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COMPUTER CODE TO INTERCHANGE CDS

AND WAVE-DRAG GEOMETRY FORMATS

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SUMMARY

A new interactive computer program provides an interface for the passage of configuration geometry data between the Rockwell Configuration Development System (CDS) and aerodynamic design and analysis codes using a wireframe geometry format. Aircraft geometry can be rapidly developed in CDS, converted to the wireframe geometry format and analyzed. Wireframe geometry files modified in the analysis process can be converted into CDS geometry files and examined for physical viability. Previously created wireframe geometry files may also be converted into CDS geometry files.

INTRODUCTION

Although aircraft geometry description can be conveniently developed using interactive computer programs, configuration development requires that geometry data be passed between the original programs and other codes, such as those for predicting aerodynamic characteristics. The Configuration Development System (CDS) described in reference 1, provides a convenient method of developing aircraft geometry on the PRIME minicomputer (ref. 2). Initially, no program existed to pass the geometry data between CDS and aerodynamic analysis codes which reside on the NOS mainframe computers at NASA Langley Research Center (ref. 3). The process of manually preparing new data files to pass geometry data between codes is tedious and time-consuming (ref. 4). A computer program has been developed on the PRIME minicomputer to enable such geometry data transfers both to and from the CDS code. The geometry-data format for the required analysis codes is commonly referred to as the "old wave-drag format;" this produces a "wireframe" geometry model. There are two versions of the wave-drag geometry formats (refs. 5 and 6) which differ only slightly in the number of descriptive elements allowed. The conversion code of this report uses the restrictions contained in reference 6. Other codes already exist to convert files from the old wave-drag format to other wireframe geometry formats (ref. 7).

The following sections present discussions of the geometry formats and their restrictions, descriptions of the process of executing the geometry file conversion, and examples of converting geometry files. The report also describes how to transfer files between the PRIME minicomputer and the NOS mainframe computer system (Appendices A and B); another section contains discussions on the use of a NOS plotting program to check the resulting geometry in the old wave-drag format. Additional descriptions cover programs to interpret the CDS binary geometry file and to pass geometry to the Langley Wireframe Geometry Standard (LaWGS) format (ref. 8), the Hess geometry format, and the arbitrary geometry format (ref. 9).

CODE DESCRIPTION

The computer program to convert data files between geometry formats is located on a PRIME computer since the CDS binary geometry file is located on PRIME and cannot be transferred between computer systems. The wave-drag format is a card-image file and may be directly transferred between systems (Appendices A and B).

Program CDS2BDP allows the conversion of data files between the CDS geometry format and wave-drag format. In either case, it is necessary to input the name of the input file and the desired name of the output file. When converting from CDS to wave-drag format, many restrictions affect the input data file and many additional inputs are required from the user. Some additions to the wave-drag format file are necessary after the conversion process. When passing data from the wave-drag geometry format to CDS, there are no restrictions on the input data and no other inputs are required from the user; however, some additions and modifications to the CDS file are recommended after the conversion process. The specific details of the code, the restrictions on the input data, and the interactive inputs required from the user are discussed in the following sections.

CDS to Wave-Drag Format

Restrictions.- The CDS file must contain components in this order: wing, fuselage, nacelles, fins, and canards/horizontal tails. The conversion code prints a list of the components and their order on the screen and gives the user an opportunity to terminate execution of the program if the components are not in the proper order. The proper order is also listed on the screen. All components in CDS should be in surface-point form for accurate conversion.

The wing may consist of several different components; however, a maximum of 20 spanwise sections can be used. The wing sections must be ordered from inboard to outboard. Each airfoil section can contain any number of points; a cubic spline routine finds 20 points along the chord at which the airfoil is defined. (This is the equivalent of 40 points per airfoil section in CDS.) The list of points defining the airfoil can begin with the leading or trailing edge. If the airfoil has an unusual shape with few points, the conversion may not be accurate. Also, each airfoil section in CDS should not contain coincidental points, other than the leading and trailing-edge points, to prevent inaccuracies in the conversion.

Like the wing, the fuselage can also be defined as several components; however, each component must have the same number of points in each cross section and each cross section can contain a maximum of 30 points per half section. The CDS geometry file contains more than four fuselage components. The conversion program produces a fuselage defined by the minimum number of components possible in the wave-drag format. The wave-drag format allows four fuselage components; if a fifth component is required, program execution stops. Use of fuselage components with the same number of points per cross section insures that the minimum number of wave-drag format components are generated. When the cambered circular fuselage is chosen, the fuselage will be transferred as circular sections of equivalent area with the midpoint of the circle at the midpoint of a line connecting the minimum and maximum z-locations.

The aircraft configuration elements can include up to three pods or nacelles on each side of the vehicle. (Nacelles must each have the same number of cross sections.) The point definition for each cross section used in CDS is converted to an equivalent radius, so the number of points per cross section is not critical. Additionally, there is no requirement that each component have the same number of points per cross section.

A maximum of six fins are allowed with three on each side for a symmetrical configuration. As with the wing, coincident points other than as the first and last points of the airfoil section cause inaccuracies for the wave-drag format. A cubic spline converts any number of points per cross section to 10, which is what is allowed in the old wave-drag format. Only the root and tip airfoil sections are preserved in the conversion. Cant effects are automatically included in the conversion process.

There may be two canards or horizontal tails. Again, as with the wing and fins, coincident points are limited to the first and last points of the airfoil section. A cubic spline converts any number of points per cross section to 10 points; the program retains only the root and tip airfoil sections. The final product does include dihedral effects.

USER INPUT DESCRIPTION.- The user input required to convert a CDS geometry file to the old wave-drag geometry format is described in the following section. (The text presented here totally in capital letters is displayed on the computer terminal screen.)

CONVERT BDAP TO CDS/CDS TO BDAP: Selects the direction of file transfer.

CDS FILE: The name of the CDS file to be converted.

BDAP FILE: The name of the file that will contain the wave-drag format description.

COMPONENTS IN RIGHT ORDER: If the components are not in the correct order, the program allows an exit at this point by inputting a 2. It is necessary to go back into CDS to modify the component order. This can be done by moving all components from the permanent file into the work file, deleting all components in the permanent file, and then putting the components from the work file back into the permanent file, one by one, in the correct order.

REFERENCE AREA: Two choices exist for this input. The first is for the user to input the reference area. The other requires the indication of the wing component number; this allows the code to find the reference area in the component data portion of the wing component. If the user definition is chosen, a prompt asks for the reference area to be specified. If the wing component option is chosen, the program calls for the wing component number. If the reference area is not defined in the component data section, output to the screen indicates this, and the options for inputting reference area are presented again. The reference area must be defined in one of these methods.

INPUT CODES: These inputs are used to tell the computer whether or not the specific types of components are present in the CDS file. If the component type exists, a "1" should be entered; otherwise, a "0" should be entered.

NUMBER OF COMPONENTS: This tells how many of each type of component are present in the CDS file. This question is only asked for those components which were indicated to be present.

FUSELAGE OPTION: The fuselage can be converted into one of two forms. The first consists of arbitrary points (the y's and z's of each point in the cross section are given). The second option is for the equivalent cambered circular sections to be output. The center of each circular cross section lies in the plane of the y-z axis and has a z value equal to the midpoint between the maximum and minimum z values of that section.

SCALE FACTOR: This will convert the CDS dimensions to dimensions of the user's choosing. The default value is 1.0.

Samples of input to the program are contained in the section entitled "Sample Cases." The program prompts for all inputs.

Certain analysis codes require additions to the file of wave-drag geometry format produced by this code. Specifically, the mean aerodynamic chord, c, and the x-location of the center of gravity, $x_{c.g.}$, must be included. This can be accomplished by manually editing the file and inserting these values in line 3, columns 8-14 and 15-22, respectively. (Line 3 initially contains only the wing reference area.)

Wave-Drag Format to CDS

Restrictions.- No restrictions are required on the wave-drag format geometry file for conversion to a file acceptable to CDS; any vehicle description written in the wave-drag format can be converted to a data file for CDS.

The conversion process does lose some of the information contained in the wave-drag format file and operates with certain default labels for files. The process does not carry the wing area, mean aerodynamic chord, and x-location of the center of gravity into the CDS geometry file. Additionally, "BDAP FILE" is always the CDS internal file name, "V JOHNSON" is the designer's name, and "AAA" is the protect code. These parameters can be changed in CDS using the CHANGE command. The conversion produces surface-point definitions of all components.

ACCESS TO COMPUTER CODE

The computer code to transfer geometry between CDS and the wave-drag format is located on the PRIME minicomputer system in the CDS user file directory (UFD) under the name CDS2BDP. To run the program from an individual user's UFD, enter:

R CDS>CDS2BDP

The files to be converted, as well as the files created, must be located in the user's UFD.

SAMPLE CASES

The following three cases illustrate the use of the conversion program. Additionally, example 2 contains extra information which may be helpful for trouble-shooting other cases.

Example 1.- An unusual aircraft configuration created in CDS (fig. 1a) provides an example to illustrate numerous features of the conversion program. The preceeding section describes how to access the program. The following material illustrates the prompting questions and appropriate answers.

BDAP to CDS or CDS to BDAP: 2   (Convert CDS to wave drag)

INPUT CDS FILE: 'EXPFTR'   (Single quotes required)

OUTPUT BDAP FILE: 'BDPFTR'   (Single quotes required)

Components in correct order?: 1   (Yes)

REFERENCE AREA: 2   (Use component definition of
                                                 wing area)

COMPONENT NUMBER: 1   (Wing component is 1, 64A
                                                 blended wing)

WING INPUT CODE: 1   (Yes, a wing exists)

FUSELAGE INPUT CODE: 1   (Yes, a fuselage exists)

NACELLE INPUT CODE: 1   (Yes, nacelles exist)

FIN INPUT CODE: 1   (Yes, fin exists)

CANARD INPUT CODE: 1   (Yes, canards exist)

NO. OF WING COMPONENTS: 1

NO. OF FUSELAGE COMPONENTS: 3

FUSELAGE TYPE: 1   (Arbitrary)

NO. OF PODS: 3

NO. OF FINS: 4

NO. OF CANARDS/HORIZONTAL TAILS: 1

SCALE FACTOR FOR LENGTH: 0.0833 (inches to feet)

Copies of the terminal screen during the conversion process are shown in Appendix E, part 1.

After transferring the wave-drag file (BDPFTR) to NOS (see Appendix A for details on how to accomplish this transfer), the file can be plotted using SEEAC. To use this program on NOS enter:

    GET,SEEAC/UN=273347N

    SEEAC,filename

where filename is the name of the wave-drag file on NOS. A three-view drawing created using SEEAC on NOS is shown in figure 1b.

Example 2.- A Bomarc missile geometry was modeled in CDS (fig. 2a). The program is run as described above and the questions answered in the following manner:

BDAP to CDS or CDS to BDAP: 2	(Convert CDS to wave drag)
INPUT CDS FILE: 'BOMARC'	(Single quotes required)
OUTPUT BDAP FILE: 'BOMARC'	(Single quotes required)
COMPONENTS IN CORRECT ORDER?: 1	(Yes)
REFERENCE AREA: 2	(Use component definition of wing area)
COMPONENT NUMBER: 1	(Blended wing)
WING INPUT CODE: 1	(Yes, a wing exists)
FUSELAGE INPUT CODE: 1	(Yes, a fuselage exists)
NACELLE INPUT CODE: 1	(Yes, a nacelle exists)
FIN INPUT CODE: 1	(Yes, fins exist)
CANARD INPUT CODE: 1	(Yes, a tail exists)
NO. OF WING COMPONENTS: 1	
NO. OF FUSELAGE COMPONENTS: 1	
FUSELAGE TYPE: 2	(Cambered circular)
NO. OF PODS: 1	
NO. OF FINS: 2	
NO. OF CANARDS/HORIZONTAL TAILS: 1	
SCALE FACTOR FOR LENGTH: 1.0	(no change)

Copies of the terminal screen during the conversion process are shown in Appendix E, part 2. The resulting wave-drag geometry format file is shown in

Appendix E, part 3. A three-view drawing created using SEEAC on NOS is shown in figure 2b. The simplistic constraints on fin definition (due to the wave-drag data format) reduce the vertical fin to a single triangle.

Occasionally a problem may arise in the file transfer due to unforeseen circumstances. When that occurs, it is possible to use a program called RDCDS to see exactly what the CDS binary data file contains before any kind of conversion is made. RDCDS reads the data file and generates a file containing an interpreted version of the data. Descriptions of the CDS parameters used can be found in reference 1.

For the Bomarc missile, RDCDS was run by entering:

R CDS>RDCDS

The questions were answered in the following manner:

GEOMETRY OUTPUT: 2	(CDS output file only)	
INPUT CDS FILE: 'BOMARC'	(Single quotes required)	
OUTPUT CDS FILE: 'RDMARC'	(Single quotes required)	

A copy of the terminal screen generated while executing RDCDS is shown in Appendix E, part 4. Appendix E, part 5, shows a partial listing of the resulting interpreted CDS file (RDMARC).

RDCDS will also convert CDS geometry to the LaWGS (Langley Wireframe Geometry Standard) format (ref. 8) and to the Hess wireframe geometry format. When the option is selected to convert to one of these formats, the CDS output file is also generated. File names are required for both the special format file and the CDS output file. Details on RDCDS are contained in Appendix C and on CDS2LRC (a program to convert from CDS to the Langley Wireframe Geometry Standard Format) in Appendix D.

Example 3.- A wave-drag format model of the AST-205 located on NOS illustrates the process of transferring a file from the wave-drag format to CDS. A three-view drawing of the AST-205, prepared with SEEAC on NOS, is shown in figure 3a. The file (AST-205) must be transferred from NOS to PRIME in order to use the conversion code. Appendix B contains the details on how to accomplish the file transfer between NOS and PRIME. It is necessary to edit the wave-drag format geometry file after it has been transferred to PRIME and remove the dayfile created during the transfer process before attempting to convert the file to the CDS binary format. Once the dayfile has been removed, CDS2BDP is run and the questions answered in the following manner:

BDAP to CDS or CDS to BDAP: 1	(Wave drag to CDS)	
INPUT BDAP FILE: 'AST205'	(Single quotes required)	
OUTPUT CDS FILE: 'CDSAST'	(Single quotes required)	

A copy of the terminal screen during this process is shown in part 6 of Appendix E. Figure 3b shows the three-view drawing of the CDS geometry file

(CDSAST) made using CDS. The required input from the user is much less when transferring from the wave-drag format to CDS; the chance of encountering a problem is also greatly reduced.

CONCLUDING REMARKS

A computer program has been written on the PRIME minicomputer to convert between geometry in the Rockwell International Configuration Development System (CDS) and the wave-drag format. Details on this conversion process are presented. Also presented are details on related CDS geometry conversion programs. Samples show that the conversion process works. In certain cases, a considerable amount of information is required from the user and some additions and modifications to the resulting geometry files are required but the bulk of the data transfer occurs automatically. The program provides a useful link between a geometry creation and manipulation code and analysis codes by providing rapid and accurate geometry conversion.

REFERENCES

1. Raymer, D. P.: Configuration Development System. Version V, Rockwell TFD 78-755-3, 1981.

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6. Middleton, W. D.; and Lundry, J. L.: A System for Aerodynamic Design and Analysis of Supersonic Aircraft. Part 2 - User's Manual. NASA CR-3352, 1980.

7. Hall, Jon F.; Neuhar, Don H.; and Walkley, Kenneth B.: An Interactive Graphics Program for Manipulation and Display of Panel Method Geometry. NASA CR 166098, 1983.

8. Craidon, Charlotte B.: A Description of the Langley Wireframe Geometry Standard (LaWGS) Format. NASA TM 85767, 1985.

9. Craidon, Charlotte B.: User's Guide for a Computer Program for Calculating the Zero-Lift Wave Drag of Complex Configurations. NASA TM 85670, 1983.

APPENDIX A

TRANSFERRING FILES FROM PRIME TO NOS

To transfer the wave-drag geometry card image file from PRIME to NOS, first create a procedure file on PRIME that looks like:

```
JOB...
USER...
CHARGE...
COPY,INPUT,FILE.                          file 'SEND'
REWIND,FILE.
REPLACE FILE.
DELIVER.$PATHNAME>FILE.SEND
EXIT.
@
```

                    CARD-IMAGE

                       FILE

                        .

                        .

                        .

where FILE is the name the card-image will be stored as on NOS and PATHNAME is the user's pathname. The user number, password, and charge number should be those valid on NOS. To send the file just created ('SEND') to NOS, give the command:

        RJSEND SEND CDC

The status of the file transfer may be checked by commanding:

        STATRJ

The card-image file will be saved as a permanent file with the name FILE on NOS.

APPENDIX B

TRANSFERRING FILES FROM NOS TO PRIME

To transfer a card-image file from NOS to PRIME, first create a file on PRIME
that looks like:

```
        JOB...
        USER...
        CHARGE...                         file 'SEND'
        DELIVER.$PATHNAME>FILE
        GET,FILE.
        COPYSBF,FILE,OUTPUT.
```

where FILE is the name of the card-image file on NOS and on PRIME and PATHNAME is
the user's pathname. The user number, password, and charge number should be those
valid on NOS. To send the file just created ('SEND') to retrieve the NOS file,
command:

```
        RJSEND SEND CDC
```

The status of the file transfer may be checked by:

```
        STATRJ
```

The card-image file will be saved on PRIME with the name FILE. It will be
necessary to edit FILE and delete the dayfile at the top before using the file.

APPENDIX C

CONVERSION FROM CDS TO OTHER GEOMETRY FORMATS

A computer program (RDCDS) has been developed on the PRIME minicomputer to read the CDS geometry file and convert it to other forms. The options include the arbitrary geometry format (ref. 9), the Hess geometry format, or a file that contains a readable version of the data in the CDS geometry file. The readable CDS file is also produced if the arbitrary geometry or Hess formats are selected. The variable names used in the readable CDS file are consistent with those used to describe the CDS geometry format in Appendix C of the CDS user's manual (ref. 1).

RDCDS is located in the CDS UFD. To run the code, enter from the user's UFD:

    R CDS>RDCDS

Required inputs include the file name of the CDS geometry file and selection of the resulting output type. If the Hess format or the readable CDS file option is selected, no further inputs from the user are required. A component list is output to the screen and each component is identified as it is dealt with. The file names requested contain the appropriate information after execution of the code is complete. A copy of the terminal screen during the conversion process to the readable CDS file for the Bomarc missile example is shown in Appendix E, part 4; part 5 of Appendix E presents a partial listing of the resulting readable CDS geometry file as discussed in the example section in the text. A copy of the terminal screen during the conversion process to the Hess format and a partial resulting geometry listing are presented in Appendix E, parts 7 and 8, respectively. Modifications to the Hess format file may be required for use in certain applications programs. A typical change is the addition of a digit to the end of each line to indicate if the component is a lifting surface.

When the arbitrary geometry format is selected, the user must supply additional information. This information is primarily related to options for the zero-lift wave-drag program. The requirement for wing reference area must be satisfied by either giving a nominal value or identifying the wing component number. If the wing component number is selected and the wing component does not contain the reference area in the proper data position, a message appears to indicate that the reference area is not defined; control then returns to the option to select the reference area input method. If the reference area is not defined in the wing component, the user should input an area. The next input required from the user is an option controlling the amount of output printed from the wave-drag program. Following that, a scale factor must be selected. (It is possible to select no scale factor, a scale factor for the entire configuration, or a scale factor for each component. If a scale factor for each component is selected, it must be input for each component.) The final required input is the specification of the surface type, either fusiform or nonfusiform, for each component. Generally, fuselage and pod components are fusiform while wing and tail components are nonfusiform. Reference B contains a detailed description of this parameter and the others related to the wave drag program.

Example for Arbitrary Geometry Format.- For the Bomarc missile, RDCDS is run as described above and the questions are answered in the following manner:

GEOMETRY OUTPUT: 0   (Arbitrary geometry format)

INPUT CDS FILE: 'BOMARC'   (Single quotes required)

OUTPUT ARB. GEO. FILE: 'BOMARCA'   (Single quotes required)

OUTPUT CDS FILE: 'BOMARC3'   (Single quotes required)

REFERENCE AREA OPTION: 1   (User input)

REFERENCE AREA: 3.51   (Same units as CDS geometry

PRINT OPTION: 0   (No extra output in wave-drag
                                               program)

SCALE FACTOR: 0   (No scale factor)

SURFACE TYPES: 1   (Wing - nonfusiform)

                0   (Fuselage - fusiform)

                0   (pods - fusiform)

                1   (Vert. fin - nonfusiform)

                1   (Pylon fins - nonfusiform)

                1   (Hor. tail - nonfusiform)

Copies of the terminal screen during the conversion process are shown in Appendix E, part 9. Appendix E, part 10, presents a partial listing of the resulting arbitrary geometry file. This file may be plotted on NOS using the program DRAWAC. To use this program, enter:

GET,DRAWAC/UN=273347N.

DRAWAC,filename.

where filename is the name of the arbitrary geometry file on NOS.

CDS TO LAWGS CONVERSION CODE

A translator has been written on the PRIME minicomputer to convert geometry in CDS to the Langley Wireframe Geometry Standard (LaWGS) format described in reference 8. However, the translator from LaWGS to CDS does not exist as of this writing.

As discussed in reference 8, the LaWGS format allows for both global and local coordinates. The CDS-LaWGS translator converts CDS components to either local coordinates or to the global coordinate system. Each CDS component must be in surface-point form, have an equal number of points per cross section, and contain more than one point per cross section. There is no limit to the number of CDS components allowed, and any size CDS component will transfer to the LaWGS format.

To run the code, enter from the user's UFD:

R CDS>CDS2LRC

The required inputs to the translator consist of the name of the input CDS file, the desired name of the output LaWGS file, and the desired type of LaWGS file (local or global). The file names must be enclosed in single quotes. The remainder of the process is automatic. A copy of the terminal screen during the conversion process for the previous Bomarc missile example is shown in Appendix E, part 11. The output LaWGS file is located in the file name requested by the user. Appendix E, part 12, gives a partial listing of the resulting output file.

A program to plot geometry in the LaWGS format does not exist as of this writing. Additionally, the number of applications codes that can use LaWGS is currently very limited.

APPENDIX E

SCREEN IMAGES OF FILE LISTINGS AND PROGRAM OPERATION

Screen images have been recorded to illustrate both program operations and output files. Screen "dumps" from operations on an interactive terminal produced the following sets of images. The Appendix is subdivided into 12 parts each of which is a separate set of screen images. The parts are numbered at the bottom of the appendix pages.

```
DO YOU WANT TO:
  1: CONVERT A BDAP FILE TO A CDS FILE
OR 2: CONVERT A CDS FILE TO A BDAP FILE?
2
INPUT NAME OF INPUT CDS FILE
'EXPFTR'
INPUT NAME OF OUTPUT BDAP FILE
'BDPFTR'
```

Listing 1.- Experimental aircraft CDS to wave-drag conversion.

ENTER SCALE FACTOR FOR LENGTH
.0833
%%%% STOP

OK,

```
1.00000    64A BLENDED WING
2.00000    POINT FWD FUSELAGE
3.00000    MID FUSELAGE-INLET
4.00000    POINT AFT FUSELAGE
5.50000    CIRCULAR NACELLE
6.50000    CIRCULAR INLET
7.00000    NACELLE COMES
8.00000    VERT TAIL BASE
9.00000    VERT TAIL MID SECT
10.00000   VERT TAIL TIP
11.00000   VENTRAL FINS-2
12.00000   BLENDED CANARD

COMPONENT ORDER MUST BE:
    WING
    FUSELAGE
    PODS
    FINS
    CANARDS

ENTER 1 IF COMPONTS ARE IN CORRECT ORDER AND YOU
WANT TO GO ON OR 2 IF YOU WISH TO STOP NOW
1

REFERENCE AREA REQUIRED
OPTIONS:
    1 - USER INPUT
    2 - USE WING AREA (WING COMPONENT
        NUMBER MUST BE INPUT
2

INPUT WING COMPONENT NUMBER
1

ENTER WING INPUT CARD
    0 - NO WING
    1 - READ WING
1

ENTER FUSELAGE INPUT CODE
    0 - NO FUSELAGE
    1 - READ FUSELAGE
1

ENTER NACELLE INPUT CODE
    0 - NO NACELLES
    1 - READ NACELLES
1

ENTER FIN INPUT CODE
    0 - NO FINS
    1 - READ FINS
1

ENTER CANARD (OR HORIZONTAL TAIL) INPUT CODE
    0 - NO CANARDS
    1 - READ CANARDS
1

ENTER NUMBER OF WING COMPONENTS
1

ENTER NUMBER OF FUSELAGE COMPONENTS
3

CONVERT FUSELAGE TO: 1. ARBITRARY FUSELAGE
                     2. CAMBERED CIRCULAR FUSELAGE
1

ENTER NUMBER OF PODS TO READ
3

ENTER NUMBER OF FINS TO READ
4

ENTER NUMBER OF CANARDS (HORIZONTAL TAILS) TO READ
1
```

Listing 1.- Concluded.

```
DO YOU WANT TO:
    1: CONVERT A BDAP FILE TO A CDS FILE
 OR 2: CONVERT A CDS FILE TO A BDAP FILE?
2
INPUT NAME OF INPUT CDS FILE
:BOMARC'
INPUT NAME OF OUTPUT BDAP FILE
:BDPMARC'
```

Listing 2.- Bomarc missile CDS to wave-drag conversion.

```
       1.000000     WING BLENDED
       2.000000     FUSELAGE
       3.000000     PODS
       4.000000     VERTICAL FIN
       5.000000     PYLON FINS
       6.000000     HORIZONTAL TAIL

COMPONENT ORDER MUST BE:
       WING
       FUSELAGE
       PODS
       FINS
       CANARDS

ENTER 1 IF COMPONTS ARE IN CORRECT ORDER AND YOU
WANT TO GO ON OR 2 IF YOU WISH TO STOP NOW
1
REFERENCE AREA REQUIRED
   OPTIONS:      1 - USER INPUT
                 2 - USE WING AREA (WING COMPONENT
                     NUMBER MUST BE INPUT
2
INPUT WING COMPONENT NUMBER
1
ENTER WING INPUT CARD     .
   0 - NO WING
   1 - READ WING
1
ENTER FUSELAGE INPUT CODE
   0 - NO FUSELAGE
   1 - READ FUSELAGE
1
ENTER NACELLE INPUT CODE
   0 - NO NACELLES
   1 - READ NACELLES
1
ENTER FIN INPUT CODE
   0 - NO FINS
   1 - READ FINS
1
ENTER CANARD (OR HORIZONTAL TAIL) INPUT CODE
   0 - NO CANARDS
   1 - READ CANARDS
1
ENTER NUMBER OF WING COMPONENTS
1
ENTER NUMBER OF FUSELAGE COMPONENTS
1
CONVERT FUSELAGE TO: 1. ARBITRARY FUSELAGE
                     2. CAMBERED CIRCULAR FUSELAGE
2
ENTER NUMBER OF PODS TO READ
1
ENTER NUMBER OF FINS TO READ
2
ENTER NUMBER OF CANARDS (HORIZONTAL TAILS) TO READ
1
ENTER SCALE FACTOR FOR LENGTH
1
XXXX STOP

OK,
```

Listing 2.- Concluded.

```
PS6
.NULL.
BOMARC MISSILE FOR LAMINAR FLOW STUDIES
1 1 -1 1 1   0   3 20 1 24  8  0  0  0  0  0  0  0  1  4  2 10 1-10
  3.5                                                                  REFA
0.000  0.250  0.500  0.750  1.000  3.000  5.000  7.500 10.000 15.000   XAF
20.000 30.000 40.000 50.000 60.000 70.000 80.000 90.000 95.000100.000  XAF
3.602  0.161  0.130  1.837                                             UORG
4.594  0.994  0.130  0.852                                             UORG
5.078  1.400  0.130  0.000                                             UORG
-0.000 -0.000 -0.000 -0.000 -0.000 -0.000 -0.000 -0.000 -0.000 -0.000  TZORD
-0.000 -0.000 -0.000 -0.000  0.000  0.000  0.000  0.000  0.000 -0.000  TZORD
-0.000 -0.000 -0.000 -0.000  0.000  0.000  0.000  0.000  0.000 -0.000  TZORD
-0.000 -0.000 -0.000 -0.000  0.000  0.000  0.000  0.000  0.000  0.000  TZORD
-0.000 -0.000 -0.000 -0.000  0.000  0.000  0.000  0.000  0.000  0.000  TZORD
0.0000 0.2323 0.2819 0.3215 0.5296 0.6574 0.7966 0.9132 1.0985         UORD
1.2387 1.5000 1.4645 1.3027 1.0449 0.7195 0.3640 0.1824 0.0000         UORD
0.0000 0.2323 0.2819 0.3215 0.5296 0.6574 0.7966 0.9132 1.0985         UORD
1.2387 1.5000 1.4645 1.3027 1.0449 0.7195 0.3640 0.1824 0.0000         UORD
0.0000 0.2257 0.2802 0.3197 0.5299 0.6553 0.7963 0.9122 1.0981         UORD
1.2375 1.4994 1.4641 1.3020 1.0446 0.7182 0.3633 0.1822 0.0000         UORD
0.000  1.183 -3.550  4.437 -5.325 -6.212 -7.100                        UORD
0.000 -1.183 -3.550  4.437 -5.325 -6.212 -7.100                        UORD
0.000 -0.004 -0.004 -0.003 -0.002 -0.001 -0.000                        UORD
0.2    0.2    0.2    0.2    0.2    0.2                                  PODORG
3.98   0.35   1.85   6.6   25.00  50.00  75.00  95.00 100.00           FINORG
0.00   1.00   0.18  10.00   0.90   1.32   1.44   0.87   0.18   0.00     XFIN
0.12   0.15   1.0    0.90   0.90   1.32   1.44   0.87                   FINORD
6.1    0.2    1.0    4.2   -0.2   -0.2    0.8                           FINORG
0.00   1.00   0.8    5.00  25.00  50.00  75.00  95.00 100.00           XFIN
4.2   -0.2    0.8   10.01   1.35   1.46   0.89   0.18   0.00            FINORD
0.00   0.50   5.00   0.66                                              CANORG
0.00   0.23   0.32   1.0                                               XCAN
6.0    0.1    1.0    6.8   25.00  50.00  75.00  95.00 100.00           CANORG
0.00   0.50   5.00  10.00  25.00  50.00  75.00  95.00 100.00           XCAN
0.16   0.08   0.53   0.79   1.24   1.37   0.77   0.03   0.15           CANORDU
0.16   0.40   0.49   1.11   1.56   1.69   1.09   0.35   0.15           CANORDL
BOTTOM
```

Listing 3.- Bomarc missile wave-drag file.

```
SELECT GEOMETRY OUTPUT
    0    LAWGS - CRAIDON
    1    HESS
    2    CDS OUTPUT FILE ONLY
2
 INPUT NAME OF CDS GEOMETRY FILE
'BOMARC'
 INPUT NAME OF CDS OUTPUT FILE
'RDMARC'
    1.00000    WING BLENDED
    2.00000    FUSELAGE
    3.00000    PODS
    4.00000    VERTICAL FIN
    5.00000    PYLON FINS
    6.00000    HORIZONTAL TAIL
THIS COMPONENT IS WING BLENDED
THIS COMPONENT IS FUSELAGE
THIS COMPONENT IS PODS
THIS COMPONENT IS VERTICAL FIN
THIS COMPONENT IS PYLON FINS
THIS COMPONENT IS HORIZONTAL TAIL
**** STOP

OK,
```

Listing 4.- Bomarc RDCDS terminal screen,

```
.NULL.
.BOMARC MISSILE FOR LAMINAR FLOW STUDIES
ZOT                    1
07/29/85                                       6
ROMARC
     1.00000   2.00000 ,   3.00000   4.00000   5.00000   6.00000
'UING BLENDED
NSEC=     0.16096         0.99386             1.39986
   1    3 ITP=    0 ISVM=  0        2 NCST=   0
  40   79

TX=      4.38433 TV=     0.00000 TZ=      0.13000
ROLL=    0.00000 PITCH=  0.00000 YAU=   90.00000
XMAX=    1.39986 YMAX=   0.78278 ZMAX=    0.02756
XMIN=    0.16096 YMIN=  -1.06166 ZMIN=   -0.02756
COMPN= 10000.00000 IUERS=      0
07/29/85
```

	C1	C2	C3	C4	C5
Y CS 1	-0.78278	-0.77359	-0.76900	-0.75981	-0.73685
	-0.69091	-0.64498	-0.59905	-0.50718	-0.41531
	-0.32344	-0.23158	-0.04784	0.13589	0.31962
	0.50336	0.59523	0.68709	0.87083	1.05456
	0.87083	0.68709	0.59523	0.50336	0.31962
	0.13589	-0.04784	-0.23158	-0.32344	-0.41531
	-0.50718	-0.59905	-0.64498	-0.69091	-0.73685
	-0.75981	-0.76900	-0.77359	-0.78278	
Z CS 1	0.00000	0.00427	0.00518	0.00660	0.00902
	0.01208	0.01464	0.01678	0.02018	0.02276
	0.02472	0.02614	0.02756	0.02691	0.02394
	0.01920	0.01633	0.01322	0.00669	0.00012
	-0.00669	-0.01322	-0.01633	-0.01920	-0.02394
	-0.02691	-0.02756	-0.02614	-0.02472	-0.02276
	-0.02018	-0.01678	-0.01464	-0.01208	-0.00902
	-0.00660	-0.00518	-0.00427	0.00000	
Y CS 2	0.20983	0.21409	0.21621	0.22047	0.23112
	0.25242	0.27371	0.29501	0.33760	0.38019
	0.42278	0.46538	0.55056	0.63574	0.72092
	0.80611	0.84870	0.89129	0.97647	1.06166
	0.97647	0.89129	0.84870	0.80611	0.72092
	0.63574	0.55056	0.46538	0.42278	0.38019
	0.33760	0.29501	0.27371	0.25242	0.23112
	0.22047	0.21621	0.21409	0.20983	
Z CS 2	0.00000	0.00198	0.00240	0.00306	0.00418
	0.00560	0.00679	0.00778	0.00936	0.01055
	0.01146	0.01212	0.01278	0.01247	0.01110
	0.00890	0.00757	0.00613	0.00310	0.00006
	-0.00310	-0.00613	-0.00757	-0.00890	-0.01110
	-0.01247	-0.01278	-0.01212	-0.01146	-0.01055
	-0.00936	-0.00778	-0.00679	-0.00560	-0.00418
Y CS 3	0.69368	0.69368	0.69368	0.69368	0.69368
	0.69369	0.69370	0.69370	0.69372	0.69373
	0.69374	0.69375	0.69378	0.69380	0.69383
	0.69385	0.69387	0.69388	0.69390	0.69393

Listing 5.- Bomarc RDCDS partial file.

21

```
         C1           C2           C3           C4           C5

Y CS 1  -0.40436     -0.39922     -0.39665     -0.39151     -0.37865
        -0.35294     -0.32722     -0.30151     -0.25008     -0.19865
        -0.14722     -0.09580      0.00706      0.10992      0.21277
        -0.31563     -0.36706      0.41848      0.52134      0.62420
         0.52134      0.41848      0.36706      0.31563      0.21277
         0.10992      0.00706      0.09580     -0.14722     -0.19865
        -0.25008     -0.30151     -0.32722     -0.35294     -0.37865
        -0.39151     -0.39665     -0.39922     -0.40436

Z CS 1  -0.00164     -0.00085      0.00138      0.00221      0.00362
         0.00541      0.00690      0.00815      0.01014      0.01164
         0.01278      0.01361      0.01444      0.01406      0.01233
         0.00956      0.00789      0.00607      0.00226     -0.00157
        -0.00554     -0.00935     -0.01117     -0.01284     -0.01561
        -0.01734     -0.01772     -0.01690     -0.01606     -0.01492
        -0.01342     -0.01143     -0.01018     -0.00869     -0.00691
        -0.00550     -0.00466     -0.00413     -0.00164

Y CS 2   0.00931      0.01240      0.01394      0.01702      0.02472
         0.04012      0.05553      0.07093      0.10174      0.13255
         0.16336      0.19417      0.25579      0.31741      0.37903
         0.44064      0.47145      0.50226      0.56388      0.62550
         0.56388      0.50226      0.47145      0.44064      0.37903
         0.31741      0.25579      0.19417      0.16336      0.13255
         0.10174      0.07093      0.05553      0.04012      0.02472
         0.01702      0.01394      0.01240      0.00931

Z CS 2   0.00000      0.00119      0.00144      0.00184      0.00251
         0.00336      0.00407      0.00466      0.00561      0.00633
         0.00687      0.00727      0.00727      0.00748      0.00665
         0.00534      0.00454      0.00367      0.00186      0.00003
        -0.00186     -0.00367     -0.00454     -0.00534     -0.00665
        -0.00748     -0.00766     -0.00727     -0.00687     -0.00633
        -0.00561     -0.00466     -0.00466     -0.00336     -0.00251
        -0.00184     -0.00144     -0.00119      0.00000

Y CS 3   0.36044      0.36044      0.36044      0.36044      0.36044
         0.36045      0.36045      0.36045      0.36046      0.36046
         0.36047      0.36048      0.36049      0.36050      0.36051
         0.36053      0.36053      0.36054      0.36055      0.36056
         0.36055      0.36054      0.36053      0.36053      0.36051
         0.36050      0.36049      0.36048      0.36047      0.36046
         0.36046      0.36045      0.36045      0.36045      0.36044
         0.36044      0.36044      0.36044      0.36044

Z CS 3   0.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      0.00000      0.00000      0.00000      0.00000
        -0.00000     -0.00000     -0.00000     -0.00000     -0.00000
        -0.00000     -0.00000     -0.00000     -0.00000     -0.00000

DP=  30000.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      0.00000      0.00000      0.00000      0.00000
         0.00000      1.05000      2.75000      0.00016     45.00000
         0.00012      0.22388      0.28324      1.69926      1.23571
         0.00000      0.00000      0.00000      0.00000      0.00000

EX
```

Listing 5.- Concluded.

```
DO YOU WANT TO:
  1: CONVERT A BDAP FILE TO A CDS FILE
OR 2: CONVERT A CDS FILE TO A BDAP FILE?
1
INPUT NAME OF INPUT BDAP FILE
'AST205'
INPUT NAME OF OUTPUT CDS FILE
'CDSAST'
xxxx STOP

OK,
```

Listing 6.- AST-205 wave-drag to CDS conversion.

```
SELECT GEOMETRY OUTPUT
     0    ARBITRARY GEOMETRY (CC) FORMAT
     1    HESS FORMAT
     2    CDS OUTPUT FILE ONLY
1

INPUT NAME OF CDS GEOMETRY FILE
'BOMARC'
INPUT NAME OF HESS FILE
'BOMARCH'
INPUT NAME OF CDS OUTPUT FILE
'BOMARC2'
     1.00000    WING BLENDED
     2.00000    FUSELAGE
     3.00000    PODS
     4.00000    VERTICAL FIN
     5.00000    PYLON FINS
     6.00000    HORIZONTAL TAIL
THIS COMPONENT IS WING BLENDED
THIS COMPONENT IS FUSELAGE
THIS COMPONENT IS PODS
THIS COMPONENT IS VERTICAL FIN
THIS COMPONENT IS PYLON FINS
THIS COMPONENT IS HORIZONTAL TAIL
XXXX STOP
2
```

Listing 7.- CDS to Hess format transfer of Bomarc missile configuration.

Listing 8.- Partial listing of Bomarc missile in Hess format file.

6.81005	-0.84963	0.1800000
6.81006	-0.84963	0.1800000
6.81007	-0.84963	0.1800000
6.81008	-0.84963	0.1800000
6.81009	-0.84963	0.1800000
6.81010	-0.84963	0.1800000
6.81012	-0.84963	0.1800000
6.81012	-0.84963	0.1800000
6.81013	-0.84963	0.1800000
6.81014	-0.84963	0.1800000
6.81015	-0.84963	0.1800000
6.81014	-0.84963	0.1800000
6.81013	-0.84963	0.1800000
6.81012	-0.84963	0.1800000
6.81010	-0.84963	0.1800000
6.81008	-0.84963	0.1800000
6.81007	-0.84963	0.1800000
6.81006	-0.84963	0.1800000
6.81005	-0.84963	0.1800000
6.81004	-0.84963	0.1800000
6.81004	-0.84963	0.1800000
6.81003	-0.84963	0.1800000
6.81003	-0.84963	0.1800000
6.81003	-0.84963	0.1800000
6.81003	-0.84963	0.1800000
6.81003	-0.84963	0.1800000

BOTTOM

Listing 8.- Concluded.

```
SELECT GEOMETRY OUTPUT
    0    ARBITRARY GEOMETRY (CC) FORMAT
    1    HESS FORMAT
    2    CDS OUTPUT FILE ONLY
0
 INPUT NAME OF CDS GEOMETRY FILE
'BOMARC,
 INPUT NAME OF ARBITRARY GEOMETRY FILE
'BOMARCA,
 INPUT NAME OF CDS OUTPUT FILE
'BOMARC3,
    1.00000   WING BLENDED
    2.00000   FUSELAGE
    3.00000   PODS
    4.00000   VERTICAL FIN
    5.00000   PYLON FINS
    6.00000   HORIZONTAL TAIL
REFERENCE AREA REQUIRED
    OPTIONS:
        1 - USER INPUT
        2 - USE WING AREA (WING COMPONENT
                 NUMBER MUST BE INPUT)
1
 INPUT REFERENCE AREA
3.51
SELECT PRINT OPTION FOR WAVE DRAG PROGRAM
    0 -  NO EXTRA OUTPUT PRINTED
    1 -  OPTIONAL PRINTING OF SCALED AND
             OFFSET COORDINATES
0
 SCALE FACTOR MUST BE SPECIFIED
    OPTIONS:
        0 OR 1. -  NO SCALE FACTOR
        S.F.    -  SCALE FACTOR FOR
                     ENTIRE CONFIGURATION
        -1      -  SPECIFY SCALE FACTOR
                     EACH COMPONENT
0
THIS COMPONENT IS WING BLENDED
SURFACE TYPE MUST BE SPECIFIED
    OPTIONS:
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
?
THIS COMPONENT IS FUSELAGE
SURFACE TYPE MUST BE SPECIFIED
    OPTIONS:
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
?
THIS COMPONENT IS PODS
SURFACE TYPE MUST BE SPECIFIED
    OPTIONS:
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
0
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
?
THIS COMPONENT IS VERTICAL FIN
SURFACE TYPE MUST BE SPECIFIED
    OPTIONS:
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
?
THIS COMPONENT IS PYLON FINS
SURFACE TYPE MUST BE SPECIFIED
    OPTIONS:
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
?
THIS COMPONENT IS HORIZONTAL TAIL
SURFACE TYPE MUST BE SPECIFIED
    OPTIONS:
        0 - FUSIFORM SURFACE
        1 - NON-FUSIFORM SURFACE
1
*** STOP
?
```

Listing 9.- CDS to arbitrary geometry format transfer of Bomarc missile configuration.

```
'BOMARC MISSILE FOR LAMINAR FLOW STUDIES
   3.51    0
'WING BLENDED
  1    1   39
  3                  1.0000    4.3843    0.0000    0.1300

  -0.7828   -0.1610   0.0000    -0.7736   -0.1610    0.0043
  -0.7690   -0.1610   0.0052    -0.7598   -0.1610    0.0066
  -0.7368   -0.1610   0.0090    -0.6909   -0.1610    0.0121
  -0.6450   -0.1610   0.0146    -0.5990   -0.1610    0.0168
  -0.5072   -0.1610   0.0202    -0.4153   -0.1610    0.0228
  -0.3234   -0.1610   0.0247    -0.2316   -0.1610    0.0261
  -0.0478   -0.1610   0.0276    -0.1359   -0.1610    0.0269
   0.3196   -0.1610   0.0239     0.1359   -0.1610    0.0192
   0.5952   -0.1610   0.0163     0.5034   -0.1610    0.0132
   0.8708   -0.1610   0.0067     0.6871   -0.1610    0.0061
   0.8708   -0.1610  -0.0067     1.0546   -0.1610   -0.0132
   0.5952   -0.1610  -0.0163     0.6871   -0.1610   -0.0192
   0.3196   -0.1610  -0.0239     0.5034   -0.1610   -0.0269
  -0.0478   -0.1610  -0.0276     0.1359   -0.1610   -0.0261
  -0.3234   -0.1610  -0.0247    -0.1359   -0.1610   -0.0228
  -0.5072   -0.1610  -0.0202    -0.2316   -0.1610   -0.0168
  -0.6450   -0.1610  -0.0146    -0.4153   -0.1610   -0.0121
  -0.7368   -0.1610  -0.0090    -0.5990   -0.1610   -0.0066
  -0.7690   -0.1610  -0.0052    -0.6909   -0.1610   -0.0043
  -0.7828   -0.1610   0.0000    -0.7598   -0.1610
                                -0.7736   -0.1610

   0.2098   -0.9939   0.0000     0.2141   -0.9939    0.0020
   0.2162   -0.9939   0.0024     0.2205   -0.9939    0.0031
   0.2311   -0.9939   0.0042     0.2524   -0.9939    0.0056
   0.2737   -0.9939   0.0068     0.2950   -0.9939    0.0078
   0.3376   -0.9939   0.0094     0.3802   -0.9939    0.0106
   0.4228   -0.9939   0.0115     0.4654   -0.9939    0.0121
   0.5506   -0.9939   0.0128     0.6357   -0.9939    0.0125
   0.7209   -0.9939   0.0111     0.8061   -0.9939    0.0089
   0.8487   -0.9939   0.0076     0.8913   -0.9939    0.0061
   0.9765   -0.9939   0.0031     1.0617   -0.9939    0.0001
   0.9765   -0.9939  -0.0031     0.8913   -0.9939   -0.0061
   0.8487   -0.9939  -0.0076     0.8061   -0.9939   -0.0089
   0.7209   -0.9939  -0.0111     0.6357   -0.9939   -0.0125
   0.5506   -0.9939  -0.0128     0.4654   -0.9939   -0.0121
   0.4228   -0.9939  -0.0115     0.3802   -0.9939   -0.0106
   0.3376   -0.9939  -0.0094     0.2950   -0.9939   -0.0078
   0.2737   -0.9939  -0.0068     0.2524   -0.9939   -0.0056
   0.2311   -0.9939  -0.0042     0.2205   -0.9939   -0.0031
   0.2162   -0.9939  -0.0024     0.2141   -0.9939   -0.0020
   0.2098   -0.9939   0.0000

   0.6937   -1.3999   0.0000     0.6937   -1.3999    0.0000
   0.6937   -1.3999   0.0000     0.6937   -1.3999    0.0000
   0.6937   -1.3999   0.0000     0.6937   -1.3999    0.0000
   0.6937   -1.3999   0.0000     0.6937   -1.3999    0.0000
   0.6937   -1.3999   0.0000     0.6937   -1.3999    0.0000
   0.6937   -1.3999   0.0000     0.6937   -1.3999    0.0000
   0.6938   -1.3999   0.0000     0.6938   -1.3999    0.0000
   0.6938   -1.3999   0.0000     0.6938   -1.3999    0.0000
   0.6939   -1.3999   0.0000     0.6939   -1.3999    0.0000
   0.6939   -1.3999   0.0000     0.6939   -1.3999    0.0000
   0.6939   -1.3999   0.0000     0.6939   -1.3999    0.0000
   0.6939   -1.3999   0.0000     0.6939   -1.3999    0.0000
```

Listing 10.- Partial listing of Bomarc missile in arbitrary geometry format file.

Listing 10.- Concluded.

BOTTOM

```
INPUT NAME OF CDS GEOMETRY FILE
FOMARC
INPUT NAME OF LAWGS GEOMETRY FILE
FOMARCL
CONVERT CDS FILE TO:
    1 - LAWGS GLOBAL COORDINATE SYSTEM
    2 - LAWGS LOCAL COORDINATE SYSTEM
1
    0.00000      WING BLENDED
    0.00000      FUSELAGE
    0.00000      PODS
    0.00000      VERTICAL FIN
    0.00000      PYLON FINS
    0.00000      HORIZONTAL TAIL
THIS COMPONENT IS WING BLENDED
THIS COMPONENT IS FUSELAGE
THIS COMPONENT IS PODS
THIS COMPONENT IS VERTICAL FIN
THIS COMPONENT IS PYLON FINS
THIS COMPONENT IS HORIZONTAL TAIL
XXXX STOP
2
```
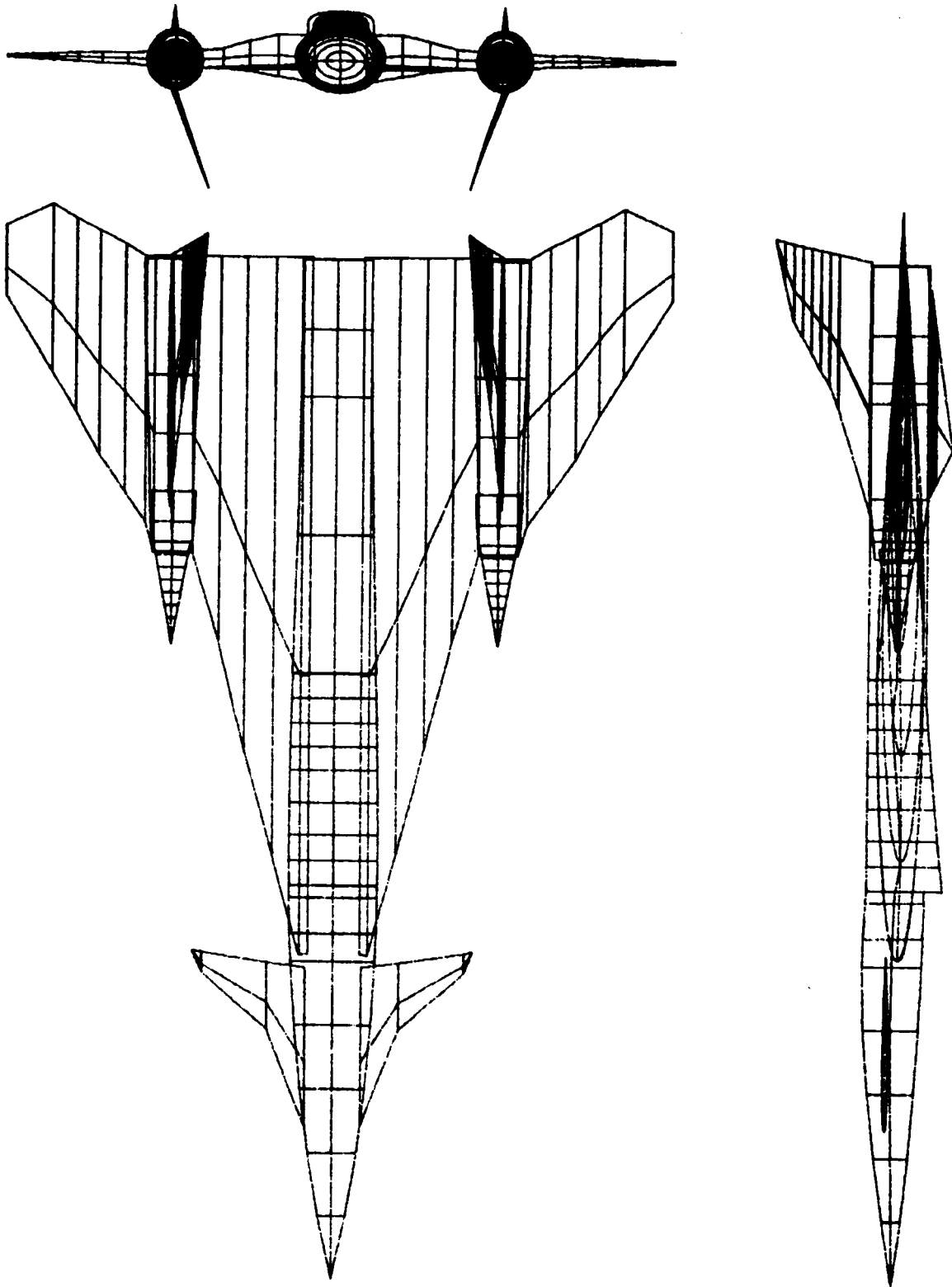
Listing 11.- CDS to LaWGS conversion.
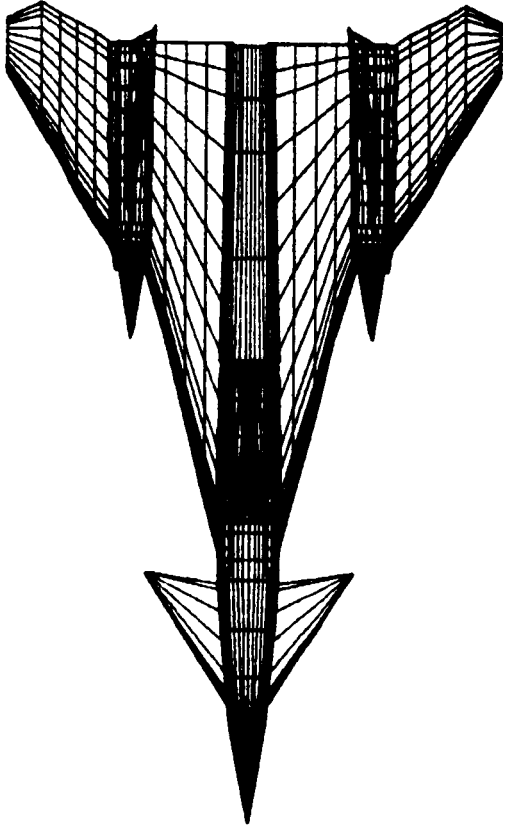
```
BOMARC MISSILE FOR LAMINAR FLOW STUDIES
WING BLENDED
   1    3   39
0.00  1.       0.00   0.00   0.00   0.00   0.00   0.00
      1.       1

3.6015  -0.1610  0.1300   3.6107  -0.1610  0.1343
3.6153  -0.1610  0.1352   3.6245  -0.1610  0.1366
3.6475  -0.1610  0.1390   3.6934  -0.1610  0.1421
3.7394  -0.1610  0.1446   3.7853  -0.1610  0.1468
3.8772  -0.1610  0.1502   3.9690  -0.1610  0.1528
4.0609  -0.1610  0.1547   4.1528  -0.1610  0.1561
4.3365  -0.1610  0.1576   4.5202  -0.1610  0.1569
4.7040  -0.1610  0.1539   4.8877  -0.1610  0.1492
4.9796  -0.1610  0.1463   5.0714  -0.1610  0.1432
5.2552  -0.1610  0.1367   5.4389  -0.1610  0.1301
4.9796  -0.1610  0.1233   5.0714  -0.1610  0.1168
4.7040  -0.1610  0.1137   4.8877  -0.1610  0.1108
4.3365  -0.1610  0.1061   4.5202  -0.1610  0.1031
4.0609  -0.1610  0.1024   4.1528  -0.1610  0.1039
3.8772  -0.1610  0.1053   3.9690  -0.1610  0.1072
3.7394  -0.1610  0.1098   3.7853  -0.1610  0.1132
3.6475  -0.1610  0.1154   3.6934  -0.1610  0.1179
3.6153  -0.1610  0.1210   3.6245  -0.1610  0.1234
3.6015  -0.1610  0.1248   3.6107  -0.1610  0.1257

4.5942  -0.9939  0.1300   4.5984  -0.9939  0.1320
4.6005  -0.9939  0.1324   4.6048  -0.9939  0.1331
4.6154  -0.9939  0.1342   4.6367  -0.9939  0.1356
4.6580  -0.9939  0.1368   4.6793  -0.9939  0.1378
4.7219  -0.9939  0.1394   4.7645  -0.9939  0.1406
4.8071  -0.9939  0.1415   4.8497  -0.9939  0.1421
4.9349  -0.9939  0.1428   5.0201  -0.9939  0.1425
5.1053  -0.9939  0.1411   5.1904  -0.9939  0.1389
5.2330  -0.9939  0.1376   5.2756  -0.9939  0.1361
5.3608  -0.9939  0.1331   5.4460  -0.9939  0.1301
5.2330  -0.9939  0.1269   5.2756  -0.9939  0.1239
5.1053  -0.9939  0.1224   5.1904  -0.9939  0.1211
4.9349  -0.9939  0.1189   5.0201  -0.9939  0.1175
4.8071  -0.9939  0.1172   4.8497  -0.9939  0.1179
4.7219  -0.9939  0.1185   4.7645  -0.9939  0.1194
4.6580  -0.9939  0.1206   4.6793  -0.9939  0.1222
4.6154  -0.9939  0.1232   4.6367  -0.9939  0.1244
4.6005  -0.9939  0.1258   4.6048  -0.9939  0.1269
4.5942  -0.9939  0.1276   4.5984  -0.9939  0.1280

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5.0780  -1.3999  0.1300   5.0780  -1.3999  0.1300
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5.0780  -1.3999  0.1300   5.0780  -1.3999  0.1300
5.0780  -1.3999  0.1300   5.0780  -1.3999  0.1300
5.0781  -1.3999  0.1300   5.0781  -1.3999  0.1300
5.0781  -1.3999  0.1300   5.0781  -1.3999  0.1300
5.0781  -1.3999  0.1300   5.0781  -1.3999  0.1300
5.0782  -1.3999  0.1300   5.0782  -1.3999  0.1300
5.0782  -1.3999  0.1300   5.0782  -1.3999  0.1300
5.0782  -1.3999  0.1300   5.0782  -1.3999  0.1300
5.0782  -1.3999  0.1300   5.0782  -1.3999  0.1300
5.0782  -1.3999  0.1300   5.0781  -1.3999  0.1300
```

Listing 12.— Partial listing of Bomarc missile in LaWGS geometry format.

|					
6.8166	-0.1125	0.1688	6.7652	-0.1125	0.1672
6.6624	-0.1125	0.1644	6.5595	-0.1125	0.1627
6.4567	-0.1125	0.1623	6.3538	-0.1125	0.1631
6.3024	-0.1125	0.1639	6.2509	-0.1125	0.1651
6.1995	-0.1125	0.1666	6.1481	-0.1125	0.1686
6.1224	-0.1125	0.1698	6.0967	-0.1125	0.1713
6.0709	-0.1125	0.1731	6.0581	-0.1125	0.1745
6.0452	-0.1125	0.1753	6.0504	-0.1125	0.1759
6.4589	-0.4985	0.1784	6.4620	-0.4985	0.1812
6.4635	-0.4985	0.1800	6.4666	-0.4985	0.1818
6.4743	-0.4985	0.1814	6.4897	-0.4985	0.1834
6.5051	-0.4985	0.1825	6.5205	-0.4985	0.1847
6.5513	-0.4985	0.1841	6.5821	-0.4985	0.1863
6.6130	-0.4985	0.1856	6.6438	-0.4985	0.1873
6.7054	-0.4985	0.1869	6.7670	-0.4985	0.1875
6.8286	-0.4985	0.1877	6.8902	-0.4985	0.1853
6.9210	-0.4985	0.1867	6.9519	-0.4985	0.1837
7.0135	-0.4985	0.1845	7.0751	-0.4985	0.1800
7.0135	-0.4985	0.1819	6.9519	-0.4985	0.1763
6.9210	-0.4985	0.1781	6.8902	-0.4985	0.1747
6.8286	-0.4985	0.1755	6.7670	-0.4985	0.1725
6.7054	-0.4985	0.1733	6.6438	-0.4985	0.1727
6.6130	-0.4985	0.1723	6.5821	-0.4985	0.1737
6.5513	-0.4985	0.1731	6.5205	-0.4985	0.1753
6.5051	-0.4985	0.1744	6.4897	-0.4985	0.1766
6.4743	-0.4985	0.1759	6.4666	-0.4985	0.1782
6.4635	-0.4985	0.1775	6.4620	-0.4985	0.1788
6.4589	-0.4985	0.1786	6.8100	-0.8496	0.1800
6.8100	-0.8496	0.1800	6.8100	-0.8496	0.1800
6.8100	-0.8496	0.1800	6.8100	-0.8496	0.1800
6.8100	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8100	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8102	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8102	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8101	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8100	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8100	-0.8496	0.1800
6.8101	-0.8496	0.1800	6.8100	-0.8496	0.1800
6.8100	-0.8496	0.1800	6.8100	-0.8496	0.1800
6.8100	-0.8496	0.1800	6.8100	-0.8496	0.1800

BOTTOM

Listing 12.- Concluded.

a. CDS Three-view drawing

Figure 1.- Experimental aircraft design for interface program.
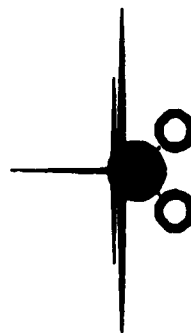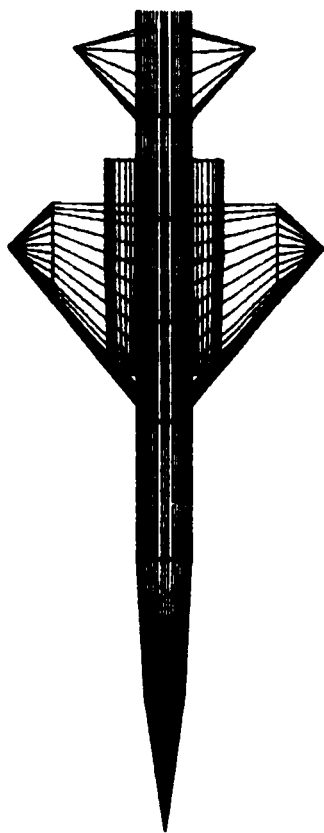
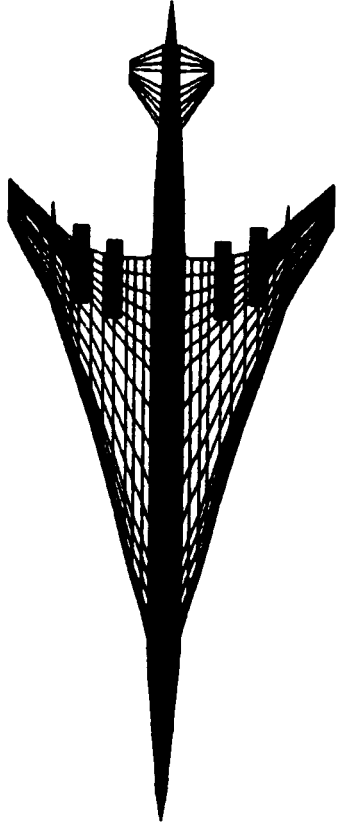b. Three-view drawing on NOS.

Figure 1.- Concluded.

34
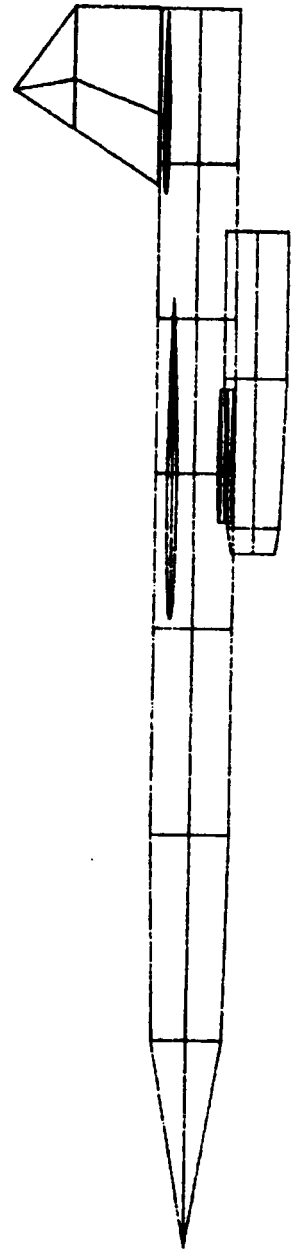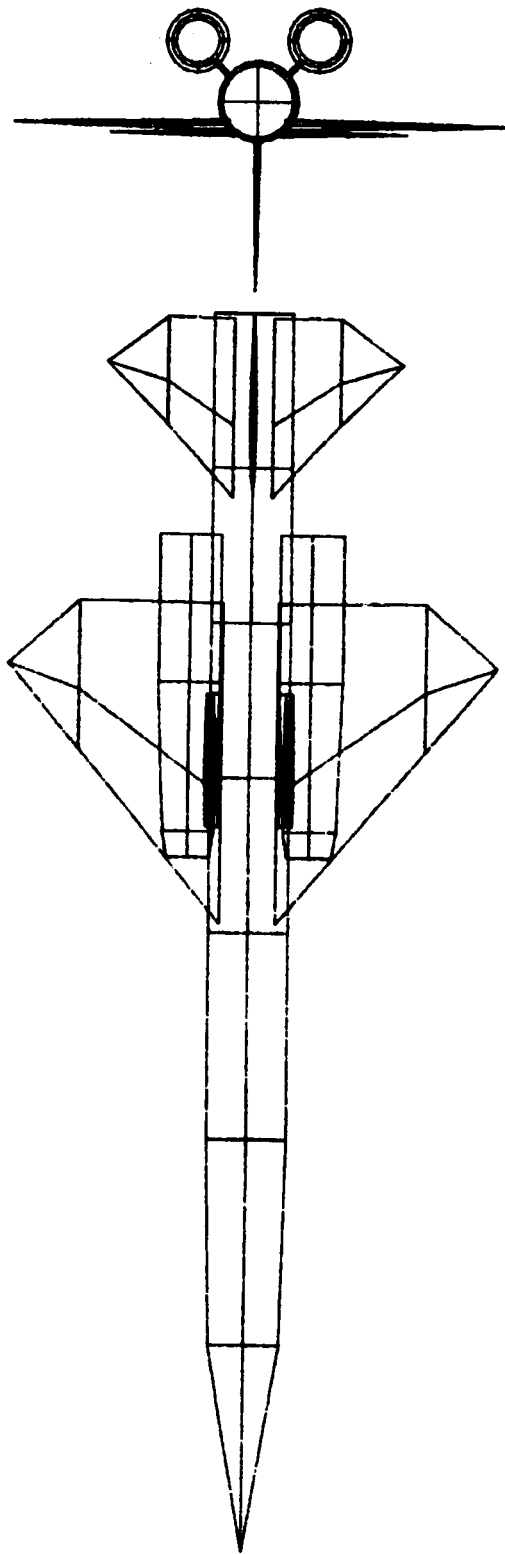
a. Three-view drawing in CDS.
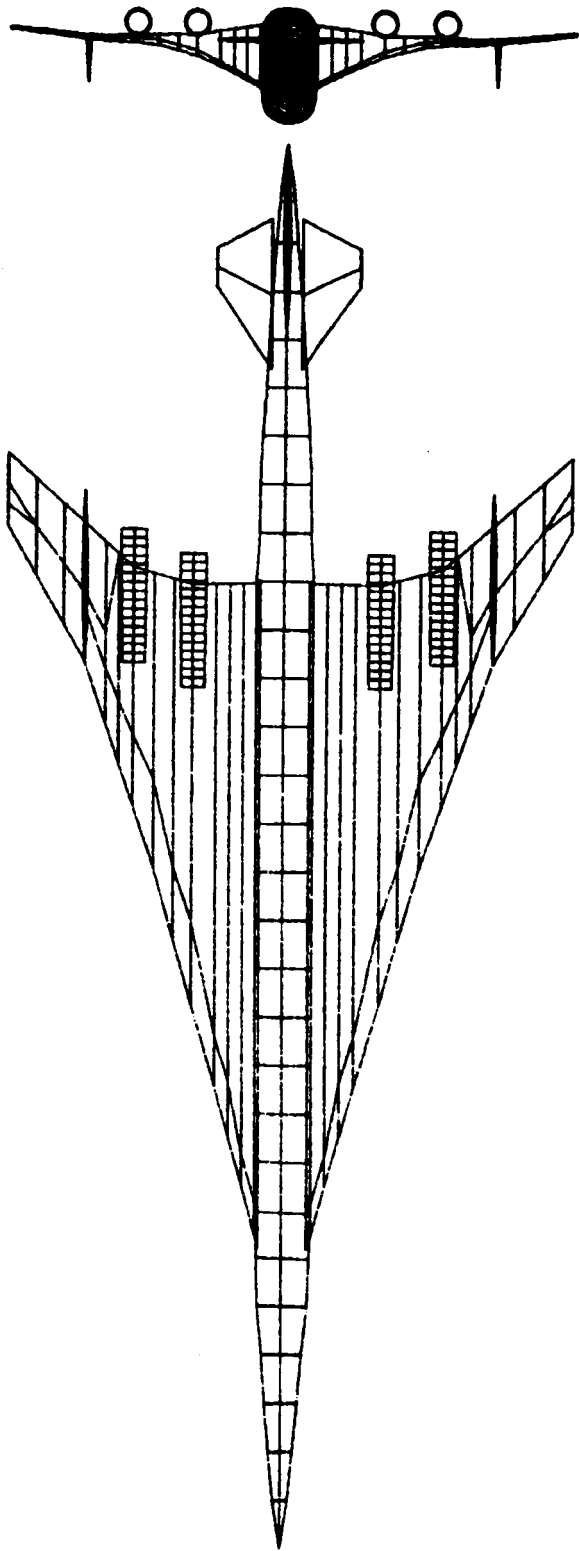
Figure 2.- Bomarc missile configuration.

b. Three-view drawing on NOS.

Figure 2.- Concluded.

a. Three-view drawing on NOS.

Figure 3.- AST-205 aircraft configuration.

b. Three-view drawing on CDS.

Figure 3.- Concluded.

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4. Title and Subtitle COMPUTER CODE TO INTERCHANGE CDS AND WAVE-DRAG GEOMETRY FORMATS		5. Report Date December 1986
		6. Performing Organization Code 505-69-71-03
7. Author(s) Vicki S. Johnson and David L. Turnock, NASA Langley Research Center Marie L. Knapp, PRC Kentron, Inc.		8. Performing Organization Report No.
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15. Supplementary Notes
Potential users of the code are urged to contact the authors for the latest system information for using the code.

16. Abstract

    A computer program has been developed on the PRIME minicomputer to provide an interface for the passage of aircraft configuration geometry data between the Rockwell Configuration Development System (CDS) and a wireframe geometry format used by aerodynamic design and analysis codes. The interface program allows aircraft geometry which has been developed in CDS to be directly converted to the wireframe geometry format for analysis. Geometry which has been modified in the analysis codes can be transformed back to a CDS geometry file and examined for physical viability. Previously created wireframe geometry files may also be converted into CDS geometry files. The program provides a useful link between a geometry creation and manipulation code and analysis codes by providing rapid and accurate geometry conversion.

17. Key Words (Suggested by Author(s)) Aircraft geometry Geometry conversion Interactive design	18. Distribution Statement UNCLASSIFIED - UNLIMITED Subject Category 05	
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