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SYSTEM DATA FILE (SDF) FOR THE INTRASYSTEM ANALYSIS PROGRAM (IA--ETC(U)
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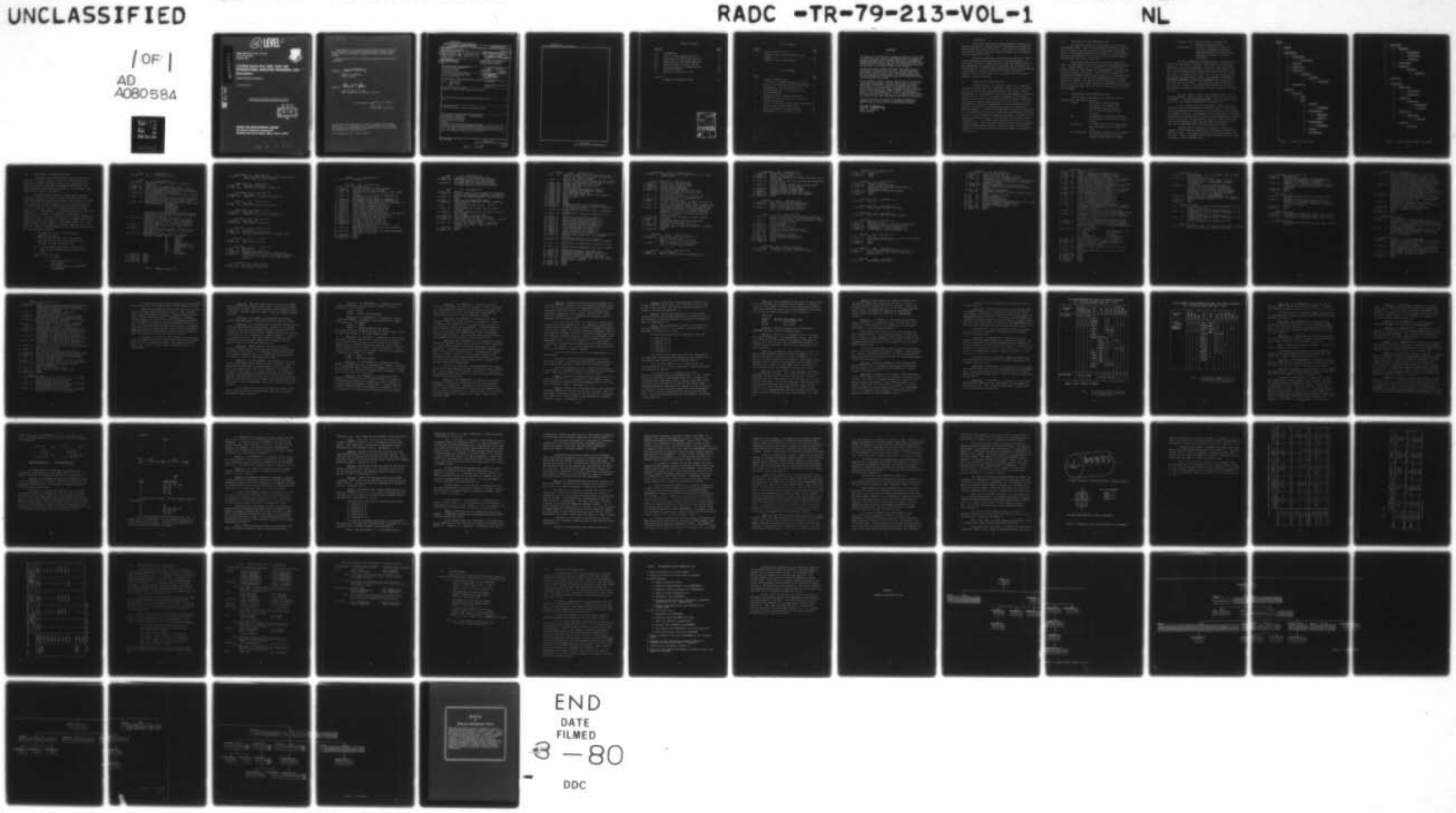

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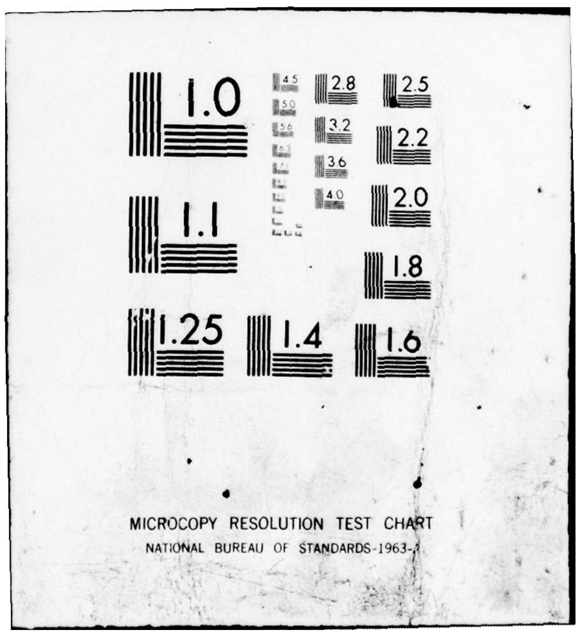
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RADC-TR-79-213, Vol I (of two)
Final Technical Report
December 1979

SYSTEM DATA FILE (SDF) FOR THE INTRASYSTEM ANALYSIS PROGRAM (IAP) Description

Atlantic Research Corporation

Richard Robertson

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This report describes the Electromagnetic Compatibility/Intrasystem Analysis Program (EMC/IAP) System Data File (SDF) and defines each data entry of the file. This report is intended for use both by personnel building an SDF file and by those wanting to extract data from the file.

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EVALUATION

The objective of this effort was to develop the schema for a system data file (SDF) which would contain the data that describe the physical and electrical characteristics of a weapon system from an electromagnetic compatibility (EMC) point of view. This file would contain data such as the description of the surface geometry of the structure and the signal characteristics of all electrical ports within the system.

This data file and its schema can be used as the nucleus on which a standardized system data file can be built. This much larger SDF would contain reliability data, cooling requirements, panel layouts, etc. for each system in the Air Force. This is made possible by the modularity designed into the present schema and the ease with which new sets and attributes can be added.

Of more immediate interest is the fact that the SDF can be used by the Intrasystem Analysis Program (EMC/IAP) computer codes as a source of system data. The EMC/IAP is a collection of computer codes that provide engineers with the capability to design EMC into a system. With an SDF for a particular system, an engineer has readily available all the system characteristics needed to perform an EMC analysis. Moreover, since the parameters are in a central digitized data file, they can be retrieved by a computer. This is quicker and more accurate when compared to the present-day method of manual search and retrieval.

The work accomplishes the objective of TPO R4C, Electromagnetic Compatibility, in that it provides an interference analysis and prediction tool for the Air Force Intrasystem Analysis Program.

Kenneth R. Siarkiewicz

KENNETH R. SIARKIEWICZ
Project Engineer

1.0 INTRODUCTION

This report describes the Electromagnetic Compatibility/ Intrasystem Analysis Program (EMC/IAP) System Data File (SDF) and defines each data entry of the file. This report is intended for use both by personnel building a SDF file and by those wanting to extract data from the file.

Additional information relating to the SDF may be found in the references listed in Section 7.0, Related Documents. In particular, the User's Manual for the System File Handler describes the procedures for loading data onto the SDF and the methods for reading the SDF. Also, the application of the SDF to program IEMCAP is described in the User Manual for the IEMCAP Translator. Volume II of the System Data file for IAP describes the surface geometry aspect of the file.

2.0 PURPOSE OF THE SYSTEM DATA FILE

The EMC analyses of a physical system (e.g., aircraft, satellite, antenna hut, etc.) generally require the use of certain physical and electrical data pertaining to the system. Much of these data are fixed quantities which are used repeatedly with each analysis of the system. For example, knowledge of the geometry shape of the exterior surface of an aircraft is usually needed for an antenna-to-antenna coupling analysis of the system. Also, the locations and electrical characteristics of all electrical equipment and intrasystem wire cabling are required for major EMC analysis studies. In order to aid EMC users in performing analyses, it is intended that a data base of physical and electrical characteristics of a large number of systems be collected. The data for each specific system are stored on a System Data File for that system. Consequently, it is intended that a separate SDF exists for each physical system. While the SDF's for the various systems generally contain different data and are of differing sizes, each SDF must conform to one organizational data structure which is described in this report.

3.0 APPLICATION OF THE SYSTEM DATA FILE

The SDF must be used in conjunction with the System File Handler (SFH). That is, the loading of all data to the SDF and the reading of data from the SDF is performed by the SFH. Also, all maintenance functions of the SDF (i.e., data addition, deletion, and updating), data display and file subsets must be accomplished with the use of the SFH.

The primary application of the SDF is to provide a source of input data for any of the various IAP computer programs (e.g., IEMCAP, GEMACS, etc.) as needed for a particular EMC analysis problem. This service is accomplished by the Translator for the particular IAP program. Each Translator program is designed to interface with the user and obtain the required subset of data from the SDF (through the SFH) pertaining to the user's particular problem. The function of the Translator is then to process the data (e.g., units conversion, coordinate transformation) and to prepare an input data set for the IAP program in the form of card images.

4.0 ORGANIZATION OF THE SYSTEM DATA FILE

The following terms which are associated with the description of the SDF are defined:

- Schema - The overall logical data-base description. It defines the hierarchical organization of all sets and attributes in the data base.
- Set - A collection of grouped attributes. All attributes in a set are logically related.
- Attribute - The lowest level of file description. Each attribute must be a member of a set.
- Attribute Name - The mnemonic assigned to an attribute. A unique name used to identify a particular attribute in a schema.

Attribute Value - The data entry in a file for a particular attribute name.

Logical Record - A group of logically related sets which lie contiguously along one hierarchical path of the schema and includes the highest level set in the schema.

The SDF is sequential and hierarchical. The schema for the SDF is illustrated in Figure 1 which shows the hierarchical structure of all sets in the file. Each box in the figure represents a set (group of attributes) with the set name given in the box. All sets aligned with a given column have the same hierarchical level. The highest level (level 1) is in the leftmost column and consists of only one set: TITLE. Sets HEADER, IDSTATEMENT, SUBSYSTEM, WIREBUNDLE, WIRETABLE, GEOMELEMENT are subsumed under set TITLE and are at level 2. The schema as shown in Figure 1 is presented in a serial or sequential manner which is often useful when trying to visualize the sequential order of the data as stored in a SDF.

The first logical record in the schema consists of sets TITLE and HEADER. The next logical record consists of sets TITLE, IDSTATEMENT, IDEFELEMENT and IDEFSUBELEM. The next logical record consists of sets TITLE, IDSTATEMENT and IDEFZONE, etc.

A set can have multiple occurrences. While each set is shown once with a unique name in the schema, data for a particular set may be entered on the physical file in accordance with multiple occurrences of the set. For example, the data for several subsystems will require a separate entry of data for set SUBSYSTEM to be entered on the file once for each subsystem. Similarly, the various equipment boxes belonging to each subsystem require multiple entries of data for set EQUIPMENT under each corresponding subsystem.

Another form of presenting the schema is given in the Appendix in which the same hierarchical structure is arranged in a parallel format. This figure also shows all attribute names within each set. Single arrowheads indicate non-repeating sets, and double arrowheads signify repeating sets.

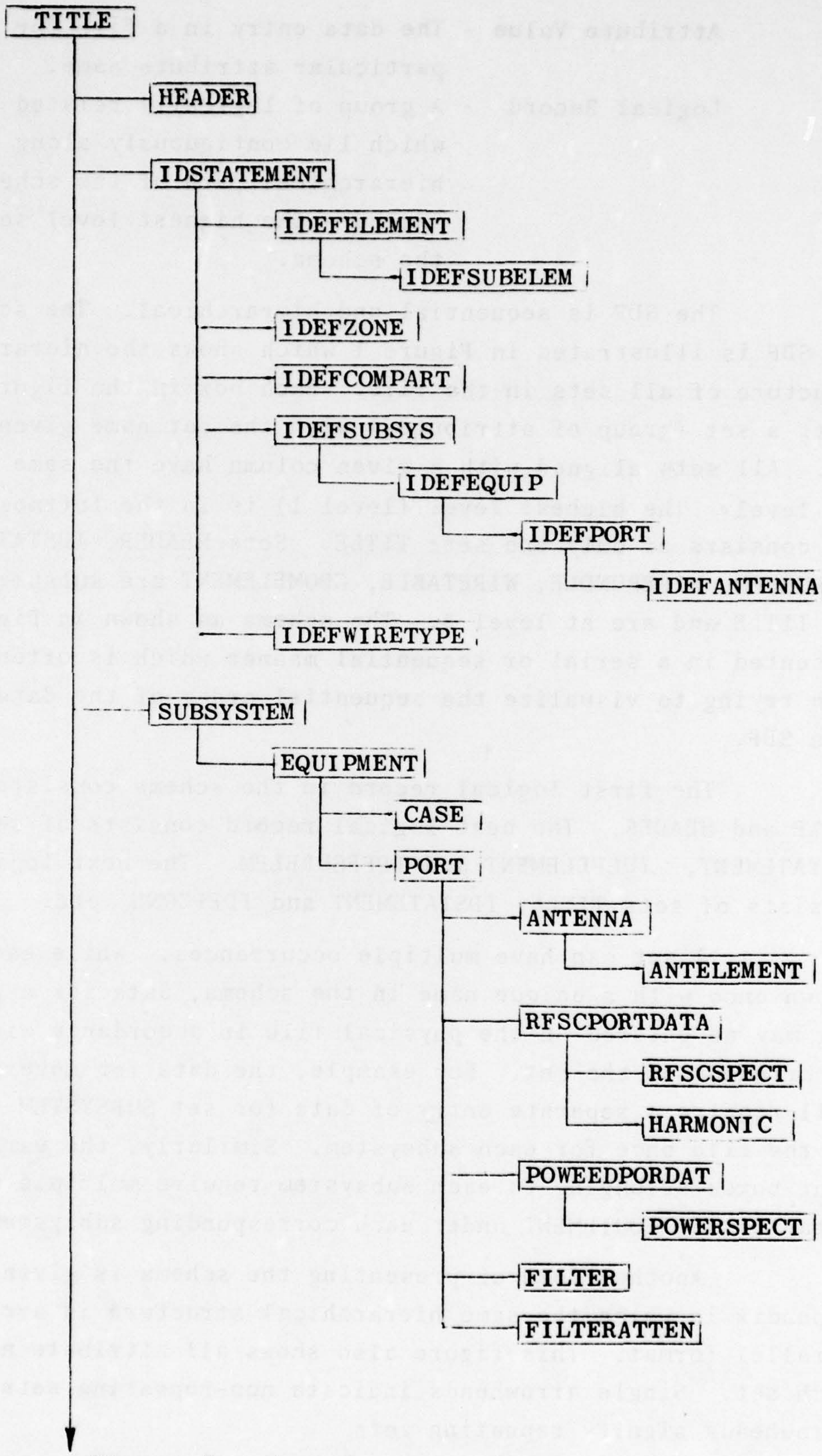

Figure 1. Serial schema of SDF.

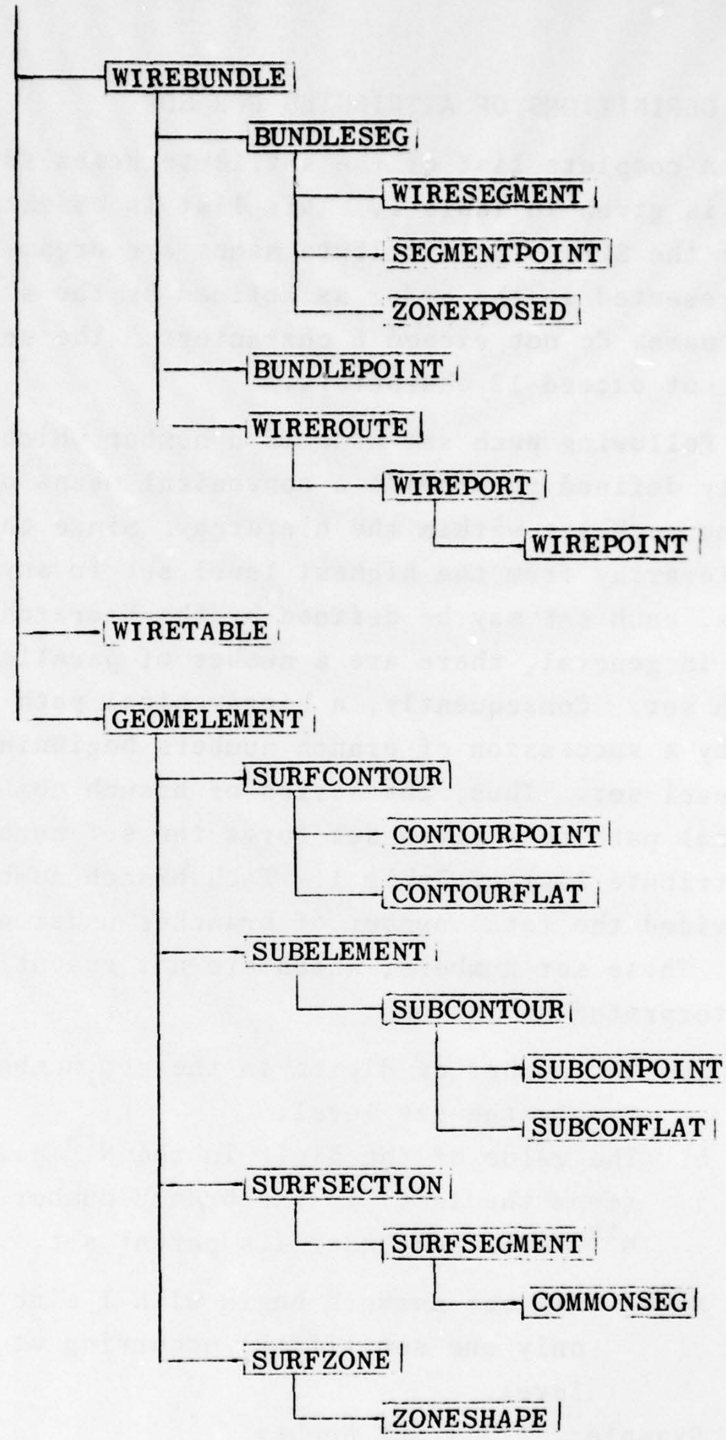

Figure 1. Serial schema of SDF. (continued)

5.0 DEFINITIONS OF ATTRIBUTES FOR SDF

A complete list of the attribute names for the System Data File is given in Table 1. This list is essentially the schema for the SDF. The attribute names are organized by set and are presented in the order as defined by the schema. The attribute names do not exceed 6 characters. The set names, also shown, do not exceed 12 characters.

Following each set name is a number which has been arbitrarily defined to provide a convenient means of uniquely identifying each set within the hierarchy. Since there is a unique path of hierarchy from the highest level set to any given set in the schema, each set may be defined by the hierarchical path to the set. In general, there are a number of parallel branches below each set. Consequently, a hierarchical path may be described uniquely by a succession of branch numbers beginning with the highest level set. Thus, the series of branch numbers defining the hierarchical path to a given set forms the set number shown in the schema attribute list of Table 1. Each branch number is a single digit provided the total number of branches under any set is less than ten. These set numbers, which are not essential to the schema, may be interpreted as follows:

a. The number of digits in the set number equals the set level.
b. The value of the digit in the N^{th} position (from the left) is the branch number of the N^{th} level set under its parent set.

Note: All set numbers begin with 1 since there is only one set (TITLE) occurring at the first level.

Example: 123 = Set Number
1 = Set TITLE
2 = Second Branch Under Set TITLE (=IDSTATEMENT)
3 = Third Branch Under set IDSTATEMENT (=IDEFCOMPART)

No.	Attribute	Type	Description
	TITLE	1	(SEE NOTE 1.0)
1.	FILNAM	C70	NAME OR DESCRIPTION OF FILE.
	HEADER	11	(SEE NOTE 2.0)
1.	SYSNAM	C80	NAME OR DESCRIPTION OF SYSTEM FOR LABELING PRINTOUTS.
2.	SYSMOD	C80	SYSTEM MODEL NO., SERIAL NO., ETC.
3.	SYSTYP	C6	SYSTEM TYPE FOR IEMCAP (=AIR, GROUND, SPACE).
4.	DATE1	C80	DATE OF FILE PREPARATION, DATES OF MODIFICATIONS WITH DESCRIPTION OF MODIFICATIONS.
5.	SOURCE	C80	NAME OR DESCRIPTION OF DATA SOURCE. (E.G., COMPANY OR INDIVIDUAL'S NAME)
6.	UNITL	C2	DIMENSIONAL LENGTH UNIT (=IN, FT, CM, ME) USED FOR ALL COORDINATES, RADII, WIDTHS, LENGTHS, HEIGHTS, EXCEPT WHERE SPECIFIED (E.G. ATTRIBUTE 15.4).
7.	UNITS	C80	DIMENSIONAL UNITS USED THROUGHOUT FILE EXCEPT WHERE USER MAY SPECIFY. FREQUENCY=HZ TIME=SECONDS IMPEDANCE=OHMS ANGLE=DEGREES VOLTAGE=VOLTS VARIABLES USED FOR IEMCAP WHOSE DIMENSIONS ARE NOT SPECIFIED BY THE ABOVE ARE DEFINED IN THE USER'S MANUAL FOR IEMCAP, VOL. II.
8.	ACCUR	C80	DISCUSSION OF ACCURACY OF SURFACE DATA POINTS ENTERED INTO FILE BASED ON LINEAR INTERPOLATION. SEE SYSTEM DATA FILE FOR IAP, VOL. II, SURFACE GEOMETRY, SECTIONS 5.3.1, 5.3.2 AND APPENDIX A.
9.	VERTAX	I2	UPWARD VERTICAL AXIS OF G.C.S. (X=1, Y=2, Z=3) (SEE NOTE 2.1)
10.	FRONAX	I2	HORIZONTAL AXIS OF G.C.S. WHICH DEFINES DIRECTION FROM FRONT TO REAR OF SYSTEM. (X=1, Y=2, Z=3) (SEE NOTE 2.2)
11.	MATDEF	C80	DEFINITION OF MATERIAL CODES FOR SURFACES. EXAMPLES OF CODES: CODE — MATERIAL AL — ALUMINUM ST — STEEL CU — COPPER GE — GRAPHITE-EPOXY BE2 — BORON-EPOXY, 2-PLY BE8 — BORON-EPOXY, 8-PLY KEV — KEVLAR GL — GLASS PLX — PLEXIGLASS NO — NO MATERIAL
12.	SPARH1	C80	SPARE.
13.	SPARH2	C80	SPARE.
14.	SPARH3	C80	SPARE.
15.	SPARH4	C80	SPARE.
16.	SPARH5	C80	SPARE.

Table 1. Schema Attribute List

```
          IDSTATEMENT  12   (SEE NOTE 3.0)
1. DEFINT I1      DUMMY ATTRIBUTE WHICH ALLOWS THIS LEADING SET TO
                  EXIST. ENTER ANY SINGLE INTEGER.

          IDEFELEMENT  121   (SEE NOTE 3.1)
1. ELDID  C5      GEOMETRIC ELEMENT ID.
2. ELDEF  C80     DEFINITION OF GEOMETRIC ELEMENT ID.

          IDEFSUBELEM  1211   (SEE NOTE 3.2)
1. SUBDID C5      SUBELEMENT ID.
2. SUBDEF C80     DEFINITION OF GEOMETRIC SUBELEMENT ID.

          IDEFZONE     122   (SEE NOTE 3.3)
1. ZIDID  C5      ZONE ID.
2. ZIDEF  C80     DEFINITION OF ZONE OR APERTURE ID.

          IDEFCOMPART  123   (SEE NOTE 3.4)
1. COMDID C5      COMPARTMENT ID.
2. COMDEF C80     DEFINITION OF INTERIOR COMPARTMENT ID.

          IDEFSUBSYS   124   (SEE NOTE 3.5)
1. SSIDID C5      SUBSYSTEM ID.
2. SSIDEF C80     DEFINITION OF SUBSYSTEM ID.

          IDEFEQUIP    1241   (SEE NOTE 3.6)
1. EIDID  C5      EQUIPMENT ID.
2. EIDEF  C80     DEFINITION OF EQUIPMENT ID.
3. EQNAME C12     STANDARD DESIGNATION CODE OF EQUIPMENT MODEL.

          IDEFPORT     12411   (SEE NOTE 3.7)
1. PIDID  C5      PORT ID.
2. PIDEF  C80     DEFINITION OF PORT ID.

          IDEFANTENNA  124111   (SEE NOTE 3.8)
1. AIDID  C5      ANTENNA ID.
2. AIDEF  C80     DEFINITION OF ANTENNA ID.
3. ANTNAM C12     STANDARD DESIGNATION CODE OF ANTENNA MODEL.
4. AIDTYP C6      ANTENNA TYPE ID AS REQUIRED FOR IEMCAP. (=DIPOLE,
                  WHIP, SLOT, LOOP, PARDSH, LGPER, HORN, PSDAR,
                  SPIRAL)

          IDEFWIRETYPE 125   (SEE NOTE 3.9)
1. WTID   C5      WIRE TYPE DESIGNATION ID.
2. WTDEF  C80     DEFINITION OF WIRE TYPE.
```

SUBSYSTEM 13 (SEE NOTE 3.5)

1. SSID	C5	SUBSYSTEM ID.

EQUIPMENT 131 (SEE NOTE 3.6)

1. EID	C5	EQUIPMENT BOX ID.
2. ELIDBX	C5	GEOMETRIC ELEMENT ID OF BOX LOCATION.
3. CIDBOX	C5	COMPARTMENT ID OF BOX LOCATION.
4. CLASS	C6	SECURITY CLASSIFICATION (= NOTCLS, CONF, SECRET, TOPSEC).
5. XBXLOC	R15	X-COORDINATE OF BOX CENTER IN ELEMENTAL C.S. (SEE NOTES 4.0 AND 4.1)
6. YBXLOC	R15	Y-COORDINATE OF BOX CENTER IN ELEMENTAL C.S.
7. ZBXLOC	R15	Z-COORDINATE OF BOX CENTER IN ELEMENTAL C.S.
8. ROT1BX	I1	FIRST AXIS OF ROTATION FOR BOX C.S. (SEE NOTE 4.0)
9. ANG1BX	R8	FIRST ROTATION ANGLE FOR BOX C.S.
10. ROT2BX	I1	SECOND AXIS OF ROTATION FOR BOX C.S.
11. ANG2BX	R8	SECOND ROTATION ANGLE FOR BOX C.S.
12. ROT3BX	I1	THIRD AXIS OF ROTATION FOR BOX C.S.
13. ANG3BX	R8	THIRD ROTATION ANGLE FOR BOX C.S.
14. DIRBOX	I2	X-AXIS REDIRECTION CODE FOR BOX C.S. (SEE NOTE 4.0)
15. DIRBOY	I2	Y-AXIS REDIRECTION CODE FOR BOX C.S.
16. DIRBOZ	I2	Z-AXIS REDIRECTION CODE FOR BOX C.S.
17. XBXDIM	R15	X-LENGTH OF BOX SIZE IN BOX C.S.
18. YBXDIM	R15	Y-LENGTH OF BOX SIZE IN BOX C.S.
19. ZBXDIM	R15	Z-LENGTH OF BOX SIZE IN BOX C.S.
20. MILSPC	C6	EMC SPEC FOR CASE (=M461A, M6181D). (SEE NOTES 4.2 AND 4.3)
21. NBUNCA	C8	NARROWBAND UNITS OF CASE SPECT DATA (=DBUVPM). (SEE NOTES 4.2 AND 4.3)
22. BBUNCA	C10	BROADBAND UNITS OF CASE SPECT DATA (=DBUVPMPMHZ). (SEE NOTES 4.2 AND 4.3)
23. SPRBX1	R15	SPARE
24. SPRBX2	R15	SPARE
25. SPRBX3	R15	SPARE

```
        CASE          1311    (SEE NOTE 4.4)
 1. CASEF  R15    FREQUENCY OF CASE SPECT DATA (=HZ).
 2. CASENB R15    NARROWBAND LEVEL OF SPECT DATA FOR CASE,
                  AT 1 METER FROM BOX, UNITS ARE DBUVPM.
 3. CASEBB R15    BROADBAND LEVEL OF SPECT DATA FOR CASE,
                  AT 1 METER FROM BOX, UNITS ARE DBUVPMPMHZ.

        PORT          1312    (SEE NOTE 3.7)
 1. PID    C5     PORT ID
 2. ANTCON I1     FLAG TO INDICATE IF PORT CONNECTS TO AN ANTENNA.
                  (IEMCAP) (0=NO ANTENNA, 1=ANTENNA) (SEE NOTE 4.5)
 3. BIDPR  C5     BUNDLE ID OF BUNDLE CONTAINING WIRE CONNECTED TO
                  PORT.
 4. WIDPR  C5     WIRE ID OF WIRE CONNECTED TO PORT.
 5. PTIDPR C5     BUNDLE POINT ID ASSOCIATED WITH PORT CONNECTION.
                  (SEE NOTE 5.5)
 6. FID    C5     FILTER TABLE ID (0=NO FILTER).  (IEMCAP)
                  (SEE NOTE 4.6)
 7. RETRN  C5     RETURN SIGNAL PATH (=UNBAL, BAL, SHD, GND).
                  (IEMCAP)
 8. SHTERM C5     SHIELD TERMINATION (=NONE, OPN, GND, OO, OG, GO,
                  GG). (IEMCAP)
 9. ZPORTR R10    PORT IMPEDANCE, REAL PART, OHMS.
10. ZPORTI R10    PORT IMPEDANCE, IMAGINARY PART, OHMS.
11. SORTYP C6     SOURCE TYPE CODE, IF PORT IS AN EMITTER.  (IEMCAP)
                  (=RF, SIGNAL, CNTROL, POWER)
12. RECTYP C6     RECEPTOR TYPE CODE, IF PORT IS A RECEPTOR.
                  (IEMCAP) (=RF, SIGNAL, CNTROL, POWER, EED)
                  (SEE NOTE 4.7)
13. SPRPO1 R15    SPARE.
14. SPRPO2 R15    SPARE.
```

ANTENNA 13121 (SEE NOTE 4.8)

1.	AID	C5	ANTENNA ID, UNIQUE FOR EACH INDIVIDUAL ANTENNA IN SYSTEM. NO MORE THAN ONE ANTENNA ALLOWED PER PORT ID. NOT USED BY IEMCAP.
2.	ANTYP	C5	ANTENNA TYPE IDENTIFICATION NAME FOR USE IN IEMCAP. THIS ID IS CALLED AID ON ANTENNA CARD IN IEMCAP.
3.	ANTMOD	C6	ANTENNA MODEL CODE AS USED IN IEMCAP.
4.	ANTS1	R12	ANTENNA DIMENSION (SEE NOTE 4.9).
5.	ANTS2	R12	MAXIMUM GAIN, DB.
6.	ANTS3	R12	3-DB VERTICAL HALF-BEAMWIDTH, DEGREES.
7.	ANTS4	R12	3-DB AZIMUTHAL HALF-BEAMWIDTH, DEGREES.
8.	ANTS5	R12	MAJOR SIDE-LOBE GAIN, DB.
9.	ANTS6	R12	SIDE LOBE ANGLE (FROM ANTS4 TO 180 DEGREES).
10.	ANTS7	R12	BACK LOBE GAIN, DB.
11.	ANTS8	R12	SPARE.
12.	ANTS9	R12	SPARE.
13.	ANTS10	R12	SPARE.
14.	ANTS11	R12	SPARE.
15.	ELIDAL	C5	GEOMETRIC ELEMENT ID OF ANTENNA LOCATION.
16.	XANTLO	R15	X-COORDINATE OF ELECTRICAL CENTER OF ANTENNA IN E.C.S. (SEE NOTE 4.10)
17.	YANTLO	R15	Y-COORDINATE OF ELECTRICAL CENTER OF ANTENNA IN E.C.S.
18.	ZANTLO	R15	Z-COORDINATE OF ELECTRICAL CENTER OF ANTENNA IN E.C.S.
19.	ROTAL1	I1	FIRST AXIS OF ROTATION FOR ANTENNA C.S.
20.	ANGAL1	R8	FIRST ROTATION ANGLE FOR ANTENNA C.S.
21.	ROTAL2	I1	SECOND AXIS OF ROTATION FOR ANTENNA C.S.
22.	ANGAL2	R8	SECOND ROTATION ANGLE FOR ANTENNA C.S.
23.	ROTAL3	I1	THIRD AXIS OF ROTATION FOR ANTENNA C.S.
24.	ANGAL3	R8	THIRD ROTATION ANGLE FOR ANTENNA C.S.
25.	DIRANX	I2	X-AXIS REDIRECTION FOR ANTENNA C.S.
26.	DIRANY	I2	Y-AXIS REDIRECTION FOR ANTENNA C.S.
27.	DIRANZ	I2	Z-AXIS REDIRECTION FOR ANTENNA C.S.
28.	VLOOK	R8	VERTICAL "LOOK" ANGLE (=0 TO 180 DEGREES). (IEMCAP)
29.	AZLOOK	R8	AZIMUTHAL "LOOK" ANGLE (=0 TO 360 DEGREES). (IEMCAP)
30.	POLAR	C2	POLARIZATION (=HZ, VE, CI). (IEMCAP)
31.	XTERM	R15	X-COORDINATE OF TERMINATION LOCATION IN ANTENNA C.S.
32.	YTERM	R15	Y-COORDINATE OF TERMINATION LOCATION IN ANTENNA C.S.
33.	ZTERM	R15	Z-COORDINATE OF TERMINATION LOCATION IN ANTENNA C.S.
34.	ZTERMR	R10	TERMINATION IMPEDANCE, REAL PART, OHMS.
35.	ZTERMI	R10	TERMINATION IMPEDANCE, IMAGINARY PART, OHMS.
36.	VSRCR	R15	EXCITATION VOLTAGE OF ANTENNA, REAL PART.
37.	VSRCI	R15	EXCITATION VOLTAGE OF ANTENNA, IMAGINARY PART.
38.	WGLOCA	C6	WING LOCATION OF ANTENNA (=NOW, BOT, TOP, FWDEDG, AFTEDG, TIP). (IEMCAP)
39.	SPAN1	R15	SPARE.
40.	SPAN2	R15	SPARE.
41.	SPAN3	R15	SPARE.

```
          ANTELEMENT   131211   (SEE NOTE 4.11)
 1. ELIDAN C5     ANTENNA ELEMENT ID. POINTER TO ELID OF GEOMETRIC
                  ELEMENT SETS.

          RFSCPORTDATA 13122    (SEE NOTE 4.12)
 1. SORECR C1     SOURCE (=S) OR RECEPTOR (=R).
 2. SRTYPR C6     SR TYPE (=RF, SIGNAL, CNTROL).
 3. FCARLO R15    LOWEST CARRIER FREQUENCY.
 4. FCARHI R15    HIGHEST CARRIER FREQUENCY.
 5. AMAX   R15    RF SOURCE: MAXIMUM OUTPUT POWER, WATTS.
                  RF RECEPTOR: MINIMUM SENSITIVITY, DBM.
                  SIG/CON: AMPLITUDE A.
 6. BWC    R15    RF: BANDWIDTH OF CHANNEL (6DB WIDTH), BWC.
                  SIG/CON: BANDWIDTH OF INFORMATION, BW.
 7. MODSIG C6     MODULATION/SIGNAL CODE.
 8. PTYPE  C6     RF: PULSE TYPE FOR RADAR, OR SIGNAL TYPE CODE SIG.
                  SIG/CON: UNIT CODE (UNIT) FOR AMAX.
 9. RATE1  R15    BIT OR PULSE REPETITION RATE, WORDS PER MINUTE WPM,
                  NON-VOICE BANDWIDTH B, INITIAL NB LO LEAKAGE DBM.
10. RATE2  R15    PULSE WIDTH OR DURATION T, TONE FREQUENCY FTONE,
                  DIFFERENCE BETWEEN UPPER AND LOWER OSCILLATOR
                  FREQUENCIES DIFF, MAXIMUM FREQUENCY DEVIATION DF,
                  INITIAL BB LO LEAKAGE OSCILLATOR FREQUENCY OF
                  DAMPED SINUSOID.
11. RISTIM R15    RISE TIME, DECAY FREQUENCY OF DAMPED SINUSOID.
12. FALTIM R15    FALL TIME.
13. PCREM  R8     AM INDEX EM, PULSE COMPRESSION RATIO PCR.
14. FIF    R15    INTERMEDIATE FREQUENCY, + OR - HZ.
15. NBUNRF C8     NARROWBAND UNIT OF SPECT DATA (=DBM).
16. BBUNRF C10    BROADBAND UNITS OF SPECT DATA (=DBMPMHZ, DBUVPMHZ,
                  DBUAPMHZ).
17. SPARE1 R15    SPARE

          RFSCSPECT    131221   (SEE NOTE 4.13)
 1. SPECRF R15    USER SUPPLIED SPECTRUM FREQUENCY, HZ.
 2. SPNBRF R15    LEVEL OF NARROWBAND SPECT
                  UNITS IF RF: SEE NBUNRF (13122.15)
                  UNITS IF SIG/CON: SEE PTYPE (13122.8)
 3. SPBBRF R15    LEVEL OF BROADBAND SPECT AMPLITUDE
                  UNITS IF RF: SEE BBUNRF (13122.16)

          HARMONIC     131222   (SEE NOTE 4.14)
 1. HARNUM I3     HARMONIC NUMBER.
 2. HARLEV R8     HARMONIC LEVEL RELATIVE TO FUNDAMENTAL, DB.
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POWFEDPORDAT 13123   (SEE NOTE 4.15)
 1. SORECP C1     SOURCE (=S) OR RECEPTOR (=R).
 2. SRTYPP C6     SR TYPE (=POWER, FED).
 3. POWFRQ R15    POWER LINE FREQUENCY, HZ. MAXIMUM FED POWER FOR NO
                  FIRE, WATTS.
 4. VOLAMP R15    RMS VOLTAGE OF POWER LINE. MAXIMUM FED CURRENT FOR
                  NO FIRE, AMPS.
 5. RSPEC  C6     RIPPLE OR NOISE SPECTRUM CODE OF POWER LINES
                  (=M461A, M6181D, M704A, SPECT).
 6. HARMAX I2     HIGHEST HARMONIC IN POWER LINES.
 7. NPHASE I1     NUMBER OF PHASES IN POWER LINES.
 8. NBUNPW C8     NARROWBAND UNIT FOR SPECT DATA (=DBW).
 9. BBUNPW C10    BROADBAND UNITS FOR SPECT DATA (=DBWPHZ).
10. SPARPE R15    SPARE.


POWERSPECT   131231   (SEE NOTE 4.16)
 1. SPECPF R15    USER SUPPLIED SPECTRUM FREQUENCY, HZ.
 2. SPNBPW R15    LEVEL OF NARROWBAND SPECT AMPLITUDE.
                  UNITS GIVEN BY NBUNPW (13123.8).
 3. SPBBPW R15    LEVEL OF BROADBAND SPECT AMPLITUDE.
                  UNITS GIVEN BY BBUNPW (13123.9).


FILTER         13124   (SEE NOTE 4.17)
 1. FILTID C5     FILTER ID, UNIQUE WITH EACH DISTINCT FILTER IN
                  SYSTEM. NO MORE THAN ONE FILTER ALLOWED PER PORT.
 2. FILTYP C6     FILTER TYPE FOR IEMCAP.  (SEE IEMCAP USER'S MANUAL
                  VOL. II, SECTION 2.3.4.3)
 3. FILSTG I2     NUMBER OF STAGES OR ORDER.
 4. FILTUF R15    TUNED FREQUENCY, HZ.
 5. FILBW  R15    BANDWIDTH OF FILTER, HZ.
 6. FILOSS R8     INSERTION LOSS, NEGATIVE DB VALUE.
 7. FILISO R8     MAXIMUM ISOLATION, NEGATIVE DB VALUE.
 8. FILQ   R9     CIRCUIT Q.
 9. FILM   R9     CIRCUIT COUPLING FACTOR, M.
10. FILFUP R15    UPPER BREAKPOINT FREQUENCY, HZ.
11. FILFLO R15    LOWER BREAKPOINT FREQUENCY, HZ.
12. SPARF1 R15    SPARE.
13. SPARF2 R15    SPARE.


FILTERATTEN  13125   (SEE NOTE 4.18)
 1. FILFRQ R15    FREQUENCY OF FILTER ATTENUATION, HZ.
 2. FILATT R8     ATTENUATION OF FILTER, NEGATIVE DB VALUE.
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        WIREBUNDLE   14    (SEE NOTE 5.0)
1. BID      C5     BUNDLE ID.
2. SPRWB1 R15      SPARE.
3. SPRWB2 I5       SPARE.

        BUNDLESEG     141    (SEE NOTE 5.1)
1. SEGID    C5     BUNDLE SEGMENT ID.
2. SEGLEN R15      LENGTH OF BUNDLE SEGMENT.
3. SEGHT   R15     AVERAGE HEIGHT OF SEGMENT ABOVE GROUND OR
                   CONDUCTING SURFACE.
4. CIDSEG C5       COMPARTMENT ID CONTAINING SEGMENT.
5. SPRBS1 R15      SPARE.
6. SPRBS2 I5       SPARE.

        WIRESEGMENT  1411    (SEE NOTE 5.2)
1. WIDSG    C5     WIRE ID.

        SEGMENTPOINT 1412    (SEE NOTE 5.3)
1. PTIDSG C5       BUNDLE POINT ID AT END OF SEGMENT.

        ZONEXPOSED    1413    (SEE NOTE 5.4)
1. ZIDSG    C5     ZONE ID OF ZONE THAT EXPOSES SEGMENT.

        BUNDLEPOINT  142    (SEE NOTE 5.5)
1. PTID     C5     BUNDLE POINT ID.
2. ELIDBP C5       GEOMETRIC ELEMENT ID CONTAINING BUNDLE POINT.
3. XBPLOC R15      X-COORDINATE OF PTID IN ELEMENTAL C.S.
4. YBPLOC R15      Y-COORDINATE OF PTID IN ELEMENTAL C.S.
5. ZBPLOC R15      Z-COORDINATE OF PTID IN ELEMENTAL C.S.

        WIREROUTE     143    (SEE NOTE 5.6)
1. WID      C5     WIRE ID.
2. WTDIDW C5       WIRE TYPE DESIGNATION ID, MUST EQUAL AN OCCURRENCE
                   OF ATTRIBUTE 15.1, WTDID.
3. SPARW1 R15      SPARE.
4. SPARW2 I5       SPARE.

        WIREPORT      1431    (SEE NOTE 5.6)
1. PAID     C5     ID OF PORT OR ANTENNA CONNECTED TO WIRE.
2. PACON   I1      FLAG TO INDICATE THAT PAID IS A PORT (=0) OR
                   ANTENNA (=1).

        WIREPOINT     14311   (SEE NOTE 5.6)
1. PTIDW   C5      BUNDLE POINT ID ON WIRE.
```

WIRETABLE 15 (SEE NOTE 6.0)

1.	WTDID	C5	WIRE TYPE DESIGNATION ID.
2.	SHCODE	C2	SHIELD CODE (=UN, SH, DS). (IEMCAP)
3.	NWT	I1	SINGLE WIRE (=0), TWISTED PAIR (=1).
4.	WIRDIM	C2	DIMENSIONAL UNIT OF LENGTH FOR ALL WIRE DIMENSIONS IN THIS SET. (=IN, FT, CM, ME, MM, ML(MILS))
5.	DC	R9	CONDUCTOR DIAMETER.
6.	SIGMAW	R12	CONDUCTOR CONDUCTIVITY IN UNITS OF UNSIGW.
7.	UNSIGW	C5	UNIT OF CONDUCTOR CONDUCTIVITY (=RELCU, MHOPM, MHOPC).
8.	TI	R9	THICKNESS OF INSULATION.
9.	REPSIN	R9	INSULATION DIELECTRIC CONSTANT, RELATIVE TO FREE SPACE.
10.	DSL	R9	SHIELD INTERNAL DIAMETER.
11.	TSL	R9	SHIELD THICKNESS.
12.	TJ	R9	SHIELD JACKET THICKNESS.
13.	CSC	R15	SHIELD-TO-CONDUCTOR CAPACITANCE IN UNITS OF UNCSC.
14.	UNCSC	C5	UNIT OF CAPACITANCE (=PFPFT, PFPME).
15.	DS2	R9	INTERNAL DIAMETER OF OUTER SHIELD.
16.	TS2	R9	THICKNESS OF OUTER SHIELD.
17.	SPRWT1	R15	SPARE.
18.	SPRWT2	R15	SPARE.

GEOMELEMENT 16 (SEE NOTE 7.0 AND 7.1)

1.	ELID	C5	ELEMENT ID.
2.	XGCS	R15	GLOBAL X-COORDINATE OF ELEMENTAL ORIGIN.
3.	YGCS	R15	GLOBAL Y-COORDINATE OF ELEMENTAL ORIGIN.
4.	ZGCS	R15	GLOBAL Z-COORDINATE OF ELEMENTAL ORIGIN.
5.	ROT1	I1	FIRST AXIS OF ROTATION FOR ELEMENT C.S. IN DEGREES (0=NO ROTATION, 1=X-AXIS, 2=Y-AXIS, 3=Z-AXIS)
6.	ANG1	R8	FIRST ROTATION ANGLE FOR ELEMENT C.S.
7.	ROT2	I1	SECOND AXIS OF ROTATION FOR ELEMENT C.S. IN DEGREES (0=NO ROTATION, 1=X-AXIS, 2=Y-AXIS, 3=Z-AXIS)
8.	ANG2	R8	SECOND ROTATION ANGLE FOR ELEMENT C.S.
9.	ROT3	I1	THIRD AXIS OF ROTATION FOR ELEMENT C.S. IN DEGREES (0=NO ROTATION, 1=X-AXIS, 2=Y-AXIS, 3=Z-AXIS)
10.	ANG3	R8	THIRD ROTATION ANGLE FOR ELEMENT C.S.
11.	DIRX	I2	X-AXIS REDIRECTION FOR ELEMENT C.S. (+ OR - 1,2,3=NEW X,Y OR Z DIRECTION)
12.	DIRY	I2	Y-AXIS REDIRECTION FOR ELEMENT C.S. (+ OR - 1,2,3=NEW X,Y OR Z DIRECTION)
13.	DIRZ	I2	Z-AXIS REDIRECTION FOR ELEMENT C.S. (+ OR - 1,2,3=NEW X,Y OR Z DIRECTION)
14.	SYMAX	I1	ELEMENTAL AXIS PERPENDICULAR TO PLANE OF SYMMETRY OF ELEMENT. (0=NO SYMMETRY OR TYPE 5, 1=X-AXIS, 2=Y-AXIS, 3=Z-AXIS)
15.	ELIDS	C5	ELEMENT ID OF ELEMENT PROVIDING SOURCE DATA. (=0 or ELID IF DATA NOT DERIVED FROM ANOTHER ELEMENT)
16.	CONEG	I1	COORDINATE AXIS OF SOURCE DATA TO BE NEGATED IF REFLECTED. (0=NO REFLECTION OR TYPE 5, 1=X-AXIS, 2=Y-AXIS, 3=Z-AXIS) APPLIES ONLY IF REFLECTION FROM ANOTHER ELEMENT.
17.	CONTYP	I1	TYPE OF CONTOUR SURFACE DEFINITION (=1,2,3,4,5)
18.	COSTAT	I1	ELEMENTAL AXIS PERPENDICULAR TO CONTOUR AND/OR SUBCONTOUR PLANES, (=1, 2, 3). APPLIES TO ELEMENT TYPES 1,2 ONLY. (=0 OTHERWISE).
19.	SKNTYP	C5	TYPE OF SKIN MATERIAL. AL ALUMINUM ST STEEL CU COPPER GE GRAPHITE-EPOXY BE2 BORON-EPOXY, 2-PLY BE8 BORON-EPOXY, 8-PLY KEV KEVLAR GL GLASS PLX PLEXIGLASS NO NO MATERIAL
20.	SIGMA	R12	SURFACE CONDUCTIVITY IN UNITS OF UNSIG.
21.	UNSIG	C5	UNIT OF CONDUCTIVITY. (=RELCU, MHOPM, MHOPC)
22.	EPSR	R9	RELATIVE DIELECTRIC CONSTANT OF SURFACE. (RELATIVE TO FREE SPACE)
23.	THIK	R15	AVERAGE THICKNESS OF SURFACE SKIN IN UNITS OF UNTHIK.
24.	UNTHIK	C2	UNIT OF SKIN THICKNESS. (=FT, IN, ME, CM, MM, ML(MILS))
25.	SPARG1	R15	SPARE.
26.	SPARG2	R15	SPARE.
27.	SPARG3	R15	SPARE.
28.	SPARG4	I5	SPARE.
29.	SPARG5	C6	SPARE.

SURFCONTOUR 161

1.	NOCON	I3	CONTOUR NUMBER. APPLIES TO ELEMENT TYPES 1,2 ONLY (=0 OTHERWISE).
2.	ICLOSE	I1	CONTOUR CLOSURE INDICATOR. (FOR ELEMENT TYPE 1: 0=NO CLOSURE, 1=CLOSURE. FOR ELEMENT TYPE 5: 0=HEMISPHERE, 1=SPHERE, =0 OTHERWISE).
3.	CONCRV	I2	INDICATOR FOR CURVATURE BETWEEN POINTS ON A CONTOUR. (FOR ELEMENT TYPE 1: 0=CURVATURE, 1=STRAIGHT LINE FOR SEGMENTS SPECIFIED IN SET CONTOURFLAT, 2=STRAIGHT LINE FOR ALL SEGMENTS) (FOR ELEMENT TYPE 5: AXIS THROUGH HEMISPHERE ZENITH= +OR- 1,2,3, =0 OTHERWISE)
4.	CONRAD	R15	RADIUS OF CIRCULAR CONTOUR (ELEMENT TYPE 2) OR SPHERE/HEMISPHERE (ELEMENT TYPE 5). (=0 OTHERWISE)
5.	SPACO1	R15	SPARE.
6.	SPACO2	I3	SPARE.

CONTOURPOINT 1611

1.	XPT	R15	X-COORDINATE OF SURFACE POINT IN ELEMENTAL C.S. FOR ELEMENT TYPES 1,3,4. (=CENTER COORDINATE FOR ELEMENT TYPES 2,5)
2.	YPT	R15	Y-COORDINATE OF SURFACE POINT IN ELEMENTAL C.S. FOR ELEMENT TYPES 1,3,4. (=CENTER COORDINATE FOR ELEMENT TYPES 2,5)
3.	ZPT	R15	Z=COORDINATE OF SURFACE POINT IN ELEMENTAL C.S. FOR ELEMENT TYPES 1,3,4. (=CENTER COORDINATE FOR ELEMENT TYPES 2,5)

CONTOURFLAT 1612

1.	NFLAT	I3	NUMBER OF SEGMENT ON A CONTOUR HAVING ACTUAL STRAIGHT LINE SHAPE. APPLIED TO ELEMENT TYPE 1 ONLY.

SUBELEMENT 162 (SEE NOTE 7.2)

1. SUBID	C5	SUBELEMENT ID.
2. SYMSUB	I1	FLAG TO INDICATE SYMMETRY OF SUBELEMENT ON A SYMMETRICAL ELEMENT WITH COINCIDENT PLANES OF SYMMETRY. (0=NO SYMMETRY, 1=SYMMETRY)
3. SUBIDS	C5	SUBELEMENT ID OF SUBELEMENT PROVIDING SOURCE DATA. (=0 OR SUBID IF DATA NOT DERIVED FROM ANOTHER SUBELEMENT)
4. SPASE1	R15	SPARE.
5. SPASE2	I3	SPARE.

SUBCONTOUR 1621

1. SUBCON	I3	SUBCONTOUR NUMBER, UNIQUE WITH CONTOUR NUMBERS FOR SYSTEM.
2. SUBCRV	I2	INDICATOR FOR CURVATURE BETWEEN POINTS ON A SUBCONTOUR. (0=CURVATURE, 1=STRAIGHT LINE FOR SEGMENTS SPECIFIED IN SET SUBCONFLAT, 2=STRAIGHT LINE FOR ALL SEGMENTS)
3. SPASC1	R15	SPARE.
4. SPASC2	I3	SPARE.

SUBCONPOINT 16211

1. XPTSUB	R15	X-COORDINATE OF SUBELEMENT SURFACE POINT IN E.C.S.
2. YPTSUB	R15	Y-COORDINATE OF SUBELEMENT SURFACE POINT IN E.C.S.
3. ZPTSUB	R15	Z-COORDINATE OF SUBELEMENT SURFACE POINT IN E.C.S.

SUBCONFLAT 16212

1. SNFLAT	I3	NUMBER OF SUBCONTOUR SEGMENT HAVING ACTUAL STRAIGHT LINE SHAPE.

SURFSECTION 163 (SEE NOTE 7.3)

1. NOSEC I4		SECTION OR SUBSECTION NUMBER. APPLIES TO A SECTION OF ELEMENT TYPES 1,2,3,4 ONLY OR TO A SUBSECTION ON ANY TYPE OF ELEMENT. ENTER NEGATIVE VALUE IF ENTIRE SECTION OR SUBSECTION IS DERIVED BY REFLECTION OF SYMMETRICAL ELEMENT OR SUBELEMENT (=0 INTRACONTOUR SEGMENT FOR TYPE 1).
2. NOCON1 I4		NUMBER OF CONTOUR (ELEMENT TYPES 1,2 ONLY) OR SUBCONTOUR (ANY ELEMENT TYPE) AT FORWARD OR FIRST END OF SECTION OR SUBSECTION. ENTER NEGATIVE VALUE IF ENTIRE CONTOUR (OR SUBCONTOUR) IS DERIVED FROM REFLECTED CONTOUR (OR SUBCONTOUR) OF SYMMETRICAL ELEMENT (OR SUBELEMENT).
3. NOCON2 I4		NUMBER OF CONTOUR (ELEMENT TYPES 1,2 ONLY) OR SUBCONTOUR (ANY ELEMENT TYPE) AT AFT OR SECOND END OF SECTION OR SUBSECTION. ENTER NEGATIVE VALUE AS WITH NOCON1.
4. SECURV I1		INDICATOR FOR CURVATURE BETWEEN CONTOURS. (0=CURVATURE, 1=STRAIGHT LINE FOR ALL SEGMENTS) APPLIES TO ELEMENT TYPES 1,2 ONLY.
5. RADMEM R15		AVERAGE OR EFFECTIVE RADIUS OF SEGMENT. APPLIES TO ELEMENT TYPE 4 ONLY.
6. SPASS1 R15		SPARE.
7. SPASS2 I3		SPARE.

SURFSEGMENT 1631

1. NOSEG I4	SEGMENT NUMBER.
2. NOPT1 I4	POINT NUMBER ON CONTOUR (ELEMENT TYPES 1,3,4 ONLY) OR SUBCONTOUR (ANY ELEMENT TYPE) NOCON1 WHICH DEFINES ONE END OF SEGMENT. ENTER NEGATIVE NUMBER IF POINT IS DERIVED FROM REFLECTION OF SYMMETRICAL ELEMENT (OR SUBELEMENT).
3. NOPT2 I4	POINT NUMBER ON CONTOUR (ELEMENT TYPES 1,3,4 ONLY) OR SUBCONTOUR (ANY ELEMENT TYPE) NOCON2 WHICH DEFINES SECOND END OF SEGMENT. ENTER NEGATIVE NUMBER AS WITH NOPT1.

COMMONSEG 16311

1. ELIDCM C5	ELEMENT ID OF INTERSECTING ELEMENT.
2. NOSECM I4	NUMBER OF SECTION OR SUBSECTION OF INTERSECTING ELEMENT CONTAINING SEGMENT. (=0 FOR INTRACONTOUR SEGMENT, THEN CONCOM APPLIES)
3. CONCOM I4	NUMBER OF CONTOUR (ELEMENT TYPE 1) OR SUBCONTOUR (ANY ELEMENT TYPE) OF INTERSECTING ELEMENT CONTAINING COMMON SEGMENT. (=0 IF NOSECM APPLIES)
4. NOSEGM I4	SEGMENT NUMBER OF SECTION, SUBSECTION, CONTOUR OR SUBCONTOUR OF INTERSECTING ELEMENT.
5. SPAGC1 R15	SPARE.
6. SPAGC2 I3	SPARE.

SURFZONE 164 (SEE NOTE 7.4)

1.	ZID	C5	ZONE ID.
2.	SYMZON	I1	FLAG TO INDICATE SYMMETRICAL ZONE ON SYMMETRICAL ELEMENT WITH COINCIDENT PLANES OF SYMMETRY. APPLICABLE TO FIXED ZONES ONLY. (0=NO SYMMETRY OR LOCAL ZONE, 1=SYMMETRY)
3.	ZIDS	C5	ZONE ID OF ZONE PROVIDING SOURCE DATA. (IF NO SOURCE ZIDS=0 OR =ZID)
4.	REFAXZ	I1	REFERENCE AXIS OF LOCAL C.S. FOR LOCAL ZONE DEFINITION. (0=FIXED ZONE, 1=X-AXIS, 2=Y-AXIS)
5.	COREFZ	I1	AXIS OF ELEMENTAL C.S. PERPENDICULAR TO REFAXZ. FOR LOCAL ZONE DEFINITION ONLY. (0=FIXED ZONE, 1=X-AXIS, 2=Y-AXIS, 3=Z-AXIS)
6.	VERAXZ	I1	AXIS OF LOCAL C.S. HAVING UPWARD COMPONENT. (0=FIXED ZONE, 1=X-AXIS, 2=Y-AXIS)
7.	ZONTYP	I1	TYPE OF ZONE DEFINITION. (=1,2(FIXED ONLY), 3,4)
8.	XLOCZ	R15	X-COORDINATE OF ZONE LOCATION IN ELEMENTAL C.S. (=COORDINATE OF CENTER FOR LOCAL ZONE AND TYPE 2 FIXED ZONE. =0 FOR FIXED ZONE TYPES 1,3,4.)
9.	YLOCZ	R15	Y-COORDINATE OF ZONE LOCATION IN ELEMENTAL C.S. (=COORDINATE OF CENTER FOR LOCAL ZONE AND TYPE 2 FIXED ZONE. =0 FOR FIXED ZONE TYPES 1,3,4.)
10.	ZLOCZ	R15	Z-COORDINATE OF ZONE LOCATION IN ELEMENTAL C.S. (=COORDINATE OF CENTER FOR LOCAL ZONE AND TYPE 2 FIXED ZONE. =0 FOR FIXED ZONE TYPES 1,3,4.)
11.	RADZON	R15	RADIUS OR WIDTH. (ZONE TYPE1=0, ZONE TYPE2=RADIUS, ZONE TYPES 3,4=WIDTH)
12.	ZONMAT	C5	MATERIAL CODE OF ZONE. SEE EXAMPLES FOR ATTRIBUTE SKNTYP (16.19).
13.	SIGZON	R12	CONDUCTIVITY OF ZONE MATERIAL IN UNITS OF UNSIGZ.
14.	UNSIGZ	C5	UNIT OF CONDUCTIVITY.(=RELCU, MHOPM, MHOPC)
15.	EPSRZ	R9	RELATIVE DIELECTRIC CONSTANT OF ZONE MATERIAL (RELATIVE TO FREE SPACE).
16.	THIKZ	R15	THICKNESS OF ZONE MATERIAL IN UNITS OF UTHIKZ.
17.	UTHIKZ	C2	UNIT OF THICKNESS. (=FT, IN, ME, CM, MM, ML(MILS))
18.	D2	R15	DISTANCE OF REFLECTING SURFACE FROM ZONE. (PROGRAM APERTURE)
19.	WGLOCZ	C6	WING LOCATION OF ZONE (IEMCAP). (=NOW, BOT, TOP, FWDEDG, AFTEDG, TIP)
20.	SPARZ1	R15	SPARE.
21.	SPARZ2	R15	SPARE.

ZONESHAPE 1641

1.	XZONE	R15	X-COORDINATE OF ZONE POINT IN E.C.S. FOR FIXED ZONE, OR LOCAL C.S. FOR LOCAL ZONE. APPLIES TO ZONE TYPES 1,3,4 ONLY.
2.	YZONE	R15	Y-COORDINATE OF ZONE POINT IN E.C.S. FOR FIXED ZONE, OR LOCAL C.S. FOR LOCAL ZONE. APPLIES TO ZONE TYPES 1,3,4 ONLY.
3.	ZZONE	R15	Z-COORDINATE OF ZONE POINT IN E.C.S. FOR FIXED ZONE TYPES 1,3,4. (=0 FOR LOCAL ZONE)

It may be noted that all sets lying along a hierarchical path which includes the highest level set form a logical record.

Under each set name in the attribute list is an ordered list of attribute names belonging to the set. Each attribute name is unique throughout the schema. Following each attribute name is the attribute type code (C = Character, I = Integer, R = Real Number), the size limit of the corresponding attribute value in number of characters, and the definition of the attribute. In those cases where an equal sign is used, the following values are the only values that may be used for that attribute. Supplemental notes are referenced in Table 1 which provide additional description of some of the items in the list.

Attributes are identified by a decimal code consisting of the set number preceding the decimal and the attribute number within the set following the decimal. For example, attribute ELDEF = 121.2 since it is the second attribute in set 121 (IDEFELEMENT).

Note 1.0. Set TITLE consisting of one attribute FILNAM exists primarily to provide a single, level 1 set for the schema. Consequently, FILNAM is the first attribute of all logical records in the SDF. The file entry for FILNAM is used as labeling information only.

Note 2.0. Set HEADER is non-repeating and contains general data pertaining to the entire SDF for a specific system.

Note 2.1. It is presumed that an absolute upward vertical direction for the system can be defined. Further, it is assumed that one of the axes of the global coordinate system (G.C.S.) is aligned with the vertical direction. VERTAX specifies the vertical axis of the G.C.S. by a positive or negative integer: 1 = x-axis, 2 = y-axis, 3 = z-axis. The sign is positive if the positive direction of the axis points upward, and is negative if the negative direction of the axis points upward.

Note 2.2. FRONAX specifies the direction in the horizontal plane which can be considered to point from the front to the rear of the system. It is presumed that one of the axes of the global coordinate system is aligned with this direction. Data entry is similar to that described in Note 2.1.

Note 3.0. Set IDSTATEMENT is the leading set of a major branch of the schema which contains ID definition data. This set, which can be loaded with any single integer, serves no purpose other than organizational and is non-repeating. The purpose of the data in this branch is to define for the user all ID names of pertinent system components which have been entered on the SDF. Generally, the person who uses the file is not the same person who built the file and, thus, is not familiar with the particular code names given to all the equipments, ports, etc., that are stored in the file.

All ID names stored in the file must not exceed 5 characters, must consist only of alphanumeric characters, and must begin with an alpha character.

Note 3.1. Set IDEFELEMENT is a repeating set which defines the geometric element that an element ID (ELID) is assigned to. For example:

ELDID = NAC3

ELDEF = NACELLE FOR 3RD ENGINE

Note 3.2. Set IDEFSUBELEM is a repeating set which defines the geometric subelement that a subelement ID (SUBID) is assigned to. For example:

SUBDID = NACB3

SUBDEF = NACELLE STRUT FOR 3RD ENGINE

Note that all values of SUBDID entered into the SDF under a value of ELDID must belong to the system element ELDID.

Note 3.3. Set IDEFZONE is a repeating set which defines the surface zone or aperture that a zone ID (ZID) is assigned to. The term zone refers in general to any portion of a geometric surface having a different dielectric constant and/or conductivity from the majority of the surface. Zones include holes, windows, cracks, dielectric panels, etc. Zones of any type are referred to as apertures in IEMCAP. For example:

ZIDID = NSEWH

ZIDEF = NOSE WHEEL OPENING

Note 3.4. Set IDEFCOMPART is a repeating set which defines the compartment that a compartment ID (COMPID) is assigned to. A compartment may be defined in the IEMCAP sense as a subspace of the system for which mutual coupling can occur among all equipments located within the compartment.

Note 3.5. Set IDEFSUBSYS is a repeating set which defines the subsystem that a subsystem ID (SSID) is assigned to. A subsystem may be defined as a group of distinct components of a system usually performing a related task. A radar package or a central computer complex are examples of subsystems. The use of subsystems is for convenience in organizing the system data.

Note 3.6. Set IDEFEQUIP is a repeating set which defines the equipment box that an equipment ID (EID) is assigned to. An equipment is a physical box mounted in the system. For each occurrence of this set, the parent set IDEFSUBSYS must define the subsystem to which the equipment belongs.

Note 3.7. Set IDEFPORT is a repeating set which defines the port that a port ID (PID) is assigned to. A port is defined in the IEMCAP sense as a point of entry or exit of electromagnetic energy from an equipment. A common example of a port is a pin in a cable connector. For each occurrence of this set, the parent set IDEFEQUIP must define the equipment which contains the port. Thus, the hierarchy indirectly defines the equipment box and subsystem of each specific port.

Note 3.8. Set IDEFANTENNA is a non-repeating set which defines the specific antenna that an antenna ID (AID) is assigned to. Each antenna within a system must be assigned a unique antenna ID. In addition, each antenna specified in the SDF must have only one port associated with it. An antenna can transmit, receive, or both. However, a single antenna structure that operates on two or more frequency bands independently or connects to two or more equipments must be identified by a different ID for each independent antenna mode.

For the case involving a single equipment port connecting to two or more antennas, by means of switches or multicouplers, etc., the port should be identified in the SDF by a separate ID name associated with each antenna in order to uniquely distinguish between each operating mode.

Note 3.9. Set IDEFWIRETYPE is a repeating set which defines the type of wire or cable that a wire type designation ID (WTDID) is assigned to. Although the construction of each wire or cable is defined in detail within the set WIRETABLE, the wire or cable will generally be a commercial model or type having a standard manufacturer's name and code number, which can be entered in WTDEF.

Note 4.0. A general procedure has been developed for allowing the user to define a local rectangular coordinate system (C.S.) at any point and with any orientation relative to a given rectangular coordinate system. A total of 12 parameters are required to define the local system and consists of a) 3 parameters for translation, b) 6 parameters for rotations, and c) 3 parameters for axis redirections.

For this case, the local C.S. defines the location and orientation of the equipment box. It is generally assumed that each box has a rectangular shape to which a rectangular coordinate system can be aligned. The given rectangular coordinate system is the elemental coordinate system for the element containing the box. The elemental coordinate system is a right- or left-handed rectangular system which is defined relative to the global C.S. in set GEOMELEMENT (16.2 - 16.13). The global C.S. is a right-handed rectangular coordinate system established for the entire physical system. The elemental C.S. is fully described in the System Data File for IAP, Volume II, Surface Geometry.

A detailed description of the 12 defining parameters is given below.

Each local system must be an orthogonal set of axes which may be right- or left-handed and arbitrarily positioned at any location and orientation relative to the elemental system.

Each local coordinate system is defined with reference to the elemental coordinate system in accordance with the following steps. These steps must be followed in the order given.

Step 1. Specify the location of the origin of the local system in terms of x, y, z coordinates of the elemental system. This represents a translation of the elemental origin to the position of the local origin. (Parameters 1, 2, 3)

Step 2A. Specify one of the three axes of the translated elemental system to be the axis for the first rotation. The rotation angle is defined to be positive if the rotation is clockwise when viewed from a positive point on the rotation axis looking toward the origin. (Parameters 4, 5)

Step 2B. Specify one of the remaining two axes of the rotated coordinate system (after first rotation) to be the axis for the second rotation. The positive sense of rotation is as defined in Step 2A. (Parameters 6, 7)

Step 2C. Specify the remaining axis of the rotated coordinate system (after second rotation) to be the axis for the third rotation. The positive sense of rotation is as defined in Step 2A. (Parameters 8, 9)

Step 3. Where appropriate, specify the redirection of each axis parallel to the x-, y-, z-axes. Six directions are available. (Parameters 10, 11, 12)

The direction of each axis is specified by the code:

1 = Directed to +X.
-1 = Directed to -X.
2 = Directed to +Y.
-2 = Directed to -Y.
3 = Directed to +Z.
-3 = Directed to -Z.

The reference coordinate directions are established by the right-hand set which was transformed from the elemental set to the present point of local origin, following Step 2C.

Note: The code numbers 1, 2, 3, specified for the directions of the x, y, z axes, respectively, signify no change or redirection of the axes.

Axis redirection is a technique which offers the user a convenient means of rearranging the x, y and z coordinates on a given set of three-dimensional axes. Although the redirection of a right-hand system to another right-hand system can be specified (in Steps 2A, 2B and 2C) by rotation angles involving appropriate multiples of 90 degrees, it may be difficult to visualize a correct rotation sequence for some arrangements. Hence, axis redirection eliminates the risk of error for these cases. Also, axis redirection provides the means for specifying a left-handed C.S.

Note 4.1. The coordinates of the center of the equipment box are to be specified relative to the elemental coordinate system for the element containing the box (specified by ELIDBX). This point becomes the origin of a local coordinate system which will be used to define the geometric size of the box.

Note 4.2.

MILSPC	EMC spec to be used as base
M461A	MIL-STD-461A
M6181D	MIL-I-6181D

Note 4.3. DBUVPM represents units of dBuV/meter. DBUVPMPMHZ represents units of dBuV/meter/MHz.

Note 4.4. The case of an equipment box is considered as a source and receptor of electromagnetic energy. Set CASE is a repeating set which stores each frequency and amplitude point of the radiation spectrum, narrowband and broadband. If no SPECT data are available, this set can be omitted for the given equipment.

Note 4.5. In general, a port connects to a wire. If the wire also connects to ports of other equipments, the given port is considered to connect to a wire, and ANTCON = 0. If the wire eventually connects to an antenna (even though it goes through filters, couplers, etc.),the port is considered to be connected to an antenna (in the IEMCAP sense), and ANTCON = 1. For this latter case, set ANTENNA for the port must exist.

Note 4.6. Attribute FID is the ID name of the filter type specified for the port. FID is used for IEMCAP and is not necessarily unique for all filters in the system. If FID is specified (non-zero) then data for the filter must exist in set FILTER for the port. All filters having the same FID name must have the same electrical data in set FILTER. Note: FILTID (13124.1) is a filter ID name unique for all filters in the system. It is recommended that the name assigned to each FID contain letters describing the filter type or model, e.g. TRC4, LP1.

Note 4.7. Data entries for SORTYP and RECTYP specify the types of signals which exist for the port as a source (emitter) and/or a receptor of electrical energy. Either one or both must be specified and must also be consistent with the values entered for SORECR and SRTYPR of set RFSCPORTDATA (13122) and/or for SORECP and SRTYPP of set POWEEDPORDAT (13123).

Note 4.8. Set ANTENNA is a non-repeating set which contains data for the antenna that connects to the port of the parent set. The existence of set ANTENNA must be consistent with ANTCON = 1 for the connecting port.

Each antenna specified in the SDF must have only one port associated with it. An antenna can transmit, receive, or both. However, a single antenna structure that operates on two or more frequency bands independently or connects to two or more equipments must be identified by a different ID for each independent antenna mode.

For the case involving a single equipment port connecting to two or more antennas by means of switches or multicouplers, etc., the port should be identified in the SDF by a separate ID name associated with each antenna in order to uniquely distinguish between each operating mode.

Note 4.9. Attributes ANTMOD and ANTS1 through ANTS7 contain data for the corresponding IEMCAP parameters required for the antenna card, as defined in the IEMCAP User's Manual, Volume II, Section 2.3.4.2.

Note 4.10. Attributes 16-27 define a local coordinate system of the antenna relative to the elemental coordinate system (E.C.S.). The local C.S. should be selected to align in a convenient and practical manner with the geometric shape of the antenna. This local C.S. will serve as a global C.S. for the detailed definition of the antenna geometry in set GEOMELEMENT (16). The element ID names assigned to this definition are specified by ELIDAN of set ANTELEMENT (131211).

See Note 4.0 for a description of attributes 13121.16 through 13121.27.

Note 4.11. A detailed description of the antenna shape or geometric construction is possible by dividing the antenna into elements and defining the geometric shape of each within the GEOMELEMENT branch of the SDF. Accordingly, set ANTELEMENT is a repeating set which contains each of the element ID names for the antenna. These names serve as pointers to the GEOMELEMENT branch where the same names must exist for attribute ELID (See Note 7.0).

The global C.S. used for defining the antenna geometry is the local C.S. established by attributes 13121.16 through 13121.27 (See Note 4.10).

Note 4.12. Set RFSCPORTDATA contains the data for either an RF or a SIGNAL/CNTROL port as required by IEMCAP. The specific assignment of the IEMCAP parameters for an RF port to the attributes of this set is defined in Table 2. Similarly, the assignment of the parameters for a SIGNAL/CNTROL port is given in Table 3. See IEMCAP User's Manual, Volume II, Sections 2.3.5.5, 2.3.5.5.1, 2.3.5.5.3.

The data entries for attributes SORECR and SRTYPR must be consistent with the data entered for SORTYP and RECTYP of the set PORT (See Note 4.7).

Note 4.13. Set RFSCSPECT is a repeating set for storing the values of SPECT data for the corresponding RF or SIGNAL/CNTROL port. This set may be omitted for a specific port if no SPECT data are available (MODSIG (13122.7) may not have the value SPECT in that case).

Note 4.14. Set HARMONIC is a repeating set for storing the amplitude (relative to the fundamental) of each harmonic of an RF source port. This set may be omitted for a specific port if no harmonic data are available.

RF SOURCE/RECEPTOR DATA ENTRY INTO SCHEMA ATTRIBUTES

Set - RF/SIGNAL/CONTROL PORT DATA 13122

Attribute Name	FCARLO	FCARHI	AMAX	BWC	MODSIG	PTYPE	RATE1	RATE2	RISTIM	FALTIM	PCREM	FIF
RF SOURCE	f_l	f_h	p	bwc	CW							
					PDM		r_b					
					NRZPCM		r_b					
					BPPCM		r_b				em	
					PPM		r_b	t				
					TELEG		wpm	ftone				
					FSK		r_b	diff				
					PAMFM			df				
					RADAR	RECTPL	r_b	t				
					"	TPZD	r_b	t	t_r	t_f		
					"	COSQD	r_b	t				
					"	GAUSS	r_b	t				
					"	CHIRP	r_b	t	t_r	t_f	pcr	
					AM	SIG*	b				em	
					DSBSC	SIG	b					
					LSSB	SIG	b					
					USSB	SIG	b					
					FM	SIG	b	df				
					LOLKG		lo_{nb}	lo_{bb}				
					SPECT							
RF RECEPTOR	f_l	f_h	s	bwc	same as source							fif

*SIG = VOICE, CVOICE, or NONVCE

Table 2. Assignment of IEMCAP Parameters for an RF Port to the Attributes of Set RFSCPORTDATA.

SIGNAL/CONTROL SOURCE/RECEPTOR DATA ENTRY INTO SCHEMA ATTRIBUTES

Set - RF/SIGNAL/CONTROL PORT DATA 13122

Attribute Name	FCARLO	FCARHI	AMAX	BWC	MODSIG	PTYPE	RATE1	RATE2	RISTIM	FALTIM	PCREM	FIF
SIGNAL/ CONTROL SOURCE or RECEPTOR	f_l	f_h	a	bw	PDM	units for AMAX (VLTS or AMPS)	r_b					
					NRZPCM		r_b					
					BPPCM		r_b				em	
	↓	↓	↓	↓	PPM		r_b	t				
					TELEG		wpm	ftone				
					PAM	↓	r_b	t				
					ESPIKE		r_b	t				
					RECTPL		r_b	t				
					TPZD		r_b	t	t_r			
					TRIANG		r_b	t				
					SAWTH		r_b	t				
					DMPSIN		r_b	f_r	f_I			
					VOICE							
					CVOICE							
			0		SPECT							

Table 3. Assignment of IEMCAP Parameters for a SIGNAL/CNTROL Port to the Attributes of Set RFSCPORTDATA.

Note 4.15. Set POWEEDPORDAT contains the data for either a POWER or EED port as required by IEMCAP. See IEMCAP User's Manual, Volume II, Sections 2.3.5.5, 2.3.5.5.2, 2.3.5.5.4.

The data entries for attributes SORECP and SRTYPP must be consistent with the data entered for SORTYP and RECTYP of the set PORT (See Note 4.7).

Note 4.16. Set POWERSPECT is a repeating set for storing the values of SPECT data for the corresponding POWER port. This set may be omitted for a specific port if no SPECT data are available (in which case RSPEC (13123.5) may not have the value SPECT).

Note 4.17. Set FILTER contains the filter parameters of a port as required by IEMCAP. This set is non-repeating and exists only if attribute FID in set PORT is non-zero.

Note: FILTID is not required in IEMCAP. The filter ID used by IEMCAP is FID (1312.6).

Attribute FILTYP may contain only those mnemonics as specified for IEMCAP parameter TYPE on the FILTER card. See IEMCAP User's Manual, Volume II, Section 2.3.4.3.

Note 4.18. Set FILTERATTEN is a repeating set which contains values of the frequency attenuation curve of the filter. This set is omitted for a filter if no data are available.

Note 5.0. The concepts of wire bundles, bundle segments, and bundle points as defined for IEMCAP are applied to the SDF. See IEMCAP User's Manual, Volume II, Section 2.3.6.

In general, a wire bundle is a group of wires which, for some portion of their lengths, follow the same route such that mutual coupling exists between wires. There is no limit to the number of wires a bundle may contain. A bundle may consist of only one wire. Every wire in a system must belong to one and only one bundle. The purpose of a wire bundle is to define a group of wires for which signal energy can couple either directly or indirectly between every pair of wires in the bundle. Usually, a wire bundle is a physical bundle of the system.

Note 5.1. A bundle segment, defined in the IEMCAP sense, is a section of a bundle that connects two consecutive bundle points. All wires within a segment are assumed to run parallel. The number of wires in a segment must be the same at all points along a segment. Any branching of a bundle must occur at a bundle point (See Note 5.5).

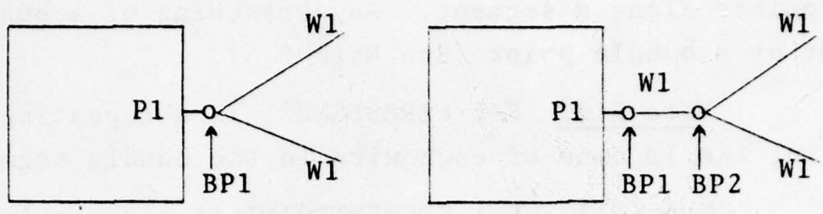
Note 5.2. Set WIRESEGMENT is a repeating set containing the ID name of each wire in the bundle segment.

Note 5.3. Set SEGMENTPOINT is a repeating set containing the ID name of each of the two bundle points which define the ends of the bundle segment. This set must have two and only two occurrences for each bundle segment defined. The order of the two points in the file is not important.

Note 5.4. Set ZONEXPOSED is a repeating set containing the ID name of each zone or aperture in the wall of the compartment enclosing the bundle segment which can allow external electromagnetic fields to couple with the wires. (See Note 3.3)

Note 5.5. A bundle point, defined by IEMCAP, is a point on a wire bundle at which the electromagnetic properties of the bundle change due to a physical change in the bundle. The most common locations for bundle points are at branch points, at corners or where the bundle changes direction, at the entry and exit points of a compartment, and at the end or port connection of each wire. The wires are assumed to run in a straight line between two consecutive bundle points. Bundle points define the physical location of a bundle in a system.

IEMCAP does not permit a wire to pass through a bundle point at a port - i.e., only one wire can connect to a port. In real cases where two or more wires connect to the same port of an equipment box, as shown below on the left, the situation may be represented by defining a second bundle point slightly offset from the port in order to remove the branching from the port, as shown below on the right. The bundle point at the port, BP1 on the right, (attribute PTIDPR 1312.5) is then the required termination of a single wire.



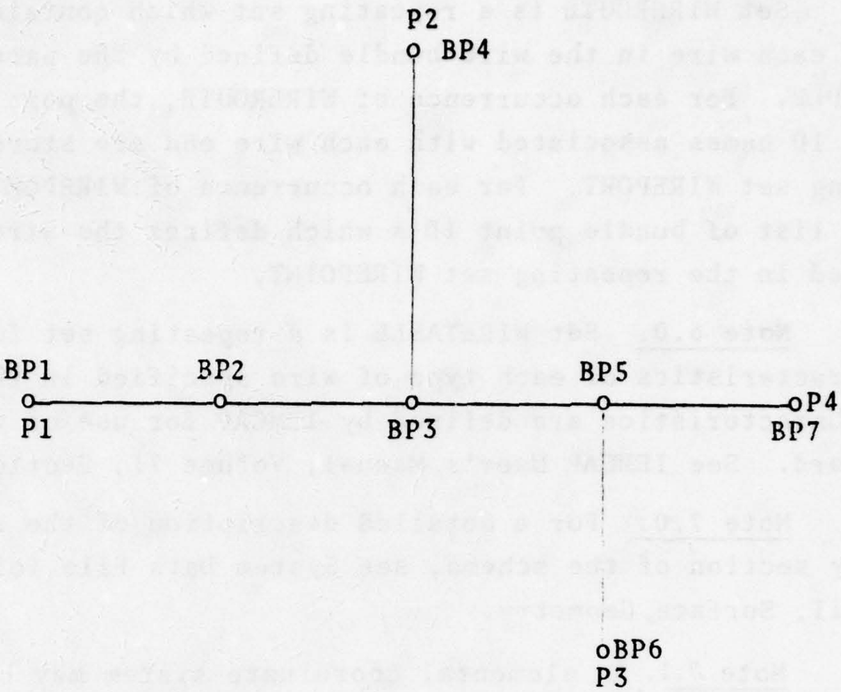
Physical Connection SDF Representation

Set BUNDLEPOINT is a repeating set containing the coordinates of the location of each bundle point on a given wire bundle. The order of the points on the SDF is not important.

Note 5.6. The WIREROUTE branch under WIREBUNDLE defines the routing of each wire in a bundle. The technique used for wire routing is described below. This method is designed to define a wire having more than two ends.

Each end of a wire must be identified by a) a bundle point and b) a port ID or antenna ID. The wire route is defined by ordered lists of bundle points, each list beginning with the point at a wire end, continuing inward along the wire, and stopping arbitrarily at a point. One list of bundle points is made for each wire end. The last point in each list must be common with a point in at least one other list. Each of the lists is defined by the port ID or antenna ID associated with the corresponding wire end.

Example:



PORT	BUNDLE POINTS
P1	BP1, BP2, BP3, BP5
P2	BP4, BP3
P3	BP6, BP5
P4	BP7, BP5

The lists are not unique. The above example could also be described as:

P1	BP1
P2	BP4, BP3, BP2, BP1
P3	BP6, BP5, BP3
P4	BP7, BP5

This method gives directly all the port ID's (and antenna ID's) on a given wire. It also permits tracing of the routing between any two ports. The order of the bundle points indicates connectivity between wire segments.

Set WIREROUTE is a repeating set which contains the ID name of each wire in the wire bundle defined by the parent set WIREBUNDLE. For each occurrence of WIREROUTE, the port ID and antenna ID names associated with each wire end are stored in the repeating set WIREPORT. For each occurrence of WIREPORT the ordered list of bundle point ID's which defines the wire routing is stored in the repeating set WIREPOINT.

Note 6.0. Set WIRETABLE is a repeating set for storing the characteristics of each type of wire specified in the system. These characteristics are defined by IEMCAP for use on the WRTBL input card. See IEMCAP User's Manual, Volume II, Section 2.3.4.4.

Note 7.0. For a detailed description of the surface geometry section of the schema, see System Data File for IAP, Volume II, Surface Geometry.

Note 7.1. An elemental coordinate system may be defined at any location and orientation relative to a global rectangular coordinate system. A total of 12 parameters is required to define the elemental coordinate system and consists of 3 parameters for translation, 6 for rotations, and 3 for axis redirections.

A right-handed global coordinate system must be defined to serve as an absolute reference, directly or indirectly, for all geometric coordinates specified in the system. The global system must be a right-handed, orthogonal set of axes which may be arbitrarily positioned relative to the geometric system.

Associated with each element defined in the geometric system must be an elemental coordinate system to which all geometric coordinates specified for the element are directly referenced. Each elemental coordinate system must be an orthogonal set of axes which may be right- or left-handed and arbitrarily positioned at any location and orientation relative to its associated geometric element.

Each elemental coordinate system is defined with reference to the global coordinate system in accordance with the following steps. These steps must be followed in the order given.

Step 1. Specify the location of the origin of the elemental system in terms of x, y, z coordinates of the global system. This represents a translation of the global origin to the position of the elemental origin. (Parameters 1, 2, 3)

Step 2A. Specify one of the three axes of the translated global system to be the axis for the first rotation. The rotation angle is defined to be positive if the rotation is clockwise when viewed from a positive point on the rotation axis looking toward the origin. (Parameters 4, 5)

Step 2B. Specify one of the remaining two axes of the rotated coordinate system (after first rotation) to be the axis for the second rotation. The positive sense of rotation is as defined in Step 2A. (Parameters 6, 7)

Step 2C. Specify the remaining axis of the rotated coordinate system (after second rotation) to be the axis for the third rotation. The positive sense of rotation is as defined in Step 2A. (Parameters 8, 9)

Step 3. Where appropriate, specify the redirection of each axis parallel to the x-, y-, or z-axes. Six directions are available, and both right-hand and left-hand coordinate systems are permitted. (Parameters 10, 11, 12)

The direction of each axis is specified by the code:

1 = Directed to +X.
-1 = Directed to -X.
2 = Directed to +Y.
-2 = Directed to -Y.
3 = Directed to +Z.
-3 = Directed to -Z.

The reference coordinate directions are established by the right-hand set which was transformed from the global set to the present point of elemental origin, following Step 2C.

Note: The code numbers 1, 2, 3 specified for the directions of the x, y, z axes, respectively, signify no change or redirection of the axes.

Axis redirection is a technique which offers the user a convenient means of rearranging the x-, y-, and z-coordinates on a given set of three-dimensional axes. Although the redirection of a right-hand system to another right-hand system can be specified (in steps 2A, 2B and 2C) by rotation angles involving appropriate multiples of 90 degrees, it may be difficult to visualize a correct rotation sequence for some arrangements. Hence, axis redirection eliminates the risk of error for these cases. Also, axis redirection provides the means for specifying a left-handed coordinate system.

If the element is not symmetrical, SYMAX = 0. With a symmetrical element for which symmetry techniques are to be applied to the data, it is essential that the origin of the elemental coordinate system lie on the plane of symmetry and that one axis be perpendicular to the plane. In this case SYMAX = 1, 2 or 3 to indicate the perpendicular axis.

If the element is to be derived by translation or reflection from another element whose surface is explicitly defined, the ID name of the source element is entered for ELIDS. Otherwise, ELIDS = 0 or ELID.

If the element is to be derived by translation of a source element, CONEG = 0. If the element is to be derived by reflection of a source element, CONEG = 1, 2 or 3 to indicate the axis for which the source data coordinates require negating.

<u>Note 7.2</u>. Subelements may be defined with any type of element. A subelement surface must be defined using point definition as described for Type 1.

If the surface shape of a subelement is not symmetrical, or is symmetrical but does not lie on a symmetrical element, then SYMSUB = 0. However, if a subelement is symmetrical and lies on a symmetrical element, and both lie on a common plane of symmetry, the subelement may be declared symmetrical by setting SYMSUB = 1.

If the surface definition of a subelement is derived by translation or reflection from another subelement which is explicitly defined, the ID name for the source subelement is entered as SUBIDS. Otherwise, SUBIDS = 0 or SUBID.

A subelement may be derived from a source subelement only if the derived subelement lies on an element whose definition is derived from the element containing the source subelement. The type of data transfer (i.e., translation or reflection) between the subelements must be the same as that specified for the respective elements. The reflection of subelement data includes the case where both subelements lie on the same element, provided that the element is symmetrical with the plane of symmetry coincident with the plane of reflection for the two subselements.

Note 7.3. The SURFSECTION branch of the SDF schema is for data which define the connectivities between surface points and, also, define the common boundaries of intersecting elements.

The surface of an element is divided into sections and subsections. The primary purpose for applying the concept of surface sections is to facilitate the organization of connectivity data in the SDF. The definition of a section depends upon the type of surface representation. For Type 1 and Type 2 surfaces, a section is the surface between two adjacent contours. For a Type 3 surface, each plane face is a section. For a Type 4 surface or frame structure, a section consists of all connecting segments or frame members of the element having the same effective radius. The concept of a surface section does not apply to a Type 5 surface.

A subsection is the surface area between two adjacent subcontours on a subelement, which may exist on any type of surface representation.

Contours (or subcontours) which bound a section (or a subsection) are specified in attributes NOCON1 and NOCON2. In general, each segment belonging to a section or subsection is defined in the repeating set SURFSEGMENT. However, for a Type 1 surface (or a subelement) the segments along a contour (or subcontour) generally do not require definition, since the connectivity of adjacent contour points as listed under set SURFCONTOUR is implied. Only the intercontour segments of these surfaces require explicit definition by set SURFSEGMENT. Attributes NOPT1 and NOPT2 define the end points of a segment; it is this specification which explicitly defines connectivity between surface definition points.

If a segment is common with another element, the data identifying that segment relative to the surface definition of the intersecting element are defined in set COMMONSEG. Note that all intercontour segments in the source data must be specified in the file for purposes of defining connectivity, whether or not they are common with an intersecting element. Intracontour segments in the source data do not require explicit definition of connectivity unless they are common to an intersecting element.

If an intracontour segment (i.e., lying on a contour of a Type 1 surface) is also common with an intersecting element, it is necessary to define this segment in sets SURFSECTION and SURFSEGMENT in order that the intersection data may be entered in set COMMONSEG. Such a segment may be defined with the following special considerations. The section number NOSEC is specified as zero. Since the end points of the segment lie on the same contour, NOCON1 and NOCON2 are both specified with the same contour number. The segment number NOSEG is the count number of the segment along the contour as defined in branch SURFCONTOUR. For example, if the Nth (intracontour) segment of a contour connects the Nth and (N+1)th contour points, NOSEG = NOPT1, and NOPT2 = NOPT1 + 1.

Another situation which requires special consideration of data entry into the SDF involves specifying a common segment lying within the derived half of a symmetrical element. The segment is not defined within the source data of the file, but since the element is declared to be symmetrical (SYMAX≠0), the segment is a reflected image of a source segment. All connectivities specified with the source data are transferred by reflection to the derived data. However, intersection data specified with the source data cannot be transferred by reflection within a symmetrical element, since the source and derived surfaces will generally intersect different elements. In fact, the derived surface may not intersect any element.

When it is necessary to specify a segment of the derived surface of a symmetrical element, negative values of the corresponding section or subsection number (NOSEC), contour or subcontour numbers (NOCON1, NOCON2), segment number (NOSEG) and point numbers (NOPT1, NOPT2) of the image data must be entered in the data file. The negative sign flags the data to indicate that they are surface components derived by reflection.

Consider, for example, that a system data file for an aircraft contains source data defining the right half of a symmetrical fuselage. The segments on the right side of the fuselage which are common with the right wing are defined under SURFSECTION using positive-valued numbers for NOSEC, NOCON1, NOCON2, NOSEG, NOPT1 and NOPT2. For the left side of the fuselage, since all surface definition is derived implicitly by reflection of the source data, no data entries under SURFSECTION are required, except for any segments common to intersecting elements. In this case, the segments which are common with the left wing are defined under SURFSECTION using negative-valued numbers NOSEC, NOCON1, NOCON2, NOSEG, NOPT1 and NOPT2. Note that the data entries for NOSECM, CONCOM and NOSEGM under set COMMONSEG must contain appropriate positive or negative numbers for the common segments as they are defined relative to the surface representation of the intersecting element.

Note 7.4. Every zone in a system must be assigned a unique ID name (ZID). The shape and location of each zone must be defined either by a fixed or local method of representation. The fixed method, which may be applied to any zone, requires that the zone boundary be defined directly in elemental coordinates. The local method must be applied only to zones that are flat or nearly flat, i.e., the maximum zone dimension is relatively small compared to the radius of curvature of the zone surface. Where there is multiplicity of one zone shape in a system, the use of the local representation simplifies the total representation by requiring the shape to be defined for only one of the zones, which serves as a source zone (ZIDS) for the remaining zones having the same shape. It is not required that a zone (ZID) and its source zone (ZIDS) lie on the same element.

If a fixed zone is not symmetrical, or is symmetrical but does not lie on a symmetrical element, then SYMZON = 0. However, if a fixed zone is symmetrical and lies on a symmetrical element, and both have a common plane of symmetry, the zone may be declared symmetrical by setting SYMZON = 1. Then only half of the zone needs to be described explicitly.

For any local zone definition, SYMZON = 0.

If a fixed zone is derived by translation or reflection from another fixed zone which is explicitly defined, the ID name of the source zone is entered as *ZIDS*. *Otherwise*, ZIDS = 0 or ZID.

The transfer of source fixed zone data is valid only if the derived zone lies on an element whose definition is derived (in whole or in part) from the element containing the source zone. The type of data transfer (i.e., translation or reflection) between the zones must be the same as that specified for the respective elements. The reflection of fixed zone data includes the case where both zones lie on the same element, provided that the element is symmetrical with the plane of symmetry coincident with the plane of reflection for the two zones.

If a zone is defined by the local method, a two-dimensional (X-Y) rectangular coordinate system must be established to define the shape of the zone. The origin of the local coordinates should be established at the geometrical center of the zone shape. The coordinate system must be oriented so that one of the axes can serve as the local reference axis (REFAXZ) for each of the zones referencing the defined shape. With the local coordinate system applied to each zone in place on the surface of the element, the REFAXZ must, in every case, be perpendicular to one of the axes (COREFZ) of the elemental coordinate system.

To illustrate this, Figure 2a shows a section of a fuselage element containing five identical windows. The shape of each window is described by local coordinates as illustrated in Figure 2b. The origin of the local coordinates is defined at the center of each window. The local coordinates are shown applied to the first window. The plane of the local coordinate system is tangent to the element surface at the origin. Since the x-axis lies in a horizontal plane at every window location, this axis is designated as the local reference axis, and REFAXZ=1. Paired with the REFAXZ is the COREFZ to which REFAXZ is perpendicular. In this example, the y-axis (vertical axis) of the elemental coordinate system is designated as COREFZ.

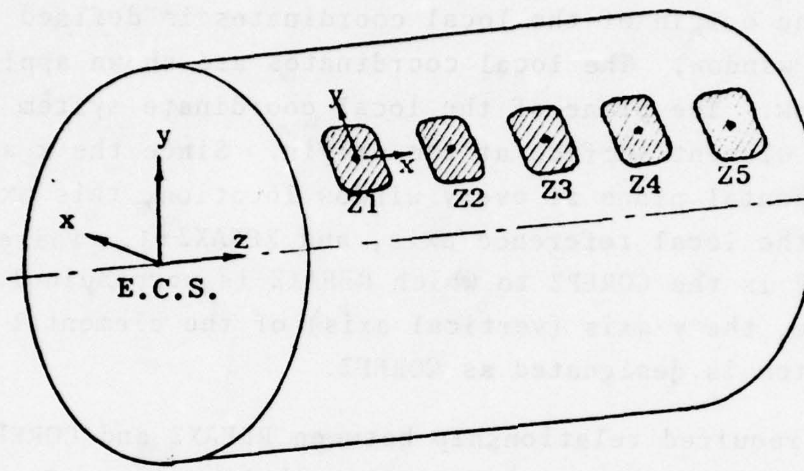
The required relationship between REFAXZ and COREFZ can, in general, be maintained at essentially all locations of a given (local) zone on an element, provided the zone is installed with one edge of the defined shape always to the top, as is normally the case for aircraft windows. Where the zone cannot meet the local reference conditions the zone must be defined by the fixed method.

While the REFAXZ/COREFZ reference axes ensure that the zone is applied horizontally, it is further necessary to specify a relative upward direction or top of the zone to ensure that the zone is not applied upside down. In the example of Figure 2 the y-axis of the local coordinates has an upward component, thus, VERAXZ = 2.

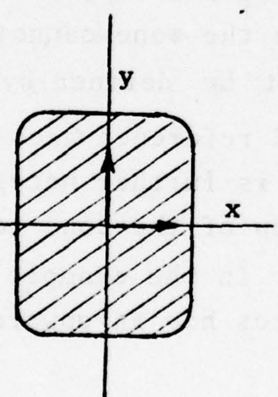
The purpose of the reference axes is to permit unambiguous orientation of the defined zone shape at each specified location on the surface of an element.

For a fixed zone, the three reference axes REFAXZ, COREFZ and VERAXZ do not apply and must be entered with zeros.

The location of a local zone is specified by the elemental coordinates (XLOCZ, YLOCZ, ZLOCZ) of the origin of the local coor-



a) Local coordinate system positioned on element surface.



For this example:

REFAXZ = 1
COREFZ = 2
VERAXZ = 2

b) Zone shape defined by local coordinates.

Figure 2. Example of local zone definition on an element.

dinate system for the zone on the element. The shape of a local zone is defined by the coordinates (XZONE, YZONE) of points defining its boundary (Type 1) or its centerline if a slit (Types 3 or 4).

Multiple zones having a circular shape (Type 2) are most easily described with the fixed method with ZONTYP = 2. The center of each zone is defined by elemental coordinates (XLOCZ, YLOCZ, ZLOCZ), and the radius is specified as RADZON. Note that the local method does not apply to a Type 2 (circular) zone.

Tables 4 and 5 provide a summary of the optional values permitted for some of the attributes of the surface geometry schema. In these tables, where an attribute is not applicable, a zero value is shown (without optional values); however, if all attributes in a set are non-applicable, dashes are entered to indicate that the set is empty.

TABLE 4. OPTIONS OF VALUES PERMITTED UNDER SET GEOMELEMENT FOR VARIOUS TYPES OF GEOMETRIC SURFACE DEFINITION.

		TYPE 1 General point definition using parallel plane contours.	TYPE 2 Circular contours in parallel planes.	TYPE 3 Plane-faced surfaces.	TYPE 4 Frame structure.	TYPE 5 Sphere / Hemisphere
GEOMELEMENT	ELID	$ELID_i$	$ELID_i$	$ELID_i$	$ELID_i$	$ELID_i$
	SYMAX	0,1,2,3	0,1,2,3	0,1,2,3	0,1,2,3	0
	ELIDS	$0,ELID_i,ELID_j$	$0,ELID_i,ELID_j$	$0,ELID_i,ELID_j$	$0,ELID_i,ELID_j$	$0,ELID_i,ELID_j$
	CONEG	0,1,2,3	0,1,2,3	0,1,2,3	0,1,2,3	0
	CONTYP	1	2	3	4	5
	COSTAT	1,2,3	1,2,3	0	0	0
SURFCONTOUR	NOCON	$1,2,3,\ldots,C_i,\ldots$	$1,2,3,\ldots,C_i,\ldots$	0	0	0
	ICLOSE	0,1	0	0	0	1 / 0
	CONCRV	0,1,2	0	0	0	0 / ±1,±2,±3
	CONRAD	0	RADIUS	0	0	RADIUS
CONTOURPOINT	XPT	x } P_i	x(CEN)	x } P_i	x } P_i	x(CEN)
	YPT	y } P_i	y(CEN)	y } P_i	y } P_i	y(CEN)
	ZPT	z } P_i	z(CEN)	z } P_i	z } P_i	z(CEN)
CONTOURFLAT	NFLAT	$-,SG_i$	-	-	-	-
SUBELEMENT	SUBID	$SUBID_i$	$SUBID_i$	$SUBID_i$	$SUBID_i$	$SUBID_i$
	SYMSUB	0,1	0,1	0,1	0,1	0,1
	SUBIDS	$0,SUBID_i,SUBID_j$	$0,SUBID_i,SUBID_j$	$0,SUBID_i,SUBID_j$	$0,SUBID_i,SUBID_j$	$0,SUBID_i,SUBID_j$
SUBCONTOUR	SUBCON	$1,2,3,\ldots,SC_i,\ldots$	$1,2,3,\ldots,SC_i,\ldots$	$1,2,3,\ldots,SC_i,\ldots$	$1,2,3,\ldots,SC_i,\ldots$	$1,2,3,\ldots,SC_i,\ldots$
	SUBCRV	0,1,2	0,1,2	0,1,2	0,1,2	0,1,2
SUBCONPOINT	XPTSUB	x } P_i	x } P_i	x } P_i	x } P_i	x } P_i
	YPTSUB	y } P_i	y } P_i	y } P_i	y } P_i	y } P_i
	ZPTSUB	z } P_i	z } P_i	z } P_i	z } P_i	z } P_i
SUBCONFLAT	SNFLAT	$-,SG_i$	$-,SG_i$	$-,SG_i$	$-,SG_i$	$-,SG_i$

TABLE 4. (CONTINUED)

		TYPE 1 General point definition using parallel plane contours.	TYPE 2 Circular contours in parallel planes.	TYPE 3 Plane-faced surfaces.	TYPE 4 Frame structure.	TYPE 5 Sphere | Hemisphere
SURFSECTION	NOSEC	$(\pm)1,2,3,\ldots,S_i,\ldots,0$	$(\pm)1,2,3,\ldots,S_i,\ldots$	$(\pm)1,2,3,\ldots,S_i,\ldots$	$(\pm)1,2,3,\ldots,S_i,\ldots$	$1,2,3,\ldots,S_i^*,\ldots,-$
	NOCON1	$(\pm)C_i,SC_i$	$(\pm)C_i,SC_i$	$(\pm)SUBID_i^*,0$	$(\pm)SUBID_i^*,0$	$SUBID_i^*,-$
	NOCON2	$(\pm)C_j,SC_j$	$(\pm)C_j,SC_j$	$(\pm)SUBID_j^*,0$	$(\pm)SUBID_j^*,0$	$SUBID_j^*,-$
	SECURV	0,1	0,1	0	0	0,-
	RADMEM	0	0	0	RADIUS	0,-
SURFSEGMENT	NOSEG	$(\pm)1,2,3,\ldots,SG_i,\ldots$	$(\pm)1,2,3,\ldots SG_i^*,\ldots,-$	$(\pm)1,2,3,\ldots,SG_i,\ldots$	$(\pm)1,2,3,\ldots,SG_i,\ldots$	$1,2,3,\ldots,SG_i^*,\ldots,-$
	NOPT1	$(\pm)P_i$	$(\pm)P_i^*,-$	$(\pm)P_i$	$(\pm)P_i$	$P_i^*,-$
	NOPT2	$(\pm)P_j$	$(\pm)P_j^*,-$	$(\pm)P_j$	$(\pm)P_j$	$P_j^*,-$
COMMONSEG	ELIDCM	$ELID_i,-$	$ELID_i,-$	$ELID_i,-$	$ELID_i,-$	$ELID_i,-$
	NOSECM	$0,(\pm)S_i,-$	$0,(\pm)S_i,-$	$0,(\pm)S_i,-$	$0,(\pm)S_i,-$	$0,(\pm)S_i,-$
	CONCOM	$(\pm)C_i,0,-$	$(\pm)C_i,0,-$	$(\pm)C_i,0,-$	$(\pm)C_i,0,-$	$(\pm)C_i,0,-$
	NOSEGM	$(\pm)SG_i,0,-$	$(\pm)SG_i,0,-$	$(\pm)SG_i,0,-$	$(\pm)SG_i,0,-$	$(\pm)SG_i,0,-$

*Applies to subelement only.

Table 5. Options of values permitted under SURFZONE for various types of zone definitions.

		TYPE 1 General point definition around boundary.		TYPE 2 Circular	TYPE 3 OR 4* Slit defined by points along centerline.	
SET	ATTRIB.	FIXED	LOCAL	FIXED	FIXED	LOCAL
SURFZONE (164)	SYMZON	0,1	0	0,1	0,1	0
	REFAXZ	0	1,2	0	0	1,2
	COREFZ	0	1,2,3	0	0	1,2,3
	VERAXZ	0	1,2	0	0	1,2
	ZONTYP	1	1	2	3,4	3,4
	XLOCZ	0	X(CEN)	X(CEN)	0	X(CEN)
	YLOCZ	0	Y(CEN)	Y(CEN)	0	Y(CEN)
	ZLOCZ	0	Z(CEN)	Z(CEN)	0	Z(CEN)
	RADZON	0	0	RADIUS	WIDTH	WIDTH
ZONESHAPE (1641)	XZONE	X	X	--	X	X
	YZONE	Y	Y	--	Y	Y
	ZZONE	Z	0	--	Z	0

*Type 3 = closed contour, Type 4 = open contour.

6.0 DATA CONSISTENCY OF ID NAME POINTERS

The System Data File contains numerous attributes whose values reference the same values which must be entered in other locations of the file. The majority of these referencing values are ID names which serve as pointers for linking two different logical records in the file. It is essential that there is consistency - i.e., identical values for synonymous attributes - of these pointers in the file data, since many of the computer programs (e.g., translators) which will be using this file will expect to find the referenced ID names within the repeating sets that should contain them.

Lack of pointer consistency does not necessarily imply incorrect or false data, but may indicate incomplete data. Table 6 summarizes the ID name pointers in the SDF. During the building of a file, the consistency of these pointers should be checked to help ensure that the file contains a complete or closed set of data.

Table 6 lists pointer pairs which are organized by the type of ID name. Each pointer is identified by its attribute name and its corresponding set name (in parentheses). The symbols shown for the pointer pairs have the following meanings:

- = Each value of the attribute on the left must also have an equal value of the attribute on the right, and vice versa.
- < Each value of the attribute on the left must also have an equal value of the attribute on the right. That is, the set of all values for the left attribute is a proper subset of all values for the right attribute.

Table 6 also notes various pairs of logically related ID names which must have equal values at two separate locations in the file.

Table 6. DATA CONSISTENCY OF ID NAME POINTERS

ID NAME TYPE	ATTRIBUTE NAME (SET NAME)		ATTRIBUTE NAME (SET NAME)
Element	ELDID (IDEFELEMENT)	=	ELID (GEOMELEMENT)
	ELIDBX (EQUIPMENT)	<	ELID (GEOMELEMENT)
	ELIDAL (ANTENNA)	<	ELID (GEOMELEMENT)
	ELIDAN (ANTELEMENT)	<	ELID (GEOMELEMENT)
	ELIDBP (BUNDLEPOINT)	<	ELID (GEOMELEMENT)
	ELIDS (GEOMELEMENT)	<	ELID (GEOMELEMENT)
Subelement	SUBDID(IDEFSUBELEM)	=	SUBID (SUBELEMENT)
	SUBIDS(SUBELEMENT)	<	SUBID (SUBELEMENT)
Note:	The values of ELID and SUBID in a logical record must equal the respective values of ELDID and SUBDID in a logical record.		
Zone	ZIDID (IDEFZONE)	=	ZID (SURFZONE)
	ZIDS (SURFZONE)	<	ZID (SURFZONE)
	ZIDSG (ZONEXPOSED)	<	ZID (SURFZONE)
Compartment	CIDBOX (EQUIPMENT)	<	COMDID (IDEFCOMPART)
	CIDSEG (BUNDLESEG)	<	COMDID (IDEFCOMPART)
Subsystem	SSIDID (IDEFSUBSYS)	=	SSID (SUBSYSTEM)
Equipment	EIDID (IDEFEQUIP)	=	EID (EQUIPMENT)
Note:	The values of SSID and EID in a logical record must equal the respective values of SSIDID and EIDID in a logical record.		
Port	PIDID (IDEFPORT)	=	PID (PORT)
	PAID* (WIREPORT)	=	PID (PORT)
	* Only if PACON=0.		
Note:	The values of EID and PID in a logical record must equal the respective values of EIDID and PIDID in a logical record.		
Antenna	AIDID (IDEFANTENNA)	=	AID (ANTENNA)
	PAID* (WIREPORT)	=	AID (ANTENNA)
	* Only if PACON=1.		
Note:	The values of PID and AID in a logical record must equal the respective values of PIDID and AIDID in a logical record.		
Antenna Type	AIDTYP (IDEFANTENNA)	=	ANTYP (ANTENNA)
Note:	The values of AID and ANTYP in a logical record must equal the respective values of AIDID and AIDTYP in a logical record.		
Bundle	BIDPR (PORT)	=	BID (WIREBUNDLE)

Table 6.(Continued) DATA CONSISTENCY OF ID NAME POINTERS

ID NAME TYPE	ATTRIBUTE NAME (SET NAME)		ATTRIBUTE NAME (SET NAME)
Wire	WIDPR (PORT)	=	WID (WIREROUTE)
	WIDSG (WIRESEGMENT)	=	WID (WIREROUTE)
Note:	The values of PAID and WID in a logical record must equal the respective values of PID and WIDPR in a logical record.		
Note:	The values of BID and WID in a logical record must equal the respective values of BIDPR and WIDPR in a logical record.		
Bundle Point	PTIDPR (PORT)	<	PTID (BUNDLEPOINT)
	PTIDSG (SEGMENTPOINT)	=	PTID (BUNDLEPOINT)
	PTIDW (WIREPOINT)	=	PTID (BUNDLEPOINT)
Note:	The values of PID and PTIDPR in a logical record must equal the respective values of PAID and the first occurrence of PTIDW in a logical record.		
Wire Type	WTID (IDEFWIRETYPE)	=	WTDID (WIRETABLE)
	WTDIDW (WIREROUTE)	=	WTDID (WIRETABLE)

7.0 RELATED DOCUMENTS

The reports listed below provide additional information relating to the development and application of the System Data File.

1. System Data File (SDF) for the Intrasystem Analysis Program (IAP), Volume II, Surface Geometry, Atlantic Research Corp., RADC Contract F30602-77-C-0126, December 1979.

2. User Manual for the IEMCAP Translator. Atlantic Research Corp., RADC Contract F30602-77-C-0126, March 1979.

3. User Manual for the System File Handler. Atlantic Research Corp., RADC Contract F30602-77-C-0106, June 1979.

4. Intrasystem Electromagnetic Compatibility Analysis Program, Vols. I and II, McDonnell Aircraft Corp., RADC-TR-74-342, RADC Contract F30602-72-C-0277, December 1974, AD A008526 and AD A008527.

Note: Vol. I: User's Manual Engineering Section.
Vol. II:User's Manual Usage Section.

8.0 BUILDING A SYSTEM DATA FILE

The building of a SDF involves loading the attribute values according to a logical, sequential order into the SFH. The precise ordering of the attribute values, and the character type and field size of each value must conform to those specified by the schema and the corresponding Input Data Format Table (IDFT) for the SDF. The SFH already contains within its files the schema and IDFT for the SDF. The IDFT defines explicitly how the attribute values must be entered on each input data card to the SFH. The complete loading procedure is described in the User Manual for the SFH.

It should be emphasized that a great deal of care must be given to data preparation prior to loading the data onto the file. The usefulness of a SDF depends not only on data accuracy but also on the completeness and correct organization of all data within the hierarchical structure of the file.

A suggested ordering of the tasks required for data preparation during the building of a SDF is given in Table 7.

Data collection requires a thorough understanding of the definitions of all attributes of the file. For the surface geometry data it is imperative that the surface definition be accomplished properly so as to meet specific accuracy requirements. A detailed description of the surface geometry methodology is given in System Data File for IAP, Volume II, Surface Geometry. Since the electrical data are primarily patterned after the organization and definitions of the input parameters used in the IEMCAP program, it is advisable that personnel building the file be knowledgeable of the IEMCAP input data requirements. These requirements are described in the IEMCAP User's Manual, Vol. II. In particular, all ID names stored in the file must not exceed 5 characters, must consist only of alphanumeric characters, and must begin with an alpha character.

TABLE 7. DEVELOPMENT OF THE SYSTEM DATA FILE

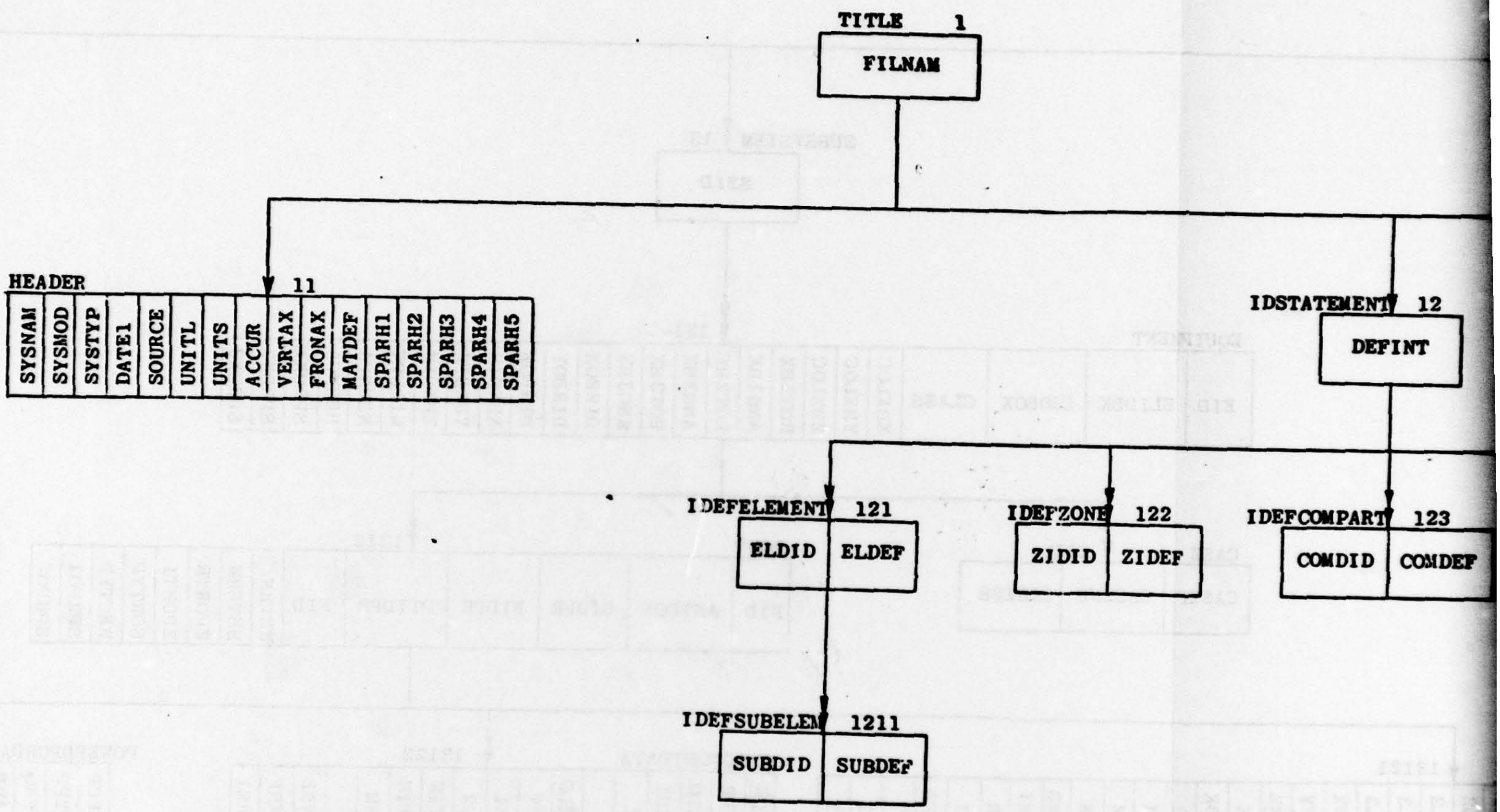
1. Define boundaries of physical system.
2. Define file header data (sets TITLE and HEADER).
3. Define geometry.
    a. Global coordinate system.
    b. Geometric surface elements (set GEOMELEMENT).
    c. Elemental coordinate systems (set GEOMELEMENT).
    d. Types of surface representation.
    e. Subelements (set SUBELEMENT).
    f. Contours, subcontours (sets SURFCONTOUR, SUBCONTOUR, SURFSECTION, and all subsumed sets).
    g. Surface zones (apertures), (set SURFZONE and all subsumed sets).
4. Define electrical data.
    a. Subsystems (set SUBSYSTEM).
    b. Equipments (sets EQUIPMENT and CASE).
    c. Ports (set PORT and subsumed sets).
    d. Antennas (sets ANTENNA and ANTELEMENT).
    e. Wire bundles (set WIREBUNDLE and all subsumed sets).
    f. Wire characteristic data (set WIRETABLE).
5. Define ID names in file (set IDSTATEMENT and all subsumed sets).
6. Organize all data according to schema hierarchy with multiple set occurrences (Table 1, Appendix A).
7. Check for data consistency (Table 6).
8. Load data using System File Handler according to IDFT (User Manual for the SFH).

Following data collection all data should be organized in accordance with the schema and ordered in the exact manner in which it will be loaded onto the file. The attribute values should first be organized into their respective sets. The attribute values within each set should be ordered as defined by the schema. Next, the sets should be ordered according to the schema with particular attention given to the ordering of repeating sets at various levels of the hierarchy. The logical relationship among data values stored on the SDF depends on the order with which the data are originally loaded onto the file.

Finally, after all the data are correctly organized a thorough check should be made of the completeness and consistency of certain aspects of the data. Some sets contain one or more attributes which indicate the existence and/or type of data of another set. Also, many of the attributes are ID names which serve as pointers to the same names in other sets. It is imperative that all such cross-references are valid and consistent throughout the file (see Section 6.0).

APPENDIX A

SCHEMA FOR SYSTEM DATA FILE



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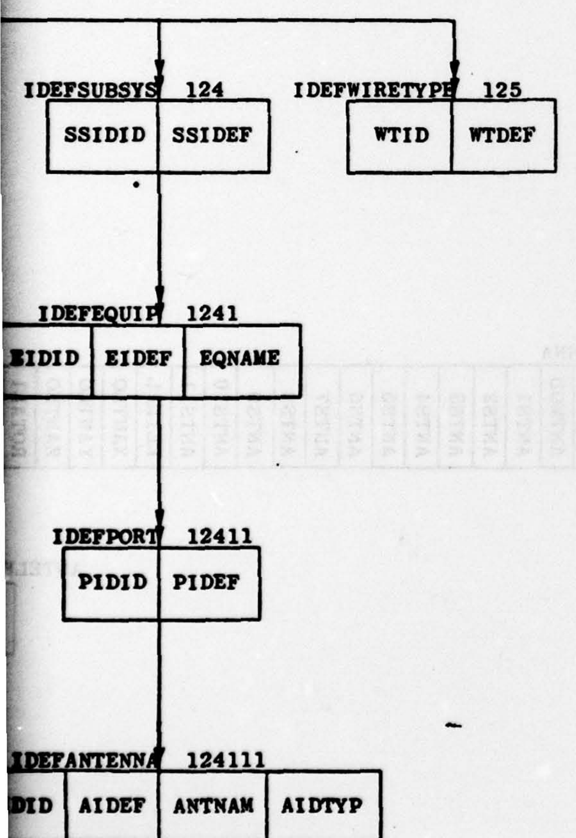
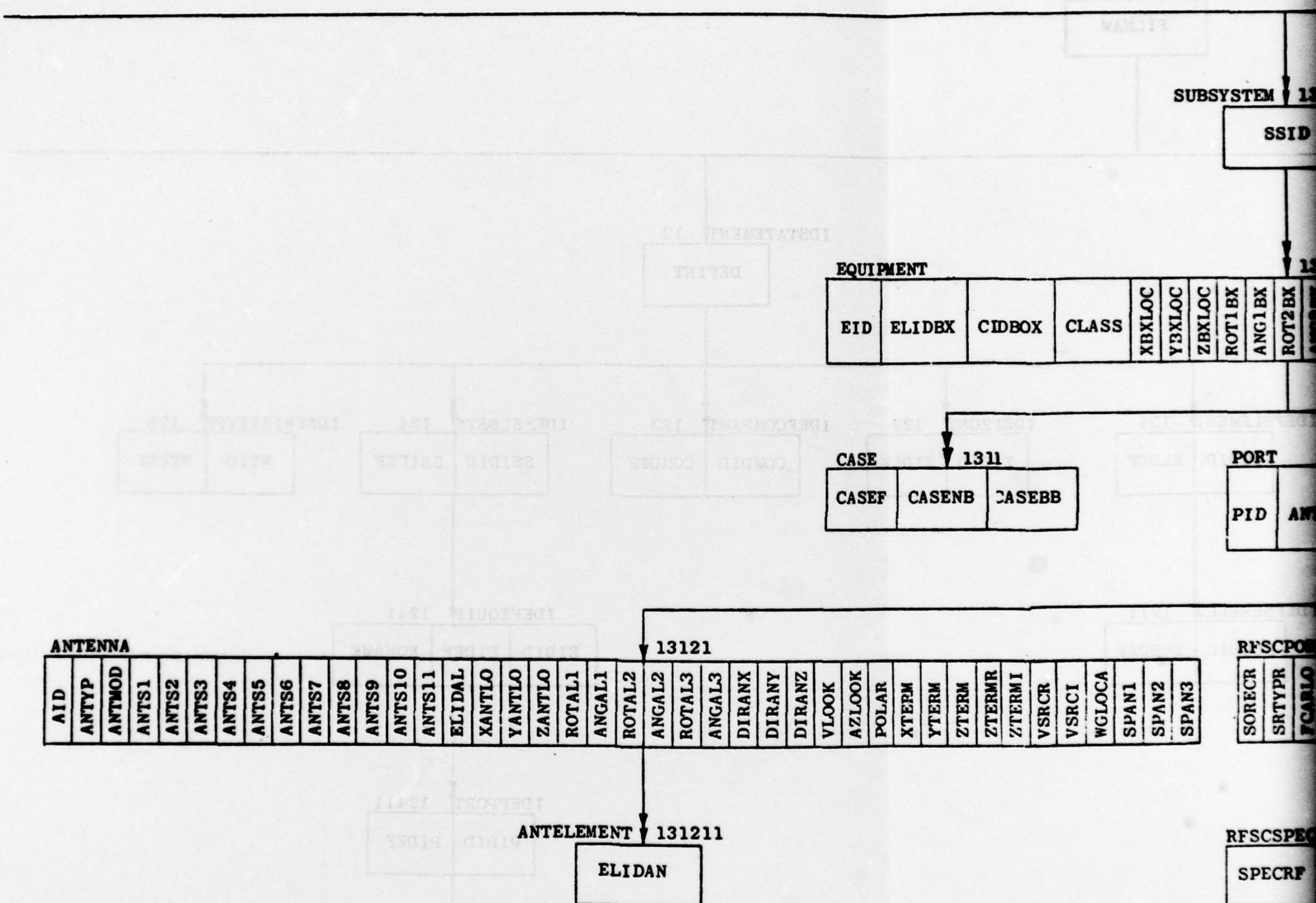
HEADER 11
SYSNAM
SYSMOD
SYSTYP
DATE1
SOURCE
UNITL
UNITS
ACCUR
VERTAX
FRONAX
MATDEF
SPARH1
SPARH2
SPARH3
SPARH4
SPARH5
IDSTATEMENT 12
DEFINT
IDEFELEMENT 121
ELDID
ELDEF
IDEFZONE 122
ZIDID
ZIDEF
IDEFCOMPART 123
COMDID
COMDEF
IDEFSUBELEM 1211
SUBDID
SUBDEF



igure 3. Schema of SDF, Parallel format.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EQUIPMENT
EID
ELIDBX
CIDBOX
CLASS
XBXLOC
YBXLOC
ZBXLOC
ROT1BX
ANG1BX
ROT2BX
CASE
1311
CASEF
CASENB
CASEBB
PORT
PID
ANTENNA
13121
AID
ANTYP
ANTMOD
ANTS1
ANTS2
ANTS3
ANTS4
ANTS5
ANTS6
ANTS7
ANTS8
ANTS9
ANTS10
ANTS11
ELIDAL
XANTLO
YANTLO
ZANTLO
ROTAL1
ANGAL1
ROTAL2
ANGAL2
ROTAL3
ANGAL3
DIRANX
DIRANY
DIRANZ
VLOOK
AZLOOK
POLAR
XTERM
YTERM
ZTERM
ZTERMR
ZTERMI
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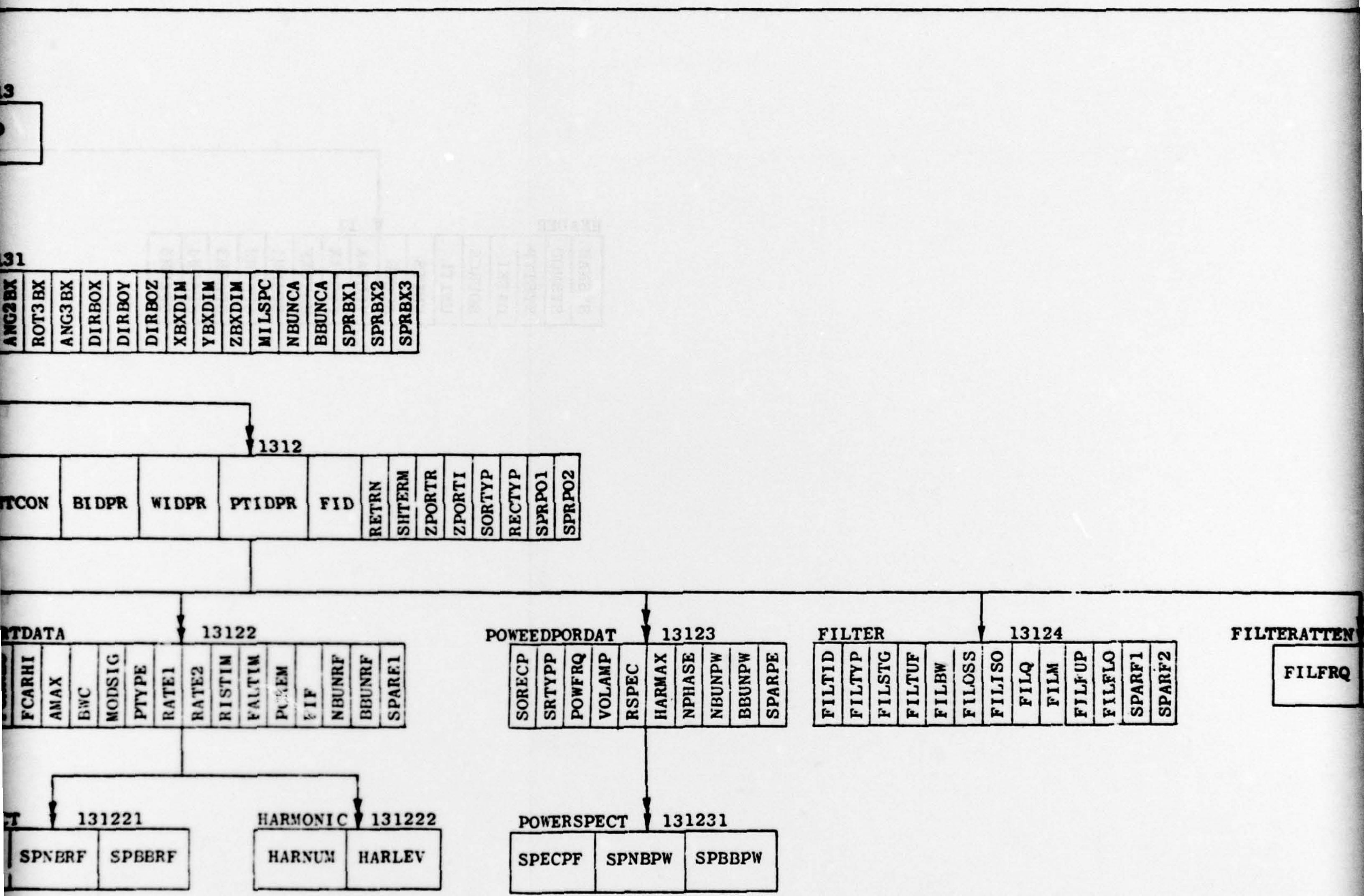
ELIDAN
SPECRF



13
131
ANG2BX
ROT3BX
ANG3BX
DIRBOX
DIRBOY
DIRBOZ
XBXDIM
YBXDIM
ZBXDIM
MILSPC
NBUNCA
BBUNCA
SPRBX1
SPRBX2
SPRBX3
1312
TCON
BIDPR
WIDPR
PTIDPR
FID
RETRN
SHTERM
ZPORTR
ZPORTI
SORTYP
RECTYP
SPRPO1
SPRPO2
TDATA
13122
FCARHI
AMAX
BWC
MODSIG
PTYPE
RATE1
RATE2
RISTIM
FALTIM
NBUNRF
BBUNRF
SPARE1
POWEEDPORDAT
13123
SORECP
SRTYPP
POWFRQ
VOLAMP
RSPEC
HARMAX
NPHASE
NBUNPW
BBUNPW
SPARPE
FILTER
13124
FILTID
FILTYP
FILSTG
FILTUF
FILBW
FILOSS
FILISO
FILQ
FILM
FILFUP
FILFLO
SPARF1
SPARF2
FILTERATTEN
FILFRQ
131221
SPNBRF
SPBBRF
HARMONIC
131222
HARNUM
HARLEV
POWERSPECT
131231
SPECPF
SPNBPW
SPBBPW

Figure 3. (Con

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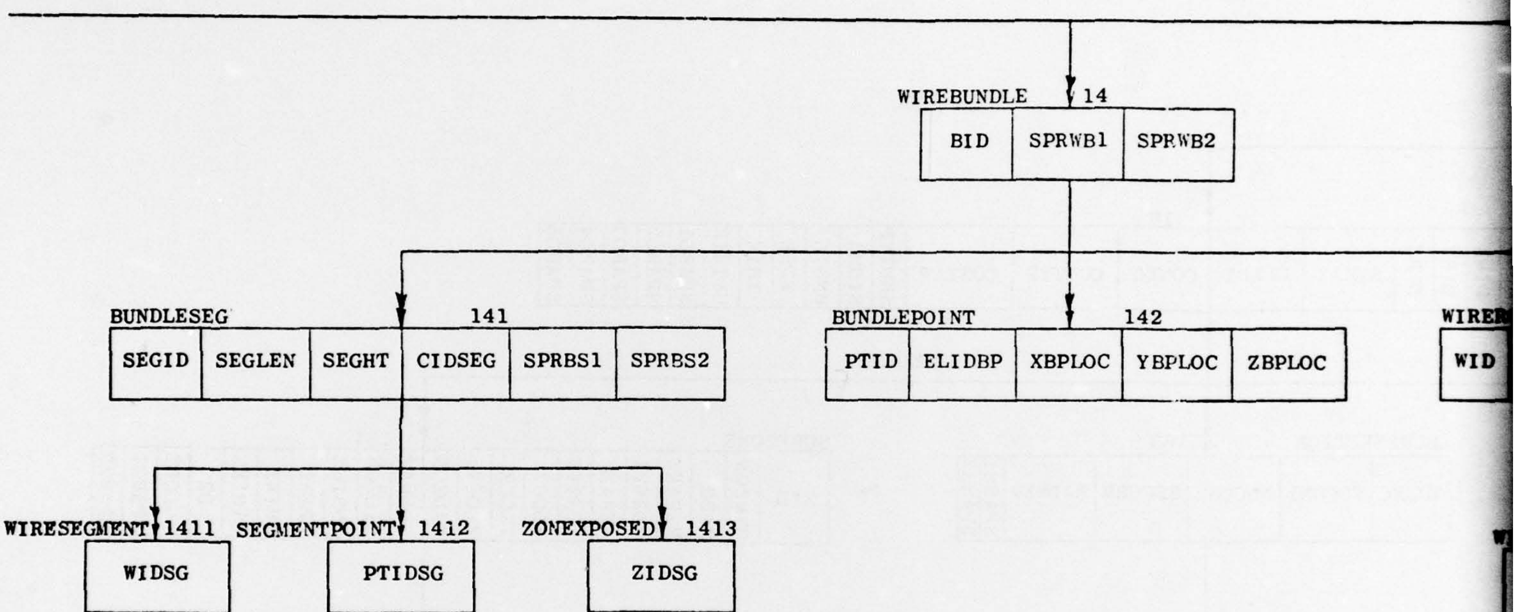

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SPRWB2
BUNDLESEG 141
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SEGLEN
SEGHT
CIDSEG
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SPRBS2
BUNDLEPOINT 142
PTID
ELIDBP
XBPLOC
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ZBPLOC
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WIDSG
SEGMENTPOINT 1412
PTIDSG
ZONEXPOSED 1413
ZIDSG

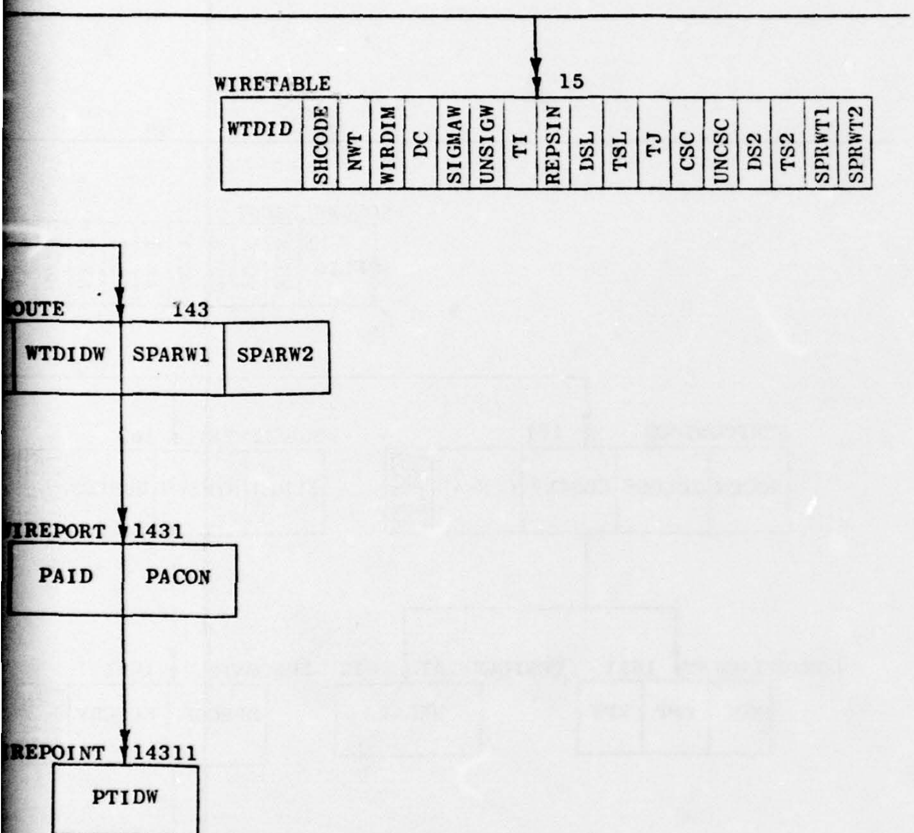
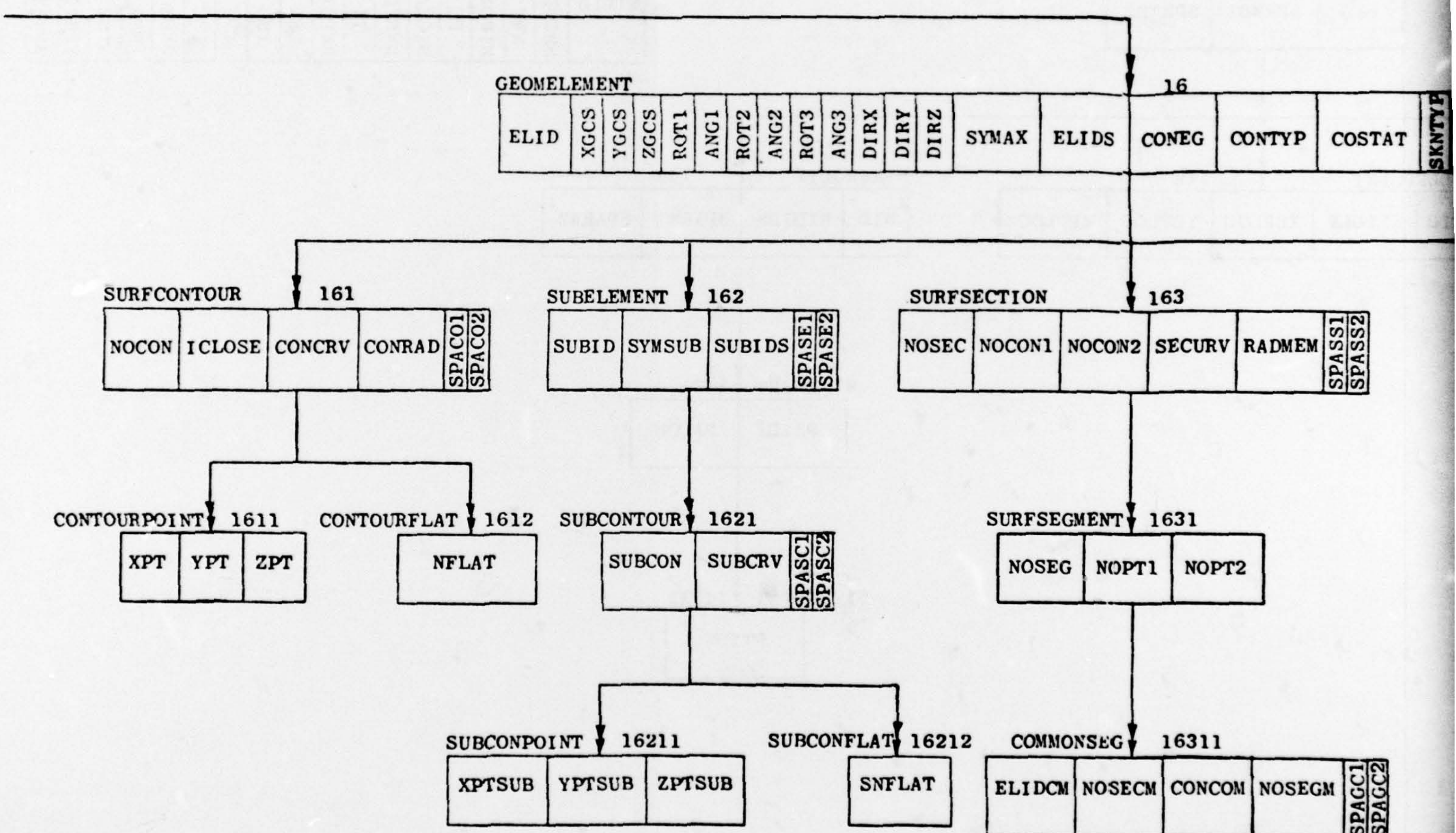


Figure 3. (Continued)



GEOMELEMENT
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YGCS
ZGCS
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ANG1
ROT2
ANG2
ROT3
ANG3
DIRX
DIRY
DIRZ
SYMAX
ELIDS
CONEG
CONTYP
COSTAT
SKNTYP
SURFCONTOUR
161
NOCON
ICLOSE
CONCRV
CONRAD
SPACO1
SPACO2
SUBELEMENT
162
SUBID
SYMSUB
SUBIDS
SPASE1
SPASE2
SURFSECTION
163
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NOCON1
NOCON2
SECURV
RADMEM
SPASS1
SPASS2
CONTOURPOINT
1611
XPT
YPT
ZPT
CONTOURFLAT
1612
NFLAT
SUBCONTOUR
1621
SUBCON
SUBCRV
SPASC1
SPASC2
SURFSEGMENT
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NOPT1
NOPT2
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YPTSUB
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SPAGC1
SPAGC2

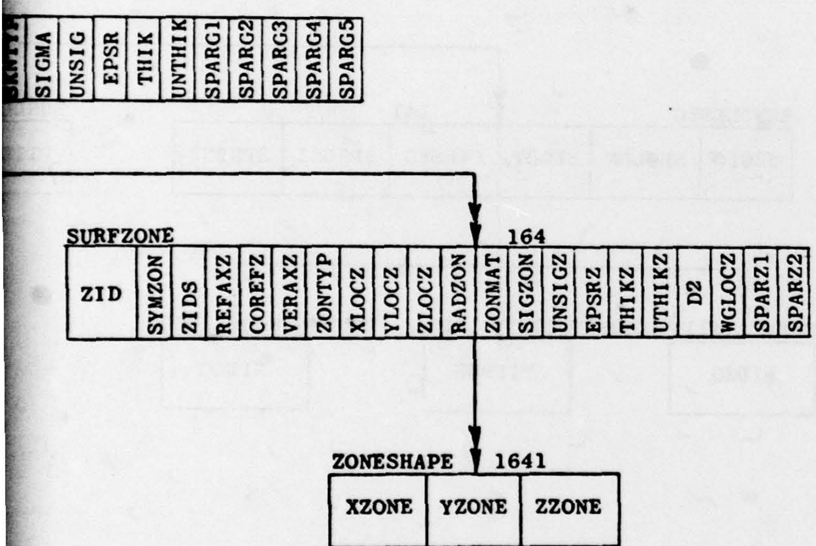

Figure 3. (Continued)

2

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RADC plans and executes research, development, test and selected acquisition programs in support of Command, Control Communications and Intelligence (C^3I) activities. T chnical and engineering support within areas of technical competence is provided to ESD Program Offices (POs) and other ESD elements. The principal technical mission areas are communications, electromagnetic guidance and control, surveillance of ground and aerospace objects, intelligence data collection and handling, information system technology, ionospheric propagation, solid state sciences, microwave physics and electronic reliability, maintainability and compatibility.