV)
IY = IV
IX = IH/2
CALL MCVREL(-IX,-IY)
CALL ANMCOE
IY = SCALSZ
WRITE(4,1110) IY
CALL MOVABS(IYI,1)
IX = LENSCAL - 2*IH
IF(I1.LT.1)) IX = IX - IH/2
IF(I1.LT.1)) IX = IX - IH/2
IF(I1.LT.1)) IX = IX - IH/2
IF(NEXP.EQ.3) IX = IX - 3*IH
CALL MCVREL(IY,-IY)
CALL ANMCOE
WRITE(4,1110) IX
IF(NEXP.EQ.3) GO TO 44
CALL MCVABS(IYI,1)
CALL MCVREL(IYI,-IY)
CALL ANMCOE
WRITE(4,1110) "*10",NEXP
44) CALL MOVABS(IYI,1)
DO 45 J = 1, 2
IF(NUNIT(J).EQ.55B) GO TO 42
NCHARS = J
45) CONTINUE
46) IX = (LENSCAL - NCHARS*IH)/2
CALL MCVREL(IY,-2*IV)
CALL ANMCOE
WRITE(4,2222) (NUNIT(J),J = 1,NCHARS)
RETURN
C REQUESTS POSITION OF SCALE KEY
ENTRY SETKEY
IF(UDRAW.EQ.1) GO TO 91
C MESSAGE - "SET SCALE POSITION."
63) CALL MESSAGE(45,NDJK)
N = 1
CALL INPJIT(X,Y,N)
IF(N.EQ.-1) GO TO 64)

C MESSAGE - "POINTER IMPROPERLY POSITIONED, TRY AGAIN."
CALL MESSAGE(6,NDUM)
RETURN

64) IX=IHRANGE*(X - XSTART)/XRANGE
       IY=IYRANGE*(Y - YSTART)/YRANGE
RETURN

C******************************************************
C
C DRAWS X-Y AXIS ON TERMINAL SCREEN
ENTRY AXIS
IF(JDRAW.NE.1) GO TO 993)
CALL MOVEXA(XSTART,.)
X=XSTART + XRANGE
CALL DASHA(X,.),77777675)
CALL MOVEX(.),YSTART)
Y=YSTART + YRANGE
CALL DASHA(.),Y,77777675)
RETURN

C******************************************************
C
C DRAWS BORDER ON TERMINAL SCREEN
ENTRY BORDER
IF(JDRAW.NE.1) GO TO 993)
CALL MOVAES(XSTART,YSTART)
CALL ORWREL(-IYRANGE,)
CALL ORWREL(-IYRANGE,)
RETURN

C MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
993) CALL MESSAGE(23,NDUM)
RETURN

C FORMATS
100) FORMAT(I1)
104) FORMAT(I4)
113) FORMAT(4X,A4,I2)
200) FORMAT(23R1)
END
CREVIVE
SUBROUTINE REVIVE
COMMON
* /BLK/
  * INORZ(4),
  * IVERT(4),
  * IYSET,
  * MAXCOL,
  * MAXIX,
  * MAXIX,
  * MAXROW,
  * MAXSR,
  * NF
COMMON
* /BLJK/
  * JCJ,
  * JDRAW,
  * JMRES,
  * JSCF,
  * JSTAG,
  * JTITL
COMMON
* /PLKPTS/
  * ARRAY(500,2),
  * ASPL(100,23),
  * NCODE(500),
  * NPTS,
  * NSPOLS(500),
  * NSWITCH,
  * NSPLSPL,
  * NVPTS,
  * UNIT
COMMON
* /BLKSCAL/
  * LENSCL,
  * NEXP,
  * SCALAST,
  * SCALES,
  * SCALET,
  * SCALSIZ
COMMON
* /BLKSD/
  * IXRANGE,
  * INSTART,
  * IX1,
  * IYRANGE,
  * IYSTART,
  * IY1,
* MUNIT(2),
* PHIC,
* RATIOQ,
* XRANGE,
* XSTART,
* XQ,
* YRANGE,
* YSTART,
* YQ

C
C MESSAGE - "INPUT TAPE NUMBER THAT CONTAINS DRAWING DATA."
CALL MESSAGE(38,NOJM)
CALL ANMODE
READ(3,*) NTAPE
C
C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-2,NOJM)
IF(EOF(3).NE.0) OR. NTAPF.LE.0) RETURN
REWIND NTAPF
READ(NTAPE,1000) IXRANGE,
* IXSTART,
* IYRANGE,
* IYSTART,
* MAXSR,
* NAQO
IF(EOF(NTAPE).NE.0) GO TO 40)
READ(NTAPE,1060) NUNIT
IF(EOF(NTAPE).NE.0) GO TO 40)
READ(NTAPE,1100) PHIC,
* RATIOQ,
* SCALET,
* 'UNIT,
* XRANGE,
* XSTART,
* XQ,
* YRANGE,
* YSTART,
* YQ
CALL VNDO(XSTART,XRANGE,YSTART,YRANGE)
IF(EOF(NTAPE).NE.3) GO TO 40)
READ(NTAPE,1233)
IF(EOF(NTAPE).NE.3) GO TO 40)
JDRAW=1
CALL SETSCR
NFIRST-3
N1=NPTS+1
N2=NPTS+NAQO
CO 300 NIMFST=N1,N2

87
READ(NTAPE,13) I, NSPLS(NTHPT), NCCOE(NTHPT), ARRAY(NTHPT,1),
* 
   ARRAY(NTHPT,2)
IF(EOF(NTAPE).NE.0) GO TO 43)
NPTS=NTHPT
IF(NCCOE(NTHPT).NE.0) GO TO 16)
IF(NTHPT - NFIRST.GT.1) GO TO 14)
C
C MESSAGE - "INSUFFICIENT NUMBER OF POINTS FOR SPLINE CURVE."
   CALL MESSAGE(25,NDUM)
   RETURN
140 CALL FIT(NFIRST)
   NFIRST=)
160 IF(NSPLS(NTHPT).EQ.0) GO TO 33)
   NFIRST=NTHPT
   NTHSPL=NTHSPL+1
   IF(NTHSPL.LE.2) GO TO 18)
C
C MESSAGE - "MAXIMUM NUMBER OF SPLINES HAS BEEN EXCEEDED."
   CALL MESSAGE(31,NDUM)
   RETURN
180 NSPLS(NTHPT)=NTHSPL
330 CONTINUE
   RETURN
C
C MESSAGE - "EOF ENCOUNTERED READING DRAWING DATA TAPE."
430 CALL MESSAGE(39,NDUM)
   RETURN
C
C FORMATS
1333 FORMAT(1X,I11)
1363 FORMAT(13X,23R1)
1133 FORMAT(8X,6F13.6)
1233 FORMAT(3A13)
1333 FORMAT(I3,4X,I2,3X,I3,3X,2G13.6)
END
CSAVE

SUBROUTINE SAVE

COMMON
* /BLK/
* /IHORZ(4),
* /IVERT(4),
* /IYSET,
* /MAXCOL,
* /MAXIX,
* /MAXIY,
* /MAXROW,
* /MAXSR,
* /NF
 COMMON
* /ELKJ/
* /JCJE,
* /JCDRAW,
* /JMESS,
* /JSCR,
* /JSTAG,
* /JTITLE
 COMMON
* /ELKPTS/
* /ARRAY(533,2),
* /ASPL(133,2)),
* /Maxcode(533)),
* /NPTS,
* /NSPL(533)),
* /NSWITCH,
* /NTHSPL,
* /NVPTS,
* /UNIT
 COMMON
* /ELKSCAL/
* /LENSCAL,
* /MEXP,
* /SCALAST,
* /SCALES,
* /SCALET,
* /SCALSIZ
 COMMON
* /ELKSO/
* /IXRANGE,
* /IXSTART,
* /IX1,
* /IYRANGE,
* /IYSTART,
* /IY1,
* NUNIT(2),
* PHID,
* RATIOD,
* XRANGE,
* XSTART,
* X0,
* YRANGE,
* YSTART,
* Y0
* IF(JDRAW.NE.0) GO TO 8)

C MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
CALL MESSAGE(23,NOM)
RETURN

C MESSAGE - "INPUT TAPE NUMBER ON WHICH DRAWING DATA IS TO BE SAVED."
8) CALL MESSAGE(11,NOM)
CALL AIMCDE
READ(3,* NTAPE
C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-2,NOM)
IF(EOF(3).NE.0 .OR. NTAPE.LE.0) RETURN
CALL AIMCDE
WRITE(NTAPE,1333) "IXRANG",IXRANGE,
* "IXSTART",IXSTART,
* "IYRANGE",IYRANGE,
* "IYSTART",IYSTART,
* "MAYS",MAYS,
* "NPTS",NPTS
WRITE(NTAPE,1365) "NUNIT",NUNIT
WRITE(NTAPE,1133) "PHID",PHID,
* "RATIOD",RATIOD,
* "SCALET",SCALET,
* "UNIT",UNIT,
* "XRANGE",XRANGE,
* "XSTART",XSTART,
* "X0",X0,
* "YRANGE",YRANGE,
* "YSTART",YSTART,
* "Y0",Y0
WRITE(NTAPE,1203)
WRITE(NTAPE,1203) ((I,NSPLS(I),XCD(I),ARRAY(I,1),ARRAY(I,2))
* ,I=1,NPTS)
RETURN

C FORMATS
1333 FORMAT(A10,I10)
136) FORMAT(A10,2JR1)
111) FCMPAT(AE,613.6)
123) FORMAT(*NTHPT NSPTS NSPDE XARRAY YARRAY*)
130) FORMAT(I3,4X,I2,3X,I3,3X,2G13.6)
END
SUBROUTINE SETCUE
COMMON */ELK*/
* IMCRZ(4),
* IVEER(4),
* IYSET,
* MAXCOL,
* MAXX,
* MAXY,
* MAXROW,
* MAXER,
* MF
COMMON */ELKCU/,
* IN HEIGHT,
* LENGTH,
* ISIDE,
* IUQDEL T,
* IXORIG,
* IJC1,
* IVQDEL T,
* IVQORIG,
* IVQ1,
* LEGEND(15,16,2),
* NCHARQ,
* PHIC,
* SIDEQ
COMMON */ELKJ/,
* JCUE,
* JORAM,
* JWESS,
* JSCR,
* JTAG,
* JTITLE

MESSAGE - "INPUT LOWER LEFT AND LOWER RIGHT CORNER POINTS OF CUE BOARD"
CALL MESSAGE(7,"IOM")
CALL BELL
CALL CNEPST(IJC1,IVC1)
CALL BELL
CALL CNEPST(IJC2,IVC2)
JDEL T=IJC2 - IJC1
VDEL T=IVC2 - IVQ1
PHIC=ATAN2(VDEL T,JDEL T)
IJCDEL T=JDEL T
IVQDEL T=MAXROW*(JDEL T/MAXCOL)
SIDEQ=JDELT/MAXCCL
JCJE=-1
RETURN
ENTRY CUEFLIP
JCJE=JCJE
RETURN
C
C FORMATS
2000 FORMAT(I5)
2100 FORMAT(R1,I2,2X,2DR1)
2200 FORMAT(2DR1)
END
CSETS C
SUBROUTINE CSETS
COMMON
*/ELK/
* IHSZ(4),
* IVERT(4),
* IYSET,
* M1AXCOL,
* MAXIX,
* MAXIY,
* MAXROW,
* MAYS,
* NF
COMMON
*/ELKJ/
* JCUE,
* JDRAW,
* JMESS,
* JSCR,
* JSTAG,
* JTITLE
COMMON
*/ELKPTS/
* ARRAY(532,2),
* ASPL(133,22),
* NC03E(530),
* NPTS,
* NSPLS(530),
* NSWITCH,
* NTHSP,
* NVPIS,
* JNIT
COMMON
*/ELKSCAL/
* LENSCAL,
* NEXP,
* SCALAST,
* SCALES,
* SCALAT,
* SCALSZ
COMMON
*/ELKSD/
* IXRANGE,
* IXSTART,
* IX1,
* IYRANGE,
* IYSTART,
* IY1,
 IF(JDRAW.NE.2) GO TO 80
C MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
   CALL MESSAGE(23,NDJM)
   RETURN
C THE FOLLOWING STATEMENT CLEARS THE SCREEN, NO MESSAGE IS WRITTEN.
80 CALL MESSAGE(),NDJM)
   WIDTHS=MAXIX
   HEIGHTS=MAXIY
100 RATIOS=WIDTHS/HEIGHTS
   IF(RATIOS.GT.1.00) GO TO 200
   IYSTART=0
   IYRANGE=HEIGHTS
   IXRANGE=IYRANGE*RATIOS
   IXSTART=(WIDTHS - IXRANGE)/2
   GO TO 240
200 IXRANGE=WIDTHS
   IXSTART=0
   IYRANGE=IXRANGE/RATIOS
   IYSTART=(HEIGHTS - IYRANGE)/2
C SETTING THE SCREEN WINDOW
240 CALL SWINGO(IXSTART,IXRANGE,IYSTART,IYRANGE)
   SCALEs=XRANGE/IXRANGE
C SETTING THE X INCREMENT FOR SPLINE FIT
   UNIT=5*(MAXSR/1024)*SCALEs
   JSCR=1
   RETURN
END
CSETD

SUBROUTINE SETD
COMMON
*/BLKJ/
* JCL,E,
* JDRAW,
* JYESS,
* JSRC,
* JSTAG,
* JTITLE
COMMON
*/ELKSCAL/
* LENSCL
* NEXP,
* SCALAST,
* SCALES,
* SCLET,
* SCALSIZ
COMMON
*/ELKSJ/
* IXRANGE,
* IXSTART,
* IX1,
* IYRANGE,
* IYSTART,
* IY1,
* NJNIT(2)),
* PHIC,
* RATIOC,
* XRANGE,
* XSTART,
* X0,
* YRANGE,
* YSTART,
* Y0
COMMON
*/ELKTC/
* JDWR1,
* JDWR2,
* JI0,
* JIVR1,
* JIVR2,
* JV0
IF(JDRAW.NE.)) CALL ERASED
C
C MESSAGE - "PLACE DRAWING ON THE GRAPHICS TABLET."
CALL MESSAGE(18,NY,6)
C MESSAGE - "INPUT LOWER LEFT AND UPPER RIGHT CORNERS OF THE DRAWING"
CALL MESSAGE(19,NDJM)
CALL BELL
CALL ONEPNT(IJDRW1,IVORW1)
CALL BELL
CALL ONEPNT(IJDRW2,IVORW2)

C MESSAGE - "SPECIFY POINT ON DRAWING AND TYPE IN THE (X,Y) COORDINATES."
CALL MESSAGE(20,NDJM)
CALL BELL
CALL ONEPNT(IIJ1,IV1)
CALL BELL
CALL ANMODE
READ(3,*X1,Y1)
IF(ECF(3).NE.0) X1=0 Y1=0

C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-2,NDJM)

C MESSAGE - "SPECIFY ANOTHER POINT AND TYPE IN (X,Y) COORDINATES."
CALL MESSAGE(21,NDJM)
CALL BELL
CALL ONEPNT(II1,IV2)
CALL BELL
CALL ANMODE
READ(3,*X2,Y2)

C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
CALL MESSAGE(-2,NDJM)

C MESSAGE - "TYPE UNIT OF DIMENSIONS (2) CHARACTERS OR LESS)."
CALL MESSAGE(24,NDJM)
CALL ANMODE
READ(3,III1 NUMIT
DJ=II1 - II1
DV=IV1 - IV1
ETA=ATAN2(DY,DJ)
DX=X1 - X1
DY=Y1 - Y1
THETA=ATAN2(DY,DX)
PHI=ETA - THETA
ARG1=DX**2 + DY**2
ARG2=DJ**2 + DV**2
IF(ARG2.LE.0.0) CALL MESSAGE(22,NDJM)
SCALE=SQR(ARG1/ARG2)

C SETTING THE SCREEN WINDOW ARGUMENTS
WIDTH=IIJDRW2 - IJDRW1
HEIGHT=IVORW2 - IVORW1
SETTING THE VIRTUAL WINDOW ARGUMENTS
XSTART = (IU/SCALET) - (XU/SCALET)
XU = IU - (XU/SCALET)
YSTART = (IV/SCALET) - (YU/SCALET)
YU = IV - (YU/SCALET)

SETTING THE VIRTUAL WINDOW
CALL WINDO(XSTART, XU, YSTART, YU)
JCRw = 1
CALL SETSCR
RETURN

FORMATS
1303 FORMAT(2JR1)
END
SUBROUTINE STAGLN
COMMON
* /ELKJ/
* /JGUE/
* /JGRAW/
* /JMSS/
* /JSCH/
* /JSTAG/
* /JTITLE/

C MESSAGE - "INPUT TAPE NUMBER THAT CONTAINS STAGNATION LINE DATA."
8) CALL MESSAGE(4),NDJM)
 CALL AHMCOE
 READ(3,*) JSTAG

C THE FOLLOWING STATEMENT SKIPS MESSAGE LINES, NO MESSAGE IS WRITTEN.
 CALL MESSAGE(-1,NDJM)
 RETURN
 ENTRY CRSTAG

C MESSAGE - "TAPE NUMBER CONTAINING STAGNATION LINE DATA HAS NOT BEEN SPECIFIED.
 IF(JSTAG.GT.0) GO TO 1JJ
 CALL MESSAGE(41,NDJM)
 GO TO 82
1JJ REWIND JSTAG
 ISIZE=1
 CALL CHRSIZ(ISIZE)
 CALL CSIZE(IH,IV)
 CALL SEED(XMIN,XMAX,YMIN,YMAX)
123 READ(JSTAG,1333) N,XPT,YPT
 IF(EOF(JSTAG),NE.0)GO TO 23)
 XPT=-XPT
 YPT=-YPT
 IF( (XPT.LT.XMIN) 
 * .OR.(XPT.GT.XMAX)
 * .OR.(YPT.LT.YMIN)
 * .OR.(YPT.GT.YMAX) ) GO TO 123)
 IF(N.GT.0)GO TO 18)
 N=-N
 CALL MCVEA(XPT,YPT)
 X=3.35*TH
 Y=3.35*TV
 CALL MCVERL(-IX,-IY)
 CALL AHMCOE
 WRITE(4,1133) N
 GO TO 123
183 CALL MCVEA(XPT,YPT)
NSIZE=10
NSYM=3
CALL SYMBOL(NSYM,NSIZE)
GO TO 120
200 RETURN
100 FORMAT(I5,2F12.6)
110 FORMAT(I1)
END
SUBROUTINE SYMBCL(NHSYM,NSIZE)
C THIS SUBROUTINE DRAWS SYMBOLS FOR THE TEKTRONIX
ISIZE=NSIZE/2
GO TO (133,233,333) NHSYM
C
C THIS DRAWS AN ASCII LIKE FIGURE
133 DO 143 I=1,8
   IDIR=I-1
   CALL INCPLT(1,DIR,ISIZE)
   IDIR=IDIR+4
   IF(IDIR.GT.7) IDIR=IDIR-8
   CALL INCPLT(1,IDIR,ISIZE)
143 CONTINUE
RETURN
C
C THIS IS A PLUS SIGN WITH OPPOSITE BARS CONNECTED
233 CALL INCPLT(1,3,ISIZE)
       CALL INCPLT(1,3,ISIZE)
       CALL INCPLT(1,6,NSIZE)
       CALL INCPLT(1,3,ISIZE)
       CALL INCPLT(1,3,ISIZE)
RETURN
C
C THIS DRAWS A SQUARE
333 CALL INCPLT(1,1,ISIZE)
       CALL INCPLT(1,1,ISIZE)
       CALL INCPLT(1,4,NSIZE)
       CALL INCPLT(1,6,NSIZE)
       CALL INCPLT(1,3,NSIZE)
       CALL INCPLT(1,2,NSIZE)
RETURN
END
CSYMMET
SUBROUTINE SYMMET
COMMON *
/BLKJ/
*JCUE,
*JDRAW,
*JMESS,
*JSCR,
*JSTAG,
*JTITLE
COMMON *
/ELKPTS/
*ASPL(100,20),
*NCODE(50),
*NPTS,
*NSPLS(50),
*NNSW,CH4,
*NTHSPL,
*NVPTS,
*UNIT
IF(JDRAW.NE.1) GO TO 80

C MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
CALL MESSAGE(23,NDJM)
RETURN
80 IF(NPTS.LT.2) RETURN
NSTOP=NPTS
NTHPT1=1
NTHPT2=NPTS+1
IF(NTHPT2.LE.50) GO TO 90

C MESSAGE - "MAXIMUM NUMBER OF POINTS HAS BEEN EXCEEDED."
CALL MESSAGE(31,NDJM)
RETURN
90 NCODE(NTHPT2)=J
IF(JABS(NCODE(NTHPT1+1)).NE.5) GO TO 140
NTHSPL=NTHSPL+1
IF(NTHSPL.LE.20) GO TO 120

C MESSAGE - "MAXIMUM NUMBER OF SPLINES HAS BEEN EXCEEDED."
CALL MESSAGE(31,NDJM)
RETURN
120 NFIRST=NTHPT2
IF(NCODE(NTHPT2).NE.0) NFIRST=NFIRST-1
NSPLS(NFIRST)=NTHSPL
140 NPTS=NTHPT2
ARRAY(NTHPT2,1)=ARRAY(NTHPT1,1)
ARRAY(NTHPT2,2)=-ARRAY(NTHPT1,2)
IF(NCCOE(NTHPT2).EQ.-5) CALL FIT(NFIRST)
NTHPT1=NTHPT1 + 1
IF(NTHPT1.GT.NSTOP) GO TO 230
NTHPT2=NTHPT2 + 1
NCCOE(NTHPT2)=NCCOE(NTHPT1)
IF(NCCOE(NTHPT2 - 1).EQ.NCCOE(NTHPT2) .CR.
   NCCOE(NTHPT2 - 1).EQ.0 .OR.
   NCCOE(NTHPT2).LT.0 ) GO TO 140
GO TO 100
230 RETURN
END
CVIEW
SUBROUTINE VIEW
COMMON
*/ELKJ*/
* JGUE, *
* JORAW, *
* JMESS, *
* JSCR, *
* JSTAG, *
* JTITLE
COMMON
*/ELKPTS/
* ARRAY(5)),2), *
* ASPL(13),2), *
* NCODE(5)), *
* NPTS, *
* NSPLS(5)), *
* NSWITCH, *
* NTHSPL, *
* NVPTS, *
* JINIT IF(JDRAW.NE.1) GO TO 60

C
MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
CALL MESSAGE(23,NJMJ)
RETURN
60 NTHPT=NVPTS + 1
GO TO 12)
ENTRY VIEWALL
IF(JDRAW.NE.1) GO TO 80

C
MESSAGE - "DRAWING DIMENSIONS HAVE NOT BEEN SPECIFIED."
CALL MESSAGE(23,NJMJ)
RETURN
80 NTHPT=1
100 NSTART=1
120 IF(NCODE(NTHPT).NE.0) NTHPT=NTHPT + 1
X=ARRAY(NTHPT,1)
Y=ARRAY(NTHPT,2)
XBEGIN=X
CALL MCVEA(X,Y)
200 NTHPT=NTHPT + 1
IF(NTHPT.GT.NPTS) GO TO 60)
IF(NCODE(NTHPT).NE.0) GO TO 200
IF(NSTART.EQ.0) GO TO 100

C
MESSAGE - "TWO CONSECUTIVE NCODES EQUAL 3."
CALL MESSAGE(32,NJMJ)
RETURN
330 IF(IABS(NCODE(NTHPT)).NE.1) GO TO 430
   X=ARRAY(NTHPT,1)
   Y=ARRAY(NTHPT,2)
   CALL DRAWA(X,Y)
   IF(NCODE(NTHPT).GT.3) GO TO 230
   NSTART=3
   XBEGIN=X
   GO TO 230
430 IF(IABS(NCODE(NTHPT)).EQ.5) GO TO 420
C             MESSAGE - "NCODE IS NOT -5 , -1 , 0 , 1 , 5."
   CALL MESSAGE(33,NJM)
   RETURN
420 NTHSPL=NSPLS(NTHPT-1)
440 NTHPT=NTHPT + 1
   IF(NTHPT.GT.NPTS) GO TO 630
   IF(NCODE(NTHPT).EQ.5) GO TO 440
   IF(NCODE(NTHPT).EQ.-5) GO TO 460
C             MESSAGE - "NCODE SHOULD BE EQUAL TO -5."
   CALL MESSAGE(34,NJM)
   RETURN
460 XEND=ARRAY(NTHPT,1)
   YEND=ARRAY(NTHPT,2)
   X=XBEGIN
450 X=X + UNIT
   IF(X.GT.XEND) GO TO 530
   Y=SPLNC1(NTHSPL,1,NTHSPL,X)
   CALL DRAWA(X,Y)
   GO TO 450
530 CALL DRAWA(XEND,YEND)
   NSTART=1
   XBEGIN=X
   GO TO 230
630 NVPTS=NTHPT - 1
RETURN
END
(E.4) Listing of the "CREATE" Computer Code

The computer code, "CREATE", reads the second file on the "ZDRAFT" input file and writes the "ZDRAFT" subroutine, CUEBRD. This subroutine manages the cueboard inputs and cells the specified subroutine. Hence, additions and revisions to the cueboard can be made by rewriting the input file. The new subroutine can be LIBEDIT into the existing "ZDRAFT". The permanent file containing the fortran compiled version of "CREATE" is named CREL4. A procedure file to run "CREATE" follows.

PCR
GET,XTAPE,CREL4.
SKIP,XTAPE.
COPYBF,XTAPE,TAPE2.
REWIND,TAPE2.
CREL4,,TAPE2,,CUEBRD.

The listing of the "CREATE" code follows.
CCREATE

PROGRAM CREATE(INPJT,OUTPJ,TAPE2,TAPE4,TAPE5,TAPE6,
  * TAPE8=INPJT, TAPE9=OUTPJ)
DIMENSION
  * NFORTRN(225,6),
  * NCHAR(83),
  * NJUMMY(RD),
  * NTHCOL(225),
  * NTHROW(225)
DATA
  * ("NTHCOL=225"),
  * ("NTHROW=225")
WRITE(6,14) "CCUEBRC"
WRITE(6,13) "SUBROUTINE CCUEBRC"
WRITE(6,14) " 4) NTHBLK="
WRITE(6,14) " 5) CALL INPUT(X,Y,NTHBLK)"
WRITE(6,14) " 6) IF(NTHBLK.GT.3) GO TO 20"
WRITE(6,13) "CALL MESSAGE(6,NJUM)
WRITE(6,13) "GO TO 40"
REWIND 2
READ(2,200)
IF(EOF(2).NE.3) STOP "INPUT DATA NOT FOUND ON TAPE2"
READ(2,200) MAXROW,MAXCOL,MAXCHAR
IF(EOF(2).NE.3) STOP "INPUT DATA NOT FOUND ON TAPE2"
MAXBLK=MAXROW*MAXCOL
IF(MAXBLK.GT.225) STOP "CUE BOARD SIZE EXCEEDS MATRIX DIMENSION."
DO 13 I=1,MAXBLK
  READ(2,190) NTHROW(I),NTHCOL(I),(NFORTRN(I,N),N=1,6)
  IF(EOF(2).NE.3) GO TO 12
  MAX=I
13) CONTINUE
12) I=I+1
  NSTATE=95
  DO 30 J=1,MNROW
  DO 29 K=1,MNCOL
  IF(NROW.LT.NTHROW(I) .OR. NCOL.LT.NTHCOL(I)) GO TO 260
  NSTATE=NSTATE + 5
  WRITE(5,110) NSTATE,(NFORTRN(I,N),N=1,6)
  WRITE(5,130) "GO TO 40"
  WRITE(4,120) NSTATE
  I=I+1
  IF(I.LE.MAX) GO TO 260
  MAXBLK=MAXCOL*(MNROW-1) + MCCL
260) WRITE(6,17) "8) MAXBLK="MAXBLK

WRITE(6,1111) "IF(NTHBLK.GT.MAXBLK) GO TO 9999"
WRITE(6,1111) "GO TO "
REWIND 4
REWIND 5
J=1
360 NBLANK=0
READ(4,1333) (NDUMMY(I),I=1,6)
IF(ZOF(4).NE.0) GO TO 520
DO 500 I=1,6
IF(NDUMMY(I).NE.55B) GO TO 400
NBLANK=NBLANK + 1
IF(NBLANK.GT.5) GO TO 360
GO TO 500
400 J=J+1
NDUMMY(J)=NDUMMY(I)
IF(J.LT.62 .OR. NDUMMY(J).NE.56B) GO TO 500
WRITE(6,1533) (NCHAR(K),K=1,J)
J=1
GO TO 360
500 CONTINUE
GO TO 360
520 IF(J.GT.J) GO TO 540
WRITE(6,1633) "*9999) NTHBLK"
GO TO 560
540 IF(NCHAR(J).EQ.56B) J=J-1
WRITE(6,1533) (NCHAR(K),K=1,J)
WRITE(6,1633) "*\) NTHBLK"
560 READ(5,1333) NDUMMY
IF(ZOF(5).NE.0) GO TO 600
WRITE(6,1333) NDUMMY
GO TO 560
600 WRITE(6,1433) "C"
WRITE(6,1433) "C MESSAGE - BLANK CUE REQUESTED. TRY AGAIN."
WRITE(6,1133) 9999,"CALL MESSAGE(17,NDUM)"
WRITE(6,1033) "GO TO 40"
WRITE(6,1033) "END"

C FORMATS
C
100 FORMAT(T7,6A10)
110 FORMAT(I5,1X,6A10)
120 FORMAT(I4,*,*)
130 FORMAT(B3R1)
140 FORMAT(9A10)
150 FORMAT(I6,1H*,66R1)
160 FORMAT(I6,7A13)
170 FORMAT(I4,A10,I3)
200 FORMAT(I5)
210 FORMAT(R1,I2,22X,6A10)
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