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(1) Program Order Number *(to be filled in by PID)* 360D-08.6.011

(2) System Type *(machine)* 360-65

(3) Search Key . . . . . PNRG, PERSPECTIVE PLOTTING

(4) Programming Language 360OS FL4G

(5) Author's Name and Address . . . . BRUCE KUBERT

(6) Direct Inquiries to Name and Address *(if different than Author)*
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(7) Title of Program . . . . PNRG, PERSPECTIVE PLOTTING ROUTINE, ARBITRARY GRID

(8) Submitter's User Group Affiliation Code and Installation Code . . . . . S ASB

(9) Submitter's Own Program Identification and Suffix *(optional)* . . . . . PNRG

(10) Primary Subject Code 08.6

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(12) Operating or Monitor System Required . . . . . OS VERSION 15/16

(13) New or Revision Code *(if revision, show prior Program Order Number in item 1)* . . . . . N

(14) Year Completed 69

(15) Date of Submittal 082869

(16) Documentation *(number of original pages submitted)* 85

(17) Abstract *(should contain sufficient information for a reader to determine the value of the program). Listed on the reverse side of this form are subjects which may serve as a guide for a descriptive abstract.*

CONTRIBUTED PROGRAM LIBRARY SUBMITTAL FORM

Submit Guide

a. Purpose
b. Programming Language used
c. Version and modification level or release number of IBM Programming System used, or program order number for non-IBM authored program used
d. Field of application
e. Type of routine (main program, subroutine, etc.)
f. Specific description of machine requirements
g. Engineering Changes (EC) level of equipment (if pertinent)

ABSTRACT

This subroutine generates perspective plots of curves and surfaces. The surfaces represent functions of two variables, f(x, y), which satisfy certain restrictions. As an option the surfaces may be taken to be opaque, in which case hidden lines are eliminated. The input data for a surface are the mesh points of two families of curves lying on the surface. They are given in three arrays, one containing x-coordinates, one containing y-coordinates, and the other containing z-coordinates of the mesh points. The input data for a curve is a set of consecutive points lying on the curve. PNRG is a modification of a subroutine written by J Szabo and S. Giulieri. It is compatible with FORTRAN H, however, it has only been checked out on FORTRAN G. The program was run on an IBM 360-IH65 using less than 270K.

(Please attach additional pages if necessary) . . . . . **Total pages attached** _____

Permission to Publish

"I hereby give anyone permission to reprint, reproduce, and distribute this program to anyone else."

(18) **Signature of Submitter and Date** Mary M Darling 3/2/70

(19) **Signature of Installation Addressee** Eileen H Worster 2/27/70

T4SF

PNRG

Table of Contents

PNRG

Card Deck Key

Deck # 1	FORTRAN Source Deck (PNRG), sequence D0800001 through D0801769 in cc 73-80; 1769 cards.
Deck # 2	Sample Driver Deck (1PNRG), sequence 1PNRG001 through 1PNRG074 in cc 73-80; 74 cards.
Deck # 3	Test Data Deck (2PNRG), sequence 2PNRG001 through 2PNRG149 in cc 73-80; 149 cards.

Identification

PNRG, Perspective Plotting Subroutine, Arbitrary Grid
OS/360 - FORTRAN
M. Barling, 3 October 1967
Aerospace Corporation, San Bernardino Operations

Purpose

The purpose of this subroutine is to generate perspective plots of curves and surfaces. The surfaces represent functions of two variables, $z=f(x,y)$, which satisfy certain restrictions. As an option the surfaces may be taken to be opaque, in which case all hidden lines are eliminated.

The input data for a surface are the mesh points of two families of curves (called the generating families which are discussed in more detail below) which lie on the surface. They are given in three arrays of M rows and N columns each, one array containing x-coordinates, one containing y-coordinates, and the other containing z-coordinates of the mesh points. The ith row in each array contains coordinates of points in the ith curve of the first generating family. This curve can be thought of as the locus of points satisfying some relation such as

$$u_i = \phi(x,y) = \text{constant}$$

A similar interpretation can be made that the points represented in the jth columns are points on the jth curve of the second generating family. These can be thought of as satisfying

$$v_j = \phi(x,y) = \text{constant}$$

Consecutive points represented in each row (and column) are joined by straight line segments. The resulting piecewise linear curves are then plotted in perspective. The input data for a curve is a set of consecutive points lying on the curve.

Restrictions

1. PNRG requires subroutine PLT 360 (Program Number D044A) which is in the S/360 Library.

2. The following named common are used in PNRG and may not appear in the calling program: VECT, ILNB, INTER, XØBS, ICHSAV, BØUND, CTRNSF, TR, ØBS, BØXES, IØ2NIC, NICPLØ, IØTINI, EPSSAV, FNP, CPLØT0, and DEBUG. *

3. The projections of the generating curves in the x-y plane for each surface must satisfy the following conditions:
   a) The curve corresponding to u_i must lie strictly between (i.e., not touching) those corresponding to u_{i-1} and u_{i+1}.
   b) The curve corresponding to v_j must lie strictly between those corresponding to v_{j-1} and v_{j+1}.
   c) The curves corresponding to u_i and v_j must intersect in one and only one point.

4. The coordinate z may assume one or more values at each mesh point. If z assumes n_ℓ values at each mesh point the surface is said to be segmented into n_ℓ levels, each z value at a particular mesh point belonging to a particular level and each level representing a contiguous portion of the surface. n_ℓ must be fixed for all mesh points of a given surface. The range of z values should not be unduly large or small compared to the range of x and y values or the resulting plot will be hardly more than a line. This is due to the procedure for scaling (see Scaling).

Method

The method is described in Reference 1.

Scaling

We wish to scale our figure in such a manner that regardless of the angles from which we view it, the picture will never fill up more than a specified area. We first find the x limits (x_{min}, x_{max}), the y limits (y_{min}, y_{max}), and the z limits (z_{min}, z_{max}) of all the points to be plotted. A centroid is computed

$$B = (b_x, b_y, b_z)$$

where

$$b_x = \frac{x_{max} + x_{min}}{2}$$

$$b_y = \frac{y_{max} + y_{min}}{2}$$

$$b_z = \frac{z_{max} + z_{min}}{2}$$

The distance R from (b_x, b_y, b_z) to$(x_{min}, y_{min}, z_{min})$ is then computed. The sphere described by

$$(x - b_x)^2 + (y - b_y)^2 + (z - b_z)^2 = R^2$$

contains the figure.

A sphere is always transformed into a figure of the same size, regardless of the angle of observation if the distance from the center to the point of observation remains fixed. Consider the projective transformation used (described in Reference 1). It can be shown that if $q > 1$ is a factor such that the observation point is at a distance of qR from point B and B is taken as the origin of the perspective plot, then the maximum and minimum x and y coordinates in the projective plane are

$$\left| x \right| \leq \frac{Rq}{\sqrt{q^2 - 1}} = x_s$$

and

$$\left| y \right| \leq \frac{Rq}{\sqrt{q^2 - 1}} = y_s$$

Therefore, taking our scales to be $[-x_s, x_s]$ and $[-y_s, y_s]$ assures us that the surface described by f will always be contained in this area.

Usage

It will be convenient to explain the usage of the program by describing the most general figure that can be plotted by PNRG and then relating properties of the various parts of the figure to particular constants and arrays that must be input to PNRG. Accordingly, let us define a basic rectangular coordinate system, R_o, to which all parts of the figure will be referred. It is required to construct a figure containing NARAYS surfaces and NCURVS space curves. A particular space curve is described by specifying the coordinates of consecutive points on the curve referred to R_o. These coordinates are stored in the three dimensional array C described below in Section B: Curve Entrance.

Let S_{NA} denote the n-th surface to be plotted and suppose that it consists of NLEVEL (NA) levels. Let a local rectangular coordinate system, R_{NA}, be given in terms of which the mesh points of S_{NA} are specified. R_{NA} is related to R_o by a translation vector, Q_{NA}, giving the coordinates of the origin of R_{NA} in terms of R_o, and a rotation matrix, A_{NA}, giving direction numbers of the x and y axes of R_{NA} with respect to R_o. (See the description of QC and AL in Section C: Rotation Entrance.)

Points on S_{NA} are specified as follows: X(I, J, NA) and Y(I, J, NA) contain the x and y coordinates referred to R_{NA} of the mesh point defined as the interesection of the I-th generating curve of the first family (i.e., u_i = constant) and the J-th generating curve of the second family (i.e., v_j = constant). Z(I, J, K, NA) = f_K (X(I, J, NA), Y(I, J, NA)) where K specifies the particular level.

We have

I = 1, 2, ... M(NA)

J = 1, 2, ... N(NA)

K = 1, 2, ... NLEVEL (NA)

where M(NA) and N(NA) are the number of generating curves in the first and second families of generating curves associated with S_{NA} respectively, and NLEVEL (NA) is the number of levels in S_{NA}.

There are seven entry points to PNRG: a setup entrance; a curve entrance; a rotation entrance; a scaling entrance; a data entrance; a cleanup entrance; and a tape-rewind entrance.

A. Setup Entrance

The call statement for the setup entrance which must be given for each series of plots of a given figure prior to any other entry to PNRG is:

CALL PERSP0 (X, Y, Z, ND1, ND2, ND3, NARAYS, NLEVEL, NCP, PT, XT, YT, Q, M, N, IVIS, LEWA, JFLAG, IBFLAG, KCHECK, P1Z, P2Z, P3Z, TEST1, TEST2, NCURVS, IRØT, ITST, IHØL, XMINI, XMAXI, YMINI, YMAXI, CZMINI, CZMAXI, EPSLN).

where

X = a three dimensional array containing x coordinates. Dimensioned at (ND1, ND2, NR) where DN1 ≥ maximum of M(NA) where NA = 1, ... NARAYS; and ND2 ≥ maximum of N(NA) where NA = 1, ... NARAYS and NR ≥ NARAYS.

Y = a three dimensional array containing y coordinates. Dimensioned at (ND1, ND2, NR) where ND1, ND2, and NR are as described above.

Z = a four dimensional array containing z coordinates. Dimensioned at (ND1, ND2, ND3, NR) where ND1, ND2, and NR are as described above. ND3 ≥ maximum of NLEVEL (NA) where NA = 1, ... NARAYS.

ND1 = the first dimension of the X, Y, and Z arrays.

ND2 = the second dimension of the X, Y, and Z arrays.

ND3 = the third dimension of the Z array.

NARAYS = the number of arrays (surfaces) to be plotted.

NLEVEL = a one dimensional array of length ≥ NARAYS. NLEVEL (NA) is the number of levels in the NA^{th} array.

NCP = the number of characters in the plot title. Maximum number of characters is 80.

PT = a one dimensional array containing the plot title.

XT = a one dimensional array of length ≥ maximum of (ND1, ND2, NP(NC), NC=1, ...NCURVS) which is used to store the X value of the projected points. (NP is defined under B, the curve entrance.)

YT = a one dimensional array of length ≥ maximum of (ND1, ND2, NP(NC), NC = 1, ...NCURVS)) which is used to store the Y value of the projected points.

Q = the factor q described in the section on scaling. The observation point will be a distance Q*R from the centroid B. Q must be greater than 1. A value of Q=5 is reasonable for most applications. As Q becomes smaller the perspective distortion increases. As $Q \rightarrow \infty$ the figure approaches a parallel projection.

M = a one dimensional array of length ≥ NARAYS; M(NA) = the number of curves in the first generating family associated with S_{NA} (i.e., the number of u_i = constant lines).

N = a one dimensional array of length ≥ NARAYS; N(NA) = the number of curves in the second generating family associated with S_{NA} (i.e., the number of v_i = constant lines).

IVIS = 1, parts of the figure which are invisible from the observation point will not be plotted.

≠ 1, all parts of the figure will be plotted.

LEWA = a two dimensional array used by PNRG for storing visibility information for each point. Dimensioned (ND1, ND2).

JFLAG = a one dimensional array of length NR ≥ NARAYS used for specifying the convexity of the projection of S_{NA} in the x-y plane.

if JFLAG(NA) = 1, the projection of S_{NA} is tested for convexity. If it is found to be convex the boundary search (see below) is not necessary and is eliminated. Otherwise, the boundary search is done.

if JFLAG(NA) ≠ 1, the grid is assumed to be convex and the boundary search is not done (the convexity is not determined). (The boundary search involves finding all points where the line of sight to a point on the grid cuts the boundaries of the grid. If the grid is convex, there is only one such point between the observed point and the observation point.)

IBFLAG = a one dimensional array of length NR ≥ NARAYS used for specifying the type of grid formed by the projection in the x-y plane of the generating families of S_{NA}.

if IBFLAG(NA) = 1, the grid is polar. (A polar grid is discussed on pp. 13-15)

if IBFLAG(NA) ≠ 1, the grid is non-polar. IBFLAG is not set by user. User only provides the array for use by PNRG.

KCHECK = a two dimensional array used by PNRG. Typed as INTEGER*2. Dimensioned at (NR, NR).

P1Z = a one dimensional array of length ND3.

P2Z = a one dimensional array of length ND3.

P3Z = a one dimensional array of length ND3.

TEST1 = a one dimensional array of length ND3.

TEST2 = a one dimensional array of length ND3.

NCURVS = the number of space curves to be plotted.

IRØT = 1, if at least one surface is rotated or translated.

= 0, if no surfaces are rotated or translated.

ITST = a one dimensional array of length ND3.

IHØL = a one dimensional array of length ND3.

XMINI = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the minimum transformed x value of each array.

XMAXI = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the maximum transformed x value of each array.

YMINI = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the minimum transformed y value of each array.

YMAXI = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the maximum transformed y value of each array.

CZMINI = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the minimum distance from C, the center of projection (i.e., the eye of the observer) to each surface.

CZMAXI = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the maximum distance from C to each surface.

EPSLN = a one dimensional array of length NR ≥ NARAYS used by PNRG to store the minimum distance between any two adjacent points on the boundary of the NAth array.

B. Curve Entrance

If at least one space curve is to be plotted (i.e., NCURVS > 0) this entry must be used. This entry stores addresses. The call statement is: CALL PERSPC (C, NC1, LCHECK, NL, NP, LEWC)

where

C = a three dimensional array containing the x, y, and z coordinates of a point on a space curve. Dimensioned at (NC1, 3, NC3) where NC1 ≥ maximum of (NP(NC), NC = 1, ... NCURVS), NP(NC) is the number of points on the NC^{th} curve. NC3 ≥ NCURVS.
C(I, 1, NC) is the x coordinate of the I^{th} point on the NC^{th} curve.
C(I, 2, NC) is the y coordinate of the I^{th} point on the NC^{th} curve.
C(I, 3, NC) is the z coordinate of the I^{th} point on the NC^{th} curve.

NC1 = the first dimension of C.

LCHECK = a two dimensional array used by PNRG. Typed as INTEGER*2. Dimensioned at (NL, NR) where NL ≥ NCURVS and NR ≥ NARAYS.

NL = the first dimension of LCHECK

NP = a one dimensional array of length NL ≥ NCURVS. NP(NC) contains the number of points in the NC^{th} curve.

LEWC = a one dimensional array used for visibility information. Dimensioned at (NL1) where NL1 ≥ maximum of (NP(NC), NC = 1, ..., NCURVS).

C. Rotation Entrance

If at least one translated or rotated surface is involved (i.e., IRØT = 1) this entry must be used. This entry computes the direction cosines of the axes of the local coordinate systems with respect to the basic coordinate system.

CALL PERSPR (AL, ID, QC)

where

AL = a three dimensional array dimensioned (3, 3, NR) where NR ≥ NARAYS, AL (I, J, NA) is the cosine of the angle between the I^{th} axis of the NA^{th} coordinate system, and the J^{th} axis of the basic coordinate system. The first, second and third coordinate axes correspond to the x, y, and z axes respectively. The user supplies direction numbers for I = 1 and 2 and the program determines the rotation matrix such that the coordinate system is right handed. For arrays which are not rotated, the user must supply the identity matrix.

ID = a one dimensional array of length ≥ NARAYS.
ID (NA) = 1 if the surface is rotated.
≠ 1 if the surface is not rotated.

QC = a two dimensional array of length (3, NR), where NR ≥ NARAYS, used to specify the origin of the NA^{th} local coordinate system.

QC(1, NA) is the x coordinate in the basic system of the origin of the NA^{th} local coordinate system.

QC(2, NA) is the y coordinate in the basic system of the origin of the NA^{th} local coordinate system.

QC(3, NA) is the z coordinate in the basic system of the origin of the NA^{th} local coordinate system.

D. Scaling Entrance

This entry computes the centroid and does the scaling. It must be made at least once for every series of plots of a given figure. If it is desired that the scaling for plot n_p be the same as that for plot n_{p-1}, this call must not be made between the two pertinent calls to PERSP2.

CALL PERSP1

E. Data Entrance

This entrance which specifies the observer's position, C, causes a new plot to be initiated. The line of sight is taken to be CB where B is the centroid of the figure (see section on scaling). There can be any number of data entrances for each setup entry.

CALL PERSP2 (THETA, PHI)

where

THETA = the longitude, in degrees, of the observation point measured from the x axis of R'_o.

$0 \leq \theta \leq 360$

PHI = co-latitude, in degrees, of the observation point measured from the Z axis of R'_o to the line through the centroid B and the observation point, C.

$0 < \phi < 180$

R'_o is a coordinate system whose axes correspond and are parallel to those of R_o and whose origin is at B.

F. Clean-up Entrance

This entry terminates the plotting of a figure and must be called before initiating a new data entry (PERSP2) or setup entry (PERSP0).

CALL PERSP4

G. Tape Rewind Entrance

This entry terminates all plotting in the run.

CALL PERSP5.

Generating Families

The generating families can be interpreted as two intersecting one parameter families of curves in the x-y plane. The i-th curve in the first family will be denoted as

$$u_i = \phi(x, y) = \text{constant}$$

The j-th curve in the second family will be denoted as

$$v_j = \psi(x, y) = \text{constant.}$$

The two families must satisfy the conditions listed in 3 under the section entitled Restrictions. The mesh formed by the intersecting families of generating curves will be termed a grid. The types of grids that satisfy the restrictions imposed above are topologically equivalent to rectangular grids (see Figure 1). By suitable stretching and compressing this type of grid can be transformed into a polar type grid with the pole excluded (see Figure 2).

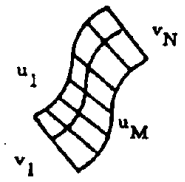

Figure 1

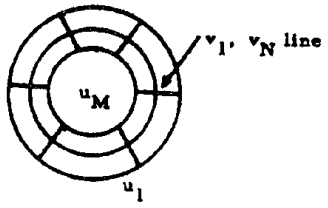

Figure 2

Here the v_1 and v_N lines are superimposed. This condition, of course, violates the restriction that each (u_i, v_j) pair intersect in a unique point. However, the coding necessary to handle this case has been included in the program. The further extension where the u_M curve shrinks down to a point is not allowed. The u_M curve in Figure 2, of course, can be taken to be sufficiently small in extent that it appears to be a point. The basic difference between the grids shown in Figures 1 and 2 is the nature of the boundary. In Figure 1 the boundary consists of two u_i lines separated by two v_j lines, the whole being one continuous curve. In Figure 2 the boundary is in two pieces, each piece being a closed u_i line. By convention, if a grid of this type is specified (i.e., a polar grid), it is required that the u_i lines be the closed curves. Also every point defined by the intersection of the v_1 line and an arbitrary u_i line must be identical to the point defined by the intersection of the v_N line and that same u_i line.

Surfaces Containing Holes

It may be desired to use a grid such as that shown in Figure 3.

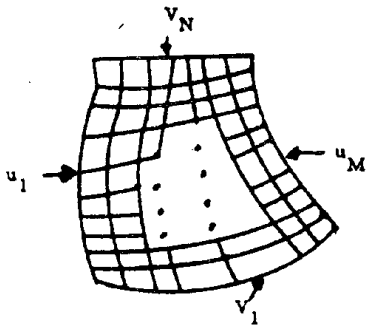

Figure 3

To indicate a grid such as this, the function values, z_{ij}, at points within the hole should contain a code word, namely $7FFFFFFF)_{16}$.

In Figure 3, there are 7 such points:

$$z_{4,4},\ z_{4,5},\ z_{4,6},\ z_{5,4},\ z_{5,5},\ z_{5,6} \text{ and } z_{5,7}$$

The surface will then be treated as if there were a hole in it.

Storage

PNRG requires 57532 bytes.

Subroutine and Entry Point Descriptions

PERSP0, PERSP1, PERSP2, PERSP4, PERSP5, PERSPC, PERSPR

This subroutine controls the flow of the program according to the options used. It calls M1, M2, DIRC, CØNV0, CØNV1, IØUT0, IØUT1, IØUT2, NICEB NICEL, NICER, PLØT0, PLØT1, PLØTC, PLØTR, TRNSF0, TRNSF1, AND PLT.

DIRC

This subroutine determines the direction cosines AL (I, J, NA), such that the coordinate system of the NA^{th} array is right handed.

M1, M2

The first entry transforms a point from the i^{th} coordinate system to the basic coordinate system. The second entry transforms a point from the basic coordinate system to the i^{th} coordinate system.

TRNSF0, TRNSF1

This subroutine transforms a point in space to a point in the perspective plane.

CØNV0, CØNV1

This subroutine determines the convexity of the grid.

IØUT0, IØUT1, IØUT2	This subroutine determines the visibility of a point. It calls ZØF, LIM0, LIM, BNDRY0, BNDRY1, BNDRY2, SEAR0, SEARCH, NTRSC0, NTRSC1, NTRSCT, DIF0, and DIFF.
NICEB, NICEC, NICEL, NICEP, NICER	This subroutine determines the visibility of points on a line between a visible mesh point and an invisible mesh point. It calls M1, M2, IØUT1, IØUT2, TRNSF1, and PLT.
PLØT0, PLØT1, PLØTR, PLØTC	This subroutine determines the points to be plotted, transforms these points and plots them. It calls M1, TRNSF1, NICEP, NICEC, and PLT.
LIM0, LIM	This subroutine determines if the subscript of a grid segment which may hide a point are within the limits of the grid.
BNDRY0, BNDRY1, BNDRY2	This subroutine finds all the points where the line of sight to a point in space cuts the boundaries of a grid. It calls NTRSCT.
ZØF	This subroutine is used to interpolate for z at an arbitrary point between two points where the values of z are known.

DIF0, DIFF	This subroutine is used to determine the visibility of a point by examining the behavior of the function δ. (See eq. (33) Reference 1) It calls HØLCHK.
HØLCHK	This subroutine determines if a hole is encountered along the line segment from the point whose visibility is being determined to the observation point.
SEAR0, SEARCH	This subroutine determines the closest point (Q) to C which is an interior point of the grid and on the line segment from the observation point to the observed point. It calls LIM and NTRSCT.
NTRSCT, NTRSC1	The first entry point of this subroutine determines if the line of sight from the observation point to the observed point intersects a grid segment at a point Q' which is closer to C than Q was to C. The second entry point sets Q equal to Q' so that IOUT2 can then call NTRSCT to find a new Q'.

Selected Messages

1. AXES NØT PERP. STOP

This message is written by subroutine DIRC and means that the x, y and z axis are not mutually perpendicular. The user should correct the AL array.

2. BØUNDRY ERRØR

This message is written by subroutine BNDRY0.

3. TWO POINTS IDENTICAL IN DEFINING GRID. THEY ARE I1, J1, I2, J2, X1, Y1, X2, Y2.

I1 is the first subscript of the x and y coordinate of the first point.

J1 is the second subscript of the x and y coordinate of the first point.

I2 is the first subscript of the x and y coordinate of the second point.

J2 is the second subscript of the x and y coordinate of the second point.

X1, Y1 is the first point.

X2, Y2 is the second point.

This message is printed by subroutine NTRSCO. The user should change the appropriate values in the X and Y arrays.

4. ILLEGAL ØBSERVATIØN PØINT .....STØP

This message is printed by subroutine TRNSF0. The user has given PHI a value of 0° or 180°.

5. INCØNSISTANT ARRAY DEFINITIØN.

NA =

This message is written by PERSP1. The NA^{th} array should be checked to see if it meets the requirements of a polar grid.

6. BØX TABLES WERE FILLED.

BØX ARRAYS EXCEEDED BY ICØUNT

This message is written by PERSP2. It is not an error message. Execution time may be decreased by increasing the dimensions of XBØX1, XBØX2, YBØX1, and YBØX2 in PERSP0 and IØUT0. ICØUNT is the number of cells each of these arrays should be increased for maximum efficiency.

7. TWØ ADJACENT PØINTS IDENTICAL *

This message is written by PERSP1 and will be followed by 6 integers which are the number of the array, the subscripts of the first point, the number of the array and the subscripts of the second point. The user should change the appropriate values.

8. $***** THE DISTANCE BETWEEN TWO OF THE BOUNDARY POINTS *
IS THIS MAY LEAD TØ A FAULTY PLØT*****$

This message is written by PERSP1. The user should examine the resulting plot carefully.

9. INNER BØUNDARY TØØ SMALL
This message is written by PERSP1 and is followed by two numbers which are an indication of the smallness of the inner boundary. Execution stopas.

References

1. "Two Computer Programs for the Perspective Representation of Curves and Surfaces," AEROSPACE REPORT NO. TR-0200(S9990)-1 by Bruce R. Kubert.

```
      SUBROUTINE PERSPO (/X/,/Y/,/Z/,/ND1/,/ND2/,/ND3/,/NARAYS/,/NLEVEL D0800001
     1/,/NCP/,/PT/,/XT/,/YT/,      /Q/,/M/,/N/,/IVIX/,/LEWA/,/JFLAG/,   D0800002
     2/IBFLG/, KCHECK ,/P1Z/,/P2Z/,/P3Z/,/TEST1/,/TEST2/,/NCURVS/,/IROX/D0800003
     2,/ITST/,/IHOL/,/XMINI/,/XMAXI/,/YMINI/,/YMAXI/,/CZMINI/,/CZMAXI/  D0800004
     1,/EPSLN/)                                                         D0800005
      INTEGER*4I1LIST,I2LIST,I3LIST,I4LIST                              D0800006
      INTEGER*2 KCHECK                                                  D0800007
      DIMENSION XMINI(1),XMAXI(1),YMINI(1),YMAXI(1),CZMINI(1),CZMAXI(1) D0800008
      DIMENSION XBOX1(500),XBOX2(500),YBOX1(500),YBOX2(500)             D0800009
      DIMENSION X(ND1,ND2,1),Y(ND1,ND2,1),Z(ND1,ND2,ND3,1),NLEVEL(1),   D0800010
     1XT(1),YT(1),M(1),N(1),LEWA(ND1,1),JFLAG(1),IBFLG(1),KCHECK(NARAYS,D0800011
     21),P1Z(1),P2Z(1),P3Z(1),TEST1(1),TEST2(1),ITST(1),                D0800012
     3IHOL(1)                                                           D0800013
      DIMENSION I1LIST(1),I2LIST(1),I3LIST(1),I4LIST(1)                 D0800014
      DIMENSION EPSLN (1)                                               D0800015
      DIMENSION PT(1)                                                   D0800016
      COMMON /BOXES/XBOX1,XBOX2,YBOX1,YBOX2                             D0800017
      COMMON /ICHSAV/ PXI                                               D0800018
      COMMON /EPSSAV/ EPS                                               D0800019
      EQUIVALENCE (XBOX1(1),I1LIST(1)),(XBOX2(1),I2LIST(1)),            D0800020
     1(YBOX1(1),I3LIST(1)),(YBOX2(1),I4LIST(1))                         D0800021
C THE LISTS WERE TYPED AS INTEGER FOUR. WHEN RELEASE 11 IS AVAILABLE    D0800022
C THEY SHOULD BE TYPED AS INTEGER TWO AND RUN ON H WHERE AN ERROR MESSAGD0800023
C MAY BE GIVEN.                                                         D0800024
      DATA MXINDX/500/                                                  D0800025
      DATA AXES /ZDF000000/                                             D0800026
      DATA SO /Z7FFFFFFF/                                               D0800027
      DATA BLANK/'    '/                                                D0800028
      COMMON /CPLOTO/IVIS                                               D0800029
      COMMON /NICPLO/IROT                                               D0800030
      COMMON /IOT1NI/LEW                                                D0800031
      COMMON /IO2NIC/ISAM                                               D0800032
      COMMON /CTRNSF/XB,YB,ZB,D                                         D0800033
      COMMON /FNP/ X100D                                                D0800034
      DATA  CONV  /.17453292519943D-1/                                  D0800035
      COMMON /OBS/ CX,CY,CZ                                             D0800036
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      COMMON /DEBUG/KBUG                                                    D0800037
      COMMON /XOBS/ CX1,CY1,CZ1                                             D0800038
      COMMON /VECT/ VO(3),VI(3)                                             D0800039
C  THE CONVENTION OF A POLAR GRID SHOULD BE CHANGED                         D0800040
      IROT = IROX                                                           D0800041
      IVIS = IVIX                                                           D0800042
      CALL IOUTO (TEST1,TEST2,ITST,IHOL)                                    D0800043
      CALL NICEB (X,Y,Z,ND1,ND2,ND3,XT,YT,M,N,P1Z,P2Z,P3Z,NARAYS,NLEVEL,    D0800044
     1KCHECK,IBFLG,JFLAG)                                                   D0800045
      CALL PLOTO (XT,YT,LEWA,ND1)                                           D0800046
      RETURN                                                                D0800047
      ENTRY PERSPC (/C/,/NC1/,        LCHECK ,/NLC/,/NP/,/LEWC/)            D0800048
      INTEGER*2 LCHECK                                                      D0800049
      DIMENSION C(NC1,  3,1),LCHECK (NLC,1),NP(1),LEWC(1)                   D0800050
      CALL NICEL (LCHECK,NLC)                                               D0800051
      RETURN                                                                D0800052
      ENTRY PERSPR (/AL/,/ID/,/QC/)                                         D0800053
      DIMENSION AL(3,3,1),QC(3,1),ID(1)                                     D0800054
      CALL NICER (AL,QC)                                                    D0800055
      DO 2 I=1,NARAYS                                                       D0800056
      CALL DIRC (AL(1,1,I))                                                 D0800057
2     CONTINUE                                                              D0800058
      RETURN                                                                D0800059
      ENTRY PERSP1                                                          D0800060
      IF (NARAYS .EQ. 0) GO TO 11                                           D0800061
      DO 1 NA=1,NARAYS                                                      D0800062
      IBFLG(NA) = 0                                                         D0800063
1     CONTINUE                                                              D0800064
   11 CONTINUE                                                              D0800065
      XMN=SO                                                                D0800066
      YMN=SO                                                                D0800067
      ZMN=SO                                                                D0800068
      XMX=-SO                                                               D0800069
      YMX=-SO                                                               D0800070
      ZMX=-SO                                                               D0800071
      IF (NARAYS .EQ. 0) GO TO 501                                          D0800072
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      DMINT=SO                                                              D0800073
      NFLAG = 0                                                             D0800074
      DO 5 NA=1,NARAYS                                                      D0800075
      MNA = M(NA)                                                           D0800076
      NNA = N(NA)                                                           D0800077
      LEV = NLEVEL(NA)                                                      D0800078
      DO 6 I=1,MNA                                                          D0800079
      DO 7 J=1,NNA                                                          D0800080
      VI(1) = X(I,J,NA)                                                     D0800081
      VI(2) = Y(I,J,NA)                                                     D0800082
      JP1 = J + 1                                                           D0800083
      IF (JP1 .GT. NNA) GO TO 13                                            D0800084
      IF (VI(1) .NE. X(I,JP1,NA)) GO TO 13                                  D0800085
      IF (VI(2) .NE. Y(I,JP1,NA)) GO TO 13                                  D0800086
      NFLAG = 1                                                             D0800087
      WRITE (6,12) NA,I,J,NA,I,JP1                                          D0800088
   12 FORMAT (1X,'TWO ADJACENT POINTS IDENTICAL',3I4,5X,3I4)                D0800089
13    IP1=I+1                                                               D0800090
      IF (IP1.GT.MNA) IP1=1                                                 D0800091
      IF (VI(1).NE.X(IP1,J,NA))GO TO 135                                    D0800092
      IF (VI(2).NE.Y(IP1,J,NA))GO TO 135                                    D0800093
      NFLAG=1                                                               D0800094
      WRITE (6,12) NA,I,J,NA,IP1,J                                          D0800095
135   CONTINUE                                                              D0800096
      DO 8 K=1,LEV                                                          D0800097
      ZI = Z(I,J,K,NA)                                                      D0800098
      IF (ZI .EQ. SO) GO TO 8                                               D0800099
      VI(3) = Z(I,J,K,NA)                                                   D0800100
      IF (IROT .EQ. 1) GO TO 4                                              D0800101
      DO 3 IS=1,3                                                           D0800102
3     VO(IS) = VI(IS)                                                       D0800103
      GO TO 9                                                               D0800104
4     CALL M1 (AL(1,1,NA),QC(1,NA))                                         D0800105
9     IF (XMN .GT. VO(1)) XMN=VO(1)                                         D0800106
      IF (XMX .LT. VO(1)) XMX=VO(1)                                         D0800107
      IF (YMN .GT. VO(2)) YMN=VO(2)                                         D0800108
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      IF (YMX .LT. VO(2)) YMX=VO(2)                                          D0800109
      IF (ZMN .GT. VO(3)) ZMN=VO(3)                                          D0800110
      IF (ZMX .LT. VO(3)) ZMX=VO(3)                                          D0800111
    8 CONTINUE                                                               D0800112
    7 CONTINUE                                                               D0800113
    6 CONTINUE                                                               D0800114
      DMIN=SQ                                                                D0800115
      MFLAG = 1                                                              D0800116
      DO 608 I = 1,NNA                                                       D0800117
      IF (X(I,1,NA) .NE. X(I,NNA,NA)  .OR.  Y(I,1,NA) .NE.  Y(I,NNA,NA))D0800118
     1GO TO 606                                                              D0800119
      IBFLG(NA) = 1                                                          D0800120
      IF (MFLAG .EQ. 1) GO TO 608                                            D0800121
      WRITE (6,604) NA                                                       D0800122
  604 FORMAT (1X,'INCONSISTANT ARRAY DEFINITION. NA = ',I4)                  D0800123
      NFLAG=2                                                                D0800124
      GO TO 5                                                                D0800125
  606 MFLAG = 0                                                              D0800126
      DSQ=(X(I,1,NA)-X(I,NNA,NA))**2+(Y(I,1,NA)-Y(I,NNA,NA))**2              D0800127
      IF (DSQ.LT.DMIN) DMIN=DSQ                                              D0800128
  608 CONTINUE                                                               D0800129
      DO 6085 J=1,NNA                                                        D0800130
      DSQ=(X(1,J,NA)-X(MNA,J,NA))**2+(Y(1,J,NA)-Y(MNA,J,NA))**2              D0800131
      IF (DSQ.LT.DMIN) DMIN=DSQ                                              D0800132
 6085 CONTINUE                                                               D0800133
      DMIN=SQRT(DMIN)                                                        D0800134
      IF (KBUG .GE. 1)                                                       D0800135
     1WRITE (6,609) NA,IBFLG(NA),DMIN                                        D0800136
  609 FORMAT (1X,'IBFLG(',I2,')=',I1,5X,'DMIN=',1PE12.4)                     D0800137
      IF (DMIN.LT.DMINT) DMINT=DMIN                                          D0800138
    5 CONTINUE                                                               D0800139
      IF (NFLAG .NE. 0) STOP                                                 D0800140
  501 CONTINUE                                                               D0800141
      IF(NCURVS .EQ. 0) GO TO 22                                             D0800142
      DO 251 NC=1,NCURVS                                                     D0800143
      NNC = NP(NC)                                                           D0800144
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      DO 26 I =1,NNC                                                         D0800145
      IF (XMN .GT. C(I,1,NC)) XMN = C(I,1,NC)                                D0800146
      IF (XMX .LT. C(I,1,NC)) XMX = C(I,1,NC)                                D0800147
      IF (YMN .GT. C(I,2,NC)) YMN = C(I,2,NC)                                D0800148
      IF (YMX .LT. C(I,2,NC)) YMX = C(I,2,NC)                                D0800149
      IF (ZMN .GT. C(I,3,NC)) ZMN = C(I,2,NC)                                D0800150
      IF (ZMN .GT. C(I,3,NC)) ZMN = C(I,3,NC)                                D0800151
      IF (ZMX .LT. C(I,3,NC)) ZMX = C(I,3,NC)                                D0800152
   26 CONTINUE                                                               D0800153
  251 CONTINUE                                                               D0800154
   22 CONTINUE                                                               D0800155
      XB=(XMN+XMX)/2.                                                        D0800156
      YB=(YMN+YMX)/2.                                                        D0800157
      ZB=(ZMN+ZMX)/2.                                                        D0800158
      RC=SQRT((XMX-XB)**2+(YMX-YB)**2+(ZMX-ZB)**2)                           D0800159
      D=RC*Q                                                                 D0800160
      PXS=-D/SQRT(Q*Q-1.)                                                    D0800161
      PXI=-PXS*0.22222222                                                    D0800162
      PXS=PXS-0.5*PXI                                                        D0800163
      IF (NARAYS .EQ. 0) IVIS = 0                                            D0800164
      IF (IVIS .NE. 1) RETURN                                                D0800165
      DMINT=DMINT/PXI                                                        D0800166
      IF (DMINT.LT.0.01) WRITE (6,612) DMINT                                 D0800167
  612 FORMAT (1H0,'$*****THE DISTANCE BETWEEN TWO OF THE BOUNDARY POINTSD0800168
     * IS',1PE11.4,'THIS MAY LEAD TO A FAULTY PLOT*****$')                   D0800169
      DO 35  NA=1,NARAYS                                                     D0800170
      SSTAR = SQ                                                             D0800171
      MNA = M(NA)                                                            D0800172
      NNA = N(NA)                                                            D0800173
      EPS = .001                                                             D0800174
      IF (IBFLG(NA) .EQ. 1) GO TO 616                                        D0800175
      MNAM1 = MNA - 1                                                        D0800176
      DO 614 I = 1,MNAM1                                                     D0800177
      SOFI1 = SQRT((X(I+1,1,NA) - X(I,1,NA))**2 + (Y(I+1,1,NA) - Y(I,1,      D0800178
     1NA))**2)/PXI                                                           D0800179
      SOFIN = SQRT((X(I+1,NNA,NA) - X(I,NNA,NA))**2 + (Y(I+1,NNA,NA) -       D0800180
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     1Y(1,NNA,NA))**2)/PXI                                                    D0800181
  614 SSTAR = AMIN1(SOFI1,SOFIN,SSTAR)                                        D0800182
  616 CONTINUE                                                                D0800183
      NNAM1 = NNA - 1                                                         D0800184
      DO 618 J = 1,NNAM1                                                      D0800185
      SOFJ1 = SQRT((X(1,J+1,NA)-X(1,J,NA))**2+ (Y(1,J+1,NA) - Y(1,J,NA))D0800186
     1**2)/PXI                                                                D0800187
      SOFJM= SQRT((X(MNA,J+1,NA)-X(MNA,J,NA))**2+(Y(MNA,J+1,NA)-Y(MNA,J,D0800188
     1NA)                                                                     D0800189
     1)**2)/PXI                                                               D0800190
  618 SSTAR = AMIN1  (SOFJ1,SOFJM,SSTAR)                                      D0800191
  619 EPS = AMIN1 ((.2*SSTAR),.001)*SSTAR                                     D0800192
      IF (EPS .GT.0.000001) GO TO 620                                         D0800193
      WRITE (6,617) SSTAR,EPS                                                 D0800194
  617 FORMAT (1X,'INNER BOUNDARY TOO SMALL',1P2E13.5)                         D0800195
      STOP                                                                    D0800196
  620 CONTINUE                                                                D0800197
      EPSLN(NA) = EPS                                                         D0800198
      IF (JFLAG(NA) .NE. 1) GO TO 35                                          D0800199
      IF ( IBFLG(NA) .EQ. 1) GO TO 35                                         D0800200
      CALL CONVO (X(1,1,NA),Y(1,1,NA),ND1,M(NA),N(NA))                        D0800201
      I1 = 1                                                                  D0800202
      DO 10 J1=3,NNA                                                          D0800203
      CALL CONV1 (I1,J1,&35)                                                  D0800204
   10 CONTINUE                                                                D0800205
      J1 = NNA                                                                D0800206
      DO 15 I1=2,MNA                                                          D0800207
      CALL CONV1 (I1,J1,&35)                                                  D0800208
   15 CONTINUE                                                                D0800209
      I1 = MNA                                                                D0800210
      N1 = NNA-1                                                              D0800211
      DO 20 J2=1,N1                                                           D0800212
      J1 = NNA-J2                                                             D0800213
      CALL CONV1 (I1,J1,&35)                                                  D0800214
   20 CONTINUE                                                                D0800215
      J1 = 1                                                                  D0800216
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      MN1 = MNA-1                                                             D0800217
      DO 25 I2=1,MN1                                                          D0800218
      I1 = MNA-I2                                                             D0800219
      CALL CONV1 (I1,J1,&35)                                                  D0800220
   25 CONTINUE                                                                D0800221
      I1 = 1                                                                  D0800222
      J1 = 2                                                                  D0800223
      CALL CONV1 (I1,J1,&35)                                                  D0800224
      JFLAG(NA) = 0                                                           D0800225
   35 CONTINUE                                                                D0800226
      RETURN                                                                  D0800227
      ENTRY PERSP2 (/THETAD/,/GAMMAD/)                                        D0800228
      KBUG = 0                                                                D0800229
      THETA=THETAD*CONV                                                       D0800230
      GAMMA=GAMMAD*CONV                                                       D0800231
      ST =  SIN(THETA)                                                        D0800232
      CT =  COS(THETA)                                                        D0800233
      SG =  SIN(GAMMA)                                                        D0800234
      CG =  COS(GAMMA)                                                        D0800235
      CX=RC*SG*CT*Q+XB                                                        D0800236
      CY=RC*SG*ST*Q+YB                                                        D0800237
      CZ=RC*CG*Q+ZB                                                           D0800238
      IF (KBUG .GE. 1)                                                        D0800239
     1WRITE (6,1000) CX,CY,CZ                                                 D0800240
 1000 FORMAT (1X, 5HCX = ,1E13.6,4X,5HCY = ,1E13.6,4X,5HCZ = ,1E13.6)         D0800241
      CX1 = CX                                                                D0800242
      CY1 = CY                                                                D0800243
      CZ1 = CZ                                                                D0800244
      CALL TRNSFO                                                             D0800245
      X100D = 100./PXI                                                        D0800246
      CALL PLT (1,NIT,PXS,PXI,XT,0,1,PXS,PXI,0,1,YT,NCP,PT,0,BLANK,0,         D0800247
     *BLANK)                                                                  D0800248
      CALL  PLT (3,0,50,-10.,1,AXES)                                          D0800249
      CALL  PLT (3,0,50,10.,1,AXES)                                           D0800250
      ICOUNT = 0                                                              D0800251
      INDX=0                                                                  D0800252
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      IF (IVIS .NE. 1) GO TO 49                                          D0800253
      IF (KCHECK(1,1).EQ.-1) GO TO 49                                    D0800254
      KCHECK(1,1)=1                                                      D0800255
      IF (NARAYS.LT.2  .AND. NCURVS .EQ. 0) GO TO 49                     D0800256
      DO 46 NA=1,NARAYS                                                  D0800257
      MNA=M(NA)                                                          D0800258
      NNA=N(NA)                                                          D0800259
      LEV=NLEVEL(NA)                                                     D0800260
      XTMIN=SO                                                           D0800261
      XTMAX=-SO                                                          D0800262
      YTMIN=SO                                                           D0800263
      YTMAX=-SO                                                          D0800264
      CZMIN=SO                                                           D0800265
      CZMAX=-SO                                                          D0800266
      DO 45 K=1,LEV                                                      D0800267
      DO 45 I=1,MNA                                                      D0800268
      DO 45 J=1,NNA                                                      D0800269
      VI(1)=X(I,J,NA)                                                    D0800270
      VI(2)=Y(I,J,NA)                                                    D0800271
      VI(3)=Z(I,J,K,NA)                                                  D0800272
      IF (VI(3).EQ.SO) GO TO 45                                          D0800273
      IF (IROT.EQ.1) GO TO 43                                            D0800274
      DO 42 IS=1,3                                                       D0800275
42    VO(IS)=VI(IS)                                                      D0800276
      GO TO 44                                                           D0800277
43    CALL MI(AL(1,1,NA),QC(1,NA))                                       D0800278
44    CALL TRNSFI(VO(1),VO(2),VO(3),XTEST,YTEST)                         D0800279
      IF (XTEST.LT.XTMIN) XTMIN=XTEST                                    D0800280
      IF (XTEST.GT.XTMAX) XTMAX=XTEST                                    D0800281
      IF (YTEST.LT.YTMIN) YTMIN=YTEST                                    D0800282
      IF (YTEST.GT.YTMAX) YTMAX=YTEST                                    D0800283
      CZTEST=(VO(1)-CX)**2+(VO(2)-CY)**2+(VO(3)-CZ)**2                   D0800284
      IF (CZTEST.LT.CZMIN) CZMIN=CZTEST                                  D0800285
      IF (CZTEST.GT.CZMAX) CZMAX=CZTEST                                  D0800286
45    CONTINUE                                                           D0800287
      XMINI(NA)=XTMIN                                                    D0800288
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      XMAXI(NA)=XTMAX                                                    D0800289
      YMINI(NA)=YTMIN                                                    D0800290
      YMAXI(NA)=YTMAX                                                    D0800291
      CZMINI(NA)=CZMIN                                                   D0800292
46    CZMAXI(NA)=CZMAX                                                   D0800293
      KBOX = 0                                                           D0800294
      KCHECK(NARAYS,NARAYS)=1                                            D0800295
      NARM1=NARAYS-1                                                     D0800296
      IF (NARM1 .LT. 1) GO TO 49                                         D0800297
      DO 48 NA=1,NARM1                                                   D0800298
      KCHECK(NA,NA)=1                                                    D0800299
      XMINNA=XMINI(NA)                                                   D0800300
      XMAXNA=XMAXI(NA)                                                   D0800301
      YMINNA=YMINI(NA)                                                   D0800302
      YMAXNA=YMAXI(NA)                                                   D0800303
      CZMINA=CZMINI(NA)                                                  D0800304
      CZMAXA=CZMAXI(NA)                                                  D0800305
      NB1=NA+1                                                           D0800306
      DO 48 NB=NB1,NARAYS                                                D0800307
      KCK=1                                                              D0800308
      XMINNB=XMINI(NB)                                                   D0800309
      XMAXNB=XMAXI(NB)                                                   D0800310
      YMINNB=YMINI(NB)                                                   D0800311
      YMAXNB=YMAXI(NB)                                                   D0800312
      CZMINB=CZMINI(NB)                                                  D0800313
      CZMAXB=CZMAXI(NB)                                                  D0800314
      IF (XMINNA.GE.XMAXNB) KCK=0                                        D0800315
      IF (XMINNB.GE.XMAXNA) KCK=0                                        D0800316
      IF (YMINNA.GE.YMAXNB) KCK=0                                        D0800317
      IF (YMINNB.GE.YMAXNA) KCK=0                                        D0800318
      KCHECK(NB,NA)=0                                                    D0800319
      KCHECK(NA,NB)=0                                                    D0800320
      IF (KCK.EQ .0) GO TO 48                                            D0800321
      IF (INDX.LT.MXINDX) GO TO 47                                       D0800322
      KCHECK(NB,NA)=-2                                                   D0800323
      KCHECK(NA,NB)=-2                                                   D0800324
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```
      ICOUNT = ICOUNT + 1                                                D0800325
      IF (KBOX .EQ. 1 ) GO TO 476                                        D0800326
      KBOX = 1                                                           D0800327
      WRITE (6,473)                                                      D0800328
  473 FORMAT (23H0BOX TABLES WERE FILLED )                               D0800329
      GO TO 476                                                          D0800330
   47 INDX=INDX+1                                                        D0800331
      KCHECK(NB,NA)=INDX                                                 D0800332
      KCHECK(NA,NB)=INDX                                                 D0800333
      XBOX1(INDX)=AMAX1(XMINNA,XMINNB)                                   D0800334
      XBOX2(INDX)=AMIN1(XMAXNA,XMAXNB)                                   D0800335
      YBOX1(INDX)=AMAX1(YMINNA,YMINNB)                                   D0800336
      YBOX2(INDX)=AMIN1(YMAXNA,YMAXNB)                                   D0800337
  476 IF (CZMINA.GE.CZMAXB) KCHECK(NB,NA)=0                              D0800338
      IF (CZMINB.GE.CZMAXA) KCHECK(NA,NB)=0                              D0800339
   48 CONTINUE                                                           D0800340
      IF (KBUG .LT. 1) GO TO 4895                                        D0800341
      WRITE (6,483)                                                      D0800342
  483 FORMAT (1X, 'KCHECK ARRAY')                                        D0800343
      DO 485 NA1 = 1, NARAYS                                             D0800344
  485 WRITE (6,484) (KCHECK(NA1,NB1),NB1=1,NARAYS)                       D0800345
  484 FORMAT (1X, (15I6))                                                D0800346
      IJ1 = 1                                                            D0800347
      DO 489 IK =1,INDX,12                                               D0800348
      IJ2 = IJ1 + 11                                                     D0800349
      WRITE (6,486) IJ1,IJ2                                              D0800350
  486 FORMAT (1H0,4X,I3,96X,I3)                                          D0800351
      WRITE (6,488)(XBOX1(IJB),IJB=IJ1,IJ2)                              D0800352
      WRITE (6,488)(XBOX2(IJB),IJB=IJ1,IJ2)                              D0800353
      WRITE (6,488) (YBOX1(IJB),IJB=IJ1,IJ2)                             D0800354
      WRITE (6,488) (YBOX2(IJB),IJB=IJ1,IJ2)                             D0800355
  487 FORMAT (1H0,12F9.4)                                                D0800356
  488 FORMAT (1X, 12F9.4)                                                D0800357
  489 IJ1 = IJ2 + 1                                                      D0800358
 4895 CONTINUE                                                           D0800359
   49 INSAV = INDX                                                       D0800360
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      IF (ICOUNT .GT. 0) WRITE (6,491) ICOUNT                            D0800361
  491 FORMAT (1X,'BOX ARRAYS EXCEEDED BY' 114)                           D0800362
      IF (NARAYS.EQ.0) GO TO 371                                         D0800363
      IF (IVIS.NE.1) GO TO 71                                            D0800364
      IF (NCURVS .EQ. 0) GO TO 705                                       D0800365
      IF (KCHECK(1,1) .EQ. -1) GO TO 705                                 D0800366
      INDX=INSAV                                                         D0800367
C RELOCATE SO DO NOT NEED BOXES LATER                                    D0800368
      DO 7005 NC = 1,NCURVS                                              D0800369
      NNC=NP(NC)                                                         D0800370
      DO 70 NA=1,NARAYS                                                  D0800371
      IF (KBUG .GE. 1)                                                   D0800372
     1WRITE (6,605) XMINI(NA),XMAXI(NA),YMINI(NA),YMAXI(NA),CZMINI(NA)   D0800373
  605 FORMAT (1X, 5E13.5,5I5)                                            D0800374
      I1=0                                                               D0800375
      I2=0                                                               D0800376
      I3=0                                                               D0800377
      I4=0                                                               D0800378
      LCHECK(NC,NA)=0                                                    D0800379
      DO 65 NPT=1,NNC                                                    D0800380
      IFLG=1                                                             D0800381
      CXTST=C(NPT,1,NC)                                                  D0800382
      CYTST=C(NPT,2,NC)                                                  D0800383
      CZTST=C(NPT,3,NC)                                                  D0800384
      CALL TRNSF1(CXTST,CYTST,CZTST,XTEST,YTEST)                         D0800385
      IF (XTEST.GE.XMAXI(NA)) IFLG=0                                     D0800386
      IF (XTEST.LE.XMINI(NA)) IFLG=0                                     D0800387
      IF (YTEST.GE.YMAXI(NA)) IFLG=0                                     D0800388
      IF (YTEST.LE.YMINI(NA)) IFLG=0                                     D0800389
      ZTEST=(CXTST-CX)**2+(CYTST-CY)**2+(CZTST-CZ)**2                    D0800390
      IF (ZTEST.LE.CZMINI(NA)) IFLG=0                                    D0800391
      IF (KBUG .GE. 1)                                                   D0800392
     1WRITE (6,607) NC,NPT,IFLG,XTEST,YTEST,ZTEST                        D0800393
  607 FORMAT (1X, 3I5, 3E13.5)                                           D0800394
      IF (IFLG.EQ.0) GO TO 63                                            D0800395
C  CHECK ON MXINOX                                                       D0800396
```

```
      IF (INDX .GT. MXINDX) GO TO 70                                    D0800397
      IF (I1.NE.0) GO TO 61                                             D0800398
      I1=NPT                                                            D0800399
      GO TO 65                                                          D0800400
 61   IF (I2.EQ.0) GO TO 65                                             D0800401
      IF (I3.NE.0) GO TO 62                                             D0800402
      I3=NPT                                                            D0800403
      GO TO 65                                                          D0800404
 62   IF (I4.EQ.0) GO TO 65                                             D0800405
      I4=NNC                                                            D0800406
      GO TO 66                                                          D0800407
 63   IF (I1.EQ.0) GO TO 65                                             D0800408
      IF (I2.NE.0) GO TO 64                                             D0800409
      I2=NPT-1                                                          D0800410
      GO TO 65                                                          D0800411
 64   IF (I3.EQ.0) GO TO 65                                             D0800412
      IF (I4.NE.0) GO TO 65                                             D0800413
      I4=NPT-1                                                          D0800414
 65   CONTINUE                                                          D0800415
 66   IF (I1.EQ.0) GO TO 70                                             D0800416
      IF (I2.NE.0) GO TO 67                                             D0800417
      I2=NNC                                                            D0800418
      GO TO 68                                                          D0800419
 67   IF (I3.EQ.0) GO TO 68                                             D0800420
      IF (I4.NE.0) GO TO 68                                             D0800421
      I4=NNC                                                            D0800422
 68   CONTINUE                                                          D0800423
      INDX=INDX+1                                                       D0800424
      LCHECK(NC,NA)=INDX                                                D0800425
      IF (KBUG .GE. 4)                                                  D0800426
     1WRITE (6,69) NC,NA,LCHECK(NC,NA),NCURVS,NARAYS,INDX               D0800427
   69 FORMAT (1X,'LCHECK(',2I2,') IS',1I3,5X,3I5)                       D0800428
      I1LIST(INDX)=I1                                                   D0800429
      I2LIST(INDX)=I2                                                   D0800430
      I3LIST(INDX)=I3                                                   D0800431
      I4LIST(INDX)=I4                                                   D0800432
```



```
 70   CONTINUE
 7002 CONTINUE                                                          D0800433
      IF (KBUG .LT.1) GO TO 7005                                        D0800434
      WRITE (6,7003) INDX,I1,I2,I3,I4                                   D0800435
 7003 FORMAT (50X, 5I5)                                                 D0800436
 7005 CONTINUE                                                          D0800437
      IF(KBUG .LT. 1) GO TO 7045                                        D0800438
      WRITE (6,704)                                                     D0800439
 704  FORMAT (1X, 'LCHECK ARRAY')                                       D0800440
 7041 CONTINUE                                                          D0800441
      DO 702 N81 = 1,NCURVS                                             D0800442
  702 WRITE  (6,703) (LCHECK(N81,NA),NA=1,NARAYS)                       D0800443
 703  FORMAT (1X, (15I6))                                               D0800444
 7031 CONTINUE                                                          D0800445
      IJ0 = INSAV + 1                                                   D0800446
      IJ1 = IJ0                                                         D0800447
      DO 7036 IK = IJ0,INDX,20                                          D0800448
      IJ2 = IJ1 + 19                                                    D0800449
      WRITE (6,7032) IJ1,IJ2                                            D0800450
 7032 FORMAT (1H0,I4,90X,I5)                                            D0800451
      WRITE (6,7034) (I1LIST(IJB),IJB=IJ1,IJ2)                          D0800452
 7034 FORMAT (20I5)                                                     D0800453
      WRITE (6,7034) (I2LIST(IJB),IJB=IJ1,IJ2)                          D0800454
      WRITE (6,7034) (I3LIST(IJB),IJB=IJ1,IJ2)                          D0800455
      WRITE (6,7034) (I4LIST(IJB),IJB=IJ1,IJ2)                          D0800456
 7036 IJ1 = IJ2 + 1                                                     D0800457
 7045 CONTINUE                                                          D0800458
  705 CONTINUE                                                          D0800459
      UFRAC = 0.                                                        D0800460
      VFRAC = 0.                                                        D0800461
      KPRNTC = 0                                                        D0800462
      DO 60 NA=1,NARAYS                                                 D0800463
      MNA = M(NA)                                                       D0800464
      NNA = N(NA)                                                       D0800465
      JN = NNA                                                          D0800466
      IF (IBFLG(NA) .EQ. 1)JN=JN-1                                      D0800467
                                                                        D0800468
```

```
      LEV = NLEVEL(NA)                                                  D0800469
      DO 565 I=1,MNA                                                    D0800470
      DO 565 J=1,JN                                                     D0800471
  565 LEWA (I,J) = 0                                                    D0800472
      DO 53 K=1,LEV                                                     D0800473
      IF (IVIS .NE. 1) GO TO 56                                         D0800474
      DO 51 I=1,MNA                                                     D0800475
      DO 52 J=1,JN                                                      D0800476
      DO 57 LVS=1,LEV                                                   D0800477
      P3Z(LVS) = Z(I,J,LVS,NA)                                          D0800478
   57 CONTINUE                                                          D0800479
      IF (P3Z(K) .EQ. SO) GO TO 52                                      D0800480
      IF (IROT .NE. 1) CALL IOUT1 (X(I,J,NA),Y(I,J,NA),P3Z,I,J,UFRAC,   D0800481
     1VFRAC,K)                                                          D0800482
      VI(1)=X(I,J,NA)                                                   D0800483
      VI(2)=Y(I,J,NA)                                                   D0800484
      VI(3)=P3Z(K)                                                      D0800485
      IF (IROT.EQ.1) GO TO 577                                          D0800486
      DO 576 IS=1,3                                                     D0800487
  576 VO(IS)=VI(IS)                                                     D0800488
      GO TO 578                                                         D0800489
  577 CALL M1(AL(1,1,NA),QC(1,NA))                                      D0800490
  578 CALL TRNSF1(VO(1),VO(2),VO(3),XTEST,YTEST)                        D0800491
      IF (KBUG .GE. 1)                                                  D0800492
     1WRITE(6,5785)NA,I,J,VI(1),VI(2),VI(3),VO(1),VO(2),VO(3),XTEST,    D0800493
     *YTEST                                                             D0800494
 5785 FORMAT (1X,3I5,8F10.4)                                            D0800495
      DO 55 NB=1,NARAYS                                                 D0800496
      EPS = EPSLN(NB)                                                   D0800497
      IF (KBUG .GE. 1)                                                  D0800498
     1WRITE (6,5789) NB                                                 D0800499
 5789 FORMAT (1X, 'NB = ', 1I5)                                         D0800500
      TEMP = P3Z(K)                                                     D0800501
      ISAM = 0                                                          D0800502
      IF (NA .EQ. NB) ISAM=1                                            D0800503
      IF (ISAM.EQ.1) GO TO 58                                           D0800504
```



```
      KCK=KCHECK(NA,NB)                                                 D0800505
      IF (KCK.EQ.0) GO TO 55                                            D0800506
      IF (KCK.LT.0) GO TO 58                                            D0800507
      IF (ISAM .EQ. 1) GO TO 58                                         D0800508
      INDX=KCK                                                          D0800509
      IF (XTEST.LT.XBOX1(INDX)) GO TO 55                                D0800510
      IF (XTEST.GT.XBOX2(INDX)) GO TO 55                                D0800511
      IF (YTEST.LT.YBOX1(INDX)) GO TO 55                                D0800512
      IF (YTEST.GT.YBOX2(INDX)) GO TO 55                                D0800513
   58 CONTINUE                                                          D0800514
      IF (IROT .NE. 1) GO TO 102                                        D0800515
      VO(1) = CX                                                        D0800516
      VO(2) = CY                                                        D0800517
      VO(3) = CZ                                                        D0800518
      CALL M2 (AL(1,1,NB),QC(1,NB))                                     D0800519
      CX1 = VI(1)                                                       D0800520
      CY1 = VI(2)                                                       D0800521
      CZ1 = VI(3)                                                       D0800522
      IF (KPRNTC .EQ. 0 .AND. KBUG .GE. 1)                              D0800523
     *WRITE (6,1001) CX1,CY1,CZ1                                        D0800524
 1001 FORMAT (1X,6HCX1 = ,1E12.4,4X,6HCY1 = ,1E12.4,4X,6HCZ1 = ,1E12.4) D0800525
      VI(1) = X(I,J,NA)                                                 D0800526
      VI(2) = Y(I,J,NA)                                                 D0800527
      IF (ISAM .EQ. 1) GO TO 101                                        D0800528
      VI(3) = P3Z(K)                                                    D0800529
      CALL M1 (AL(1,1,NA),QC(1,NA))                                     D0800530
      CALL M2 (AL(1,1,NB),QC(1,NB))                                     D0800531
      P3Z(K) = VI(3)                                                    D0800532
  101 CALL IOUT1 (VI(1),VI(2),P3Z,I,J,UFRAC,VFRAC,K)                    D0800533
 1015 FORMAT (1X,  'REACHED CALL TO IOUT2')                             D0800534
  102 CONTINUE                                                          D0800535
      IF (KBUG .GE. 1)                                                  D0800536
     1WRITE (6,1015)                                                    D0800537
      CALL IOUT2 (X(1,1,NB),Y(1,1,NB),Z(1,1,1,NB),ND1,ND2,NLEVEL(NB),   D0800538
     1M(NB),N(NB),IBFLG(NB),JFLAG(NB),&54)                              D0800539
      P3Z(K) = TEMP                                                     D0800540
```

```
      55   CONTINUE                                                          D0800541
           KPRNTC = 1                                                        D0800542
      54   LEWA(I,J) = LEW                                                   D0800543
      52   CONTINUE                                                          D0800544
           IF (IBFLG(NA) .EQ. 1) LEWA(I,NNA)=LEWA(I,1)                       D0800545
      51   CONTINUE                                                          D0800546
           IF (KBUG .LT. 1) GO TO 7025                                       D0800547
           DO 700 I=1,MNA                                                    D0800548
           WRITE (6,701) (LEWA(I,J),J=1,NNA)                                 D0800549
     701   FORMAT(1H0/(15I6))                                                D0800550
     700   CONTINUE                                                          D0800551
    7025   CONTINUE                                                          D0800552
      56   IF (IROT .NE. 1) GO TO 103                                        D0800553
           CALL PLOT1 (AL(1,1,NA),QC(1,NA))                                  D0800554
     103   CALL PLOTR (X(1,1,NA),Y(1,1,NA),Z(1,1,K,NA),ND1,M(NA),N(NA),NA,K, D0800555
          1 IBFLG(NA))                                                       D0800556
      53   CONTINUE                                                          D0800557
      60   CONTINUE                                                          D0800558
        71 CONTINUE                                                         D0800559
           IF (NCURVS.EQ.0) GO TO 81                                         D0800560
       371 CONTINUE                                                         D0800561
           IF (KBUG .GE. 1)                                                  D0800562
          1WRITE (6,376)                                                     D0800563
       376   FORMAT ('1CURVES')                                             D0800564
           DO 80 NC=1,NCURVS                                                 D0800565
           NNC=NP(NC)                                                        D0800566
           LEV=1                                                             D0800567
           DO 715 I =1,NNC                                                   D0800568
       715 LEWC(I) = 0                                                      D0800569
           DO 77 I=1,NNC                                                     D0800570
           CXTST=C(I,1,NC)                                                   D0800571
           CYTST=C(I,2,NC)                                                   D0800572
           CZTST=C(I,3,NC)                                                   D0800573
           IF (IVIS.NE.1) GO TO 78                                           D0800574
           IF (KBUG .GE. 1)                                                  D0800575
          1WRITE (6,717) NC,I,CXTST,CYTST,CZTST                              D0800576
```



```
     717   FORMAT (1X, 2I5,3F10.4)
           DO 75 NB=1,NARAYS                                                 D0800577
           EPS = EPSLN(NB)                                                   D0800578
           KCK=LCHECK(NC,NB)                                                 D0800579
           IF (KCK.EQ.0) GO TO 75                                            D0800580
           IF (KCK.LT.0) GO TO 72                                            D0800581
           IF (I1LIST(KCK).LE.I.AND.I.LE.I2LIST(KCK)) GO TO 72               D0800582
           IF (I3LIST(KCK).LE.I.AND.I.LE.I4LIST(KCK)) GO TO 72               D0800583
           GO TO 75                                                          D0800584
      72   ISAM=0                                                            D0800585
           IF (IROT.NE.1) GO TO 725                                          D0800586
           IF (ID(NB).EQ.1) GO TO 73                                         D0800587
     725   CX1=CX                                                            D0800588
           CY1=CY                                                            D0800589
           CZ1=CZ                                                            D0800590
           VI(1)=CXTST                                                       D0800591
           VI(2)=CYTST                                                       D0800592
           VI(3)=CZTST                                                       D0800593
           GO TO 74                                                          D0800594
      73   VO(1)=CX                                                          D0800595
           VO(2)=CY                                                          D0800596
           VO(3)=CZ                                                          D0800597
           CALL M2(AL(1,1,NB),QC(1,NB))                                      D0800598
           CX1=VI(1)                                                         D0800599
           CY1=VI(2)                                                         D0800600
           CZ1=VI(3)                                                         D0800601
           VO(1)=CXTST                                                       D0800602
           VO(2)=CYTST                                                       D0800603
           VO(3)=CZTST                                                       D0800604
           CALL M2(AL(1,1,NB),QC(1,NB))                                      D0800605
      74   P3Z(1)=VI(3)                                                      D0800606
           TEMP=P3Z(1)                                                       D0800607
           CALL IOUT1(VI(1),VI(2),P3Z,I,I,0.,0.,LEV)                         D0800608
           CALL IOUT2 (X(1,1,NB),Y(1,1,NB),Z(1,1,1,NB),ND1,ND2,NLEVEL(NB),   D0800609
          1M(NB),N(NB),IBFLG(NB),JFLAG(NB),&76)                              D0800610
      75   CONTINUE                                                          D0800611
                                                                             D0800612
```

```
      P3Z(I)=TEMP                                                        D0800613
   76 LEWC(I)=LEW                                                        D0800614
   77 CONTINUE                                                           D0800615
   78 CALL PLOTC(C(1,1,NC),NC1,LEWC,NNC,NC)                              D0800616
      IF (KBUG .GE. 1) WRITE (6,701) (LEWC(I),I=1,NNC)                   D0800617
   80 CONTINUE                                                           D0800618
   81 CONTINUE                                                           D0800619
      RETURN                                                             D0800620
      ENTRY PERSP4                                                       D0800621
      CALL PLT (5,IL,PLIM)                                               D0800622
      RETURN                                                             D0800623
      ENTRY PERSP5                                                       D0800624
      CALL PLT (6)                                                       D0800625
      RETURN                                                             D0800626
      END                                                                D0800627
      SUBROUTINE IOUTO (/TEST1/,/TEST2/,/ITST/,/IHOL/)                   D0800628
      DIMENSION AL (3,3,1)                                               D0800629
      DIMENSION TEST1(1),TEST2(1),ITST(1),IHOL(1)                        D0800630
      DIMENSION ITBL(13),IS(19)                                          D0800631
      COMMON /IOUTBN/ KSERCH                                             D0800632
      COMMON /IOTINI/ LEW                                                D0800633
      COMMON /XOBS/ CX,CY,CZ                                             D0800634
      COMMON /DEBUG/KBUG                                                 D0800635
      COMMON /INTER/ QX,QY,QXPR,QYPR,UFRAC,VFRAC,FRAC,IU,JV,DU,DV,IFLAG  D0800636
      COMMON /ILN8/ I1,J1,I2,J2                                          D0800637
      COMMON /BOUND/ DIST,INT                                            D0800638
      COMMON /ICHSAV/ PXI                                                D0800639
      DATA ITBL /2*-1,0,3*1,0,3*-1,0,2*1 /                               D0800640
      DATA IS /0,2*1,0,2*-1,0,3*1,3*0,3*1,3*0 /                          D0800641
      DATA SO /Z7FFFFFFF/                                                D0800642
      DATA EPSIN/0.002/                                                  D0800643
      CALL SEARO (IS,ITBL)                                               D0800644
      RETURN                                                             D0800645
      ENTRY IOUT1 (/PX/,/PY/,/PZL/,/IP/,/JP/,/UFRAC1/,/VFRAC1/,/LEV/)    D0800646
      DIMENSION PZL(1)                                                   D0800647
      LEW = 0                                                            D0800648
```



```
      RETURN
      ENTRY IOUT2 (/X/,/Y/,/Z/,/ND1/,/ND2/,/NLEV/,/M/,/N/,/IBFLG/,/JFLAG  D0800649
     1/,*)                                                               D0800650
      DIMENSION X(ND1,1),Y(ND1,1),Z(ND1,ND2,1)                           D0800651
      COMMON /IO2NIC/ ISAM                                               D0800652
      CALL LIMO (M,N,IBFLG)                                              D0800653
      CALL NTRSCO (X,Y,Z,ND1,ND2,IHOL,ITST,NLEV,IBFLG,N)                 D0800654
      CALL BNDRYO (M,N,JFLAG,IBFLG)                                      D0800655
      CALL DIFO (TEST1,TEST2,ITST,IHOL,PX,PY,PZ,X,Y,Z,ND1,ND2,NLEV)      D0800656
 1020 FORMAT (6X,2I5,8F10.4)                                             D0800657
      KSWTCH = 1                                                         D0800658
      KSERCH = 0                                                         D0800659
      QX = PX                                                            D0800660
      QY = PY                                                            D0800661
      QZ = PZL(LEV)                                                      D0800662
      PZ = QZ                                                            D0800663
      IF ( QZ .EQ. SO) GO TO 167                                         D0800664
      IU = IP                                                            D0800665
      JV = JP                                                            D0800666
      UFRAC = UFRAC1                                                     D0800667
      VFRAC = VFRAC1                                                     D0800668
      DCP = (CX-PX)**2 + (CY-PY)**2                                      D0800669
      DIST = DCP                                                         D0800670
      DO 1 K=1,NLEV                                                      D0800671
      ITST(K) = 0                                                        D0800672
    1 CONTINUE                                                           D0800673
      IF (ISAM .EQ. 1) GO TO 3                                           D0800674
      IU = 0                                                             D0800675
      JV = 0                                                             D0800676
      INT = 0                                                            D0800677
      CALL BNDRY2                                                        D0800678
      IF (KBUG .GE. 1)                                                   D0800679
     1WRITE  (6,411)                                                     D0800680
  411 FORMAT (1X,14HREACHED DEBUG1)                                      D0800681
      IF (KBUG .GE. 1)                                                   D0800682
     1WRITE  (6,412) QXPR,QYPR,FRAC,I1,I2,J1,J2,INT                      D0800683
                                                                         D0800684
```

```
  412 FORMAT (1X,3E17.9/ 5I3)                                          D0800685
      IF (INT .EQ. 0) RETURN                                           D0800686
      IBNDRY = MOD(INT,2)                                              D0800687
      INT = INT - 1                                                    D0800688
      IF (IBNDRY .EQ. 0 ) GO TO 280                                    D0800689
      PXSAV = PX                                                       D0800690
      PYSAV = PY                                                       D0800691
  210 PX = PX +10.*(PX - CX)                                           D0800692
      PY = PY +10.*(PY - CY)                                           D0800693
      CX = PX                                                          D0800694
      CY = PY                                                          D0800695
      DCP = (CX-PX)**2 + (CY-PY)**2                                    D0800696
      DIST = DCP                                                       D0800697
      IC=0                                                             D0800698
      JC=0                                                             D0800699
      INT = 0                                                          D0800700
      CALL BNDRY2                                                      D0800701
C     IBNDRY = MOD(INT,2)                                              D0800702
C     IF (IBNDRY .NE. 0) GO TO 210                                     D0800703
      PX = PXSAV                                                       D0800704
      PY = PYSAV                                                       D0800705
      IF (IPY = 1                                                      D0800706
      INT = INT -1                                                     D0800707
      KSAV=0                                                           D0800708
  220 CALL NTRSC1                                                      D0800709
      IF (KBUG .GE. 3)                                                 D0800710
     1WRITE (6,404)                                                    D0800711
      IF (KBUG .GE. 3)                                                 D0800712
     1WRITE (6,402) PX,PY,IP,JP,UFRAC,VFRAC,X(I1,J1),X(I2,J2),Y(I1,J1) D0800713
     1,Y(I2,J2)                                                        D0800714
      IF (KBUG .GE. 3)                                                 D0800715
     1WRITE (6,405) INT,QX,QY,DU,DV,IU,JV                              D0800716
      SCAPRD=(QX-CX)*(QX-PX)+(QY-CY)*(QY-PY)                           D0800717
      IF (KBUG .GE. 3) WRITE (6,2202) SCAPRD,QX,QY,PX,PY,CX,CY         D0800718
 2202 FORMAT (8HOSCAPRD=E13.5,1P6E16.8)                                D0800719
      IF (SCAPRD) 221,2206,2204                                        D0800720
```



```
 2204 QXSAV=QX                                                         D0800721
      QYSAV=QY                                                         D0800722
      I1SAV = I1                                                       D0800723
      J1SAV = J1                                                       D0800724
      I2SAV = I2                                                       D0800725
      J2SAV = J2                                                       D0800726
      KSAV=1                                                           D0800727
      KSWTCH = 2                                                       D0800728
      GO TO 30                                                         D0800729
 2206 IUFRAC=UFRAC+0.1                                                 D0800730
      JVFRAC=VFRAC+0.1                                                 D0800731
      IU=IU+IUFRAC                                                     D0800732
      JV=JV+JVFRAC                                                     D0800733
      UFRAC=0.                                                         D0800734
      VFRAC=0.                                                         D0800735
      DO 2208 K=1,NLEV                                                 D0800736
      ZI=Z(IU,JV,K)                                                    D0800737
      IF (ZI .EQ. SO) GO TO 2208                                       D0800738
      TEST1(K)=PZ-ZI                                                   D0800739
      IF (ABS(TEST1(K)/PZI).LT.EPSIN) TEST1(K)=0.                      D0800740
      IF (TEST1(K).EQ.0.) GO TO 2208                                   D0800741
      ITST(K)=1                                                        D0800742
 2208 CONTINUE                                                         D0800743
      GO TO 240                                                        D0800744
  221 IF (KSAV.EQ.0) GO TO 2204                                        D0800745
      DO 237 K=1,NLEV                                                  D0800746
C     ADD CODING TO HANDLE HOLES                                       D0800747
      X1 = X(I1SAV,J1SAV)                                              D0800748
      Z1 = Z(I1SAV,J1SAV,K)                                            D0800749
      X2 = X(I2SAV,J2SAV)                                              D0800750
      Z2 = Z(I2SAV,J2SAV,K)                                            D0800751
      IF (Z1 .EQ. SO .OR. Z2 .EQ. SO) GO TO 237                        D0800752
      IF (X1 .EQ. X2) GO TO 223                                        D0800753
      Z11= ZOF(QXSAV,X1,Z1,X2,Z2)                                      D0800754
      GO TO 225                                                        D0800755
  223 Z11= ZOF(QYSAV,Y(I1SAV,J1SAV),Z1,Y(I2SAV,J2SAV),Z2)              D0800756
```

```
 225   CONTINUE                                                          D0800757
       IF (KBUG .GE. 3)                                                  D0800758
      *WRITE (6,2235) I1SAV,J1SAV,I2SAV,J2SAV,I1,J1,I2,J2,K              D0800759
 2235  FORMAT (9I5)                                                      D0800760
       IF (KBUG .GE. 3)                                                  D0800761
      *WRITE (6,226) X1,Y(I1SAV,J1SAV),Z1,X2,Y(I2SAV,J2SAV),Z2,QXSAV,    D0800762
      *QYSAV,ZI1                                                         D0800763
 226   FORMAT (7H AT 225,1P9E12.5)                                       D0800764
       X1 = X(I1,J1)                                                     D0800765
       Z1 = Z(I1,J1,K)                                                   D0800766
       X2 = X(I2,J2)                                                     D0800767
       Z2 = Z(I2,J2,K)                                                   D0800768
       IF (Z1 .EQ. S0 .OR. Z2 .EQ. S0) GO TO 237                         D0800769
       IF (X1 .EQ. X2) GO TO 227                                         D0800770
       ZI2 = ZOF(QX,X1,Z1,X2,Z2)                                         D0800771
       GO TO 230                                                         D0800772
  227 ZI2 = ZOF(QY,Y(I1,J1),Z1,Y(I2,J2),Z2)                              D0800773
C      ADD CODING TO HANDLE HOLES                                        D0800774
  230 IF (QX .EQ. QXSAV) GO TO 232                                       D0800775
       ZI = ZOF (PX,QX,ZI2,QXSAV,ZI1)                                    D0800776
       GO TO 235                                                         D0800777
  232 ZI = ZOF (PY,QY,ZI2,QYSAV,ZI1)                                     D0800778
  235 TEST1(K) = PZ - ZI                                                 D0800779
       IF (ABS(TEST1(K)/PXI).LT.EPSIN) TEST1(K)=0.                       D0800780
       IF (KBUG .GE. 3)                                                  D0800781
      * WRITE (6,236) X1,Y(I1,J1),Z1,X2,Y(I2,J2),Z2,ZI2,ZI,PZ            D0800782
 236   FORMAT (7H AT 235,1P9E12.5)                                       D0800783
       IF (TEST1(K).EQ.0.) GO TO 237                                     D0800784
       ITST(K)=1                                                         D0800785
 237   CONTINUE                                                          D0800786
 240   KSWTCH=1                                                          D0800787
       GO TO 16                                                          D0800788
  280 CALL NTRSC1                                                        D0800789
       GO TO 16                                                          D0800790
 3     DO 4 K=1,NLEV                                                     D0800791
       IF (K .EQ. LEV) GO TO 4                                           D0800792
```



```
       IF (PZL(K) .EQ. S0) GO TO 4                                       D0800793
       TEST1(K) = PZ - PZL(K)                                            D0800794
       IF (ABS(TEST1(K)/PXI).LT.EPSIN) TEST1(K)=0.                       D0800795
       IF (TEST1(K) .EQ. 0.) GO TO 4                                     D0800796
       ITST(K) = 1                                                       D0800797
 4     CONTINUE                                                          D0800798
 5     INT = -1                                                          D0800799
       IBNDRY = -1                                                       D0800800
       CALL SEARCH (&15)                                                 D0800801
       CALL BNDRY1                                                       D0800802
       IBNDRY = MOD(INT,2)                                               D0800803
       IF (INT.LE.1) RETURN                                              D0800804
       IF (KBUG .GE. 3)                                                  D0800805
      1WRITE (6,401)                                                     D0800806
 15    CALL NTRSC1                                                       D0800807
 16    CONTINUE                                                          D0800808
       CALL DIFF (&167,&30)                                              D0800809
 30    CONTINUE                                                          D0800810
       IF (KBUG .GE. 3)                                                  D0800811
      1WRITE (6,405) INT,QX,QY,DU,DV,IU,JV                               D0800812
       IF (KBUG .GE. 3)                                                  D0800813
      1WRITE (6,402) PX,PY,IP,JP,UFRAC,VFRAC,X(I1,J1),X(I2,J2),Y(I1,J1) D0800814
      1,Y(I2,J2)                                                         D0800815
       IF (VFRAC .EQ. 0.) GO TO 40                                       D0800816
       K = 1                                                             D0800817
       IF (DU .LT. 0.) K=-1                                              D0800818
       L = 1                                                             D0800819
       IF (DV .LT. 0.) L=0                                               D0800820
       L1 = 1-L                                                          D0800821
       I1 = IU                                                           D0800822
       J1 = JV + L                                                       D0800823
       I2 = IU + K                                                       D0800824
       J2 = J1                                                           D0800825
       CALL LIM (&31)                                                    D0800826
       CALL NTRSCT                                                       D0800827
       IF (KBUG .GE. 3) WRITE (6,305) I1,J1,I2,J2,IFLAG,K,L,L1,QXPR,QYPR D0800828
```

```
305   FORMAT (7H AT 305,8I5,2E17.9)                                          D0800829
      IF (IFLAG.NE.0) GO TO 450                                              D0800830
 31   I1 = I2                                                                D0800831
      J1 = JV + L1                                                           D0800832
      CALL LIM (&32)                                                         D0800833
      CALL NTRSCT                                                            D0800834
      IF (KBUG .GE. 3) WRITE (6,315) I1,J1,I2,J2,IFLAG,K,L,L1,QXPR,QYPR      D0800835
315   FORMAT (7H AT 315,8I5,2E17.9)                                          D0800836
      IF (IFLAG.NE.0) GO TO 450                                              D0800837
 32   CONTINUE                                                               D0800838
      I1 = IU                                                                D0800839
      J2 = J1                                                                D0800840
      CALL LIM (&70)                                                         D0800841
      CALL NTRSCT                                                            D0800842
      IF (KBUG .GE. 3) WRITE (6,325) I1,J1,I2,J2,IFLAG,K,L,L1,QXPR,QYPR      D0800843
325   FORMAT (7H AT 325,8I5,2E17.9)                                          D0800844
      IF (IFLAG.NE.0) GO TO 450                                              D0800845
      GO TO 70                                                               D0800846
 40   IF (UFRAC .EQ. 0.) GO TO 50                                            D0800847
      K = 1                                                                  D0800848
      IF (DV .LT. 0.) K=-1                                                   D0800849
      L = 1                                                                  D0800850
      IF (DU .LT. 0.) L=0                                                    D0800851
      L1 = 1-L                                                               D0800852
      I1 = IU + L                                                            D0800853
      J1 = JV                                                                D0800854
      I2 = I1                                                                D0800855
      J2 = JV + K                                                            D0800856
      CALL LIM (&41)                                                         D0800857
      CALL NTRSCT                                                            D0800858
      IF (KBUG .GE. 3) WRITE (6,4051)I1,J1,I2,J2,IFLAG,K,L,L1,QXPR,QYPR      D0800859
4051  FORMAT (7H AT 405,8I5,2E17.9)                                          D0800860
      IF (IFLAG.NE.0) GO TO 450                                              D0800861
 41   I1 = IU + L1                                                           D0800862
      J1 = J2                                                                D0800863
      CALL LIM (&42)                                                         D0800864
```



```
      CALL NTRSCT
      IF (KBUG .GE. 3) WRITE (6,415) I1,J1,I2,J2,IFLAG,K,L,L1,QXPR,QYPR      D0800865
415   FORMAT (7H AT 415,8I5,2E17.9)                                          D0800866
      IF (IFLAG.NE.0) GO TO 450                                              D0800867
 42   CONTINUE                                                               D0800868
      J1 = JV                                                                D0800869
      I2 = I1                                                                D0800870
      CALL LIM (&70)                                                         D0800871
      CALL NTRSCT                                                            D0800872
      IF (KBUG .GE. 3) WRITE (6,425) I1,J1,I2,J2,IFLAG,K,L,L1,QXPR,QYPR      D0800873
425   FORMAT (7H AT 425,8I5,2E17.9)                                          D0800874
      IF (IFLAG.EQ.0) GO TO 70                                               D0800875
450   DOTPR=(QXPR-QX)*(CX-QX)+(QYPR-QY)*(CY-QY)                              D0800876
      IF (DOTPR.GT.0) GO TO (15,220),KSWTCH                                  D0800877
      GO TO 70                                                               D0800878
 50   IUPPR=6                                                                D0800879
      IF (KBUG .GE. 3) WRITE (6,502) DU,DV                                   D0800880
502   FORMAT (6H AT 50,2E13.5)                                               D0800881
      IF (DU .LT. 0.) GO TO 52                                               D0800882
      IF (DU .NE. 0.) GO TO 505                                              D0800883
      IUPPR=4                                                                D0800884
      IF (DV .GT. 0.) GO TO 53                                               D0800885
      GO TO 51                                                               D0800886
505   IF (DV .LT. 0.) GO TO 51                                               D0800887
      IF (DV .EQ. 0.) IUPPR=4                                                D0800888
      K = 2                                                                  D0800889
      L = 0                                                                  D0800890
      GO TO 55                                                               D0800891
 51   K = 0                                                                  D0800892
      L = 6                                                                  D0800893
      GO TO 55                                                               D0800894
 52   IF (DV .GT. 0.) GO TO 53                                               D0800895
      IF (DV .EQ. 0.) IUPPR=4                                                D0800896
      K=6                                                                    D0800897
      L=4                                                                    D0800898
      GO TO 55                                                               D0800899
                                                                             D0800900
```

```
 53     K=4                                                                  D0800901
        L=2                                                                  D0800902
 55     DO 56 I=1,IUPPR                                                      D0800903
        KI = K + I                                                           D0800904
        LI = L + I                                                           D0800905
        I1 = IU + ITBL(KI)                                                   D0800906
        J1 = JV + ITBL(LI)                                                   D0800907
        I2 = IU + ITBL(KI+1)                                                 D0800908
        J2 = JV + ITBL(LI+1)                                                 D0800909
        CALL LIM (&56)                                                       D0800910
        CALL NTRSCT                                                          D0800911
        IF (IFLAG .EQ. 0) GO TO 56                                           D0800912
        DOTPR=(QXPR-QX)*(CX-QX)+(QYPR-QY)*(CY-QY)                            D0800913
        IF (DOTPR.GT.0) GO TO (15,220),KSWTCH                                D0800914
 56     CONTINUE                                                             D0800915
   70   CONTINUE                                                             D0800916
        KSERCH = 1                                                           D0800917
        IF (KBUG .GE. 3)                                                     D0800918
       1WRITE (6,403)                                                        D0800919
        IF (KBUG .GE. 3)                                                     D0800920
       1WRITE (6,402) PX,PY,IP,JP,UFRAC,VFRAC,X(I1,J1),X(I2,J2),Y(I1,J1)     D0800921
       1,Y(I2,J2)                                                            D0800922
        IF (KBUG .GE. 3)                                                     D0800923
       1WRITE (6,405) INT,QX,QY,DU,DV,IU,JV                                  D0800924
  401  FORMAT (1X,10HREACHED 15)                                            D0800925
  402  FORMAT (1X,2E17.9,2I4/6E13.5)                                        D0800926
  403  FORMAT (1X,10HREACHED 70)                                            D0800927
  404  FORMAT  (1X,11HREACHED 220)                                          D0800928
  405  FORMAT (5X,I14,4E17.9, 2I4)                                          D0800929
        IF ( INT .EQ. 0 .OR. INT .EQ. 1) RETURN                              D0800930
        DO 72 K=1,NLEV                                                       D0800931
        ITST(K) = 0                                                          D0800932
 72     CONTINUE                                                             D0800933
        DIST = (CX-QX)**2 + (CY-QY)**2                                       D0800934
        CALL BNDRY1                                                          D0800935
        IF (INT .EQ. 0) RETURN                                               D0800936
```



```
        IBNDRY = 1                                                           D0800937
        INT = INT-1                                                          D0800938
        GO TO (15,220),KSWTCH                                                D0800939
 167    LEW = 1                                                              D0800940
        IF (KBUG .GE. 3)                                                     D0800941
       1WRITE (6,405) INT,QX,QY,DU,DV,IU,JV                                  D0800942
        IF (KBUG .GE. 3)                                                     D0800943
       1WRITE (6,402) PX,PY,IP,JP,UFRAC,VFRAC,X(I1,J1),X(I2,J2),Y(I1,J1)     D0800944
       1,Y(I2,J2)                                                            D0800945
        RETURN 1                                                             D0800946
        END                                                                  D0800947
        SUBROUTINE NICEB (/X/,/Y/,/Z/,/ND1/,/ND2/,/ND3/,/XT/,/YT/,/M/,/N/,D0800948
       1/P1Z/,/P2Z/,/P3Z/,/NARAYS/,/NLEVEL/,/KCHECK/,/IBFLG/,/JFLAG/)        D0800949
        INTEGER*2 KCHECK,LCHECK                                              D0800950
        DIMENSION XBOX1(500),XBOX2(500),YBOX1(500),YBOX2(500)                D0800951
        DIMENSION X(ND1,ND2,1),Y(ND1,ND2,1),Z(ND1,ND2,ND3,1),XT(1),YT(1),    D0800952
       1 M(1),N(1),P1Z(1),P2Z(1),P3Z(1),NLEVEL(1),KCHECK(NARAYS,1),          D0800953
       2 IBFLG(1),JFLAG(1)                                                   D0800954
        COMMON /BOXES/XBOX1,XBOX2,YBOX1,YBOX2                                D0800955
        COMMON /IO2NIC/ ISAM                                                 D0800956
        COMMON /NICPLO/ IROT                                                 D0800957
        COMMON /VECT/ VO(3),VI(3)                                            D0800958
        COMMON /DEBUG/KBUG                                                   D0800959
        COMMON /OBS/ CX,CY,CZ                                                D0800960
        COMMON /XOBS/ CX1,CY1,CZ1                                            D0800961
        COMMON /IOT1NI/ LEW                                                  D0800962
        COMMON /FNP/ X100D                                                   D0800963
        DATA  AL2   /0.69314718 /                                            D0800964
        DATA  CHECK /1.0E38/                                                 D0800965
        DATA SO /Z7FFFFFFF/                                                  D0800966
        RETURN                                                               D0800967
        ENTRY NICEL (/LCHECK/,/NLC/)                                         D0800968
        DIMENSION LCHECK (NLC,1)                                             D0800969
        RETURN                                                               D0800970
        ENTRY NICER (/AL/,/QC/)                                              D0800971
        DIMENSION AL(3,3,1),QC(3,1)                                          D0800972
```

```
      RETURN                                                            D0800973
      ENTRY NICEP (/I1/,/J1/,/I2/,/J2/,/NA/,/LEV/)                      D0800974
      P1X = X(I1,J1,NA)                                                 D0800975
      P1Y = Y(I1,J1,NA)                                                 D0800976
      P2X = X(I2,J2,NA)                                                 D0800977
      P2Y = Y(I2,J2,NA)                                                 D0800978
      NLV = NLEVEL(NA)                                                  D0800979
      DO 5 K=1,NLV                                                      D0800980
      P1Z(K) = Z(I1,J1,K,NA)                                            D0800981
      P2Z(K) = Z(I2,J2,K,NA)                                            D0800982
    5 CONTINUE                                                          D0800983
      ICRV =0                                                           D0800984
      VI(1) = P1X                                                       D0800985
      VI(2) = P1Y                                                       D0800986
      VI(3) = P1Z(LEV)                                                  D0800987
      IF (IROT .EQ. 1) GO TO 200                                        D0800988
      DO 201 IS=1,3                                                     D0800989
  201 VO(IS) = VI(IS)                                                   D0800990
      GO TO 202                                                         D0800991
  200 CALL M1 (AL(1,1,NA),QC(1,NA))                                     D0800992
  202 CALL TRNSF1 (VO(1),VO(2),VO(3),XT,YT)                             D0800993
      VI(1) = P2X                                                       D0800994
      VI(2) = P2Y                                                       D0800995
      VI(3) = P2Z(LEV)                                                  D0800996
      IF (IROT .EQ. 1) GO TO 210                                        D0800997
      DO 211 IS=1,3                                                     D0800998
  211 VO(IS) = VI(IS)                                                   D0800999
      GO TO 212                                                         D0801000
  210 CALL M1 (AL(1,1,NA),QC(1,NA))                                     D0801001
  212 CALL TRNSF1 (VO(1),VO(2),VO(3),XT(2),YT(2))                       D0801002
      GO TO 6                                                           D0801003
      ENTRY NICEC (/PX1/,/PY1/,/PZ1/,/PX2/,/PY2/,/PZ2/,/NC/)            D0801004
      P1X = PX1                                                         D0801005
      P1Y = PY1                                                         D0801006
      P1Z(1) = PZ1                                                      D0801007
      P2X = PX2                                                         D0801008
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      P2Y = PY2                                                         D0801009
      P2Z(1) = PZ2                                                      D0801010
      LEV = 1                                                           D0801011
      NLV = 1                                                           D0801012
      ICRV = 1                                                          D0801013
      CALL TRNSF1 (P1X,P1Y,P1Z(1),XT(1),YT(1))                          D0801014
      CALL TRNSF1 (P2X,P2Y,P2Z(1),XT(2),YT(2))                          D0801015
    6 CONTINUE                                                          D0801016
      D = SQRT ((XT(1) - XT(2))**2 +(YT(1) - YT(2))**2)                 D0801017
      ISTOP = ALOG(X100D*D)/AL2                                         D0801018
      ISTOP = ISTOP + 1                                                 D0801019
      IP = MIN0(I1,I2)                                                  D0801020
      JP = MIN0(J1,J2)                                                  D0801021
      K = -1                                                            D0801022
      L = -1                                                            D0801023
      IT = -1                                                           D0801024
      UFRAC = 0.                                                        D0801025
      VFRAC = 0.                                                        D0801026
      IF (I1.EQ.I2) K=0                                                 D0801027
      IF (J1 .EQ. J2) L=0                                               D0801028
      IF (J1 .GT. J2 .OR. I1.GT.I2) IT=+1                               D0801029
      IF (K .NE.0) UFRAC=1.                                             D0801030
      IF (L .NE.0) VFRAC=1.                                             D0801031
      ICUT = 1                                                          D0801032
      IK = 0                                                            D0801033
      PXVIS = CHECK                                                     D0801034
   20 P3X = (P1X+P2X)/2.                                                D0801035
      P3Y = (P1Y+P2Y)/2.                                                D0801036
      DO 21 K1=1,NLV                                                    D0801037
      IF (P1Z(K1).EQ.SO .OR. P2Z(K1).EQ.SO) GO TO 205                   D0801038
      P3Z(K1) = (P1Z(K1)+P2Z(K1))/2.                                    D0801039
      GO TO 21                                                          D0801040
  205 CONTINUE                                                          D0801041
C     **********                                                        D0801042
C     THE NEXT STATEMENT IS INCORRECT                                   D0801043
      IF (P1Z(K1).EQ.SO .OR. P2Z(K1).EQ.SO) P3Z(K1)=SO                  D0801044
```

```
C     **************                                                    D0801045
 21   CONTINUE                                                          D0801046
      FIC2 = 2.**ICUT                                                   D0801047
      UFRAC = UFRAC + FLOAT(K)/FIC2                                     D0801048
      VFRAC = VFRAC + FLOAT(L)/FIC2                                     D0801049
      ICUT = ICUT + 1                                                   D0801050
      IF (IROT .NE. 1) CALL IOUT1 (P3X,P3Y,P3Z,IP,JP,UFRAC,VFRAC,LEV)  D0801051
      VI (1) = P3X                                                      D0801052
      VI (2) = P3Y                                                      D0801053
      VI (3) = P3Z(LEV)                                                 D0801054
      IF (ICRV .EQ. 1) GO TO 213                                        D0801055
      IF (IROT .EQ. 1) GO TO 216                                        D0801056
  213 CONTINUE                                                          D0801057
      DO 214 IS = 1,3                                                   D0801058
  214 VO(IS) = VI(IS)                                                   D0801059
      GO TO 218                                                         D0801060
  216 CALL M1 (AL(1,1,NA),QC(1,NA))                                     D0801061
  218 CALL TRNSF1 (VO(1),VO(2),VO(3),XTEST,YTEST)                       D0801062
      IF (IROT .EQ. 1 .AND. ICRV .EQ. 0) GO TO 219                      D0801063
      CALL IOUT1 (P3X,P3Y,P3Z,IP,JP,UFRAC,VFRAC,LEV)                    D0801064
  219 CONTINUE                                                          D0801065
      DO 55 N8=1,NARAYS                                                 D0801066
      ISAM = 0                                                          D0801067
      IF (NA .EQ. NB) ISAM=1                                            D0801068
      IF ( ICRV .EQ. 1) ISAM = 0                                        D0801069
      TEMP = P3Z(LEV)                                                   D0801070
      IF (ICRV .EQ. 0) GO TO 23                                         D0801071
      IF (LCHECK(NC,NB) .EQ. 0) GO TO 55                                D0801072
      GO TO 58                                                          D0801073
   23 CONTINUE                                                          D0801074
      KCK = KCHECK (NA,NB)                                              D0801075
      IF (KCK .EQ. 0) GO TO 55                                          D0801076
      IF (KCK .LT. 0) GO TO 58                                          D0801077
      IF (ISAM .EQ. 1) GO TO 58                                         D0801078
      INDX = KCK                                                        D0801079
      IF (XTEST .LT. XBOX1(INDX)) GO TO 55                              D0801080
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      IF (XTEST .GT. XBOX2(INDX)) GO TO 55                              D0801081
      IF (YTEST .LT. YBOX1(INDX)) GO TO 55                              D0801082
      IF (YTEST .GT. YBOX2(INDX)) GO TO 55                              D0801083
   58 CONTINUE                                                          D0801084
      IF (IROT .NE. 1) GO TO 302                                        D0801085
      VO(1) = CX                                                        D0801086
      VO(2) = CY                                                        D0801087
      VO(3) = CZ                                                        D0801088
      CALL M2 (AL(1,1,NB),QC(1,NB))                                     D0801089
      CX1 = VI(1)                                                       D0801090
      CY1 = VI(2)                                                       D0801091
      CZ1 = VI(3)                                                       D0801092
      VI(1) = P3X                                                       D0801093
      VI(2) = P3Y                                                       D0801094
      IF (ISAM .EQ. 1) GO TO 101                                        D0801095
      VI(3) = P3Z(LEV)                                                  D0801096
      CALL M1 (AL(1,1,NA),QC(1,NA))                                     D0801097
      CALL M2 (AL(1,1,NB),QC(1,NB))                                     D0801098
      P3Z(LEV) = VI(3)                                                  D0801099
  101 CALL IOUT1 (VI(1),VI(2),P3Z,IP,JP,UFRAC,VFRAC,LEV)                D0801100
  302 CONTINUE                                                          D0801101
      CALL IOUT2 (X(1,1,NB),Y(1,1,NB),Z(1,1,1,NB),ND1,ND2,NLEVEL(NB),  D0801102
     1M(NB),N(NB),IBFLG(NB),JFLAG(NB),&54)                              D0801103
      P3Z(LEV) = TEMP                                                   D0801104
   55 CONTINUE                                                          D0801105
   54 P3Z(LEV) = TEMP                                                   D0801106
      IF (LEW .EQ. 0) GO TO 25                                          D0801107
   15 P2X = P3X                                                         D0801108
      P2Y = P3Y                                                         D0801109
      DO 16 K1=1,NLV                                                    D0801110
   16 P2Z(K1) = P3Z(K1)                                                 D0801111
      IF (IT .NE. 1) GO TO 17                                           D0801112
      K = -K                                                            D0801113
      L = -L                                                            D0801114
      IT = -1                                                           D0801115
   17 CONTINUE                                                          D0801116
```

```
      IF (ICUT .LT. ISTOP) GO TO 20                                    D0801117
      IF (PXVIS .EQ. CHECK) RETURN                                     D0801118
      IF (IK .EQ. 1) GO TO 30                                          D0801119
      IK = IK+1                                                        D0801120
      GO TO 20                                                         D0801121
25    IF (ICUT .GE. ISTOP) GO TO 35                                    D0801122
      P1X = P3X                                                        D0801123
      P1Y = P3Y                                                        D0801124
      DO 26 K1=1,NLV                                                   D0801125
26    P1Z(K1) = P3Z(K1)                                                D0801126
      PXVIS = P1X                                                      D0801127
      PYVIS = P1Y                                                      D0801128
      PZVIS = P1Z(LEV)                                                 D0801129
      IF (IT .EQ. 1) GO TO 27                                          D0801130
      K = -K                                                           D0801131
      L = -L                                                           D0801132
      IT = 1                                                           D0801133
27    CONTINUE                                                         D0801134
      GO TO 20                                                         D0801135
30    P3X = PXVIS                                                      D0801136
      P3Y = PYVIS                                                      D0801137
      P3Z(LEV) = PZVIS                                                 D0801138
35    CONTINUE                                                         D0801139
      VI(1) = P3X                                                      D0801140
      VI(2) = P3Y                                                      D0801141
      VI(3) = P3Z(LEV)                                                 D0801142
      IF (IROT .EQ. 1) GO TO 36                                        D0801143
      DO 37 IS=1,3                                                     D0801144
37    VO(IS) = VI(IS)                                                  D0801145
      GO TO 38                                                         D0801146
36    CALL MI (AL(1,1,NA),QC(1,NA))                                    D0801147
38    CALL TRNSF1 (VO(1),VO(2),VO(3),XT(2),YT(2))                      D0801148
      CALL  PLT (2,2,1)                                                D0801149
      RETURN                                                           D0801150
      END                                                              D0801151
      SUBROUTINE PLOTO (/XT/,/YT/,/LEWA/,/ND1/)                        D0801152
```



```
      DIMENSION XT(1),YT(1),LEWA(ND1,1)                                D0801153
      COMMON /NICPLO/ IROT                                             D0801154
      COMMON /CPLOTO/ IVIS                                             D0801155
      DATA SO /ZTFFFFFFFF/                                             D0801156
      COMMON /VECT/ VO(3),VI(3)                                        D0801157
      RETURN                                                           D0801158
      ENTRY PLOT1 (/AL/,/QC/)                                          D0801159
      DIMENSION AL(3,3,1),QC(1)                                        D0801160
      RETURN                                                           D0801161
      ENTRY PLOTR (/X/,/Y/,/Z/,/ND1/,/M/,/N/,/NA/,/K/,/IBFLG/)         D0801162
      DIMENSION X(ND1,1),Y(ND1,1),Z(ND1,1)                             D0801163
      DO 440 I=1,M                                                     D0801164
      I1 = I                                                           D0801165
      I2 = I                                                           D0801166
      JQ = 1                                                           D0801167
      KPLOT = 0                                                        D0801168
      DO 430 J=1,N                                                     D0801169
      J1 = J-1                                                         D0801170
      J2 = J                                                           D0801171
      IF (Z(I,J) .NE. SO) GO TO 441                                    D0801172
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                           D0801173
      JQ = J+1                                                         D0801174
      KPLOT = 0                                                        D0801175
      GO TO 430                                                        D0801176
441   IF (IVIS .NE. 1) GO TO 4289                                      D0801177
      IF (LEWA(I,J) .EQ. 0) GO TO 4288                                 D0801178
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                           D0801179
      IF (KPLOT .GE. 1) CALL NICEP (I1,J1,I2,J2,NA,K)                  D0801180
      KPLOT = 0                                                        D0801181
      GO TO 430                                                        D0801182
4288  IF (KPLOT .EQ. 0 .AND. J.NE.JQ) CALL NICEP (I1,J2,I2,J1,NA,K)    D0801183
4289  KPLOT = KPLOT + 1                                                D0801184
      VI(1) = X(I,J)                                                   D0801185
      VI(2) = Y(I,J)                                                   D0801186
      VI(3) = Z(I,J)                                                   D0801187
      IF (IROT .EQ. 1) GO TO 10                                        D0801188
```

```
      DO 11 IS=1,3                                                    D0801189
11    VO(IS) = VI(IS)                                                 D0801190
      GO TO 15                                                        D0801191
10    CALL M1 (AL,QC)                                                 D0801192
15    CALL TRNSF1 (VO(1),VO(2),VO(3),XT(KPLOT),YT(KPLOT))             D0801193
430   CONTINUE                                                        D0801194
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                          D0801195
440   CONTINUE                                                        D0801196
      JN = N                                                          D0801197
      IF (IBFLG .EQ. 1) JN=JN-1                                       D0801198
      DO 460 J=1,JN                                                   D0801199
      J1 = J                                                          D0801200
      J2 = J                                                          D0801201
      KPLOT = 0                                                       D0801202
      IQ = 1                                                          D0801203
      DO 450 I=1,M                                                    D0801204
      I1 = I-1                                                        D0801205
      I2 = I                                                          D0801206
      IF (Z(I,J) .NE. SO) GO TO 461                                   D0801207
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                          D0801208
      IQ = I+1                                                        D0801209
      KPLOT = 0                                                       D0801210
      GO TO 450                                                       D0801211
461   IF (IVIS .NE. 1) GO TO 4489                                     D0801212
      IF (LEW(I,J) .EQ. 0) GO TO 4488                                 D0801213
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                          D0801214
      IF (KPLOT .GE. 1) CALL NICEP (I1,J1,I2,J2,NA,K)                 D0801215
      KPLOT = 0                                                       D0801216
      GO TO 450                                                       D0801217
4488  IF (KPLOT .EQ. 0 .AND.I.NE.IQ) CALL NICEP (I2,J1,I1,J2,NA,K)    D0801218
4489  KPLOT = KPLOT + 1                                               D0801219
      VI(1) = X(I,J)                                                  D0801220
      VI(2) = Y(I,J)                                                  D0801221
      VI(3) = Z(I,J)                                                  D0801222
      IF (IROT .EQ. 1) GO TO 110                                      D0801223
      DO 111 IS=1,3                                                   D0801224
```



```
111   VO(IS) = VI(IS)                                                 D0801225
      GO TO 115                                                       D0801226
110   CALL M1 (AL,QC)                                                 D0801227
115   CALL TRNSF1 (VO(1),VO(2),VO(3),XT(KPLOT),YT(KPLOT))             D0801228
450   CONTINUE                                                        D0801229
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                          D0801230
460   CONTINUE                                                        D0801231
      RETURN                                                          D0801232
      ENTRY PLOTC (/C/,/N/,/LEW/,/NP/,/NC/)                           D0801233
      DIMENSION C(N,1),LEW(1)                                         D0801234
      KPLOT = 0                                                       D0801235
      DO 540 I=1,NP                                                   D0801236
      IF (IVIS .NE. 1) GO TO 4589                                     D0801237
      IF (LEW(I) .EQ. 0) GO TO 4588                                   D0801238
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                          D0801239
      IF (KPLOT .GE. 1) CALL NICEC (C(I-1,1),C(I-1,2),C(I-1,3),C(I,1),D0801240
     1C(I,2),C(I,3),NC)                                               D0801241
      KPLOT = 0                                                       D0801242
      GOTO 540                                                        D0801243
4588  IF (KPLOT .EQ. 0 .AND. I .NE. 1) CALL NICEC (C(I,1),C(I,2),C(I,3),D0801244
     1C(I-1,1),C(I-1,2),C(I-1,3),NC)                                  D0801245
4589  KPLOT = KPLOT + 1                                               D0801246
      CALL TRNSF1 (C(I,1),C(I,2),C(I,3),XT(KPLOT),YT(KPLOT))          D0801247
 540  CONTINUE                                                        D0801248
      IF (KPLOT .GT. 1) CALL PLT (2,KPLOT,1)                          D0801249
      RETURN                                                          D0801250
      END                                                             D0801251
      SUBROUTINE NTRSCO (/X/,/Y/,/Z/,/ND1/,/ND2/,/IHOL/,/ITST/,/NLEV/,D0801252
     1/IBFLG/,/N/)                                                    D0801253
      DIMENSION X(ND1,1),Y(ND1,1),Z(ND1,ND2,1),IHOL(1),ITST(1)        D0801254
      COMMON /XOBS/ CX,CY,CZ                                          D0801255
      COMMON /DEBUG/KBUG                                              D0801256
      COMMON /ILNB/ I1,J1,I2,J2                                       D0801257
      COMMON /INTER/ QX,QY,QXPR,QYPR,UFRAC,VFRAC,FRAC,IU,JV,DU,DV,IFLAG D0801258
      COMMON /ICHSAV/ PXI                                             D0801259
      COMMON /EPSSAV/ EPS                                             D0801260
```

```
      DATA SO /Z7FFFFFFFF/                                                  D0801261
      EPSPL1= EPS + 1.                                                      D0801262
      RETURN                                                                D0801263
      ENTRY NTRSCT                                                          D0801264
      IFLAG = 0                                                             D0801265
      X1 = X(I1,J1)                                                         D0801266
      Y1 = Y(I1,J1)                                                         D0801267
      X2 = X(I2,J2)                                                         D0801268
      Y2 = Y(I2,J2)                                                         D0801269
      DX1 = QX-CX                                                           D0801270
      DY1 = QY-CY                                                           D0801271
      DX2 = X2-X1                                                           D0801272
      DY2 = Y2-Y1                                                           D0801273
      DENOM = DY1*DX2 - DY2*DX1                                             D0801274
      RT1 = DY1*CX - DX1*CY                                                 D0801275
      RT2 = DY2*X1 - DX2*Y1                                                 D0801276
      IF (DENOM.NE.0) GO TO 22                                              D0801277
      WRITE (6,20)                                                          D0801278
20    FORMAT (1HO,'TWO POINTS IDENTICAL IN DEFINING GRID. THEY ARE')        D0801279
      WRITE (6,21) I1,J1,I2,J2,X1,Y1,X2,Y2                                  D0801280
21    FORMAT (1X,4I5,1P5E17.8)                                              D0801281
      RETURN                                                                D0801282
  22  CONTINUE                                                              D0801283
      QXPR = (RT1*DX2 - RT2*DX1)/DENOM                                      D0801284
      QYPR = -(DY1*RT2 - DY2*RT1)/DENOM                                     D0801285
      IF (X1.EQ.X2) QXPR=X1                                                 D0801286
      IF (Y1.EQ.Y2) QYPR=Y1                                                 D0801287
      GX1 = X1 - QXPR                                                       D0801288
      GY1 = Y1 - QYPR                                                       D0801289
      GX2 = X2 - QXPR                                                       D0801290
      GY2 = Y2 - QYPR                                                       D0801291
      DOTPR =(GX1*GX2 + GY1*GY2)/(PX1**2)                                   D0801292
C     AT ONE TIME IT WAS REQUIRED THAT QPR BE ON THE INTERIOR OF THE        D0801293
C    1SEGMENT IF THE TRANSFER TO 30 WAS MADE                                D0801294
      IF (KBUG .GE. 4)                                                      D0801295
     1WRITE (6,11) DOTPR,X1,Y1,X2,Y2,QXPR,QYPR,DOTPR,GY1,GX1,GY2,GX2,EPSD0801296
```



```
11    FORMAT (1X, 7E16.8,/1X, 7E16.8)                                       D0801297
      IF (DOTPR .LT. EPS )   GO TO 30                                       D0801298
      RETURN                                                                D0801299
 30   IFLAG = 1                                                             D0801300
      IF (DOTPR .LT. (-EPS) ) GO TO 304                                     D0801301
      QXPR = X1                                                             D0801302
      QYPR = Y1                                                             D0801303
      G1SQ = GX1**2 + GY1**2                                                D0801304
      G2SQ = GX2**2 + GY2**2                                                D0801305
      IF (KBUG .GE. 4)                                                      D0801306
     1WRITE (6,11) G1SQ,G2SQ                                                D0801307
      IF (G1SQ .LT. G2SQ) GO TO 304                                         D0801308
      QXPR = X2                                                             D0801309
      QYPR = Y2                                                             D0801310
304   CONTINUE                                                              D0801311
      DSQ = DX2**2 + DY2**2                                                 D0801312
      IF ( IBFLG .NE. 1) GO TO 305                                          D0801313
       IF (J1 .GT. 2 .AND. J1 .LT. (N-1)) GO TO 305                         D0801314
       IF (J2 .GT. 2 .AND. J2 .LT. (N-1)) GO TO 305                         D0801315
      IF ( J1 .EQ. 2 .AND. J2 .EQ. N ) J2 = 1                               D0801316
      IF ( J1 .EQ. N .AND. J2 .EQ. 2 ) J1 = 1                               D0801317
      IF ( J1 .EQ. 1 .AND. J2 .EQ.(N-1) ) J1 = N                            D0801318
      IF (J1 .EQ. (N-1) .AND. J2 .EQ. 1) J2 = N                             D0801319
305     CONTINUE                                                            D0801320
      IF (I1.GT.I2 .OR.J1.GT.J2) GO TO 31                                   D0801321
      PSQ = (QXPR-X1)**2 + (QYPR-Y1)**2                                     D0801322
      GO TO 32                                                              D0801323
 31   PSQ = (QXPR-X2)**2 + (QYPR-Y2)**2                                     D0801324
 32   CONTINUE                                                              D0801325
      FRAC =  SQRT(PSQ/DSQ)                                                 D0801326
      IF (FRAC .LT..001) FRAC = 0.                                          D0801327
      RETURN                                                                D0801328
      ENTRY NTRSC1                                                          D0801329
      QX = QXPR                                                             D0801330
      QY = QYPR                                                             D0801331
      IUNEW = MIN0(I1,I2)                                                   D0801332
```

```
      JVNEW = MINO(J1,J2)                                                    D0801333
      IF (I1 .NE. I2) GO TO 50                                               D0801334
      UFRACN = 0.                                                            D0801335
      IF (EPSPL1*FRAC .LT. 1.) GO TO 40                                      D0801336
      VFRACN = 0.                                                            D0801337
      JVNEW = JVNEW + 1                                                      D0801338
      GO TO 70                                                               D0801339
   40 VFRACN = FRAC                                                          D0801340
      GO TO 70                                                               D0801341
   50 VFRACN = 0.                                                            D0801342
      IF (EPSPL1*FRAC .LT. 1.)GO TO 60                                       D0801343
      UFRACN = 0.                                                            D0801344
      IUNEW = IUNEW + 1                                                      D0801345
      GO TO 70                                                               D0801346
   60 UFRACN = FRAC                                                          D0801347
   70 DU = IUNEW-IU                                                          D0801348
      IF (DU .EQ. 0.) DU=UFRACN-UFRAC                                        D0801349
      DV = JVNEW-JV                                                          D0801350
      IF (DV .EQ. 0.) DV=VFRACN-VFRAC                                        D0801351
C     IF DV IS .GT. 1 ,IT MEANS THAT THE SIGN OF DV IS INCORRECT             D0801352
      IF(ABS(DV) .GT. EPSPL1) DV = - DV                                      D0801353
      UFRAC = UFRACN                                                         D0801354
      VFRAC = VFRACN                                                         D0801355
      IU = IUNEW                                                             D0801356
      JV = JVNEW                                                             D0801357
      DO 80 K=1,NLEV                                                         D0801358
      IHOL(K) = 0                                                            D0801359
      IF (Z(I1,J1,K).NE.SO .AND. Z(I2,J2,K).NE.SO) GO TO 80                  D0801360
      IHOL(K) = 1                                                            D0801361
      ITST(K) = 0                                                            D0801362
   80 CONTINUE                                                               D0801363
      IF (IBFLG.NE.1) RETURN                                                 D0801364
      IF (DV .GT. 0. .AND. JV .EQ. N) JV = 1                                 D0801365
      IF (DV .LT. 0. .AND. JV .EQ. 1) JV = N                                 D0801366
      RETURN                                                                 D0801367
      END                                                                    D0801368
```



```
      SUBROUTINE BNDRY0 (/M/,/N/,/JFLAG/,/IBFLG/)                            D0801369
      COMMON /XOBS/ CX,CY,CZ                                                 D0801370
      COMMON /IOUTBN/ KSERCH                                                 D0801371
      COMMON /DEBUG/KBUG                                                     D0801372
      COMMON /ILNB/ I1,J1,I2,J2                                              D0801373
      COMMON /INTER/ QX,QY,QXPR,QYPR,UFRAC,VFRAC,FRAC,IU,JV,DU,DV,IFLAG      D0801374
      COMMON /BOUND/ DIST,INT                                                D0801375
      RETURN                                                                 D0801376
      ENTRY BNDRY1                                                           D0801377
      INT = 0                                                                D0801378
      IF (JFLAG .NE. 1) RETURN                                               D0801379
      ENTRY BNDRY2                                                           D0801380
      DQPQ = 1.E+38                                                          D0801381
      M1 = M-1                                                               D0801382
      N1 = N-1                                                               D0801383
      I1 = 1                                                                 D0801384
    5 I2 = I1                                                                D0801385
      DO 10 J1=1,N1                                                          D0801386
      J2 = J1+1                                                              D0801387
      IF (UFRAC .NE. 0.) GO TO 15                                            D0801388
      IF (I1 .NE. IU) GO TO 15                                               D0801389
      IF (J1 .EQ. JV) GO TO 10                                               D0801390
      IF (J2 .EQ. JV .AND. VFRAC .EQ. 0.) GO TO 10                           D0801391
      IF (IBFLG .NE. 1)GO TO 15                                              D0801392
      IF (JV .EQ. 1 .AND. J2 .EQ. N .AND. VFRAC .EQ. 0.)GO TO 10             D0801393
      IF (JV .EQ. N .AND. J1 .EQ. 1) GO TO 10                                D0801394
   15 CONTINUE                                                               D0801395
      CALL NTRSCT                                                            D0801396
      IF (IFLAG .EQ. 0) GO TO 10                                             D0801397
      DSCQP = (CX-QXPR)**2 + (CY-QYPR)**2                                    D0801398
      IF (KBUG .GE. 4)                                                       D0801399
     1WRITE (6,16)KSERCH,DIST,DSCQP                                          D0801400
   16 FORMAT (1X,'BNDRY',I15,2E16.8)                                         D0801401
      IF (DSCQP .GT. DIST) GO TO 10                                          D0801402
      IF (KSERCH .EQ. 1 .AND. DSCQP .EQ.DIST)GO TO 10                        D0801403
      INT = INT + 1                                                          D0801404
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      DQPQ1 = (QXPR-QX)**2 + (QYPR-QY)**2                              D0801405
      IF (DQPQ1 .GE. DQPQ) GO TO 10                                    D0801406
      DQPQ = DQPQ1                                                     D0801407
      QX1 = QXPR                                                       D0801408
      QY1 = QYPR                                                       D0801409
      FRAC1 = FRAC                                                     D0801410
      I1P = I1                                                         D0801411
      I2P = I2                                                         D0801412
      J1P = J1                                                         D0801413
      J2P = J2                                                         D0801414
10    CONTINUE                                                         D0801415
      IF (I1 .EQ. M) GO TO 18                                          D0801416
      I1 = M                                                           D0801417
      GO TO 5                                                          D0801418
18    IF (IBFLG .EQ. 1) GO TO 30                                       D0801419
      J1 = N                                                           D0801420
19    J2 = J1                                                          D0801421
      DO 20 I1=1,M1                                                    D0801422
      I2 = I1+1                                                        D0801423
      IF (VFRAC .NE. 0.) GO TO 25                                      D0801424
      IF (J1 .NE. JV) GO TO 25                                         D0801425
      IF (I1 .EQ. IU) GO TO 20                                         D0801426
      IF (I2 .EQ. IU .AND. UFRAC .EQ. 0.) GO TO 20                     D0801427
25    CONTINUE                                                         D0801428
      CALL NTRSCT                                                      D0801429
      IF (IFLAG .EQ. 0) GO TO 20                                       D0801430
      DSCQP = (CX-QXPR)**2 + (CY-QYPR)**2                              D0801431
      IF (KBUG .GE. 4)                                                 D0801432
     1WRITE (6,16)KSERCH,DIST,DSCQP                                    D0801433
      IF (DSCQP .GT. DIST) GO TO 20                                    D0801434
      IF (KSERCH .EQ. 1 .AND. DSCQP .EQ.DIST)GO TO 20                  D0801435
      INT = INT+1                                                      D0801436
      DQPQ1 = (QXPR-QX1)**2 + (QYPR-QY)**2                             D0801437
      IF (DQPQ1 .GE. DQPQ) GO TO 20                                    D0801438
      DQPQ = DQPQ1                                                     D0801439
      QX1 = QXPR                                                       D0801440
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      QY1 = QYPR                                                       D0801441
      FRAC1 = FRAC                                                     D0801442
      I1P = I1                                                         D0801443
      I2P = I2                                                         D0801444
      J1P = J1                                                         D0801445
      J2P = J2                                                         D0801446
20    CONTINUE                                                         D0801447
      IF (J1 .EQ. 1) GO TO 30                                          D0801448
      J1 = 1                                                           D0801449
      GO TO 19                                                         D0801450
30    IF (INT .EQ. 0) RETURN                                           D0801451
      QXPR = QX1                                                       D0801452
      QYPR = QY1                                                       D0801453
      FRAC = FRAC1                                                     D0801454
      I1 = I1P                                                         D0801455
      I2 = I2P                                                         D0801456
      J1 = J1P                                                         D0801457
      J2 = J2P                                                         D0801458
      IU = MINO(I1,I2)                                                 D0801459
      JV = MINO (J1,J2)                                                D0801460
      IF (I1 .NE. 1 .OR. I2 .NE. 1)GO TO 40                            D0801461
      UFRAC = -1.                                                      D0801462
      VFRAC = 0.                                                       D0801463
      GO TO 99                                                         D0801464
 40   IF (I1 .NE. M .OR. I2 .NE. M) GO TO 42                           D0801465
      UFRAC = +1.                                                      D0801466
      VFRAC = 0.                                                       D0801467
      GO TO 99                                                         D0801468
 42   IF (J1 .NE. 1 .OR. J2 .NE. 1) GO TO 44                           D0801469
      UFRAC = 0.                                                       D0801470
      VFRAC = -1.                                                      D0801471
      GO TO 99                                                         D0801472
 44   IF (J1 .NE. N .OR. J2 .NE. N) GO TO 46                           D0801473
      UFRAC = 0.                                                       D0801474
      VFRAC = +1.                                                      D0801475
      GO TO 99                                                         D0801476
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      46 WRITE (6,98)                                                          D0801477
      98 FORMAT (1X,13HBOUNDRY ERROR)                                          D0801478
         STOP                                                                  D0801479
   99    RETURN                                                               D0801480
         END                                                                   D0801481
         SUBROUTINE SEARO (/IS/,/ITBL/)                                        D0801482
         DIMENSION IS(1),ITBL(1)                                               D0801483
         COMMON /DEBUG/KBUG                                                    D0801484
         COMMON /XOBS/ CX,CY,CZ                                                D0801485
         COMMON /ILNB/ I1,J1,I2,J2                                             D0801486
         COMMON /BOUND/ DIST,INT                                               D0801487
         COMMON /INTER/ QX,QY,QXPR,QYPR,UFRAC,VFRAC,FRAC,IU,JV,DU,DV,IFLAG     D0801488
         RETURN                                                                D0801489
         ENTRY SEARCH (*)                                                      D0801490
         IF (UFRAC .EQ. 0.) GO TO 7                                            D0801491
         K = 8                                                                 D0801492
         L = 0                                                                 D0801493
         GO TO 8                                                               D0801494
    7    IF (VFRAC .EQ. 0.) GO TO 10                                          D0801495
         K = 0                                                                 D0801496
         L = 11                                                                D0801497
    8    DO 9 I=1,6                                                           D0801498
         KI = K + I                                                            D0801499
         LI = L + I                                                            D0801500
         I1 = IU + IS(KI)                                                      D0801501
         J1 = JV + IS(LI)                                                      D0801502
         I2 = IU + IS(KI+1)                                                    D0801503
         J2 = JV + IS(LI+1)                                                    D0801504
         CALL LIM (&9)                                                         D0801505
         CALL NTRSCT                                                           D0801506
         IF (IFLAG .EQ. 0) GO TO 9                                             D0801507
         DCQPR = (CX-QXPR)**2 + (CY-QYPR)**2                                   D0801508
         IF (DCQPR .LT. DIST) RETURN 1                                         D0801509
    9    CONTINUE                                                             D0801510
         GO TO 30                                                              D0801511
   10    K = 2                                                                D0801512
```



```
         DO 12 I=1,8                                                           D0801513
         KI = K+I                                                              D0801514
         I1 = IU + ITBL(KI)                                                    D0801515
         J1 = JV + ITBL(I)                                                     D0801516
         I2 = IU + ITBL(KI+1)                                                  D0801517
         J2 = JV + ITBL(I+1)                                                   D0801518
         IF (KBUG .GE. 4)                                                      D0801519
        *WRITE (6,11) I,KI,IU,JV,I1,J1,I2,J2                                   D0801520
   11    FORMAT (1X,'IN SEARCH',8I5)                                           D0801521
         CALL LIM (&12)                                                        D0801522
         CALL NTRSCT                                                           D0801523
         IF (IFLAG .EQ. 0) GO TO 12                                            D0801524
         DCQPR = (CX-QXPR)**2 + (CY-QYPR)**2                                   D0801525
         IF (KBUG .GE. 4)                                                      D0801526
        *WRITE (6,13) DCQPR,DIST                                               D0801527
   13    FORMAT (1X,'IN SEARCH',2E15.7)                                        D0801528
         IF (DCQPR  .LT. DIST) RETURN 1                                        D0801529
   12    CONTINUE                                                              D0801530
   30    CONTINUE                                                              D0801531
         RETURN                                                                D0801532
         END                                                                   D0801533
         SUBROUTINE DIFO (/TEST1/,/TEST2/,/ITST/,/IHOL/,/PX/,/PY/,/PZ/,/X/,D0801534
        1/Y/,/Z/,/ND1/,/ND2/,/NLEV/)                                           D0801535
         DIMENSION TEST1(1),TEST2(1),ITST(1),IHOL(1),X(ND1,1),Y(ND1,1),        D0801536
        1 Z(ND1,ND2,1)                                                         D0801537
         COMMON /XOBS/ CX,CY,CZ                                                D0801538
         COMMON /DEBUG/KBUG                                                    D0801539
         COMMON /ILNB/ I1,J1,I2,J2                                             D0801540
         COMMON /INTER/ QX,QY,QXPR,QYPR,UFRAC,VFRAC,FRAC,IU,JV,DU,DV,IFLAG     D0801541
         COMMON /ICHSAV/ PXI                                                   D0801542
         DATA EPSIN/0.002/                                                     D0801543
         RETURN                                                                D0801544
         ENTRY DIFF (*,*)                                                      D0801545
         DENOM = CX - PX                                                       D0801546
         IF (DENOM .EQ. 0) GO TO 20                                            D0801547
         SLOPE = ABS((CY-PY)/DENOM)                                            D0801548
```

```
      IF (KBUG .GE. 4)                                                  D0801549
     1WRITE (6,18) SLOPE,DENOM,CX,PX,CY,PY                              D0801550
   18 FORMAT (1X,'SLOPE = ',1E13.5,' DENOM = ',5E13.5)                  D0801551
      IF (SLOPE .GT. 1) GO TO 20                                        D0801552
      TEST = ZOF(QX,CX,CZ,PX,PZ)                                        D0801553
      GO TO 21                                                          D0801554
   20 TEST = ZOF(QY,CY,CZ,PY,PZ)                                        D0801555
   21 DO 35 K=1,NLEV                                                    D0801556
      IF (IHOL(K) .EQ. 1) GO TO 30                                      D0801557
      IF (X(I1,J1).EQ.X(I2,J2)) GO TO 23                                D0801558
      QZ = ZOF(QX,X(I1,J1),Z(I1,J1,K),X(I2,J2),Z(I2,J2,K))              D0801559
      GO TO 24                                                          D0801560
   23 QZ = ZOF (QY,Y(I1,J1),Z(I1,J1,K),Y(I2,J2),Z(I2,J2,K))             D0801561
   24 IF (ITST(K) .EQ. 1) GO TO 31                                      D0801562
      TEST1(K) = TEST-QZ                                                D0801563
      IF (ABS(TEST1(K)/PXI).LT.EPSIN) TEST1(K)=0.                       D0801564
      IF (KBUG .GE. 4)                                                  D0801565
     *WRITE (6,312)PX,PZ,QX,TEST,QZ,TEST1(K),TEST2(K),I1,J1,I2,J2,ITST(KD0801566
     *)                                                                 D0801567
      IF (KBUG .GE. 4 .AND. TEST1(K) .EQ. 0)                            D0801568
     1WRITE (6,9)                                                       D0801569
    9 FORMAT (1X,'DIFF RETURN 2')                                       D0801570
      IF (TEST1(K) .EQ. 0.) RETURN 2                                    D0801571
      ITST(K) = 1                                                       D0801572
      GO TO 30                                                          D0801573
   31 TEST2(K) = TEST-QZ                                                D0801574
      IF (ABS(TEST2(K)/PXI).LT.EPSIN) TEST2(K)=0.                       D0801575
      IF (KBUG .GE. 4)                                                  D0801576
     *WRITE (6,312)PX,PZ,QX,TEST,QZ,TEST1(K),TEST2(K),I1,J1,I2,J2,ITST(KD0801577
     *)                                                                 D0801578
  312 FORMAT (5HODIFF,1P7E15.7,5I2)                                     D0801579
      IF (TEST1(K)*TEST2(K).GE. 0.) GO TO 30                            D0801580
      CALL HOLCHK (TEST1(K),TEST2(K),Z(1,1,K),ND1,&30)                  D0801581
      RETURN 1                                                          D0801582
   30 CONTINUE                                                          D0801583
   35 CONTINUE                                                          D0801584
```



```
      RETURN                                                            D0801585
      END                                                               D0801586
      SUBROUTINE HOLCHK (/TEST1/,/TEST2/,/Z/,/ND1/,*)                   D0801587
      DIMENSION Z(ND1,1)                                                D0801588
      COMMON /DEBUG/KBUG                                                D0801589
      COMMON /ILNB/ I1,J1,I2,J2                                         D0801590
      COMMON /INTER/ QX,QY,QXPR,QYPR,UFRAC,VFRAC,FRAC,IU,JV,DU,DV,IFLAG D0801591
      DATA SO /Z7FFFFFFF/                                               D0801592
C     NESECCARY TO ADD FOR POLAR CASE                                   D0801593
      IF (I1 .EQ. I2) GO TO 5                                           D0801594
      I11 = IU                                                          D0801595
C     I11 IS INDEX OF U LINE WE JUST CROSSED                            D0801596
      J11 = J1-1                                                        D0801597
      IF (DV .LT. 0.) J11 = J1 + 1                                      D0801598
      IF (Z(I11 + 1, J11) .EQ. SO) GO TO 9                              D0801599
      IF (KBUG .GE. 4)                                                  D0801600
     1WRITE (6,1) I11,J11                                               D0801601
    1 FORMAT (1X, 'HOLCHK ' 2I5)                                        D0801602
      GO TO 6                                                           D0801603
    5 I11 = I1-1                                                        D0801604
C ON A U LINE                                                           D0801605
      IF (DU .LT. 0.) I11=I1+1                                          D0801606
      J11 = JV                                                          D0801607
      IF ( Z(I11,J11 + 1) .EQ. SO) GO TO 9                              D0801608
      IF (KBUG .GE. 4)                                                  D0801609
     1WRITE (6,1) I11,J11                                               D0801610
    6 IF (Z(I11,J11) .NE. SO ) RETURN                                   D0801611
    9 TEST1 = TEST2                                                     D0801612
      IF (KBUG .GE. 4)                                                  D0801613
     1WRITE (6,1) I11,J11                                               D0801614
      RETURN 1                                                          D0801615
      END                                                               D0801616
      FUNCTION ZOF (/X/,/X1/,/Z1/,/X0/,/Z0/)                            D0801617
      ZOF = Z0 + (X-X0)*(Z1-Z0)/(X1-X0)                                 D0801618
      RETURN                                                            D0801619
      END                                                               D0801620
```

```
      SUBROUTINE LIMO (/M/,/N/,/IBFLG/)                                  D0801621
      COMMON /ILN8/ I1,J1,I2,J2                                          D0801622
      RETURN                                                             D0801623
      ENTRY LIM (*)                                                      D0801624
      IF (I1.LT.1 .OR. I1.GT.M) RETURN 1                                 D0801625
      IF (I2 .LT.1 .OR. I2.GT.M) RETURN 1                                D0801626
      IF (IBFLG.EQ.1) GO TO 30                                           D0801627
      IF (J1.LT.1 .OR. J1.GT.N) RETURN 1                                 D0801628
      IF (J2.LT.1 .OR. J2.GT.N) RETURN 1                                 D0801629
      RETURN                                                             D0801630
30    IF (J1.LT.1) J1=N-1                                                D0801631
      IF (J1.GT.N) J1=2                                                  D0801632
      IF (J2.LT.1) J2=N-1                                                D0801633
      IF (J2.GT.N) J2=2                                                  D0801634
      RETURN                                                             D0801635
      END                                                                D0801636
      SUBROUTINE CONVO (/X/,/Y/,/ND1/,/M/,/N/)                           D0801637
      DIMENSION X(ND1,1),Y(ND1,1)                                        D0801638
      SIGNT = 0.                                                         D0801639
      THETA = 0.                                                         D0801640
      MODE = 0                                                           D0801641
C     INITILIZING ENTRY  START CONVEXITY SEARCH AT U=1 AND V=1 GOING     D0801642
C    *TOWARD U=1, V=2.                                                   D0801643
      X1 = X(1,1)                                                        D0801644
      Y1 = Y(1,1)                                                        D0801645
      X3 = X(1,2)                                                        D0801646
      Y3 = Y(1,2)                                                        D0801647
      BX = X3-X1                                                         D0801648
      BY = Y3-Y1                                                         D0801649
      ABSB = SQRT(BX**2 + BY**2)                                         D0801650
      RETURN                                                             D0801651
      ENTRY CONV1 (/I1/,/J1/,*)                                          D0801652
C     EPS IS ABOUT 5 DEGREES  USING EPS AS A CHECK SMALL NONCONVEXITIES  D0801653
C    *WILL BE IGNORED.                                                   D0801654
      DATA  EPS   /.08727 /                                              D0801655
      AX = BX                                                            D0801656
```



```
      AY = BY                                                            D0801657
      X2 = X3                                                            D0801658
      Y2 = Y3                                                            D0801659
      X3 = X(I1,J1)                                                      D0801660
      Y3 = Y(I1,J1)                                                      D0801661
      BX = X3-X2                                                         D0801662
      BY = Y3-Y2                                                         D0801663
      ABSA = ABSB                                                        D0801664
      ABSB = SQRT(BX**2 + BY**2)                                         D0801665
C     DIRECTION OF GRID PERIMETER WILL BE DETERMINED BY SIGN OF SINE OF  D0801666
C    *ANGLE BETWEEN SUCCEEDING GRID LINES (VECTORS)                      D0801667
      SINAB = (AX*BY - AY*BX)/(ABSA*ABSB)                                D0801668
      DTH = ARSIN(SINAB)                                                 D0801669
      THETA = THETA + DTH                                                D0801670
      IF (SIGNT .NE. 0.) GO TO 60                                        D0801671
      IF (ABS(THETA) .LT. EPS) RETURN                                    D0801672
      SIGNT = SIGN(1.,THETA)                                             D0801673
      THETA = 0.                                                         D0801674
      SGNDT = SIGNT                                                      D0801675
      RETURN                                                             D0801676
60    IF (MODE .EQ. 1) GO TO 90                                          D0801677
      SNDTH = SIGN(1.,DTH)                                               D0801678
      IF (SNDTH .EQ. SGNDT) RETURN                                       D0801679
C     MODE IS FLAG TO INDICATE THAT A DIRECTION CHANGE HAS OCCURRED      D0801680
      MODE = 1                                                           D0801681
      THETA = DTH                                                        D0801682
90    IF (ABS(THETA) .LT. EPS) RETURN                                    D0801683
      SGNTH = SIGN(1.,THETA)                                             D0801684
      IF (SGNTH .NE. SIGNT) RETURN 1                                     D0801685
      MODE = 0                                                           D0801686
      RETURN                                                             D0801687
      END                                                                D0801688
      SUBROUTINE DIRC (/A/)                                              D0801689
      DIMENSION A(3,1)                                                   D0801690
      DATA  E /1.E-06/                                                   D0801691
      SUM = 0.                                                           D0801692
```

```
      DO 10 J=1,3                                                       D0801693
10    SUM = SUM + A(1,J)*A(2,J)                                         D0801694
      IF (ABS(SUM) .GT. E) GO TO 100                                    D0801695
      DO 15 I=1,2                                                       D0801696
      DIV = 0.                                                          D0801697
      DO 16 J=1,3                                                       D0801698
      DIV = DIV + A(I,J)**2                                             D0801699
16    CONTINUE                                                          D0801700
      DIV = SQRT(DIV)                                                   D0801701
      DO 17 J=1,3                                                       D0801702
      A(I,J) = A(I,J)/DIV                                               D0801703
17    CONTINUE                                                          D0801704
15    CONTINUE                                                          D0801705
      DO 18 J=1,3                                                       D0801706
      GO TO (19,20,21),J                                                D0801707
19    J1 = 2                                                            D0801708
      J2 = 3                                                            D0801709
      GO TO 22                                                          D0801710
20    J1 = 3                                                            D0801711
      J2 = 1                                                            D0801712
      GO TO 22                                                          D0801713
21    J1 = 1                                                            D0801714
      J2 = 2                                                            D0801715
22    A(3,J) = A(1,J1)*A(2,J2) - A(1,J2)*A(2,J1)                        D0801716
18    CONTINUE                                                          D0801717
      RETURN                                                            D0801718
100   WRITE (6,600)                                                     D0801719
600   FORMAT(1H1  20H AXES NOT PERP. STOP )                             D0801720
      STOP                                                              D0801721
      END                                                               D0801722
      SUBROUTINE M1 (/A1/,/QI/)                                         D0801723
      COMMON /VECT/ V0(3),VI(3)                                         D0801724
      DIMENSION A1(3,1),QI(1)                                           D0801725
      DO 10 I=1,3                                                       D0801726
      SUM = 0.                                                          D0801727
      DO 15 J=1,3                                                       D0801728
```



```
      SUM = SUM + A1(J,I)*VI(J)                                         D0801729
15    CONTINUE                                                          D0801730
      V0(I) = SUM + QI(I)                                               D0801731
10    CONTINUE                                                          D0801732
      RETURN                                                            D0801733
      ENTRY M2 (/AJ/,/QJ/)                                              D0801734
      DIMENSION AJ(3,1),QJ(1)                                           D0801735
      DO 20 I=1,3                                                       D0801736
      SUM = 0.                                                          D0801737
      DO 25 J=1,3                                                       D0801738
      SUM = SUM + AJ(I,J) * (V0(J)-QJ(J))                               D0801739
25    CONTINUE                                                          D0801740
      VI(I) = SUM                                                       D0801741
20    CONTINUE                                                          D0801742
      RETURN                                                            D0801743
      END                                                               D0801744
      SUBROUTINE TRNSF0                                                 D0801745
      COMMON /CTRNSF/XB,YB,ZB,D                                         D0801746
      COMMON /TR/ CTHETA,STHETA,THTA                                    D0801747
      COMMON /OBS/ CX,CY,CZ                                             D0801748
      CALPHA=(XB-CX)/D                                                  D0801749
      CBETA =(YB-CY)/D                                                  D0801750
      CGAMMA=(ZB-CZ)/D                                                  D0801751
      SGAMMA=SQRT(1.0-CGAMMA*CGAMMA)                                    D0801752
      IF  (SGAMMA.EQ.0.)  GO  TO  20                                    D0801753
      DEN = SQRT(CALPHA**2 + CBETA**2)                                  D0801754
      CTHETA = CALPHA/DEN                                               D0801755
      STHETA = CBETA/DEN                                                D0801756
      THTA = ATAN2(STHETA,CTHETA)                                       D0801757
      RETURN                                                            D0801758
      ENTRY TRNSF1 (/X/,/Y/,/Z/,/XCAP/,/YCAP/)                          D0801759
      XK=     D/((X-CX)*CALPHA+(Y-CY)*CBETA+(Z-CZ)*CGAMMA)              D0801760
      A=CX+XK*(X-CX)                                                    D0801761
      B=CY+XK*(Y-CY)                                                    D0801762
      C=CZ+XK*(Z-CZ)                                                    D0801763
      XCAP=((A-XB)*CBETA-(B-YB)*CALPHA)/SGAMMA                          D0801764
```

```
      YCAP=(C-ZB)/SGAMMA                                                D0801765
      RETURN                                                            D0801766
20    WRITE (6,25)                                                      D0801767
25    FORMAT (36H0 ILLEGAL OBSERVATION POINT... STOP)                   D0801768
      STOP                                                              D0801769
      END                                                               D0801770
```



```
      INTEGER*2 KCHECK,LCHECK
      DIMENSION X(19,37,1),Y(19,37,1),Z(19,37,2,1),NLEVEL(1),           1PNRG001
     *XT(500),YT(500),LEWA(19,37),P1Z(2),P2Z(2),P3Z(2),TEST1(2),TEST2(2)1PNRG002
     *,ITST(2),IHOL(2)                                                  1PNRG003
      DIMENSION C(361,3,10),LCHECK(10,1),NP(10),LEWC(361),PT(20)        1PNRG004
      DIMENSION S(100),T(100),D(20),F(20),E(20)                         1PNRG005
      DATA SO /Z7FFFFFFF/                                               1PNRG006
      DATA R1,R2/1.35,2.25/                                             1PNRG007
      NLEVEL(1)=2                                                       1PNRG008
      Q=5.                                                              1PNRG009
      IVIS=1                                                            1PNRG010
      JFLAG=1                                                           1PNRG011
      IROT=0                                                            1PNRG012
      READ (5,20) PT                                                    1PNRG013
20    FORMAT (20A4)                                                     1PNRG014
      READ (5,22) THETAD,GAMMAD,DU,DV,DT,NC                             1PNRG015
22    FORMAT (5F10.0,I5)                                                1PNRG016
      M=91./DU+1.                                                       1PNRG017
      N=361./DV+1.                                                      1PNRG018
      NM1=N-1                                                           1PNRG019
      DR=(R2-R1)/FLOAT(NC-1)                                            1PNRG020
      NPTS=360.1/DT+1.                                                  1PNRG021
      DT=.0174533*DT                                                    1PNRG022
      DO 30 I=1,M                                                       1PNRG023
30    XT(I)=FLOAT(I-1)*DU + 0.01                                        1PNRG024
      XT(M) = 90.                                                       1PNRG025
      DO 32 J=1,N                                                       1PNRG026
32    YT(J)=FLOAT(J-1)*DV                                               1PNRG027
      DO 38 I=1,M                                                       1PNRG028
      DO 36 J=1,NM1                                                     1PNRG029
      CALL FUNCT (XT(I),YT(J),X(I,J,1),Y(I,J,1),Z(I,J,1,1))            1PNRG030
      WRITE (6,34) XT(I),YT(J),X(I,J,1),Y(I,J,1),Z(I,J,1,1)            1PNRG031
34    FORMAT (5E17.8)                                                   1PNRG032
      Z(I,J,2,1)=-Z(I,J,1,1)                                            1PNRG033
36    CONTINUE                                                          1PNRG034
      X(I,N,1)=X(I,1,1)                                                 1PNRG035
                                                                        1PNRG036
```

```
      Y(I,N,1)=Y(I,1,1)                                                          1PNRG037
      Z(I,N,1,1)=Z(I,1,1,1)                                                      1PNRG038
38    Z(I,N,2,1)=Z(I,1,2,1)                                                      1PNRG039
      DO 44 J=1,NC                                                               1PNRG040
      R=R1+FLOAT(J-1)*DR                                                         1PNRG041
      DO 42 I=1,NPTS                                                             1PNRG042
      TH=FLOAT(I-1)*DT                                                           1PNRG043
      C(I,1,J)=R*COS(TH)                                                         1PNRG044
      C(I,2,J)=R*SIN(TH)                                                         1PNRG045
      C(I,3,J)=0.                                                                1PNRG046
42    CONTINUE                                                                   1PNRG047
44    NP(J)=NPTS                                                                 1PNRG048
      CALL PERSPO (X,Y,Z,19,37,2,1,NLEVEL,80,PT,XT,YT,    Q,M,N,IVIS,           1PNRG049
     *LEWA,JFLAG,IBFLG,KCHECK,P1Z,P2Z,P3Z,TEST1,TEST2,NC,IROT,ITST,IHOL,1PNRG050
     *XMINI,XMAXI,YMINI,YMAXI,CZMINI,CZMAXI)                                     1PNRG051
      CALL PERSPC (C,361,  LCHECK,NC,NP,LEWC)                                    1PNRG052
      CALL PERSP1                                                                1PNRG053
      CALL PERSP2 (THETAD,GAMMAD)                                                1PNRG054
      CALL PERSP4                                                                1PNRG055
      CALL PERSP5                                                                1PNRG056
      STOP                                                                       1PNRG057
      END                                                                        1PNRG058
      SUBROUTINE FUNCT(U,V,X,Y,Z)                                                1PNRG059
      DATA  RAD /.17453293E-1 /                                                  1PNRG060
      DATA  RHO / 2.25/                                                          1PNRG061
      UR = U*RAD                                                                 1PNRG062
      VR = V*RAD                                                                 1PNRG063
      SUR = SIN(UR)                                                              1PNRG064
      X = SUR * COS(VR)                                                          1PNRG065
      Y = SUR * SIN(VR)                                                          1PNRG066
      Z = COS (UR)                                                               1PNRG067
      IF (ABS (Z) .LT. 1.E-05) Z = +.0001                                        1PNRG068
      RETURN                                                                     1PNRG069
      END                                                                        1PNRG070
/*                                                                               1PNRG071
$DATA                                                                            1PNRG072
```



```
SATURN                                                                           1PNRG073
20.       70.       10.       20.       10.          4                         1PNRG074
```

```
      INTEGER*2 KCHECK,LCHECK                                                    2PNRG001
      DIMENSION AL(3,3,2),QC(3,2),ID(2)                                          2PNRG002
      DIMENSION XMINI(2),XMAXI(2),YMINI(2),YMAXI(2),CZMINI(2),CZMAXI(2)          2PNRG003
      DIMENSION EPSLN(2)                                                         2PNRG004
      DIMENSION X(10,10,2),Y(10,10,2),Z(10,10,2,2),NLEVEL(2),                    2PNRG005
     1   M(2),N(2),LEWA(10,10),JFLAG(2),IBFLG(2),KCHECK(2,2),P1Z(2),P2Z(2)2PNRG006
     22),P3Z(2),TEST1(2),TEST2(2),WP(2),WDP(2),ITST(2),IHOL(2),PT(20),XS2PNRG007
     3(2),YS(2),XB(2),YB(2),DLX(2),DLY(2),E(20),D(20),S(100),T(100)              2PNRG008
      DIMENSION C(361,3,10),LCHECK(10,2),NP(10),LEWC(361)                        2PNRG009
      DIMENSION XT(361),YT(361)                                                  2PNRG010
      COMMON /DEBUG/KBUG                                                         2PNRG011
      DATA  END /4HEND   /                                                       2PNRG012
      DATA IRITE /0/                                                             2PNRG013
      DATA  R1,R2 / 1.35,2.25/                                                   2PNRG014
      DATA SO /Z7FFFFFFF/                                                        2PNRG015
      KBUG = 1                                                                   2PNRG016
      KBUG = 0                                                                   2PNRG017
      JFLAG(1)= 0                                                                2PNRG018
      JFLAG(2)= 0                                                                2PNRG019
      IROT = 1                                                                   2PNRG020
      ID(1) = 1                                                                  2PNRG021
      ID(2) = 0                                                                  2PNRG022
      DO 54 I = 1,2                                                              2PNRG023
      DO 51 J = 1,3                                                              2PNRG024
      AL(I,J,1) = 0.                                                             2PNRG025
      AL(I,J,2) = 0.                                                             2PNRG026
   51 CONTINUE                                                                   2PNRG027
   54 CONTINUE                                                                   2PNRG028
      AL(1,1,1) = 1.                                                             2PNRG029
      AL(1,1,2) = 1.                                                             2PNRG030
      AL(2,2,2) = 1.                                                             2PNRG031
      AL(2,3,1)= 1.                                                              2PNRG032
      NCP = 80                                                                   2PNRG033
   10 READ  (5,15) PT                                                            2PNRG034
      IF(PT(1).EQ.END) GO TO 80                                                  2PNRG035
      READ  (5,15) E                                                             2PNRG036
```



```
      READ  (5,15) D                                                             2PNRG037
   15 FORMAT(20A4)                                                               2PNRG038
      READ  (5,20) NARAYS                                                        2PNRG039
   20 FORMAT(I6)                                                                 2PNRG040
      DO 52 NA = 1,NARAYS                                                        2PNRG041
      DO 53 I = 1,3                                                              2PNRG042
      QC (I,NA) = 0.                                                             2PNRG043
   53 CONTINUE                                                                   2PNRG044
   52 CONTINUE                                                                   2PNRG045
      READ (5,210) (M(NA),N(NA),NLEVEL (NA),NA=1,NARAYS)                         2PNRG046
  210 FORMAT ((3I6))                                                            2PNRG047
      READ  (5,25) (XS(NA),YS(NA),XB(NA),YB(NA),NA=1,NARAYS)                     2PNRG048
   25 FORMAT(4E12.8)                                                            2PNRG049
      READ  (5,25) Q                                                             2PNRG050
      READ (5,21) IVIS,NVIEW                                                     2PNRG051
   21 FORMAT(2I6)                                                               2PNRG052
      READ (5,22) THETAD,GAMMAD,DU,DV,DT,NC                                      2PNRG053
   22 FORMAT (5F10.0,I5)                                                        2PNRG054
      DR = (R2 - R1)/ FLOAT(NC-1)                                                2PNRG055
      NPTS = 360.1/DT + 1                                                        2PNRG056
      DT = .0174533*DT                                                           2PNRG057
      DO 44 J=1,NC                                                               2PNRG058
      R=R1+FLOAT(J-1)*DR                                                         2PNRG059
      DO 42 I=1,NPTS                                                             2PNRG060
      TH=FLOAT(I-1)*DT                                                           2PNRG061
      C(I,1,J)=R*COS(TH)                                                         2PNRG062
      C(I,2,J)=R*SIN(TH)                                                         2PNRG063
      C(I,3,J)=0.                                                                2PNRG064
   42 CONTINUE                                                                  2PNRG065
   44 NP(J)=NPTS                                                                2PNRG066
      DO 30 NA=1,NARAYS                                                          2PNRG067
      DLX(NA) = (XB(NA)-XS(NA))/FLOAT(M(NA)-1)                                   2PNRG068
      DLY(NA) = (YB(NA)-YS(NA))/FLOAT(N(NA)-1)                                   2PNRG069
   30 CONTINUE                                                                  2PNRG070
      CALL PLT (I,16,-5.0,1.,S,0,1,-3.0,1.,0,0,T,NCP,PT,NCP,E,NCP,D)             2PNRG071
      DO 35 NA=1,NARAYS                                                          2PNRG072
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      MNA = M(NA)                                                        2PNRG073
      NNA = N(NA)                                                        2PNRG074
      DO 26 I=1,MNA                                                      2PNRG075
26    XT(I) = XS(NA) + FLOAT (I-1)*DLX(NA)                               2PNRG076
      DO 27 J=1,NNA                                                      2PNRG077
27    YT(J) = YS(NA) + FLOAT (J-1)*DLY(NA)                               2PNRG078
      LEV = NLEVEL(NA)                                                   2PNRG079
      JN = NNA                                                           2PNRG080
      K = 1                                                              2PNRG081
      DO 40 I=1,MNA                                                      2PNRG082
      DO 41 J=1,JN                                                       2PNRG083
      CALL FUNCT (XT(I),YT(J),X(I,J,NA),Y(I,J,NA),Z(I,J,K,NA),K,NA)      2PNRG084
      WRITE (6,700) XT(I),YT(J),X(I,J,NA),Y(I,J,NA),Z(I,J,K,NA),K,NA     2PNRG085
700   FORMAT(5E17.8,2I6)                                                 2PNRG086
      IF (LEV .GT. 1) Z(I,J,2,NA)=-Z(I,J,K,NA)                           2PNRG087
41    CONTINUE                                                           2PNRG088
40    CONTINUE                                                           2PNRG089
      DO 33 I = 1,MNA                                                    2PNRG090
      DO 32 J = 1,JN                                                     2PNRG091
      S(J)  = X(I,J,NA)                                                  2PNRG092
      T(J)  = Y(I,J,NA)                                                  2PNRG093
   32 CONTINUE                                                           2PNRG094
      CALL PLT (2,JN,1)                                                  2PNRG095
   33 CONTINUE                                                           2PNRG096
      DO 331 J = 1,JN                                                    2PNRG097
      DO 332 I = 1,MNA                                                   2PNRG098
      S(I)  = X(I,J,NA)                                                  2PNRG099
      T(I)  = Y(I,J,NA)                                                  2PNRG100
  332 CONTINUE                                                           2PNRG101
      CALL PLT (2,MNA,1)                                                 2PNRG102
  331 CONTINUE                                                           2PNRG103
35    CONTINUE                                                           2PNRG104
      CALL PLT (5,IL,PLIM)                                               2PNRG105
      NCURVS = NC                                                        2PNRG106
      NL = 10                                                            2PNRG107
      NK = 2                                                             2PNRG108
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      CALL PERSPO (X,Y,Z,10,10,2,NARAYS,NLEVEL,80,PT,XT,YT,    Q,M,N,IVIS2PNRG109
     1,LEWA,JFLAG,IBFLG,KCHECK,P1Z,P2Z,P3Z,TEST1,TEST2,     NCURVS,    2PNRG110
     2IROT,ITST,IHOL,XMINI,XMAXI,YMINI,YMAXI,CZMINI,CZMAXI,EPSLN)        2PNRG111
      CALL PERSPR (AL,ID,QC)                                             2PNRG112
      CALL PERSPC (C,361,  LCHECK,NL,NP,LEWC)                            2PNRG113
      CALL PERSP1                                                        2PNRG114
      CALL PERSP2 (THETAD,GAMMAD)                                        2PNRG115
      CALL PERSP4                                                        2PNRG116
1002  CONTINUE                                                           2PNRG117
 333  CONTINUE                                                           2PNRG118
  38  CONTINUE                                                           2PNRG119
      GO TO 10                                                           2PNRG120
80    CALL PERSP5                                                        2PNRG121
      STOP                                                               2PNRG122
      END                                                                2PNRG123
      SUBROUTINE FUNCT (/U/,/V/,/X/,/Y/,/Z/,/K/,/NA/)                    2PNRG124
      X = U                                                              2PNRG125
      Y = V                                                              2PNRG126
      IF (NA .EQ. 2) GO TO 20                                            2PNRG127
      ZSQ = 1. - X**2                                                    2PNRG128
      GO TO 30                                                           2PNRG129
20    ZSQ = 1. - Y**2                                                    2PNRG130
30    IF (ZSQ .LT. 0.) ZSQ=0.                                            2PNRG131
      Z = SQRT(ZSQ)                                                      2PNRG132
      IF (NA .EQ. 2) Z=-Z                                                2PNRG133
      RETURN                                                             2PNRG134
      END                                                                2PNRG135
/*                                                                       2PNRG136
$DATA                                                                    2PNRG137
     CURVES,ROTATION AND INTERSECTIONS WITH PNRG       DEC. 20, 1967     2PNRG138
                                                                         2PNRG139
                                                                         2PNRG140
     2                                                                   2PNRG141
    10    10     2                                                      2PNRG142
    10    10     2                                                      2PNRG143
-1.         -2.          1.          2.                                 2PNRG144
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0.          -1.          4.          1.                                    2PNRG145
 10.                                                                       2PNRG146
      1      1      1                                                      2PNRG147
20.         70.         10.         20.         10.          4            2PNRG148
END                                                                        2PNRG149
```