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REPORT NO. 1829

THE EDIT-COMGEOM CODE

Gary G. Kuehl

September 1975

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report assumes a familiarity with the GIFT and MAGIC computer codes. The EDIT-COMGEOM code is a FORTRAN computer code. The EDIT-COMGEOM code converts the target description data which was used in the MAGIC computer code to the target description data which can be used in the GIFT computer code. Changes are also made to the target description data to decrease computer run time and computer memory.		

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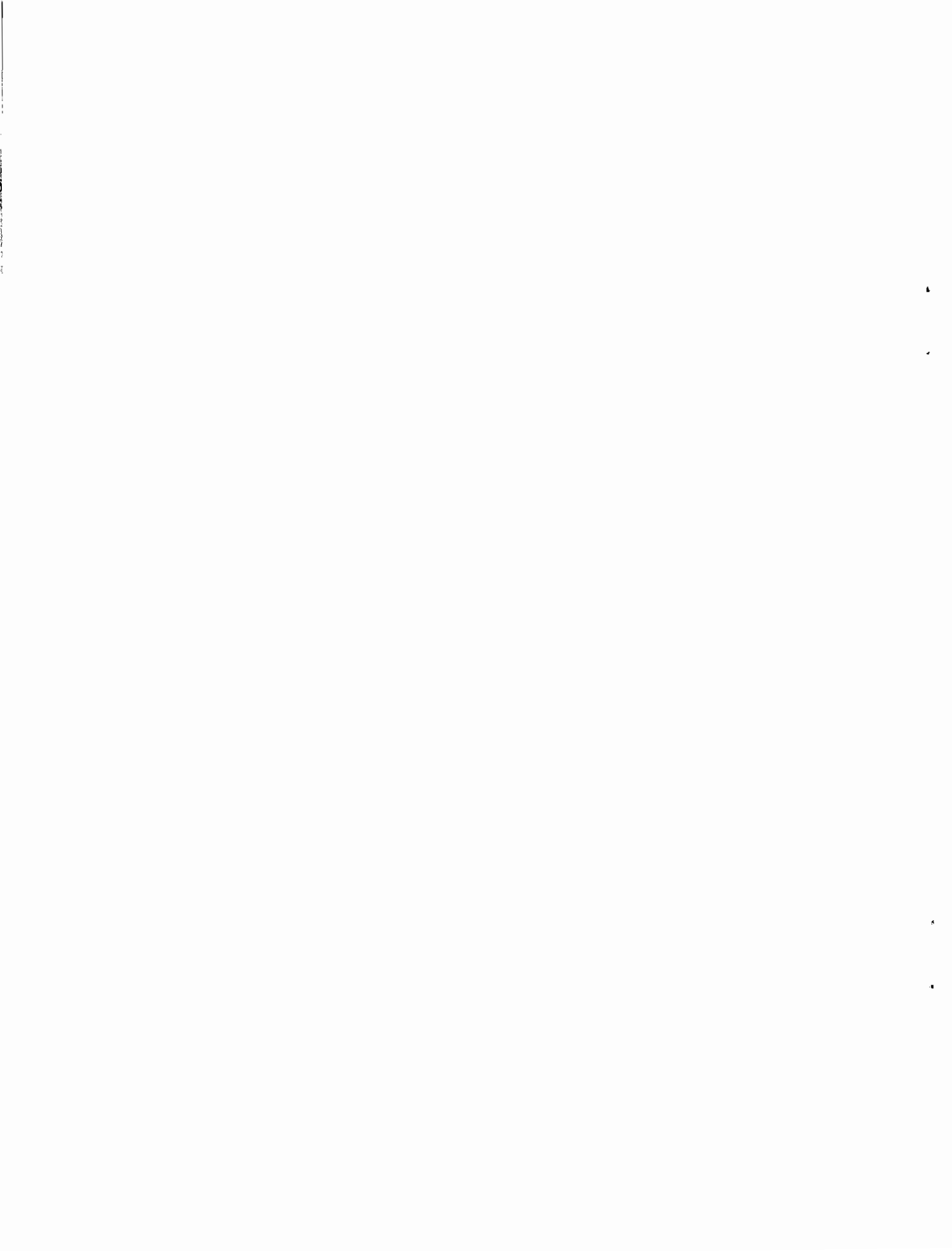
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I. INTRODUCTION

1.1 Background

The original EDIT-COMGEOM code was written by Mr. Larry Bain of Army Materiel Systems Analysis Agency: the version of the EDIT-COMGEOM code presented in this report is an improvement of the original code.

This report assumes a familiarity with the MAGIC¹ and the GIFT² codes. The EDIT-COMGEOM code converts target description data used as input to the MAGIC code into target description data which can be used as input to the GIFT code.

The air space (01) enclosing the target used by the MAGIC code can be deleted in the GIFT code. The EDIT-COMGEOM code deletes those regions defined as "01" air spaces and when possible the solids associated with those regions are also deleted. The GIFT code has a new solid type called RPP which requires less computer storage and computer run time than either the BOX or the ARB solid. The EDIT-COMGEOM code converts the BOX and the ARB solids which are equivalent to RPP's into RPP solids.

After the above changes are made, a renumbering and reordering of the target description data for the MAGIC code is required before the data can be used as input for the GIFT code. The EDIT-COMGEOM code does the renumbering and reordering.

1.2 Contents of this Report

This report contains three sections and three appendices. The first section discusses the requirements and limitations of the EDIT-COMGEOM code. The second section describes the input requirements for the code. The third section describes the output of the code. Appendix A is a listing (print-out) of the code. Appendix B is a listing of a sample input. Appendix C is a listing of the output from the sample input.

¹NWC Technical Note 4565-3-71; Volumes I & II; "MAGIC Computer Simulation, Volume I, User Manual; Volume II, Analyst Manual," by Armament Systems, Inc., and Propulsion Development Department, May 1971. (Available from Department of the Navy, Naval Weapons Center, China Lake, California 93555).

²Lawrence W. Bain & Mathew J. Reisinger, "The GIFT Code User Manual; Volume I Introduction and Input Requirements," BRL Report No. 1802, April 1975.

II. GENERAL DISCUSSION

2.1 Required Tapes

The EDIT-COMGEOM code requires three temporary binary tapes on FORTRAN units 10, 11, and 12. Disc or drum may be substituted for these tapes. The tape on FORTRAN unit 10 contains the region table created by EDIT-COMGEOM Code. The tape on FORTRAN unit 11 contains the MAGIC Solid Table, and the tape on FORTRAN unit 12 contains the original MAGIC Region Table.

An array called "IDENT" is used to store the Region Identification Table. It is dimensioned for 1000 regions. An array called "ISOLID" flags those solids to be kept in the target description data. It is dimensioned for 2500 solids. The Solid Table, Region Table and Region Identification Table will be discussed in more detail in later sections of this report.

2.2 Converting the Code for use by Different Computers

The EDIT-COMGEOM code, listed in Appendix A, runs on either the CDC or Univac computers. The code can be made to run on BRLESC (or IBM) computer by changing the comment cards labeled in card columns 73-80 with "BRLESC" (or "IBM") to executable statements. Cards labeled in columns 73-80 with other computers must be removed or changed to comment cards.

For example, the arrowed lines in the listing of the code in Appendix A are as follows:

```
C 104 CALL SETCMD (4)                                BRLESC  
C      DECODE (80,32,SOL(I)) IREG, (IOP(I),ISOL(I),I=1,9)  BRLESC
```

In order to use the EDIT-COMGEOM code on the BRLESC computer, "C" would be removed. The four lines following the above lines:

```
104 WRITE (10,31) SOL                                UNIVAC  
      REWIND 10                                     IBM  
      READ (10,40) IREG, (IOP(I),ISOL(I),I=1,9)     AND  
      REWIND 10                                     CDC
```

would be removed or changed to comment cards.

III. INPUT

3.1 Control Card

The control card is the first data card. It specifies the FORTRAN input and output unit numbers. The format of the card is shown in Figure 1.

3.2 MAGIC Target Description Data

The MAGIC target description data follows the control card. The form of the data is reported in reference 1, "MAGIC Computer Simulation."

The data consists of:

- (a) A Title Card.
- (b) A Target Input Constraints Card.
- (c) A set of solid descriptions called a Solid Table.
- (d) A set of regions described in terms of combinations of solids called a Region Table.
- (e) A set of alphanumeric descriptions of a region called a Region Identification Table.

3.3 Target Input Constraints Card

The input data for the EDIT-COMGEOM code uses the same input format as stated in technical note "MAGIC Computer Simulation," except for the Target Input Constraints card. The format of the Target Input Constraints card is shown in Figure 2.

3.4 Order of Input

A summary of the order of the data for EDIT-COMGEOM code is shown in Figure 3. A listing of a sample input for the EDIT-COMGEOM code is located in Appendix B.

1-5	6-10	11-15
(BLANK)	IN	IOUT

FORMAT: (5X, 2I5)

<u>Name</u>	<u>Columns</u>	<u>Remarks</u>
IN	6-10	The FORTRAN unit number for the input. (If "IN" equals 0, it is set to 5 by the code.)
IOUT	11-15	The FORTRAN unit number for the output. (If "IOUT" equals zero, it is set to 6 by the code.)

Figure 1. Control Card

1-10	11-20	21-30
NRPP	NSOL	NREGON

FORMAT: (3I10)

<u>Name</u>	<u>Columns</u>	<u>Remarks</u>
NRPP	1-10	The number of rectangular parallelepipeds (RPPs) used to describe the target's environment.
NSOL	11-20	The number of solids other than the above RPPs used to describe the target.
NREGON	21-30	The number of regions used to describe the target.

Figure 2. The Target Input Constraints Card

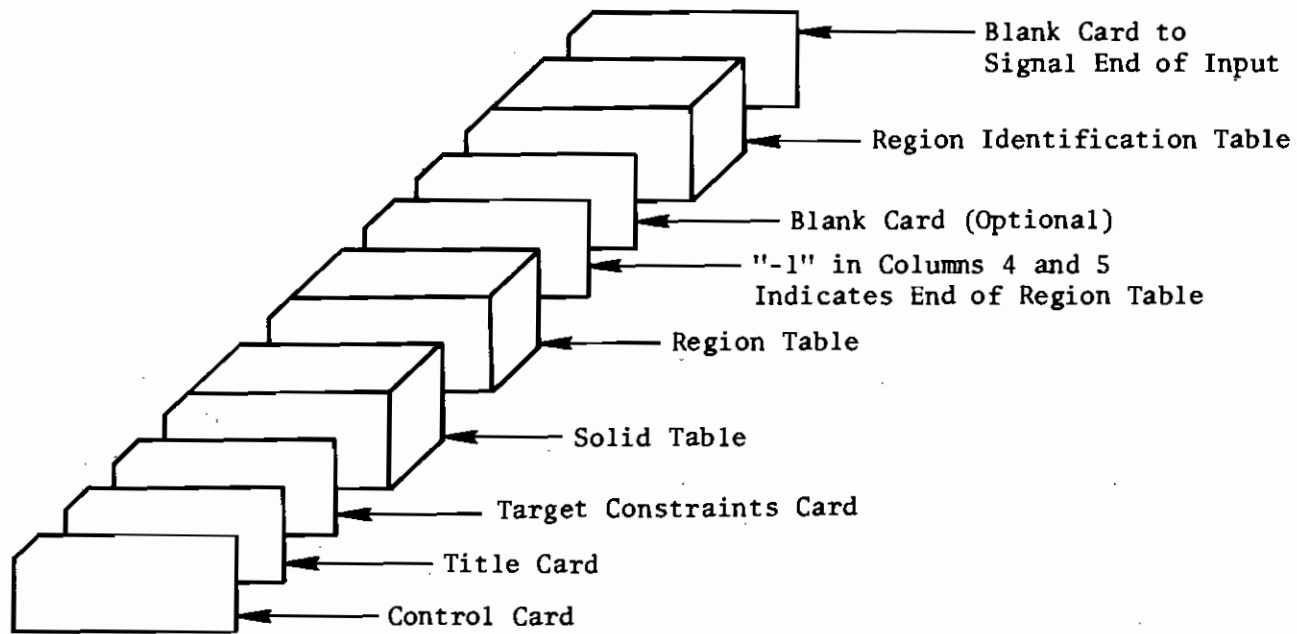


Figure 3. Card Order for Input

IV. OUTPUT

A listing of the output of the EDIT-COMGEOM using the Sample Input of Appendix B is located in Appendix C.

4.1 Solid Table

A sample line of output of the Solid Table is:

```
1RPP      -75,0000   75,0000  -36,0000   36,0000   12,0000   48,0000   2   3
```

The number in columns 1-3 (the number is 1 in the example above) is the new solid number. If the solid number is greater than 1000, only the last three digits are used. The number in columns 70-75 ("2" in the example above) is the solid number used in the MAGIC target description data. The number in columns 76-80 ("3" in the example above) is the card or line count of the GIFT target description data.

Those ARB or BOX solids which have been converted to an RPP have the following message printed:

```
BOX   3 HAS BEEN CONVERTED TO A RPP.
```

4.2 Region Table

A sample line of output of the Region Table is:

```
1 OR   1   -2   -6   -7   -8   -9   -100R   30R   4   2   81
```

The number in columns 1-5 (the number is 1 in the example above) is the new region number. The number in columns 71-75 ("2" in the example above) is the region number used in the MAGIC target description data. The number in columns 76-80 ("81" in the example above) is the card or line count of the GIFT target description data.

The solid numbers in columns 6-69 in the MAGIC target description used to describe a region are replaced with the new solid numbers represented in the new Solid Table of the output.

4.3 Region Identification Table

A sample line of output for the Region Identification Table is:

```
1       100       0       BODY       2   96
```

Columns 71-80 are used for labeling as described for the Region Table above. Any alphanumeric region description data located in columns 71-80 of the MAGIC target description data will be deleted.

4.4 Summary Table

The Summary Table contains the number and listing of solids and regions deleted from the MAGIC target description data. In the sample below, 1 solid and 1 region were deleted: the solid deleted and region deleted were both numbered "1":

NUMBER OF SOLIDS DELETED 1
1

NUMBER OF REGIONS DELETED 1
1



1

.

.

.

.

Appendix A: A Listing of the Code

NRUTER

```

C   EDIT-CONGEOM PROGRAM
C
C   PROGRAM DELETES ALL REGIONS IDENTIFIED AS AIR 1
C   AND CHANGES 'MAGIC' BODIES TO 'GIFT' BODIES
C   ARRAYS ARE DIMENSIONED FOR 1000 REGIONS AND 2500 SOLIDS
C
C   INPUT
C   SPECIFY INPUT AND OUTPUT UNITS
C   6-10 IN  - INPUT UNIT - IF 0 DEFAULTS TO CARD READER IN=5
C   10-15 IOUT - OUTPUT UNIT - IF 0 DEFAULTS TO PRINTER IOUT=6
C   TITLE CARD
C   CONTROL CARD
C   SOLID TABLE
C   REGION TABLE FOLLOWED BY -1 CARD
C   IDENT TABLE FOLLOWED BY BLANK CARD
C
C   UNIT IN  - INPUT OLD COM GEOM DESCRIPTION
C   UNIT IOUT- OUTPUT NEW COM GEOM DESCRIPTION (EDITED)
C   UNIT 10  - NEW REGION TABLE   (TEMPORARY - BINARY)
C   UNIT 11  - OLD SOLID TABLE     (TEMPORARY - BINARY)
C   UNIT 12  - OLD REGION TABLE   (TEMPORARY - BINARY)

```

```

C   DIMENSION TITLE(18)
C   DIMENSION RPP(18), SOL(18), ISOLID(2500)
C   DIMENSION IOP(9), ISOL(9)
C   DIMENSION KARD(11), IDENT(12,1000)
C   EQUIVALENCE (SOL(2),SOLTYP)
C   LOGICAL DELETE, PRNT
C   DATA BOX,ARB /3HBOX,3HARB /
C   DATA ATE /4H8 /
C   DATA ARS /3HARS/
C   DATA BLANK / 3H /
C   DATA END / 3HEND /

```

BOX/ARB
ARB

```

C   1 FORMAT(5X,2I5)
C   2 FORMAT(1H1,10HUNIT IN = ,I4/
C   1 1H ,10HUNIT OUT = ,I4//)
C   10 FORMAT(17A4,A2,I10)
C   15 FORMAT(1H ,17A4,A2,I10)
C   20 FORMAT(3I10,40X,I10)
C   25 FORMAT(1H ,3I10,40X,I10)
C   30 FORMAT(17A4,A2,2I5)
C   31 FORMAT(I3,A3,16A4,2I5)
C   32 FORMAT(I8,9(A2,I5))
C   35 FORMAT(1H ,17A4,A2,2I5)
C   36 FORMAT(1H ,I3,A3,16A4,2I5)
C   40 FORMAT(I5,1X,9(A2,I5),1X,2I5)
C   41 FORMAT(5X,1X,9(A2,I5),1X,2I5)
C   42 FORMAT(I5,70X,I5)
C   43 FORMAT(75X,I5)
C   45 FORMAT(1H ,I5,1X,9(A2,I5),1X,2I5)
C   46 FORMAT(1H ,5X,1X,9(A2,I5),1X,2I5)
C   47 FORMAT(1H ,I5,70X,I5)
C   48 FORMAT(1H ,75X,I5)
C   50 FORMAT(3I10,10X,7A4,A2,2I5)
C   55 FORMAT(1H ,3I10,10X,7A4,A2,2I5)

```

BRLESC


```

C      INITIALIZE
C
  READ 1 , IN , IOUT
  IF (IN.EQ.0) IN = 5
  IF (IOUT.EQ.0) IOUT = 6
  WRITE(6,2) IN,IOUT
  NCARD = 0
  INCCRD = 1
C  CALL DISC (10,200) & CALL DISC (11,200) & CALL DISC (12,200)      BRLESC
  REWIND 10
  REWIND 11
  REWIND 12
  IF (IN.NE.5) REWIND IN
  IF (IOUT.NE.6) REWIND IOUT
  PRNT=.FALSE.
  IF(IOUT.EQ.6) PRNT=.TRUE.
C  PRNT=.TRUE.      BRLESC
C  CLEAR IDENT STORAGE
  DO 90 I=1,12
  DO 90 L=1,1000
90  IDENT(I,L)=0
C  CLEAR SOLID TABLE
  DO 91 I=1,2500
91  ISOLID(I)=0
C
C      READ AND WRITE TITLE CARD
C
  READ (IN,10) TITLE
  NCARD = NCARD + INCCRD
  IF (PRNT) WRITE(IOUT,15) TITLE, NCARD
  IF (.NOT.PRNT) WRITE(IOUT,10) TITLE, NCARD
C
C      READ CONTROL CARD
C
  READ (IN,20) NRPP, NSOL, NREGON
  NSOLID = NRPP + NSOL
C
C      READ SOLIDS AND STORE ON UNIT 11
C
  IF (NRPP.EQ.0) GOTO 101
  DO 100 I=1,NRPP
  READ (IN,30) RPP
  WRITE (11) RPP
100 CONTINUE
101 MSOL=0
102 READ (IN,31) SOL
  IF (SOLTYP.EQ.BLANK) GOTO 103
  MSOL=MSOL+1
  IF (MSOL.GT.NSOL) GOTO 104
103 WRITE (11) SOL
  GOTO 102
→ C 104 CALL SETCWD (4)      BRLESC
→ C 104 DECODE (80,32,SOL(1)) IREG, (IOP(I),ISOL(I),I=1,9)      BRLESC
104 WRITE (10,31) SOL      UNIVAC
  REWIND 10      IBM
  READ (10,40) IREG, (IOP(I),ISOL(I),I=1,9)      AND
  REWIND 10      CDC
  SOLTYP = END
  WRITE (11) SOL
C

```

```

C          READ REGIONS AND STORE ON UNIT 12
C
110 WRITE (12) IREG,IOP,ISOL
    IF (IREG.LT.0) GOTO 111
    READ (IN,40) IREG, (IOP(I),ISOL(I),I=1,9)
    GOTO 110
C          CHECK FOR REGION RPP
111 READ (IN,50) KARD
    IF (KARD(1).NE.0) GOTO 121
C
C          READ IDENT TABLE AND STORE IN ARRAY IDENT
C
120 READ (IN,50) KARD
    IF (KARD(1).EQ.0) GOTO 200
121 L=KARD(1)
    IDENT(1,L)=0
    IF (KARD(3).EQ.1) GOTO 120
    IF (KARD(2).EQ.999) GOTO 120
    DO 122 I=1,11
    IDENT(I,L) = KARD(I)
122 CONTINUE
    IDENT(12,L)= KARD(1)
    GOTO 120
C
C          READ OLD REGION TABLE FROM UNIT 12
C          DELETE AIR 1
C          FLAG SOLIDS USED IN REGION DESCRIPTION
C          STORE NEW REGION TABLE ON UNIT 10
C
200 NEWREG=0
    NREG=0
    REWIND 12
210 READ (12) IREG,IOP,ISOL
    IF (IREG) 290,220,230
C          SAME REGION
220 IF (DELETE) GOTO 210
    GOTO 250
C          NEW REGION
230 NREG=NREG+1
    IF (IDENT(1,NREG).NE.0) GOTO 240
    DELETE = .TRUE.
    GOTO 210
C          KEEP THIS REGION
240 DELETE = .FALSE.
    NEWREG = NEWREG + 1
    IDENT(1,NREG) = NEWREG
C          FLAG SOLIDS USED
250 DO 251 I=1,9
    IF (ISOL(I).EQ.0) GOTO 251
    L = IABS (ISOL(I))
    ISOLID(L) = 1
251 CONTINUE
C          STORE NEW REGION
    WRITE (10) NEWREG,IOP,ISOL,IREG
    GOTO 210
C          END OF REGIONS FLAG
290 WRITE (10) IREG,IOP,ISOL,IREG
C
C          SET UP SOLIDS
C

```

```

NEWSOL = 0
DO 300 I=1,NSOLID
IF (ISOLID(I).EQ.0) GOTO 300
NEWSOL = NEWSOL + 1
ISOLID(I) = NEWSOL
300 CONTINUE
NBWRPP = 0
IF (NRPP.EQ.0) GOTO 310
DO 301 I=1,NRPP
IR (ISOLID(I).NE.0) NEWRPP=NEWRPP+1
301 CONTINUE
C
C      WRITE NEW CONTROL CARD
C
310 NEWSOL = NEWSOL - NEWRPP
NCARD = NCARD + INCCRD
IF (PRNT) WRITE(IOUT,25) NEWRPP,NEWSOL,NEWREG,NCARD
IF (.NOT.PRNT) WRITE(IOUT,20) NEWRPP,NEWSOL,NEWREG,NCARD
C
C      WRITE NEW RPP CARDS
C
REWIND 11
IF (NRPP.EQ.0) GOTO 330
DO 320 IRPP=1,NRPP
RBAD (11) RPP
IF (ISOLID(IRPP).EQ.0) GOTO 320
NCARD = NCARD + INCCRD
IF (PRNT) WRITE(IOUT,35) RPP,IRPP,NCARD
IF (.NOT.PRNT) WRITE(IOUT,30) RPP,IRPP,NCARD
320 CONTINUE
C
C      WRITE NEW SOLID TABLE
C
330 NSOL=NRPP
340 READ (11) SOL
IF (SOLTYP.EQ.END) GOTO 400
IF (SOLTYP.NE.BLANK) GOTO 350
C      SAME SOLID
IF (DELETE) GOTO 340
GOTO 370
C      NEW SOLID
350 NSOL = NSOL + 1
IF (ISOLID(NSOL).NE.0) GOTO 360
DELETE = .TRUE.
GOTO 340
C      KEEP THIS SOLID
360 DELETE = .FALSE.
NEWSOL = MOD( ISOLID(NSOL) , 1000 )
C      CHANGE 'MAGIC' ARS TO 'GIFT' ARS
IF (SOLTYP.NE.ARS) GOTO 364
DO 362 I=4,18
IF (SOL(I).NE.BLANK) GOTO 370
362 CONTINUE
RBAD(11) SOL
SOLTYP=ARS
GOTO 370
C      CHECK BOX OR ARS FOR OGENERATION TO AN RPP BODY
364 IF (SOLTYP.NE.BOX) GOTO 365
CALL CKBOX (SOL,NEWSOL,NCARD,INCCRD,NSOL,IOUT,PRNT)
GOTO 340

```

```

365 IF(SOL TYP.NE.ARB) GOTO 370
IR(SOL(3).NE.ATE.AND.SOL(3).NE.BLANK) GOTO 370
CALL CKARB (SOL,NEWSOL,NCARD,INCCRD,NSOL,IOUT,PRNT)
GOTO 340
C   WRITE NEW SOLID
370 NCARD = NCARD + INCCRD
IF(PRNT) WRITE(IOUT,36) NEWSOL,(SOL(I),I=2,18),NSOL,NCARD
IF(.NOT.PRNT) WRITE(IOUT,31) NEWSOL,(SOL(I),I=2,18),NSOL,NCARD
GOTO 340
C
C   WRITE NEW REGION TABLE
C
400 REWIND IO
410 READ (IO) NEWREG,IOP,ISOL,IREG
IF (NEWREG.LT.0) GOTO 490
DO 420 I=1,9
IF (ISOL(I).EQ.0) GOTO 420
L = IABS (ISOL(I))
ISOL(I) = ISIGN (ISOLID(L),ISOL(I))
420 CONTINUE
NCARD = NCARD + INCCRD
IF (IREG.EQ.0) GOTO 430
NREG = IREG
IF(PRNT) WRITE(IOUT,45) NEWREG,(IOP(I),ISOL(I),I=1,9),NREG,NCARD
IF(.NOT.PRNT) WRITE(IOUT,40)NEWREG,(IOP(I),ISOL(I),I=1,9),NREG,
1      NCARD
GOTO 410
430 IF(PRNT) WRITE(IOUT,46)(IOP(I),ISOL(I),I=1,9),NREG,NCARD
IF(.NOT.PRNT) WRITE(IOUT,46)(IOP(I),ISOL(I),I=1,9),NREG,NCARD
GOTO 410
C   END OF REGION FLAG
490 NCARD = NCARD + INCCRD
IF(PRNT) WRITE(IOUT,47) NEWREG,NCARD
IF(.NOT.PRNT) WRITE(IOUT,42) NEWREG,NCARD
C   BLANK CARD FOR REGION RPP
NCARD = NCARD + INCCRD
IF(PRNT) WRITE(IOUT,48) NCARD
IF(.NOT.PRNT) WRITE(IOUT,43) NCARD
C
C   WRITE NEW IDENT TABLE
C
DO 500 L=1,NREGION
IF (IDENT(1,L).EQ.0) GOTO 500
NCARD = NCARD + INCCRD
IF(PRNT) WRITE(IOUT,55) (IDENT(I,L),I=1,12),NCARD
IF(.NOT.PRNT) WRITE(IOUT,50)(IDENT(I,L),I=1,12),NCARD
500 CONTINUE
C   END OF TABLE FLAG
NCARD = NCARD + INCCRD
IF(PRNT) WRITE(IOUT,48) NCARD
IF(.NOT.PRNT) WRITE(IOUT,43) NCARD
C
C   LIST SOLIDS DELETED
C
NSOL = 0
DO 1000 I=1,NSOLID
IF (ISOLID(I).NE.0) GOTO 1000
NSDL = NSOL + 1
ISOLID(NSOL) = I
1000 CONTINUE

```

```

PRINT 1001 , NSOL
IF (NSOL.NE.0) PRINT 1002 , (ISOLID(I),I=1,NSOL)
C
1001 FORMAT(1H1,'NUMBER OF SOLIDS DELETED',15 )
1002 FORMAT(1H ,10I5)
C
C LIST REGIONS DELETED
C
NREG = 0
DO 2000 I=1,NREGON
IF (IDENT(1,I).NE.0) GOTO 2000
NREG = NREG + 1
ISOLID(NREG) = I
2000 CONTINUE
PRINT 2001 , NREG
PRINT 2002 , (ISOLID(I),I=1,NREG)
C
2001 FORMAT(1H0,'NUMBER OF REGIONS DELETED', 15 )
2002 FORMAT(1H ,10I5)
C
STOP
END

```

```

SUBROUTINE CKARB(SOL,NEWSOL,NCARD,INCCRD,NSOL,IOUT,PRNT)

```

```

C
C THIS SUBROUTINE CHANGES AN ARB TO A RPP
C
DOUBLE PRECISION X,Y,Z,A,B,C
DIMENSION SOL(18),X(8),Y(8),Z(8),R(6),IV(4,6),A(6),B(6),C(6)
DIMENSION TEMP(10)
LOGICAL PRNT
DATA ARB /3HARB/
DATA ATE /4H8 /
DATA BLANK /4H /
DATA RPP /3HRPP/
DATA IV / 1,2,3,4, 5,6,7,8, 1,5,8,4, 2,3,7,6, 1,2,6,5, 4,3,7,8/
1 FORMAT(2A3,16A4)
2 FORMAT(6F10.0)
3 FORMAT(10X,6F10.0)
4 FORMAT(1H ,I3,A3,A4,6F10.4,2I5)
5 FORMAT(1H ,I3,7X,6F10.4,2I5)
6 FORMAT(5H ARB ,I3,29H HAS BEEN CONVERTED TO A RPP.)
7 FORMAT(6(1X,4I1))
8 FORMAT(10X,6(1X,4I1))
9 FORMAT(15A4)
10 FORMAT(1H ,I3,7X,6(1X,4I1),30X,2I5)
11 FORMAT(I3,A3,A4,6F10.4,2I5)
12 FORMAT(I3,7X,6F10.4,2I5)
13 FORMAT(I3,7X,6(1X,4I1),30X,2I5)
TOL=.0001
HSOL=SOL(3)
C CONVERT TO FLOATING POINT FORMAT
C
REWIND 12
DO 100 I=1,8,2
ENCODE(60,9,TEMP(1))(SOL(J),J=4,18)
DECODE(60,2,TEMP(1)) X(I),Y(I),Z(I),X(I+1),Y(I+1),Z(I+1)
C DECODE(60,2,SOL(4)) X(I),Y(I),Z(I),X(I+1),Y(I+1),Z(I+1)
C WRITE(12,1) SOL
100 IF(N.NE.4.OR.HSOL.NE.ATE) READ(11) SOL

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C      IF(HSOL.EQ.BLANK) WRITE(12,1) SOL
C      RBWIND 12
C      DO 101 I=1,B,2
C 101  READ(12,3) X(I),Y(I),Z(I),X(I+1),Y(I+1),Z(I+1)
C      IF(HSOL.EQ.BLANK) READ(12,B) IV
C      IF(HSOL.EQ.BLANK) DECODE(30,7,SOL(4)) IV
C      IF(HSOL.EQ.ATE) GOTO 110
C      ENCODE(32,9,TEMP(1))(SOL(J),J=4,11)
C      DECODE(30,7,TEMP(1))IV
C      FIND EQUATION OF FACES, TEST FOR RPP
110  NZ=0
C      DO 120 I=1,6
C      CALL EQFACE (AP,BP,CP,X(L),Y(L),Z(L),1,2,3)
C      IF (ABS(A(I)).LE.TOL) NZ=NZ+1
C      IF (ABS(B(I)).LE.TOL) NZ=NZ+1
120  IF (ABS(C(I)).LE.TOL) NZ=NZ+1
C      IF (NZ.EQ.12) GOTO 200
C      FAILED, REMAINED AN ARB
C      NCARD=NCARD+INCCRD
C      IF (PRNT)WRITE (IOUT,4)NEWSOL,ARB,HSOL,(X(I),Y(I),Z(I),I=1,2),NSOL,
1      NCARD
C      IF (.NOT.PRNT) WRITE (IOUT,11)NEWSOL,ARB,HSOL,(X(I),Y(I),Z(I),I=1,2)
1      ,NSOL,NCARD
C      DO 130 I=3,8,2
C      NCARD=NCARD+INCCRD
C      IF (PRNT)WRITE (IOUT,5)NEWSOL,X(I),Y(I),Z(I),X(I+1),Y(I+1),Z(I+1),
1      NSOL,NCARD
C      IF (.NOT.PRNT)WRITE (IOUT,12)NEWSOL,X(I),Y(I),Z(I),X(I+1),Y(I+1),
1      Z(I+1),NSOL,NCARD
130  CONTINUE
C      IF (HSOL.EQ.ATE) RETURN
C      NCARD=NCARD+INCCRD
C      IF (PRNT)WRITE (IOUT,10) NEWSOL,IV,NSOL,NCARD
C      IF (.NOT.PRNT) WRITE (IOUT,13) NEWSOL,IV,NSOL,NCARD
C      RETURN
C      CONVERT TO RPP
200  DO 210 I=2,8
C      IF (X(I).NE.X(1))X(2)=X(I)
C      IF (Y(I).NE.Y(1))Y(2)=Y(I)
210  IF (Z(I).NE.Z(1))Z(2)=Z(I)
C      R(1)=AMIN1(X(1),X(2))
C      R(2)=AMAX1(X(1),X(2))
C      R(3)=AMIN1(Y(1),Y(2))
C      R(4)=AMAX1(Y(1),Y(2))
C      R(5)=AMIN1(Z(1),Z(2))
C      R(6)=AMAX1(Z(1),Z(2))
C      NCARD=NCARD+INCCRD
C      IF (PRNT)WRITE (IOUT,4) NEWSOL,RPP,BLANK,R,NSOL,NCARD
C      IF (.NOT.PRNT) WRITE (IOUT,11) NEWSOL,RPP,BLANK,R,NSOL,NCARD
C      WRITE(6,6) NSOL
C      RETURN
C      END

C      SUBROUTINE CKBOX (SOL,NEWSOL,NCARD,INCCRD,NSOL,IOUT,PRNT)
C      THIS SUBROUTINE CONVERTS A BOX TO A RPP
C      DIMENSION SOL(18),B(12),TEMP(10),R(6)
C      LOGICAL PRNT

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```

DATA BOX /3HBOX/
DATA RPP /3HRPP/
1 FORMAT(2A3,16A4)
2 FORMAT(6F10.0)
3 FORMAT(10X,6F10.0)
4 FORMAT(1H ,I3,A3,4X,6F10.4,2I5)
5 FORMAT(1H ,I3,7X,6F10.4,2I5)
6 FORMAT(5H BOX ,I3,29H HAS BEEN CONVERTED TO A RPP.)
7 FORMAT(15A4)
8 FORMAT(I3,A3,4X,6F10.4,2I5)
9 FORMAT(I3,7X,6F10.4,2I5)
C      CONVERT TO FLOATING POINT FORMAT
      ENCODE(60,7,TEMP(1))(SOL(I),I=4,18)
      DECODE(60,2,TEMP(1))(B(I),I=1,6)
C      DECODE(60,2,SOL(4))(B(I),I=1,6)
C      REWIND 12
C      WRITE(12,1) SOL
      READ(11) SOL
      ENCODE(60,7,TEMP(1))(SOL(I),I=4,18)
      DECODE(60,2,TEMP(1))(B(I),I=7,12)
C      DECODE(60,2,SOL(4))(B(I),I=7,12)
C      WRITE(12,1) SOL
C      REWIND 12
C      READ(12,3) B
C      CHECK FOR RPP
      NZ=0
      DO 100 I=4,12
100  IF(B(I).EQ.0.0) NZ=NZ+1
      IF(NZ.EQ.6) GOTO 200
C      FAILED, REMAINS A BOX
      NCARD=NCARD+INCCRD
      IF(PRNT) WRITE(IOUT,4) NEWSOL,BOX,(B(I),I=1,6),NSOL,NCARD
      IF(.NOT.PRNT) WRITE(IOUT,8) NEWSOL,BOX,(B(I),I=1,6),NSOL,NCARD
      NCARD=NCARD+INCCRD
      IF(PRNT) WRITE(IOUT,5) NEWSGL,(B(I),I=7,12),NSOL,NCARD
      IF(.NOT.PRNT) WRITE(IOUT,9) NEWSOL,(B(I),I=7,12),NSOL,NCARD
      RETURN
C      CONVERT BOX TO RPP
200  B(4)=B(1)+B(4)+B(7)+B(10)
      B(5)=B(2)+B(5)+B(8)+B(11)
      B(6)=B(3)+B(6)+B(9)+B(12)
      R(1)=AMIN1(B(1),B(4))
      R(2)=AMAX1(B(1),B(4))
      R(3)=AMIN1(B(2),B(5))
      R(4)=AMAX1(B(2),B(5))
      R(5)=AMIN1(B(3),B(6))
      R(6)=AMAX1(B(3),B(6))
      NCARD=NCARD+INCCRD
      IF(PRNT) WRITE(IOUT,4) NEWSOL,RPP,R,NSOL,NCARD
      IF(.NOT.PRNT) WRITE(IOUT,8) NEWSOL,RPP,R,NSOL,NCARD
      WRITE(6,6) NSOL
      RETURN
      END

```

```

SUBROUTINE EQFACE (X,Y,Z,A,B,C,K,L,M)

```

```

C
C      THIS SUBROUTINE CALCULATES A,B,C OF THE EQUATION OF FACE AX+BY+CZ=1.0
C      IT ALSO CALCULATES THE POINT OF INTERSECT OF THREE PLANES
C

```

```
DOUBLE PRECISION A,B,C,D,X,Y,Z
DIMENSION X(8),Y(8),Z(8)
D=X(K)*Y(L)*Z(M)+X(M)*Y(K)*Z(L)+X(L)*Y(M)*Z(K)-X(M)*Y(L)*Z(K)-X(L)
1*Y(K)*Z(M)-X(K)*Y(M)*Z(L)
IF(D.EQ.0.0) D=.00001
A=(Y(K)*(Z(L)-Z(M))+Y(L)*(Z(M)-Z(K))+Y(M)*(Z(K)-Z(L)))/D
B=(Z(K)*(X(L)-X(M))+Z(L)*(X(M)-X(K))+Z(M)*(X(K)-X(L)))/D
C=(X(K)*(Y(L)-Y(M))+X(L)*(Y(M)-Y(K))+X(M)*(Y(K)-Y(L)))/D
RETURN
END
```


Appendix B: A Sample Input for Code

1

I/O	5	6	SAMPLE INPUT USED IN NWC DOCUMENTATION					
	1	24	12					
	-10000.	10000.	-10000.	10000.	-10000.	10000.		
2 BOX	75.	-36.	12.	-150.	0.	0.	BODY	
2	0.	72.	0.	0.	0.	36.		
3 BOX	74.	-35.	13.	-148.	0.	0.	(1.0)	
3	0.	70.	0.	0.	0.	34.		
4 ARB	75.	-36.	12.	75.	36.	12.	FRONT	
4	75.	36.	48.	75.	-36.	48.		
4	100.	0.	12.	100.	0.	12.		
4	100.	0.	12.	100.	0.	12.		
4	1234	6435	6128	6237	7415	7415		
5 ARB	-75.	-36.	12.	-75.	36.	12.	REAR	
5	-75.	36.	48.	-75.	-36.	48.		
5	-100.	-24.	12.	-100.	24.	12.		
5	-100.	24.	20.	-100.	-24.	20.		
5	1234	5678	3487	1265	2376	1485		
6 ELL	20.	0.	48.	-20.	0.	48.	BUBBLE	
6	50.							
7 ELL	0.	0.	48.	24.	0.	0.	(1.0)	
7	14.							
8 RCC	60.	-36.	12.	-0.	8.	0.	WHEEL	
8	12.							
9 RCC	60.	36.	12.	0.	-8.	0.	WHEEL	
9	12.							
10 RCC	-60.	-36.	12.	0.	8.	0.	WHEEL	
10	12.							
11 RCC	-60.	36.	12.	0.	-8.	0.	WHEEL	
11	12.							
12 BOX	-70.	-20.	15.	40.	0.	0.	ENGINE	
12	0.	40.	0.	0.	0.	30.		
13 RAW	-70.	-20.	45.	0.	0.	-10.	(ENGINE)	
13	0.	10.	0.	40.	0.	0.		
14 RAW	-70.	20.	45.	0.	0.	-10.	(ENGINE)	
14	0.	-10.	0.	40.	0.	0.		
15 ARB	-70.	-10.	45.	-70.	10.	45.	(ENGINE)	
15	-70.	0.	35.	-70.	0.	35.		
15	-30.	-10.	45.	-30.	10.	45.		
15	-30.	0.	35.	-30.	0.	35.		
15	3124	7658	1375	2376	1265	1265		
16 ARS								
16		4	5					
16	-70.	-20.	15.	-70.	-20.	15.	1	
16	-70.	-20.	15.	-70.	-20.	15.	2	
16	-70.	-20.	15.				3	
16	-70.	-20.	15.	-70.	-10.	15.	4	
16	-70.	-10.	25.	-70.	-20.	35.	5	
16	-70.	-20.	15.				6	
16	-30.	-20.	15.	-30.	-10.	15.	7	
16	-30.	-10.	25.	-30.	-20.	35.	8	
16	-30.	-20.	15.				9	
16	-30.	-20.	15.	-30.	-20.	15.	10	
16	-30.	-20.	15.	-30.	-20.	15.	11	
16	-30.	-20.	15.				12	
17 ARS								
17		5	4					
17	-70.	20.	15.	-70.	20.	15.	1	
17	-30.	20.	15.	-30.	20.	15.	2	

17		-70.	20.	15.	-70.	10.	15.		3
17		-30.	10.	15.	-30.	20.	15.		4
17		-70.	20.	15.	-70.	10.	25.		5
17		-30.	10.	25.	-30.	20.	15.		6
17		-70.	20.	15.	-70.	20.	35.		7
17		-30.	20.	35.	-30.	20.	15.		8
17		-70.	20.	15.	-70.	20.	15.		9
17		-30.	20.	15.	-30.	20.	15.		10
18	REC	0.	0.	24.	0.	0.	28.	TRUNK	
18		0.	7.5	0.	5.	0.	0.		
19	SPH	0.	0.	52.	5.			HEAD	
20	TEC	0.	-7.5	49.	20.	0.	-12.	ARM	
20		0.	0.	3.	0.	2.	0.		
20		2.							
21	TEC	0.	7.5	49.	20.	0.	-12.	ARM	
21		0.	0.	3.	0.	2.	0.		
21		2.							
22	TRC	-2.	-4.5	27.	32.	0.	-12.	LEG	
22		3.	2.						
23	TRC	-2.	4.5	27.	32.	0.	-12.	LEG	
23		3.	2.						
24	TUR	21.5	0.	37.	1.	0.	0.	STEERING	
24		8.	1.					WHEEL	
25	ARB	21.5	-6.	33.5	21.5	6.	33.5	CENTER	
25		21.5	0.	44.	40.	0.	37.	STEERING	
25		21.5	-6.	33.5	21.5	6.	33.5	WHEEL	
25		21.5	0.	44.	40.	0.	37.		

25		3127	2146	4328	1345	3127	3127			
1		1	-2	-4	-5	-6	-8	-9	-10	-11
2	OR	2	-3	-7	-8	-9	-10	-11CR	4JR	5
3		6	-7	-2						
4		8								
5		9								
6		10								
7		11								
8	OR	3	-18	-19	-20	-21	-22	-23	-24	-25
		-8	-9	-10	-11	-12CR	7	-18	-19	-20
		-21	-24	-25OR	13OR	14OR	15OR	16CR	17	
9		3	12	-13	-14	-15	-16	-17		
10	OR	18OR	19OR	20OR	21OR	22OR	23			
11		3	24	-25						
12		3	25							

-1										
1				01		OUTSIDE AIR				
2		100				BODY				
3		101				BUBBLE				
4		151				WHEEL RIGHT FRONT				
5		152				WHEEL LEFT FRONT				
6		153				WHEEL RIGHT REAR				
7		154				WHEEL LEFT REAR				
8				02		AIR INSIDE				
9		200				ENGINE				
10		300				MAN				
11		400				STEERING WHEEL				
12		401				STEERING SHAFT				

<<

Appendix C: Sample Output of Code

UNIT IN = 5
UNIT OUT = 6

SAMPLE INPUT USED IN NWC DOCUMENTATION								1	2
	0	24	11						
1RPP	-75.0000	75.0000	-36.0000	36.0000	12.0000	48.0000		2	3
BOX 2 HAS BEEN CONVERTED TO A RPP.									
2RPP	-74.0000	74.0000	-35.0000	35.0000	13.0000	47.0000		3	4
BOX 3 HAS BEEN CONVERTED TO A RPP.									
3ARB	75.0000	-36.0000	12.0000	75.0000	36.0000	12.0000		4	5
3	75.0000	36.0000	48.0000	75.0000	-36.0000	48.0000		4	6
3	100.0000	0.0000	12.0000	100.0000	0.0000	12.0000		4	7
3	100.0000	0.0000	12.0000	100.0000	0.0000	12.0000		4	8
3	1234 6435 6128 6237 7415 7415							4	9
4ARB	-75.0000	-36.0000	12.0000	-75.0000	36.0000	12.0000		5	10
4	-75.0000	36.0000	48.0000	-75.0000	-36.0000	48.0000		5	11
4	-100.0000	-24.0000	12.0000	-100.0000	24.0000	12.0000		5	12
4	-100.0000	24.0000	20.0000	-100.0000	-24.0000	20.0000		5	13
4	1234 5678 3487 1265 2376 1485							5	14
5ELL	20.	0.	48.	-20.	0.	48.		6	15
5	50.							6	16
6ELL 7	0.	0.	48.	24.	0.	0.		7	17
6	14.							7	18
7RCC	60.	-36.	12.	-0.	8.	0.		8	19
7	12.							8	20
8RCC	60.	36.	12.	0.	-8.	0.		9	21
8	12.							9	22
9RCC	-60.	-36.	12.	0.	8.	0.		10	23
9	12.							10	24
10RCC	-60.	36.	12.	0.	-8.	0.		11	25
10	12.							11	26
11RPP	-70.0000	-30.0000	-20.0000	20.0000	15.0000	45.0000		12	27
BOX 12 HAS BEEN CONVERTED TO A RPP.									
12RAW	-70.	-20.	45.	0.	0.	-10.		13	28
12	0.	10.	0.	40.	0.	0.		13	29
13RAW	-70.	20.	45.	0.	0.	-10.		14	30
13	0.	-10.	0.	40.	0.	0.		14	31
14ARB	-70.0000	-10.0000	45.0000	-70.0000	10.0000	45.0000		15	32
14	-70.0000	0.0000	35.0000	-70.0000	0.0000	35.0000		15	33
14	-30.0000	-10.0000	45.0000	-30.0000	10.0000	45.0000		15	34
14	-30.0000	0.0000	35.0000	-30.0000	0.0000	35.0000		15	35
14	3124 7658 1375 2376 1265 1265							15	36
15ARS		4	5					16	37
15	-70.	-20.	15.	-70.	-20.	15.		16	38
15	-70.	-20.	15.	-70.	-20.	15.		16	39
15	-70.	-20.	15.					16	40
15	-70.	-20.	15.	-70.	-10.	15.		16	41
15	-70.	-10.	25.	-70.	-20.	35.		16	42
15	-70.	-20.	15.					16	43
15	-30.	-20.	15.	-30.	-10.	15.		16	44
15	-30.	-10.	25.	-30.	-20.	35.		16	45
15	-30.	-20.	15.					16	46
15	-30.	-20.	15.	-30.	-20.	15.		16	47
15	-30.	-20.	15.	-30.	-20.	15.		16	48
15	-30.	-20.	15.					16	49
16ARS		5	4					17	50
16	-70.	20.	15.	-70.	20.	15.		17	51
16	-30.	20.	15.	-30.	20.	15.		17	52
16	-70.	20.	15.	-70.	10.	15.		17	53

16	-30.	10.	15.	-30.	20.	15.	17	54				
16	-70.	20.	15.	-70.	10.	25.	17	55				
16	-30.	10.	25.	-30.	20.	15.	17	56				
16	-70.	20.	15.	-70.	20.	35.	17	57				
16	-30.	20.	35.	-30.	20.	15.	17	58				
16	-70.	20.	15.	-70.	20.	15.	17	59				
16	-30.	20.	15.	-30.	20.	15.	17	60				
17REC	0.	0.	24.	0.	0.	28.	18	61				
17	0.	7.5	0.	5.	0.	0.	18	62				
18SPH	0.	0.	52.	5.			19	63				
19TEC	0.	-7.5	49.	20.	0.	-12.	20	64				
19	0.	0.	3.	0.	2.	0.	20	65				
19	2.						20	66				
20TEC	0.	7.5	49.	20.	0.	-12.	21	67				
20	0.	0.	3.	0.	2.	0.	21	68				
20	2.						21	69				
21TRC	-2.	-4.5	27.	32.	0.	-12.	22	70				
21	3.	2.					22	71				
22TRC	-2.	4.5	27.	32.	0.	-12.	23	72				
22	3.	2.					23	73				
23TOR	21.5	0.	37.	1.	0.	0.	24	74				
23	8.	1.					24	75				
24ARB	21,5000	-6,0000	33,5000	21,5000	6,0000	33,5000	25	76				
24	21,5000	0,0000	44,0000	40,0000	0,0000	37,0000	25	77				
24	21,5000	-6,0000	33,5000	21,5000	6,0000	33,5000	25	78				
24	21,5000	0,0000	44,0000	40,0000	0,0000	37,0000	25	79				
24	3127	2146	4328	1345	3127	3127	25	80				
1 OR	1	-2	-6	-7	-8	-9	-10OR	3OR	4	2	81	
2	5	-6	-1	0	0	0	0	0	0	0	3	82
3	7	0	0	0	0	0	0	0	0	0	4	83
4	8	0	0	0	0	0	0	0	0	0	5	84
5	9	0	0	0	0	0	0	0	0	0	6	85
6	10	0	0	0	0	0	0	0	0	0	7	86
7 OR	2	-17	-18	-19	-20	-21	-22	-23	-24	-24	8	87
	-7	-8	-9	-10	-11OR	6	-17	-18	-19	-19	8	88
	-20	-23	-24OR	12OR	13OR	14OR	15OR	16	0	0	8	89
8	2	11	-12	-13	-14	-15	-16	0	0	0	9	90
9 OR	17OR	18OR	19OR	20OR	21OR	22	0	0	0	0	10	91
10	2	23	-24	0	0	0	0	0	0	0	11	92
11	2	24	0	0	0	0	0	0	0	0	12	93
-1												94
												95
1	100	0		BODY						2	96	
2	101	0		BUBBLE						3	97	
3	151	0		WHEEL RIGHT FRONT						4	98	
4	152	0		WHEEL LEFT FRONT						5	99	
5	153	0		WHEEL RIGHT REAR						6	100	
6	154	0		WHEEL LEFT REAR						7	101	
7	0	2		AIR INSIDE						8	102	
8	200	0		ENGINE						9	103	
9	300	0		MAN						10	104	
10	400	0		STEERING WHEEL						11	105	
11	401	0		STEERING SHAFT						12	106	
												107

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1

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