Volume 5

OGC CDB Radar Cross Section (RCS) Models (Best Practice)

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i. Abstract

This CDB volume provides all of the information required to store Radar Cross Section (RCS) data within a conformant CDB data store.

Please note that the current CDB standard only provides encoding rules for using Esri ShapeFiles for storing RCS models. However, this Best Practice has been modified to change most of the ShapeFile references to “vector data sets” or “vector attributes” and “Point Shapes” to “Point geometries”. This was done in recognition that future versions of the CDB standard and related Best Practices will provide guidance on using other encodings/formats, such as OGC GML.

ii. Keywords

The following are keywords to be used by search engines and document catalogues.

ogcdoc, OGC document, cdb, radar, radar cross section, models, rcs, shapefile

iii. Preface

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium shall not be held responsible for identifying any or all such patent rights.

Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.

iv. Submitting organizations

The following organizations submitted this Document to the Open Geospatial Consortium (OGC):

Organization name(s)

- CAE Inc.
- Carl Reed, OGC Individual Member
- Envitia, Ltd
- Glen Johnson, OGC Individual Member
- KaDSci, LLC
- Laval University
- Open Site Plan
- University of Calgary
- UK Met Office

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Chapter 1. Scope

This CDB Best Practice (BP) defines a RCS (Radar Cross-Section) model representation for use by Sensor Simulation client-devices such as Radar and/or Sonar. The BP provides a signature model representing the overall relative reflectivity levels of a given Model Representation when viewed at discrete azimuth and elevation angles. The RCS data is then used in range and aspect calculations for the detection and classification of simulated targets (either static or moving).

For ease of editing and review, the standard has been separated into 16 Volumes, one being a schema repository.

- Volume 0: OGC CDB Companion Primer for the CDB standard (Best Practice).
- Volume 1: OGC CDB Core Standard: Model and Physical Data Store Structure. The main body (core) of the CDB standard (Normative).
- Volume 2: OGC CDB Core Model and Physical Structure Annexes (Best Practice).
- Volume 3: OGC CDB Terms and Definitions (Normative).
- Volume 4: OGC CDB Rules for Encoding CDB Vector Data using Shapefiles (Best Practice).
- Volume 5: OGC CDB Radar Cross Section (RCS) Models (Best Practice).
- Volume 6: OGC CDB Rules for Encoding CDB Models using OpenFlight (Best Practice).
- Volume 7: OGC CDB Data Model Guidance (Best Practice).
- Volume 8: OGC CDB Spatial Reference System Guidance (Best Practice).
- Volume 9: OGC CDB Schema Package: http://schemas.opengis.net/cdb/ provides the normative schemas for key features types required in the synthetic modelling environment. Essentially, these schemas are designed to enable semantic interoperability within the simulation context (Normative).
- Volume 10: OGC CDB Implementation Guidance (Best Practice).
- Volume 11: OGC CDB Core Standard Conceptual Model (Normative).
- Volume 12: OGC CDB Navaids Attribution and Navaids Attribution Enumeration Values (Best Practice).
- Volume 13: OGC CDB Rules for Encoding CDB Vector Data using GeoPackage (Normative, Optional Extension).
- Volume 14: OGC CDB Guidance on Conversion of CDB Shapefiles into CDB GeoPackages (Best Practice).
- Volume 15: OGC CDB Optional Multi-Spectral Imagery Extension (Normative).

Chapter 2. Conformance

This Best Practice defines one conformance class.

Conformance with this Best Practice shall be checked using all the relevant tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site [1: www.opengeospatial.org/cite].

All requirements-classes and conformance-classes described in this document are owned by the standard(s) identified.

Chapter 3. References

The following normative documents contain provisions that, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

[R22] Parsch, A.: AN/APA to AN/APD - Equipment Listing (2008)

[R23] National Resources Canada: Radar Polarimetry - Fundamentals of Remote Sensing (2015)

[R24] Harre, I.: RCS in Radar Range Calculations for Maritime Targets.(V2.0-20040206), Bremen, Germany (2004)

[R25] Shengyun, Z.: Decibels relative to a square meter – dBsm (2007)

Chapter 4. Terms and Definitions

This document uses the terms defined in Sub-clause 5.3 of [OGC 06-121r8], which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this OGC Best Practice.

See the complete list of CDB Terms and Definitions in OGC CDB Volume 3: Terms and Definitions.

Chapter 5. Conventions

This section provides details and examples for any conventions used in the document. Examples of conventions are symbols, abbreviations, use of XML schema, or special notes regarding how to read the document.

5.1. Identifiers

The normative provisions in this Best Practice are denoted by the URI

http://www.opengis.net/spec/1.1/cdb-radar

All requirements and conformance tests that appear in this document are denoted by partial URIs which are relative to this base.

For the sake of brevity, the use of “req” in a requirement URI denotes:

http://www.opengis.net/spec/core/1.1/cdb-radar

An example might be:

req/cdb-radar/storage

Chapter 6. Radar Cross Section Models

For devices such as Radar, a geometric representation of a model may often provide a level of fidelity which is insufficient or inappropriate for use in simulation. Alternately, it may not be feasible to compute a radar cross-section of the model in real-time. Further, a user may wish to incorporate real-world RCS data into the simulator client-devices in order to further improve simulation fidelity. To this end, this document defines a RCS (Radar Cross-Section) model representation for use by Sensor Simulation client-devices such as Radar and/or Sonar. This model provides a signature model representing the overall relative reflectivity levels of a given Model Representation when viewed at discrete azimuth and elevation angles. The RCS data is then used in range and aspect calculations for the detection and classification of simulated targets (either ground or moving).

The following Section 6 Clauses provide a primer on radar, basic principles of operation and radar cross sections (RCS).

The Radar Cross-Section (RCS) of a target is a measure of the radar reflection characteristics of a target (usually expressed in m^2, dBsm, or volts). It is equal to the power reflected back to the radar divided by power density of the wave striking the target. For most targets, the radar cross-section corresponds to the area of the cross section of the sphere that would reflect the same energy back to the radar, if a metal sphere were substituted. A sphere is sometimes used since the RCS of a sphere is independent of frequency if operating in the far field region of the radar (Reference [R24]).

The RCS data unit of measure for the intensity are usually referenced as a normalized ratio in Decibels relative to a square meter (reference [R25]), or otherwise known as dBsm. Another data measure that is linked to the intensity measure is also the ‘phase shift’ angle (in degrees) of the returned energy. It can provide some additional information about the reflective attributes of the elements reflecting back to the radar.

However, the RCS defines the echo at the radar for the model (target) in question, which varies considerably depending on the target’s orientation, its relative distance and size with respect to the simulated radar’s antenna. The viewing angles are shown in the diagram below.

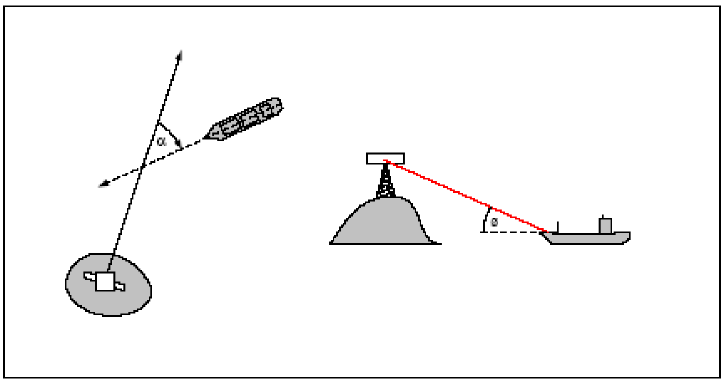

Figure A-19: Relative Azimuth (α) and Elevation (ϕ) Angles

RCS curves are normally produced using highly specialized off-line tools which input the model geometry and material attributes (typically an OpenFlight file) and applies physics-based processing like geometric ray-tracing, optical reflections/refractions, corner detection, material absorption and so on to the geometric data representation of the model. This processing is computationally expensive and is usually performed in non real-time. The end-result of this computation (usually 2D arrays of data points in elevation and azimuth) provides data that can be used more efficiently by simulation modeling such as radar at run-time. Those data curves are stored in a polar-type representation table, which provide specific reflectivity levels given a set of azimuth and elevation aspect angles.

6.1. Functional Description

To simulate a target for most modes of operation, the Radar software uses an RCS Polar Diagram as shown below:

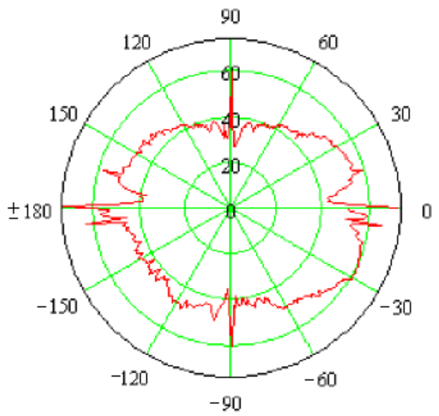

Figure A-20: Polar Diagram of RCS data in Decibels at a given elevation angle

The polar diagram allows the radar to use an RCS value array (indexed by azimuth/elevation angles) for getting an approximation of the overall RCS of distant targets. The approximated RCS data is a function of the model's materials, geometry, view angles, and multi-paths reflections generated within the model itself.

RCS data can also be depicted more linearly as shown in the following diagram:

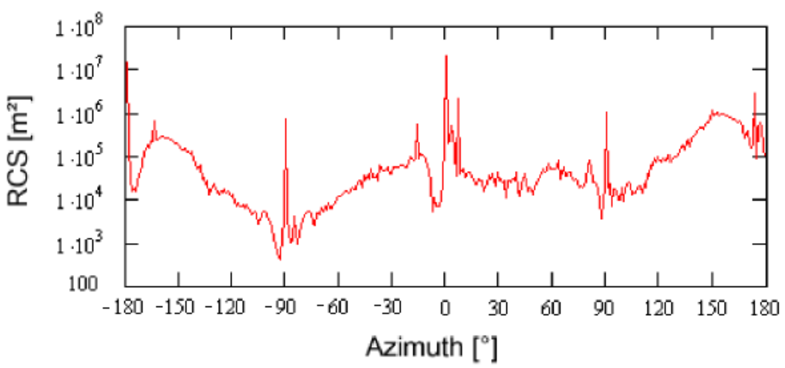

Figure A-21: Linear Diagram of RCS data in Decibels at a given elevation angle

As can be seen in the example above, relative intensities are much greater when viewing the model directly in front (0° azimuth), from the back (±180° azimuth) and on the sides (-90° and +90°

azimuth).

The RCS data is often characterized by its data resolution and physical modeling parameters. The data resolution determines the angular increments between successive RCS values, and modeling parameters specify the attributes of the physical parameters used to drive the RCS mathematical model computations (such as the Electro-Magnetic properties of the simulated electric field).

Both wavelength and polarization affect how a radar system "sees" the elements in the scene. Therefore, radar using different polarization and wavelength combinations may provide different and complementary information, which can be used to enhance the radar image in a specific way.

6.2. Wave Polarization

When computing an RCS model, it is important to consider microwave energy propagation and scattering, and also the polarization of the radiation, which is an important property. For a plane electromagnetic (EM) wave, polarization refers to the locus of the electric field vector in the plane perpendicular to the direction of propagation. The length of the vector represents the amplitude of the wave, and the rotation rate of the vector represents the frequency of the wave. Polarization refers to the orientation and shape of the pattern traced by the tip of the vector (Reference [R23]).

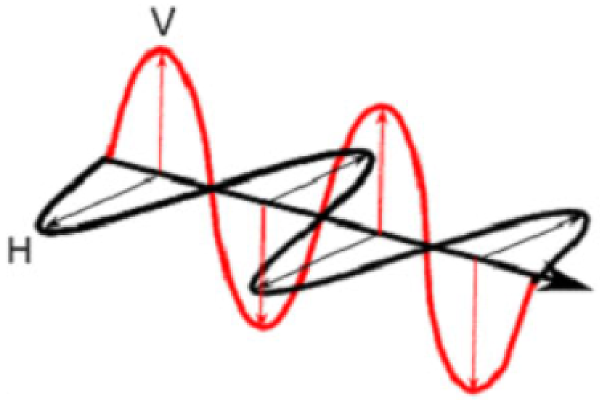

Figure A-22: Horizontal and Vertical Polarization of a plane of EM wave

The waveform of the electric field strength (voltage) of an EM wave can be predictable (the wave is polarized) or random (the wave is un-polarized), or a combination of both. In the latter case, the degree of polarization describes the ratio of polarized power to total power of the wave. An example of a fully polarized wave would be a monochromatic sine wave, with a single, constant frequency and stable amplitude.

Many types of radar antennae are designed to transmit and/or receive microwave radiation that is either horizontally (H) or vertically (V) polarized, or a combination of both. A transmitted wave of either polarization can generate a backscattered wave with a variety of polarizations, thus an equal amount of resulting RCS curves.

Polarization type on either transmission or reception mode can be synthesized by using H and V components, with a well-defined relationship between them. For this reason, systems that transmit and receive both of these linear polarizations are commonly used. With these radars, there can be four combinations of transmit and receive polarizations:

- HH - for horizontal transmit and horizontal receive
- VV - for vertical transmit and vertical receive
- HV - for horizontal transmit and vertical receive, and
- VH - for vertical transmit and horizontal receive.

The first two polarization combinations are referred to as “like-polarized” because transmit and receive polarization types are the same. The last two combinations are referred to as “cross-polarized” because transmit and receive polarizations are orthogonal to one another.

Radar systems can have one, two, or all four of these transmit/receive polarization combinations. Examples include the following types of radar systems:

- Single polarized: HH or VV (or possibly HV or VH)
- Dual polarized: HH and HV, VV and VH, or HH and VV
- Alternating polarization: HH and HV, alternating with VV and VH
- Polarimetric: HH, VV, HV, and VH

Both wavelength and polarization affect how a radar system “sees” the elements in the scene. Therefore, radar using different polarization and wavelength combinations may provide different and complementary information, which can be used to enhance the radar image in a specific way.

Therefore, polarization information is an important part of the CDB’s RCS Data representation.

6.3. Wave Parameters

In addition to the wave polarization explained above, other physical parameters of the modeled electromagnetic wave are also a contributing factor to the RCS of a target when seen by Radar. Therefore those parameters are available in conjunction with the RCS data curves:

Those parameters are generally as follows:

- Radar Mode (Continuous wave or Pulsed)
- Radiating Frequency
- Antenna Main Lobe Gain
- Antenna Main Lobe Bandwidth
- Antenna Side Lobe 3dB point
- Radar Pulse width (if pulsed radar mode)
- Radar Pulse Repetition Frequency (if pulsed radar mode)

Chapter 7. RCS Data Model

7.1. Radar Cross Section Data Model

The Radar Cross-Section (RCS) of a target is a measure of the radar reflection characteristics of a target (usually expressed in m^2, dBsm, or volts). It is equal to the power reflected back to the radar divided by power density of the wave striking the target. For most targets, the radar cross-section corresponds to the area of the cross section of the sphere that would reflect the same energy back to the radar, if a metal sphere were substituted. A sphere is sometimes used since the RCS of a sphere is independent of frequency if operating in the far field region of the radar. The following sections define the requirements for an RCS in a conformant CDB data store.

7.2. RCS Data Model

The CDB RCS data is organized so that client-devices can easily retrieve the following information from the RCS model (Figure 1: Graphical Representation of the 3D Model RCS Vector Data) below:

- The modeling (physical) parameters that were used to generate the RCS polar data.
- The RCS polar representation corresponding to one or more levels of resolution of the RCS polar data.
- The RCS polar representation corresponding to distinct radar mode of operation.
- The RCS polar representation corresponding to a distinct radar model type.

RCS resolution refers to the angular pitch used in gathering RCS data for the model in question. At a given RCS resolution, it is possible to have two or more RCS polar representations due to the fact that the RCS data is computed based on a number of physical modeling properties such as the characteristics of the electromagnetic beam, its frequency, polarization, amplitude and phase. A simulated sensor operating in a given mode of operation, over a given range of frequencies, will require the RCS data closest to this mode. It will therefore need to use the closest matching Polar Diagram from the RCS model data.

7.3. RCS Polar Diagram Data Representation using Shapefile

This section provides a detailed description of the content and format of RCS data for a conformant implementation of a CDB data store.

7.3.1. Shapefile Internal Data Structure

Requirement 1	req/cdb-radar/storage Within a CDB, the RCS model SHALL be stored as a series of Esri's ShapeFiles in accordance with the Esri Shapefile Specification [2: https://en.wikipedia.org/wiki/Shapefile].

This section describes the vector data structure for the representation of RCS model data. This format provides the required flexibility to create and visualize the RCS data including:

- Easy modification of data attributes
- Simple visualization of RCS data in polar form
- Allow irregular steps in azimuth/elevation (X/Y)
- Allow some possibly missing values

RCS data is inherently two-dimensional in nature and is naturally organized as a two-dimensional array of RCS polar values computed at various azimuth and elevation angles from the target. Each element of this array represents the RCS data value over each uniformly distributed azimuth angle and distinct elevation angle.

Therefore, each of such array element can be represented as a "Point" geometry, with the azimuth angle value (X) at a given elevation angle (Y), while at the same time storing the associated attributes such as the RCS, Amplitude or Phase data in the instance attribute database (dbf file) associated to the vector data, currently a Shapefile. Typical azimuth angles would range between -180° and +180°, whereas the elevation angles would cover from -90° to +90°. However, the RCS data set could potentially only cover just a partial range of those angles if data is incomplete for example. This can be visualized in the next diagram, showing RCS values at various azimuth angles corresponding to an elevation angle of 20° with respect to the model (cube). Note that the axis conventions follow those described in Section 6.3, Coordinate Systems.

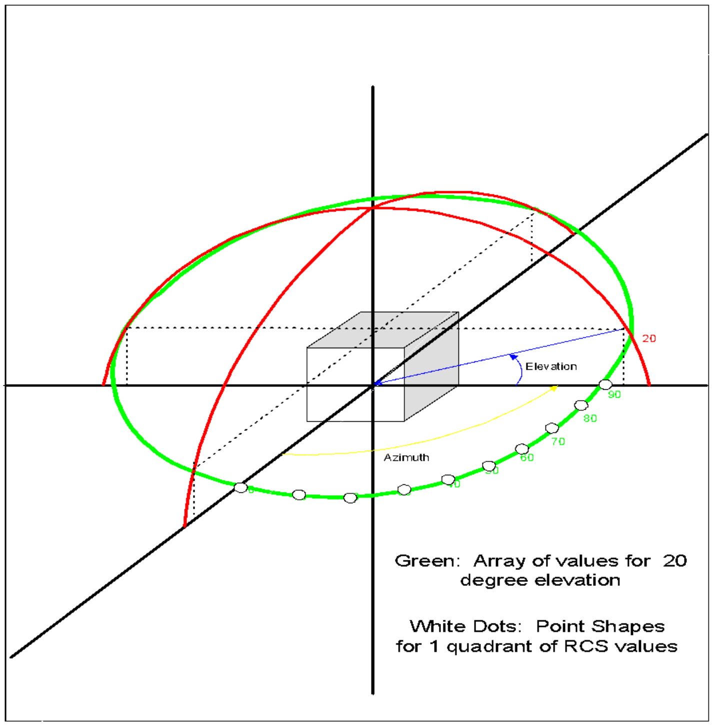

Figure 7-1: Graphical Representation of the 3D Model RCS Vector Data

Partial RCS data is permitted, i.e., it is permitted to cover a sub-region of the RCS polar diagram with only points corresponding to known values.

For example, consider an RCS model consisting of data values in 5^{o} elevation increments and 2^{o} azimuth increments covering the entire aspect angle range of the target. The CDB representation would consist of (180°/5°)+1 = 37 sets of (360°/2°)+1 = 181 points (vertices) for a full target aspect coverage; yielding 6697 point shapes with their attribute data.

Requirement 2	req/cdb-radar/storage-vertices For each of the vector point vertices, the X component SHALL represent the azimuth angle (equivalent to longitude) and the Y component SHALL represent the elevation angle (equivalent to latitude). The RCS value (and other attributes) SHALL be stored in the instance attributes within the DBF file.-azimuth

Requirement 3	req/cdb-radar/storage-sig-angle The eight prescribed values for azimuth and elevation increments SHALL be used for specifying the ModelSignature Significant Angle. The table below shows the correspondence between the ModelSignature LOD level number and the ModelSignature Significant Angle.

Table 7-1: ModelSignature Significant Angle per LOD

ModelSignature LOD level	Significant Angle	Number of values
0	90° ≤ Significant angle	Less than 8
1	45° ≤ Significant angle < 90°	between 8 and 32
2	22.5° ≤ Significant angle < 45°	between 32 and 128
3	11.25° ≤ Significant angle < 22.5°	between 128 and 512
4	5.625° ≤ Significant angle < 11.25°	between 512 and 2048
5	2.80° ≤ Significant angle < 5.625°	between 8192 and 32768
6	1.40° ≤ Significant angle < 2.80°	between 32768 and 131072
7	0.70° ≤ Significant angle < 1.40°	between 131072 and 524288

Such a data representation would typically produce the following diagram when viewed in 2D (Figure 7-2: Polar Diagram of RCS Data in Planar Representation) and 3D (Figure 7-3: Polar Diagram of RCS Data in Spherical Representation) polar forms (color representing the RCS Intensity attribute):

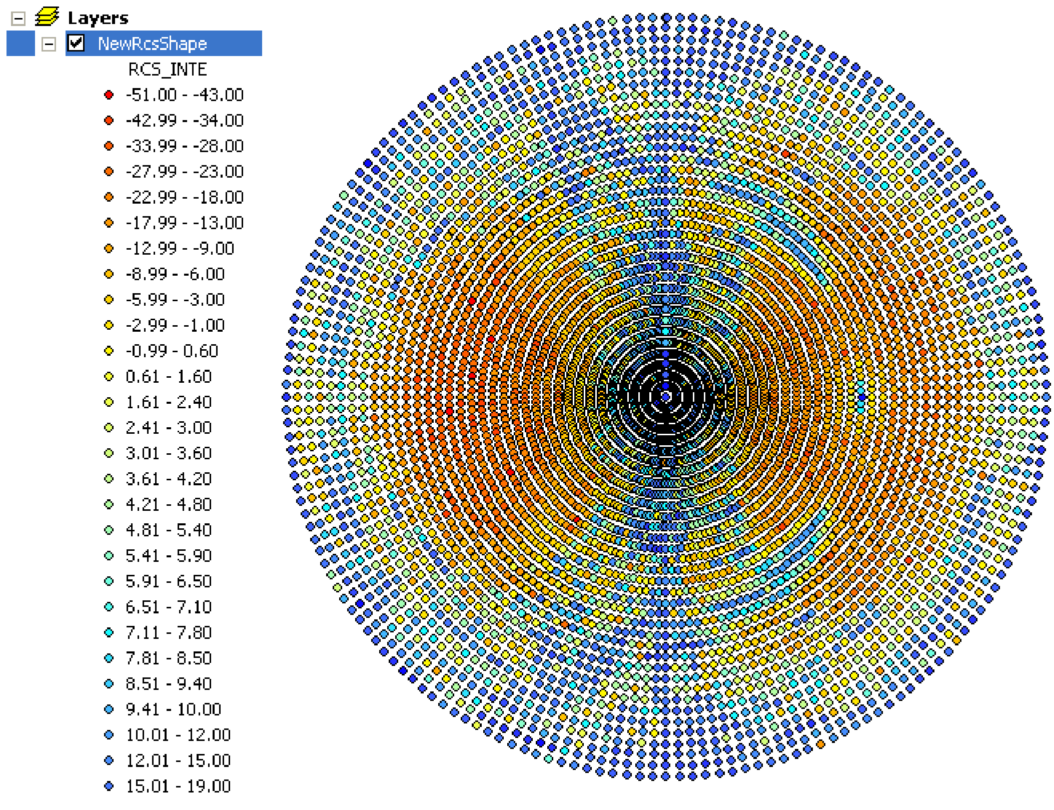

Figure 7-2: Polar Diagram of RCS Data in Planar Representation

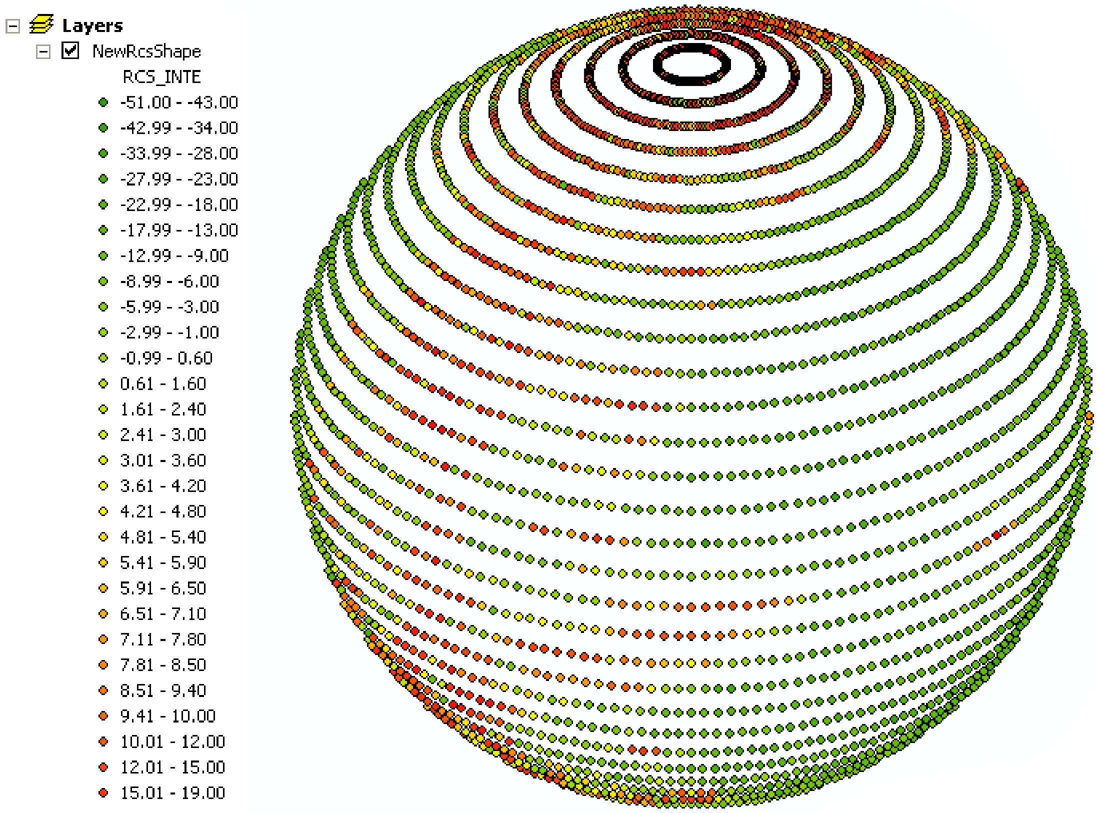

Figure 7-3: Polar Diagram of RCS Data in Spherical Representation

In addition, specific attributes within the vector data are required to specify other characteristics of the RCS data, like EM polarization mode and frequency that were used when characterizing the target's RCS signature. Those are the class-level attributes and are described below.

Requirement 4	req/cdb-radar/attributes The data for each distinct RCS representation model SHALL have two different types of attributes: RCS model class attributes and RCS instance attributes as defined below.

1. RCS Model Class-level attribution: These are attributes that can be shared by all of the RCS model instances of the RCS representation. The attributes and their values are logically re-grouped under a classname that stands for the entire attributes specific to the RCS model. All of the classnames are re-grouped into a model.dbf file referred to as the RCS Class Attribute file for the RCS model. (See Section 7.4.1, Directory Structure) Each row of the model.dbf file corresponds to a different classname. The first column of the file is the classname attribute and acts as the primary key to access subsequent table entries; all other columns correspond to the attributes represented by the classname.

2. RCS Instance-level attribution: This is the data that represents a particular instance of the RCS model for a RCS representation. The data is contained in the attribution columns of the model.dbf file that accompanies the RCS's *.shp file. This *.dbf file is referred to as the RCS Instance Attribute file of the RCS model. (See Section 7.4.1, Directory Structure) The first column

of each row is always the classname attribute. The other columns in a RCS Instance Attribute file are used to describe further the associated shape.

Requirement 5	req/cdb-radar/storage-files In summary, for a single RCS model in the CDB, the data files SHALL consist of: • One *.shp main file that provides the geometric aspect (Points) for each data instance of a RCS model. • Two *.dbf files (one instance-level on a-per RCS feature basis, and one class-level at the RCS model level) that collectively provide the attribution for all of the possible RCS models of a given RCS Model. • One *.shx index file that stores the file offsets and content lengths for each of the records of the main *.shp file. The only purpose of this file is to provide a simple means for clients to step through the individual records of the *.shp file (i.e., it contains no CDB modeled data).

RCS Model Class-Level Attributes

Many attributes within the vector data are required to specify the physical modeling parameters corresponding to those used to produce the RCS data. These include, for instance, the electromagnetic (EM) polarization mode and the frequency that were used when characterizing the target's RCS signature.

The CDB RCS model representation offers a comprehensive set of class attributes that are described below. Please note that these attributes are an elaborate set of fields to indicate in which physical environment the RCS data were computed and does not necessarily reflect a precise operating mode of a particular radar.

A description of the attribute information follows below. (The reader should keep in mind that the 10-character limitation of attribute names is imposed by the dBASE III+ file format used by the Shapefile .DBF data format).

Table 7-2: XML Tags for Hot Spots

Attribute	Format	Description	Values	Units
CLASSNAME	STRING	Unique string identifying the RCS model class attribute characteristics	Uniquely identifiable character string for the class name	String of 32 characters

VERSION	STRING	String representing the version level of the RCS Data	XX.YY.ZZ	String of 8 characters
PROD_DAY	INT	Number representation of the computation day	DD	N/A
PROD_MTH	INT	Number representation of the computation month	MM	N/A
PROD_YEA	INT	Number representation of the computation year	YYYY	N/A
CLASS_TYP	INT	Level of Classification	0 – 999 0 : UNKNOWN 1 : UNCLASSIFIED 2 : SECRET 3 : TOP SECRET 4 : DECLASSIFIED 999: OTHER	Enumerated
DAT_SRC_T	INT	Data from which RCS was derived	0 - 999 0 : UNKNOWN 100 : OPENFLIGHT 200 : EMPIRICAL 300 : THIRD-PARTY TOOL 400 : US Air Force 401 : US Army 402 : US Navy 999 : OTHER	Enumerated
RCS_VARI	STRING	Radar Model Variant (e.g., “AN/APG-65”)	7.3.2, Multi-Variant RCS Model Applicability	String of 10 characters

3RD_PARTY	INT	3rd party tool used for RCS Production	0 - 999 0 : UNKNOWN 100 : RADBASE 200 : XPATCH 300 : MATHLAB/SIMULINK 999 : OTHER	Enumerated
POL_TYPE	INT	Polarization Mode of RF emission used to characterize RCS	0- 999 0 : UNKNOWN 1 : LINEAR 2 : CIRCULAR 3 : ELLIPTICAL 4 : SINGLE HH 5 : SINGLE HV 6 : SINGLE VV 7 : SINGLE VH 8 : DUAL HH-HV 9 : DUAL VV-VH 10 : DUAL HH-VV 11 : ALTERNATING HH-HV 12 : ALTERNATING VV-VH 13 : POLARIMETRIC HH 14 : POLARIMETRIC VV 15 : POLARIMETRIC HV 16 : POLARIMETRIC VH 999: OTHER	Enumerated
EX_AMPL	DOUBLE	Transmitted Ex-component amplitude level		INTENS_TY

EY_AMPL	DOUBLE	Transmitted Ey-component amplitude level		INTENS_TY
EX_PHASE	DOUBLE	Transmitted Ex-component phase		ANGL_TYP
EY_PHASE	DOUBLE	Transmitted Ey-component phase		ANGL_TYP
EX_FREQ	DOUBLE	Transmitted Ex-component frequency		FREQU_TY
EY_FREQ	DOUBLE	Transmitted Ey-component frequency		FREQU_TY
INTENS_TY	INT	RCS Value units	0 – 999 0 : UNKNOWN 1 : DB 2 : DBSM 3 : VOLTS 4 : SURFACE 5 : M2 999: OTHER	N/A
ANGL_TYP	INT	RCS Angular Value units	0 : UNKNOWN 1 : DEGREES 2 : RADIANS 3 : GRADIANS 4 : STERADIANS	N/A
FREQU_TY	INT	RCS Frequency Value units	0 : UNKNOWN 1 : HERTZ 2 : KILOHERTZ 3 : MEGAHERTZ 4 : GIGAHERTZ 5 : TERAHERTZ 6 : PETAHERTZ	N/A

TGT_TY	INT	Target Mode Value units	0 : UNKNOWN 1 : NORMAL 2 : SLIGHTLY DAMAGED 3 : DAMAGED 4 : DESTROYED	Enumerated
TIME_TY	INT	Time Value units	0 : UNKNOWN 1 : SECONDS 2 : MILLI-SECONDS 3 : MICRO-SECONDS	Enumerated
RF_TY	INT	RF Emission Mode Type	0 : UNKNOWN 1 : CONTINUOUS WAVE 2 : PULSED	Enumerated
LENGTH_TY	INT	Length Value units	0 – 999 0 : UNKNOWN 1 : NANOMETER 2 : MICRON 3 : MILLIMETER 4 : CENTIMETER 5 : METER 6 : KILOMETER 999: OTHER	N/A
RF_FREQ	DOUBLE	Frequency of RF emission used to characterize RCS		FREQU_TY
TGT_SS	DOUBLE	Significant size of input Source Model Data		LENGTH_TY
MLOBEGAIN	DOUBLE	Antenna Main Lobe Gain		INTENS_TY

MLOBEBW	DOUBLE	Antenna Main Lobe Bandwidth		ANGL_TYP
SLOBE3DB	DOUBLE	Antenna Side Lobe 3dB Point		ANGL_TYP
RF_PWIDTH	DOUBLE	RF Pulse Width		TIME_TY
RF_PRF	DOUBLE	RF Pulse Repetition Frequency		FREQU_TY
RCS_AVG_I	DOUBLE	RCS Intensity Average (or mean) Value. This represents the arithmetic mean of the RCS table.		INTENS_TY
RCS_AVG_A	DOUBLE	RCS Amplitude Average (or mean) Value. This represents the arithmetic mean of the RCS table.		INTENS_TY
RCS_AVG_P	DOUBLE	RCS Phase Shift Average (or mean) Value. This represents the arithmetic mean of the RCS table.		ANGL_TYP
RCS_NML_I	DOUBLE	Approximated RCS Intensity Value for ‘Normal’ state		INTENS_TY
RCS_NML_A	DOUBLE	Approximated RCS Amplitude Value for ‘Normal’ state		INTENS_TY
RCS_NML_P	DOUBLE	Approximated RCS Phase Shift Value for ‘Normal’ state		ANGL_TY
RCS_SD_I	DOUBLE	Approximated RCS Intensity Value for ‘Slightly Damaged’ state		INTENS_TY
RCS_SD_A	DOUBLE	Approximated RCS Amplitude Value for ‘Slightly Damaged’ state		INTENS_TY
RCS_SD_P	DOUBLE	Approximated RCS Phase Shift Value for ‘Slightly Damaged’ state		ANGL_TY

RCS_DMG_I	DOUBLE	Approximated RCS Intensity Value for ‘Damaged’ state		INTENS_TY
RCS_DMG_A	DOUBLE	Approximated RCS Amplitude Value for ‘Damaged’ state		INTENS_TY
RCS_DMG_P	DOUBLE	Approximated RCS Phase Shift Value for ‘Damaged’ state		ANGL_TY
RCS_DST_I	DOUBLE	Approximated RCS Intensity Value for ‘Destroyed’ state		INTENS_TY
RCS_DST_A	DOUBLE	Approximated RCS Amplitude Value for ‘Destroyed’ state		INTENS_TY
RCS_DST_P	DOUBLE	Approximated RCS Phase Shift Value for ‘Destroyed’ state		ANGL_TY
RCS_FLU_I	DOUBLE	RCS Intensity Fluctuation (or Variance); the mean of all squared deviations from the mean for all RCS values.		N/A
RCS_FLU_A	DOUBLE	RCS Amplitude Fluctuation (or Variance); the mean of all squared deviations from the mean for all RCS values.		N/A
RCS_FLU_P	DOUBLE	RCS Phase Fluctuation (or Variance); the mean of all squared deviations from the mean for all RCS values.		N/A

RCS_SCINT	DOUBLE	This value specifies a level of scintillation to be added to the simulated radar signature when model parts are being articulated.	7.3.3, Model's Articulations Effect on RCS Data	INTENS_TY
RCS_FLASH	DOUBLE	RCS Intensity of Target when viewed directly at 0˚ (face) or 180˚ (back) degrees azimuth. This "face" value is sometimes necessary when viewpoint turns around target and gets a "flash" at those specific angles.		INTENS_TY
EQ_SPH_RD	DOUBLE	Radius of an approximated equivalent metallic sphere substituting the model		LENGTH_TY
MAX_VAL_I	DOUBLE	RCS Table Max Intensity Value		INTENS_TY
MAX_VAL_A	DOUBLE	RCS Table Max Amplitude Value		INTENS_TY
MAX_VAL_P	DOUBLE	RCS Table Max Phase Shift Value		ANGL_TY
MIN_VAL_I	DOUBLE	RCS Table Min Intensity Value		INTENS_TY
MIN_VAL_A	DOUBLE	RCS Table Min Amplitude Value		INTENS_TY
MIN_VAL_P	DOUBLE	RCS Table Min Phase Shift Value		ANGL_TY
AZ_SSANGL	DOUBLE	Azimuth smallest significant delta angle	Smallest azimuth angle increment found in data	ANGL_TYP
EL_SSANGL	DOUBLE	Elevation smallest delta significant angle	Smallest elevation angle increment found in data	ANGL_TYP

AZ_LSANGL	DOUBLE	Azimuth largest significant delta angle	Smallest azimuth angle increment found in data	ANGL_TYP
EL_LSANGL	DOUBLE	Elevation largest significant delta angle	Smallest elevation angle increment found in data	ANGL_TYP

RCS Instance-Level Attribute Data

The data for an entire RCS model itself is stored as a series of Point geometries, each representing the RCS data values with respect to the model's center for the corresponding azimuth and elevation angles as represented by the point X and Y coordinates. The *.dbf portion of the vector data set provides the instance attribute information for each of the RCS Point. A description of the attribute information follows below:

ShapeType = POINT

Values:

X coordinate is the Azimuth angle of the RCS sample

Y coordinate is the Elevation angle of the RCS sample

NOTE:The RCS of the model when viewed at +90° elevation (top view) is significantly different than the one at -90° elevation (bottom view), so there should be (180/EL_STEP)+1 point values to cover all elevations. The azimuth, which has the same RCS value for +180° and -180° will cover (360/AZ_STEP) point values.

Table 7-3: RCS Instance Attribute Fields

ATTRIBUTE	TYPE	DESCRIPTION	VALUES	UNITS
CLASSNAME	STRING	Unique string referring to the RCS model class attribute name	String of 32 characters	
RCS_INTE	DOUBLE	RCS Intensity Level		INTEN_TY
RCS_AMPL	DOUBLE	RCS Amplitude Level		INTEN_TY
RCS_PHAS	DOUBLE	RCS Phase		ANGL_TYP

Figure 7-4: UML Representation of the 3D Model RCS Vector Data Structure image::images/image8.png[image,width=482,height=312]

For a given RCS curve in a vector data set, an attribute "CLASSNAME" indicates which type of sensor application the curve data is derived for, and under which resolution the data was produced. Therefore, the single vector data set of the Model can regroup all sensor data pertaining to various RCS signature types and resolutions for a given RCS Model. Consider the next example. The vector data format therefore should not preclude the capability to support multiple RCS curves simultaneously for a given model.

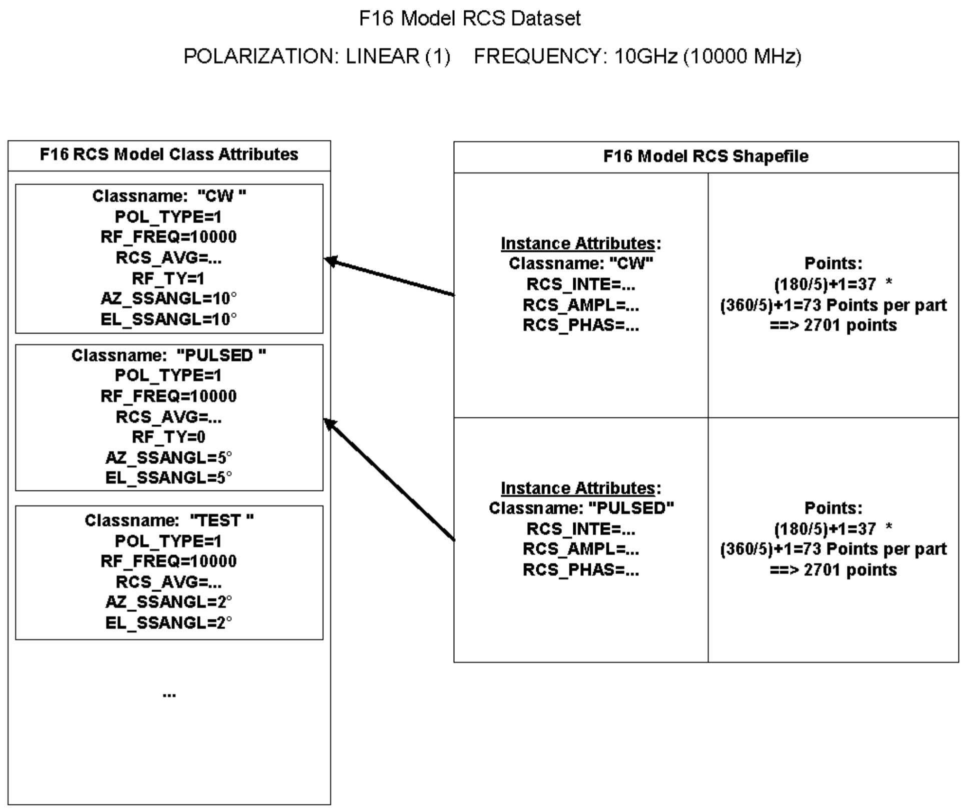

Figure 7-5: Example of RCS Vector Data

7.3.2. Multi-Variant RCS Model Applicability

Requirement 6	req/cdb-radar/rcs-vari Each variant of the RCS model in the vector data set SHALL have a 10-character string attribute called “RCS_VARI”. The string may contain the specific Radar model number (and possibly its frequency band L-Band, S-Band, X-Band, Ku-Band) for which this RCS variant applies to. The suggested string convention for this field is as described in reference [R22].

For example: The “AN/APG-65” Radar model name represents a Pulse Doppler X-Band Multi-Mode Radar manufactured by Raytheon (Hughes) and used in F/A-18, AV-8B+ aircraft.

Table 7-4: Radar Model Numbers AN/APA - Airborne Radar Auxiliary Assemblies

Model Number	**Description**
AN/APA-1	Indicator Unit (Remote Repeater Scope) used with US Navy ASB radar
AN/APA-2	Radar Antenna Equipment
AN/APA-3	Radar Antenna Equipment

AN/APA-4	Radar Alarm Unit
AN/APA-5	Auxiliary Electronic Bombsight Equipment; used in P-2
AN/APA-6	Panoramic Radio Receiving Set; used with AN/APR-9 and AN/APR-14
AN/APA-7	Movie-Camera Photo Set
AN/APA-8	Video Amplifier; used with AN/APS-2
AN/APA-9	ECM Equipment; used in P2V-5
AN/APA-10	Panoramic Radio Receiving Set; used with AN/SPR-2
AN/APA-11	Panoramic Radio Receiving Set (Pulse Analyzer); used in B-52 EW pod, RC-121C, P2V-5, PBM-5S used with AN/APR-9 and AN/APR-14;
AN/APA-12	Sector Scan Antenna Adapter; used with AN/APS-2
AN/APA-13	Component of AN/APS-15
AN/APA-14	Component of AN/APS-15
AN/APA-15	Elevation Stabilizer; used with AN/APS-15
AN/APA-16	Auxiliary Electronic Bombsight Equipment used in PBY-6A
AN/APA-17	250-1000 MHz Broadband Direction Finding Radar (used with search receivers); manufactured by Hoffman Radio Corp., Aviola
AN/APA-19	Bombing Aid
AN/APA-21	Radar Bombing Compensating Unit
AN/APA-23	Automatic Tape Recorder; manufactured by Gamewell; used with AN/APR-1/2/4/5/6
AN/APA-24	50-280 MHz Direction Finding Radar (used with search receivers); manufactured by Heyer Products used in P4M-1Q
AN/APA-25	Radar Direction Finding Antenna Unit
AN/APA-26	S-Band Attenuator
AN/APA-27	Automatic Search & Jam Tuning Adapter
AN/APA-28	Multiple Indicator Equipment (6 displays); used with AN/APQ-13
AN/APA-29	Bombing Altitude Control Unit
AN/APA-33	Multiple Indicator Equipment (4 displays); used with AN/APQ-7
AN/APA-35	Radar Signal Recording Camera Unit
AN/APA-36	Remote Repeater Scope (modified AN/APA-1); used with AN/APQ-13

AN/APA-38	Panoramic Radio Receiving Set; used in PBM-5S
AN/APA-39	Radar Identification Unit
AN/APA-40	Bombing/Navigation System used with AN/APS-15; used in B-17
AN/APA-42	Bombing/Navigation System; used with AN/APS-23; used in XB-48 (see AN/APA-59)
AN/APA-43	Airborne Searchlight Control
AN/APA-44	Ground Position Indicator System; manufactured by Bell Telephone Lab; used with AN/ASB-3 and AN/APS-23/27/31 used in B-45 (together with AN/APS-23 to form AN/APQ-24), RB-66
AN/APA-45	Radar Antenna Tilt Stabilizer Unit
AN/APA-48	Radar Homing Equipment, 140-300 MHz; manufactured by RRL
AN/APA-49	Radar Bombing Ground Position Indicator
AN/APA-50	Low Altitude Rocket Bombing Unit
AN/APA-51	Radar Indicator Unit
AN/APA-52	X-Band TACAN Doppler Navaid; used in F-8, SB-29
AN/APA-54	Radar Recorder Group (SHORAN); used in B-57
AN/APA-55	Radar Adapter Unit
AN/APA-56	Radar Display Console; used with AN/APS-45/95; used in EC-121
AN/APA-57	Ground Position Indicator Group; used in AF-2W, P-2, S-2; replaced by AN/ASA-13
AN/APA-58	Ground Position Computer
AN/APA-59	Bombing/Navigation Computer "SRC-1"; manufactured by Sperry; used in B-36, XB-48
AN/APA-60	Autopilot
AN/APA-61	Radar Bombing Navigational Computer
AN/APA-62	Panoramic Receiver
AN/APA-63	Autopilot
AN/APA-64	Radar Signal Analyzer used in P2V-4
AN/APA-66	Radar Monitor
AN/APA-69	Direction Finding Radar Set; used in RB-57D, A-1, C-47, P-2, P-5, S-2, RC-121C, Z-1, ZPK
AN/APA-70	Direction Finder Group; used with AN/APR-9; used in AF-2W, P-2, S-2, TBM-3S
AN/APA-72	Signal Analyzer; used in E-2

AN/APA-74	Pulse Analyzer Group; manufactured by Loral; used in EB-66, A-3, EC-47, P-2, P-5, Z-1, ZPK; replaced AN/APA-11
AN/APA-80	Control & Guidance Monitoring Group; used in AUM-N-2, HSL-1, P-2, P-5, S-2
AN/APA-81	Ground Position Indicator Group; used with AN/APS-20; used in AF-2W, EC-121
AN/APA-82	Direction Finder Group; used in B-52, C-130, C-133, C-135
AN/APA-84	Radar Intercept Targeting Computer; used with APG-37; used in F-86D/K
AN/APA-85	Control-Indicator Group; used with AN/APS-42 used in R6D-1
AN/APA-89	Coder Group; used in A-3, UH-1E
AN/APA-90	Indicator Group; used with AN/APW-11; used in B-57, B-66
AN/APA-91	used with AN/APS-33
AN/APA-92	ECM Set
AN/APA-94	Signal Analyzer
AN/APA-95	Doppler Navigation Computer
AN/APA-106	Bomb Damage Evaluation Group; used with AN/APQ-24; used in B-50D
AN/APA-109	Radar Control; manufactured by Westinghouse
AN/APA-113	used with AN/APS-62
AN/APA-122	Radar Set
AN/APA-125	Radar Display; used with AN/APS-80/82, AN/ASA-47; used in P-2H, P-3A, P-5, E-1
AN/APA-126	Doppler Equipment; used in A-7
AN/APA-127	Sparrow Missile Fire Control System; manufactured by Raytheon; used in F-3, F-4B/C
AN/APA-128	Sparrow Missile Radar Set Group; manufactured by Raytheon; used with AN/AWG-7; used in XF8U-3, F-4
AN/APA-138	Radar Display; used with AN/AWG-7; used in XF8U-3
AN/APA-141	Radar Set; used in B-52G/H
AN/APA-143	Rotodome Antenna Group; manufactured by Dalmo Victor; used with AN/APS-96; used in E-2A/B
AN/APA-144	Signal Analyzer Group; used in EA-1F, EC-121M, P-3A
AN/APA-150	Station Keeping System; used in SH-34J

AN/APA-153	Cable Breakout Adapter Set; manufactured by AC Spark Plug; used with AN/APS-104
AN/APA-157	Continuous Wave Illuminator (for AIM-7 targeting); manufactured by Raytheon; used in F-4B/C
AN/APA-159	Radar Set Group; manufactured by Hazeltine; used in EC-121D/H
AN/APA-160	Test Adapter; manufactured by Sperry; used with AN/APN-42
AN/APA-161	Station Keeping System used in ASW helicopters
AN/APA-162	Map Matcher
AN/APA-164	Rotodome; used with AN/APS-111; used in E-2A/B
AN/APA-165	Intercept Computer (for AIM-9 firing); manufactured by Raytheon; used with AN/APQ-109 used in F-4D
AN/APA-167	used with AN/APG-53
AN/APA-170	Radar Set
AN/APA-171	Rotodome Antenna Group; used with AN/APS-120, AN/APX-76; used in E-2C
AN/APA-172	Control Indicator Group; used with AN/APS-120, AN/APX-76; used in E-2C
AN/APA-173	Test Bench

AN/APB - Airborne Bombing Radars

Model Number	**Description**
AN/APB-1	Radar Beacon
AN/APB-2	Bombing Radar; used in B-58

AN/APD - Airborne Direction Finding and Surveillance Radars

Model Number	**Description**
AN/APD-1	Homing Radar; used in TBF/TBM
AN/APD-2	Radar Direction Finding Set; used with AN/APR-1 and AN/APA-48
AN/APD-4	D/E/F-Bamd Radar Direction Finding System; manufactured by ITT; used in RB-47H, B-52, EB-66C
AN/APD-5	Reconnaissance Radar
AN/APD-7	Radar Surveillance System; manufactured by Westinghouse; used in OV-1D, RA-5C

AN/APD-8	Side-Looking Reconnaissance Radar; manufactured by Westinghouse; proposed for RF-111A
AN/APD-9	Radar Set
AN/APD-10	Side-Looking Reconnaissance and Mapping Radar; used in F-4, RF-4B/C, CP-140; special tests in NC-141, C-130
AN/APD-11	Side-Looking Radar Reconnaissance Set; part of AN/UPD-6; used in RF-4E
AN/APD-12	I/J-band Side-Looking Reconnaissance System; manufactured by Lockheed Martin; part of AN/UPD-8 and AN/UPD-9; used in Israeli RF-4B
AN/APD-13	QUICK LOOK Electronic Intelligence Subsystem; manufactured by Systems & Electronics; used in "Guardrail" RC-12
AN/APD-14	SAROS (SAR for Open Skies) Radar System; manufactured by Sandia; part of AN/UPD-8; used in OC-135
AN/APD-501	Maritime Patrol Radar; used in Lancaster (Canada)

AN/APG - Airborne Fire Control Radars

Model Number	**Description**
AN/APG-1	S-Band Intercept Radar used in P-61B
AN/APG-2	S-Band Intercept & Gun Laying Radar used in P-61
AN/APG-3	Tail Gun Laying Radar; manufactured by General Electric used in B-29 and B-36B
AN/APG-4	L-Band Low Altitude Torpedo Release Radar "Sniffer" used in TBM
AN/APG-5	S-Band Gun Laying/Range-Finding Radar used in B-17, B-24 and F-86A (AN/APG-5C)
AN/APG-6	L-Band Low Altitude Bomb Release Radar "Super Sniffer" (improved AN/APG-4)
AN/APG-7	Glide Bomb Control Radar "SRB" (Seeking Radar Bomb)
AN/APG-8	S-Band Turret Fire Control Radar used in B-29B
AN/APG-9	L-Band Low Altitude Bomb Release Radar (improved AN/APG-6)

AN/APG-10	Weapons System Radar
AN/APG-11	L-Band Toss Bombing Radar
AN/APG-12	L-Band Low Altitude Bomb Release Radar (improved AN/APG-9)
AN/APG-13	S-Band Nose Gun Laying Radar "Falcon"; manufactured by General Electric used with 75mm nose gun of B-25H
AN/APG-14	S-Band Gun Sight Radar used in B-29
AN/APG-15	S-Band Tail Gun Radar used in B-29B, PB4Y
AN/APG-16	X-Band Gun Laying Radar (modification of AN/APG-2) used in B-32, XB-48
AN/APG-17	S-Band Low Altitude Bomb Release Radar (improved AN/APG-4)
AN/APG-18	X-Band Turret Control Radar (improved AN/APG-5); manufactured by Martin used with "S-4" gunfight
AN/APG-19	X-Band Fire Control Radar; manufactured by Martin (improved AN/APG-8 and -18)
AN/APG-20	S-Band Low Altitude Bomb Release Radar (improved AN/APG-6)
AN/APG-21	Ground-Ranging Radar
AN/APG-22	X-Band Gun Sight Radar; manufactured by Raytheon used with Mk.18/23 Lead-Computing Gun Sights
AN/APG-23	Weapons System Radar used in B-36A
AN/APG-24	Weapons System Radar used in B-36B
AN/APG-25	X-Band Gun Tracking Radar used in F-100
AN/APG-26	Weapons System Tracking Radar; manufactured by Westinghouse used in F3D
AN/APG-27	Tail Gun Radar used in XB-46 and XB-48
AN/APG-28	Intercept Radar (modified AN/APG-1) used in F-82F
AN/APG-29	Night/All-Weather Fighter Fire-Control Radar (for Type D-1 Fire-Control System)
AN/APG-30	X-Band Fire Control Radar; manufactured by Sperry used in B-45, B-57, F-4E, F-8A, F-84E, F-86A (final blocks only), F-86E/F, F-100, FJ-2, F2H-2
AN/APG-31	Gun Laying Radar; manufactured by Raytheon used in B-57
AN/APG-32	X-Band Tail Turret Autotrack Radar; manufactured by General Electric used in B-36D/F, B-47E

AN/APG-33	X-Band Fire Control Radar; manufactured by Hughes used in TB-25K, F-94A/B, F-89A
AN/APG-34	Computing Radar Gunfight used in F-104C
AN/APG-35	Radar used in F3D
AN/APG-36	Search Radar used in F2H-2N, F-86D (replaced by AN/APG-37)
AN/APG-37	Search Radar; manufactured by Hughes used in F-86D/K/L, F2H-4
AN/APG-39	Gun Laying Radar used in B-47E
AN/APG-40	Fire Control Radar; manufactured by Hughes used in TB-25M, F-94C, F-89D, CF-100 (Canada)
AN/APG-41	Tail Gun Radar (twin radomes); manufactured by General Electric used in B-36H
AN/APG-43	Continuous Wave Interception Radar; manufactured by Raytheon
AN/APG-45	Fire-Control Radar (miniaturized AN/APG-30); manufactured by General Electric; intended for patrol aircraft gun turrets
AN/APG-46	Fire-Control Radar; tested in A-6A
AN/APG-48	Airborne Fire-Control System Mk.22
AN/APG-50	Intercept Radar used in F-4
AN/APG-51	Intercept Radar; manufactured by Hughes used in F3H-2, F3D
AN/APG-53	Weapons System Radar; manufactured by Stewart-Warner used in A-4
AN/APG-55	Pulse Doppler Intercept Radar; manufactured by Westinghouse
AN/APG-56	Fire Control Radar (similar to AN/APG-30) used in F-86 (only Australian models with A-4 gun sight)
AN/APG-57	Fire-Control Radar; manufactured by Gould
AN/APG-59	Pulse-Doppler Gunnery Radar; manufactured by Westinghouse; part of AN/AWG-10 used in F-4J
AN/APG-60	Doppler Radar; part of AN/AWG-11 used in F-4K
AN/APG-61	Fire-Control Radar; part of AN/AWG-12 used in F-4M
AN/APG-63	Pulse Doppler X-Band Fire Control Radar (AN/APG-63(V)2 is an AESA variant); manufactured by Raytheon (Hughes) used in F-15A/B/C/D/H/K
AN/APG-64	Fire-Control Radar (development of AN/APG-63); not produced

AN/APG-65	Pulse Doppler X-Band Multi-Mode Radar; manufactured by Raytheon (Hughes) used in F/A-18A/B, F-4 ICE/Peace Ikarus 2000, AV-8B+ (upgraded)
AN/APG-66	Pulse Doppler X-Band Multi-Mode Radar; manufactured by Northrop Grumman (Westinghouse) used in F-16A/B, F-4EJ (Japan), Hawk 200 (UK)
AN/APG-67	Pulse Doppler X-Band Multi-Mode Radar; manufactured by Lockheed Martin (General Electric) (Model G-200) used in F-20, A-50 (Korea), F-5-2000 (Taiwan), Ching Kuo (Taiwan)
AN/APG-68	Pulse Doppler X-Band Multi-Mode Radar (improved AN/APG-66); manufactured by Northrop Grumman (Westinghouse) used in F-16C/D-30/40/50
AN/APG-69	Radar Set; manufactured by Emerson used in F-5E, AV-8?
AN/APG-70	Pulse Doppler X-Band Multi-Mode Radar (upgrade of AN/APG-63); manufactured by Raytheon (Hughes) used in F-15C/D/E
AN/APG-71	Pulse Doppler X-Band Multi-Mode Radar; manufactured by Raytheon (Hughes) used in F-14D
AN/APG-73	Pulse Doppler X-Band Multi-Mode Radar (upgrade of AN/APG-65); manufactured by Raytheon (Hughes) used in F/A-18C/D/E/F
AN/APG-74	Pod-mounted Radar System; manufactured by Northrop Grumman (Norden)
AN/APG-76	Pulse Doppler Ku-Band Multi-Mode Radar; manufactured by Northrop Grumman (Norden) used in F-4E (Israel); tested in pod with F-16, S-3B
AN/APG-77	Pulse Doppler X-Band AESA (Active Electronically Scanned Array) Multi-Mode Radar; manufactured by Northrop Grumman/Raytheon used in F/A-22A
AN/APG-78	Fire Control Radar "Longbow"; manufactured by Northrop Grumman & Lockheed Martin used on mast in AH-64D, RAH-66, underwing on AH-1W/Z
AN/APG-79	AESA (Active Electronically Scanned Array) Multi-Mode Radar (based on AN/APG-73); manufactured by Raytheon used in F/A-18E/F/G as replacement for AN/APG-73

AN/APG-80	"Agile Beam Radar" AESA (Active Electronically Scanned Array) Multi-Mode Radar (based on AN/APG-68); manufactured by Northrop Grumman; intended for F-16E/F
AN/APG-81	AESA (Active Electronically Scanned Array) Radar planned for F-35
AN/APG-501	X-Band Ranging Radar used in F-86
AN/APG-T1	Radar Training Set for AN/APG-1

AN/APN - Airborne Navigation Radars

Model Number	Description
AN/APN-1	Radio Altimeter (improved AN/ARN-1) used in P-61, C-119, B-32, C-121, H-19, P-5, AF-2W, AD-5, F2H-2/2N/2P, F3D, F6F-5N, F9F, XF10F-1, P2V-4, PB4Y-2, PBM-5S, PBY-6A, R5C-1, R5D-2, R6D-1, SB2C-5, TBM-3S
AN/APN-2	"Rebecca" Radio Beacon used with AN/PPN-1, AN/TPN-2
AN/APN-3	SHORAN used with AN/CPN-2 used in B-45A
AN/APN-4	LORAN; manufactured by Philco used in B-29, B-32, C-47, C-54, C-117, C-121, P2V-4, PBM-5S, PBY-6A, PB4Y-2, R4Q-1, R6D-1
AN/APN-5	Radar Beacon Navigation Aid used in F-86
AN/APN-6	S-Band Beacon used with AN/PPN-10, AN/PPN-11
AN/APN-7	LORAN S-Band Beacon used with AN/APS-2
AN/APN-8	Radar Beacon
AN/APN-9	LORAN; manufactured by RCA used in B-29, B-32, RC-121, C-97 replaced AN/APN-4
AN/APN-10	"Rebecca" Interrogation Set
AN/APN-11	X-Band Beacon used with AN/APS-3/4/6/10/15/31/33 used in B-47, KC-97, XS-1
AN/APN-12	Rendezvous Radar (or 160-230 MHz "Rebecca" Interrogator) used in B-47, C-97
AN/APN-13	S-Band Beacon (improved AN/APN-7)
AN/APN-14	Navigation Aid
AN/APN-15	Low Level Altimeter Set; manufactured by Sperry used in B-52, CH-3C
AN/APN-16	Radar Beacon
AN/APN-18	Radar Beacon
AN/APN-19	"Rosebud" S-Band Beacon used in F-82D
AN/APN-20	Radar Beacon

AN/APN-21	Radar Beacon
AN/APN-22	Radar Altimeter; manufactured by Electronic Assistance Corp used in A-3, B-66, C-119, RC-121, C-130, RF-101C, OV-1, AD-5, P2V-5, R6D-1
AN/APN-23	Active Seeker used in KAY-1(XSAM-N-4)
AN/APN-24	Navigation Set
AN/APN-25	Doppler Navigator; manufactured by GPI
AN/APN-26	SG-Band (VHF) Beacon
AN/APN-29	SG-Band (VHF) Beacon
AN/APN-30	Radar Beacon
AN/APN-33	S-Band Beacon; replaced AN/APN-7 used in XSSM-N-8
AN/APN-34	Distance Measuring Radar used in C-97C, R6D-1
AN/APN-35	Radar Beacon
AN/APN-36	Radar Beacon
AN/APN-37	Radar Beacon
AN/APN-38	Radar Beacon
AN/APN-39	Radar Beacon
AN/APN-40	Radar Beacon
AN/APN-41	Missile Beacon for LTV-N-2 replaced AN/APN-33
AN/APN-42	Radar Altimeter used in WC-130, WB-47E, B-52
AN/APN-45	Tracking Radar Beacon used in DC-130A
AN/APN-46	Radar Beacon
AN/APN-47	Radar Beacon
AN/APN-48	Radar Beacon
AN/APN-49	Radar Beacon
AN/APN-50	Navigation Radar; manufactured by Sperry
AN/APN-52	Radar Set
AN/APN-54	Radar Beacon
AN/APN-55	Radar Beacon (for missiles)
AN/APN-56	Navigation Radar; manufactured by Gould
AN/APN-57	Ground Position Indicator
AN/APN-58	Navigation Radar; manufactured by Sperry
AN/APN-59	Search & Weather Radar; manufactured by Sperry used in C-130, C-135, B-57, C-133, C-141, KC-97
AN/APN-60	S-Band Beacon used in B-52
AN/APN-61	Radar Beacon used in XF-85

AN/APN-63	S-Band (Receive)/L-Band (Transmit) Beacon; manufactured by Melpar
AN/APN-66	Doppler Navigation Radar used in SM-62, B-47
AN/APN-67	Doppler Set used in P6M-1, NC-121 "Project Magnet", USN helicopters; tested in P-2
AN/APN-68	IFF Beacon used with AN/APX-6
AN/APN-69	X-Band Rendezvous Beacon used in B-47, B-52, C-97, RB-57D, KC-135 used with AN/APN-59
AN/APN-70	LORAN; manufactured by Dayton Aviation Radio & Equip Corp used in B-50, C-54, C-119, C-121, RC-121D, C-130, C-135, P-2, P-3A, T-29C/D, Z-1, R6D-1
AN/APN-71	Flare-Out Unit
AN/APN-75	Rendezvous Radar used in B-47
AN/APN-76	Rendezvous Radar; manufactured by Olympic used in KC-97, B-47B/E
AN/APN-77	Doppler Set used in SZ-1B, USN helicopters
AN/APN-78	Doppler Set used in helicopters
AN/APN-79	Doppler Set manufactured by Teledyne Ryan used in helicopters
AN/APN-81	Doppler Set used in RB/WB-66, WB-50, C-130, KC-135
AN/APN-82	Doppler Navigation Radar (combination of AN/APN-81 and AN/ASN-6) used in EB/RB/WB-66, KC-135
AN/APN-84	SHORAN Set; manufactured by Hazeltine used in RC-130A
AN/APN-85	Navigation Radar; manufactured by Hazeltine
AN/APN-89	Doppler Set; part of AN/ASQ-38 used in B-52E/G/H
AN/APN-90	Doppler Set
AN/APN-91	Tracking Beacon used in BQM-34C
AN/APN-92	Navigation Radar
AN/APN-96	Doppler Set
AN/APN-97	Doppler Set; manufactured by Ryan used in UH-2A, SH-3, SH-34J
AN/APN-99	Doppler Navigation Set (combination of AN/APN-81 and AN/ASN-7) used in B-52, AC-130A, KC-135
AN/APN-100	Radar Altimeter; manufactured by Litton used in CH-47A
AN/APN-101	Airborne Radar used in RF-4C, F-4E (possible confusion with AN/ARN-101)

AN/APN-102	Doppler Set; manufactured by GPI used in RB-47, WB-47E, RB-57F, WB-57F, F-100C/F, RF-101
AN/APN-103	Navigational Computer System
AN/APN-105	All-Weather Doppler Navigation System; manufactured by LFE used in F-105B/D, T-39B
AN/APN-107	Navigation Radar used in RB-57D
AN/APN-108	Doppler Set (derivative of AN/APN-89 with gyro components from AN/APN-81) used in B-52E
AN/APN-109	Altimeter; manufactured by Honeywell
AN/APN-110	Doppler Navigation Set used in B-58, F-100D/F, RF-101
AN/APN-113	Doppler Radar; part of AN/ASQ-42 used in B-58
AN/APN-114	Automatic Landing System used with AN/GSN-5; tested in TF-102
AN/APN-115	Navigation Radar; manufactured by General Electric
AN/APN-116	Doppler Set
AN/APN-117	Low-Level Radar Altimeter (in combination with AN/APN-22); manufactured by Electronic Assistance Corp used in A-6A, P-2, S-2, SH-3A, H-13H, CH-47A, HH-52, CH-53A
AN/APN-118	Doppler Navigation Set
AN/APN-119	Doppler Set
AN/APN-120	Radar Altimeter; planned for A-5, A-6A, but not produced
AN/APN-122	Doppler Navigation Set used in S-2, A-2, A-3, A-4, A-6, RA-5C, C-47, C-54, EC-121, E-2, TF-8, P-2, P-3, P-5
AN/APN-126	Doppler Set
AN/APN-127	Collision Warning System
AN/APN-128	Navigation Radar; manufactured by Teledyne used in C-130
AN/APN-129	Doppler Navigation System; manufactured by Teledyne used in OV-1A/B
AN/APN-130	Doppler Radar; manufactured by Teledyne Ryan used in UH-2, SH-3, SH-34J, CH-53D, Z-1
AN/APN-131	Doppler Navigation Radar used in F-105, T-39B, TF-8A
AN/APN-132	X-Band Beacon; manufactured by Motorola used in BQM-34A, QF-9G
AN/APN-133	High-Altitude Radar Altimeter (upgraded SCR-728) used in C-130, C-135

AN/APN-134	Ku-Band Beacon; manufactured by Bendix used in KC-135
AN/APN-135	X-Band Beacon (for in-flight refueling); manufactured by Bendix used in B-58
AN/APN-136	Ku-Band Beacon (for in-flight refueling); manufactured by Bendix used in B-58
AN/APN-140	Radar Altimeter
AN/APN-141	Low Altitude Radar Altimeter; manufactured by Bendix used in A/TA-4, A-6, A-7, C-2, C-130, C-141, E-2C, F-4, F-8, F-104, F-105, P-3, S-2, T-39, SH-3
AN/APN-142	Navigation Radar used in F-4C
AN/APN-144	Doppler Navigation Radar used in EC-121, VC-137
AN/APN-145	LORAN C Set used in RC-135D
AN/APN-146	Radar Altimeter
AN/APN-147	Doppler Navigation System; manufactured by Canadian Marconi used in AC-119, C-124C, C-130, WC-130B/E, RC-135A, WC-135B, C-135F, C-141
AN/APN-148	Doppler Navigation Radar used in F-105D/F
AN/APN-149	Terrain Avoidance Radar used in TF-8
AN/APN-150	Radar Altimeter used in CH-3C, B-52, C-130, EC-130E, C-135
AN/APN-151	LORAN C Receiver; manufactured by ITT used in RC-135B, C-141A, H-3
AN/APN-152	LORAN C Receiver
AN/APN-153	Doppler Navigation Radar used in A-6, A-4, EA-6A/B, A-7, C-130G, E-2, P-3A, S-2E
AN/APN-154	X-Band Beacon Augmenter (Tracking Beacon); manufactured by Motorola used with AN/TPB-1, AN/TPQ-10 used in A-4, A-7, F-14, A-6, AH-1T, H-46, CH-53
AN/APN-155	Low Altitude Radar Altimeter; manufactured by Stewart-Warner used in F-4
AN/APN-157	LORAN C Receiver; manufactured by ITT used in C-130, RC-135B, C-141, P-3C, EP-3E
AN/APN-158	Weather Radar; manufactured by Collins used in HC-123B, U-8F, U-21A, CV-2
AN/APN-159	Radar Altimeter; manufactured by Stewart-Warner used in RF-4
AN/APN-161	High-Resolution Mapping Radar; manufactured by Sperry used in C-130
AN/APN-162	manufactured by Canadian Marconi

AN/APN-163	Doppler Navigation System
AN/APN-165	Terrain-Following/Ground-Mapping Radar; manufactured by Texas Instruments used in OV-1
AN/APN-167	Radar Altimeter; manufactured by Honeywell used in F/FB-111A
AN/APN-168	Doppler Radar; manufactured by Canadian Marconi used with AN/AYA-3 used in CH-53A, OV-1
AN/APN-169	Station-Keeping Radar; manufactured by Sierra Research used in C-130, C-141
AN/APN-170	Terrain Following Radar; manufactured by General Dynamics; tested in A-4C, B-52, B-58
AN/APN-171	Radar Altimeter; manufactured by Honeywell used in C-130, E-2C, SH-2F, SH-3H, OH-6A, CH-46, CH-53
AN/APN-172	Doppler Set; manufactured by Marconi used with AN/ASN-73 used in HH-53C, CH-53G
AN/APN-174	Station-Keeping Subsystem; manufactured by Teledyne used in CH-46, CH-53
AN/APN-175	Doppler Radar used in C-130, CH-3B, HH-3E, MH-53
AN/APN-176	Radar Altimeter; manufactured by Texas Instruments used in FB-111A
AN/APN-177	Doppler Altimeter
AN/APN-178	Navigation Radar; manufactured by Sierra used in C-130
AN/APN-179	Doppler Navigation Radar; manufactured by Bendix used in EC-47
AN/APN-180	LORAN A Automatic Tracking Receiver used with AN/AYN-1 used in HH-3F
AN/APN-181	LORAN C/D Receiver
AN/APN-182	Doppler Radar Navigation System; manufactured by Ryan used with AN/AYK-2 used in SH-3H, CH-46, HH-46A/D, SH-2D, UH-2C, RH-53
AN/APN-184	Radar Altimeter; manufactured by Bendix used in C-130, Hawker P-1127 (UK)
AN/APN-185	Doppler Navigation Radar; manufactured by Singer-Kearfott used in FB-111A, A-7D, B-1A
AN/APN-186	Doppler System; tested in A-6 ILAAS (AN/ASQ-116)
AN/APN-187	Doppler Navigation Radar; manufactured by Singer-Kearfott used in P-3

AN/APN-189	Doppler Navigation Radar; manufactured by Marconi used in F-111D
AN/APN-190	Doppler Radar; manufactured by Singer-Kearfott used in A-7, AC-130E, F-111
AN/APN-191	Radar Altimeter used in A-7D
AN/APN-192	Short-Pulse Radar Altimeter; manufactured by Teledyne used in CH-47
AN/APN-193	Doppler Velocity Sensor; manufactured by Ryan
AN/APN-194	Radar Altimeter; manufactured by Honeywell used in F-14, A-6E, AH-1W, HH-60H, EA-6B, AV-8B, C-2A, P-3C, EP-3E, F/A-18, SH-60B/F, T-45A, TA-4J, TC-130G, S-3, A-4, A-7, A-10, B-1, TC-4C, QF-4, BQM-8D/F, MQM-8G, BQM-34S, AQM-34U, RGM/UGM-109B
AN/APN-195	Nose-Mounted Radar; manufactured by Collins used in SH-3D, HH-3E
AN/APN-196	Doppler Radar used in F-105
AN/APN-197	STATE Airborne Station; manufactured by Honeywell used with AN/TPN-21, AN/UPN-33; tested in C-123, C-131, T-39, CH-3
AN/APN-198	Radar Altimeter; manufactured by Honeywell used in F-104G, AV-8, Sea King (UK), Lynx (UK)
AN/APN-199	LORAN Receiver; manufactured by Collins used in C-5A
AN/APN-200	Doppler Velocity Sensor; manufactured by Teledyne used in B-1, E-3, S-3
AN/APN-201	Radar Altimeter; manufactured by Hoffman Electronics used in S-3
AN/APN-202	Radar Beacon; manufactured by Motorola used with AN/SPN-46 ACLS (Automatic Carrier Landing System) used in AV-8B, F/A-18, S-3, C-2, P-3C
AN/APN-203	Radar Altimeter; manufactured by Stewart-Warner used in T-43A
AN/APN-205	Doppler Radar; manufactured by Teledyne used in SH-2, SH-60B
AN/APN-206	Doppler Set used in B-1A
AN/APN-208	Doppler Navigation Radar; manufactured by Marconi used in HH-53H, Bell 412
AN/APN-209	Radar Altimeter; manufactured by Honeywell/Stewart-Warner used in AH-1F, UH-1V, CH-47D, OH-58C/D, H-60, T-43A
AN/APN-210	Doppler Set; manufactured by Singer used in CH-53G

AN/APN-211	Navigation Radar; manufactured by Teledyne-Ryan used in helicopters
AN/APN-213	Doppler Velocity Sensor; manufactured by Litton (Teledyne-Ryan) used in E-3; tested in KC-135
AN/APN-214	Radar Altimeter
AN/APN-215	Weather & Search Radar; manufactured by Bendix/King used in RU-38A, U-21, C-130
AN/APN-217	Doppler Radar Navigation Sensor; manufactured by Litton (Teledyne-Ryan) used in AH-1W, UH-1N, SH-2G, SH-3D, HH-3F, CH-46, CH-53E, MH-53E, RH-53D, HH-60H/J, SH-60B/F/J, V-22
AN/APN-218	Doppler Radar Navigation System; manufactured by Litton (Teledyne-Ryan) used in B-1B, B-52G/H, KC-135, C-130, F-111G
AN/APN-220	Doppler Radar; manufactured by Teledyne-Ryan
AN/APN-221	Doppler Radar (derived from AN/APN-208); manufactured by Marconi used in C-141, HH-53H, MH-53J
AN/APN-222	Radar Altimeter; manufactured by Honeywell used in C-130, E-6A
AN/APN-224	Radar Altimeter; manufactured by Honeywell used in B-52G/H, B-1B
AN/APN-227	Doppler Radar used in P-3C
AN/APN-230	Doppler Navigation Radar (improved AN/APN-218) used in B-1B
AN/APN-231	Radar Navigation System; manufactured by Teledyne-Ryan used in EA-6A
AN/APN-232	CARA (Combined Altitude Radar Altimeter); manufactured by Gould used in C-5, C-17, C-130, OC-135, C-141, F-16
AN/APN-233	Doppler Navigation Radar (developed from AN/APN-220); manufactured by Teledyne-Ryan used in C-2, OV-10D, CH-47, S-2, Alpha Jet (Germany), DHC-5
AN/APN-234	Weather and SAR Radar (Model RDR-1400C; improved AN/APN-215); manufactured by Telephonics (originally by Bendix/King) used in P-3, C-2
AN/APN-235	Doppler Navigation Set (development of AN/APN-221) used in HH-60A
AN/APN-236	Doppler Radar System; manufactured by Teledyne
AN/APN-237	Ku-Band Terrain-Following Radar; manufactured by Texas-Instruments; part of AN/AAQ-13

AN/APN-238	
AN/APN-239	Weather and SAR Radar (Model RDR-1400C, similar to AN/APN-234); manufactured by Telephonics (originally by Bendix/King) used in HH-60G, MH-60G
AN/APN-240	Station-Keeping System; manufactured by Sierra Research; replaced AN/APN-169
AN/APN-241	Weather & Navigation Radar; manufactured by Northrop Grumman (Westinghouse) used in C-130H/J, C-27J, HS-748 (Australia)
AN/APN-242	Weather & Navigation Radar; manufactured by Sperry; replacement for AN/APN-59
AN/APN-243	Station-Keeping Equipment; manufactured by Sierra Technologies used in C-17, C-130J
AN/APN-244	E-TCAS (Enhanced Traffic Alert Collision Avoidance System); manufactured by Honeywell (AlliedSignal) used in C-130E/H/J
AN/APN-245	Radar Beacon used with ACLS (Automatic Carrier Landing System) AN/SPN-46 used in F/A-18
AN/APN-501	Doppler Radar used in C-141(?)
AN/APN-503	Doppler Radar used in CP-121 (Canada)
AN/APN-509	Radar Altimeter
AN/APN-510	Doppler Navigation System used in CP-140 (Canada)
AN/APN-511	Radar Altimeter
AN/APN-512	Radar Altimeter used in CC-130E/H (Canada)
AN/APN-513	Doppler Radar Navigation Set used in CH-124A (Canada)
AN/APN-T6	Radar Interpretation Trainer
AN/APN-T8	Doppler System Trainer used with C-5
AN/APN-T10	Radar Trainer used with C-5

AN/APQ - Airborne Multipurpose/Special Radars

Model Number	Description
AN/APQ-1	Radar Jammer RT-26
AN/APQ-2	450-750 MHz High Power Barrage Jamming Transmitter "Rug"; manufactured by General Motors (Delco Div.) used in PB4Y-2
AN/APQ-3	S-Band Radar Receiver; later redesignated AN/APR-5

AN/APQ-4	Panoramic Radar Receiver; later redesignated AN/APR-6
AN/APQ-5	Low Level Radar Bombsight; manufactured by Western Electric used with AN/APS-2/3/15 used in B-24, B-25, B-32, PBJ, PBM
AN/APQ-7	X-BAND Search & Bombing Radar "Eagle Mk.1"; manufactured by Western Electric used in B-17, B-24, B-25J, B-29, B-32
AN/APQ-8	Deception Radar "Spoofer"
AN/APQ-9	475-585 MHz High Power Barrage Jamming Transmitter "Carpet III"; manufactured by General Motors (Delco Div.)
AN/APQ-10	X-Band High Altitude Bombing Radar "Eagle Mk.2"; manufactured by Western Electric used in B-29
AN/APQ-11	Torpedo Launching Radar (formerly SCR-626)
AN/APQ-12	Torpedo & Bombing Radar (formerly SCR-631)
AN/APQ-13	X-Band Bombing Radar "Mickey" (British equivalent is H2X); manufactured by Western Electric used in B-29, B-32
AN/APQ-14	Radar "Moth-1"
AN/APQ-15	88-162 MHz Radar Spoofing Transmitter "Moonshine"; manufactured by RRL
AN/APQ-16	Radar Bombing Aid
AN/APQ-17	Radar Jammer
AN/APQ-19	S-Band Search & Bombing Radar
AN/APQ-20	S-Band Radar Jammer; manufactured by RRL, Delmont Radio; uses AN/APA-41, AN/APR-10, AN/APT-10
AN/APQ-21	Countermeasures Set; similar to AN/SPT-7
AN/APQ-22	Radar System
AN/APQ-23	X-Band High Altitude Bombing Radar used in B-29
AN/APQ-24	K-1 Radar Navigation & Bombing System used in B-36B, B-45A, B-50, B-66B
AN/APQ-27	Radar Jamming System; uses AN/APT-16 (2x), AN/APR-9
AN/APQ-29	Radar Relay Set
AN/APQ-31	Bombing & Navigation Radar
AN/APQ-32	RT-119 Radar Jammer
AN/APQ-33	Countermeasures Set used in AC-119K

AN/APQ-34	K-Band Bombing Radar; manufactured by Western Electric
AN/APQ-35	X-Band Search, Fire Control & Tail-Warning Radar (components are AN/APS-21, AN/APS-28, AN/APG-26); manufactured by Westinghouse used in F3D, F2H, F3H
AN/APQ-36	Search & Acquisition Radar; manufactured by Westinghouse used in F3D-2M, F7U-3M
AN/APQ-39	Weather Radar(?) used in B-52D
AN/APQ-41	X-Band Search & Intercept Radar (improved AN/APQ-35); manufactured by Westinghouse used in F3D-2, F2H-3
AN/APQ-43	Multipurpose Radar; designated AI22 in UK used in Javelin FAW.2/6 (UK)
AN/APQ-46	Radar Set; proposed for F3D-3
AN/APQ-50	X-Band Fighter Interceptor Radar; manufactured by Westinghouse used in F-4, F3H, F4D; planned for F12F
AN/APQ-51	X-Band Missile Radar; manufactured by Sperry used in F3H, F7U
AN/APQ-54	Chronograph Set (projectile velocity measuring equipment)
AN/APQ-55	K-Band Side-Looking Radar used in RF-4C
AN/APQ-56	Side-Looking, Real-Aperture Radar; manufactured by Westinghouse used in RB-57D, RB-47
AN/APQ-57	Millimeter-Wavelength Navigation Radar
AN/APQ-58	Millimeter-Wavelength Navigation Radar
AN/APQ-59	Side-Looking Airborne Radar; manufactured by Westinghouse
AN/APQ-60	Missile Illumination Radar; manufactured by Raytheon
AN/APQ-62	Side-Looking Radar
AN/APQ-63	Radar
AN/APQ-64	Radar used in F5D with AAM-N-3/AIM-7B Sparrow II missile
AN/APQ-65	Interception Radar used in Aquilon 203 (French-built D.H. Vampire)
AN/APQ-67	Interception Radar; manufactured by Raytheon
AN/APQ-68	HIRAN used in RC-130A
AN/APQ-69	Experimental SLAR Pod for B-58; manufactured by Hughes

AN/APQ-70	Millimeter-Wavelength Navigation Radar
AN/APQ-72	X-Band Intercept Radar; manufactured by Westinghouse used in F-4 (replaced AN/APQ-50); tested in F3D
AN/APQ-73	Side-Looking Radar; planned for RS-70
AN/APQ-74	X-Band Missile Control Radar used with AN/APA-138, AN/APX-20, AN/APN-22
AN/APQ-81	Doppler Navigation Radar; manufactured by Northrop used in SM-62; planned for F6D and tested in A-3
AN/APQ-83	Fire-Control Radar; manufactured by Magnavox used in F-8D
AN/APQ-84	Radar used in F-8
AN/APQ-86	K-Band Side-Looking Surveillance & Mapping Radar; manufactured by Texas Instruments used in RL-23D, RU-8D
AN/APQ-88	Tracking Radar; manufactured by Naval Avionics used in A-6 (replaced by AN/APQ-112)
AN/APQ-89	Terrain Following Radar; tested in T-2
AN/APQ-92	Ku-Band Search Radar; manufactured by Norden used in A-6, EA-6B, AP-2H
AN/APQ-93	Synthetic-Aperture Ground-Mapping Radar
AN/APQ-94	Radar Set; manufactured by Magnavox used in F-8D/E, T-39D
AN/APQ-95	Collision Avoidance Radar used in helicopters
AN/APQ-96	Radar Set used in OV-10A
AN/APQ-97	K-Band Side-Looking Imaging Radar; manufactured by Westinghouse; tested in OV-1A, YEA-3, DC-6
AN/APQ-99	J-Band Forward-Looking Multipurpose Radar; manufactured by Texas Instruments used in A-7A, RF-4B/C, RF-101
AN/APQ-100	Search & Mapping Radar; manufactured by Westinghouse used in F-4C, RF-101
AN/APQ-101	Terrain Following Radar; manufactured by Texas Instruments
AN/APQ-102	Side-Looking Mapping Radar; manufactured by Goodyear used in RB-57, RF-4B/C
AN/APQ-103	Search Radar; manufactured by Norden used in EA-6A, A-6B
AN/APQ-104	Radar Set; manufactured by Magnavox (similar to AN/APQ-94 used in F-8E(FN)
AN/APQ-105	Distance Integrating Set used in RC-135

AN/APQ-107	Radar Altimeter Warning System used with AN/APN-117 used in CH-47A, P-3A/C, EP-3E, S-2, SH-3H
AN/APQ-108	Mapping Radar (SAR?); developed by Conductron used in SR-71
AN/APQ-109	Fire Control & Search Radar; manufactured by Westinghouse used in F-4C/D/E
AN/APQ-110	Ku-Band Terrain Following Radar; manufactured by Texas Instruments used in RF-4C, F/FB-111
AN/APQ-111	X-Band Altimeter-Recorder used with AN/ASQ-92 in KC-135
AN/APQ-112	Tracking Radar; manufactured by Norden used in A-6
AN/APQ-113	Ku-Band Search & Attack Radar; manufactured by General Electric used in F-111, F-5E
AN/APQ-114	Ku-Band Attack Radar; manufactured by General Electric used in F/FB-111A, F-4, F-5E
AN/APQ-115	Terrain Following Radar; manufactured by Texas Instruments used in "Combat Talon" C-130E, A-7A, F-111, RF-4C
AN/APQ-116	Terrain Following Radar; manufactured by Texas Instruments used in A-7A/B/C, C-130
AN/APQ-117	Terrain-Following & Attack Radar (development of AN/APQ-109) used in F-4D/E
AN/APQ-118	Terrain Following Radar; manufactured by Norden used in MH-53H, AH-56A
AN/APQ-119	Ground Mapping & Interception Radar (modified AN/APQ-113); manufactured by General Electric used in F-111A/D
AN/APQ-120	X-Band Fire Control Radar; manufactured by Westinghouse used in F-4D/E/F/G
AN/APQ-122	X-Band Multimode (Terrain Mapping/Target Locating/Navigation/Weather) Radar; manufactured by Raytheon (Texas Instruments) used in MC-130E/H, KC-135A, RC-135A/C, T-43A, C-130, E-4B
AN/APQ-123	used in F-111
AN/APQ-124	Navigation & Fire-Control Radar; manufactured by Magnavox used in F-8J
AN/APQ-125	Doppler Ranging Radar; manufactured by Magnavox used in F-8J
AN/APQ-126	J-Band Terrain Following Radar; manufactured by Raytheon (Texas Instruments) used in A-7D/E, T-39D, AC-130E, CH-53

AN/APQ-127	Forward Looking Radar; manufactured by Sperry-Rand used with AN/ASQ-116; tested in A-6
AN/APQ-128	J-Band Terrain Following Radar; manufactured by Sperry used in A-7D/E, F-111C/D
AN/APQ-129	Search Radar used in EA-6B
AN/APQ-130	Attack Radar; manufactured by Rockwell Autonetics used in F-111D
AN/APQ-131	Target Acquisition Radar; manufactured by Texas Instruments used in OP-2E
AN/APQ-133	X-Band Side Looking Tracking Radar; manufactured by Motorola used in AC-119K, C-130, AC-130
AN/APQ-134	Ku-Band Terrain Following Radar; manufactured by Texas Instruments used in F/FB-111A
AN/APQ-135	Sink-Rate Radar System used in A-4, F-4, F-8, C-130, CH-47
AN/APQ-136	Search Radar; manufactured by Texas Instruments used in AC-119K, AC-130A
AN/APQ-137	Moving Target Indicator Radar; manufactured by Emerson used in AH-1G
AN/APQ-138	Radar Set
AN/APQ-139	Ku-Band Multi-Mode Radar; manufactured by Texas Instruments used in B-57G
AN/APQ-140	J-Band Multi-Mode Scan Radar; manufactured by Raytheon (E-Systems); planned for B-1A; tested in KC-135
AN/APQ-141	Terrain Following Radar; manufactured by Norden used in AH-56, HH-53 Pave Low
AN/APQ-142	Surveillance Radar "Quick Look I" used in RV-1C
AN/APQ-144	Ku-Band Attack Radar (improved AN/APQ-113); manufactured by General Electric used in F-111F, FB-111A
AN/APQ-145	Mapping & Ranging Radar; manufactured by Stewart-Warner used in A-4E/F/N/S/SU
AN/APQ-146	Ku-Band Terrain Following Radar; manufactured by Texas Instruments used in F-111F
AN/APQ-148	J-Band Navigation & Attack Radar; manufactured by Norden used in A-6E, TC-4C
AN/APQ-149	Navigation & Fire Control Radar used in F-8
AN/APQ-150	Beacon Tracking Radar used in AC-130E/H

AN/APQ-152	Topographical Mapping Radar; manufactured by Goodyear used in RC-130
AN/APQ-153	I-Band Fire Control Radar; manufactured by System & Electronics Inc. (Emerson Electric) used in F-5E/F
AN/APQ-154	Terrain-Following Radar; manufactured by Texas Instruments used in HH-53C
AN/APQ-155	Strategic Radar; manufactured by Northrop Grumman (Norden) used with AN/ASQ-176 used in B-52H
AN/APQ-156	J-Band Navigation & Attack Radar (improved AN/APQ-148); manufactured by Northrop Grumman (Norden) used in A-6E, TC-4C
AN/APQ-157	I-Band Fire Control Radar (modified AN/APQ-153); manufactured by System & Electronics Inc. (Emerson Electric) used in F-5E/F
AN/APQ-158	Terrain Following Radar (improved AN/APQ-126); manufactured by Raytheon used in MH-53J
AN/APQ-159	I/J-Band Multipurpose Radar (improved AN/APQ-153); manufactured by System & Electronics Inc. (Emerson Electric) used in F-5E/F
AN/APQ-160	Attack Radar used in EF-111A
AN/APQ-161	Attack Radar; manufactured by General Electric used in F-111F
AN/APQ-162	Forward Looking Radar (development of AN/APQ-99?) used in RF-4C
AN/APQ-163	Forward Looking Radar; manufactured by General Electric used in B-1
AN/APQ-164	Pulse Doppler I-Band Multimode Radar; manufactured by Northrop Grumman (Westinghouse) used in B-1B
AN/APQ-165	Attack Radar; manufactured by Texas Instruments used in F-111C
AN/APQ-166	Strategic Radar used in B-52G/H
AN/APQ-167	Radar Set (development of AN/APQ-159); developed by ESCO used in T-47
AN/APQ-168	Multi-Mode Radar; manufactured by Raytheon (Texas Instruments) used in HH-60D, MH-60K; proposed for V-22
AN/APQ-169	J-Band Attack Radar (upgraded AN/APQ-165); manufactured by Lockheed Martin (General Electric) used in F-111C
AN/APQ-170	Terrain Following Radar; manufactured by System & Electronics used in MC-130H

AN/APQ-171	Attack & Terrain Following Radar (improved AN/APQ-128/146); manufactured by Raytheon (Texas Instruments) used in F-111C/F
AN/APQ-172	J-Band Terrain Following Radar (upgraded AN/APQ-99); manufactured by Raytheon (Texas Instruments) used in RF-4C
AN/APQ-173	Radar Set; manufactured by Norden; proposed for A-6F
AN/APQ-174	Multi-Mode Radar; manufactured by Raytheon used in MV-22, MH-60K, MH-47E; MH-53
AN/APQ-175	X/Ku-Band Multi-Mode Radar; manufactured by Systems & Electronics Inc. used in C-130E
AN/APQ-178	used in E-2C (developmental item only?)
AN/APQ-179	Control Indicator Set (Display System) used in E-2C
AN/APQ-180	Pulse Doppler Attack Radar (modification of AN/APG-70); manufactured by Raytheon (Hughes) used in AC-130U
AN/APQ-181	Synthetic Aperture J-Band Multi-Mode Radar; manufactured by Raytheon (Hughes) used in B-2A
AN/APQ-183	Multi-Mode Radar; manufactured by Northrop Grumman (Westinghouse); was planned for cancelled A-12A, a derivative was used in RQ-3A
AN/APQ-186	Multi-Mode Radar (improved AN/APQ-174); manufactured by Raytheon used in CV-22
AN/APQ-501	Radar Altitude Warning System used in CP-140?; replaced AN/APQ-107
AN/APQ-T1	Trainer for Aircraft Gun Laying Radar
AN/APQ-T10	Bombing/Navigation Simulator used with B-52D
AN/APQ-T11	Bombing/Navigation Radar Trainer used with B-47, B-52, B-58
AN/APQ-T12	Bombing/Navigation Radar Trainer used with B-47, B-52, KC-97, KC-135

AN/APS - Airborne Search & Detection Radars

Model Number	Description
AN/APS-1	X-Band Radar (conflicting references to purpose: either Mapping/Bombing or Tail-Warning)
AN/APS-2	S-Band Search Radar & Beacon used with AN/APQ-5 used in PBJ-1 (if w/o AN/APS-3), PBM-5S, PB4Y-2

AN/APS-3	X-Band Search & Bombing Radar used in PBJ-1, OA-10, PBY-6A, TBM-1D/3E, P-82F
AN/APS-4	X-Band Intercept Radar; manufactured by Western Electric used in C-47, C-117, P-38J, P-82D/F/H, AD, XBT2C-1, F4U-4E, F6F-3E/5E, SB2C-5, SBF-4E, TBF-3, TBM-3S; tested in JRB; British designation is AI Mk XV
AN/APS-5	Intercept Radar (development of AN/APS-4); manufactured by Western Electric used in F4U-4N
AN/APS-6	Intercept Radar (development of US Navy AIA radar); manufactured by Sperry used in P-38M, F2H-2N, F-82D, F6F-3N/5N, F7F-4N, F8F-1N/2N, F4U-4N/5N; tested in SNB-1
AN/APS-7	Search Radar (or Tail-Warning Radar?); manufactured by Westinghouse
AN/APS-8	Conflicting data! I have references for: ASW Search Radar used in P-2E wingtip pod; and Tracking Radar for KDB-1(MQM-39 used in AJ-2P
AN/APS-9	Search Radar used in FR-1N
AN/APS-10	X-Band Search Radar
AN/APS-11	Tail Warning Radar
AN/APS-12	Fire Control Radar
AN/APS-13	Tail Warning Radar used in P-38L, P-47D, P-51, P-61, P-63, P-82D, PBJ
AN/APS-14	Gun Laying Radar used in B-17, B-24
AN/APS-15	X-Band Bombing & Navigation Radar "Mickey" (equivalent to British "H2S"); manufactured by Philco used in B-29, PBM-3C/5/5E, B-17, B-24, PB4Y-2, PV-2, PBM-5S
AN/APS-16	L-Band Bomber Tail Warning Radar
AN/APS-17	S-Band Bomber Tail Warning Radar
AN/APS-18	Early Warning Radar (another source has this as Drone Radar used with AN/ARR-9)
AN/APS-19	X-Band Search & Intercept Radar; manufactured by Sperry used in AD-4N/5/6, F2H-2N, F4U-5N, F7F-4N, F8F-1N
AN/APS-20	S-Band Search & Early-Warning Radar; manufactured by Hazeltine/General Electric used with AN/ARW-35 and AN/ART-28 used in TBM-3W, WV-2, PB-1W, ZPG-2W(EZ-1), AF-2W, HR2S-1W, P-2, WB-29, RC-121C, Gannet (UK), Shackleton (UK)
AN/APS-21	Search Radar; manufactured by Westinghouse; part of AN/APQ-35 used in F3D, Meteor NF (UK)

AN/APS-23	Search Radar; manufactured by Western Electric; part of AN/ASB-3 used in B-36, B-45C, B-47E, XB-48, B-50, B-52, C-130, C-135
AN/APS-24	Radar Set used with System 416L
AN/APS-25	Search Radar used in XF10F-1
AN/APS-27	Search Radar used in B-52, RB-66, C-130, C-135
AN/APS-28	Search Radar used in F3D
AN/APS-29	Search Radar
AN/APS-30	Search Radar used in AF-2S
AN/APS-31	Search Radar; manufactured by Westinghouse used in P5M, PBM-3, A-1, P-2, U-16, AF-2S
AN/APS-32	Search Radar used in TBM-3
AN/APS-33	X-Band Search Radar used in S-2F, P4M, P2V-6, ZPG-1W, ZPK
AN/APS-34	Search Radar (similar to AN/APS-33)
AN/APS-35	Search & IFF Radar; manufactured by Philco?
AN/APS-37	Search Radar
AN/APS-38	Search Radar used in S-2
AN/APS-42	Weather Radar; manufactured by Bendix used in C-54, C-97, C-118, C-119, C-121, C-124, C-130, C-131
AN/APS-44	Search Radar used in PB4Y-2, P-5
AN/APS-45	Height-Finding Radar; manufactured by Texas Instruments used in WV-2(EC-121)
AN/APS-46	Interception Radar used in F2H-2N
AN/APS-48	Unattended Radar
AN/APS-49	Rapid Scan Search Radar; manufactured by Hazeltine used for ASW
AN/APS-50	Search Radar; planned for F11F-1, but not used
AN/APS-54	Tail-Warning Radar System; manufactured by ITT used in B-47B/E, B-52, B-57, EB-66B, F-101A/C, F-105D, "EF-101B" (Canada)
AN/APS-57	X-Band Search & Intercept Radar; manufactured by Western Electric used in Venom NF.3 (UK; designated AI Mk 21)
AN/APS-59	Search Radar used in CP-109 (Canada)
AN/APS-60	High-Altitude Mapping Radar used in NRB-57A
AN/APS-61	Monopulse Radar
AN/APS-62	Height-Finding Radar used in ZPG-2W/3W
AN/APS-63	Radar Set used in B-66, T-29, F-4C (tests?)

AN/APS-64	Search Radar used in WB-47E, B-52, RB-66B/C
AN/APS-67	Search Radar Set; manufactured by Magnavox used in F-8B, S-2
AN/APS-69	Height-Finding Radar used in ZPG-2W, P-2
AN/APS-70	Early-Warning Radar; manufactured by General Electric used in P2V-6, EC-121, EZ-1C
AN/APS-73	X-Band Synthetic Aperture Radar; manufactured by Goodyear used in experimental pod for B-58; tested in C-97, C-135, RF-4C; ground-component in AN/GSQ-28
AN/APS-75	"SABRE" High-Resolution X-Band Side-Looking Radar; manufactured by General Electric; under consideration for B-70
AN/APS-76	Search Radar used in EC-121
AN/APS-80	Maritime Surveillance Radar; manufactured by Texas Instruments used in E-1B, P-3A/B, NP-3D, P5M-2
AN/APS-81	Search Radar used in B-52
AN/APS-82	Early Warning/Aircraft Direction Radar; manufactured by Hazeltine used in EC-121L, E-1B, E-2; tested in SH-3G
AN/APS-84	Tracking Radar used with QB-47
AN/APS-85	Side-Looking Surveillance Radar; manufactured by Motorola used with RL-23D, RU-8D
AN/APS-87	Early Warning Radar (development of AN/APS-82)
AN/APS-88	Search Radar; manufactured by Texas Instruments used in HU-16B, S-2
AN/APS-91	Early Warning Radar used in E-2
AN/APS-92	Radar Warning Receiver used in F-105D
AN/APS-94	Side-Looking Airborne Surveillance & Mapping Radar; manufactured by Motorola used in OV-1B/D, P-2, P-3, EA-6A, UH-1 ALARM, B-26
AN/APS-95	Search & Warning Radar; manufactured by Hazeltine used in EC/RC-121
AN/APS-96	Air Surveillance Radar; manufactured by General Electric used in E-2A/B
AN/APS-103	Height Finding Radar used in EC/RC-121
AN/APS-104	Bombing/Navigation Radar System; part of AN/ASQ-48 used in B-52C/D
AN/APS-105	Radar Homing & Warning System; manufactured by Dalmo-Victor used in B-52

AN/APS-107	Radar Homing & Warning System; manufactured by Bendix used for targeting AGM-78 used in A-7D, F-105G, F-111A, F-4D; improved version tested in F-4E
AN/APS-108	Search Radar; manufactured by Motorola/Raytheon used in B-52D
AN/APS-109	Radar Homing & Warning System; manufactured by Dalmo-Victor used in F-111A/D/E/F, FB-111A
AN/APS-111	UHF Air Surveillance Radar (modified AN/APS-96); manufactured by Lockheed Martin (General Electric) used in E-2A
AN/APS-112	Early Warning Radar AWACS (development of AN/APS-59)
AN/APS-113	Weather Radar; manufactured by Bendix; manufactured by Bendix used in EC-47, UH-1
AN/APS-115	X-Band Sea Surveillance/ASW Radar; manufactured by Raytheon (Texas Instruments) used in P-3C, SH-2D
AN/APS-116	X-Band Sea Surveillance/ASW Radar; manufactured by Raytheon (Texas Instruments) used in EP-3E, S-3A, SH-3, CP-140 (Canada; Canadian version called AN/APS-506), P-3C (Australia); proposed for cancelled U-2EPX
AN/APS-117	TIAS (Target Identification & Acquisition System) for AGM-45 used in some A-4
AN/APS-118	TIAS (Target Identification & Acquisition System) for AGM-78; manufactured by IBM used in A-6B (Mod 1)
AN/APS-119	Weather Avoidance Search Radar used in HC-130B
AN/APS-120	Air Surveillance Radar; manufactured by General Electric used in E-2C
AN/APS-121	Radar Set
AN/APS-122	Search Radar used in YSH-2E
AN/APS-123	Search Radar used in S-2D
AN/APS-124	Sea Surveillance/ASW Radar; manufactured by Raytheon used in SH-60B, YSH-2E; tested in SH-3
AN/APS-125	Pulse Doppler UHF Air Surveillance Radar; manufactured by Lockheed Martin (General Electric) used in E-2C, EC-130V; replaced AN/APS-120
AN/APS-126	Surface Search Radar used in P-3

AN/APS-127	Raytheon Sea Surveillance Radar; manufactured by Raytheon used in HU-25A/B, Gulfstream III (Denmark)
AN/APS-128	Sea Surveillance Radar; manufactured by Telephonics used in E-9A, P-95 (Brazil), D.3B (Spain)
AN/APS-130	Multimode Search Radar (derivative of AN/APG-156); manufactured by Northrop Grumman (Norden) used in EA-6B
AN/APS-131	Sideways Looking Sea Surveillance Radar; manufactured by Motorola used in HU-25B, C-130
AN/APS-133	X-Band Multifunction Radar; manufactured by Allied Signal (Model RDR-1F) used in EA-6A, C-5, KC-10, C-17, EC-24A, VC-25, C-130, C-141, E-3, E-4, E-6, E-8
AN/APS-134	Multimode Search Radar; manufactured by Raytheon (Texas Instruments) used in P-3B, EP-3E, HC-130H, CP-140A (Canada; Canadian version called AN/APS-507), Atlantique (Germany/France), P-3K (New Zealand), Fokker 50 Mk 2 (Singapore), CN-235MPA (Brunei), P-3C (South Korea)
AN/APS-135	Side-Looking Airborne Surveillance Radar; manufactured by Motorola used in HC-130H
AN/APS-136	I-Band MTI Radar; planned for EH-60C
AN/APS-137	Pulse Doppler X-Band Sea Surveillance/ASW Radar; manufactured by Raytheon used in: - AN/APS-137(V)1: A-6E, S-3B - AN/APS-137(V)2: PHM2 Hydrofoil - AN/APS-137(V)3: P-3C - AN/APS-137(V)4: HC-130H - AN/APS-137(V)5: P-3C - AN/APS-137(V)6: ES-3A - AN/APS-137(V)?: EP-3E
AN/APS-138	Pulse Doppler UHF Air Surveillance Radar (upgraded AN/APS-125); manufactured by Lockheed Martin (General Electric) used in E-2C; planned for P-3AEW
AN/APS-139	Pulse Doppler UHF Air Surveillance Radar (upgraded AN/APS-138); manufactured by Lockheed Martin used in E-2C(Grp.I)
AN/APS-140	I/J-Band Multimode Surveillance Radar (US version of AN/APS-504); manufactured by Litton Canada

AN/APS-141	I/J-Band Multimode Surveillance Radar (US version of AN/APS-504(V)3); manufactured by Litton Canada
AN/APS-143	X-Band Sea Surveillance Radar "Ocean Eye"; manufactured by Telephonics used in E-9A, S-2E, HU-25, SH-60, SH-2G (Australia, New Zealand), and in aerostats
AN/APS-144	Pulse Doppler Ku-Band Land Surveillance Radar; manufactured by AIL used in EO-5, RQ-5A(BQM-155A); tested in C-27, UH-60A
AN/APS-145	Pulse Doppler UHF Air Surveillance Radar (upgraded AN/APS-139); manufactured by Lockheed Martin used in E-2C(Grp.II), EC-130V
AN/APS-146	manufactured by Northrop Grumman; intended for EA-6B
AN/APS-147	Multi-Mode Surveillance Radar; manufactured by Telephonics used in MH-60R
AN/APS-148	"SeaVue" Lightweight Multi-Platform Sea/Land Surveillance Radar; manufactured by Raytheon
AN/APS-149	Pod-Mounted Surveillance Radar used on P-3C (to provide targeting coordinates of mobile targets for the AGM-84H)
AN/APS-150	Sea Surveillance Radar; modified AN/APS-115 (or AN/APS-137?) for use with C-130; probably used on HC-130H
AN/APS-503	I-Band Multimode Surveillance Radar; manufactured by Litton Canada used in CH-124
AN/APS-504	I/J-Band Multimode Surveillance Radar (improved AN/APS-503); manufactured by Litton Canada used in EC/RC-26D (AN/APS-504(V)5), CP-121
AN/APS-505	Beacon-Equipped Multimode Radar
AN/APS-506	Maritime Surveillance Radar (Canadian version of AN/APS-116); manufactured by Raytheon (Texas Instruments) used in CP-140
AN/APS-507	Maritime Surveillance Radar (Canadian version of AN/APS-134); manufactured by Raytheon (Texas Instruments) used in CP-140A
AN/APS-509	Search Radar used in S-2T
AN/APS-T1	Air-to-Surface Vessel Radar Trainer
AN/APS-T2	Air-to-Surface Vessel Radar Trainer

AN/APY - Airborne Surveillance Radars

Model Number	Description

AN/APY-1	Pulse Doppler S-Band Air & Sea Surveillance Radar (AWACS); manufactured by Northrop Grumman used in E-3
AN/APY-2	Pulse Doppler S-Band Air & Sea Surveillance Radar (AWACS); manufactured by Northrop Grumman used in E-3
AN/APY-3	Sideways Looking Air-to-Ground Surveillance Radar (JSTARS); manufactured by Northrop Grumman used in E-8
AN/APY-6	Multi-Mode High Resolution Surveillance Radar; manufactured by Northrop Grumman; tested in NP-3C
AN/APY-7	Sideways Looking Air-to-Ground Surveillance Radar (improved AN/APY-3) used in E-8
AN/APY-8	"Lynx" SAR/GMTI (Synthetic Aperture Radar/Ground Moving Target Indicator); manufactured by General Atomics; tested in C-12, U-21 and others; planned for use in MQ-9A
AN/APY-9	UHF Air Surveillance Radar; manufactured by Lockheed Martin used in E-2D
AN/APY-10	Maritime Surveillance Radar; manufactured by Raytheon used in P-8A
AN/APY-12	"Phoenix" SAR (Synthetic Aperture Radar)
AN/APY-T1	RMTS (Radar Maintenance Training Set); part of E-3 AWACS MTS (Maintenance Training System)
AN/APY-T2	ARMTS (Advanced Radar Maintenance Training Set); part of E-3 AWACS MTS (Maintenance Training System)

7.3.3. Model’s Articulations Effect on RCS Data

Most man-made models (aircraft, tanks, trucks, etc.) have parts that can be articulated (flaps, turrets, rotating antennae, landing gears, etc). It is impractical to pre-compute and store within the CDB an RCS model for every possible position of those articulated parts taken individually. Instead, a CDB RCS model attribute provides the means to store an overall RCS variation effect, or otherwise called “scintillation effect”. The scintillation effect value is added to the RCS at run-time during movement of any of such articulated parts of the model. This is a parameter in the vector data attributes called “RCS_SCINT” and this attribute can be used by the radar client-devices at runtime to provide a correlated (but approximated) variation level of the model RCS while any of its parts are articulated.

For example, for a tank in the process of rotating its turret, the radar simulation client would take its overall RCS (based on aspect angles) and add the scintillation factor on the end-result RCS value to slightly alter the RCS to introduce the turning turret effect while the part is moving. While this adds an approximation factor on the RCS, it provides a coherent and correlated variation level to all clients using the RCS data set layer. The “RCS_SCINT” is therefore the value that represents a scaling factor of RCS noise that would be superimposed while the part is being articulated.

Annex A: Conformance Class Abstract Test Suite (Normative): OGC CDB Radar Cross Section (RCS)

This section describes conformance test for the OGC CDB Radar Cross Section model. These abstract test cases describe the conformance criteria for verifying the structure and content of any data store claiming conformance to this CDB Best Practice.

The conformance class id is “http://opengis.net/spec/CDB/1.0/core/lod-hierarchy/conf/” and all of the other conformance tests URLs are created in this path. Another issue that the reader should pay attention to is the test method. When the test method is assigned with “Visual”, it means that the purpose of the test should be “visually” investigate the file contents, image, or other content.

A.1. General RCS Implementation

The following conformance test is designed to determine if a RCS instance is a CDB implementation is a Shapefile.

Test identifier	/conf/core-radar/storage
Requirement	req/cdb-radar/storage
Dependency	Shapefile specification
Test purpose	Verify that the RCS model is stored as a series of Esri’s ShapeFiles in accordance with the Esri Shapefile Specification.
Test method	Visual inspection. Pass if verified
Test type	Conformance

A.2. Shapefile Point Vertices

This test determines that for each of those Shapefile point vertices, the X component represent the azimuth angle (equivalent to longitude) and the Y component represent the elevation angle (equivalent to latitude); the RCS value (and other attributes) are stored in the instance attributes within the DBF file.-azimuth.

Test identifier	/conf/core-radar/storage-vertices
Requirement	req/cdb-radar/storage-vertices
Dependency	Shapefile specification
Test purpose	Verify that point vertices follow the requirement for representing an RCS instance.
Test method	Visual inspection. Pass if verified
Test type	Conformance

A.3. Model Signature Significant Angle

Test to determine if the eight prescribed values for azimuth and elevation increments are used for specifying the Model Signature Significant Angle.

Test identifier	/conf/core-radar/storage-sig-angle
Requirement	req/cdb-radar/storage-sig-angle
Dependency	Table showing ModelSignature LOD level number and the ModelSignature Significant Angle
Test purpose	Verify that the 8 values are used
Test method	Check values against Table 7-1.
Test type	Conformance

A.4. RCS Attributes

Test for conformance that the RCS data for each distinct RCS representation model has two different types of attributes; RCS model class attributes and RCS instance attributes as defined below.

Test identifier	/conf/core-radar/attributes
Requirement	req/cdb-radar/attributes
Dependency	Rules defined in Section 7.3.1.1 of this document.
Test purpose	Verify that each distinct RCS representation model has two different types of attributes: RCS model class attributes and RCS instance attributes.
Test method	Check values against rules defined in Section 7.3.1.1.
Test type	Conformance

A.5. RCS Storage Files

Test that a single RCS model in the CDB data store consists of the data files.

- One *.shp main file that provides the geometric aspect (Points) for each data instance of a RCS model.
- Two *.dbf files (one instance-level on a per RCS Shape basis, and one class-level at the RCS model level) that collectively provide the attribution for all of the possible RCS models of a given RCS Model.
- One *.shx index file that stores the file offsets and content lengths for each of the records of the main *.shp file. The only purpose of this file is to provide a simple means for clients to step through the individual records of the *.shp file (i.e., it contains no CDB modeled data).

Test identifier	/conf/core-radar/storage-files
Requirement	req/cdb-radar/storage-files
Dependency	Shapefile specification

Test purpose	Verify that a single RCS model in the CDB data store consists of the data files: • One *.shp, • two *.dbf, and • one *.shx
Test method	Visual inspection.
Test type	Conformance

A.6. RCS Storage Files - Variant

Test that each variant of the RCS model in the Shapefile has a 10-character string attribute called “RCS_VARI”. The string may contain the specific Radar model number (and possibly its frequency band L-Band, S-Band, X-Band, Ku-Band) for which this RCS variant applies to. The suggested string convention for this field is as described in AN/APA to AN/APD - Equipment Listing. http://www.designation-systems.net/usmilav/jetds/an-apa2apd.html#_APA.

Test identifier	/conf/core-radar/rcs-vari
Requirement	req/cdb-radar/rcs-vari
Dependency	Shapefile specification and Reference as given above.
Test purpose	Verify that each variant of the RCS model in the Shapefile has a 10-character string attribute called "RCS_VARI"
Test method	Visual inspection.
Test type	Conformance

Annex B: Revision History

Date	Release	Editor	Primary clauses modified	Description
2016-02-06	Draft	C. Reed	Many	Ready for OAB review
2016-12-06	Vote version	C. Reed	Various	Generalize as many ShapeFile references as possible
2016-10-06	1.0	C. Reed	Various	Final edits for publication
2016-11-21	1.0	C. Reed		Ready for publication
2017-12-28	1,1	C. Reed	Various	Minor edits and changes to URI identifiers for 1.1.
2019-11-05	1.2	C. Reed	Various	Minor edits for version 1.2

Annex C: Bibliography