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DESCRIPTION OF A DIGITAL COMPUTER PROGRAM FOR AIRPLANE CONFIGURATION PLOTS

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16. Abstract

This computer program (D2290) generates the necessary instructions for automatic plotting of the numerical model of an airplane configuration. Program options may be used to draw three-view and oblique orthographic projections, as well as perspective projections of an airplane. These plots are useful in checking the accuracy of the numerical model data. Magnetic tape output from this program has been used to drive a CalComp plotter and a Gerber plotter. The program has also been used for online display of a configuration on a cathode-ray-tube device.

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SUMMARY

A digital computer program (D2290) is presented which generates the necessary instructions for automatic plotting of an airplane numerical model. Program options may be used to draw three-view and oblique orthographic projections, as well as perspective projections of an airplane. These plots are useful in checking the accuracy of the numerical model data. Magnetic tape output from this program has been used to drive a CalComp plotter and a Gerber plotter. The program has also been used for online display of a configuration on a cathode-ray-tube device.

INTRODUCTION

In order to study the aerodynamic characteristics of an airplane configuration with the aid of a digital computer, it is first necessary to construct an accurate numerical model of the configuration from engineering drawings, or other sources, in a form acceptable to the computer. This model may then be used as input for computer programs which compute aerodynamic characteristics such as lift and drag.

Checking of the voluminous and often complicated numerical model input data poses a difficult task. All geometry must be input correctly to avoid erroneous analysis results. A numerical description of any aircraft, particularly a very complex configuration, may contain errors which occur through human judgment, mispunched data cards, and incorrectly transcribed data. The purpose of this report is to describe the digital computer program, D2290, which has been developed to generate the necessary instructions for automatic plotting of an airplane numerical model. The program was written in FORTRAN Version 2.0 for Control Data series 6000 computer systems. Approximately 55000 octal locations of core storage are required and the processing of information for one plot requires less than 1 minute of computer time.

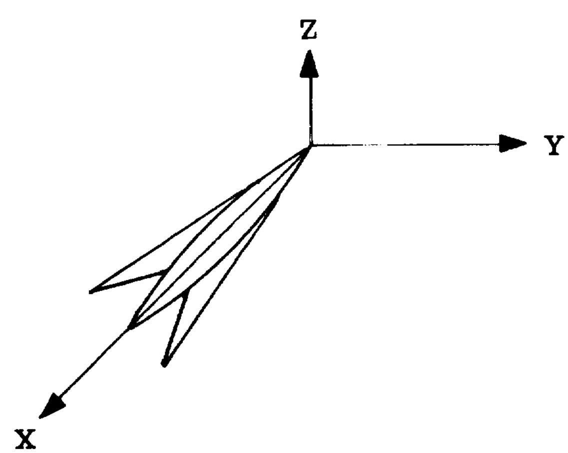
The graphical representation of the configuration in orthographic, perspective, and stereo views has proven to be an effective method of verifying the numerical input data. The viewing angles used in producing the figures are specified as part of the input to the program. In general, several plots of a single configuration from different viewing angles are made to insure the detection of all errors. Sample input listings for typical configuration plots are presented in tables I to IV and the corresponding plots are shown in figures 1 to 6.

PROBLEM DESCRIPTION AND METHOD OF SOLUTION

The numerical model of the airplane configuration is assumed to be symmetrical about the XZ-plane and may include any combination of components: wing, body, pods, fins, and canards. The wing is made up of airfoil sections, the body is defined by either circular or arbitrary sections, the pods are defined similar to the fuselage, and fins and canards are defined similar to the wings.

The configuration is usually positioned with its nose at the coordinate system origin and with the length of the body stretching in the positive x-direction.

The coordinate system used for this program is a right-handed Cartesian system as illustrated in the following sketch:

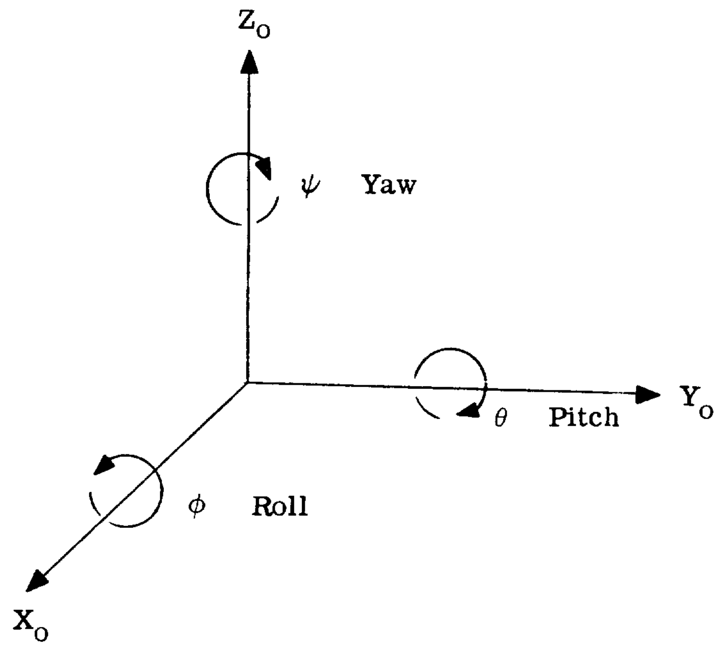


Successive points in the plotted arrays are connected by straight lines; therefore, sufficient points must be given to approximate a desired curve.

ORTHOGRAPHIC PROJECTIONS

The orthographic projections illustrated in this report are created by rotating each point on the body surface to the desired viewing angle and then transforming the points into a coordinate system in the plane of the paper. The body coordinate system is coincident with the fixed system in the plane of the paper when all of the rotation angles are zero; for example, the configuration X-axis and Y-axis would coincide with the paper for plots in the X_0Y_0 paper plane.

The rotations of the body and its coordinate system to give a desired viewing angle are specified by angles of roll, pitch, and yaw (ϕ, θ, and ψ), shown in the following sketch:



The equations used to transform the given points on the body (x,y,z) with a specified set of rotation angles (ϕ, θ, ψ) into the desired paper plane are

$$x_0 = x(\cos\theta \cos\psi) + y(-\sin\psi \cos\phi + \sin\theta \cos\psi \sin\phi) + z(\sin\psi \sin\phi + \sin\theta \cos\psi \cos\phi)$$

$$y_0 = x(\cos\theta \sin\psi) + y(\cos\psi \cos\phi + \sin\theta \sin\psi \sin\phi) + z(-\cos\psi \sin\phi + \sin\theta \sin\psi \cos\phi)$$

$$z_0 = x(-\sin\theta) + y(\cos\theta \sin\phi) + z(\cos\theta \cos\phi)$$

For each set of four adjoining input data points numbered counterclockwise, the unit normal vectors are computed as follows:

$$T_{1,x} = x_3 - x_1 \qquad T_{1,y} = y_3 - y_1 \qquad T_{1,z} = z_3 - z_1$$

$$T_{2,x} = x_4 - x_2 \qquad T_{2,y} = y_4 - y_2 \qquad T_{2,z} = z_4 - z_2$$

$$N_x = T_{2,y}T_{1,z} - T_{1,y}T_{2,z}$$

$$N_y = T_{1,x}T_{2,z} - T_{2,x}T_{1,z}$$

$$N_z = T_{2,x}T_{1,y} - T_{1,x}T_{2,y}$$

$$n_x = \frac{N_x}{N}$$

$$n_y = \frac{N_y}{N}$$

$$n_z = \frac{N_z}{N}$$

where $N = \sqrt{N_x^2 + N_y^2 + N_z^2}$.

The value of the component of the unit normal in the x_o direction (out of the Y_oZ_o paper plane) may be found from the following equation:

$$n_{xo} = n_x(\cos\theta\cos\psi) + n_y(-\sin\psi\cos\phi + \sin\theta\cos\psi\sin\phi) + n_z(\sin\psi\sin\phi + \sin\theta\cos\psi\cos\phi)$$

The components n_{yo} and n_{zo} may be found in a similar manner using the same angles and equations used in rotating the coordinate points.

If n_{xo} is positive and the specified paper plane is the Y_oZ_o-plane, the four data points are facing the viewer. If n_{xo} is negative, the four points face away from the Y_oZ_o-plane. In the same manner, n_{yo} may be tested for the X_oZ_o paper plane and n_{zo} for the X_oY_o paper plane. These results may be used by the program to provide the capability of deleting most elements on the surface of the configuration which would not be seen by a viewer; thus, many confusing elements are removed. No provision is made in this program for deleting portions of an element or components hidden by other components.

PLAN, FRONT, AND SIDE VIEWS

In addition to the option of single orthographic projections of each view, another option to combine the plan, front, and side views is provided. This option provides for a compact and pleasing-to-the-eye arrangement where the three views are spaced one above the other.

PERSPECTIVE VIEWS

The perspective views represent the projection of a given three-dimensional array. The two-dimensional view is constructed relative to a viewing point and a focal point specified by coordinate points in the input data coordinate system. Data are scaled to the viewer page size automatically by the specification of the viewing field diameter and the viewing field distance. The viewer page represents the portion of the image seen from the view point relative to the focal point and viewing plane. The coordinates of the viewing point determine the position from which the data array will be viewed, and the coordinate values of the focal point control the direction and focus. The size of the projection on the viewing plane will reflect the distance between the viewing point and focal point. Data which are within the cone of the viewing plane but not in the immediate range of the focal point may be distorted.

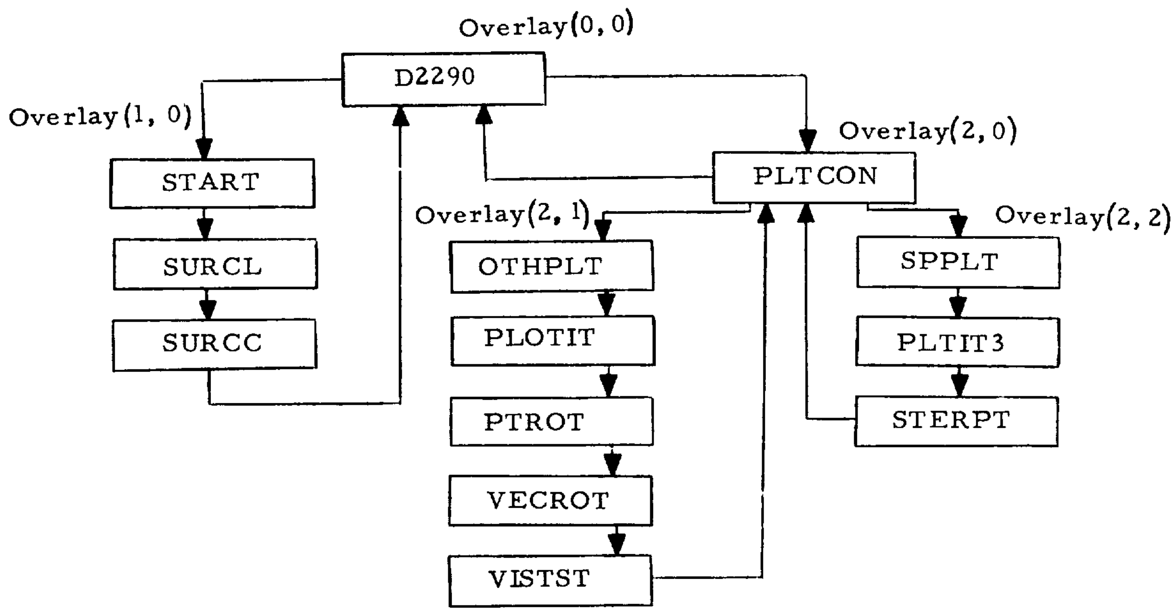
STEREO VIEWS

The explanation of the perspective views also applies to the stereo views. The use of the stereo option causes the program to be executed twice in setting up two plots for the left and right frames. These frames are suitable for viewing in a stereoscope.

PROGRAM DESCRIPTION

OVERLAY ARRANGEMENT

The program is set up in the overlay mode and the following chart illustrates the overlay arrangement:

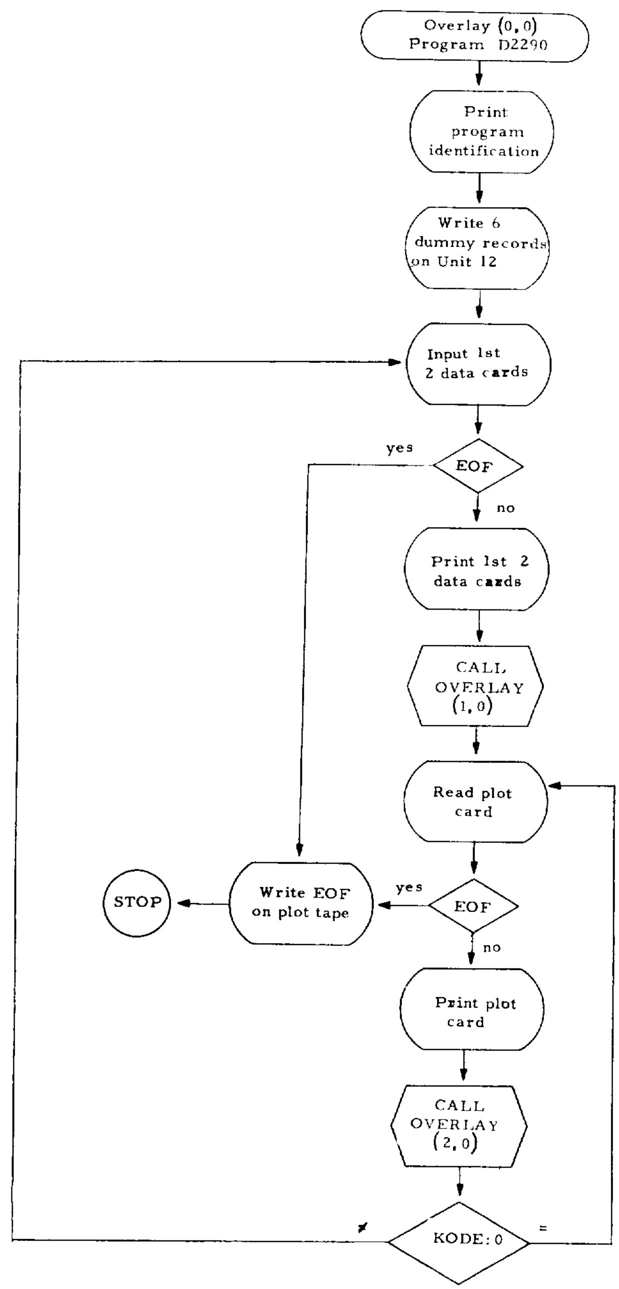


The control program (0,0) calls in the other parts of the program as they are needed. The initialization overlay (1,0) reads the numerical model, converts the input data to actual units, computes the unit normal vectors, and temporarily stores the airplane description as a series of lines with associated vectors. The plot control overlay (2,0) is called after the plot specifications are read, and notation and spacing for the plots are determined from these data. The next overlay (2,1) or (2,2) is determined by the type of plot desired.

PROGRAMS AND SUBROUTINES

Program D2290

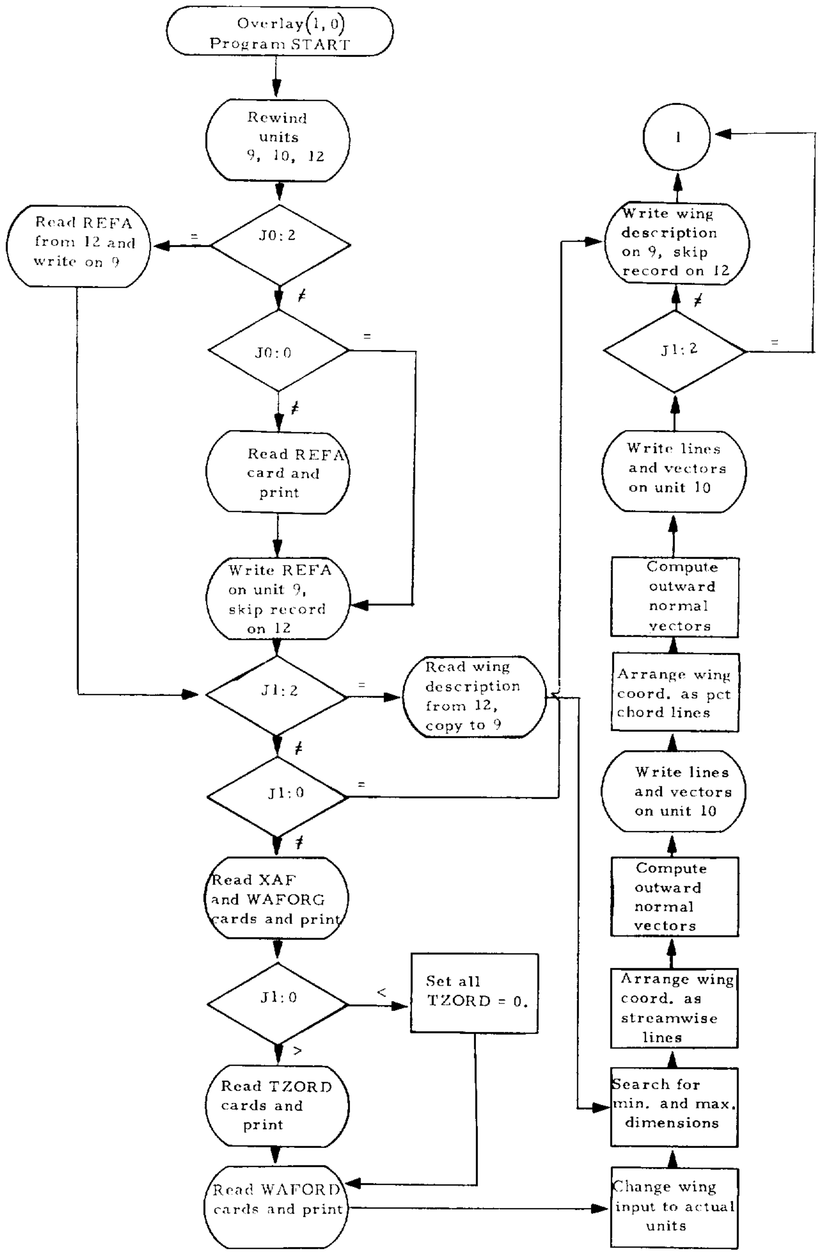
Program D2290 (overlay (0,0)) is the control program. It reads the airplane configuration identification card, the card containing control numbers for the configuration description, and the plot specification card. Other parts of the program are called as they are needed. The flow chart and the FORTRAN statements for this overlay are as follows:

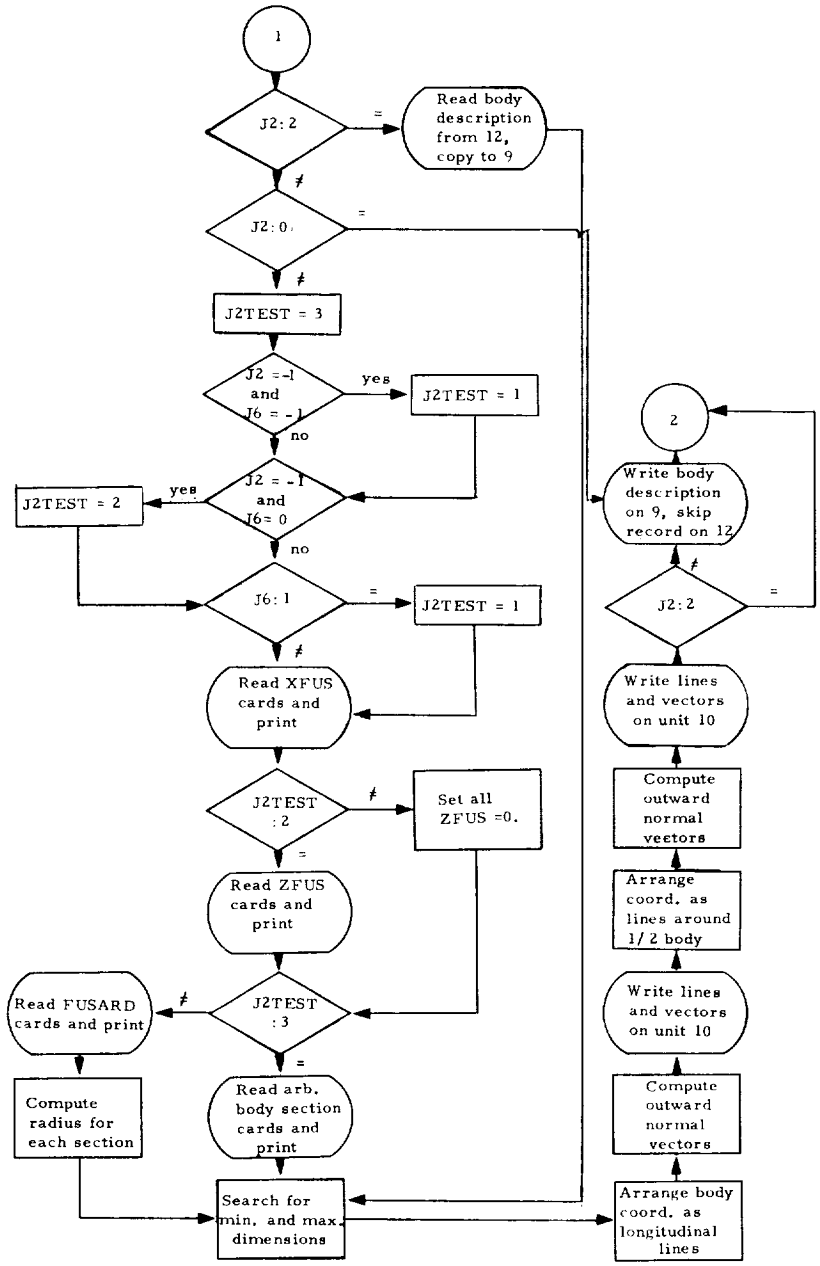


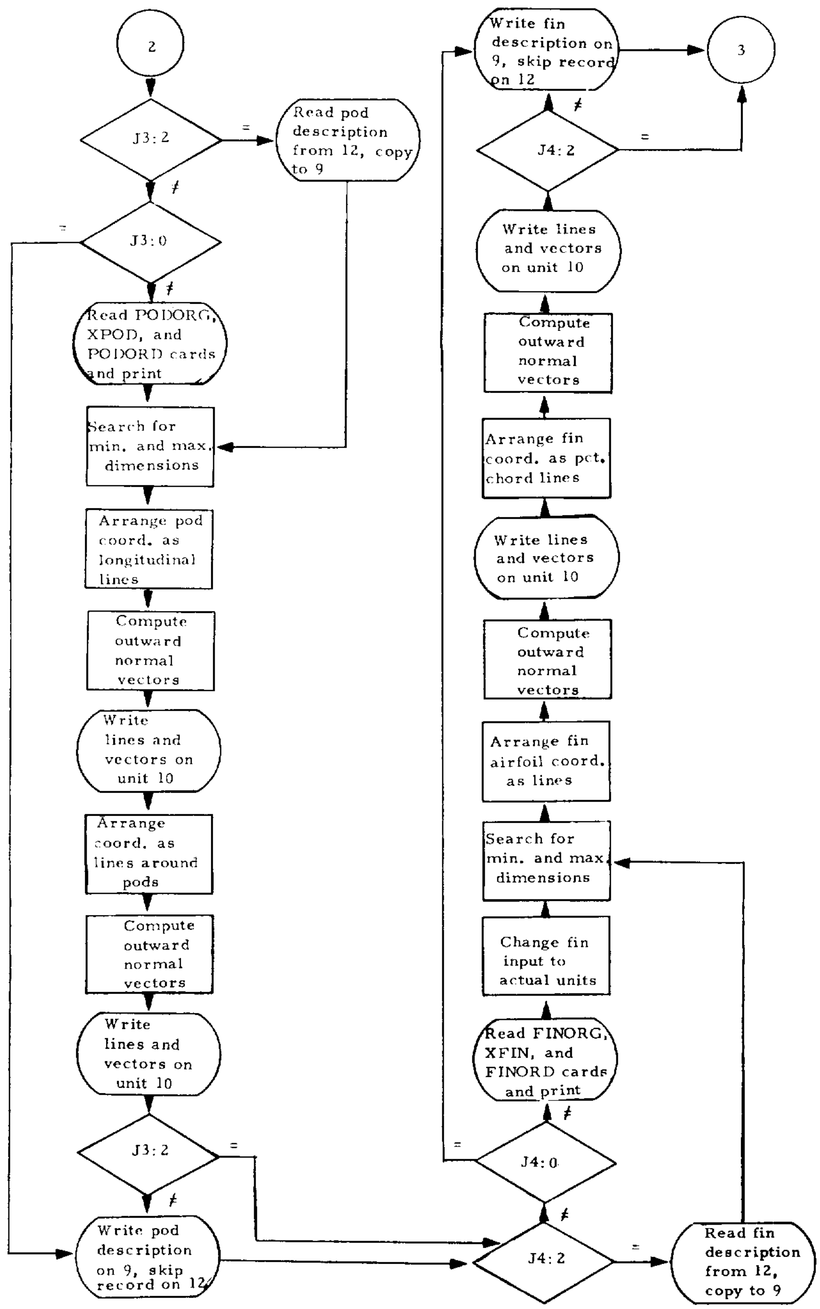
```
      OVERLAY (CBC,0,0)
      PROGRAM D2290 (INPUT=1001,OUTPUT=1001,
     1TAPE5=INPUT,TAPE6=OUTPUT,
     2TAPE9=1001,TAPE10=1001,TAPE12=1001)
C
C     D2290      AIRCRAFT CONFIGURATION PLOTS
C      PROGRAMER - CHARLOTTE B. CRAIDON
C
      COMMON ABC(8),J0,J1,J2,J3,J4,J5,J6,
     1NWAF,NWAFOR,NFUS,NRADX(4),NFORX(4),NP,NPODOR,
     2NF,NFINOR,NCAN,NCANOR,
     3J2TEST,NW,NC,
     4ABCDE(8),HORZ,VERT,TEST1,PHI,THETA,PSI,XF,YF,ZF,DIST,FMAG,
     5PLOTSZ,TYPE,KODE,
     6XMIN,XMAX,YMIN,YMAX,ZMIN,ZMAX,
     7XMID,YMID,ZMID,BIGD,ISP
C
      DIMENSION ABCD(8)
C
      CBC=3LCBC
      RECALL=6HRECALL
      CALL CALCOMP
      WRITE(6,1)
    1 FORMAT(1H117X47HPROGRAM D2290    PLOTS OF AIRCRAFT CONFIGURATION//)
      DO 2 I=1,6
    2 WRITE (12) DUM
C
C          INPUT 1ST TWO CARDS
C
    3 FORMAT (8A10)
    5 READ (5,3)ABC
      IF (EOF,5)25,7
    7 WRITE (6,10)ABC
   10 FORMAT (28X25HCONFIGURATION DESCRIPTION//1X8A10/)
      READ (5,3) ABCD
      WRITE (6,12)ABCD
   12 FORMAT (1X8A10/)
      DECODE (72,14,ABCD) J0,J1,J2,J3,J4,J5,J6,NWAF,NWAFOR,
     1NFUS,(NRADX(I),NFORX(I),I=1,4),NP,NPODOR,
     2NF,NFINOR,NCAN,NCANOR
   14 FORMAT (24I3)
C
C          INPUT CONFIGURATION DESCRIPTION AND INITIALIZE
C
      CALL OVERLAY (CBC,1,0,0)
C
C          PLOT CONFIGURATION
C
      WRITE (6,20)
   20 FORMAT (//36X9HPLOT DATA//)
   22 READ (5,3) ABCDE
      IF (EOF,5) 25,30
   25 CALL CALPLT (0.,0.,999)
      STOP
   30 WRITE (6,12) ABCDE
      DECODE (72,35,ABCDE)HORZ,VERT,TEST1,PHI,THETA,PSI,XF,YF,ZF,DIST,
     1FMAG,PLOTSZ,TYPE,KODE
   35 FORMAT (2A2,A3,9F5.0,A3,16X,I1)
      CALL OVERLAY (CBC,2,0,RECALL)
      IF (KODE.EQ.0) GO TO 22
      WRITE (6,40)
   40 FORMAT (1H1)
      GO TO 5
C
C          END OF D2290
C
      END
```

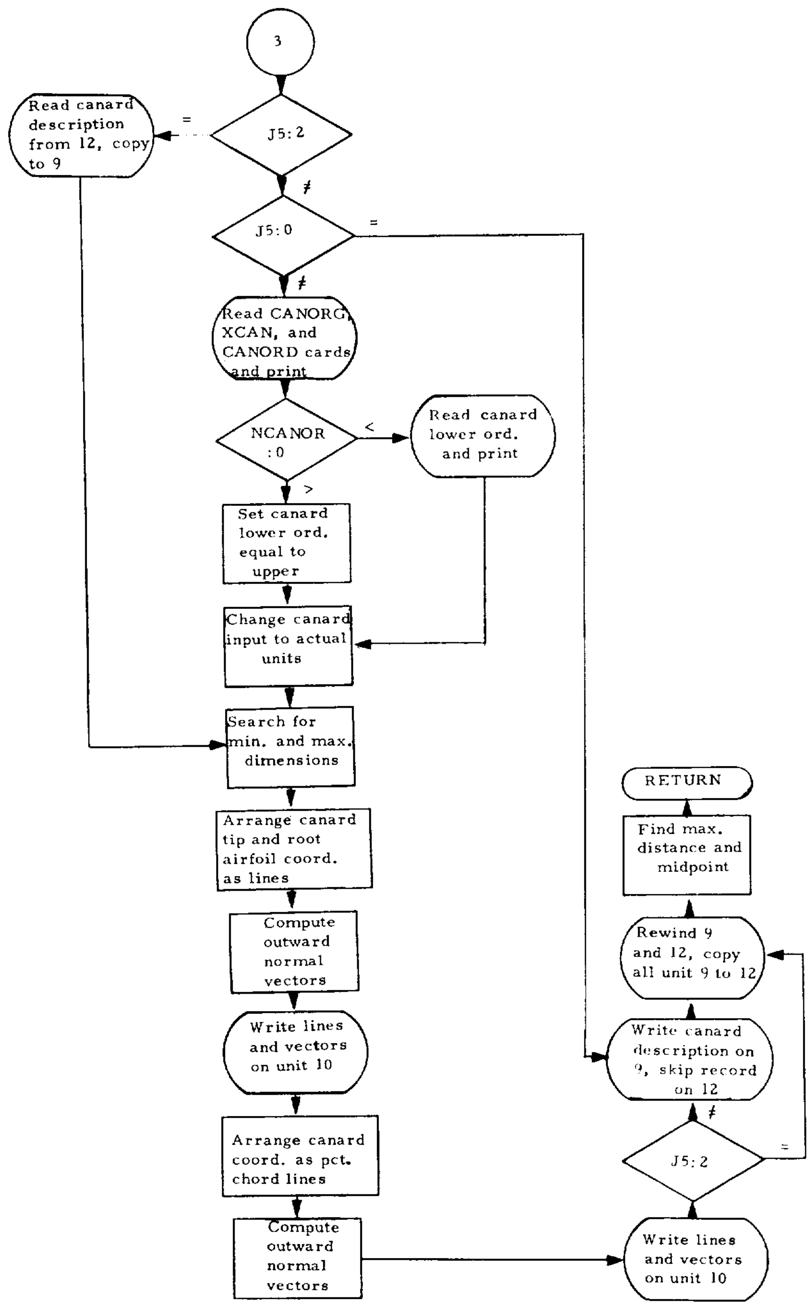
Program START

Program START (overlay (1,0)) reads the configuration description cards, changes the input values to actual units where necessary, and computes the minimum and maximum dimensions of the given configuration. It then computes the outward normal vectors and uses intermediate storage for the configuration description and vectors. This program is called only once for a given configuration. The flow chart and the FORTRAN statements for this program are as follows:




1
J2: 2
=
Read body description from 12, copy to 9
≠
J2: 0
=
≠
J2TEST = 3
J2 = -1 and J6 = -1
yes
J2TEST = 1
no
J2 = -1 and J6 = 0
yes
J2TEST = 2
no
J6: 1
=
J2TEST = 1
≠
Read XFUS cards and print
J2TEST : 2
≠
Set all ZFUS =0.
=
Read ZFUS cards and print
J2TEST : 3
≠
Read FUSARD cards and print
Compute radius for each section
=
Read arb. body section cards and print
Search for min. and max. dimensions
2
Write body description on 9, skip record on 12
≠
J2: 2
=
Write lines and vectors on unit 10
Compute outward normal vectors
Arrange coord. as lines around 1/2 body
Write lines and vectors on unit 10
Compute outward normal vectors
Arrange body coord. as longitudinal lines


2
J3: 2
=
Read pod description from 12, copy to 9
≠
J3: 0
=
≠
Read PODORG, XPOD, and PODORD cards and print
Search for min. and max. dimensions
Arrange pod coord. as longitudinal lines
Compute outward normal vectors
Write lines and vectors on unit 10
Arrange coord. as lines around pods
Compute outward normal vectors
Write lines and vectors on unit 10
J3: 2
=
≠
Write pod description on 9, skip record on 12
J4: 2
=
Read fin description from 12, copy to 9
≠
J4: 0
=
≠
Read FINORG, XFIN, and FINORD cards and print
Change fin input to actual units
Search for min. and max. dimensions
Arrange fin airfoil coord. as lines
Compute outward normal vectors
Write lines and vectors on unit 10
Arrange fin coord. as pct. chord lines
Compute outward normal vectors
Write lines and vectors on unit 10
J4: 2
=
≠
Write fin description on 9, skip record on 12
3


3
J5: 2
=
Read canard description from 12, copy to 9
≠
J5: 0
=
≠
Read CANORG, XCAN, and CANORD cards and print
NCANOR : 0
<
Read canard lower ord. and print
>
Set canard lower ord. equal to upper
Change canard input to actual units
Search for min. and max. dimensions
Arrange canard tip and root airfoil coord. as lines
Compute outward normal vectors
Write lines and vectors on unit 10
Arrange canard coord. as pct. chord lines
Compute outward normal vectors
Write lines and vectors on unit 10
J5: 2
=
≠
Write canard description on 9, skip record on 12
Rewind 9 and 12, copy all unit 9 to 12
Find max. distance and midpoint
RETURN

```
      OVERLAY (CBC,1,0)
      PROGRAM START
C
C          INPUTS AND INITIALIZES CONFIGURATION DESCRIPTION
C
      COMMON ABC(8),J0,J1,J2,J3,J4,J5,J6,
     1NWAF,NWAFOR,NFUS,NRADX(4),NFORX(4),NP,NPODOR,
     2NF,NFINOR,NCAN,NCANOR,
     3J2TEST,NW,NC,
     4ABCDE(8),HORZ,VERT,TEST1,PHI,THETA,PSI,XF,YF,ZF,DIST,FMAG,
     5PLOTSZ,TYPE,KODE,
     6XMIN,XMAX,YMIN,YMAX,ZMIN,ZMAX,
     7XMID,YMID,ZMID,BIGD,ISP
C
      DIMENSION BLOCK (7500)
C
      DIMENSION XAF(30),WAFORG(20,4),WAFORD(20,3,30),TZORD(20,30)
      EQUIVALENCE (BLOCK,XAF),(BLOCK(31),WAFORG),
     1(BLOCK(111),WAFORD),(BLOCK(1911),TZORD)
C
      DIMENSION XFUS(30,4),ZFUS(30,4),FUSARD(30,4),FUSRAD(30,4),
     1SFUS(30,30,8)
      EQUIVALENCE (BLOCK,XFUS),(BLOCK(121),ZFUS),(BLOCK(241),FUSARD),
     1(BLOCK(361),FUSRAD),(BLOCK(241),SFUS)
C
      DIMENSION PODORG(9,3),XPOD(9,30),PODORD(9,30),XPOD1(9,30)
      EQUIVALENCE (BLOCK,PODORG),(BLOCK(28),XPOD),(BLOCK(298),PODORD),
     1(BLOCK(568),XPOD1)
C
      DIMENSION FINORG(6,2,4),XFIN(6,10),FINORD(6,2,10),
     1FINX2(6,2,10),FINX3(6,2,10)
      EQUIVALENCE (BLOCK,FINORG),(BLOCK(49),XFIN),(BLOCK(109),FINORD),
     1(BLOCK(229),FINX2),(BLOCK(349),FINX3)
C
      DIMENSION CANORG(2,2,4),XCAN(2,10),CANORD(2,2,10),
     1CANOR1(2,2,10),CANORX(2,2,10)
      EQUIVALENCE (BLOCK,CANORG),(BLOCK(17),XCAN),(BLOCK(37),CANORD),
     1(BLOCK(77),CANOR1),(BLOCK(117),CANORX)
C
      DIMENSION ABCD(8)
      DIMENSION ALRT(31,3,2),VECRT(30,3),
     1ANSIN(30),ANCOS(30)
      DATA NAN2/24/
      DATA PI/3.14159265/
C
C
      REWIND 9
      REWIND 10
      REWIND 12
    1 FORMAT (8A10)
    2 FORMAT (1X8A10)
    4 FORMAT (10F7.0)
C
C          REFERENCE AREA
C
      IF (J0.NE.2) GO TO 12
      READ (12) REFA
      WRITE (9) REFA
      GO TO 15
   12 IF (J0.EQ.0) GO TO 14
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (7,4,ABCD) REFA
   14 WRITE (9) REFA
      READ (12) DUM
C
C          WING
C
   15 IF (J1.NE.2) GO TO 18
      NWAFOR=IABS(NWAFOR)
      NW=NWAFOR
      READ (12) BLOCK
      WRITE (9) BLOCK
      GO TO 306
   18 IF (J1.EQ.0) GO TO 45
      N=IABS(NWAFOR)
      NREC=(N+9)/10
      I1=-9
      I2=0
      DO 20 NN=1,NREC
      READ (5,1)ABCD
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE  (70,4,ABCD)(XAF(I),I=I1,I2)
   20 CONTINUE
      DO 24 I=1,NWAF
      READ (5,1) ABCD
```

```
      WRITE (6,2) ABCD
      DECODE (28,4,ABCD) (WAFORG(I,J),J=1,4)
   24 CONTINUE
      IF (J1.LT.0) GO TO 30
      DO 28 NN=1,NWAF
      I1=-9
      I2=0
      DO 26 N1=1,NREC
      READ (5,1) ABCD
      WRITE (6,2)ABCD
      I1=I1+10
      I2=I2+10
      DECODE    (70,4,ABCD) (TZORD(NN,I),I=I1,I2)
   26 CONTINUE
   28 CONTINUE
      GO TO 35
   30 DO 32 I=1,NWAF
      DO 32 K=1,N
   32 TZORD(I,K)=0.
   35 L=1
      IF (NWAFOR.LT.0) L=2
      DO 40 NN=1,NWAF
      DO 40 K=1,L
      I1=-9
      I2=0
      DO 38 NI=1,NREC
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE    (70,4,ABCD) (WAFORD(NN,K,I),I=I1,I2)
   38 CONTINUE
   40 CONTINUE
      IF (NWAFOR.LT.0) GO TO 44
      DO 42 NN=1,NWAF
      DO 42 K=1,N
   42 WAFORD(NN,2,K)=WAFORD(NN,1,K)
   44 CONTINUE
      NWAFOR=IABS(NWAFOR)
      NW=NWAFOR
      J1=IABS(J1)
C
C          CHANGE TO ACTUAL UNITS, COMPUTE MINIMUMS AND MAXIMUMS
C
      DO 215 I=1,NWAF
      E=.01*WAFORG(I,4)
      E3=WAFORG(I,3)
      DO 210 J=1,NWAFOR
      WAFORD(I,1,J)=E*WAFORD(I,1,J)+E3+TZORD(I,J)
      WAFORD(I,2,J)=-E*WAFORD(I,2,J)+E3+TZORD(I,J)
  210 WAFORD(I,3,J)=WAFORG(I,1)+E*XAF(J)
  215 CONTINUE
  306 XMIN=XMAX=WAFORG(1,1)
      YMAX=WAFORG(1,2)
      ZMIN=ZMAX=WAFORD(1,1,1)
      DO 310 N=1,NWAF
      XMAX=AMAX1(XMAX,WAFORD(N,3,NW))
      XMIN=AMIN1(XMIN,WAFORD(N,3,1))
      YMAX=AMAX1(YMAX,WAFORG(N,2))
      DO 308 NN=1,NW
      ZMAX=AMAX1(ZMAX,WAFORD(N,1,NN))
      ZMIN=AMIN1(ZMIN,WAFORD(N,2,NN))
  308 CONTINUE
  310 CONTINUE
C
C          WRITE PLOT TAPE
C
      NL1=NW-1
C
C          SETUP 1ST LINE IN STREAMWISE DIRECTION
C
      DO 430 I=1,2
      DO 405 N=1,NW
      ALRT(N,1,2)=WAFORD(1,3,N)
      ALRT(N,2,2)=WAFORG(1,2)
      ALRT(N,3,2)=WAFORD(1,I,N)
  405 CONTINUE
      WRITE (10) ((ALRT(N,N3,2),N=1,NW),N3=1,3)
      DO 425 NN=2,NWAF
      DO 410 N=1,NW
      DO 410 N3=1,3
      ALRT(N,N3,1)=ALRT(N,N3,2)
  410 CONTINUE
      DO 415 N=1,NW
      ALRT(N,1,2)=WAFORD(NN,3,N)
      ALRT(N,2,2)=WAFORG(NN,2 )
      ALRT(N,3,2)=WAFORD(NN,I,N)
  415 CONTINUE
```

```
      GO TO (420,421),I
  420 CALL SURCC(NW,ALRT,VECRT)
      GO TO 422
  421 CALL SURCL(NW,ALRT,VECRT)
  422 CONTINUE
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NW),N3=1,3)
  425 CONTINUE
  430 CONTINUE
      NL1=NWAF-1
      DO 470 I=1,2
      DO 435 N=1,NWAF
C
C           SETUP 1ST LINE IN SPANWISE DIRECTION
C
      ALRT(N,1,2)=WAFORD(N,3,1)
      ALRT(N,2,2)=WAFORG(N,2)
      ALRT(N,3,2)=WAFORD(N,I,1)
  435 CONTINUE
      WRITE (10) ((ALRT(N,N3,2),N=1,NWAF),N3=1,3)
      DO 460 NN=2,NW
      DO 440 N=1,NWAF
      DO 440 N3=1,3
      ALRT(N,N3,1)=ALRT(N,N3,2)
  440 CONTINUE
      DO 445 N=1,NWAF
      ALRT(N,1,2)=WAFORD(N,3,NN)
      ALRT(N,2,2)=WAFORG(N,2)
      ALRT(N,3,2)=WAFORD(N,I,NN)
  445 CONTINUE
      GO TO (450,451),I
  450 CALL SURCL(NWAF,ALRT,VECRT)
      GO TO 452
  451 CALL SURCC(NWAF,ALRT,VECRT)
  452 CONTINUE
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NWAF),N3=1,3)
  460 CONTINUE
  470 CONTINUE
      IF (J1.EQ.2) GO TO 46
   45 WRITE (9) BLOCK
      READ (12) DUM
C
C           FUSELAGE
C
   46 IF(J2.NE.2) GO TO 47
      READ (12) BLOCK
      WRITE (9) BLOCK
      GO TO 315
   47 IF (J2.EQ.0) GO TO 68
      J2TEST=3
      IF(J2.EQ.-1.AND.J6.EQ.-1) J2TEST=1
      IF(J2.EQ.-1.AND.J6.EQ.0) J2TEST=2
      IF (J6.EQ.1) J2TEST=1
      J2=1
      DO 67 NFU=1,NFUS
      NRAD=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      N=NFUSOR
      NREC=(N+9)/10
      I1=-9
      I2=0
      DO 48 N1=1,NREC
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE    (70,4,ABCD) (XFUS(I,NFU),I=I1,I2)
   48 CONTINUE
      IF (J2TEST.NE.2) GO TO 50
      I1=-9
      I2=0
      DO 49 N1=1,NREC
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE  (70,4,ABCD) (ZFUS(I,NFU),I=I1,I2)
   49 CONTINUE
      GO TO 52
   50 DO 51 I=1,N
   51 ZFUS(I,NFU)=0.
   52 IF (J2TEST.NE.3) GO TO 60
      NCARD=(NRAD+9)/10
      DO 56 LN=1,N
      DO 55 K=1,2
      KK=K+(NFU-1)*2
      I1=10
```

```
      I1=-9
      I2=0
      DO 54 NN=1,NCARD
      IF (NN.EQ.NCARD) II=MOD(NRAD,10)
      IF (II.EQ.0) II=10
      I1=I1+10
      I2=I2+II
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (70,4,ABCD)(SFUS(I,LN,KK),I=I1,I2)
   54 CONTINUE
   55 CONTINUE
   56 CONTINUE
      GO TO 67
   60 I1=-9
      I2=0
      DO 62 N1=1,NREC
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE (70,4,ABCD)   (FUSARD(I,NFU),I=I1,I2)
   62 CONTINUE
      DO 64 I=1,N
   64 FUSRAD(I,NFU)=SQRT(FUSARD(I,NFU)/PI)
   67 CONTINUE
C
C        FUSELAGE MIN AND MAX
C
  315 IF (J1.NE.0) GO TO 320
      XMIN=XFUS(1,1)
      XMAX=XFUS(1,1)
      IF (J2TEST.EQ.3)GO TO 317
      YMAX=FUSRAD(1,1)
      ZMIN=-FUSRAD(1,1)+ZFUS(1,1)
      ZMAX=FUSRAD(1,1)+ZFUS(1,1)
      GO TO 320
  317 YMAX=SFUS(1,1,1)
      ZMIN=SFUS(1,1,2)
      ZMAX=SFUS(1,1,2)
  320 DO 330 N=1,NFUS
      NRAD=NRADX(N)
      NFUSOR=NFORX(N)
      XMIN=AMIN1(XMIN,XFUS(1,N))
      XMAX=AMAX1(XMAX,XFUS(NFUSOR,N))
      DO 328 NN=1,NFUSOR
      IF (J2TEST.EQ.3) GO TO 322
      YMAX=AMAX1(YMAX,FUSRAD(NN,N))
      ZMAX=AMAX1(ZMAX,FUSRAD(NN,N)+ZFUS(NN,N))
      ZMIN=AMIN1(ZMIN,-FUSRAD(NN,N)+ZFUS(NN,N))
      GO TO 328
  322 KK=1+(N-1)*2
      DO 325 NR=1,NRAD
      YMAX=AMAX1(YMAX,SFUS(NR,NN,KK))
      ZMIN=AMIN1(ZMIN,SFUS(NR,NN,KK+1))
  325 ZMAX=AMAX1(ZMAX,SFUS(NR,NN,KK+1))
  328 CONTINUE
  330 CONTINUE
C
C        WRITE PLOT TAPE
C
C        SETUP 1ST LINE IN STREAMWISE DIRECTION
C
      DO 496 NFU=1,NFUS
      NRAD=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      NL1=NFUSOR-1
      NAN=NRAD
      IF (J2TEST.EQ.3) GO TO 481
      FANG=(NRAD-1)*2
      DELE=6.2831853/FANG
      DO 480 N=1,NAN
      E=N-1
      ANSIN(N)=SIN(E*DELE+4.712389)
  480 ANCOS(N)=COS(E*DELE+4.712389)
  481 CONTINUE
      KK=1+(NFU-1)*2
      DO 484 N=1,NFUSOR
      ALRT(N,1,2)=XFUS(N,NFU)
      IF (J2TEST.EQ.3) GO TO 482
      ALRT(N,2,2)=FUSRAD(N,NFU)*ANCOS(1)
      ALRT(N,3,2)=FUSRAD(N,NFU)*ANSIN(1)+ZFUS(N,NFU)
      GO TO 483
  482 ALRT(N,2,2)=SFUS(1,N,KK)
      ALRT(N,3,2)=SFUS(1,N,KK+1)
  483 CONTINUE
  484 CONTINUE
      WRITE (10) ((ALRT(N,N3,2),N=1,NFUSOR),N3=1,3)
```

```
      DO 495 NN=2,NAN
      DO 488 N=1,NFUSOR
      DO 488 N3=1,3
      ALRT(N,N3,1)=ALRT(N,N3,2)
  488 CONTINUE
      DO 492 N=1,NFUSOR
      IF (J2TEST.EQ.3) GO TO 490
      ALRT(N,2,2)=FUSRAD(N,NFU)*ANCOS(NN)
      ALRT(N,3,2)=FUSRAD(N,NFU)*ANSIN(NN)+ZFUS(N,NFU)
      GO TO 491
  490 ALRT(N,2,2)=SFUS(NN,N,KK)
      ALRT(N,3,2)=SFUS(NN,N,KK+1)
  491 CONTINUE
  492 CONTINUE
      CALL SURCL(NFUSOR,ALRT,VECRT)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NFUSOR),N3=1,3)
  495 CONTINUE
  496 CONTINUE
C
C          SETUP 1ST LINE AROUND BODY
C
      DO 511 NFU=1,NFUS
      NRAD=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      NAN=NRAD
      NL1=NAN-1
      IF (J2TEST.EQ.3) GO TO 494
      FANG=(NRAD-1)*2
      DELE=6.2831853/FANG
      DO 493 N=1,NAN
      E=N-1
      ANSIN(N)=SIN(E*DELE+4.712389)
  493 ANCOS(N)=COS(E*DELE+4.712389)
  494 CONTINUE
      KK=1+(NFU-1)*2
      DO 499 N=1,NAN
      ALRT(N,1,2)=XFUS(1,NFU)
      IF (J2TEST.EQ.3) GO TO 497
      ALRT(N,2,2)=FUSRAD(1,NFU)*ANCOS(N)
      ALRT(N,3,2)=FUSRAD(1,NFU)*ANSIN(N)+ZFUS(1,NFU)
      GO TO 498
  497 ALRT(N,2,2)=SFUS(N,1,KK)
      ALRT(N,3,2)=SFUS(N,1,KK+1)
  498 CONTINUE
  499 CONTINUE
      WRITE (10) ((ALRT(N,N3,2),N=1,NAN),N3=1,3)
      DO 510 NN=2,NFUSOR
      DO 502 N=1,NAN
      DO 502 N3=1,3
      ALRT(N,N3,1)=ALRT(N,N3,2)
  502 CONTINUE
      DO 508 N=1,NAN
      ALRT(N,1,2)=XFUS(NN,NFU)
      IF (J2TEST.EQ.3) GO TO 504
      ALRT(N,2,2)=FUSRAD(NN,NFU)*ANCOS(N)
      ALRT(N,3,2)=FUSRAD(NN,NFU)*ANSIN(N)+ZFUS(NN,NFU)
      GO TO 505
  504 ALRT(N,2,2)=SFUS(N,NN,KK)
      ALRT(N,3,2)=SFUS(N,NN,KK+1)
  505 CONTINUE
  508 CONTINUE
      CALL SURCC(NAN,ALRT,VECRT)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NAN),N3=1,3)
  510 CONTINUE
  511 CONTINUE
      IF (J2.EQ.2) GO TO 70
   68 WRITE (9) BLOCK
      READ (12) DUM
C
C          NACELLES
C
   70 IF (J3.NE.2) GO TO 72
      READ (12) BLOCK
      WRITE (9) BLOCK
      GO TO 342
   72 IF (J3.EQ.0) GO TO 79
      N=NPODOR
      NREC=(N+9)/10
      DO 78 NN=1,NP
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (21,4,ABCD) (PODORG(NN,I),I=1,3)
      I1=-9
      I2=0
      DO 74 N1=1,NREC
      READ (5,1) ABCD
```

```
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE     (70,4,ABCD) (XPOD(NN,I),I=I1,I2)
   74 CONTINUE
      I1=-9
      I2=0
      DO 76 N1=1,NREC
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      I1=I1+10
      I2=I2+10
      DECODE     (70,4,ABCD)(PODORD(NN,I),I=I1,I2)
   76 CONTINUE
   78 CONTINUE
C
C          COMPUTE ACTUAL X,MINIMUM,MAXIMUM
C
  342 DO 343 N=1,NP
      DO 343 NN=1,NPODOR
  343 XPOD1(N,NN)=XPOD(N,NN)+PODORG(N,1)
      IF (J1.NE.0.OR.J2.NE.0) GO TO 345
      XMIN=XPOD1(1,1)
      XMAX=XPOD1(1,NPODOR)
      YMAX=PODORG(1,2)+PODORD(1,1)
      ZMIN=PODORG(1,3)-PODORD(1,1)
      ZMAX=PODORG(1,3)+PODORD(1,1)
  345 DO 350 N=1,NP
      XMIN=AMIN1(XMIN,XPOD1(N,1))
      XMAX=AMAX1(XMAX,XPOD1(N,NPODOR))
      DO 348 NN=1,NPODOR
      YMAX=AMAX1(YMAX,PODORD(N,NN)+PODORG(N,2))
      ZMIN=AMIN1(ZMIN,PODORG(N,3)-PODORD(N,NN))
  348 ZMAX=AMAX1(ZMAX,PODORG(N,3)+PODORD(N,NN))
  350 CONTINUE
      NANG1=NAN2+1
      FANG=NAN2
      DELE=6.2831853/FANG
      DO 518 N=1,NANG1
      E=N-1
      ANSIN(N)=SIN(E*DELE)
  518 ANCOS(N)=COS(E*DELE)
C
C          WRITE PLOT TAPE
C
      NL1=NPODOR-1
C
C          SETUP 1ST LINE IN STREAMWISE DIRECTION
C
      DO 540 NP1=1,NP
      DO 522 N=1,NPODOR
      ALRT(N,1,2)=XPOD(NP1,N)+PODORG(NP1,1)
      ALRT(N,2,2)=PODORD(NP1,N)*ANCOS(1)+PODORG(NP1,2)
      ALRT(N,3,2)=PODORD(NP1,N)*ANSIN(1)+PODORG(NP1,3)
  522 CONTINUE
      WRITE (10) ((ALRT(N,N3,2),N=1,NPODOR),N3=1,3)
      DO 535 NN=2,NANG1
      DO 525 N=1,NPODOR
      DO 525 N3=1,3
      ALRT(N,N3,1)=ALRT(N,N3,2)
  525 CONTINUE
      DO 530 N=1,NPODOR
      ALRT(N,2,2)=PODORD(NP1,N)*ANCOS(NN)+PODORG(NP1,2)
      ALRT(N,3,2)=PODORD(NP1,N)*ANSIN(NN)+PODORG(NP1,3)
  530 CONTINUE
      CALL SURCL(NPODOR,ALRT,VECRT)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NPODOR),N3=1,3)
  535 CONTINUE
  540 CONTINUE
C
C     SETUP 1ST LINE AROUND PODS
C
      NL1=NANG1-1
      DO 555 NP1=1,NP
      DO 542 N=1,NANG1
      M=N
      ALRT(M,1,2)=XPOD(NP1,1)+PODORG(NP1,1)
      ALRT(M,2,2)=PODORD(NP1,1)*ANCOS(N)+PODORG(NP1,2)
      ALRT(M,3,2)=PODORD(NP1,1)*ANSIN(N)+PODORG(NP1,3)
  542 CONTINUE
      WRITE (10) ((ALRT(N,N3,2),N=1,NANG1),N3=1,3)
C
      DO 550 NN=2,NPODOR
      DO 545 N=1,NANG1
      DO 545 N3=1,3
      ALRT(N,N3,1)=ALRT(N,N3,2)
  545 CONTINUE
```

```
      DO 548 N=1,NANG1
      M=N
      ALRT(M,1,2)=XPOD(NP1,NN)+PODORG(NP1,1)
      ALRT(M,2,2)=PODORD(NP1,NN)*ANCOS(N)+PODORG(NP1,2)
      ALRT(M,3,2)=PODORD(NP1,NN)*ANSIN(N)+PODORG(NP1,3)
  548 CONTINUE
      CALL SURCC(NANG1,ALRT,VECRT)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NANG1),N3=1,3)
  550 CONTINUE
  555 CONTINUE
      IF (J3.EQ.2) GO TO 80
   79 WRITE (9) BLOCK
      READ (12) DUM
C
C          FINS
C
   80 IF (J4.NE.2) GO TO 82
      READ (12) BLOCK
      WRITE (9) BLOCK
      GO TO 360
   82 IF (J4.EQ.0) GO TO 88
      N=NFINOR
      DO 85 NN=1,NF
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (56,4,ABCD)  ((FINORG(NN,I,J),J=1,4),I=1,2)
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE    (70,4,ABCD)    (XFIN(NN,I),I=1,N)
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE    (70,4,ABCD)   (FINORD(NN,1,J),J=1,N)
   85 CONTINUE
C
C          CHANGE TO ACTUAL UNITS, COMPUTE MINIMUMS AND MAXIMUMS
C
      DO 225 LQ=1,NF
      DO 225 I=1,2
      J=3-I
      E=.01*FINORG(LQ,J,4)
      E2=FINORG(LQ,J,2)
      DO 220 K=1,NFINOR
      EE=FINORD(LQ,1,K)*E
      FINORD(LQ,J,K)=E2+EE
      FINX2(LQ,J,K)=E2-EE
  220 FINX3(LQ,J,K)=FINORG(LQ,J,1)+E*XFIN(LQ,K)
  225 CONTINUE
C
  360 IF (J1.NE.0.OR.J2.NE.0.OR.J3.NE.0)GO TO 365
      XMIN=FINORG(1,1,1)
      XMAX=FINORG(1,1,1)
      YMAX=FINORG(1,1,2)
      ZMIN=FINORG(1,1,3)
      ZMAX=FINORG(1,1,3)
  365 DO 370 N=1,NF
      ZMIN=AMIN1(ZMIN,FINORG(N,1,3))
      ZMAX=AMAX1(ZMAX,FINORG(N,2,3))
      DO 370 N2=1,2
      XMIN=AMIN1(XMIN,FINORG(N,N2,1))
      XMAX=AMAX1(XMAX,FINX3(N,N2,NFINOR))
      DO 370 NN=1,NFINOR
      YMAX=AMAX1(YMAX,FINORD(N,N2,NN))
  370 CONTINUE
C
C          WRITE PLOT TAPE
C
      NL1=NFINOR-1
C
C          SETUP LOWER AND UPPER LINES IN STREAMWISE DIRECTION
C
      DO 580 NF1=1,NF
      DO 565 N2=1,2
      DO 565 N=1,NFINOR
      ALRT(N,1,N2)=FINX3(NF1,N2,N)
      ALRT(N,2,N2)=FINORD(NF1,N2,N)
      ALRT(N,3,N2)=FINORG(NF1,N2,3)
  565 CONTINUE
C
      CALL SURCL(NFINOR,ALRT,VECRT)
      WRITE (10) ((ALRT(N,N3,1),N=1,NFINOR),N3=1,3)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NFINOR),N3=1,3)
C
C          CHANGE Y FOR INSIDE LINES
C
      DO 570 N2=1,2
      DO 570 N=1,NFINOR
```

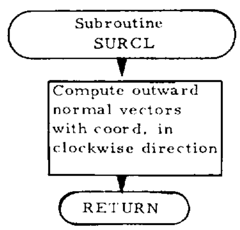
```
      ALRT(N,2,N2)=FINX2(NF1,N2,N)
  570 CONTINUE
C
      CALL SURCC(NFINOR,ALRT,VECRT)
      WRITE (10) ((ALRT(N,N3,1),N=1,NFINOR),N3=1,3)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NFINOR),N3=1,3)
  580 CONTINUE
C
C         SETUP LINES IN VERTICAL DIRECTION
C
      DO 625 NF1=1,NF
      DO 620 NN2=1,2
      DO 588 N2=1,2
      ALRT(N2,1,2)=FINX3(NF1,N2,1)
      IF (NN2.EQ.2) GO TO 582
      ALRT(N2,2,2)=FINORD(NF1,N2,1)
      GO TO 585
  582 ALRT(N2,2,2)=FINX2(NF1,N2,1)
  585 CONTINUE
      ALRT(N2,3,2)=FINORG(NF1,N2,3)
  588 CONTINUE
C
      WRITE (10) ((ALRT(N,N3,2),N=1,2),N3=1,3)
C
      DO 610 NN=2,NFINOR
      DO 590 N3=1,3
      DO 590 N2=1,2
      ALRT(N2,N3,1)=ALRT(N2,N3,2)
  590 CONTINUE
      DO 598 N2=1,2
      ALRT(N2,1,2)=FINX3(NF1,N2,NN)
      IF (NN2.EQ.2) GO TO 592
      ALRT(N2,2,2)=FINORD(NF1,N2,NN)
      GO TO 595
  592 ALRT(N2,2,2)=FINX2(NF1,N2,NN)
  595 CONTINUE
      ALRT(N2,3,2)=FINORG(NF1,N2,3)
  598 CONTINUE
C
      GO TO (602,604),NN2
  602 CALL SURCC (2,ALRT,VECRT)
      GO TO 605
  604 CALL SURCL (2,ALRT,VECRT)
  605 CONTINUE
      WRITE (10) (VECRT(1,N3),N3=1,3)
      WRITE (10) ((ALRT(N2,N3,2),N2=1,2),N3=1,3)
  610 CONTINUE
  620 CONTINUE
  625 CONTINUE
      IF (J4.EQ.2) GO TO 90
   88 WRITE (9) BLOCK
      READ (12) DUM
C
C         CANARDS
C
   90 IF (J5.NE.2) GO TO 94
      NCANOR=IABS(NCANOR)
      NC=NCANOR
      READ (12) BLOCK
      WRITE (9) BLOCK
      GO TO 375
   94 IF (J5.EQ.0) GO TO 99
      N=IABS(NCANOR)
      DO 98 NN=1,NCAN
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (56,4,ABCD) ((CANORG(NN,I,J),J=1,4),I=1,2)
      READ (5,1)ABCD
      WRITE (6,2) ABCD
      DECODE (70,4,ABCD) (XCAN(NN,I),I=1,N)
      READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (70,4,ABCD) (CANORD(NN,1,J),J=1,N)
      IF (NCANOR.LT.0) GO TO 97
      DO 96 J=1,N
   96 CANOR1(NN,1,J)=CANORD(NN,1,J)
      GO TO 98
   97 READ (5,1) ABCD
      WRITE (6,2) ABCD
      DECODE (70,4,ABCD) (CANOR1(NN,1,J),J=1,N)
   98 CONTINUE
      NCANOR=IABS(NCANOR)
      NC=NCANOR
C
C         CHANGE TO ACTUAL UNITS, COMPUTE MINIMUMS AND MAXIMUMS
C
      DO 250 NN=1,NCAN
```

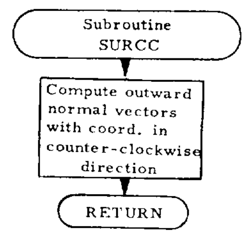
```
      DO 245 K=1,2
      I=3-K
      E=.01*CANORG(NN,I,4)
      E3=CANORG(NN,I,3)
      DO 240 J=1,NCANOR
      CANORD(NN,I,J)=E*CANORD(NN,1,J)+E3
      CANORI(NN,I,J)=-E*CANORI(NN,1,J)+E3
  240 CANORX(NN,I,J)=CANORG(NN,I,1)+E*XCAN(NN,J)
  245 CONTINUE
  250 CONTINUE
  375 IF(J1.NE.0.OR.J2.NE.0.OR.J3.NE.0.OR.J4.NE.0) GO TO 377
      XMIN=CANORX(1,1,1)
      XMAX=CANORX(1,1,NCANOR)
      YMAX=CANORG(1,2,2)
      ZMIN=CANORI(1,1,1)
      ZMAX=CANORD(1,1,1)
  377 DO 390 NCA=1,NCAN
      YMAX=AMAX1(YMAX,CANORG(NCA,2,2))
      DO 388 N2=1,2
      XMIN=AMIN1(XMIN,CANORX(NCA,N2,1))
      XMAX=AMAX1(XMAX,CANORX(NCA,N2,NCANOR))
      DO 385 NN=1,NCANOR
      ZMIN=AMIN1(ZMIN,CANORI(NCA,N2,NN))
  385 ZMAX=AMAX1(ZMAX,CANORD(NCA,N2,NN))
  388 CONTINUE
  390 CONTINUE
C
C          WRITE PLOT TAPE
C
      NL1=NC-1
C
C          SETUP TWO LINES IN STREAMWISE DIRECTION FOR UPPER AND LOWER
C
      DO 642 NCA=1,NCAN
      DO 640 I=1,2
      DO 635 N2=1,2
      DO 635 N=1,NC
      ALRT(N,1,N2)=CANORX(NCA,N2,N)
      ALRT(N,2,N2)=CANORG(NCA,N2,2)
      IF (I.EQ.2) GO TO 632
      ALRT(N,3,N2)=CANORD(NCA,N2,N)
      GO TO 635
  632 ALRT(N,3,N2)=CANORI(NCA,N2,N)
  635 CONTINUE
      GO TO (637,638),I
  637 CALL SURCC (NC,ALRT,VECRT)
      GO TO 639
  638 CALL SURCL (NC,ALRT,VECRT)
  639 CONTINUE
      WRITE (10) ((ALRT(N,N3,1),N=1,NC),N3=1,3)
      WRITE (10) ((VECRT(N,N3),N=1,NL1),N3=1,3)
      WRITE (10) ((ALRT(N,N3,2),N=1,NC),N3=1,3)
  640 CONTINUE
  642 CONTINUE
C
C          SETUP LINES IN SPANWISE DIRECTION
C
      DO 665 NCA=1,NCAN
      DO 660 I=1,2
      DO 648 N2=1,2
      ALRT(N2,1,2)=CANORX(NCA,N2,1)
      ALRT(N2,2,2)=CANORG(NCA,N2,2)
      IF (I.EQ.2) GO TO 643
      ALRT(N2,3,2)=CANORD(NCA,N2,1)
      GO TO 648
  643 ALRT(N2,3,2)=CANORI(NCA,N2,1)
  648 CONTINUE
      WRITE (10)((ALRT(N2,N3,2),N2=1,2),N3=1,3)
      DO 659 NN=2,NC
      DO 650 N3=1,3
      DO 650 N2=1,2
      ALRT(N2,N3,1)=ALRT(N2,N3,2)
  650 CONTINUE
      DO 654 N2=1,2
      ALRT(N2,1,2)=CANORX(NCA,N2,NN)
      ALRT(N2,2,2)=CANORG(NCA,N2,2)
      IF (I.EQ.2) GO TO 652
      ALRT(N2,3,2)=CANORD(NCA,N2,NN)
      GO TO 654
  652 ALRT(N2,3,2)=CANORI(NCA,N2,NN)
  654 CONTINUE
      GO TO (656,657),I
  656 CALL SURCL (2,ALRT,VECRT)
      GO TO 658
  657 CALL SURCC (2,ALRT,VECRT)
  658 CONTINUE
      WRITE (10) (VECRT(1,N3),N3=1,3)
      WRITE (10) ((ALRT(N2,N3,2),N2=1,2),N3=1,3)
```

```
  659 CONTINUE
  660 CONTINUE
  665 CONTINUE
      IF (J5.EQ.2) GO TO 105
   99 WRITE (9) BLOCK
      READ (12) DUM
  105 REWIND 9
      REWIND 12
      READ (9) REFA
      WRITE (12) REFA
      DO 700 K=1,5
      READ (9) BLOCK
  700 WRITE (12) BLOCK
C
C           FIND MAXIMUM DISTANCE AND MIDPOINT
C
      YMIN=-YMAX
      XDIS=XMAX-XMIN
      YDIS=YMAX-YMIN
      ZDIS=ZMAX-ZMIN
      BIGD=AMAX1(XDIS,YDIS,ZDIS)
      XMID=.5*(XMAX-XMIN)+XMIN
      YMID=0.
      ZMID=.5*(ZMAX-ZMIN)+ZMIN
      RETURN
C
C           END OF START
C
      END
```

Subroutines SURCL and SURCC

Subroutine SURCL computes the outward normal vectors with four adjoining input points used in a clockwise direction and subroutine SURCC computes the outward normal vectors with four adjoining input points used in a counterclockwise direction. Although the input points are numbered in a counterclockwise direction, if computing the normals with Subroutine SURCC would yield inward normals, Subroutine SURCL is used. The flow charts and the FORTRAN statements for these subroutines are as follows:



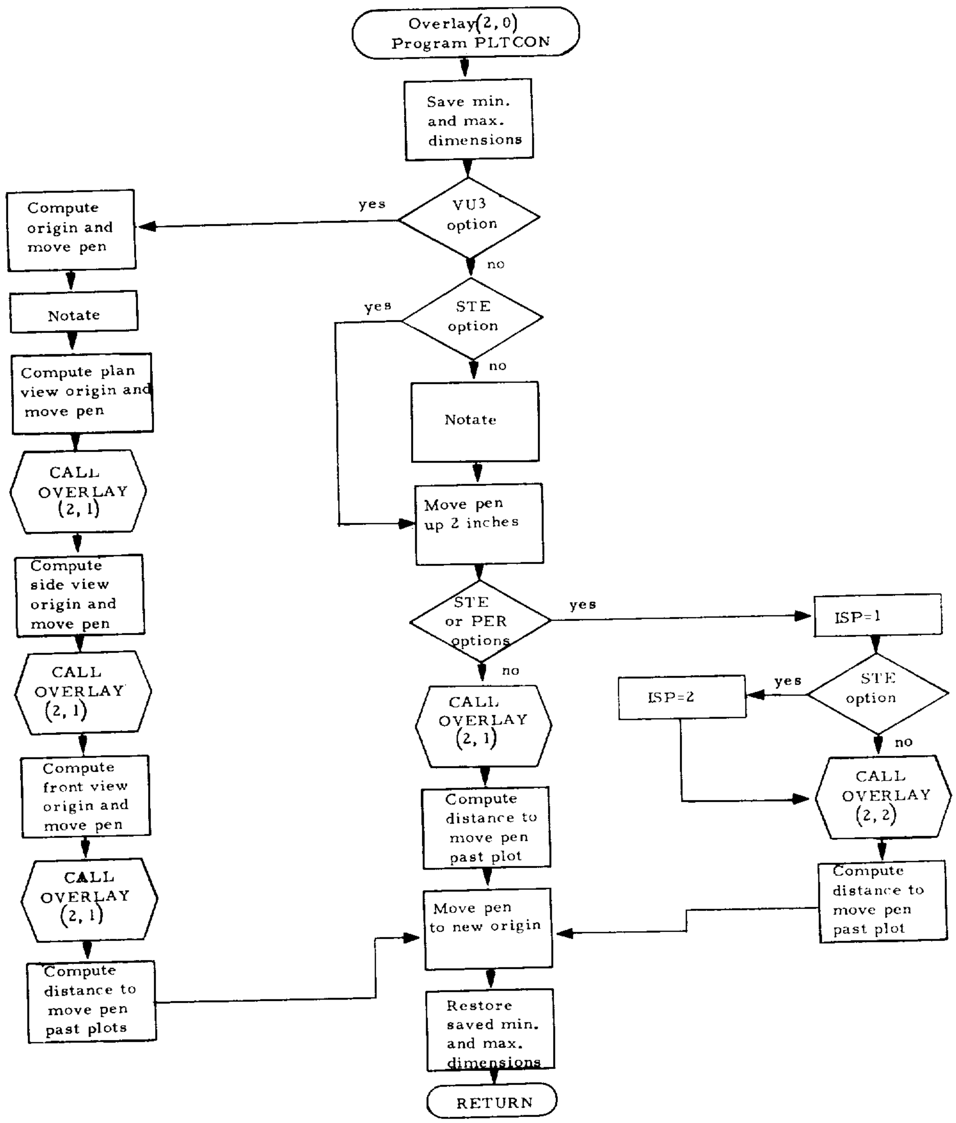



```
      SUBROUTINE SURCL(NPT,FLINE,FVEC)
C
C         COMPUTES SURFACE UNIT NORMALS
C
      DIMENSION FLINE(31,3,2),FVEC(30,3)
C
C
      DO  50  N=2,NPT
      T1X=FLINE(N,1,2)-FLINE(N-1,1,1)
      T2X=FLINE(N-1,1,2)-FLINE(N,1,1)
      T1Y=FLINE(N,2,2)-FLINE(N-1,2,1)
      T2Y=FLINE(N-1,2,2)-FLINE(N,2,1)
      T1Z=FLINE(N,3,2)-FLINE(N-1,3,1)
      T2Z=FLINE(N-1,3,2)-FLINE(N,3,1)
      XNX=T2Y*T1Z-T1Y*T2Z
      YNY=T1X*T2Z-T2X*T1Z
      ZNZ=T2X*T1Y-T1X*T2Y
      FN=SQRT(XNX**2+YNY**2+ZNZ**2)
      IF (FN.EQ.0.) GO TO 40
      FVEC(N-1,1)=XNX/FN
      FVEC(N-1,2)=YNY/FN
      FVEC(N-1,3)=ZNZ/FN
      GO TO 50
   40 FVEC(N-1,1)=0.
      FVEC(N-1,2)=0.
      FVEC(N-1,3)=0.
   50 CONTINUE
      RETURN
C
C         END OF SURCL
C
      END
```

```
      SUBROUTINE SURCC(NPT,FLINE,FVEC)
C
C         COMPUTES SURFACE UNIT NORMALS
C
      DIMENSION FLINE(31,3,2),FVEC(30,3)
C
C
      DO  50  N=2,NPT
      T1X=FLINE(N,1,2)-FLINE(N-1,1,1)
      T2X=FLINE(N,1,1)-FLINE(N-1,1,2)
      T1Y=FLINE(N,2,2)-FLINE(N-1,2,1)
      T2Y=FLINE(N,2,1)-FLINE(N-1,2,2)
      T1Z=FLINE(N,3,2)-FLINE(N-1,3,1)
      T2Z=FLINE(N,3,1)-FLINE(N-1,3,2)
      XNX=T2Y*T1Z-T1Y*T2Z
      YNY=T1X*T2Z-T2X*T1Z
      ZNZ=T2X*T1Y-T1X*T2Y
      FN=SQRT(XNX**2+YNY**2+ZNZ**2)
      IF (FN.EQ.0.) GO TO 40
      FVEC(N-1,1)=XNX/FN
      FVEC(N-1,2)=YNY/FN
      FVEC(N-1,3)=ZNZ/FN
      GO TO 50
   40 FVEC(N-1,1)=0.
      FVEC(N-1,2)=0.
      FVEC(N-1,3)=0.
   50 CONTINUE
      RETURN
C
C         END OF SURCC
C
      END
```

Program PLTCON

Program PLTCON (overlay (2,0)) is the control routine for the various plot options and calls in the other needed parts of the program. This program generates instructions for the plot titles and origin. The flow chart and the FORTRAN statements for this program are as follows:

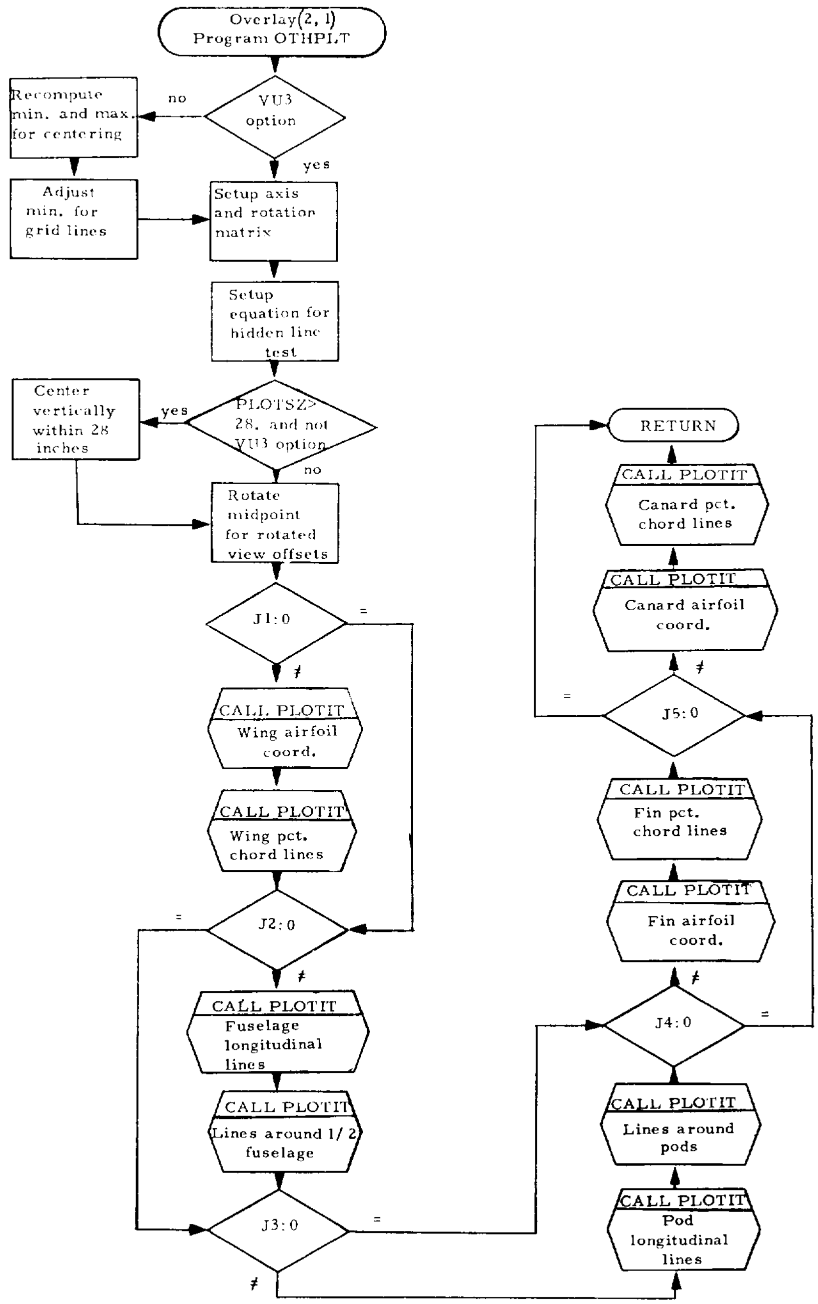


```
      OVERLAY (CBC,2,0)
      PROGRAM PLTCON
C
C          CONTROL ROUTINE FOR VARIOUS TYPES OF PLOTS
C          OF AN AIRCRAFT CONFIGURATION
C
      COMMON ABC(8),J0,J1,J2,J3,J4,J5,J6,
     1NWAF,NWAFOR,NFUS,NRADX(4),NFORX(4),NP,NPODOR,
     2NF,NFINOR,NCAN,NCANOR,
     3J2TEST,NW,NC,
     4ABCDE(8),HORZ,VERT,TEST1,PHI,THETA,PSI,XF,YF,ZF,DIST,FMAG,
     5PLOTSZ,TYPE,KODE,
     6XMIN,XMAX,YMIN,YMAX,ZMIN,ZMAX,
     7XMID,YMID,ZMID,BIGD,ISP
C
      DIMENSION ORG(3)
      DATA TYPEO/3HORT/,TYPEP/3HPER/,TYPES/3HSTE/
     1,TYPEV/3HVU3/
C
      CBC=3LCBC
      RECALL=6HRECALL
      REWIND 10
C
C          SAVE MIN AND MAX
C
      XSAV=XMIN
      YSAV=YMIN
      ZSAV=ZMIN
      XMSAV=XMAX
      YMSAV=YMAX
      ZMSAV=ZMAX
      IF (TYPE.NE.TYPEV) GO TO 49
      SCALE=BIGD/PLOTSZ
      ORG(1)=PHI
      ORG(2)=THETA
      ORG(3)=PSI
      PHI=THETA=PSI=0.
      YBIG=ORG(1)
      YORG=FLOAT(IFIX(YMAX/SCALE))+ORG(1)
      IF   (YBIG.GT.ORG(2))GO TO 5
      YBIG=ORG(2)
      YORG=FLOAT(IFIX(ZMAX/SCALE))+ORG(2)
    5 IF   (YBIG.GT.ORG(3))GO TO 8
      YBIG=ORG(3)
      YORG=FLOAT(IFIX(ZMAX/SCALE))+ORG(3)
    8 CALL CALPLT(0.,YORG,-3)
C
C          NOTATE ON 3VIEW PLOTS
C
      NCHAR=IFIX(6.*PLOTSZ)
      IF (NCHAR.GT.80) GO TO 9
      X=0.
      GO TO 10
    9 CONTINUE
      NDIF=(NCHAR-80)/2
      X=FLOAT(NDIF)/6.
      NCHAR=80
   10 CALL NOTATE(X,0.,.2,ABC,0.,NCHAR)
      XMIN=YMIN=ZMIN=0.
      HORZ=1HX
      VERT=1HY
      YORG=ORG(1)-YORG-1
      CALL CALPLT(0.,YORG,-3)
      CALL OVERLAY(CBC,2,1,RECALL)
      REWIND 10
      VERT=1HZ
      YORG=ORG(2)-ORG(1)
      CALL CALPLT(0.,YORG,-3)
      CALL OVERLAY (CBC,2,1,RECALL)
      REWIND 10
      HORZ=1HY
      YORG=ORG(3)-ORG(2)
      YMIN=FLOAT(IFIX(YSAV/SCALE))*SCALE
      CALL CALPLT (0.,YORG,-3)
      CALL OVERLAY (CBC,2,1,RECALL)
      X=FLOAT(IFIX(PLOTSZ+6.))
      Y=1.-ORG(3)
      GO TO 60
   49 CONTINUE
      IF (TYPE.EQ.TYPES) GO TO 52
C
C          NOTATE ID ON PLOT
C
      X=0.
      NCHAR=IFIX(11.*PLOTSZ)+3
      IF (NCHAR.LE.80) GO TO 50
      NDIF=(NCHAR-80)/2
      X=FLOAT(NDIF)/11.
```

```
      NCHAR=80
   50 CALL NOTATE (X,0.,.1,ABC,0.,NCHAR)
      CALL NOTATE (X,-.5,.1,ABCDE,0.,NCHAR)
   52 CONTINUE
      CALL CALPLT (0.,2.,-3)
      IF (TYPE.EQ.TYPEP.OR.TYPE.EQ.TYPES) GO TO 54
C
C          ORTHOGRAPHIC
C
      CALL OVERLAY (CBC,2,1,RECALL)
      X=FLOAT(IFIX(PLOTSZ+2.))
      Y=-2.
      GO TO 60
   54 ISP=1
      IF (TYPE.EQ.TYPES) ISP=2
C
C          PERSPECTIVE OR STEREO
C
      CALL OVERLAY (CBC,2,2,RECALL)
      X=PLOTSZ+2.
      IF (TYPE.EQ.TYPES) X=X+PLOTSZ
      Y=-2.
C
C          END OF COMPLETE PLOT
C
   60 CONTINUE
      CALL CALPLT (X,Y,-3)
C
C          RESTORE MIN AND MAX
C
   70 XMIN=XSAV
      YMIN=YSAV
      ZMIN=ZSAV
      XMAX=XMSAV
      YMAX=YMSAV
      ZMAX=ZMSAV
      RETURN
C
C          END OF PLTCON
C
      END
```

Program OTHPLT

Program OTHPLT (overlay (2,1)) is the control routine for the orthographic projections. It determines the specified axis system and paper plane, sets up the rotation matrix and the equation for transformation of the outward normal vectors, and establishes the necessary offsets for placement of a plot. The flow chart and the FORTRAN statements for this program are as follows:



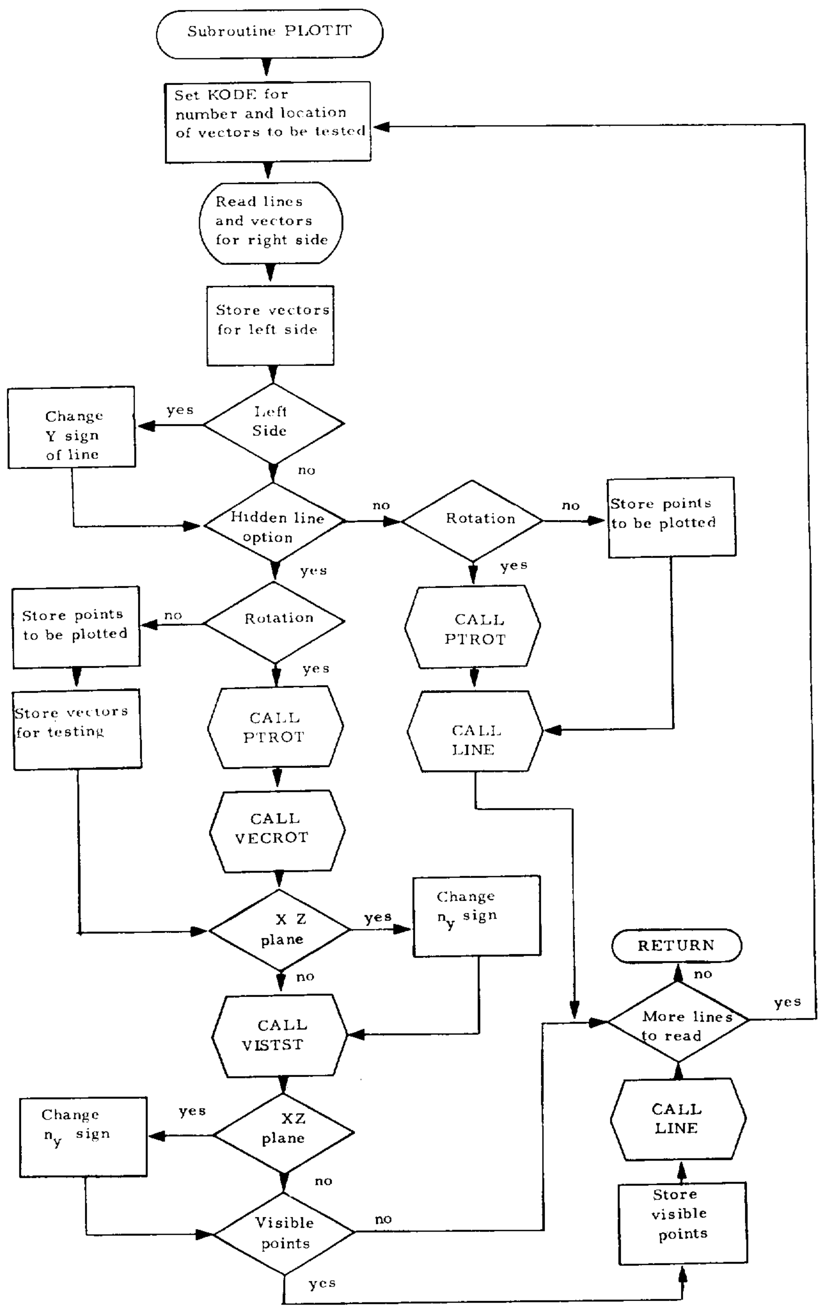
```
      OVERLAY (CBC,2,1)
      PROGRAM OTHPLT
C
C          CONTROL ROUTINE FOR ORTHOGRAPHIC PROJECTIONS
C
C
C
      COMMON ABC(8),J0,J1,J2,J3,J4,J5,J6,
     1NWAF,NWAFOR,NFUS,NRADX(4),NFORX(4),NP,NPODOR,
     2NF,NFINOR,NCAN,NCANOR,
     3J2TEST,NW,NC,
     4ABCDE(8),HORZ,VERT,TEST1,PHI,THETA,PSI,XF,YF,ZF,DIST,FMAG,
     5PLOTSZ,TYPE,KODE,
     6XMIN,XMAX,YMIN,YMAX,ZMIN,ZMAX,
     7XMID,YMID,ZMID,BIGD,ISP
C
      DIMENSION A(2,3),C(3)
C
      DATA XSEE/2HX /,YSEE/2HY /,ZSEE/2HZ /,
     1XINTST/3HOUT/,CONV/.017453293/,NUM2/2/,NAN2/24/
C
C          INITIALIZE
C
      DMAX=BIGD
      ITEST1=1
      ITEST2=1
      IF (XINTST.NE.TEST1) ITEST1=0
      IF (PSI.EQ.0..AND.THETA.EQ.0..AND.PHI.EQ.0.)ITEST2=0
      SCALE=DMAX/PLOTSZ
      PHI=CONV*PHI
      THETA=CONV*THETA
      PSI=CONV*PSI
      IF (TYPE.EQ.3HVU3) GO TO 12
C
C
      XDIS=XMAX-XMIN
      YDIS=YMAX-YMIN
      ZDIS=ZMAX-ZMIN
      XFIX=.5*(DMAX-XDIS)
      XMIN=XMIN-XFIX
      XMAX=XMAX+XFIX
      YFIX=.5*(DMAX-YDIS)
      YMIN=YMIN-YFIX
      YMAX=YMAX+YFIX
      ZFIX=.5*(DMAX-ZDIS)
      ZMIN=ZMIN-ZFIX
      ZMAX=ZMAX+ZFIX
C
C          ADJUST MINIMUMS FOR GRID LINES
C
      XMIN=FLOAT (IFIX(XMIN/SCALE))*SCALE
      YMIN=FLOAT (IFIX(YMIN/SCALE))*SCALE
      ZMIN=FLOAT (IFIX(ZMIN/SCALE))*SCALE
   12 CONTINUE
C
C          SETUP AXIS
C
      SINPSI=SIN(PSI)
      SINTHE=SIN(THETA)
      SINPHI=SIN(PHI)
      COSPSI=COS(PSI)
      COSTHE=COS(THETA)
      COSPHI=COS(PHI)
 2020 IF (XSEE.NE.HORZ) GO TO 2030
C
C          USE X FOR HORIZONTAL VARIABLE
C
      IF (ITEST2.EQ.0) GO TO 2025
      A(1,1)=COSTHE*COSPSI
      A(1,2)=-SINPSI*COSPHI+SINTHE*COSPSI*SINPHI
      A(1,3)=SINPSI*SINPHI+SINTHE*COSPSI*COSPHI
 2025 HMIN=XMIN
      HMAX=XMAX
      HMID=XMID
      IHORZ=1
      GO TO 2050
 2030 IF (YSEE.NE.HORZ) GO TO 2040
C
C          USE Y FOR HORIZONTAL VARIABLE
C
      IF (ITEST2.EQ.0) GO TO 2035
      A(1,1)=COSTHE*SINPSI
      A(1,2)=COSPSI*COSPHI+SINTHE*SINPSI*SINPHI
      A(1,3)=-COSPSI*SINPHI+SINTHE*SINPSI*COSPHI
 2035 HMIN=YMIN
      HMAX=YMAX
      HMID=YMID
      IHORZ=2
```

```
      GO TO 2050
C
C           USE Z FOR HORIZONTAL VARIABLE
C
 2040 CONTINUE
      IF (ITEST2.EQ.0) GO TO 2045
      A(1,1)=-SINTHE
      A(1,2)=COSTHE*SINPHI
      A(1,3)=COSTHE*COSPHI
 2045 HMIN=ZMIN
      HMAX=ZMAX
      HMID=ZMID
      IHORZ=3
 2050 IF (XSEE.NE.VERT) GO TO 2060
C
C           USE X FOR VERTICAL VARIABLE
C
      IF (ITEST2.EQ.0) GO TO 2055
      A(2,1)=COSTHE*COSPSI
      A(2,2)=-SINPSI*COSPHI+SINTHE*COSPSI*SINPHI
      A(2,3)=SINPSI*SINPHI+SINTHE*COSPSI*COSPHI
 2055 VMIN=XMIN
      VMAX=XMAX
      VMID=XMID
      IVERT=1
      GO TO 2080
 2060 IF (YSEE.NE.VERT) GO TO 2070
C
C           USE Y FOR VERTICAL VARIABLE
C
      IF (ITEST2.EQ.0) GO TO 2065
      A(2,1)=COSTHE*SINPSI
      A(2,2)=COSPSI*COSPHI+SINTHE*SINPSI*SINPHI
      A(2,3)=-COSPSI*SINPHI+SINTHE*SINPSI*COSPHI
 2065 VMIN=YMIN
      VMAX=YMAX
      VMID=YMID
      IVERT=2
      GO TO 2080
C
C           USE Z FOR VERTICAL VARIABLE
C
 2070 CONTINUE
      IF (ITEST2.EQ.0) GO TO 2075
      A(2,1)=-SINTHE
      A(2,2)=COSTHE*SINPHI
      A(2,3)=COSTHE*COSPHI
 2075 VMIN=ZMIN
      VMAX=ZMAX
      VMID=ZMID
      IVERT=3
C
C           CHECK PAPER PLANE
C
 2080 IF (.NOT.((IHORZ.EQ.1.AND.IVERT.EQ.2).OR.
     1(IVERT.EQ.1.AND.IHORZ.EQ.2))) GO TO 2083
      ITEST=3
      C(1)=-SINTHE
      C(2)=COSTHE*SINPHI
      C(3)=COSTHE*COSPHI
      GO TO 2088
 2083 IF (.NOT.((IHORZ.EQ.1.AND.IVERT.EQ.3).OR.
     1(IVERT.EQ.1.AND.IHORZ.EQ.3)))GO TO 2086
      ITEST=2
      C(1)=COSTHE*SINPSI
      C(2)=COSPSI*COSPHI+SINTHE*SINPSI*SINPHI
      C(3)=-COSPSI*SINPHI+SINTHE*SINPSI*COSPHI
      GO TO 2088
 2086 ITEST=1
      C(1)=COSTHE*COSPSI
      C(2)=-SINPSI*COSPHI+SINTHE*COSPSI*SINPHI
      C(3)=SINPSI*SINPHI+SINTHE*COSPSI*COSPHI
 2088 CONTINUE
C
C           CENTER WITHIN PAGE SIZE IF SIZE GREATER THAN 28 INCHES
C
      IF (PLOTSZ.GT.28..AND.TYPE.NE.3HVU3) VMIN=-13.*SCALE
     1+FLOAT(IFIX(VMID/SCALE))*SCALE
C
C           ROTATE MIDPOINT TO PLACE ROTATED VIEW CORRECTLY
C
      IF (ITEST2.EQ.0) GO TO 2095
      AMID1=A(1,1)*XMID+A(1,2)*YMID+A(1,3)*ZMID
      AMID2=A(2,1)*XMID+A(2,2)*YMID+A(2,3)*ZMID
      HMIN=HMIN-HMID+AMID1
      VMIN=VMIN-VMID+AMID2
 2095 CONTINUE
C
```

```
C          BEGIN PLOTTING LINES
C
C          WING
C
 2100 IF (J1.EQ.0) GO TO 2200
      DO 2120 I=1,2
      CALL PLOTIT (NWAF,NW,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2120 CONTINUE
      DO 2140 I=1,2
      CALL PLOTIT (NW,NWAF,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2140 CONTINUE
C
C          FUSELAGE
C
 2200 IF (J2.EQ.0) GO TO 2300
      DO 2210 NFU=1,NFUS
      NANG1=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      CALL PLOTIT (NANG1,NFUSOR,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2210 CONTINUE
      DO 2220 NFU=1,NFUS
      NANG1=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      CALL PLOTIT (NFUSOR,NANG1,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2220 CONTINUE
C
C          NACELLES
C
 2300 IF (J3.EQ.0) GO TO 2400
      NANG1=NAN2+1
      DO 2340 NP1=1,NP
      CALL PLOTIT (NANG1,NPODOR,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2340 CONTINUE
      DO 2360 NP1=1,NP
      CALL PLOTIT (NPODOR,NANG1,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2360 CONTINUE
C
C          FINS
C
 2400 IF (J4.EQ.0) GO TO 2500
      DO  2420 NF1=1,NF
      CALL PLOTIT  (NUM2,NFINOR,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
      CALL PLOTIT  (NUM2,NFINOR,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2420 CONTINUE
      DO 2440  NF1=1,NF
      CALL PLOTIT  (NFINOR,NUM2,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
      CALL PLOTIT  (NFINOR,NUM2,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2440 CONTINUE
C
C          CANARD
C
 2500 IF (J5.EQ.0) GO TO 2600
      DO 2525 NCA=1,NCAN
      DO 2520 I=1,2
      CALL PLOTIT (2,NC,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2520 CONTINUE
 2525 CONTINUE
      DO 2545 NCA=1,NCAN
      DO 2540 I=1,2
      CALL PLOTIT (NC,2,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
 2540 CONTINUE
 2545 CONTINUE
 2600 CONTINUE
      RETURN
C
C          END OF OTHPLT
C
      END
```

Subroutine PLOTIT

Subroutine PLOTIT reads lines of points and associated vectors from intermediate storage and calls for transformation of the points and vectors. It writes instructions for driving automatic equipment to plot the desired orthographic lines. The flow chart and the FORTRAN statements for this subroutine are as follows:

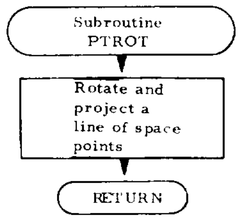


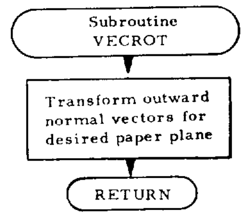
```
      SUBROUTINE PLOTIT (NL,NPT,ITEST,ITEST1,ITEST2,IHORZ,IVERT,
     1HMIN,VMIN,SCALE,A,C)
C
C           READS LINES OF POINTS DEFINING A SURFACE FROM TAPE,
C           MANIPULATES IN SPECIFIED MANNER, AND PLOTS
C
      DIMENSION VECRT(30,3,2),VECLF(30,3,2),ALINE(31,3),RLINE(31,2),
     1RVEC(30,2),XLINE(33,2),NNUM(4),PLINE(31,2),A(2,3),C(3)
C
C
      NVEC=NPT-1
      DO 500 N=1,NL
      IF (N.GT.1) GO TO 10
      KODE=3
      K1=2
      K2=2
      GO TO 50
   10 KODE=1
      K1=1
      K2=2
      DO 30 NV=1,NVEC
      DO 25 N3=1,3
      VECRT(NV,N3,1)=VECRT(NV,N3,2)
      VECLF(NV,N3,1)=VECLF(NV,N3,2)
   25 CONTINUE
   30 CONTINUE
C
   50 READ (10) ((ALINE(NN,N3),NN=1,NPT),N3=1,3)
      IF (N.NE.NL) GO TO 60
      KODE=2
      K1=1
      K2=1
      GO TO 70
   60 READ (10) ((VECRT(NN,N3,2),NN=1,NVEC),N3=1,3)
      DO 65 NN=1,NVEC
      VECLF(NN,1,2)=VECRT(NN,1,2)
      VECLF(NN,2,2)=-VECRT(NN,2,2)
   65 VECLF(NN,3,2)=VECRT(NN,3,2)
C
C           LOOP FOR RIGHT AND LEFT SIDE OF AIRCRAFT
C
   70 DO 490 NN2=1,2
      IF (NN2.EQ.1) GO TO 80
      DO 75 NN=1,NPT
   75 ALINE(NN,2)=-ALINE(NN,2)
   80 IF (ITEST1.EQ.1) GO TO 290
      IF (ITEST2.EQ.1) GO TO 200
C
C           NO ROTATION OR VISIBILITY TEST
C
      DO 110 NN=1,NPT
      XLINE(NN,1)=ALINE(NN,IHORZ)
  110 XLINE(NN,2)=ALINE(NN,IVERT)
      GO TO 250
C
C           ROTATE BUT NO VISIBILITY TEST
C
  200 CALL PTROT (NPT,A,ALINE,RLINE)
      DO 225 NN=1,NPT
      DO 225 N2=1,2
      XLINE(NN,N2)=RLINE(NN,N2)
  225 CONTINUE
C
C           SCALE AND PLOT
C
  250 XLINE(NPT+1,1)=HMIN
      XLINE(NPT+1,2)=VMIN
      XLINE(NPT+2,1)=SCALE
      XLINE(NPT+2,2)=SCALE
      CALL LINE (XLINE(1,1),XLINE(1,2),NPT,1,0,0,0)
      GO TO 490
  290 IF(ITEST2.EQ.1) GO TO 400
C
C           CHECK VISIBILITY BUT NO ROTATION
C
      DO 310 NN=1,NPT
      RLINE(NN,1)=ALINE(NN,IHORZ)
      RLINE(NN,2)=ALINE(NN,IVERT)
  310 CONTINUE
      DO 340 NN=1,NVEC
      DO 330 N2=1,2
      IF (NN2.EQ.2) GO TO 320
      RVEC(NN,N2)=VECRT(NN,ITEST,N2)
      GO TO 330
  320 RVEC(NN,N2)=VECLF(NN,ITEST,N2)
  330 CONTINUE
  340 CONTINUE
      GO TO 450
```

```
C
C         ROTATE AND CHECK VISIBILITY
C
  400 CALL PTROT(NPT,A,ALINE,RLINE)
      IF (NN2.EQ.2) GO TO 420
      DO 410 N2=K1,K2
      CALL VECROT (NVEC,C,VECRT(1,1,N2),RVEC(1,N2))
  410 CONTINUE
      GO TO 450
  420 DO 430 N2=K1,K2
      CALL VECROT (NVEC,C,VECLF(1,1,N2),RVEC(1,N2))
  430 CONTINUE
C
C         FIND VISIBLE LINES
C
  450 IF (ITEST.NE.2) GO TO 455
      DO 452 N2=K1,K2
      DO 452 M=1,NVEC
  452 RVEC(M,N2)=-RVEC(M,N2)
  455 CALL VISTST (KODE,NPT,NSET,NNUM,RLINE,RVEC,PLINE)
      IF (ITEST.NE.2) GO TO 460
      DO 457 N2=K1,K2
      DO 457 M=1,NVEC
  457 RVEC(M,N2)=-RVEC(M,N2)
  460 CONTINUE
      IF (NSET.EQ.0) GO TO 490
C
C         SCALE AND PLOT
C
      NIT=0
      DO 480 N1=1,NSET
      NN=NNUM(N1)
      DO 470 NN1=1,NN
      NIT=NIT+1
      XLINE(NN1,1)=PLINE(NIT,1)
      XLINE(NN1,2)=PLINE(NIT,2)
  470 CONTINUE
      XLINE(NN+1,1)=HMIN
      XLINE(NN+1,2)=VMIN
      XLINE(NN+2,1)=SCALE
      XLINE(NN+2,2)=SCALE
      CALL LINE (XLINE(1,1),XLINE(1,2),NN,1,0,0,0)
  480 CONTINUE
  490 CONTINUE
  500 CONTINUE
      RETURN
C
C         END OF PLOTIT
C
      END
```

Subroutines PTROT and VECROT

Subroutine PTROT rotates and projects a line of space points, and subroutine VECROT transforms a set of outward normal vectors. The flow charts and the FORTRAN statements for these subroutines are as follows:



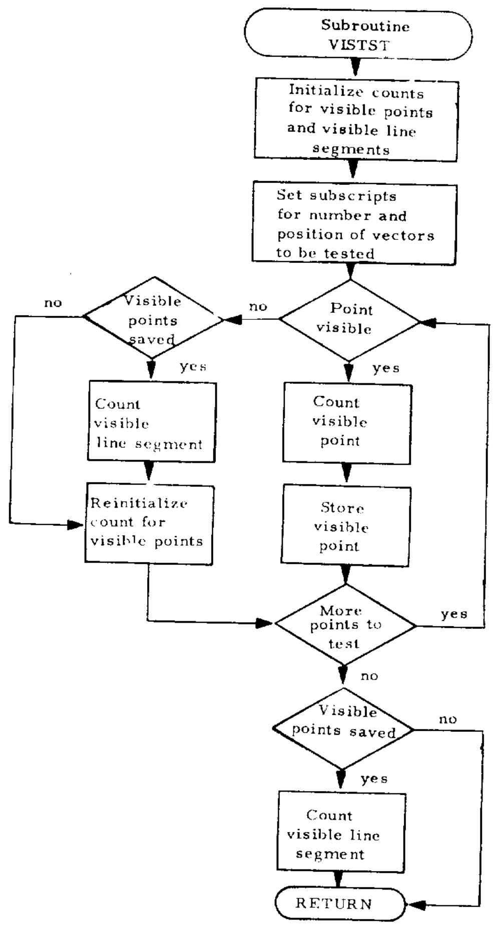



```
      SUBROUTINE PTROT (NPT,A,ALINE,RLINE)
C
C         ROTATES AND PROJECTS A SET OF 3D POINTS
C
      DIMENSION A(2,3),ALINE(31,3),RLINE(31,2)
C
C
      DO 10 N=1,NPT
      RLINE(N,1)=0.
      RLINE(N,2)=0.
      DO 5 I=1,2
      DO 5 J=1,3
    5 RLINE(N,I)=RLINE(N,I)+A(I,J)*ALINE(N,J)
   10 CONTINUE
      RETURN
C
C         END OF PTROT
C
      END
```

```
      SUBROUTINE VECROT (NVEC,C,FVEC,RVEC)
C
C         TRANSFORMS VECTORS
C
C
      DIMENSION C(3),FVEC(30,3),RVEC(30)
C
C
      DO 40 N=1,NVEC
      SUM=0.
      DO 20 NN=1,3
   20 SUM=SUM+C(NN)*FVEC(N,NN)
   40 RVEC(N)=SUM
      RETURN
C
C         END OF VECROT
C
      END
```

Subroutine VISTST

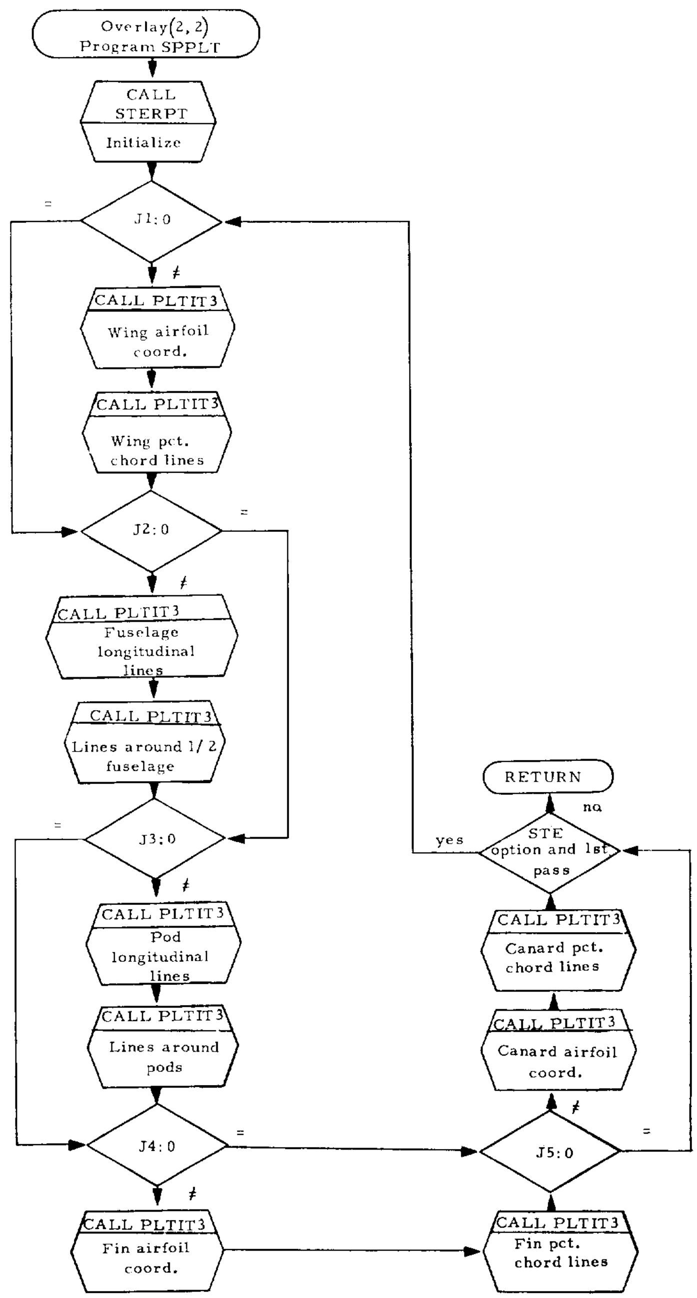
Subroutine VISTST tests a line of points for visibility. The flow chart and the FORTRAN statements for this subroutine are as follows:



```
      SUBROUTINE VISTST (KODE,NPT,NSET,NNUM,RLINE,RVEC,PLINE)
C
C          TESTS A LINE OF POINTS FOR VISIBILITY
C
      DIMENSION NNUM(4),RLINE(31,2),RVEC(30,2),PLINE(31,2)
C
C
      NVEC=NPT-1
      NPLT=0
      NSET=0
      ICOUNT=0
      GO TO (5,10,15),KODE
    5 N1=1
      N2=2
      GO TO 20
   10 N1=1
      N2=1
      GO TO 20
   15 N1=2
      N2=2
   20 DO 75 N=1,NPT
      IF (N.EQ.1) GO TO 30
      IF (N.EQ.NPT) GO TO 40
      DO 25 NN=N1,N2
      IF ((RVEC(N-1,NN).GT.0.).OR.(RVEC(N,NN).GT.0.)) GO TO 70
   25 CONTINUE
      GO TO 60
   30 DO 35 NN=N1,N2
      IF (RVEC(1,NN).GT.0.) GO TO 70
   35 CONTINUE
      GO TO 60
   40 DO 45 NN=N1,N2
      IF (RVEC(NVEC,NN).GT.0.) GO TO 70
   45 CONTINUE
C
C          POINT NOT VISIBLE
C
   60 IF (ICOUNT.LE.1) GO TO 65
      NSET=NSET+1
      NNUM(NSET)=ICOUNT
   65 ICOUNT=0
      GO TO 75
C
C          POINT IS VISIBLE
C
   70 NPLT=NPLT+1
      ICOUNT=ICOUNT+1
      PLINE(NPLT,1)=RLINE(N,1)
      PLINE(NPLT,2)=RLINE(N,2)
   75 CONTINUE
      IF (ICOUNT.LE.1) GO TO 85
      NSET=NSET+1
      NNUM(NSET)=ICOUNT
   85 RETURN
C
C          END OF VISTST
C
      END
```

Program SPPLT

Program SPPLT (overlay (2,2)) is the control routine for the perspective and stereo views. The flow chart and the FORTRAN statements for this program are as follows:

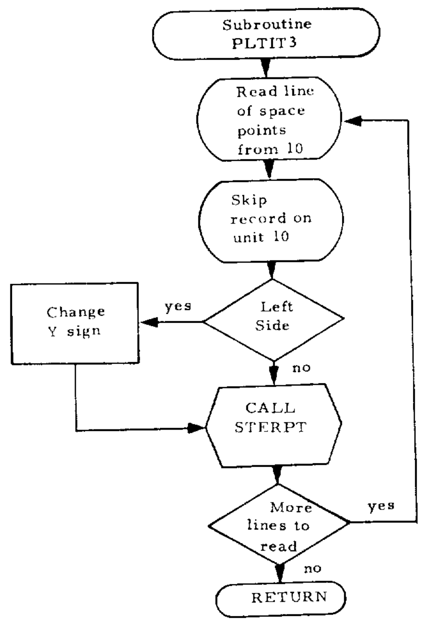


```
      OVERLAY   (CBC,2,2)
      PROGRAM   SPPLT
C
C         CONTROL ROUTINE FOR PERSPECTIVE AND STEREO
C
      COMMON ABC(8),J0,J1,J2,J3,J4,J5,J6,
     1NWAF,NWAFOR,NFUS,NRADX(4),NFORX(4),NP,NPODOR,
     2NF,NFINOR,NCAN,NCANOR,
     3J2TEST,NW,NC,
     4ABCDE(8),HORZ,VERT,TEST1,PHI,THETA,PSI,XF,YF,ZF,DIST,FMAG,
     5PLOTSZ,TYPE,KODE,
     6XMIN,XMAX,YMIN,YMAX,ZMIN,ZMAX,
     7XMID,YMID,ZMID,BIGD,ISP
C
C
      DIMENSION XINIT(2),YINIT(2),ZINIT(2)
C
      DATA NAN2/24/
C
      XINIT(1)=PHI
      XINIT(2)=XF
      YINIT(1)=THETA
      YINIT(2)=YF
      ZINIT(1)=PSI
      ZINIT(2)=ZF
      CALL STERPT(XINIT,YINIT,ZINIT,0,1,0,3,PLOTSZ,DIST,FMAG)
C
C         LOOP FOR RIGHT AND LEFT FRAMES
C
      DO 99 IC=1,ISP
      REWIND 10
      NCI=-IC
C
C         BEGIN PLOTTING LINES
C         WING
   10 IF (J1.EQ.0) GO TO 22
      DO 15 I=1,2
   15 CALL PLTIT3(NWAF,NW,PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
      DO 20 I=1,2
   20 CALL PLTIT3(NW,NWAF,PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
C
C         FUSELAGE
C
   22 IF (J2.EQ.0) GO TO 30
      DO 24 NFU=1,NFUS
      NANG1=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      CALL PLTIT3(NANG1,NFUSOR,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   24 CONTINUE
      DO 26 NFU=1,NFUS
      NANG1=NRADX(NFU)
      NFUSOR=NFORX(NFU)
      CALL PLTIT3(NFUSOR,NANG1,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   26 CONTINUE
C
C         NACELLES
C
   30 IF (J3.EQ.0) GO TO 40
      NANG1=NAN2+1
      DO 34 NP1=1,NP
      CALL PLTIT3(NANG1,NPODOR,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   34 CONTINUE
      DO 36 NP1=1,NP
      CALL PLTIT3(NPODOR,NANG1,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   36 CONTINUE
C
C         FINS
C
   40 IF (J4.EQ.0) GO TO 50
      DO 42 NF1=1,NF
      CALL PLTIT3(2,NFINOR,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   42 CALL PLTIT3(2,NFINOR,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
      DO 46 NF1=1,NF
      CALL PLTIT3(NFINOR,2,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   46 CALL PLTIT3(NFINOR,2,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
C
C         CANARD
C
   50 IF (J5.EQ.0) GO TO 60
      DO 56 NCA=1,NCAN
```

```
      DO 54 I=1,2
   54 CALL PLTIT3(2,NC,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   56 CONTINUE
      DO 59 NCA=1,NCAN
      DO 58 I=1,2
   58 CALL PLTIT3(NC,2,
     1PHI,THETA,PSI,XF,YF,ZF,PLOTSZ,DIST,FMAG,NCI)
   59 CONTINUE
   60 CONTINUE
   99 CONTINUE
      RETURN
C
C           END OF SPPLT
C
      END
```

Subroutine PLTIT3

Subroutine PLTIT3 reads lines of points from intermediate storage and calls subroutine STERPT for the perspective and stereo views. The flow chart and the FORTRAN statements for this subroutine are as follows:




```
      SUBROUTINE PLTIT3(NL,NPT,PHI,THETA,PSI,XF,YF,ZF,
     1PLOTSZ,DIST,FMAG,NCI)
C
C          READS LINES OF POINTS DEFINING A SURFACE FROM TAPE
C          AND PLOTS PERSPECTIVE VIEWS OR STEREO FRAMES
C
      DIMENSION ALINE(33,3)
C
      ALINE(NPT+1,1)=PHI
      ALINE(NPT+2,1)=XF
      ALINE(NPT+1,2)=THETA
      ALINE(NPT+2,2)=YF
      ALINE(NPT+1,3)=PSI
      ALINE(NPT+2,3)=ZF
      DO 500 N=1,NL
      READ (10)((ALINE(NN,N3),NN=1,NPT),N3=1,3)
      IF (N.EQ.NL) GO TO 70
C
C          SKIP VECTORS
C
      READ (10)VEC
C
C          LOOP FOR RIGHT AND LEFT SIDE OF AIRCRAFT
C
   70 DO 490 NN2=1,2
      IF (NN2.EQ.1) GO TO 80
      DO 75 NN=1,NPT
   75 ALINE(NN,2)=-ALINE(NN,2)
   80 CALL STERPT(ALINE(1,1),ALINE(1,2),ALINE(1,3),NPT,1,NCI,
     13,PLOTSZ,DIST,FMAG)
  490 CONTINUE
  500 CONTINUE
      RETURN
C
C          END OF PLTIT3
C
      END
```

Subroutine STERPT

By George C. Salley
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Subroutine STERPT generates instructions for driving automatic equipment to plot the perspective projection of data for a given three-dimensional array. Two passes through this subroutine will generate instructions for a pair of stereo frames. The FORTRAN statements for this subroutine are as follows:

```
      SUBROUTINE STERPT (X,Y,Z,N,K,NC,IP,PAG,PLA,XPR)
C
C         PROGRAMER - GEORGE C. SALLEY
C
      DIMENSION VP(3), TRAN(3), SANG(3), CANG(3), ADJ(3), PT(4), XLP(2),
     1ZLP(2)
      DIMENSION X(1), Y(1), Z(1)
      DIMENSION PLX(4), PLY(4), PLZ(2)
      DIMENSION PIX(4), PIY(4), PIZ(2)
      DIMENSION ILP(4), IPL(4)
      DATA PI,PI2,PI32,PI42/3.1415926,1.5707963,4.7123889,6.2831952/
      DATA PAR/1.125/
      DATA NPG/0/
      DATA NPT/1/
      DATA FRAME/9.80/
      DATA TURN/11.01/
      NO=1
      KK=K
      II=IP
      IF (NC) 80,5,110
C     *
5     NP=N*K+1
      NR=NP+K
      PLIM=PAG/2.
      SF=XPR
      VPL=PLA
      DO 10 I=1,4
      PLX(I)=0.
      PLY(I)=0.
      PIX(I)=0.
      PIY(I)=0.
      IPL(I)=0
10    ILP(I)=0
      DO 15 I=1,2
      PLZ(I)=0.
15    PIZ(I)=0.
      VPX=X(NP)
      VPY=Y(NP)
      VPZ=Z(NP)
      FPX=X(NR)
      FPY=Y(NR)
      FPZ=Z(NR)
      VX=VPX-FPX
      VY=VPY-FPY
```

```
      VZ=VPZ-FPZ
      VP(2)=SQRT((VX**2)+(VY**2))
      VP(3)=SQRT((VZ**2)+(VP(2)**2))
      TRAN(1)=VPX-(VPL*(VX/VP(2)))
      TRAN(2)=VPY-(VPL*(VY/VP(2)))
      TRAN(3)=VPZ-(VPL*(VZ/VP(3)))
      VANG=ATAN((PAR/VP(3)))
      IF (VX) 55,20,35
20    IF (VY) 30,300,25
25    PANG=PI2
      GO TO 75
30    PANG=PI32
      GO TO 75
35    IF (VY) 50,40,45
40    PANG=0.
      GO TO 75
45    PANG=ATAN((VY/VX))
      GO TO 75
50    PANG=PI42-ATAN(((ABS(VY))/VX))
      GO TO 75
55    IF (VY) 70,60,65
60    PANG=PI
      GO TO 75
65    PANG=PI-ATAN((VY/(ABS(VX))))
      GO TO 75
70    PANG=PI+ATAN(((ABS(VY))/(ABS(VX))))
75    PANG=PI32-PANG
      UANG=PANG-VANG
      RANG=UANG+(2.*VANG)
      SANG(1)=SIN(UANG)
      SANG(2)=SIN(RANG)
      CANG(1)=COS(UANG)
      CANG(2)=COS(RANG)
      SANG(3)=VZ/VP(3)
      CANG(3)=VP(2)/VP(3)
      VP(3)=VPL
      XLP(1)=0.
      ZLP(1)=0.
      XLP(2)=FRAME
      ZLP(2)=0.
      ADJ(1)=PLIM
      ADJ(2)=PLIM
      ADJ(3)=ADJ(2)+FRAME
      IF (N) 300,300,110
80    M=IABS(NC)
      L=M
      IF (NPG+NC) 115,85,115
85    IF (2+NC) 300,95,90
90    NPG=2
      GO TO 100
95    NPG=1
100   CONTINUE
      DO 105 I=1,L
      CALL CALPLT (TURN,0.,-3)
  105 CONTINUE
      CALL CALPLT (XLP(M),ZLP(M),3)
      GO TO 115
110   M=1
      L=2
115   DO 295 I=M,L
      IF (NPG) 300,120,150
120   IF (NC) 125,145,145
125   IF (NPT+NC) 150,130,150
130   IF (2+NC) 300,140,135
135   NPT=2
      GO TO 145
140   NPT=1
145   CONTINUE
      CALL CALPLT (XLP(I),ZLP(I),3)
150   DO 290 J=1,N
      PT(1)=((X(NO)-TRAN(1))*CANG(I))-((Y(NO)-TRAN(2))*SANG(I))
      PT(4)=((X(NO)-TRAN(1))*SANG(I))+((Y(NO)-TRAN(2))*CANG(I))
      PT(2)=((PT(4)*CANG(3))-((Z(NO)-TRAN(3))*SANG(3)))
      PT(3)=((PT(4)*SANG(3))+((Z(NO)-TRAN(3))*CANG(3)))
      IF (PT(2)) 155,180,180
155   IF (ILP(I)) 300,160,175
160   IF (II-3) 165,170,300
165   VX=PLX(I)-PT(1)
      VY=PLY(I)-PT(2)
      VZ=PLZ(I)-PT(3)
      VP(1)=SQRT((VX**2)+(VY**2))
      VP(2)=SQRT((VZ**2)+(VP(1)**2))
      VPL=PLY(I)/(VY/VP(1))
      PT(4)=PLX(I)-((VX/VP(1))*VPL)
      PLX(I)=PT(1)
      PT(1)=PT(4)
      PLY(I)=PT(2)
      PT(2)=0.
```

```
      PT(4)=PLZ(I)-((VZ/VP(2))*VPL)
      PLZ(I)=PT(3)
      PT(3)=PT(4)
      ILP(I)=1
      GO TO 205
170   ILP(I)=1
175   PLX(I)=PT(1)
      PLY(I)=PT(2)
      PLZ(I)=PT(3)
      GO TO 270
180   IF (ILP(I)) 300,200,185
185   IF (II-3) 190,195,300
190   II=3
      IPL(I)=1
      PIX(I)=PT(1)
      PIY(I)=PT(2)
      PIZ(I)=PT(3)
      VX=PT(1)-PLX(I)
      VY=PT(2)-PLY(I)
      VZ=PT(3)-PLZ(I)
      VP(1)=SQRT((VX**2)+(VY**2))
      VP(2)=SQRT((VZ**2)+(VP(1)**2))
      VPL=PT(2)/(VY/VP(1))
      PT(2)=0.
      PT(1)=PT(1)-((VX/VP(1))*VPL)
      PT(3)=PT(3)-((VZ/VP(2))*VPL)
195   ILP(I)=0
200   PLX(I)=PT(1)
      PLY(I)=PT(2)
      PLZ(I)=PT(3)
205   XP=(PT(1)+(PT(2)*(-PT(1))/(PT(2)+VP(3))))*SF
      ZP=(PT(3)+(PT(2)*(-PT(3))/(PT(2)+VP(3))))*SF
      VPL=SQRT((XP**2)+(ZP**2))
      IF (VPL-PLIM) 235,235,210
210   IF (ILP(I+2)) 300,215,230
215   IF (II-3) 394,225,300
  394 IF(PLX(I+2)-XP)212,211,212
 211  PLX(I+2)=XP
      PLY(I+2)=ZP
      XP=PLIM*(XP/VPL)
      ZP=PLIM*(ZP/VPL)
      GO TO 337
 212  R= (PLY(I+2)-ZP)/ (PLX(I+2)-XP )
 213  PLXX=PLX(I+2) $ PLYY=PLY(I+2)
      B= ZP -R*XP
      XXP=XP  $ ZZP=ZP
      XA= (-R*B -SQRT( -B**2+(R**2)*(PLIM**2)+PLIM**2))/(R**2 +1 )
      YA=R*XA+B
      III=MMM=0
      IPLXX=PLXX*10**3
      IPLYY=PLYY*10**3
      IXXP=XXP*10**3
      IZZP=ZZP*10**3
      PLXX=IPLXX/(10**3*1.)
      PLYY=IPLYY/(10**3*1.)
      XXP=IXXP/(10**3*1.)
      ZZP=IZZP/(10**3*1.)
  316 CONTINUE
      IXA=XA*10**3
      IYA=YA*10**3
      XX=IXA/((10**3)*1.)
      YY=IYA/((10**3)*1.)
      IF(PLYY- ZZP) 303,302,301
  301 IF(YY.GE.ZZP.AND.YY.LE.PLYY) GO TO 304
      GO TO  320
 302  YY=ZZP
      GO TO 304
  303 IF(YY.GE.PLYY .AND.YY.LE.ZZP) GO TO 304
      GO TO 320
  304 IF(PLXX-XXP) 307,220,305
  305 IF(XX.GE.XXP.AND.XX.LE.PLXX) GO TO 220
      GO TO320
  307 IF(XX.GE.PLXX .AND.XX.LE.XXP) GO TO 220
  320 IF(III.EQ.0) GO TO  321
      STOP 3333
  321 III=1
      XA= (-R*B  +SQRT( -B**2 + R**2*PLIM**2  +PLIM**2)) /(R**2 +1)
      YA=R*XA+B
      GO TO 316
220   PLX(I+2)=XP
      PLY(I+2)=ZP
      XP=XX
      ZP=YY
      III=0
  337 ILP(I+2)=1
      GO TO 265
225   ILP(I+2)=1
230   PLX(I+2)=XP
```

```
      PLY(I+2)=ZP
      GO TO 270
235   IF (ILP(I+2)) 300,255,240
240   IF (II-3) 245,250,300
245   II=3
      IPL(I+2)=1
      PIX(I+2)=XP
      PIY(I+2)=ZP
      IF(PLX(I+2).NE.XP) GO TO 400
      VPL=SQRT((PLX(I+2)**2)+(PLY(I+2)**2))
      PIX(I+2)=XP
      PIZ(I+2)=ZP
      GO TO 250
 400  R= (PLY(I+2)-ZP)/ (PLX(I+2)-XP )
 455  PLXX=PLX(I+2) $ PLYY=PLY(I+2)
      B= ZP -R*XP
      XXP=XP   $ ZZP=ZP
      XA= (-R*B -SQRT( -B**2+(R**2)*(PLIM**2)+PLIM**2))/(R**2 +1  )
      YA=R*XA+B
      III=MMM=0
      IPLXX=PLXX*10**4
      IPLYY=PLYY*10**4
      IXXP=XXP*10**4
      IZZP=ZZP*10**4
      PLXX=IPLXX/(10**4*1.)
      PLYY=IPLYY/(10**4*1.)
      XXP=IXXP/(10**4*1.)
      ZZP=IZZP/(10**4*1.)
 416  IXA=XA*10**4
      IYA=YA*10**4
      XX=IXA/((10**4)*1.)
      YY=IYA/((10**4)*1.)
      IF(PLYY- ZZP) 403,402,401
  401 IF(YY.GE.ZZP.AND.YY.LE.PLYY) GO TO 404
      GO TO  420
  402 YY=ZZP
      GO TO 404
  403 IF(YY.GE.PLYY .AND.YY.LE.ZZP) GO TO 404
      GO TO 420
  404 IF(PLXX-XXP) 407,246,405
  405 IF(XX.GE.XXP.AND.XX.LE.PLXX) GO TO 246
      GO TO420
  407 IF(XX.GE.PLXX .AND.XX.LE.XXP) GO TO 246
  420 IF(III.EQ.0) GO TO  421
      STOP 6666
  421 III=1
      XA= (-R*B  +SQRT( -B**2 + R**2*PLIM**2  +PLIM**2)) /(R**2 +1)
      YA=R*XA+B
      GO TO 416
  246 XP=XX
      ZP=YY
      III=0
250   ILP(I+2)=0
      GO TO 260
255   IF ((SQRT(((PLX(I+2))**2)+((PLY(I+2))**2)))-PLIM) 260,260,240
260   PLX(I+2)=XP
      PLY(I+2)=ZP
265   XPT=XP+ADJ(I+1)
      YPT=ZP+ADJ(I)
      CALL CALPLT (XPT,YPT,II)
270   II=2
      IF (IPL(I+2)) 300,280,275
275   IPL(I+2)=0
      XP=PIX(I+2)
      ZP=PIY(I+2)
      GO TO 255
280   IF (IPL(I)) 300,290,285
285   IPL(I)=0
      PT(1)=PIX(I)
      PT(2)=PIY(I)
      PT(3)=PIZ(I)
      GO TO 200
290   NO=NO+KK
      XLP(I)=XPT
      ZLP(I)=YPT
      NO=1
295   II=IP
300   CONTINUE
      RETURN
      END
```

PROGRAM USE

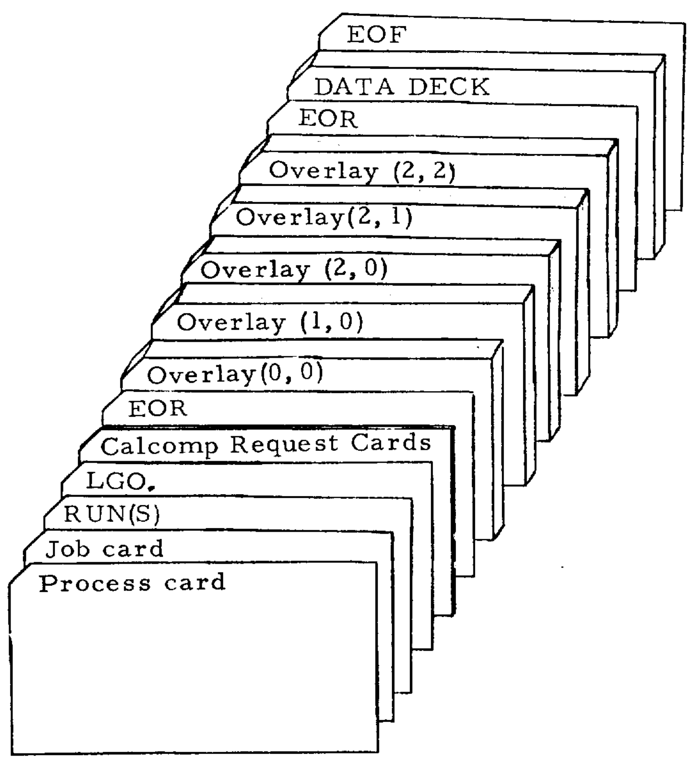
PROGRAM IDENTIFICATION

This program is for airplane configuration plots and is identified as program D2290.

PROGRAM SETUP FOR A COMPILE AND EXECUTE

This section describes the input data requirements, limitations, and the punched card formats. Samples of the input data sheets for preparation by the user are shown in figure 7.

The input data cards are assembled with the program decks in the order illustrated below:



DESCRIPTION OF INPUT DATA CARDS

Configuration

Since the airplane has to be symmetrical about the XZ-plane, only half of the airplane need be described to the computer. The convention used in presenting the input data is that the half of the airplane on the positive Y-side of the XZ-plane is presented. The program then uses this information to construct the complete airplane. The number of input cards depends on the number of components used to describe the configuration, whether a component has been described previously, and the amount of detail used to describe each component. The method of input is by FORTRAN "READ" statements.

Card 1 – Identification.- Card 1 contains any desired identifying information in columns 1 to 80. (See fig. 7(a).)

Card 2 – Control integers.- Card 2 contains 24 integers, each punched right justified in a 3-column field. (See fig. 7(a).) Columns 73 to 80 may be used in any desired manner. An identification of the card columns, the name used by the source program, and a description of each integer is given in the following table:

Columns	FORTRAN Name	Description
01 to 03	J0	If J0 = 0, no reference area If J0 = 1, reference area to be read If J0 = 2, reference area same as previously read
04 to 06	J1	If J1 = 0, no wing data If J1 = 1, cambered wing data to be read If J1 = -1, uncambered wing data to be read If J1 = 2, wing data same as previously read
07 to 09	J2	If J2 = 0, no fuselage data If J2 = 1, data for arbitrarily shaped fuselage to be read If J2 = -1, data for circular fuselage to be read (with J6 = 0, fuselage will be cambered; with J6 = -1, fuselage will be symmetrical with XY-plane; with J6 = 1, entire configuration will be symmetrical with XY-plane) If J2 = 2, fuselage data same as previously read

Columns	FORTRAN Name	Description
10 to 12	J3	If J3 = 0, no pod data If J3 = 1, pod data to be read If J3 = 2, pod data same as previously read
13 to 15	J4	If J4 = 0, no fin data If J4 = 1, fin data to be read If J4 = 2, fin data same as previously read
16 to 18	J5	If J5 = 0, no canard data If J5 = 1, canard data to be read If J5 = 2, canard data same as previously read
19 to 21	J6	Simplification code: If J6 = 0, indicates a cambered circular or arbitrary fuselage if $J2 \neq 0$ If J6 = 1, complete configuration is symmetrical with respect to XY-plane, which implies uncambered circular fuselage if there is a fuselage If J6 = -1, indicates uncambered circular fuselage with $J2 \neq 0$
22 to 24	NWAF	Number of airfoil sections used to describe the wing; $2 \leq \text{NWAF} \leq 20$
25 to 27	NWAFOR	Number of ordinates used to define each wing airfoil section; $3 \leq \text{NWAFOR} \leq 30$
28 to 30	NFUS	Number of fuselage segments; $1 \leq \text{NFUS} \leq 4$
31 to 33	NRADX(1)	Number of points used to represent half-section of first fuselage segment; if fuselage is circular, the program computes indicated number of y- and z-ordinates; $3 \leq \text{NRADX(1)} \leq 30$
34 to 36	NFORX(1)	Number of stations for first fuselage segment; $4 \leq \text{NFORX(1)} \leq 30$
37 to 39 40 to 42	NRADX(2) NFORX(2)	Same as NRADX(1) and NFORX(1), but for second fuselage segment
43 to 45 46 to 48	NRADX(3) NFORX(3)	Same as NRADX(1) and NFORX(1), but for third fuselage segment

Columns	FORTRAN Name	Description
49 to 51	NRADX(4)	Same as NRADX(1) and NFORX(1), but for fourth fuselage segment
52 to 54	NFORX(4)	
55 to 57	NP	Number of pods described; NP ≤ 9
58 to 60	NPODOR	Number of stations at which pod radii are to be specified; 4 ≤ NPODOR ≤ 30
61 to 63	NF	Number of fins (vertical tails) described; NF ≤ 6
64 to 66	NFINOR	Number of ordinates used to define each fin airfoil section; 3 ≤ NFINOR ≤ 10
67 to 69	NCAN	Number of canards (horizontal tails) described; NCAN ≤ 2
70 to 72	NCANOR	Number of ordinates used to define each canard airfoil section; 3 ≤ NCANOR ≤ 10; if NCANOR is given a negative sign, the program will expect to read lower ordinates also; otherwise, airfoil is assumed to be symmetrical

Cards 3, 4, . . . – remaining data input cards.- The remaining data input cards contain a detailed description of each component of the airplane. (See fig. 7(a).) Each card contains up to 10 values, each value punched in a 7-column field with a decimal and may be identified in columns 73 to 80. The cards are arranged in the following order: reference area, wing data cards, fuselage data cards, pod (or nacelle) data cards, fin (vertical tail) data cards, and canard (or horizontal tail) data cards.

Reference area card: The reference area value is punched in columns 1 to 7 and may be identified as REFA in columns 73 to 80.

Wing data cards: The first wing data card (or cards) contains the locations in percent chord at which the ordinates of all the wing airfoils are to be specified. There will be exactly NWAFOR locations in percent chord given. Each card may be identified in columns 73 to 80 by the symbol XAF j where j denotes the number of the last location in percent chord given on that card. For example, if NWAFOR = 16, there are 16 ordinates to be specified for every airfoil, and two data cards will be required. The first XAF card is identified as XAF 10 and the second as XAF 16.

The next wing data cards (there will be NWAF cards) each contain four numbers which give the origin and chord length of each of the wing airfoils that is to be specified.

The cards representing the most inboard airfoil are given first, followed by the cards for successive airfoils. The information is arranged on each card as follows:

Columns	Description
1 to 7	x-ordinate of airfoil leading edge
8 to 14	y-ordinate of airfoil leading edge
15 to 21	z-ordinate of airfoil leading edge
22 to 28	airfoil streamwise chord length
73 to 80	card identification, WAFORGj where j denotes the particular airfoil; for example, WAFORG 1 denotes first (most inboard) airfoil

If a cambered wing has been specified, the next set of wing data cards is the mean camber line (TZORD) cards. The first card contains up to 10 Δz values, referenced to the z-ordinate of the airfoil leading edge, at each of the specified percents of chord for the first airfoil. If more than 10 values are to be specified for each airfoil (there will be NWAFOR values), the remaining values are continued on successive cards. The remaining airfoils are described in the same manner, data for each airfoil starting on a new card, and the cards arranged in the order which begins with the most inboard airfoil and proceeds to the outboard. Each card may be identified in columns 73 to 80 as TZORDj, where j denotes the particular airfoil.

Next are the wing airfoil ordinate (WAFORD) cards. The first card contains up to 10 half-thickness ordinates of the first airfoil expressed as percent chord. If more than 10 ordinates are to be specified for each airfoil (there will be NWAFOR values), the remaining ordinates are continued on successive cards. The remaining airfoils are each described in the same manner, and the cards are arranged in the order which begins with the most inboard airfoil and proceeds to the outboard. Each card may be identified in columns 73 to 80 as WAFORDj, where j denotes the particular airfoil.

Fuselage data cards: The first card (or cards) specifies the x values of the fuselage stations of the first segment. There will be NFORX(1) values and the cards may be identified in columns 73 to 80 by the symbol XFUSj where j denotes the number of the last fuselage station given on that card.

If the fuselage is circular and cambered, the next set of cards specifies the z locations of the center of the circular sections. There will be NFORX(1) values and the cards may be identified in columns 73 to 80 by the symbol ZFUSj where j denotes the number of the last fuselage station given on that card.

If the fuselage is circular, the next card (or cards) gives the fuselage cross-sectional areas, and may be identified in columns 73 to 80 by the symbol FUSARDj where j denotes the number of the last fuselage station given on that card. If the fuselage is of arbitrary shape, the y-ordinates for a half-section are given (NRADX(1) values) and identified in columns 73 to 80 as Yi where i is the station number. Following these are the corresponding z-ordinates (NRADX(1) values) for the half-section identified in columns 73 to 80 as Zi where i is the station number. Each station will have a set of Y and Z cards, and the convention of ordering the ordinates from bottom to top is observed.

For each fuselage segment a new set of cards as described must be provided. The segment descriptions should be given in order of increasing values of x.

Pod data cards: The first pod or nacelle data card specifies the location of the origin of the first pod. The information is arranged on the card as follows:

Columns	Description
1 to 7	x-ordinate of origin of first pod
8 to 14	y-ordinate of origin of first pod
15 to 21	z-ordinate of origin of first pod
73 to 80	card identification, PODORGj where j denotes pod number

The next pod input data card (or cards) contains the x-ordinates, referenced to the pod origin, at which the pod radii (there will be NPODOR of them) are to be specified. The first x-value must be zero, and the last x-value is the length of the pod. These cards may be idenfied in columns 73 to 80 by the symbol XPODj where j denotes the pod number. For example, XPOD1 represents the first pod.

The next pod input data cards give the pod radii corresponding to the pod stations that have been specified. These cards may be identified in columns 73 to 80 as PODRj where j denotes the pod number.

For each additional pod, new PODORG, XPOD, and PODR cards must be provided. Only single pods are described but the program assumes that if the y-ordinate is not zero an exact duplicate is located symmetrically with respect to the XZ-plane; a y-ordinate of zero implies a single pod.

Fin data cards: Exactly three data input cards are used to describe a fin. The information presented on the first fin data input card is as follows:

Columns	Description
1 to 7	x-ordinate of lower airfoil leading edge
8 to 14	y-ordinate of lower airfoil leading edge
15 to 21	z-ordinate of lower airfoil leading edge
22 to 28	chord length of lower airfoil
29 to 35	x-ordinate of upper airfoil leading edge
36 to 42	y-ordinate of upper airfoil leading edge
43 to 49	z-ordinate of upper airfoil leading edge
50 to 56	chord length of upper airfoil
73 to 80	card identification, FINORGj where j denotes fin number

The second fin data input card contains up to 10 locations in percent chord (exactly NFINOR of them) at which the fin airfoil ordinates are to be specified. The card may be identified in columns 73 to 80 as XFINj where j denotes the fin number.

The third fin data input card contains the fin airfoil half-thickness ordinates expressed in percent chord. Since the fin airfoil must be symmetrical, only the ordinates on the positive y side of the fin chord plane are specified. The card identification, FINORDj, may be given in columns 73 to 80, where j denotes the fin number.

For each fin, new FINORG, XFIN, and FINORD cards must be provided.

Only single fins are described but the program assumes that if the y-ordinate is not zero an exact duplicate is located symmetrically with respect to the XZ-plane; a y-ordinate of zero implies a single fin.

Canard data cards: If the canard (or horizontal tail) airfoil is symmetrical, exactly three cards are used to describe a canard, and the input is given in the same manner as for the fin. If, however, the canard airfoil is not symmetrical (indicated by a negative value of NCANOR), a fourth canard data input card will be required to give the lower ordinates. The information presented on the first canard data input card is as follows:

Columns	Description
1 to 7	x-ordinate of inboard airfoil leading edge
8 to 14	y-ordinate of inboard airfoil leading edge
15 to 21	z-ordinate of inboard airfoil leading edge
22 to 28	chord length of inboard airfoil

Columns	Description
29 to 35	x-ordinate of outboard airfoil leading edge
36 to 42	y-ordinate of outboard airfoil leading edge
43 to 49	z-ordinate of outboard airfoil leading edge
50 to 56	chord length of outboard airfoil
73 to 80	card identification, CANORGj where j denotes the canard number

The second canard data input card contains up to 10 locations in percent chord (exactly NCANOR of them) at which the canard airfoil ordinates are to be specified. The card may be identified in columns 73 to 80 as XCANj where j denotes the canard number.

The third canard data input card contains the upper half-thickness ordinates, expressed in percent chord, of the canard airfoil. This card may be identified in columns 73 to 80 as CANORDj where j denotes the canard number. If the canard airfoil is not symmetrical, the lower ordinates are presented on a second CANORD card. The program expects both upper and lower ordinates to be punched as positive values in percent chord.

For another canard, new CANORG, XCAN, and CANORD cards must be provided.

Plot Cards

A single card contains all the necessary information for one plot. The available options and the necessary input for each are described in the succeeding sections.

Orthographic projections.- For orthographic projections, the card should be set up as follows (see fig. 7(b)):

Columns	FORTRAN Name	Description
1	HORZ	"X", "Y", or "Z" for horizontal axis
3	VERT	"X", "Y", or "Z" for vertical axis
5 to 7	TEST1	Word "OUT" for deletion of hidden lines; otherwise, leave blank
8 to 12	PHI	Roll angle, degrees
13 to 17	THETA	Pitch angle, degrees
18 to 22	PSI	Yaw angle, degrees
48 to 52	PLOTSZ	PLOTSZ determines the size of plot (scale factor is computed using PLOTSZ and maximum dimension of configuration)

Columns	FORTRAN Name	Description
53 to 55	TYPE	Word "ORT"
72	KODE	If KODE = 0, continue reading plot cards If KODE = 1, after processing this plot, read new configuration description

An attempt is made to center the given configuration within the specified field. If the desired plot size is greater than 28 inches, centering is attempted within 28 inches so care must be taken in choosing the view. Minimum values are adjusted so that body axis lines with no rotation angles coincide with grid lines on the plotter paper. Therefore, the plotter pen should always be positioned exactly 1 inch from the side of the plotting space and on the intersection of heavy grid lines at the start of plotting.

Plan, front, and side views (stacked).- For plan, front, and side views, the card should be set up as follows (see fig. 7(b)):

Columns	FORTRAN Name	Description
8 to 12	PHI	y-origin on paper of plan view, inches
13 to 17	THETA	y-origin on paper of side view, inches
18 to 22	PSI	y-origin on paper of front view, inches
48 to 52	PLOTSZ	PLOTSZ determines size of plot (a scale factor is computed using PLOTSZ and maximum dimension of configuration)
53 to 55	TYPE	Word "VU3"
72	KODE	If KODE = 0, continue reading plot cards If KODE = 1, after processing this plot, read new configuration description

Perspective views.- For perspective views, the card should be set up as follows (see fig. 7(b)):

Columns	FORTRAN Name	Description
8 to 12	PHI	x of view point (location of viewer) in data coordinate system
13 to 17	THETA	y of view point in data coordinate system
18 to 22	PSI	z of view point in data coordinate system

Columns	FORTRAN Name	Description
23 to 27	XF	x of focal point (determines direction and focus) in data coordinate system
28 to 32	YF	y of focal point in data coordinate system
33 to 37	ZF	z of focal point in data coordinate system
38 to 42	DIST	Distance from eye to viewing plane, inches
43 to 47	FMAG	Viewing-plane magnification factor; it controls size of projected image
48 to 52	PLOTSZ	Diameter of viewing plane, inches; DIST and PLOTSZ together determine a cone which is field of vision; PLOTSZ value is also relative to type of viewer which is to be used.
53 to 55	TYPE	Word "PER"
72	KODE	If KODE = 0, continue reading plot cards If KODE = 1, after processing this plot, read new configuration description.

Stereo frames suitable for viewing in a stereoscope.- For stereo frames suitable for viewing in a stereoscope, the input is identical to that for the perspective views except that the word "STE" is used in columns 53 to 55.

OUTPUT

The card images of all the input data – configuration description and plot cards – are printed. The necessary instructions for driving automatic plotting equipment are written on a scratch file.

MACHINE SETUP

This program was written in FORTRAN Version 2.0 for Control Data series 6000 computer systems with the Scope 3 operating system and library tape. Tape unit 5 is used for input, unit 6 for output, and units 9, 10, and 12 for intermediate storage. Approximately 55000 octal locations of core storage are required and the processing of information for one plot is less than 1 minute of computer time.

The decoupled version of the plotting system routes plotter output to a scratch file during job execution; therefore, this file has to be copied to a tape file at job completion for off-line plotting on a CalComp digital incremental plotter. The plotter pen should always be positioned at least 1 inch in the positive y-direction at the beginning of plotting. If grid paper is used, the starting pen location should be exactly at an x of zero and a y of 1 inch.

OPERATIONAL DETAILS

Subroutines CALCOMP, CALPLT, NOTATE, and LINE are the basic subroutines used from the CalComp software package. Subroutine CALCOMP causes the necessary parameters and linkage to be set up to output a file in suitable form for a CalComp digital incremental plotter. Subroutine CALPLT causes the plotter pen to move to a new location with pen either up or down. Subroutine NOTATE draws alphanumeric information for annotation and labeling. Subroutine LINE draws a continuous line through a set of successive data points where the minimum values and scale factors are stored at the end of the data arrays.

CONCLUDING REMARKS

A digital computer program (D2290) is presented which generates the necessary instructions for automatic plotting of an airplane numerical model. Program options may be used to draw three-view and oblique orthographic projections, as well as perspective projections of an airplane. These plots are useful in checking the accuracy of the numerical model data. Magnetic tape output from this program has been used to drive a CalComp plotter and a Gerber plotter. The program has also been used for online display of a configuration on a cathode-ray-tube device.

Langley Research Center,
National Aeronautics and Space Administration,
Hampton, Va., May 13, 1970.

TABLE I.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR THE ORTHOGRAPHIC PRESENTATIONS SHOWN IN FIGURES 1 TO 3

```
                        SST CONFIGURATION WITH CAMBERED CIRCULAR BODY
 1   1 -1   1   1        12 13   1 17 26                          2 10   3 10
9494.                                                                           REFA
0       .1      .6       10.0     20.0     30.0     40.0     50.0     60.0     70.0     XAF    10
80.0    90.0    100.0                                                                   XAF    13
82.30   5.05    0.       180.100                                                        WAFORG  1
93.80   6.60    0.       166.201                                                        WAFORG  2
114.1999.90     -.45     142.351                                                        WAFORG  3
130.629 13.20   -1.40    124.870                                                        WAFORG  4
157.98  19.80   -1.85    98.570                                                         WAFORG  5
181.29  26.40   -1.15    78.510                                                         WAFORG  6
202.41  33.00   -.35     61.241                                                         WAFORG  7
221.63   39.60  -1.60    47.819                                                         WAFORG  8
239.18  46.20   -2.80    36.719                                                         WAFORG  9
255.00  52.80   -3.75    25.35                                                          WAFORG10
269.23  59.40   -4.30    15.670                                                         WAFORG11
282.00  66.00   -4.40    7.400                                                          WAFORG12
3.60    3.70    3.90     3.75     2.75     .95      -1.35    -3.45    -5.30    -6.80    TZORD  1
-8.20   -9.10   -9.40                                                                   TZORD  1
.10     .50     1.75     2.00     2.10     1.20     -.05     -1.85    -3.25    -4.70    TZORD  2
-6.30   -7.70   -8.80                                                                   TZORD  2
0.      .35     .90      1.20     1.35     .70      -.20     -1.20    -2.35    -3.45    TZORD  3
-4.55   -5.75   -6.80                                                                   TZORD  3
0.      .165    .72      .93      1.0      .6875    .15      -.56     -1.35    -2.205   TZORD  4
-3.07   -3.9375 -4.801                                                                  TZORD  4
0.      .10     .45      .60      .72      .695     .40      .0875    -.295    -.7825   TZORD  5
-1.15   -1.685  -2.173                                                                  TZORD  5
0.      .05     .285     .42      .5925    .625     .47      .3125    .12      -.10     TZORD  6
-.345   -.6175  -.8989                                                                  TZORD  6
0.      .04     .1935    .2765    .3950    .4395    .4330    .3860    .3085    .2075    TZORD  7
.0915   -.0390  -.1820                                                                  TZORD  7
0.      .0225   .1085    .160     .249     .2980    .3135    .3040    .2780    .2380    TZORD  8
.185    .1235   .0568                                                                   TZORD  8
0.      .02     .1055    .1580    .248     .2858    .305     .311     .308     .2995    TZORD  9
.2845   .2635   .2385                                                                   TZORD  9
0.      .0085   .049     .0695    .1175    .144     .155     .158     .1595    .1585    TZORD 10
.1545   .148    .1398                                                                   TZORD 10
0.      -.003   -.014    -.023    -.043    -.061    -.077    -.090    -.1005   -.110    TZORD 11
-.1155  -.1190  -.1224                                                                  TZORD 11
0.      -.0025  -.010    -.017    -.0325   -.047    -.062    -.075    -.088    -.100    TZORD 12
-.1115  -.1220  -.1324                                                                  TZORD 12
0.0     .304    .491     .803     1.069    1.280    1.430    1.518    1.550    1.451    WAFORD  1
1.162   .678    0.0                                                                     WAFORD  1
0.0     .265    .423     .710     .962     1.156    1.296    1.373    1.396    1.294    WAFORD  2
1.028   .593    0.0                                                                     WAFORD  2
0.0     .226    .338     .635     .889     1.079    1.204    1.272    1.263    1.136    WAFORD  3
.886    .506    0.0                                                                     WAFORD  3
0.      .204    .274     .596     .870     1.074    1.200    1.250    1.234    1.083    WAFORD  4
```

TABLE I.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR THE ORTHOGRAPHIC PRESENTATIONS SHOWN IN FIGURES 1 TO 3 – Concluded

.832	.472	0.								WAFORD 4
0.0	.144	.175	.559	.886	1.111	1.246	1.294	1.242	1.087	WAFORD 5
.828	.466	0.0								WAFORD 5
0.	.066	.09	.522	.886	1.145	1.289	1.341	1.285	1.125	WAFORD 6
.852	.48	0.								WAFORD 6
0.0	.006	.033	.495	.880	1.155	1.320	1.375	1.320	1.155	WAFORD 7
.880	.495	0.0								WAFORD 7
0.0	.006	.033	.495	.880	1.155	1.320	1.375	1.320	1.155	WAFORD 8
.880	.495	0.0								WAFORD 8
0.0	.006	.033	.495	.880	1.155	1.320	1.375	1.320	1.155	WAFORD 9
.880	.495	0.0								WAFORD 9
0.0	.006	.033	.495	.880	1.155	1.320	1.375	1.320	1.155	WAFORD10
.880	.495	0.0								WAFORD10
0.0	.006	.033	.495	.880	1.155	1.320	1.375	1.320	1.155	WAFORD11
.880	.495	0.0								WAFORD11
0.0	.006	.033	.495	.880	1.155	1.320	1.375	1.320	1.155	WAFORD12
.880	.495	0.0								WAFORD12
0.	20.	40.	50.	60.	70.	80.	90.	100.	120.	XFUS 10
130.	140.	150.	160.	180.	200.	220.	230.	240.	250.	XFUS 20
260.	270.	280.	290.	300.	312.					XFUS 26
7.4	7.4	7.4	7.4	7.4	7.4	7.	6.15	5.	2.5	ZFUS 10
1.25	0.	-1.3	-2.5	-5.	-7.45	-9.2	-9.75	-10.	-10.15	ZFUS 20
-10.2	-10.2	-10.2	-10.2	-10.2	-10.2					ZFUS 26
0.	18.5	48.	65.	83.	96.	95.5	92.2	92.5	96.	AFUS 10
98.	100.7	101.	98.	89.5	79.	70.	68.5	68.5	67.3	AFUS 20
62.	50.5	37.	24.	11.5	0.					AFUS 26
236.8	7.50	-11.55								PODORG 1
0.0	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	34.5	XPOD 1
2.292	2.477	2.644	2.791	2.915	3.012	3.076	3.097	3.100	3.100	PODR 1
241.0	31.75	-3.60								PODORG 2
0.0	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	34.5	XPOD 2
2.292	2.477	2.644	2.791	2.915	3.012	3.076	3.097	3.100	3.100	PODR 2
252.0	47.0	-2.95	35.3	285.36	47.0	6.31	4.77			FINORG 2
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	90.0	100.0	XFIN 2
0.0	0.311	0.564	0.759	0.897	0.977	0.999	0.927	0.427	0.0	FINORD 2
277.9	0.	-6.77	35.3	311.3	0.	2.49	4.77			FINORG 3
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	90.0	100.0	XFIN 3
0.0	0.311	0.564	0.759	0.897	0.977	0.999	0.927	0.427	0.0	FINORD 3
312.	0.	-10.2	0.	277.9	0.	-6.77	35.3			FINORG3A
0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	90.0	100.0	XFIN 3
0.0	0.311	0.564	0.759	0.897	0.977	0.999	0.927	0.427	0.0	FINORD 3
X Y	0.	0.	0.				18.	ORT		
X Z	0.	0.	0.				18.	ORT		
Y Z	0.	0.	0.				42.	ORT		
X Z	-45.	10.	-30.				18.	ORT		
Y Z OUT	-45.	10.	-20.				18.	ORT		
X Z OUT	-60.	-20.	-40.				18.	ORT		

TABLE II.- INPUT DATA FOR A SIMPLIFIED AIRPLANE CONFIGURATION AND PLOT SPECIFICATIONS FOR THE THREE-VIEW PRESENTATION OF FIGURE 4

```
SIMPLIFIED AIRCRAFT CONFIGURATION
 1 -1 -1  1  1  1 -1  4 10  1 13 18                             2  5  3 10  1 10
3207.0                                                                               REFA
0.0     10.0    20.0    30.0    40.0    50.0    60.0    70.0    80.0    100.0      XAF     10
42.8    5.2     0.0     89.2                                                       WAFORG  1
56.2    8.0     0.0     66.0                                                       WAFORG  2
141.5   31.7    0.0     19.7                                                       WAFORG  3
156.4   36.0    0.0     0.0                                                        WAFORG  4
0.0     1.66    2.19    2.45    2.49    2.33    2.00    1.56    1.05    0.0        WAFORD  1
0.0     1.62    2.14    2.39    2.43    2.27    1.96    1.53    1.02    0.0        WAFORD  2
0.0     1.17    1.54    1.73    1.75    1.64    1.42    1.10    0.96    0.0        WAFORD  3
0.0     1.17    1.54    1.73    1.75    1.64    1.42    1.10    0.96    0.0        WAFORD  4
0.0     10.0    20.0    30.0    40.0    50.0    60.0    70.0    80.0    90.0       XFUS    10
100.0   110.0   121.0   131.0   141.0   151.0   161.0   170.0                      XFUS    18
0.0     18.1    44.0    59.3    70.5    75.2    75.2    75.2    75.2    75.2       FUSARD10
75.2    75.2    74.0    64.4    50.2    28.4    10.7    0.0                        FUSARD18
141.0   4.6     8.0                                                                PODORG  1
0.0     4.0     8.0     10.75   29.4                                               XPOD    1
1.890   2.050   2.205   2.325   2.325                                              PODR    1
94.0    9.4     -6.3                                                               PODORG  2
0.0     4.0     8.0     10.75   29.4                                               XPOD    2
1.890   2.050   2.205   2.325   2.325                                              PODR    2
97.0    9.4     -3.7    24.0    94.0    9.4     -1.7    24.0                       FINORG  1
0.0     10.0    20.0    30.0    40.0    50.0    60.0    70.0    80.0    100.0      XFIN    1
0.0     0.558   0.992   1.302   1.488   1.550   1.488   1.302   0.992   0.0        FINORD  1
144.0   4.6     3.7     24.0    141.0   4.6     5.7     24.0                       FINORG  2
0.0     10.0    20.0    30.0    40.0    50.0    60.0    70.0    80.0    100.0      XFIN    2
0.0     0.558   0.992   1.302   1.488   1.550   1.488   1.302   0.992   0.0        FINORD  2
134.2   0.0     3.2     28.2    160.8   0.0     23.6    6.6                        FINORG  3
0.0     10.0    20.0    30.0    40.0    50.0    60.0    70.0    80.0    100.0      XFIN    3
0.0     0.558   0.992   1.302   1.488   1.550   1.488   1.302   0.992   0.0        FINORD  3
147.6   2.4     0.0     19.6    167.8   14.3    0.0     6.1                        CANORG
0.0     10.0    20.0    30.0    40.0    50.0    60.0    70.0    80.0    100.0      XCAN
0.0     0.54    0.96    1.26    1.44    1.50    1.44    1.26    0.96    0.0        CANORD
        9.      3.      6.                            17.   VU3
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TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5

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                    FIGHTER TYPE CONFIGURATION WITH ARBITRARY BODY
  1   1   1   1   1   1   0   7 13   4 21  13 24  10 30  21 25   2   2   9   6 10   2 10
131.184                                                                              REFA
0.      .01     5.      10.     20.     30.     40.     50.     60.     70.          XAF 10
80.     90.     100.                                                                 XAF 13
11.8    1.4     2.00    13.6                                                         WORG 1
16.25   3.0     1.83    11.625                                                       WORG 2
18.975  4.0     1.763   10.460                                                       WORG 3
22.150  5.0     1.719   8.856                                                        WORG 4
25.332  6.0     1.709   7.250                                                        WORG 5
26.688  6.43    1.695   6.550                                                        WORG 6
32.140  8.120   1.670   0.                                                           WORG 7
0.      0.      .01     .02     .02     -.02    -.09    -.17    -.20    -.14         TZORD 1
-.05    .05     .19                                                                  TZORD 1
0.      0.      .02     .03     .02     .01     -.02    -.01    .01     0.           TZORD 2
.02     .04     .02                                                                  TZORD 2
0.      0.      -.002   -.001   -.003   .003    .010    .013    .017    .019         TZORD 3
.022    .020    .018                                                                 TZORD 3
0.      0.      .002    .012    .024    .040    .045    .051    .057    .063         TZORD 4
.070    .073    .074                                                                 TZORD 4
0.      0.      -.004   .005    .021    .034    .047    .056    .064    .076         TZORD 5
.087    .093    .099                                                                 TZORD 5
0.      0.      .003    .012    .029    .043    .057    .068    .078    .090         TZORD 6
.104    .114    .120                                                                 TZORD 6
0.      0.      0.      0.      0.      0.      0.      0.      0.      0.           TZORD 7
0.      0.      0.                                                                   TZORD 7
0.      0.      1.09    1.71    2.63    3.22    3.65    3.90    3.68    3.08         WORD 1
2.21    1.18    0.                                                                   WORD 1
0.      0.      1.125   1.800   2.810   3.380   3.300   2.405   2.190   1.821        WORD 2
1.267   .660    0.                                                                   WORD 2
0.      0.      1.363   1.855   2.199   2.314   2.423   2.405   2.190   1.821        WORD 3
1.267   .660    0.                                                                   WORD 3
0.      0.      1.225   1.604   2.078   2.366   2.484   2.422   2.197   1.813        WORD 4
1.248   .638    0.                                                                   WORD 4
0.      0.      1.297   1.682   2.138   2.393   2.476   2.407   2.159   1.738        WORD 5
1.193   .600    0.                                                                   WORD 5
0.      0.      1.306   1.703   2.153   2.390   2.489   2.397   2.138   1.718        WORD 6
1.153   .580    0.                                                                   WORD 6
0.      0.      1.306   1.703   2.153   2.390   2.489   2.397   2.138   1.718        WORD 7
1.153   .580    0.                                                                   WORD 7
  0.000   1.542   2.375   3.208   4.042   4.875   5.708   6.542   7.375   8.625      XFUS   10
  9.458  10.292  11.125                                                              XFUS   13
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000      Y       1
  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000      Y       1
```

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Continued

0.000										Y	1
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Z	1
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Z	1
0.000										Z	1
0.000	.064	.142	.216	.290	.366	.428	.479	.516	.531	Y	2
.533	.516	.486	.442	.389	.329	.267	.195	.130	.068	Y	2
0.000										Y	2
-.482	-.480	-.475	-.455	-.425	-.376	-.321	-.252	-.175	-.093	Z	2
.001	.088	.155	.224	.285	.333	.370	.400	.419	.428	Z	2
.435										Z	2
0.000	.102	.207	.306	.405	.505	.585	.654	.700	.718	Y	3
.721	.701	.659	.592	.525	.450	.361	.275	.180	.089	Y	3
0.000										Y	3
-.675	-.665	-.642	-.612	-.570	-.511	-.436	-.339	-.227	-.118	Z	3
.003	.116	.213	.314	.390	.455	.509	.546	.577	.595	Z	3
.602										Z	3
0.000	.123	.244	.372	.494	.611	.713	.799	.851	.877	Y	4
.879	.854	.809	.740	.656	.561	.455	.338	.225	.111	Y	4
0.000										Y	4
-.755	-.750	-.733	-.700	-.652	-.581	-.494	-.378	-.252	-.109	Z	4
.028	.165	.285	.406	.503	.584	.646	.696	.728	.748	Z	4
.756										Z	4
0.000	.138	.268	.409	.539	.675	.790	.890	.957	.993	Y	5
1.002	.985	.940	.868	.779	.673	.537	.404	.272	.136	Y	5
0.000										Y	5
-.825	-.818	-.801	-.764	-.715	-.636	-.545	-.425	-.279	-.128	Z	5
.035	.187	.338	.478	.594	.694	.779	.837	.874	.896	Z	5
.904										Z	5
0.000	.153	.299	.454	.599	.747	.876	.980	1.052	1.089	Y	6
1.091	1.074	1.025	.949	.853	.733	.592	.455	.308	.153	Y	6
0.000										Y	6
-.845	-.839	-.822	-.787	-.733	-.645	-.542	-.412	-.250	-.075	Z	6
.103	.267	.429	.581	.709	.824	.921	.981	1.026	1.052	Z	6
1.063										Z	6
0.000	.156	.310	.466	.623	.775	.912	1.035	1.118	1.164	Y	7
1.174	1.155	1.107	1.032	.933	.805	.666	.506	.333	.163	Y	7
0.000										Y	7
-.831	-.826	-.809	-.779	-.729	-.654	-.548	-.410	-.244	-.067	Z	7
.126	.300	.482	.648	.792	.944	1.044	1.122	1.177	1.206	Z	7
1.217										Z	7
0.000	.158	.312	.472	.636	.790	.937	1.070	1.159	1.215	Y	8
1.238	1.230	1.194	1.124	1.015	.886	.729	.563	.377	.188	Y	8
0.000										Y	8
-.796	-.794	-.782	-.755	-.707	-.636	-.532	-.385	-.225	-.041	Z	8

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Continued

.162	.352	.542	.719	.899	1.044	1.165	1.258	1.324	1.359	Z	8
1.374										Z	8
0.000	.166	.342	.522	.684	.867	1.008	1.126	1.217	1.261	Y	9
1.274	1.266	1.225	1.147	1.040	.908	.750	.584	.400	.203	Y	9
0.000										Y	9
-.760	-.760	-.753	-.725	-.672	-.581	-.463	-.310	-.113	.079	Z	9
.277	.464	.664	.860	1.024	1.174	1.301	1.394	1.467	1.514	Z	9
1.531										Z	9
0.000	.188	.375	.562	.753	.935	1.090	1.205	1.283	1.312	Y	10
1.319	1.327	1.313	1.248	1.149	.992	.873	.684	.500	.247	Y	10
0.000										Y	10
-.714	-.714	-.712	-.687	-.629	-.526	-.381	-.213	-.016	.196	Z	10
.401	.606	.817	1.040	1.224	1.392	1.572	1.753	1.873	1.968	Z	10
1.995										Z	10
0.000	.252	.468	.720	.935	1.102	1.241	1.322	1.344	1.351	Y	11
1.358	1.356	1.321	1.252	1.127	1.029	.898	.713	.495	.244	Y	11
0.000										Y	11
-.719	-.719	-.704	-.650	-.548	-.406	-.201	.049	.265	.483	Z	11
.703	.921	1.138	1.327	1.514	1.728	1.907	2.082	2.216	2.297	Z	11
2.323										Z	11
0.000	.235	.466	.707	.933	1.136	1.263	1.336	1.365	1.372	Y	12
1.380	1.386	1.377	1.333	1.243	1.156	.998	.807	.554	.277	Y	12
0.000										Y	12
-.701	-.700	-.697	-.652	-.553	-.386	-.182	.044	.290	.521	Z	12
.738	.951	1.185	1.414	1.635	1.886	2.135	2.327	2.488	2.588	Z	12
2.617										Z	12
0.000	.232	.467	.715	.945	1.149	1.277	1.348	1.370	1.380	Y	13
1.390	1.397	1.405	1.390	1.337	1.242	1.076	.864	.606	.308	Y	13
0.000										Y	13
-.688	-.688	-.683	-.645	-.553	-.392	-.181	.063	.309	.537	Z	13
.757	.972	1.208	1.464	1.710	1.999	2.259	2.469	2.634	2.739	Z	13
2.776										Z	13
11.125	11.958	12.792	13.625	14.458	15.292	16.125	16.958	17.792	18.333	XFUS	10
0.000	.238	.472	.721	.958	1.161	1.287	1.356	1.379	1.387	Y	1
1.397	1.405	1.410	1.398	1.344	1.253	1.253	1.253	1.253	1.087	Y	1
.875	.611	.312	0.000							Y	1
-.691	-.690	-.687	-.648	-.551	-.389	-.178	.070	.319	.548	Z	1
.767	.988	1.225	1.479	1.723	2.009	2.009	2.009	2.009	2.281	Z	1
2.490	2.657	2.759	2.794							Z	1
0.000	.229	.476	.722	.965	1.166	1.294	1.367	1.384	1.396	Y	2
1.408	1.419	1.430	1.436	1.410	1.379	1.407	1.407	1.344	1.146	Y	2
.913	.650	.333	0.000							Y	2
-.688	-.688	-.683	-.650	-.559	-.399	-.183	.073	.321	.543	Z	2
.769	.990	1.227	1.493	1.791	1.938	1.958	2.070	2.108	2.334	Z	2

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Continued

2.563	2.725	2.841	2.873							Z	2
0.000	.231	.471	.727	.972	1.175	1.300	1.366	1.381	1.394	Y	3
1.405	1.419	1.431	1.444	1.448	1.444	1.402	1.402	1.402	1.175	Y	3
.936	.647	.331	0.000							Y	3
-.676	-.676	-.673	-.653	-.566	-.404	-.190	.064	.316	.547	Z	3
.762	.984	1.226	1.506	1.813	1.845	1.845	2.216	2.216	2.388	Z	3
2.599	2.768	2.872	2.904							Z	3
0.000	.234	.475	.730	.978	1.180	1.306	1.370	1.387	1.400	Y	4
1.413	1.426	1.439	1.456	1.471	1.407	1.407	1.407	1.407	1.208	Y	4
.947	.658	.326	0.000							Y	4
-.666	-.666	-.666	-.650	-.584	-.416	-.186	.061	.310	.539	Z	4
.760	.993	1.233	1.513	1.764	1.759	1.759	2.323	2.323	2.433	Z	4
2.620	2.771	2.867	2.901							Z	4
0.000	.225	.459	.721	.981	1.201	1.319	1.376	1.392	1.407	Y	5
1.424	1.442	1.459	1.479	1.489	1.409	1.409	1.409	1.409	1.244	Y	5
.953	.664	.334	0.000							Y	5
-.657	-.657	-.656	-.650	-.586	-.431	-.194	.058	.313	.541	Z	5
.767	.993	1.239	1.519	1.687	1.677	1.677	2.389	2.389	2.464	Z	5
2.621	2.752	2.837	2.867							Z	5
0.000	.214	.447	.712	.976	1.201	1.324	1.384	1.403	1.419	Y	6
1.437	1.453	1.470	1.490	1.498	1.409	1.409	1.409	1.409	1.249	Y	6
.942	.647	.333	0.000							Y	6
-.647	-.647	-.647	-.643	-.601	-.447	-.215	.049	.298	.530	Z	6
.757	.984	1.230	1.519	1.615	1.603	1.603	2.418	2.418	2.473	Z	6
2.600	2.715	2.786	2.809							Z	6
0.000	.223	.459	.719	.991	1.224	1.341	1.390	1.410	1.428	Y	7
1.446	1.464	1.484	1.504	1.504	1.403	1.403	1.403	1.403	1.236	Y	7
.917	.624	.313	0.000							Y	7
-.643	-.643	-.643	-.639	-.604	-.447	-.214	.055	.307	.536	Z	7
.772	1.004	1.250	1.546	1.546	1.532	1.532	2.431	2.431	2.475	Z	7
2.575	2.675	2.737	2.755							Z	7
0.000	.224	.459	.716	.993	1.233	1.359	1.402	1.424	1.443	Y	8
1.463	1.483	1.503	1.520	1.401	1.401	1.401	1.401	1.401	1.231	Y	8
.896	.607	.297	0.000							Y	8
-.639	-.639	-.639	-.635	-.604	-.477	-.231	.048	.303	.539	Z	8
.767	1.010	1.256	1.475	1.456	1.456	1.456	2.423	2.423	2.456	Z	8
2.539	2.612	2.667	2.679							Z	8
0.000	.221	.456	.715	.999	1.274	1.382	1.429	1.452	1.472	Y	9
1.488	1.507	1.529	1.539	1.409	1.409	1.409	1.409	1.409	1.217	Y	9
.878	.585	.296	0.000							Y	9
-.624	-.624	-.624	-.622	-.602	-.483	-.244	.037	.296	.538	Z	9
.778	1.014	1.269	1.403	1.384	1.384	1.384	2.411	2.411	2.437	Z	9
2.495	2.553	2.601	2.616							Z	9
0.000	.223	.454	.702	.989	1.268	1.393	1.436	1.456	1.478	Y	10

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Continued

1.497	1.516	1.540	1.547	1.401	1.401	1.401	1.401	1.401	1.209	Y	10
.864	.581	.284	0.000							Y	10
-.618	-.618	-.618	-.616	-.600	-.505	-.259	.028	.281	.528	Z	10
.761	.984	1.259	1.361	1.340	1.340	1.339	2.393	2.393	2.416	Z	10
2.460	2.504	2.551	2.564							Z	10
18.333	18.625	19.075	19.458	20.194	21.125	21.958	22.792	23.625	24.458	XFUS	10
25.292	26.125	26.958	27.519	28.000	28.625	29.458	30.292	31.125	31.958	XFUS	20
32.563										XFUS	21
0.000	.706	.992	1.272	1.399	1.435	1.686	1.939	2.186	2.414	Y	1
2.626	2.780	2.906	2.989	3.027	3.011	3.011	3.011	3.011	3.011	Y	1
2.766	2.357	2.043	1.726	1.408	1.408	1.215	.874	.283	0.000	Y	1
-.623	-.619	-.603	-.506	-.257	-.018	-.018	.016	.098	.225	Z	1
.403	.593	.820	1.071	1.336	1.583	1.583	1.583	1.583	1.583	Z	1
1.546	1.484	1.438	1.389	1.342	2.401	2.423	2.471	2.566	2.580	Z	1
0.000	.714	1.007	1.278	1.403	1.433	1.692	1.957	2.223	2.458	Y	2
2.667	2.830	2.957	3.044	3.071	3.054	3.054	3.054	3.054	3.054	Y	2
2.766	2.354	2.043	1.727	1.411	1.411	1.198	.869	.281	0.000	Y	2
-.621	-.618	-.608	-.500	-.253	-.108	-.107	-.063	.025	.156	Z	2
.336	.551	.788	1.053	1.310	1.569	1.569	1.569	1.569	1.569	Z	2
1.528	1.467	1.422	1.373	1.324	2.396	2.417	2.457	2.542	2.560	Z	2
0.000	.710	.996	1.274	1.420	1.446	1.708	1.978	2.242	2.470	Y	3
2.675	2.840	2.969	3.048	3.083	3.076	3.076	3.076	3.076	3.076	Y	3
2.768	2.359	2.043	1.724	1.411	1.411	1.190	.850	.295	0.000	Y	3
-.620	-.616	-.610	-.519	-.278	-.160	-.152	-.110	-.019	.112	Z	3
.292	.497	.740	1.000	1.263	1.525	1.525	1.525	1.525	1.525	Z	3
1.487	1.434	1.391	1.347	1.306	2.372	2.394	2.429	2.502	2.522	Z	3
0.000	.706	.993	1.294	1.435	1.451	1.716	1.980	2.235	2.468	Y	4
2.673	2.844	2.971	3.059	3.092	3.081	3.081	3.081	3.081	3.081	Y	4
2.769	2.364	2.047	1.734	1.413	1.413	1.166	.838	.303	0.000	Y	4
-.609	-.607	-.595	-.514	-.276	-.188	-.184	-.144	-.051	.087	Z	4
.268	.479	.711	.967	1.234	1.498	1.498	1.498	1.498	1.498	Z	4
1.464	1.420	1.387	1.352	1.318	2.355	2.378	2.410	2.475	2.489	Z	4
0.000	.705	.990	1.292	1.452	1.464	1.728	1.999	2.246	2.470	Y	5
2.673	2.830	2.952	3.025	3.058	3.052	3.052	3.052	3.052	3.052	Y	5
2.768	2.359	2.045	1.730	1.411	1.411	1.138	.812	.310	0.000	Y	5
-.604	-.600	-.586	-.501	-.275	-.249	-.245	-.197	-.098	.047	Z	5
.228	.436	.684	.929	1.191	1.443	1.443	1.443	1.443	1.443	Z	5
1.424	1.401	1.382	1.365	1.346	2.328	2.344	2.372	2.422	2.435	Z	5
0.000	.699	.984	1.264	1.475	1.475	1.754	2.027	2.292	2.503	Y	6
2.694	2.827	2.929	2.992	3.016	3.027	3.027	3.027	3.027	3.027	Y	6
2.766	2.353	2.040	1.725	1.407	1.407	1.113	.781	.313	0.000	Y	6
-.594	-.592	-.578	-.487	-.325	-.325	-.317	-.254	-.133	.022	Z	6
.243	.461	.704	.962	1.216	1.457	1.457	1.457	1.457	1.457	Z	6
1.455	1.448	1.440	1.435	1.431	2.295	2.305	2.318	2.368	2.381	Z	6

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Continued

0.000	.686	.964	1.219	1.414	1.414	1.718	2.000	2.270	2.492	Y	7
2.671	2.798	2.890	2.942	2.966	2.973	2.973	2.973	2.973	2.973	Y	7
2.768	2.356	2.042	1.729	1.411	1.411	1.098	.777	.318	0.000	Y	7
-.584	-.580	-.570	-.500	-.408	-.408	-.381	-.315	-.175	.014	Z	7
.248	.488	.746	1.002	1.259	1.509	1.509	1.509	1.509	1.509	Z	7
1.514	1.519	1.525	1.528	1.533	2.271	2.270	2.283	2.333	2.348	Z	7
0.000	.685	.966	1.225	1.440	1.440	1.762	2.071	2.340	2.547	Y	8
2.704	2.798	2.852	2.875	2.890	2.896	2.896	2.896	2.896	2.896	Y	8
2.770	2.356	2.042	1.725	1.412	1.412	1.090	.760	.314	0.000	Y	8
-.586	-.583	-.562	-.499	-.461	-.461	-.429	-.319	-.129	.110	Z	8
.379	.647	.917	1.179	1.405	1.632	1.632	1.632	1.632	1.632	Z	8
1.634	1.647	1.656	1.664	1.673	2.257	2.250	2.245	2.295	2.309	Z	8
0.000	.680	.957	1.192	1.410	1.410	1.748	2.068	2.325	2.524	Y	9
2.653	2.743	2.797	2.814	2.824	2.830	2.830	2.830	2.830	2.830	Y	9
2.768	2.356	2.041	1.726	1.408	1.408	1.069	.742	.316	0.000	Y	9
-.569	-.565	-.557	-.526	-.511	-.511	-.478	-.343	-.124	.146	Z	9
.426	.695	.958	1.213	1.440	1.676	1.676	1.676	1.676	1.676	Z	9
1.680	1.723	1.757	1.789	1.820	2.239	2.234	2.221	2.277	2.298	Z	9
0.000	.684	.972	1.193	1.414	1.414	1.779	2.094	2.339	2.506	Y	10
2.618	2.695	2.743	2.767	2.785	2.787	2.787	2.787	2.787	2.787	Y	10
2.764	2.356	2.044	1.729	1.408	1.408	1.057	.728	.318	0.000	Y	10
-.559	-.557	-.560	-.566	-.567	-.567	-.522	-.352	-.091	.208	Z	10
.518	.785	1.036	1.283	1.505	1.722	1.722	1.722	1.722	1.722	Z	10
1.725	1.808	1.870	1.929	1.990	2.226	2.217	2.199	2.257	2.283	Z	10
0.000	.585	.827	1.109	1.414	1.414	1.772	2.094	2.329	2.482	Y	11
2.577	2.639	2.688	2.720	2.746	2.756	2.756	2.756	2.756	2.756	Y	11
2.756	2.357	2.043	1.731	1.411	1.411	1.036	.716	.320	0.000	Y	11
-.533	-.531	-.530	-.575	-.593	-.593	-.545	-.359	-.071	.257	Z	11
.561	.824	1.077	1.305	1.515	1.728	1.805	1.805	1.805	1.805	Z	11
1.805	1.920	2.007	2.094	2.179	2.214	2.199	2.181	2.236	2.255	Z	11
0.000	.602	.849	1.152	1.411	1.411	1.769	2.082	2.313	2.450	Y	12
2.539	2.594	2.636	2.670	2.703	2.718	2.719	2.719	2.719	2.719	Y	12
2.722	2.357	2.041	1.725	1.409	1.409	1.015	.699	.313	0.000	Y	12
-.508	-.508	-.508	-.571	-.600	-.600	-.551	-.361	-.051	.281	Z	12
.596	.856	1.092	1.307	1.518	1.720	1.794	1.794	1.794	1.794	Z	12
1.892	1.998	2.089	2.154	2.189	2.189	2.170	2.147	2.207	2.227	Z	12
0.000	.626	.885	1.146	1.411	1.411	1.769	2.076	2.308	2.436	Y	13
2.523	2.576	2.612	2.641	2.669	2.688	2.690	2.690	2.690	2.690	Y	13
2.704	2.359	2.045	1.732	1.420	1.420	.996	.686	.319	0.000	Y	13
-.469	-.469	-.467	-.539	-.572	-.572	-.516	-.311	.002	.313	Z	13
.618	.877	1.117	1.332	1.531	1.729	1.793	1.793	1.793	1.793	Z	13
2.029	2.091	2.102	2.147	2.179	2.179	2.147	2.127	2.187	2.215	Z	13
0.000	.619	.882	1.138	1.409	1.409	1.756	2.058	2.281	2.422	Y	14
2.513	2.565	2.599	2.629	2.650	2.672	2.672	2.672	2.672	2.672	Y	14

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Continued

2.673	2.365	2.045	1.729	1.414	1.414	.998	.678	.318	0.000	Y	14
-.439	-.439	-.439	-.518	-.545	-.545	-.485	-.282	.014	.324	Z	14
.634	.883	1.116	1.330	1.522	1.719	1.793	1.793	1.793	1.793	Z	14
2.010	2.072	2.088	2.128	2.166	2.166	2.134	2.100	2.170	2.197	Z	14
0.000	.629	.888	1.148	1.411	1.411	1.751	2.054	2.275	2.413	Y	15
2.511	2.560	2.588	2.613	2.635	2.664	2.705	2.864	2.864	2.673	Y	15
2.673	2.362	2.044	1.728	1.406	1.406	.997	.679	.317	0.000	Y	15
-.426	-.426	-.424	-.498	-.527	-.527	-.467	-.269	.016	.301	Z	15
.615	.878	1.117	1.326	1.519	1.718	1.766	1.786	1.797	1.827	Z	15
2.015	2.064	2.074	2.124	2.162	2.162	2.129	2.094	2.164	2.186	Z	15
0.000	.657	.928	1.161	1.417	1.417	1.746	2.043	2.259	2.401	Y	16
2.491	2.538	2.563	2.580	2.613	2.673	2.758	2.862	2.862	2.641	Y	16
2.641	2.359	2.048	1.727	1.389	1.389	.981	.667	.314	0.000	Y	16
-.374	-.371	-.371	-.445	-.472	-.472	-.406	-.214	.063	.353	Z	16
.644	.896	1.136	1.345	1.528	1.616	1.697	1.723	1.858	1.892	Z	16
2.009	2.040	2.051	2.104	2.154	2.154	2.116	2.079	2.144	2.166	Z	16
0.000	.616	.876	1.151	1.412	1.412	1.738	2.021	2.237	2.382	Y	17
2.479	2.528	2.546	2.571	2.643	2.742	2.860	2.860	2.860	2.611	Y	17
2.611	2.359	2.044	1.728	1.412	1.412	.993	.687	.315	0.000	Y	17
-.299	-.299	-.302	-.377	-.403	-.403	-.331	-.140	.108	.380	Z	17
.663	.914	1.147	1.340	1.455	1.551	1.610	1.610	1.906	1.953	Z	17
1.986	2.016	2.030	2.089	2.136	2.136	2.094	2.079	2.124	2.122	Z	17
0.000	.587	.836	1.127	1.414	1.414	1.725	2.001	2.217	2.359	Y	18
2.459	2.510	2.530	2.597	2.661	2.749	2.862	2.862	2.862	2.676	Y	18
2.676	2.362	2.044	1.699	1.412	1.412	.990	.693	.316	0.000	Y	18
-.213	-.213	-.217	-.296	-.319	-.319	-.248	-.080	.163	.417	Z	18
.682	.921	1.153	1.344	1.440	1.519	1.556	1.556	1.939	1.964	Z	18
1.964	1.990	2.000	2.078	2.121	2.121	2.078	2.075	2.093	2.093	Z	18
0.000	.557	.789	1.103	1.418	1.418	1.710	1.968	2.183	2.336	Y	19
2.440	2.490	2.527	2.602	2.706	2.864	2.864	2.864	2.864	2.682	Y	19
2.682	2.362	2.048	1.735	1.414	1.414	1.010	.708	.317	0.000	Y	19
-.125	-.125	-.124	-.179	-.208	-.208	-.149	.002	.214	.449	Z	19
.700	.936	1.150	1.333	1.444	1.505	1.505	1.505	1.938	1.939	Z	19
1.939	1.948	1.964	2.043	2.098	2.098	2.077	2.076	2.073	2.071	Z	19
0.000	.547	.769	1.072	1.420	1.420	1.694	1.939	2.144	2.299	Y	20
2.396	2.440	2.461	2.523	2.679	2.862	2.862	2.862	2.862	2.679	Y	20
2.679	2.360	2.048	1.733	1.418	1.418	1.026	.714	.315	0.000	Y	20
-.043	-.043	-.043	-.050	-.059	-.059	-.006	.115	.296	.505	Z	20
.743	.976	1.188	1.315	1.417	1.478	1.478	1.478	1.911	1.917	Z	20
1.917	1.924	1.928	2.015	2.082	2.082	2.081	2.078	2.076	2.074	Z	20
0.000	.519	.745	1.026	1.417	1.417	1.677	1.912	2.106	2.251	Y	21
2.348	2.391	2.430	2.518	2.673	2.863	2.863	2.863	2.863	2.670	Y	21
2.670	2.362	2.042	1.698	1.418	1.418	1.027	.714	.316	0.000	Y	21
.022	.024	.026	.028	.036	.036	.084	.196	.365	.550	Z	21

TABLE III.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR A FIGHTER-TYPE CONFIGURATION SHOWN IN THE PERSPECTIVE VIEWS OF FIGURE 5 – Concluded

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  .789  1.011  1.201  1.312  1.412  1.452  1.452  1.452  1.858  1.881  Z      21
 1.881  1.888  1.894  2.028  2.079  2.079  2.078  2.077  2.074  2.073  Z      21
32.563 35.323                                                          XFUS    2
 0.000   .519   .626   .740  1.021  1.410  1.672  1.907  2.100  2.245  Y       1
 2.343  2.382  2.365  2.279  2.133  1.937  1.692  1.411  1.021   .711  Y       1
  .655   .593   .520   .313  0.000                                     Y       1
  .019   .022   .023   .023   .025   .029   .081   .193   .358   .546  Z       1
  .781  1.005  1.250  1.503  1.724  1.895  2.019  2.070  2.070  2.067  Z       1
 2.067  2.067  2.067  2.066  2.066                                     Z       1
 0.000   .508   .624   .739  1.016  1.407  1.666  1.903  2.096  2.240  Y       2
 2.338  2.377  2.360  2.279  2.130  1.931  1.690  1.409  1.014   .709  Y       2
  .659   .591   .512   .312  0.000                                     Y       2
  .314   .314   .211   .206   .206   .206   .258   .369   .534   .723  Z       2
  .950  1.173  1.423  1.674  1.895  2.073  2.188  2.241  2.241  2.241  Z       2
 2.240  2.213  2.067  2.066  2.062                                     Z       2
33.129 0.     6.511                                                    PODORG 1
0.      .183   .367   .733  1.09   1.467  1.917  3.612  3.712          XPOD 1
0.      .025   .048   .088   .122   .148   .167   .167   .167          PODR 1
32.563 2.558  1.502                                                    PODORG 2
0.      .437   .837  1.207  1.582  1.957  2.437  3.037  3.875          XPOD 2
 .336   .295   .275   .265   .265   .265   .240   .165  0.             PODR 2
26.771 0.     2.059  8.896  33.129 0.     6.511  3.654                 FINORG 1
0.     29.742 40.    50.    60.    62.529 70.    80.    90.    100.    XFIN 1
0.     1.034  1.338  1.518  1.596  1.607  1.540  1.259   .753  0.      FINORD 1
27.058 0.     2.191  0.     21.125 0.     2.371  6.145                 FINORG 2
0.     20.26  30.    40.    50.    60.    70.    84.    98.373 100.    XFIN 2
0.      .765   .765   .765   .765   .765   .765   .765   .765  0.      FINORD 2
21.125 0.     2.371  6.145  22.370 0.     2.532  0.                    FINORG 3
0.     20.26  30.    40.    50.    60.    70.    84.    98.373 100.    XFIN 3
0.      .765   .765   .765   .765   .765   .765   .765   .765  0.      FINORD 3
25.758 2.488  -.925  0.     25.292 2.138  -.300  6.008                 FINORG 4
0.     10.    20.    30.    40.    50.    60.    70.    80.    100.    XFIN 4
0.      .462   .819  1.113  1.324  1.429  1.450  1.345  1.113  0.      FINORD 4
25.292 2.138  -.300  6.008  29.062 2.050  -.170  3.512                 FINORG 5
0.     10.    20.    30.    40.    50.    60.    70.    80.    100.    XFIN 5
0.      .462   .819  1.113  1.324  1.429  1.450  1.345  1.113  0.      FINORD 5
29.062 2.050  -.170  3.512  32.604 1.869   .132  0.                    FINORG 6
0.     10.    20.    30.    40.    50.    60.    70.    80.    100.    XFIN 6
0.      .462   .819  1.113  1.324  1.429  1.450  1.345  1.113  0.      FINORD 6
27.958 2.842  1.680  7.504  32.471 5.717  1.680  3.758                 CANORG 1
0.     10.    20.    30.    40.    50.    60.    70.    80.    100.    XCAN 1
0.      .856  1.393  1.755  1.975  2.062  1.909  1.722  1.332  0.      CANORD 1
32.471 5.717  1.680  3.758  35.007 7.334  1.680  0.                    CANORG 2
0.     10.    20.    30.    40.    50.    60.    70.    80.    100.    XCAN 2
0.      .856  1.393  1.755  1.975  2.062  1.909  1.722  1.332  0.      CANORD 2
       -20. 50.  50.  18.  0.   0.   14.  3.   24.  PER
       -20. -50. -50. 18.  0.   0.   14.  3.   24.  PER
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TABLE IV.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR THE STEREO FRAMES SHOWN IN FIGURE 6

BLENDED WING-BODY FIGHTER

1 -1	1	1 1	11 13	1 19 15					5 10	2 101/1/70
637.94										REFA
0.	.5	10.	20.	30.	40.	50.	60.	70.	80.	XAF 10
90.	95.	100.								XAF 13
14.	3.0	0.	31.							WORG 1
24.	4.0	0.	21.1							WORG 2
28.	5.	0.	17.7							WORG 3
30.	6.	0.	16.2							WORG 4
33.3	8.	0.	13.5							WORG 5
36.	10.	0.	11.5							WORG 6
38.5	12.	0.	9.6							WORG 7
41.2	14.	0.	7.6							WORG 8
44.2	16.	0.	5.2							WORG 9
48.	17.6	0.	2.							WORG 10
50.	18.	0.	0.							WORG 11
0.	.95	1.8	3.2	4.2	4.8	5.0	4.8	4.2	3.2	WORD 1
1.8	.95	0.								WORD 1
0.	.655	1.26	2.24	2.94	3.36	3.5	3.36	2.94	2.24	WORD 2
1.26	.655	0.								WORD 2
0.	.57	1.08	1.92	2.52	2.88	3.0	2.88	2.52	1.92	WORD 3
1.08	.57	0.								WORD 3
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 4
.9	.475	0.								WORD 4
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 5
.9	.475	0.								WORD 5
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 6
.9	.475	0.								WORD 6
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 7
.9	.475	0.								WORD 7
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 8
.9	.475	0.								WORD 8
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 9
.9	.475	0.								WORD 9
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 10
.9	.475	0.								WORD 10
0.	.475	.9	1.6	2.1	2.4	2.5	2.4	2.1	1.6	WORD 11
.9	.475	0.								WORD 11
0.	2.0	4.	6.	12.	16.	20.	24.	28.	32.	XFUS 10
36.	40.	48.	52.	65.						XFUS 15
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	Y 1
0.	0.	0.	0.	0.	0.	0.	0.	0.		Y 1
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	Z 1
0.	0.	0.	0.	0.	0.	0.	0.	0.		Z 1

TABLE IV.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR THE STEREO FRAMES SHOWN IN FIGURE 6 – Continued

0.	.061	.124	.18	.276	.375	.476	.637	.793	.887	Y 2
.793	.637	.476	.375	.276	.18	.124	.061	0.		Y 2
-.336	-.335	-.331	-.316	-.306	-.275	-.221	-.127	-.007	0.	Z 2
.007	.127	.221	.275	.306	.316	.331	.335	.336		Z 2
0.	.138	.272	.427	.582	.754	.985	1.179	1.394	1.488	Y 3
1.394	1.179	.985	.754	.582	.427	.272	.138	0.		Y 3
-.743	-.735	-.716	-.684	-.634	-.549	-.428	-.228	-.022	0.	Z 3
.022	.228	.428	.549	.634	.684	.716	.735	.743		Z 3
0.	.185	.383	.602	.81	1.077	1.363	1.66	1.924	2.028	Y 4
1.924	1.66	1.363	1.077	.81	.602	.383	.185	0.		Y 4
-1.032	-1.02	-.981	-.938	-.873	-.754	-.548	-.273	-.067	0.	Z 4
.067	.273	.548	.754	.873	.938	.981	1.02	1.032		Z 4
0.	.294	.6	.935	1.283	1.664	2.049	2.466	2.789	2.905	Y 5
2.789	2.466	2.049	1.664	1.283	.935	.6	.294	0.		Y 5
-1.655	-1.637	-1.581	-1.494	-1.368	-1.168	-.882	-.473	-.005	0.	Z 5
.005	.473	.882	1.168	1.368	1.494	1.581	1.637	1.655		Z 5
0.	.35	.725	1.125	1.575	2.0	2.475	3.0	3.0	3.0	Y 6
3.0	3.0	2.475	2.0	1.575	1.125	.725	.35	0.		Y 6
-2.05	-2.04	-2.0	-1.95	-1.825	-1.65	-1.425	-1.05	-.5	0.	Z 6
.5	1.05	1.425	1.65	1.825	1.95	2.0	2.04	2.05		Z 6
0.	.35	.725	1.15	1.575	2.05	2.55	3.0	3.0	3.0	Y 7
3.0	3.0	2.55	2.05	1.575	1.15	.725	.35	0.		Y 7
-2.0	-2.0	-1.975	-1.95	-1.85	-1.7	-1.45	-1.1	-.5	0.	Y 7
.5	1.1	1.45	1.7	1.85	1.95	1.975	2.	2.		Z 7
0.	.35	.725	1.15	1.65	2.2	3.0	3.0	3.0	3.0	Y 8
3.0	3.0	3.0	2.2	1.65	1.15	.725	.35	0.		Y 8
-2.0	-2.0	-2.	-2.	-1.95	-1.85	-1.5	-1.05	-.5	0.	Y 8
.5	1.05	1.5	1.85	1.95	2.	2.	2.	2.		Z 8
0.	.35	.725	1.15	1.65	2.15	3.0	3.0	3.0	3.0	Y 9
3.0	3.0	3.0	2.15	1.65	1.15	.725	.35	0.		Y 9
-2.0	-2.0	-2.	-2.	-1.95	-1.8	-1.5	-1.05	-.5	0.	Y 9
.5	1.05	1.5	1.8	1.95	2.	2.	2.	2.		Z 9
0.	.35	.725	1.15	1.65	2.15	3.0	3.0	3.0	3.0	Y 10
3.0	3.0	3.0	2.15	1.65	1.15	.725	.35	0.		Y 10
-2.0	-2.0	-2.	-2.	-1.95	-1.8	-1.5	-1.05	-.5	0.	Y 10
.5	1.05	1.5	1.8	1.95	2.	2.	2.	2.		Z 10
0.	.35	.725	1.15	1.65	2.15	3.0	3.0	3.0	3.0	Y 11
3.0	3.0	3.0	2.15	1.65	1.15	.725	.35	0.		Y 11
-2.0	-2.0	-2.	-2.	-1.95	-1.8	-1.5	-1.05	-.5	0.	Y 11
.5	1.05	1.5	1.8	1.95	2.	2.	2.	2.		Z 11
0.	.35	.725	1.15	1.65	2.15	2.5	3.0	3.0	3.0	Y 12
3.0	3.0	2.5	2.15	1.65	1.15	.725	.35	0.		Y 12
-2.0	-2.0	-2.	-2.	-1.95	-1.8	-1.4	-1.05	-.5	0.	Y 12
.5	1.05	1.4	1.8	1.95	2.	2.	2.	2.		Z 12

TABLE IV.- INPUT CONFIGURATION DATA AND PLOT SPECIFICATIONS FOR THE STEREO FRAMES SHOWN IN FIGURE 6 – Concluded

0.	.35	.725	1.15	1.65	2.15	2.5	2.875	2.95	3.0	Y 13
2.95	2.875	2.5	2.15	1.65	1.15	.725	.35	0.		Y 13
-2.0	-2.0	-2.	-2.	-1.95	-1.8	-1.4	-.975	-.5	0.	Y 13
.5	.975	1.4	1.8	1.95	2.	2.	2.	2.		Z 13
0.	.35	.725	1.125	1.525	1.9	2.25	2.55	2.8	3.0	Y 14
2.8	2.55	2.25	1.9	1.525	1.125	.725	.35	0.		Y 14
-2.0	-2.0	-2.	-1.95	-1.8	-1.6	-1.275	-.9	-.5	0.	Y 14
.5	.9	1.275	1.6	1.8	1.95	2.	2.	2.		Z 14
0.	.35	.725	1.125	1.525	1.9	2.25	2.55	2.8	3.0	Y 15
2.8	2.55	2.25	1.9	1.525	1.125	.725	.35	0.		Y 15
-2.0	-2.0	-2.	-1.95	-1.8	-1.6	-1.275	-.9	-.5	0.	Y 15
.5	.9	1.275	1.6	1.8	1.95	2.	2.	2.		Z 15
53.091	0.	2.0	12.182	62.215	0.	8.483	6.129			VTORG 1
0.	10.	20.	30.	40.	50.	60.	70.	80.	100.	XFIN
0.	.72	1.28	1.68	1.92	2.0	1.92	1.68	1.28	0.	FINORD
62.215	0.	8.483	6.129	64.602	0.	10.18	0.			VTORG 2
0.	10.	20.	30.	40.	50.	60.	70.	80.	100.	XFIN
0.	.72	1.28	1.68	1.92	2.0	1.92	1.68	1.28	0.	FINORD
55.724	0.	-4.481	0.	55.026	0.	-3.948	8.498			VORG 3
0.	13.722	20.	30.	40.	50.	60.	70.	86.278	100.	
0.	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	0.	VORD
55.026	0.	-3.948	8.498	53.073	0.	-2.455	11.473			VORG 4
0.	13.722	20.	30.	40.	50.	60.	70.	86.278	100.	
0.	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	0.	VORD
53.073	0.	-2.455	11.473	52.481	0.	-2.0	12.066			VORG 5
0.	13.722	20.	30.	40.	50.	60.	70.	86.278	100.	
0.	1.49	1.49	1.49	1.49	1.49	1.49	1.49	1.49	0.	VORD
57.473	3.0	0.	8.567	66.868	11.315	0.	3.413			CANORG 1
0.	10.	20.	30.	40.	50.	60.	70.	80.	100.	XCAN
0.	.72	1.28	1.68	1.92	2.0	1.92	1.68	1.28	0.	CANORD
66.868	11.315	0.	3.413	68.115	12.419	0.	0.			CANORG 2
0.	10.	20.	30.	40.	50.	60.	70.	80.	100.	XCAN
0.	.72	1.28	1.68	1.92	2.0	1.92	1.68	1.28	0.	CANORD
	-50.	-30.	-50.	28.	0.	0.	19.	1.	10.	STE
	-50.	40.	50.	28.	0.	0.	18.	1.	10.	STE

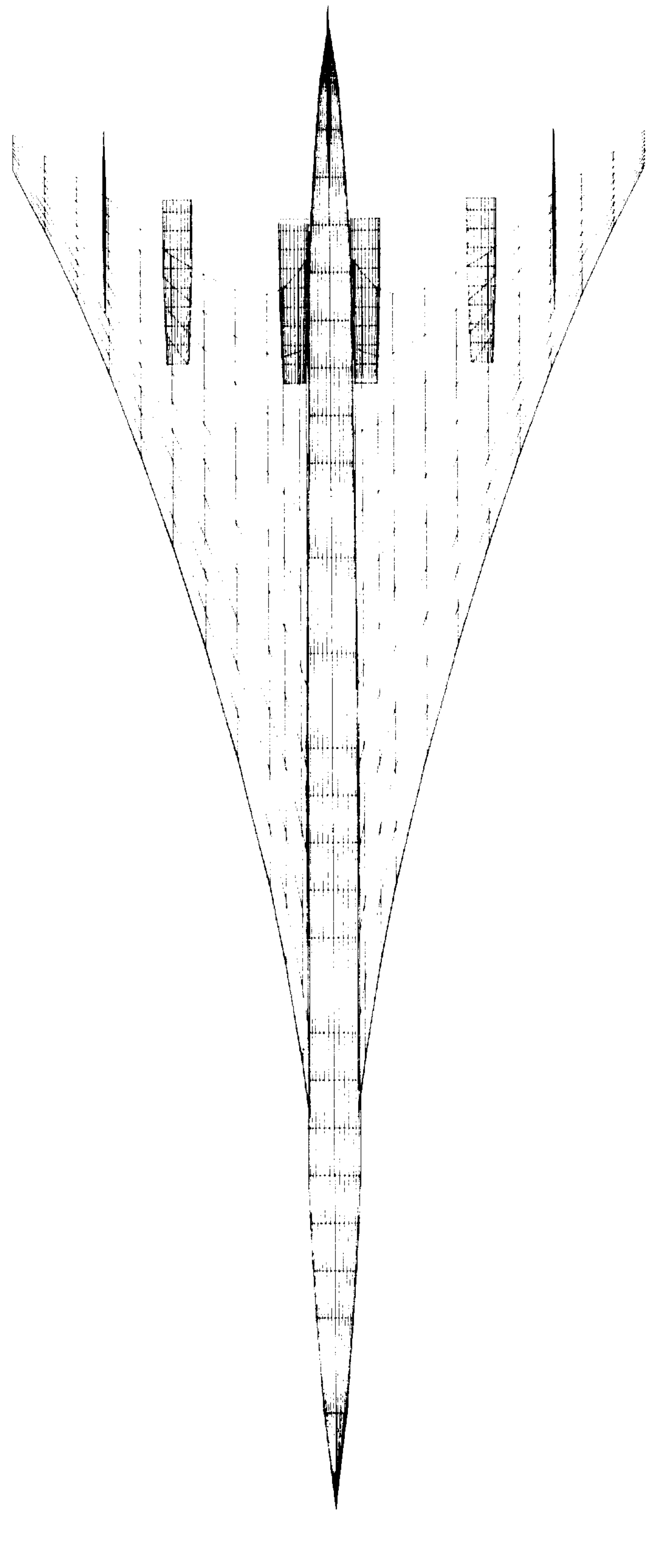

Figure 1.- Orthographic projections of a representative airplane configuration.

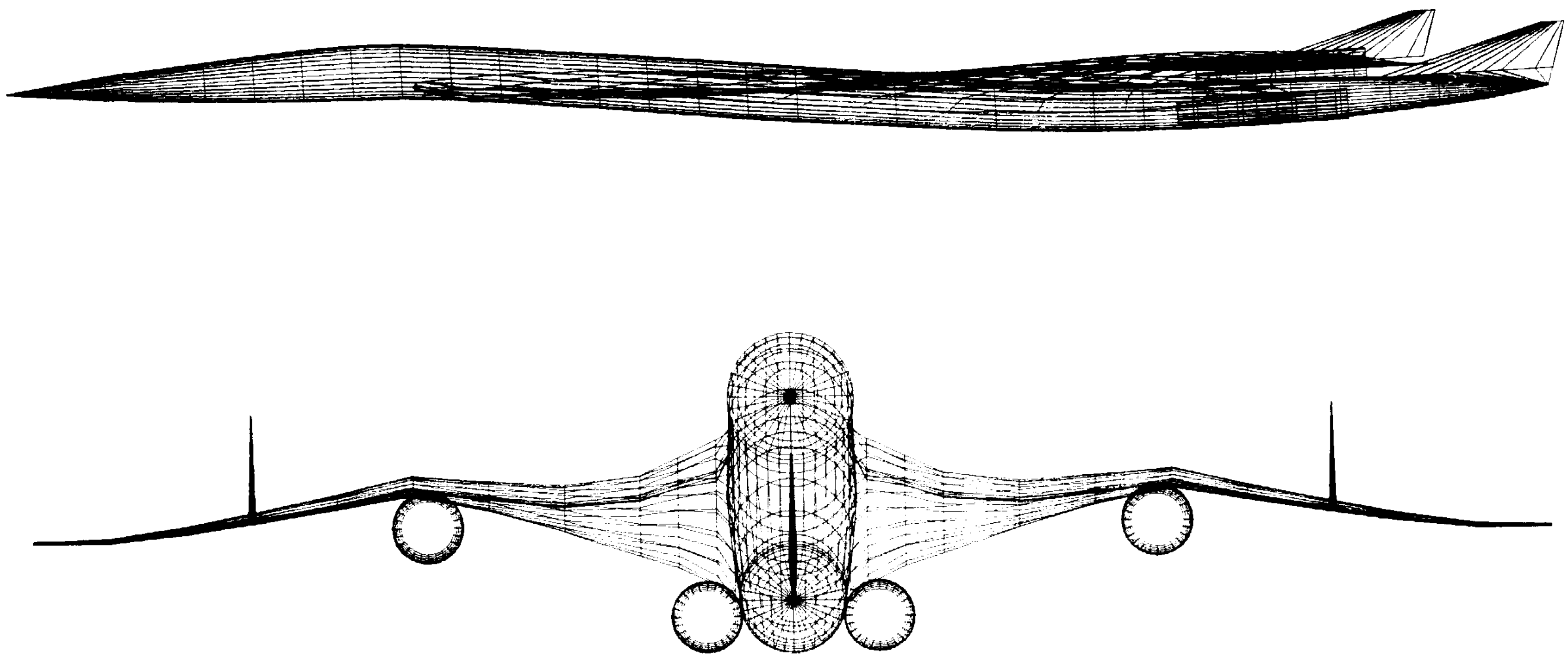

Figure 1.- Concluded.

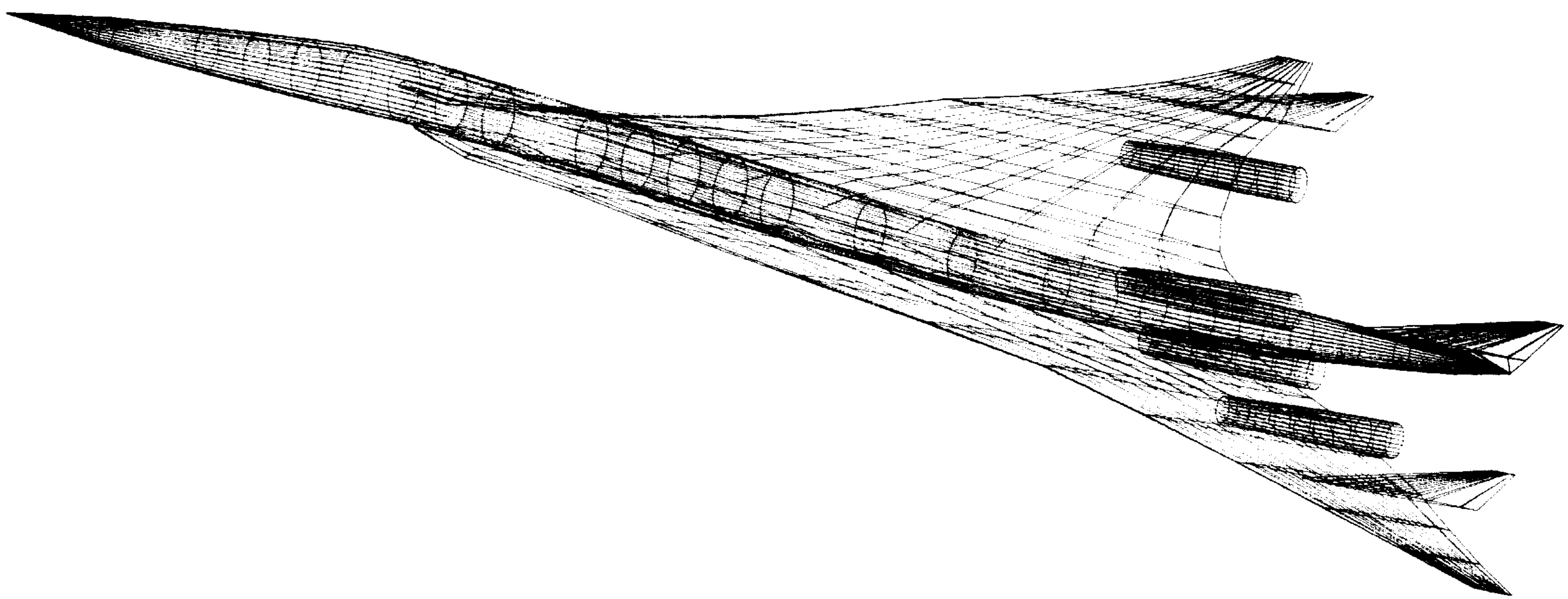

Figure 2.- Oblique orthographic view of a representative airplane configuration with rotation in roll, pitch, and yaw.

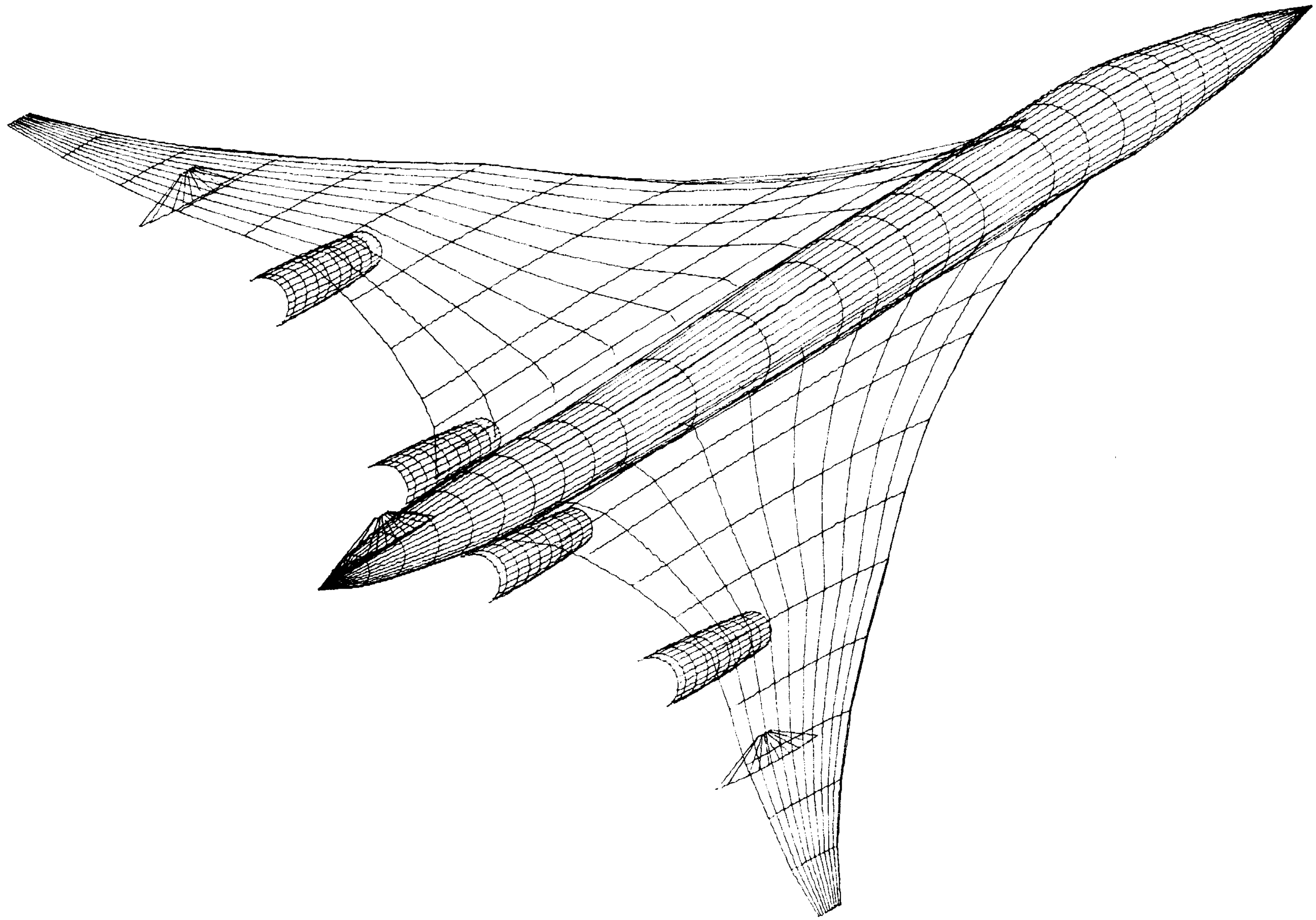

Figure 3.- Oblique orthographic views with rotations in roll, pitch, and yaw with only obverse line segments.

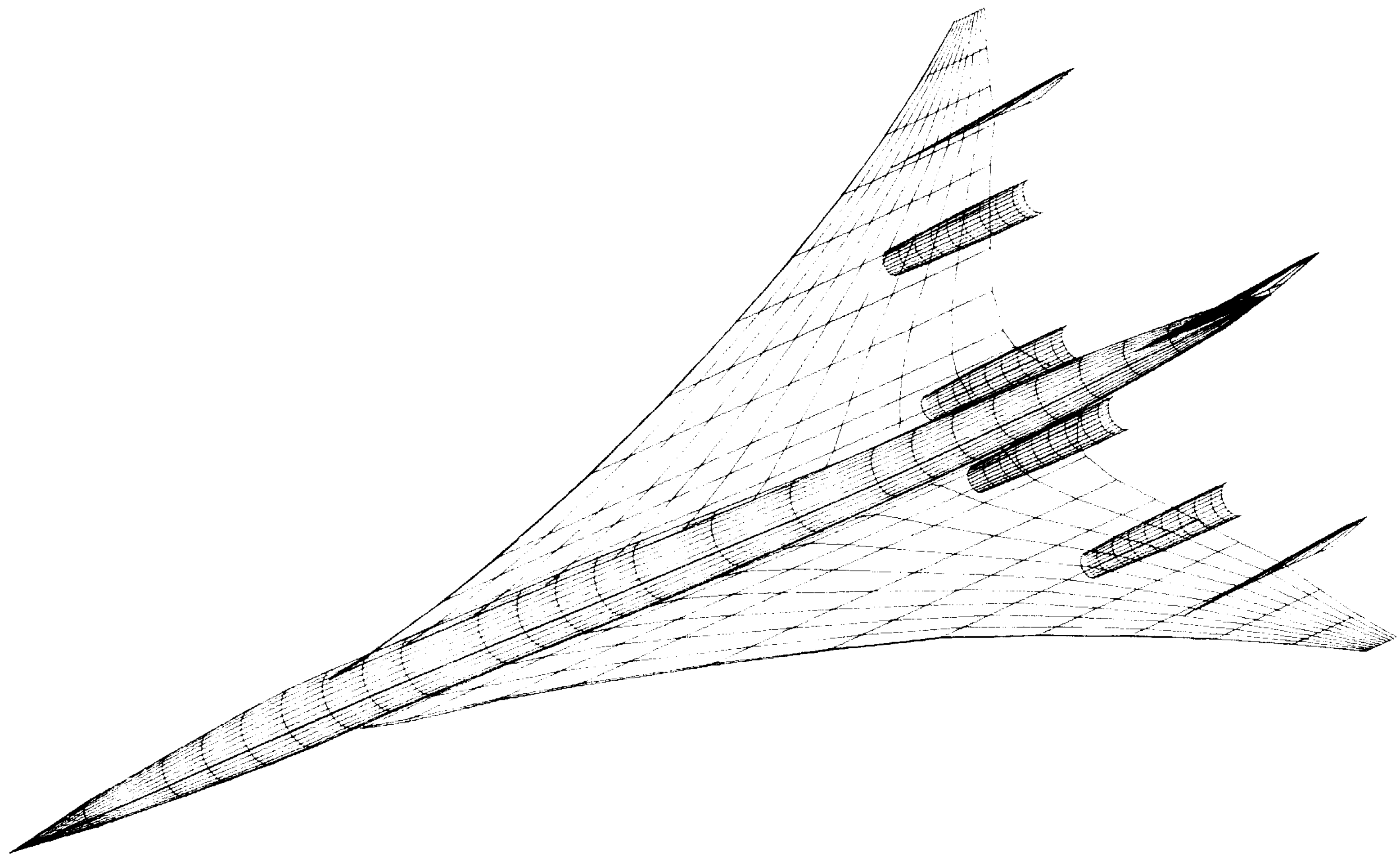

Figure 3.- Concluded.

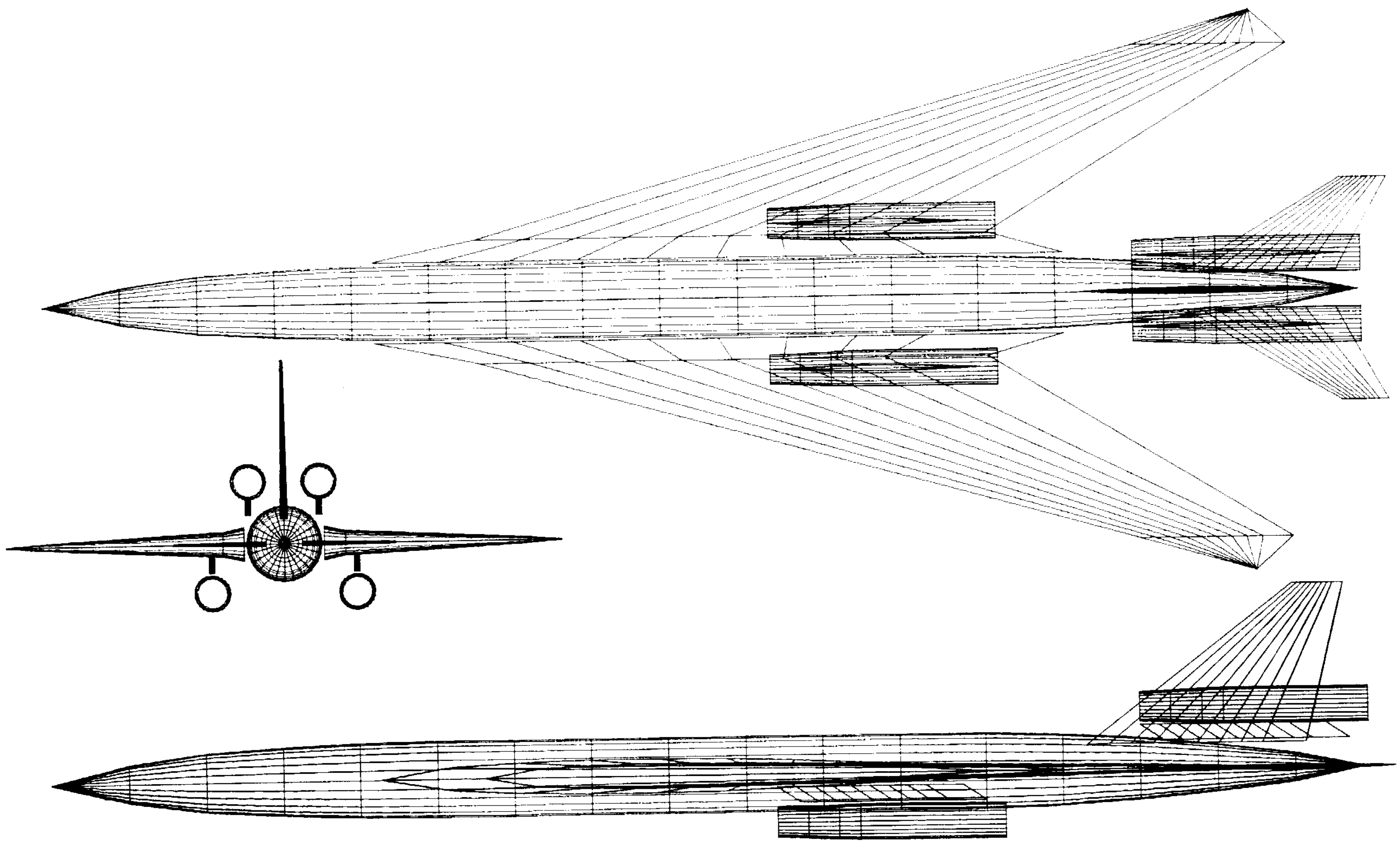

Figure 4.- Typical three-view orthographic representation of an airplane configuration.

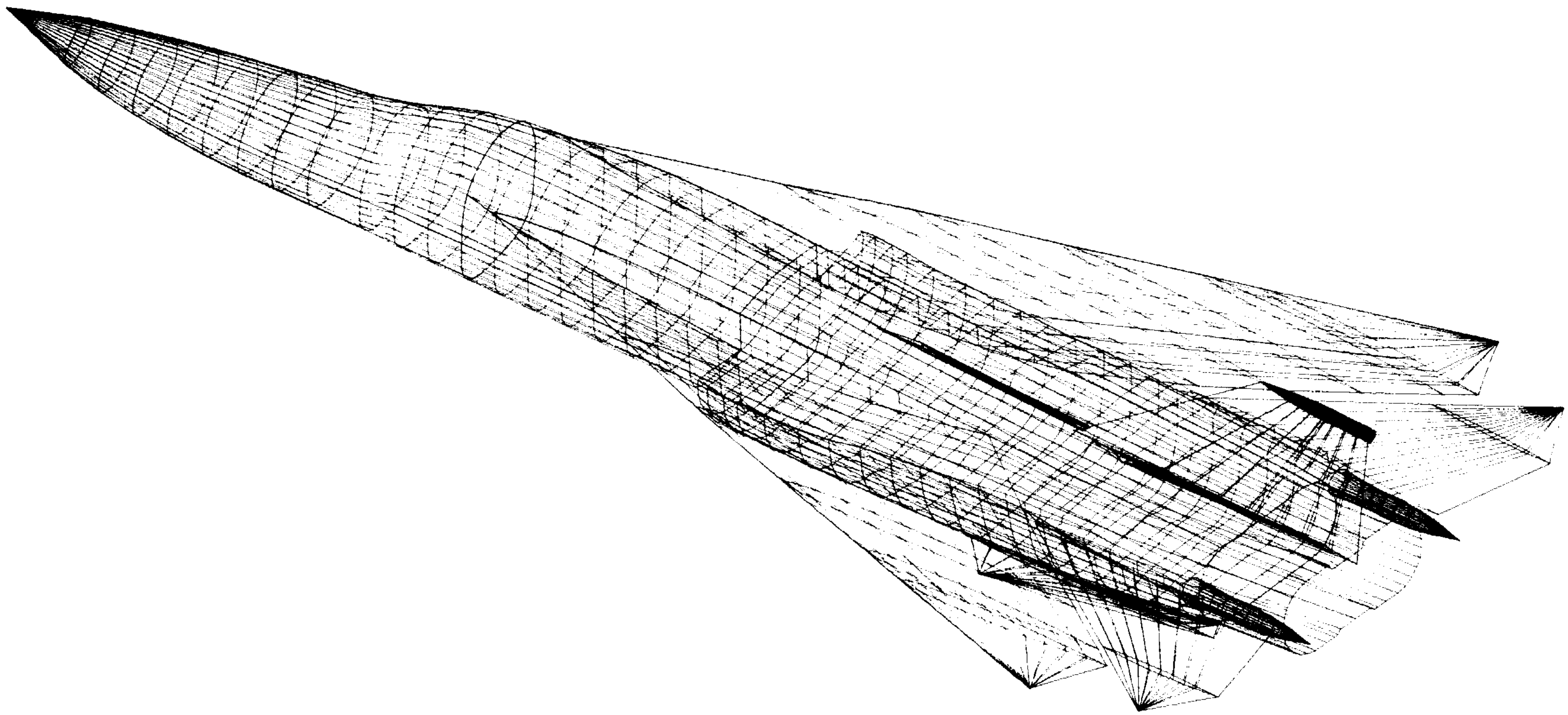

Figure 5.- Perspective views of a representative airplane configuration.

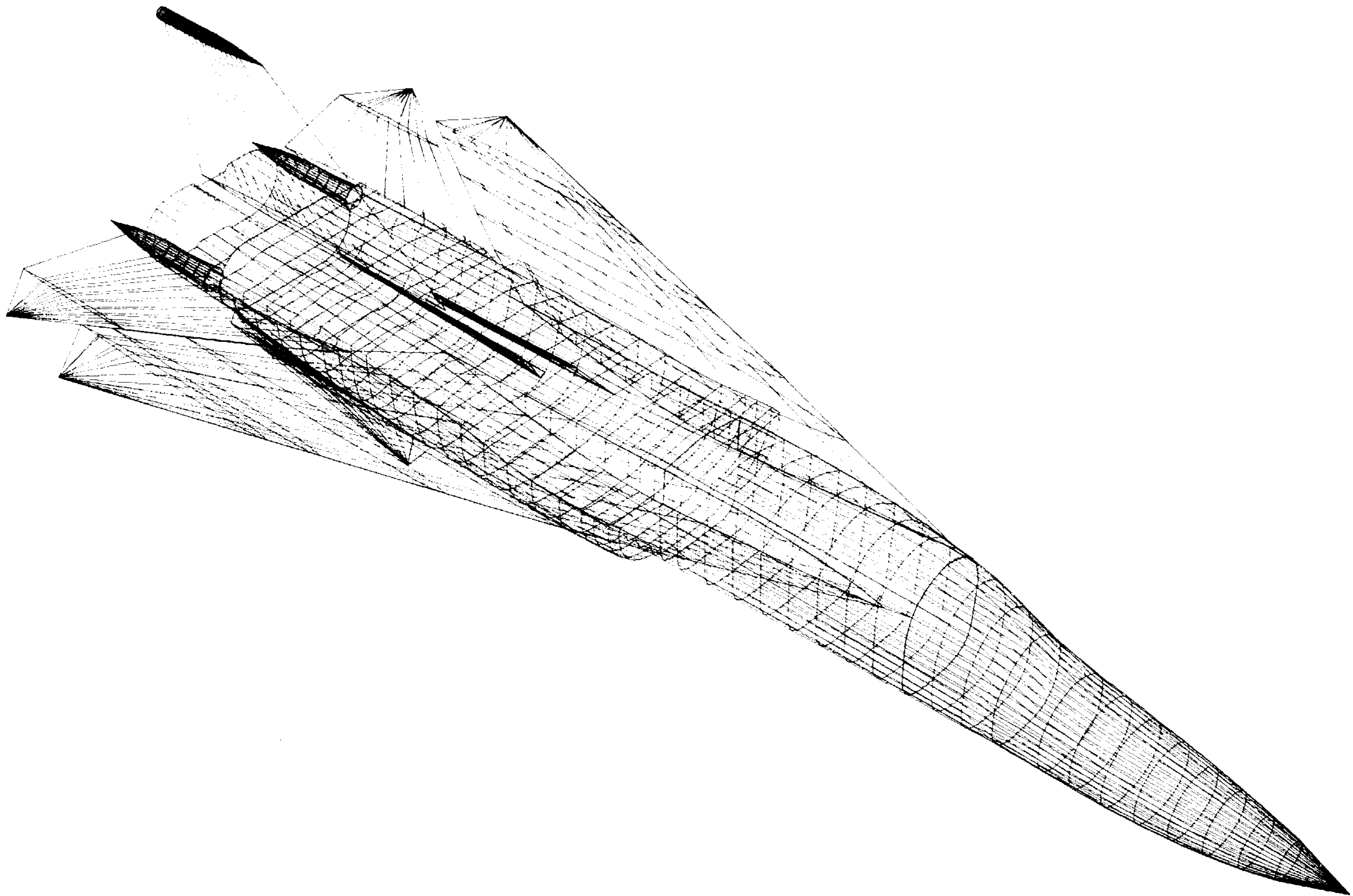

Figure 5.- Concluded.

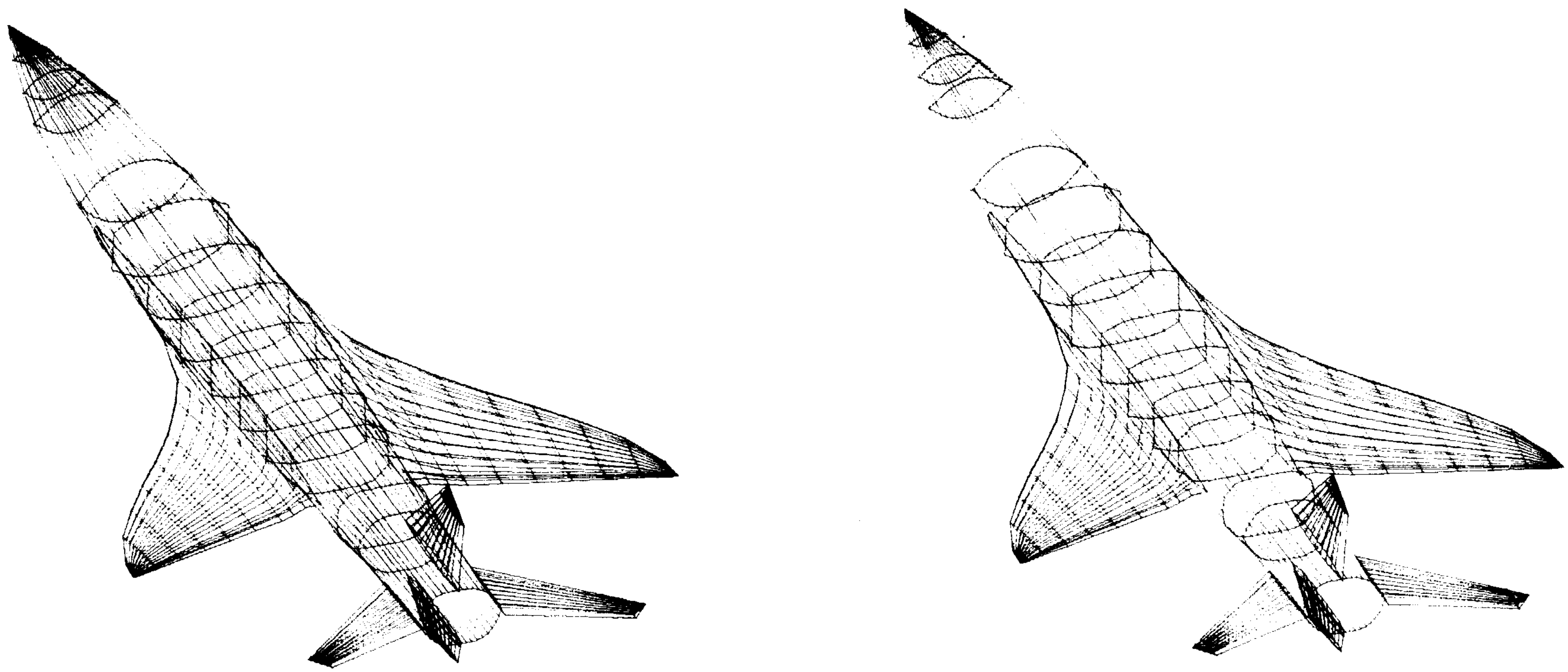

Figure 6.- Examples of stereo frames for three-dimensional viewing of an airplane configuration.

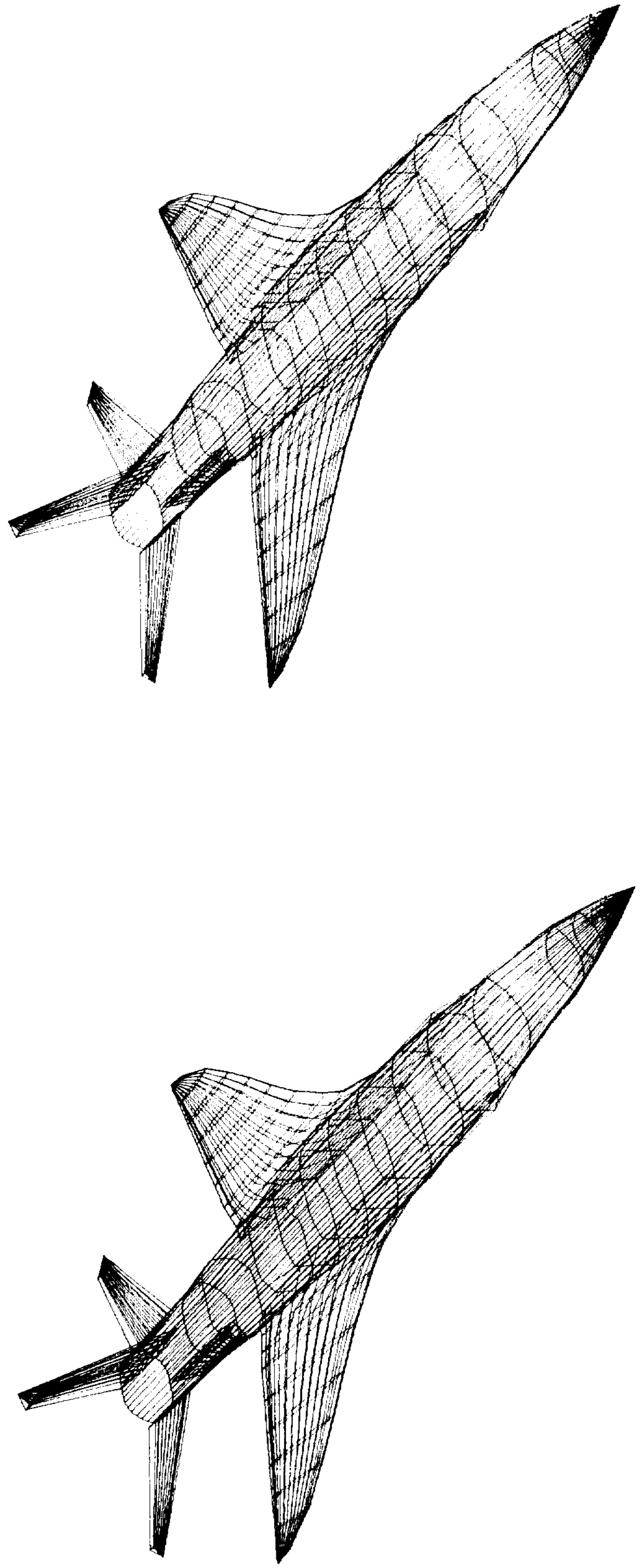

Figure 6.- Concluded.

INPUT FORMAT

(a) Configuration Description

Identification Card:

Card col. 1 – 80

Control Card (punch to right with no decimals):

0: There is none
1: Read in Geom. data
2: Same Geom. as prev. case

Item	Card col.	Variable
Ref. Area	3	J0
Wing (1)	6	J1
Fuselage (2)	9	J2
Nacelle	12	J3
Fin	15	J4
Canard	18	J5
Simplification code (3)	21	J6
No. wing airfoil sections ($2 \leq NWAF \leq 20$)	24	NWAF
No. of ordinates each wing airfoil ($3 \leq NWAFOR \leq 30$)	27	NWAFOR
No. of fuse. segs. (≤ 4)	30	NFUS
1st seg. No. pts. on fuse. 1/2 section ($3 \leq NRADX \leq 30$)	33	NRADX (1)
1st seg. No. of fuselage stations ($4 \leq NFORX \leq 30$)	36	NFORX (1)
2nd seg. No. pts. on fuse. 1/2 section ($3 \leq NRADX \leq 30$)	39	NRADX (2)
2nd seg. No. of fuselage stations ($4 \leq NFORX \leq 30$)	42	NFORX (2)
3rd seg. No. pts. on fuse. 1/2 section ($3 \leq NRADX \leq 30$)	45	NRADX (3)
3rd seg. No. of fuselage stations ($4 \leq NFORX \leq 30$)	48	NFORX (3)
4th seg. No. pts. on fuse. 1/2 section ($3 \leq NRADX \leq 30$)	51	NRADX (4)
4th seg. No. of fuselage stations ($4 \leq NFORX \leq 30$)	54	NFORX (4)
No. of pods described (≤ 9)	57	NP
No. of pod stations ($4 \leq NPODOR \leq 30$)	60	NPODOR
No. of fins described (≤ 6)	63	NF
No. of fin airfoil ordinates ($3 \leq NFINOR \leq 10$)	66	NFINOR
No. of canards (≤ 2)	69	NCAN
No. of canard airfoil ordinates ($3 \leq NCANOR \leq 10$)	72	NCANOR
Config. Code	80	

Notes: 1. -1 indicates uncambered wing (do not input TZORD values)
2. -1 indicates circular fuselage sections (input ZFUS and FUSARD values)
3. -1 indicates uncambered circular fuselage when -1 in cols. 8, 9 (omit ZFUS values)
1 if complete config. is also symmetrical w.r.t. XY plane

Figure 7.- Input data sheets for use with program D2290.

Component Description Cards (punch with a decimal):

Card Col.	1	8	15	22	29	36	43	50	57	64		73 80

Figure 7.- Continued.

(b) Plot Specification Cards

Card col.	1	3	5	8	13	18	23	28	33	38	43	48	53	72
ORTHOGRAPHIC PROJECTIONS	Horz. variable	Vert. variable	"OUT" for hidden line op.	Roll angle, deg.	Pitch angle, deg.	Yaw angle, deg.						Plot size, inches	Plot option: "ORT"	Kode for new config.
PERSPECTIVE OR TWO STEREO VIEWS				View point x	View point y	View point z	Focal point x	Focal point y	Focal point z	Dist. from eye to viewing plane, inches	Magnification factor	Plot size, inches	Plot option: "PER" or "STE"	Kode for new config.
PLAN, SIDE, and FRONT VIEWS				Origin of plan view, inches	Origin of side view, inches	Origin of front view, inches						Plot size, inches	Plot option: "VU3"	Kode for new config.
	[illegible]		[illegible]	PHI	THETA	PSI	XF	YF	ZF	DIST	FMAG	PLOTSZ	TYPE	KODE

Notes: Data in columns 1-7 and 53-58 should be alphanumeric characters.
Punch values in columns 8-52 with a decimal point.

Figure 7.- Concluded.

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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