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MILITARY SPECIFICATION

ARC DIGITIZED RASTER GRAPHICS (ADRG)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. Scope

1.1 Scope. These specifications are designed to provide quidelines for the preparation and use of ARC Digitized Raster Graphics to support various weapons and mission support systems. ADRG are designed to provide a general purpose data set of support data and computer readable digital images of hardcopy graphic products.

1.2 Purpose. The purpose of this document is to specify the data format and characteristics of DMA ARC Digitized Raster Graphics (ADRG).

1.3 Security.

1.3.1 Security classification of specification. This product specification is UNCLASSIFIED

1.3.2 Security classification of product. CD-ROMs containing DMA ARC Digitized Raster Graphics shall carry the highest classification and restrictions determined for the original source graphic.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the current Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

MIL-STD-600010 "Standard Department of Defense DMA Stock Bar Coding".

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to : Director, Defense Mapping Agency, ATTN: PR, 8613 Lee Highway, Fairfax, VA 22031-2137 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

a. Map Projections - A Working Manual, U.S. Geological Survey Professional Paper 1395, First Edition, 1987.

b. DMA Technical Report, "Supplement to Department of Defense World Geodetic System 1984 Technical Report: Part II-Parameters Formulas and Graphics for the Practical Application of WGS 84", (DMA TR 8350.2-B), 1 December 1987 (Second Printing).

c. FIPSPUB 123 (ANSI/ISO 8211-1985) "Information Processing-specification for a Data Descriptive File for Information Interchange", 1985.

d. DMA Technical Instructions and Quality Requirements for Printing and Finishing of Jewel Case Liners & Information Booklets (Inserts) for Mapping, Charting and Geodetic (MC&G) Compact Disk Storage Media, DMA TI/2DJ/001.

(Copies of Map Projections - A Working Manual, are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-0001. Copies of DMA TR 8350.2-B, and DMA TI/2DJ/001 are available from the Director, Defense Mapping Agency, 8613 Lee Highway, Fairfax, VA 22031-2137. Copies of FIPSPUB 123 are available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

a. Phillips/Sony Red Book Specifications.

b. Phillips/Sony Yellow Book Specifications.

(Application for copies should be addressed to Sony Corporation of America, 5001 Forbes Boulevard, Lanham, MD 20706.)

c. International Standard Organization (ISO) 9660: International Standard. Information Processing - Volume and File Structure of CD-ROM for Information Interchange, 1988-04-15.

(Application for copies should be addressed to Global Engineering Documents, 2805 McGaw Ave., Irvine, CA 92714.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Accuracy.

3.1.1 Horizontal accuracy.

a. ADRG data collected from source graphics at scales of 1:100,000 or smaller will retain the horizontal accuracy of the original source graphic. The inaccuracy added as a result of digitization and transformation is negligible when compared to the error tolerances built into the original source graphic's horizontal accuracy figure.

b. Horizontal accuracy for ADRG data collected from source graphics at scales larger than 1:100,000 may be determined using the method detailed in the following: Coordinates of control points obtained from ADRG data will not deviate from the cartometrically derived coordinates of those points on the source graphics by more than twice the nominal sampling interval (i.e., the ground distance equivalent of 2 pixels) times the reciprocal scale of the graphic. Example: Locations of points in an ADRG at a scale of 1:50,000, sampled at a nominal 100 micron interval in both X and Y, will differ from the locations of those points on the source map by no more than 2 x 100 microns x 50,000 = 10 meters in both X and Y.

c. Nine out of ten points per graphic will fulfill the condition required in 3.1.1.b.

3.1.2 Vertical accuracy. Vertical accuracy is the same as that of the original source graphic.

3.1.3 Radiometric fidelity. The red, green and blue pixels of the ADRG are nearly exact representations of the colors printed on the hard copy source graphics. Color differences among maps and charts will not be removed. Output systems (e.g., CRT displays, printers), however, may not be able to faithfully reproduce the colors as depicted on the source graphics.

3.2 Datums.

3.2.1 Vertical datum. The vertical datum for ADRG data is the same as the vertical datum of the source graphic.

3.2.2 Horizontal datum. The horizontal datum for ADRG data is the World Geodetic System (WGS) 1984. ADRG data is converted from source graphic datum to WGS 84 using the Abridged Molodensky Formulas, transformation parameters, and reference ellipsoid parameter differences published in DMA Technical Report, "Supplement to Department of Defense World Geodetic System 1984 Technical Report: Part II - Parameters, Formulas, and Graphics for the Practical Application of WGS 84".

3.3 Product description.

3.3.1 Exchange medium. The exchange medium for ADRG is a compact disk - read only memory (CD-ROM). The volume and file structure of the CD-ROM conforms to Level 1 of International Standard ISO 9660. The contents of ADRG files are formatted to conform to FIPSPUB 123 (International Standard ISO 8211).

3.3.2 Digitized graphics. To digitally replicate the multiple colors present on many of the DMA hard copy graphic products, each multicolor graphic is scanned at a nominal collection interval of 100 microns (254 lines and samples per inch) into its red, green, and blue (RGB) components. The results are three separate raster images (one each for red, green, and blue) that, when combined, provide a multicolor digital replica of the original hard copy graphic product.

3.3.3 Equal arc-second raster chart/map (ARC) system. The ARC system provides a rectangular coordinate and projection system at any scale for the entire ellipsoid based on the World Geodetic System 1984 (WGS 84). ARC Digitized Raster Graphics (ADRG) are digitized graphics transformed into the ARC system and accompanied by ASCII encoded support files.

3.3.4 Distribution rectangles. For distribution ADRG data is divided into geographic data sets referred to throughout this document as Distribution Rectangles (DRs). One or more DRs fit onto a single CD-ROM. The boundary of a DR is the minimum bounding rectangle that encloses all input source graphics contained in the DR. (See figures 18-21.)

3.3.5 ADRG source graphics. One or more source graphics are placed into each DR. A source graphic is normally a sheet. However, in some instances a sheet will be split into two or more source graphics. Circumstances causing a sheet to be treated as multiple sources include sheets with insets, sheets too large to scan at one time, sheets with multiple datums, and sheets with special processing requirements. Source graphic unique margin information, accuracy information, and ancillary data is provided for each source graphic.

3.3.6 ADRG image data. ADRG is designed to be seamless. Raster graphic data from adjacent DRs abuts exactly to provide unbroken coverage. However, gaps in coverage may occur as a result of datum transformations and incomplete source graphic coverage. Gaps can occur within a DR, and between DRs. Datum differences between source graphics can also cause overlap between adjacent DRs. Overlap may also occur with maps such as 1:50,000 Topographic Line Maps where series coverage is country oriented. Each country series will be as seamless as possible, but overlap between country series may occur along borders.

3.3.7 Data organization. ADRG data files are arranged hierarchically. The top level of the hierarchy contains information relevant to the entire CD-ROM volume. The second level contains DR related files, and the bottom level contains source graphic related files. (See figure 33).

a. Each ADRG volume contains a header file, TRANSH01.THF, and a color test patch image file, TESTPA01.CPH. There will also be one or more DR subdirectories.

b. Each DR subdirectory contains a general information file, ('.GEN' extension on file name), a quality file ('.QAL' extension), and a reduced resolution overview image file ('.OVR' extension). There will be one or more ADRG image files ('.IMG' extension) and one or more source graphic subdirectories.

c. Each source graphic subdirectory contains a source graphic information file ('.SOU extension) and zero or more legend image files ('.Lgg' extension, where gg is as defined in paragraph 3.11.2.c).

3.4 ARC system.

3.4.1 Latitudinal bands/zones. The ARC system divides the surface of the ellipsoid into 18 latitudinal bands called zones with zones 1-9 covering the Northern hemisphere and zones 10-18 covering the Southern hemisphere. One zone in each hemisphere covers the polar area. Each non-polar zone covers a part of the ellipsoid between two latitude limits and completely encircles the Earth. (See figure 22 and table I.)

3.4.2 Zone overlap. Each non-polar zone overlaps the next zone poleward by 1024 rows of pixels, thus duplicating coverage of 1024 rows of the next zone. The poleward latitude limit of a non-polar zone will therefore depend on the scale of data portrayed in that zone. (See figure 23.)

3.4.3 Pixel spacing. In the non-polar zones pixel spacing is nominally 100 microns in both the East-West and North-South directions on the WGS 84 ellipsoid at the scale of the chart or map. In the polar zones pixel spacing is nominally 100 microns in both *X* and *Y* axes of the Azimuthal Equidistant projection, polar aspect, using the spherical form with radius taken to be the WGS 84 semimajor axis (a) at chart or map scale. The nominal spacing approximates a 100 micron sample interval of the source graphic, but spacing variations occur due to the projection and datum used for the source. Within a non-polar zone pixel spacing is fixed in units of arc-seconds of latitude per pixel and arc-seconds of longitude per pixel. Within a polar zone pixel spacing is fixed in units on the *X* and *Y* axes of the polar projection.

a. The east-west pixel spacing for non-polar zones is determined by the scale of the data and the zone in which that data falls. The east-west pixel spacing constant A_{sz} gives the number of pixels per 360 degrees longitude for scale S and zone Z.

b. The north-south pixel spacing in non-polar zones is determined by the scale of the data and applies to all zones. The north-south pixel spacing constant B_s gives the number of pixels per 360 degrees latitude for scale S.

c. Polar zone pixel spacing is defined along the 0° meridian and the 90° meridian (which align with the *X* and *Y* axes of the polar projection reference system). It is the same for both the *X* and *Y* axes. The pixel spacing constants A_{sz} and B_s are defined with $A_{sz}=B_s$ and give the number of pixels per 360 degrees along the *X* and *Y* axes.

d. Appropriate pixel spacing constants A_{sz} and B_s are provided for each ADRG image, and may be used to scale pixel coordinates to WGS 84 coordinates. The A_{sz} and B_s values provided are specific to the scale $_s$ and zone $_z$ of the data in the image.

3.4.4 Zone limits. Additional information about the ARC system may be found in the Appendix, section 80.

TABLE I. ARC system zones for ADRG data.

Zone Limits in Degrees of Latitude (WGS 84)		
Zones	Equatorward	Poleward
1,10	0	32 + overlap
2,11	32	48 + overlap
3,12	48	56 + overlap
4,13	56	64 + overlap
5,14	64	68 + overlap
6,15	68	72 + overlap
7,16	72	76 + overlap
8,17	76	80 + overlap
9,18	80	90

3.5 ADRG zones.

3.5.1 Zone distribution rectangles. At latitudes defined by the ARC system zone limits, the raster data for a DR is divided into images called Zone Distribution Rectangles (ZDRs). There is one ZDR for each ARC system zone covering any part of the DR; the ZDR depicts all the DR data that falls within that zone's limits. A DR covered by only one zone will thus contain a single ZDR; a DR covered by more than one zone will contain more than one ZDR. Note that a DR which is fully covered by one zone but which lies at the equatorward limit of that zone is also covered by the overlap portion of the adjoining equatorward zone and will contain two ZDRs (one depicting the entire DR and a second depicting that part of the DR covered by the adjoining zone's overlap). (See figures 24 and 25.)

3.5.2 Raster image file. Each ZDR will be stored on the CD-ROM as a single raster image file. Included are all raster data for a DR from a single ARC system zone, together with Black pixel padding needed to satisfy image format requirements.

3.6 ZDR coordinates.

3.6.1 Non-polar coordinates. Coordinates in a ZDR in non-polar zones are proportional to WGS 84 latitude and longitude under the Equirectangular projection (as defined in *Map Projections—A Working Manual*, U.S. Geological Survey Professional Paper 1395, First Edition, 1987, page 90). Thus row and column coordinates of each pixel transform to latitude and longitude coordinates respectively by a "scale and translate" operation. Scale and offset values are provided in the ZDR support data. (See figure 25.)

3.6.2 Polar coordinates. Coordinates in a polar ZDR are proportional to the rectangular coordinates of the Azimuthal Equidistant projection, polar aspect, spherical form (as defined in *Map Projections-A Working Manual*, U.S. Geological Survey Professional Paper 1395, First Edition, 1987, page 191), using the WGS 84 ellipsoid semimajor axis (a) as the radius. Thus row and column coordinates transform respectively to polar projection Y and X coordinates by a "scale and translate" operation; WGS 84 latitude and longitude are derived using the Polar projection equations. Scale and offset values are provided in the ZDR support data to derive the Y and X values. (See figure 26.)

3.6.3 WGS 84 coordinates. WGS 84 coordinates λ (longitude) and ϕ (latitude) are signed values in an ADRG with $-180° \leq \lambda \leq +180°$ and $-90° \leq \phi \leq +90°$.

3.6.4 Pixel coordinates. Equations relating pixel coordinates in the ZDR images to WGS 84 coordinates are given in the Appendix, section 30.

3.7 ADRG projection distortion.

3.7.1 Projection distortion. Transformation into ARC zones involves a modest distortion due to the projections used. This distortion is apparent when the DR images are viewed or printed directly in a rectangular format. Additional information about projection distortion may be found in Appendix, paragraph 80.3.

3.7.2 Non-polar zone distortion. In each non-polar zone distortion is seen as a stretch (at the poleward limit) or shrink (at the equatorward limit) in the East-West direction. There is no distortion along a parallel near the center of each zone. The stretch or shrink does not exceed 18%, exclusive of the overlap extent. Stretch in the overlap area is typically less than 25%.

3.7.3 Polar zone distortion. Distortion in the polar zones is less than 10%.

3.8 Image formats.

3.8.1 Images. ADRG images include a test patch, DR overview images, ZDR images, and legend images. All images use the same data format.

a. The test patch image portrays a set of standard colors, which may be used to adjust a video monitor for more accurate color viewing of the ADRG data.

b. Each overview image presents a 16:1 reduction of a DR. The ZDRs in a DR are resampled to a common reduced pixel spacing and merged into a single, continuous image of the DR. The reduction retains the ARC system projection of the data. If multiple DRs are present, each will have a separate overview image. Scale and offset parameters are provided to permit computation of geographic coordinates corresponding to pixel locations in the overview image. The A and B values for the overview are the A and B values of the equatormost zone in the DR, divided by 16.

c. Each ZDR image portrays digital map data under the ARC system projections.

d. Each legend image is a rectangular patch taken from the margin of the source graphic showing data that is not readily encoded as text and is unique to the particular source graphic. Any legend or margin information that is common or standard in a series (such as road symbology) will NOT appear as a legend image. When a group of source graphics within a DR have legend or margin information in common that is not standard for the entire series, the legend image may be collected for only a representative sample of the source graphics in the DR due to space limitations on the CD-ROM.

3.8.2 Padding. Each image is padded using Black pixels (value zero in Red, Green, Blue component) to form a rectangle whose size is an integral multiple of 128 pixels in each of the row and column dimensions. Padding on the four sides of ZDR and overview images accommodates the global tiling format described below and in the Appendix, section 80. Test patch and legend images are padded along the right and bottom edges, if padding is required.

3.8.3 ADRG image tiling. On the CD-ROM each image is divided into tiles of size 128 by 128 pixels. The tiles of ZDRs and overviews are defined by a global tiling which is specific to the scale of data portrayed. Thus adjoining ZDRs or overviews in a common zone can be merged to form larger images without re-tiling or transforming the data. (See figures 27, 28 and the Appendix, paragraph 80.4)

3.8.4 Tile organization. Within each tile color pixels are organized in band sequential form with the red band followed by green followed by blue. Pixels are stored in row major order beginning with the tile's upper-left pixel of the red band, continuing across the top row of red pixels, then by rows from the top to bottom of the red band of the tile, left-to-right in each row, followed by the green and then the blue band pixels similarly. The tiles from one image are placed in the image file in row-major order, beginning with the upper-left tile of the image (where the "upper-left" tile of an ADRG image is the northwesternmost tile for a non-polar zone, or the "least X, greatest Y" tile for a polar zone), continuing across the top row of tiles, then by rows of tiles from top to bottom of the image, left-to-right in each row. (See figures 29 and 30.)

3.8.5 Tile index map. Full tiles of Black pixels are omitted from an image on the CD-ROM. Tiles containing non-Black pixels are placed into the image file in row-major order, as indicated above, but without leaving space for omitted tiles. A rectangular array of integers, the tile index map ($M_{c,r}$), is used to indicate which tiles are present. There is one row of integers in the tile map for each row of tiles in the image, and each integer in the row corresponds with a tile in the row of tiles in the image. The value of each entry $M_{c,r}$ indicates whether or not tile (c,r) of the image is present in the image file, and for a tile which is present, tells the tile's sequence position in the image file. $M_{c,r}$ is defined by:

$M_{c,r}$ = 0 , if tile (c,r) is omitted
$M_{c,r}$ = (sequence number > 0) , if tile (c,r) is present

When $M_{c,r} > 0$ the value $M_{c,r} - 1$ indicates how many tiles of stored data in the image file must be skipped to access the tile in column c , row r of the image. The tile index map is present only when tiles have been omitted from the image file. (See figure 31.)

3.8.6 Image support data. Support data for images is provided as follows:

a. The transmittal header file, TRANSH01.THF, contains image parameters and support data for the color control image file, TESTPA01.CPH.

b. Image parameters and support data for the overview and ZDR image files associated with a DR are contained in the general information ('.GEN') file for the DR.

c. Image parameters and support data for legend images are contained in the source file ('.SOU') associated with the source graphic from which the legend is derived.

3.9 Source support data.

3.9.1 Ancillary data. Each source graphic in a DR is described by source file ('.SOU'), which provides various ancillary data values describing the source graphic. This includes such items as source graphic classification, geographic boundary, and datum.

3.9.2 Metric Support Data (MSD). Polynomial coefficients and parameters are computed for each source graphic to support WGS 84 to source datum and source datum coordinate to projection space computations. These coefficients and parameters are called MSD. Appendix, section 30 provides guidance for the use of MSD.

3.10 Preparation of source material.

3.10.1 Source material. For maps and charts flat litho copies are preferred sources. Folded maps and charts are used only when flat litho copies are not available.

3.10.2 Update information. For product series that are supported by periodic updates, such as DMA Aeronautical Chart Updating Manual (CHUM), the update information will be graphically incorporated into the ADRG. Updated data will include selected obstruction and elevation information that may be a hazard to flight. (See figure 32 for added feature symbology examples).

Note: Graphic updates will be discontinued when computer readable versions of the periodic updates become widely available.

3.10.3 Maximum terrain elevation. All Maximum Terrain Elevation (MTE) values appearing on aeronautical charts will be converted to Maximum Elevation Figures (MEF). The changes will be represented by cross-hatching through the MTE value and placement of the MEF as close as possible to the crossed-out MTE value. The new MEF will be placed to cause the least obstruction of existing cartographic detail. (See figure 32 for an example of MTE/MEF conversion symbology).

3.11 Directory and file descriptions.

3.11.1 File description terminology.

a. File names. This specification provides two names for each file. The external name, by which the file is known in the ISO 9660 file structure,

is described in 3.11.2. A descriptive file name, provided in the ISO 8211 file control field, identifies the file type.

b. Records. ISO 8211 files are organized into records. The record names used in this specification do not appear in the file itself. However, the RECORD_ID_FIELD contents provide a means of identifying records.

c. Fields. Each record is subdivided into fields. Both the field name and field identifier tag appear in the ISO 8211 file.

d. Subfields. Subfields are elementary data items. Subfield labels appear in the ISO 8211 file.

e. Repetition/non-occurence. Some records, fields and subfields may repeat or are optional. Items marked with '*' may repeat, and those marked with '(o)' may not be present in the file.

3.11.2 Directory and file naming conventions. Directory and file names within the ISO 9660 file structure are given in figure 33 and use the codes discussed in the following paragraphs.

a. Each DR is assigned a unique code, ssccdd, where ss is the chart series code (see Appendix, section 70 for the chart series code), cc is the country code of source graphic number 01 in the DR and dd is the DR number on the CD-ROM, ranging sequentially from 01 through 99. DR directories and their files and subdirectories include the unique DR code (ssccdd) within their names.

b. Each ZDR is assigned a number zz, where zz ranges from 01 through 18 corresponding to the ARC zone number in which the image data exists. GEO_DATA_FILEs include the number (zz) within their names.

c. Each source graphic is assigned a number gg, where gg ranges from 01 through 99. The numbering of source graphics in each DR begins with 01 for the northwesternmost source graphic, and increases sequentially west to east, then north to south. Source directories and their files include the gg code within their names.

d. Each legend image is assigned an alphabetic code kk, where kk is one of the codes specified in Appendix, section 40. LEGEND_IMAGE_FILEs include the kk code within their names.

3.11.3 External/descriptive file names.

Descriptive Name	External Name
TRANSMITTAL_HEADER_FILE	TRANSH01.THF
TEST_PATCH_IMAGE_FILE	TESTPA01.CPH
GENERAL_INFORMATION_FILE	ssccdd01.GEN
QUALITY_FILE	ssccdd01.QAL
OVERVIEW_IMAGE_FILE	ssccdd01.OVR
GEO_DATA_FILE	ssccddzz.IMG
SOURCE_FILE	ssccddgg.SOU
LEGEND_IMAGE_FILE	ssccddkk.Lgg

3.12 Root directory. The root directory contains the TRANSMITTAL_HEADER_FILE, the TEST_PATCH_IMAGE_FILE, and one or more distribution rectangle (DR) subdirectories.

3.12.1 TRANSMITTAL_HEADER_FILE.

a. This file, named TRANSH01.THF on the CD-ROM, contains data describing the contents of the CD-ROM.

b. Records and fields.

```
TRANSMITTAL_DESCRIPTION_RECORD
     RECORD_ID_FIELD (tag 001)
     TRANSMITTAL_HEADER_FIELD (tag VDR)
     *DATA_SET_DESCRIPTION_FIELD (tag FDR)
SECURITY_AND_UPDATE_RECORD
     RECORD_ID_FIELD (tag 001)
     SECURITY_AND_RELEASE_FIELD (tag QSR)
     VOLUME_UP_TO_DATENESS_FIELD (tag QUV)
TEST_PATCH_DATA_RECORD
     RECORD_ID_FIELD (tag 001)
     *TEST_PATCH_IDENTIFIER_FIELD (tag CPS)
     TEST_PATCH_INFORMATION_FIELD (tag CPT)
     DATA_SET_PARAMETERS_FIELD (tag SPR)
     BAND_ID_FIELD (tag BDF)
TRANSMITTAL_FILENAMES_RECORD
     RECORD_ID_FIELD (tag 001)
     *TRANSMITTAL_FILENAMES_FIELD (tag VFF)
```

3.12.2 TEST_PATCH_IMAGE_FILE.

a. The test patch image is derived from a standard graphic arts color control patch. The test patch is provided as a standard which can be used by the user to evaluate the color images on the volume relative to the display device and the color control patch. The test patch image is contained in the file TESTPA01.CPH.

b. Records and fields.

```
IMAGE_RECORD_(TEST_PATCH)
     RECORD_ID_FIELD (tag 001)
     PADDING_FIELD (tag PAD)
     PIXEL_FIELD (tag SCN)
```

3.12.3 Distribution rectangle directory. A single CD-ROM contains one or more DRs. DR directories are given unique names of the form ssccdd01. Each DR directory contains a GENERAL_INFORMATION_FILE, a QUALITY_FILE, an OVERVIEW_IMAGE_FILE, one or more GEO_DATA_FILEs, and one or more source graphic subdirectories.

3.13 Distribution rectangle directory file descriptions.

3.13.1 GENERAL_INFORMATION_FILE.

a. The general information file contains support data for the overview and ZDR image(s) for the DR. The file name is the same as the directory name, with a filename extension of '.GEN'.

b. Records and fields.

```
DATA_SET_DESCRIPTION_RECORD
     RECORD_ID_FIELD (tag 001)
     DATA_SET_DESCRIPTION_FIELD (tag DRF)
OVERVIEW_RECORD
     RECORD_ID_FIELD (tag 001)
     DATA_SET_ID_FIELD (tag DSI)
     OVERVIEW_INFORMATION_FIELD (tag OVI)
     DATA_SET_PARAMETERS_FIELD(tag SPR)
     BAND_ID_FIELD (tag BDF)
     (c)TILE_INDEX_MAP_FIELD (tag TIM)
*GENERAL_INFORMATION_RECORD
     RECORD_ID_FIELD (tag 001)
     DATA_SET_ID_FIELD (tag DSI)
     GENERAL_INFORMATION_FIELD (tag GEN)
     DATA_SET_PARAMETERS_FIELD (tag SPR)
     BAND_ID_FIELD (tag BDF)
     (o)TILE_INDEX_MAP_FIELD (tag TIM)
```

3.13.2 QUALITY_FILE.

a. Quality data consists of the horizontal and vertical accuracies (absolute and relative) for a DR. Accuracies are given for one or more subregions, each of which is defined by a set of geographic coordinates. The quality data is contained in the file ssccdd01.QAL.

b. Records and fields.

```
QUALITY_RECORD
      RECORD_ID_FIELD (tag 001)
      SECURITY_AND_RELEASE_FIELD (tag QSR)
     UP_TO_DATENESS_FIELD (tag QUP)
*HORIZONTAL_ACCURACY_RECORD
      RECORD_ID_FIELD (tag 001)
      HORIZONTAL_ACCURACY_FIELD (tag ASH)
      BOUNDING_POLYGON_COORDINATES_FIELD (tag RCI)
*VERTICAL_ACCURACY_RECORD
      RECORD_ID_FIELD (tag 001)
      VERTICAL_ACCURACY_FIELD (tag ASV)
      BOUNDING_POLYGON_COORDINATES_FIELD (tag RCI)
```

3.13.3 OVERVIEW_IMAGE_FILE.

a. The overview image is a reduced resolution image of the DR. A tile index map is provided in the GENERAL_INFORMATION_FILE to indicate when tiles full of Black pixels have been omitted. The overview image file is named ssccdd01.OVR.

b. Records and fields.

IMAGE_RECORD_(OVERVIEW)
RECORD_ID_FIELD (tag 001)
PADDING_FIELD (tag PAD)
PIXEL_FIELD (tag SCN)

3.13.4 GEO_DATA_FILE.

a. The ZDR image contains that part of the DR data which falls within a zone. If a single DR spans multiple zones, it will contain multiple ZDRs. ZDR image files are named ssccddzz.IMG .

b. Records and fields.

IMAGE_RECORD_(ZDR)
RECORD_ID_FIELD (tag 001)
PADDING_FIELD (tag PAD)
PIXEL_FIELD (tag SCN)

3.13.5 Source directory. Images and data associated with each source graphic in the DR are stored in a subdirectory (below the DR directory). These source directories are given names of the form ssccddgg . Each source graphic directory contains a SOURCE_FILE, and zero or more LEGEND_IMAGE_FILEs.

3.14 Source directory file descriptions.

3.14.1 SOURCE_FILE.

a. The SOURCE_FILE name is the same as the source subdirectory name, with an extension of '.SOU'.

b. Records and fields.

SOURCE_RECORD
RECORD_ID_FIELD (tag 001)
SOURCE_SUMMARY_FIELD (tag SCF)
SOURCE_FIELD (tag SOR)
BOUNDING_POLYGON_COORDINATES_FIELD (tag BCI)
PROJECTION_FIELD (tag PRR)
SECURITY_AND_RELEASE_FIELD (tag QSR)
*(o)INSET_FIELD (tag INS)
COPYRIGHT_FIELD (tag CPY)
*(c)LEGEND_RECORD
RECORD_ID_FIELD (tag 001)

```
        LEGEND_DATA_FIELD (tag LGI)
        DATA_SET_PARAMETERS_FIELD (tag SPR)
        BAND_ID_FIELD (tag BDF)
        (o)TILE_INDEX_MAP_FIELD (tag TIM)
    METRIC_SUPPORT_DATA_RECORD
        RECORD_ID_FIELD (tag 001)
        NORMALIZATION_CONSTANTS_FIELD (tag NCD)
        SOURCE_DATUM_COEFFICIENTS_FIELD (tag SDC)
        MAP_PROJECTION_COEFFICIENTS_FIELD (tag MPC)
    (o)SUPPLEMENTAL_TEXT_RECORD
        RECORD_ID_FIELD (tag 001)
        *SUPPLEMENTAL_TEXT_FIELD (tag SUP)
```

3.14.2 LEGEND_IMAGE_FILE.

a. Each LEGEND_IMAGE_FILE contains an image of selected margin information. The LEGEND_IMAGE_FILE is named ssccddkk.Lgg.

b. Records and fields.

```
IMAGE_RECORD_(LEGEND)
        RECORD_ID_FIELD (tag 001)
        PADDING_FIELD (tag PAD)
        PIXEL_FIELD (tag SCN)
```

3.15 Data descriptions.

3.15.1 Description format. For each file type, identified by the internal file name, the records, fields, and subfields are listed. Each level is indented. Following each subfield label are the data type, the subfield size (in bytes), field contents (optional), and the subfield description.

a. Data types. A (alphanumeric), I (integer), R (explicit-point unscaled), and S (explicit-point scaled).

b. Contents. When filled in, the contents field will contain either a constant, a range of values, or a format template. 'SP' represents the ASCII code for space (Hex 20). Templates include 'YYYYMMDD' for year, month, day, and '±DDDMMSS.SS' for a signed geographic.

3.15.2 Subfield repetition. Repeating subfields are indicated by an '*'. All subfields from the '*' to the end of the field repeat.

3.16 Root directory files.

3.16.1 TRANSMITTAL_HEADER_FILE.

```
TRANSMITTAL_DESCRIPTION_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    VTH          Record type
    RID  A  2    01           Record ID number
```

```
  TRANSMITTAL_HEADER_FIELD (tag VDR)
    MSD  A  1    SP              Media recording standard (not used)
    VOO  A  200                  Free text, title and address of originator (A
                                 back slash (\) is used as a line separator.)
                                 Example:  Defense Mapping Agency\3200 S. Second
                                 St.\St. Louis, Missouri U.S.A.  63118-3399
    ADR  A  1    SP              Free text, title and address of addressee (not
                                 used)
    NOV  I  1    1               Number of media volumes comprising the data in this
                                 transmittal
    SQN  I  1    1               Volume sequence number
    NOF  I  3    001..999        Number of distribution rectangles appearing on
                                 this volume
    URF  A  16                   DMA stock number for this CD-ROM
    EDN  I  3    001..999        Edition number of volume
    DAT  A  12   017,YYYYMMDD    Publication date

  *DATA_SET_DESCRIPTION_FIELD (tag FDR)
    NAM  A  8    ssccdd01        Distribution rectangle name
    STR  I  1    3               Data structure type (3=Raster RGB)
    PRT  A  4    ADRG            Series designator
    SWO  A  11   ±DDDMMSS.SS     WGS 84 longitude of west edge of the DR  (-180° if
                                 either North or South pole is included in the DR)
    SWA  A  10   ±DDMMSS.SS      WGS 84 latitude of south edge of the DR  (-90° if
                                 South pole is included in the DR)
    NEO  A  11   ±DDDMMSS.SS     WGS 84 longitude or east edge of the DR  (+180° if
                                 either North or South pole is included in the DR)
    NEA  A  10   ±DDMMSS.SS      WGS 84 latitude of north edge of the DR  (+90° if
                                 North pole is included in the DR)

SECURITY_AND_UPDATE_RECORD
  RECORD_ID FIELD (tag 001)
    RTY  A  3    LCF             Record type
    RID  A  2    01              Record ID number

  SECURITY_AND_RELEASE_FIELD (tag QSR)
    QSS  A  1                    Security classification of the volume (T=Top Se-
                                 cret, S=Secret, C=Confidential, R=Restricted, and
                                 U=Unclassified)
    QOD  A  1    Y or N          Originating agency's determination required
    DAT  A  12   010,YYYYMMDD    Date of downgrading. If QOD is Y or QSS is U, then
                                 this subfield will contain SP.
    QLE  A  200                  Releasability statement

  VOLUME_UP_TO_DATENESS_FIELD (tag QUV)
    SRC  A  100                  Free text, ADRG Specification ID
    DAT  A  12   022,YYYYMMDD    ADRG Specification date
    SPA  A  20                   ADRG Specification amendment number

TEST_PATCH_DATA_RECORD
  RECORD_ID FIELD (tag 001)
    RTY  A  3    TPA             Record type
    RID  A  2    01              Record ID number
```

```
*TEST_PATCH_IDENTIFIER_FIELD (tag CPS)
  PNM  A  7                    Patch color name
  DWV  I  6                    Dominant wavelength in nanometers (if unavailable,
                               subfield will contain SP).
  REF  R  5                    Reflectance in percentage (if unavailable, subfield
                               will contain SP).
  PUR  R  5                    Purity in percentage (if unavailable, subfield
                               will contain SP).
  PIR  I  3    000..255        Patch color intensity value (Red)
  PIG  I  3    000..255        Patch color intensity value (Green)
  PIB  I  3    000..255        Patch color intensity value (Blue)

TEST_PATCH_INFORMATION_FIELD (tag CPT)
  STR  I  1    3               Data structure type (3=Raster RGB)
  SCR  A  100                  Free text, standard color patch reference identi-
                               fier

DATA_SET_PARAMETERS_FIELD (tag SPR)
```

Note: All ADRG images have a DATA_SET_PARAMETERS_FIELD. The constant values shown for subfields PNC, PNL, COD, ROD, POR, PCB AND PVB represent current requirements. Future requirements or coproduced ADRG may use different values.

```
  NUL  I  6                    Row number of upper right corner of image MBR (in
                               pixels)
  NUS  I  6                    Column number of upper right corner of image MBR
                               (in pixels)
  NLL  I  6                    Row number of lower left corner of image MBR (in
                               pixels)
  NLS  I  6                    Column number of lower left corner of image MBR (in
                               pixels)
  NFL  I  3                    Image height (in tiles)
  NFC  I  3                    Image width (in tiles)
  PNC  I  6    000128          Number of pixels per tile row
  PNL  I  6    000128          Number of rows per tile
  COD  I  1    0               Column direction (left to right)
  ROD  I  1    1               Row direction (top to bottom)
  POR  I  1    0               Pixel order (column in row in band in tile)
  PCB  I  1    0               Bits per pixel (not applicable)
  PVB  I  1    8               Bits per pixel value
  BAD  A  12   TEST PA01.CPH   TEST_PATCH_IMAGE_FILE name
  TIF  A  1    N               Tile index map flag (always N for color patch).

BAND_ID_FIELD (BDF)
  *BID A  5                    Band color
  WS1  I  5                    Lower band edge wavelength in nanometers
  WS2  I  5                    Upper band edge wavelength in nanometers

TRANSMITTAL_FILENAMES_RECORD
  RECORD_ID_FIELD (tag 001)
  RTY  A  3    TFN             Record type
  RID  A  2    01              Record ID number
```

```
  *TRANSMITTAL_FILENAMES_FIELD (tag VFF)
    VFF  A  51                  Path names for all directories and files on the
                                volume.  Slash (/) used to separate directory from
                                file names.
```

3.16.2 TEST_PATCH_IMAGE_FILE.

```
IMAGE_RECORD_(TEST_PATCH)
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    IMG            Record type
    RID  A  2    01             Record ID number

  PADDING_FIELD (tag PAD)
    PAD  A  Var  SP             Padding so that the image pixels start at the
                                beginning of a CD-ROM logical sector.

  PIXEL_FIELD (tag SCN)
    *PIX A  1                   Pixel value (unsigned 8 bit integer)
```

3.17 Distribution rectangle directory files.

3.17.1 GENERAL_INFORMATION_FILE.

```
DATA_SET_DESCRIPTION_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    DSS            Record type
    RID  A  2    01             Record ID number

  DATA_SET_DESCRIPTION_FIELD (tag DRF)
    NSH  I  2    01..99         Number of horizontal accuracy subregions
    NSV  I  2    01..99         Number of vertical accuracy subregions
    NOZ  I  2    01..99         Number of ZDR image files
    NOS  I  2    01..99         Number of source graphics

OVERVIEW_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    OVV            Record type
    RID  A  2    01             Record ID number

  DATA_SET-ID_FIELD (tag DSI)
    PRT  A  4    ADRG           Product type
    NAM  A  8    ssccdd01       Overview image name

  OVERVIEW_INFORMATION_FIELD (tag OVI)
    STR  I  1    3              Data structure type code (3=Raster RGB)
    ARV  I  8                   ARC value A'' (adjusted for scale and zone)
    BRV  I  8                   ARC value B' (adjusted for scale)
    LSO  A  11   ±DDDMMSS.SS    Longitude of upper left corner of the overview
                                image
    PSO  A  10   ±DDMMSS.SS     Latitude of upper left corner of the overview image
```

DATA_SET_PARAMETERS_FIELD (tag SPR)

Note: All ADRG images have a DATA_SET_PARAMETERS_FIELD. The constant values shown for subfields PNC, PNL, COD, ROD, POR, PCB AND PVB represent current requirements. Future requirements or coproduced ADRG may use different values.

NUL	I	6		Row number of the upper right corner of overview image MBR (in pixels)
US	I	6		Column number of the upper right corner of overview image (in pixels)
NLL	I	6		Row number of the lower left corner of overview image (in pixels)
NLS	I	6		Column number of the lower left corner of overview image (in pixels)
NFL	I	3		Image height (in tiles)
NFC	I	3		Image width (in tiles)
PNC	I	6	000128	Number of pixels per tile row
PNL	I	6	000128	Number of rows per tile
COD	I	1	0	Column direction (left to right)
ROD	I	1	1	Row direction (top to bottom)
POR	I	1	0	Pixel order (column in row in band in tile)
PCB	I	1	0	Bits per pixel (not applicable)
PVB	I	1	8	Bits per pixel value
BAD	A	12	ssccdd01.OVR	OVERVIEW_IMAGE_FILE name (external)
TIF	A	1	Y or N	Tile index map flag (Y indicates there are tiles with no data; N indicates that all tiles contain RGB graphic data.)

BAND_ID_FIELD (tag BDF)

*BID	A	5		Band color
WS1	I	5		Lower band edge wavelength in nanometers
WS2	I	5		Upper band edge wavelength in nanometers

TILE_INDEX_MAP_FIELD (tag TIM)

Note: This field appears only if the Tile Index Map Flag (TIF) above is "Y".

*TSI	I	5		Tile index map value

*GENERAL_INFORMATION_RECORD

RECORD_ID_FIELD (tag 001)

RTY	A	3	GIN	Record type
RID	A	2		Record ID number

DATA_SET-ID_FIELD (tag DSI)

PRI	A	4	ADRG	Product type
NAM	A	8	ssccddzz	ZDR image name

GENERAL_INFORMATION_FIELD (tag GEN)

STR	I	1	3	Data structure type code (3=Raster RGB)
DEN	R	6		Data density (E-W) [illegible] spacing.)

LAD	R	6		Data density (N-S) (see table III for nominal pixel spacing.)
UNIloa	I	3		Data density unit of measure
SWO	A	11	±DDDMMSS.SS	Longitude of the lower left corner of the extent of the unpadded ZDR image in WGS 84 coordinates
SWA	A	10	±DDMMSS.SS	Latitude of the lower left corner of the extent of the unpadded ZDR image in WGS 84 coordinates
NWO	A	11	±DDDMMSS.SS	Longitude of the upper left corner of the extent of the unpadded ZDR image in WGS 84 coordinates
NWA	A	10	±DDMMSS.SS	Latitude of the upper left corner of the extent of the unpadded ZDR image in WGS 84 coordinates
NEO	A	11	±DDDMMSS.SS	Longitude of the upper right corner of the extent of the unpadded ZDR image in WGS 84 coordinates
NEA	A	10	±DDMMSS.SS	Latitude of the upper right corner of the extent of the unpadded ZDR image in WGS 84 coordinates
SEO	A	11	±DDDMMSS.SS	Longitude of the lower right corner of the extent of the unpadded ZDR image in WGS 84 coordinates
SEA	A	10	±DDMMSS.SS	Latitude of the lower right corner of the extent of the unpadded ZDR image in WGS 84 coordinates
SCA	I	9		Source graphic scale reciprocal
ZNA	I	2	01..18	ARC zone number
PSP	R	5	100.0	Sample (pixel) spacing at capture (in microns)
IMR	A	1	N	Image rectified during scanning
ARV	I	8		ARC value A_{zz} (adjusted for scale and zone)
BRV	I	8		ARC value B_{s} (adjusted for scale)
LSO	A	11	±DDDMMSS.SS	Longitude of the upper left corner of the ZDR image in WGS 84 coordinates
PSO	A	10	±DDMMSS.SS	Latitude of the upper left corner of the ZDR image in WGS 84 coordinates
TXT	A	64		Free text (e.g., digitizing system description)

DATA_SET_PARAMETERS_FIELD (tag SPR)

Note: All ADRG images have a DATA_SET_PARAMETERS_FIELD. The constant values shown for subfields PNC, PNL, COD, ROD, POR, PCB AND PVB represent current requirements. Future requirements or coproduced ADRG may use different values.

NUL	I	6		Row number of the upper right corner of the ZDR image MBR (in pixels)
NUS	I	6		Column number of the upper right corner of the ZDR image MBR (in pixels)
NLL	I	6		Row number of the lower left corner of the ZDR image MBR (in pixels)
NLS	I	6		Column number of the lower left corner of the ZDR image MBR (in pixels)
NFL	I	3		Image height (in tiles)
NFC	I	3		Image width (in tiles)
PNC	I	6	000128	Number of pixels per tile row
PNL	I	6	000128	Number of rows per tile
COD	I	1	0	Column direction (left to right)
ROD	I	1	1	Row direction (top to bottom)

```
    POR  I  1    0              Pixel order (column in row in band in tile)
    PCB  I  1    0              Bits per pixel (not applicable)
    PVB  I  1    8              Bits per pixel value
    BAD  A  12   ssccddzz.IMG   GEO_DATA_FILE name (external)
    TIF  A  1    Y or N         Tile Index Map Flag (Y indicates there are tiles
                                with no data; N indicates that all tiles contain RGB
                                graphic data.)

  BAND_ID_FIELD (tag BDF)
    *BID A  5                   Band color
    WS1  I  5                   Lower band edge wavelength in nanometers
    WS2  I  5                   Upper band edge wavelength in nanometers

  TILE_INDEX_MAP_FIELD (tag TIM)

  Note: This field appears only if the Tile Index Map Flag (TIF) above is "Y".

    *TSI I  5                   Tile index map value (see paragraph 3.8.5 for a
                                definition of tile index map values.)
```

3.17.2 QUALITY_FILE.

```
QUALITY_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    QAL            Record type
    RID  A  2    01             Record ID number

  SECURITY_AND_RELEASE_FIELD (tag QSR)
    QSS  A  1                   Security classification of the DR: T = Top
                                Secret,S=Secret, C=Confidential, R=Restricted,
                                and U=Unclassified)
    QOD  A  1    Y or N         Originating Agency's determination is required
    DAT  A  12   010,YYYYMMDD   Date of downgrading (if QOD is Y or QSS is U, then
                                these subfield characters are SP.)
    QLE  A  200                 Releasability statement.

  UP_TO_DATENESS_FIELD (tag QUP)
    EDN  A  20                  Edition number of data set
    DAT  A  12   007,YYYYMMDD   Date of creation of data set
    DAT  A  12   024,YYYYMMDD   Date of revision or update
    REC  I  3                   Recompilation count
    REV  1  3                   Revision count
    SRC  A  100                 Free text, Specification Identification for ADRG
    DAT  A  12   022,YYYYMMDD   Date of ADRG Specification
    SPA  A  20                  ADRG Specification amendment number
    DAT  A  12   kkk,YYYYMMDD   Reserved for future use
    DAT  A  12   kkk,YYYYMMDD   Reserved for future use

*HORIZONTAL_ACCURACY_RECORD
    RTY  A  3    HOR            Record type
    RID  A  2                   Record ID number
```

```
  HORIZONTAL_ACCURACY_FIELD (tag ASH)
    AAH  I  5    00001..99999  Absolute Horizontal Accuracy (HA)
    UNIaah I 3                 Absolute HA unit of measurement
    APH  I  5    00001..99999  Relative Horizontal Accuracy (HA)
    UNIaph I 3                 Relative HA unit of measurement

  BOUNDING_POLYGON_COORDINATES_FIELD (tag RCI)
```

Note: Coordinate pairs repeat to define a region. Coordinates are ordered clockwise, and the first point is repeated for closure.

```
    *LON A  11   ±DDDMMSS.SS   WGS 84 longitude coordinate
     LAT A  10   ±DDMMSS.SS    WGS 84 latitude coordinate

*VERTICAL_ACCURACY_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    VER           Record type
    RID  A  2                  Record ID number

  VERTICAL_ACCURACY_FIELD (tag ASV)
    AAV  I  5    00001..99999  Absolute Vertical Accuracy (VA)
    UNIaav I 3                 Absolute VA unit of measurement
    APV  I  5    00001..99999  Relative Vertical Accuracy (VA)
    UNIapv I 3                 Relative VA unit of measurement

  BOUNDING_POLYGON_COORDINATES_FIELD (tag RCI)
```

Note: Coordinate pairs repeat to define a region. Coordinates are ordered clockwise, and the first point is repeated for closure.

```
    *LON A  11   ±DDDMMSS.SS   WGS 84 longitude coordinate
     LAT A  10   ±DDMMSS.SS    WGS 84 latitude coordinate
```

3.17.3 OVERVIEW_IMAGE_FILE.

```
IMAGE_RECORD_(OVERVIEW)
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    IMG           Record type
    RID  A  2    01            Record ID number

  PADDING_FIELD (tag PAD)
    PAD  A  Var  SP            Padding so that the image pixels start at the
                               beginning of a CD-ROM logical sector.

  PIXEL_FIELD (tag SCN)
    *PIX A  1                  Pixel value (unsigned 8-bit binary integer)
```

3.17.4 GEO_DATA_FILE.

```
IMAGE_RECORD_(ZDR)
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    IMG          Record type
    RID  A  2    01           Record ID number

  PADDING_FIELD (tag PAD)
    PAD  A  Var  SP           Padding so that the image pixels start at the
                              beginning of a CD-ROM logical sector.

  PIXEL_FIELD (tag SCN)
    *PIX A  1                 Pixel value (Unsigned 8-bit binary integer)
```

3.18 Source directory files.

3.18.1 SOURCE_FILE.

```
SOURCE_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY   A 3    SOU          Record type
    RID   A 2    01           Record ID number

  SOURCE_SUMMARY_FIELD (tag SGF)
    NST  I  4    0000..9999   Number of supplementary text records
    NLI  I  2    00..99       Number of legend images
    NIN  I  2    00..99       Number of insets

  SOURCE_FIELD (tag SOR)
    PRT  A  10                Series designator (a short title for the identi-
                              fication of a group of products usually having the
                              same scale and/or cartographic specifications.
    URF  A  20                Unique source ID (Item) (the item number or name
                              which when used in conjunction with the series and
                              Edition will identify a unique product.
    EDN  A  7                 Source edition identifier (the edition identifier
                              uniquely identifies a product within a series and
                              item number.
    NAM  A  100               Full name (the complete name of a graphic)
    DAT  A  12   kkk,YYYYMMDD Significant date (a designated date that most
                              accurately describes the basic date of the product
                              for computation of the probable obsolescence date.
                              It can be the completion date, revision date, or
                              other date depending on the product and circum-
                              stances.)
    DAT  A  12   kkk,YYYYMMDD CHUM date (reflects date of CHUM information
                              applied to source graphic.)
    COU  A  2                 Country code (used to identify the primary
                              geopolitical area associated with the product. See
                              DIA Manual 65-18 for Country Codes.)
    SCA  I  9                 Cartographic scale reciprocal
```

GRD	A 4		Cartographic grid(s) (formatted 2A2, provides up to two grid codes)
SQU	I 6		Area coverage
UNIsqu	I 3		Area coverage unit of measurement
PCI	I 4	0001..9999	Contour interval of the map or chart
UNIpci	I 3		Contour unit of measurement
WPC	I 3	000..100	Percent water (the percentage of the product that is covered by water)
NST	I 3		Navigational systems type
ELL	A 15		Ellipsoid name
ELC	A 3		Ellipsoid code
DVR	A 20		Datum of vertical reference name
VDCdvr	A 4		Datum of vertical reference code
SDA	A 20		Sounding datum name
VDCsda	A 4		Sounding datum code
DAG	A 21		Geodetic datum name
DCD	A 3		Geodetic datum code
SRN	A 12		TDLS number (library/source reference number)
DAT	A 12	kkk,YYYYMMDD	Date of information
RAT	R 8		Easterly annual magnetic change
UNIrat	I 3		Easterly change units
RTW	R 8		Westerly annual magnetic change
UNIrtw	I 3		Westerly change units
GMA	R 8		Grid north - magnetic north (G-M) angle
UNIgma	I 3		Units of G-M angle
GCA	R 8		Grid convergence angle
UNIgca	I 3		Units of grid convergence angle
HKE	I 6		Highest known elevation (the elevation and its associated coordinates are identified within the legend information on the source graphic within the CD ROM boundary. Some products do not portray this information and hence this field and its associated subfields may be SP.)
UNIhke	I 3		Units of highest known elevation
LON	A 11	±DDDMMSS.SS	Longitude coordinate of the highest known elevation
LAT	A 10	±DDMMSS.SS	Latitude coordinate of the highest known elevation

BOUNDING_POLYGON_COORDINATES_FIELD (tag RCI)

Note: Coordinate pairs repeat to define a region. Coordinates are ordered clockwise, and the first point is repeated for closure.

*LON	A 11	±DDDMMSS.SS	WGS 84 longitude coordinate
LAT	A 10	±DDMMSS.SS	WGS 84 latitude coordinate

PROJECTION_FIELD (tag PRR)

PRN	A 100		Projection name
PCO	A 2		Projection code
PAA	A 11	±DDDMMSS.SS	Projection parameter 1
PAB	A 11	±DDDMMSS.SS	Projection parameter 2

PAC	A	11	±DDDMMSS.SS	Projection parameter 3
PAE	A	11	±DDDMMSS.SS	Projection parameter 4
XOO	A	11		X false origin (0 if not applicable)
YOO	A	10		Y false origin (0 if not applicable)

SECURITY_AND_RELEASE_FIELD (tag QSR)

QSS	A	1		Security classification (code used to define the security classification of the source graphic: T=Top Secret, S=Secret, C=Confidential, R=Restricted, and U=Unclassified)
QOD	A	1	Y or N	Originating Agency's determination is required
DAT	A	12	010,YYYYMMDD	Date of downgrading (if QOD is Y or QSS is U, then these subfield characters are SP.)
QLE	A	200		Releasability statement

*(o)INSET_FIELD (tag INS)

Note: External insets at the same scale as the main graphic will normally be placed in the same DR as the main graphic. Internal insets and external insets at a scale different than the main graphic will be in a seperate DR. Regardless, there will be a source record for the inset in addition to this inset field.

INT	A	2		Inset (insets will be assigned values 01, 02, ...)
SCA	I	9		Inset scale (cartographic scale reciprocal of the inset.)
NAM	A	100		Free text, inset name
NTL	A	11	±DDDMMSS.SS	WGS 84 longitude of lower left corner of inset
TTL	A	10	±DDMMSS.SS	WGS 84 latitude of lower left corner of inset
NVL	A	11	±DDDMMSS.SS	WGS 84 longitude of upper left corner of inset
TVL	A	10	±DDMMSS.SS	WGS 84 latitude of upper left corner of inset
NTR	A	11	±DDDMMSS.SS	WGS 84 longitude of upper right corner of inset
TTR	A	10	±DDMMSS.SS	WGS 84 latitude of upper right corner of inset
NVR	A	11	±DDDMMSS.SS	WGS 84 longitude of lower right corner of inset
TVR	A	10	±DDMMSS.SS	WGS 84 latitude of lower right corner of inset

Note: The area of the inset in the main body of the source graphic will be filled with black pixels. The WGS 84 coordinates of the area will be given in the following subfields.

NRL	A	11	±DDDMMSS.SS	Longitude of the lower left corner
TRL	A	10	±DDMMSS.SS	Latitude of the lower left corner
NSL	A	11	±DDDMMSS.SS	Longitude of the upper left corner
TSL	A	10	±DDMMSS.SS	Latitude of the upper left corner
NRR	A	11	±DDDMMSS.SS	Longitude of the upper right corner
TRR	A	10	±DDMMSS.SS	Latitude of the upper right corner
NSR	A	11	±DDDMMSS.SS	Longitude of the lower right corner
TSR	A	10	±DDMMSS.SS	Latitude of the lower right corner

COPYRIGHT_FIELD (tag CPY)

CPZ	A	200		Copyright statement (if the copyright statement exceeds 200 characters this field will state 'Refer to supplemental text for copyright notice' and the copyright notice will appear in a supplemental text field.)

```
*(o)LEGEND_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    LEG          Record type
    RID  A  2                 Record ID number

LEGEND_DATA_FIELD (tag LGI)
    NAM  A  8    ssccddkk     Legend image name
    STR  I  1    3            Data structure type code (3=Raster RGB)
```

DATA_SET_PARAMETERS_FIELD (tag SPR)

Note: All ADRG images have a DATA_SET_PARAMETERS_FIELD. The constant values shown for subfields PNC, PNL, COD, ROD, POR, PCB AND PVB represent current requirements. Future requirements or coproduced ADRG may use different values.

NUL	I	6		Row number of the upper right corner of the legend image MBR (in pixels)
NUS	I	6		Column number of the upper right corner of the legend image MBR (in pixels)
NLL	I	6		Row number of the lower left corner of the legend image MBR (in pixels)
NLS	I	6		Column number of the lower left corner of the legend image MBR (in pixels)
NFL	I	3		Image height (in tiles)
NFC	I	3		Image width (in tiles)
PNC	I	6		Number of pixels per tile row
PNL	I	6		Number of rows per tile
COD	I	1	0	Column direction (left to right)
ROD	I	1	1	Row direction (top to bottom)
POR	I	1	0	Pixel order (column in row in band in tile)
PCB	I	1	0	Bits per pixel (not applicable)
PVB	I	1	8	Bits per pixel value
BAD	A	12	ssccddkk.Lgg	LEGEND_IMAGE_FILE name (external)
TIF	A	1	Y or N	Tile Index Map Flag (Y indicates there are tiles with no data; N indicates that all tiles contain RGB graphic data.)

BAND_ID_FIELD (tag BDF)

*BID	A	5		Band color
WS1	I	5		Lower band edge wavelength in nanometers
WS2	I	5		Upper band edge wavelength in nanometers

TILE_INDEX_MAP_FIELD (tag TIM)

Note: This field appears only if the Tile Index Map Flag (TIF) above is "Y".

*TSI	I	5		Tile index map value (See paragraph 3.8.5 for a definition of tile index map values.)

METRIC_SUPPORT_DATA_RECORD

Note: Refer to Appendix, section 30 for the equations which use the coefficients and normalization constants given in the three fields below. All metric support subfields are formatted E22.15.

```
RECORD_ID_FIELD (tag 001)
  RTY  A  3    MSD          Record type
  RID  A  2    01           Record ID number

NORMALIZATION_CONSTANTS_FIELD (tag NCD)
  TSF  S  22                Latitude scale factor
  GSF  S  22                Longitude scale factor
  TTT  S  22                Latitude translation term
  GTT  S  22                Longitude translation term
  NSF  S  22                Northing scale factor
  ESF  S  22                Easting scale factor
  NTT  S  22                Northing translation term
  ETT  S  22                Easting translation term

SOURCE_DATUM_COEFFICIENTS_FIELD (tag SDC)
  AX1  S  22                Latitude coefficient 1
  AX2  S  22                Latitude coefficient 2
  AX3  S  22                Latitude coefficient 3
  AX4  S  22                Latitude coefficient 4
  AX5  S  22                Latitude coefficient 5
  AX6  S  22                Latitude coefficient 6
  AX7  S  22                Latitude coefficient 7
  BX1  S  22                Longitude coefficient 1
  BX2  S  22                Longitude coefficient 2
  BX3  S  22                Longitude coefficient 3
  BX4  S  22                Longitude coefficient 4
  BX5  S  22                Longitude coefficient 5
  BX6  S  22                Longitude coefficient 6
  BX7  S  22                Longitude coefficient 7

MAP_PROJECTION COEFFICIENTS FIELD (tag MPC)
  CX1  S  22                Northing coefficient 1
  CX2  S  22                Northing coefficient 2
  CX3  S  22                Northing coefficient 3
  CX4  S  22                Northing coefficient 4
  CX5  S  22                Northing coefficient 5
  CX6  S  22                Northing coefficient 6
  CX7  S  22                Northing coefficient 7
  CX8  S  22                Northing coefficient 8
  CX9  S  22                Northing coefficient 9
  CXA  S  22                Northing coefficient 10
  DX1  S  22                Easting coefficient 1
  DX2  S  22                Easting coefficient 2
  DX3  S  22                Easting coefficient 3
  DX4  S  22                Easting coefficient 4
  DX5  S  22                Easting coefficient 5
  DX6  S  22                Easting coefficient 6
  DX7  S  22                Easting coefficient 7
  DX8  S  22                Easting coefficient 8
  DX9  S  22                Easting coefficient 9
  DXA  S  22                Easting coefficient 10
```

```
(o)SUPPLEMENTAL_TEXT_RECORD
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    SPT          Record type
    RID  A  2    01           Record ID number

  *SUPPLEMENTAL_TEXT_FIELD (tag SUP)
    TRY  A  4                 Supplementary text record type
    TRI  A  4                 Supplementary text field reference ID
    TXT  A  Var               Free text
```

3.18.2 LEGEND_IMAGE_FILE.

```
IMAGE_RECORD_(LEGEND)
  RECORD_ID_FIELD (tag 001)
    RTY  A  3    IMG          Record type
    RID  A  2    01           Record ID number

  PADDING_FIELD (tag PAD)
    PAD  A  Var  SP           Padding so that the image pixels start at the
                              beginning of a CD-ROM logical sector.

  PIXEL_FIELD (tag SCN)
    *PIX A  1                 Pixel value (Unsigned 8-bit binary integer)
```

4. QUALITY ASSURANCE

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use their own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of a contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

5. PACKAGING

5.1 General (packaging). Each CD-ROM will be labelled indicating the cartographic contents of the CD-ROM, security restrictions, stock number,

producer, edition number and date. Each CD-ROM will be distributed in a clear plastic case (also known as a "Jewel Box"). The Jewel Box will contain a location diagram and an information booklet.

5.1.1 CD-ROM labelling. CD-ROMs will be color coded to indicate the highest level of classification of the contents of the CD-ROM. Figures 1 and 2 show the label format for unclassified and classified CD-ROMs.

a. UNCLASSIFIED CD-ROMs will have a White background (SPC 57309 or equivalent color). Text and symbols will be overprinted in Black (SPC 58400 or equivalent color).

b. CONFIDENTIAL CD-ROMs will have a Dark Blue background (SPC 46961 or equivalent color). Text and symbols will be overprinted in White (SPC 57309 or equivalent color).

c. SECRET CD-ROMs will have a Red background (SPC 62841 or equivalent color). Text and symbols will be overprinted in White (SPC 57309 or equivalent color).

d. TOP SECRET CD-ROMs will have an Orange background (SPC 59063 or equivalent color). Text and symbols will be overprinted in Black (SPC 58400 or equivalent color).

5.1.2 Location diagram. The Location Diagram is a graphic depiction of the geographic location of the cartographic contents of the CD-ROM. Figure 3 shows the format of the Location Diagram.

5.1.3 Information booklet. An information booklet will provide information about the contents of the CD-ROM, security, releasability, handling instructions, and DMA points of contact. Figures 4 and 5 show the format for the information booklet covers.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory).

6.1 Intended use. This specification is intended to provide guidelines for the preparation and use of ARC Digitized Raster Graphics to support various weapons and mission support systems.

6.2 Supersession. This specification supersedes Defense Mapping Agency Product Specifications for ARC Digitized Raster Graphics (ADRG), PS/2DJ/100, First Edition, April 1989.

6.3 Definitions.

6.3.1 ARC system coordinates. In a non-polar zone these are the WGS 84 phi and lambda (ϕ and λ) under the equirectangular projection; in a polar zone, these are the X and Y coordiantes under the azimuthal equidistant projection, polar aspect, spherical form.

(Black Plate)

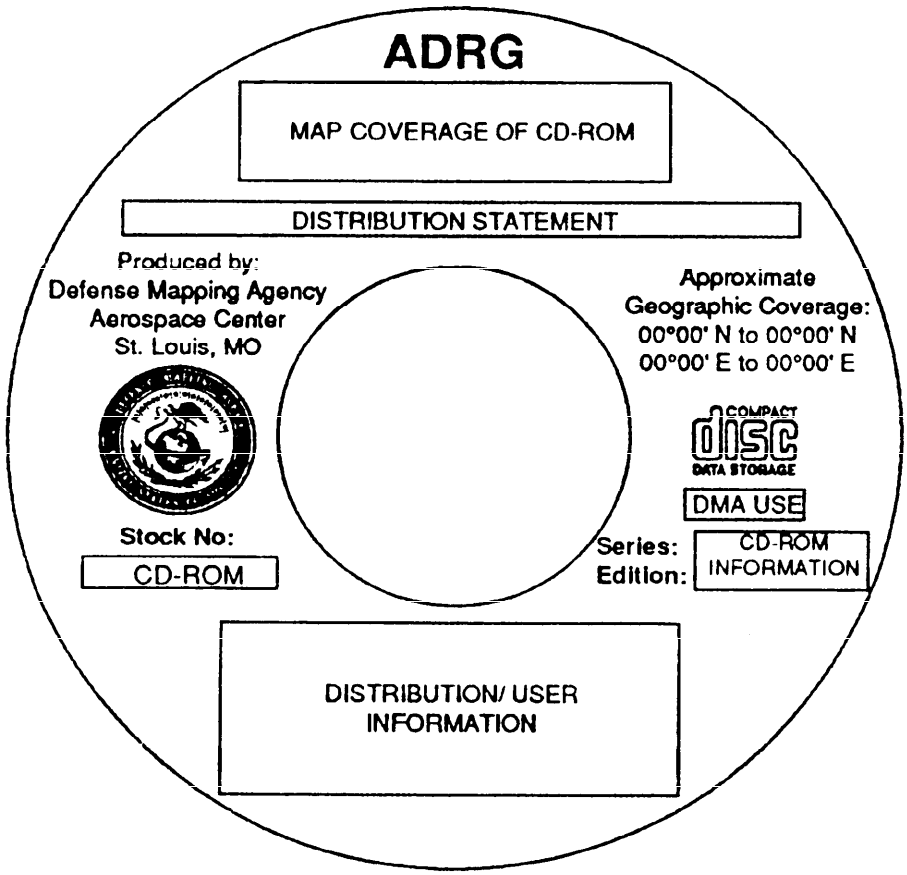


FIGURE 1. ADRG CD-ROM label (UNCLASSIFIED).

(Black Plate)

FIGURE 2. ADRG CD-ROM label (CLASSIFIED).

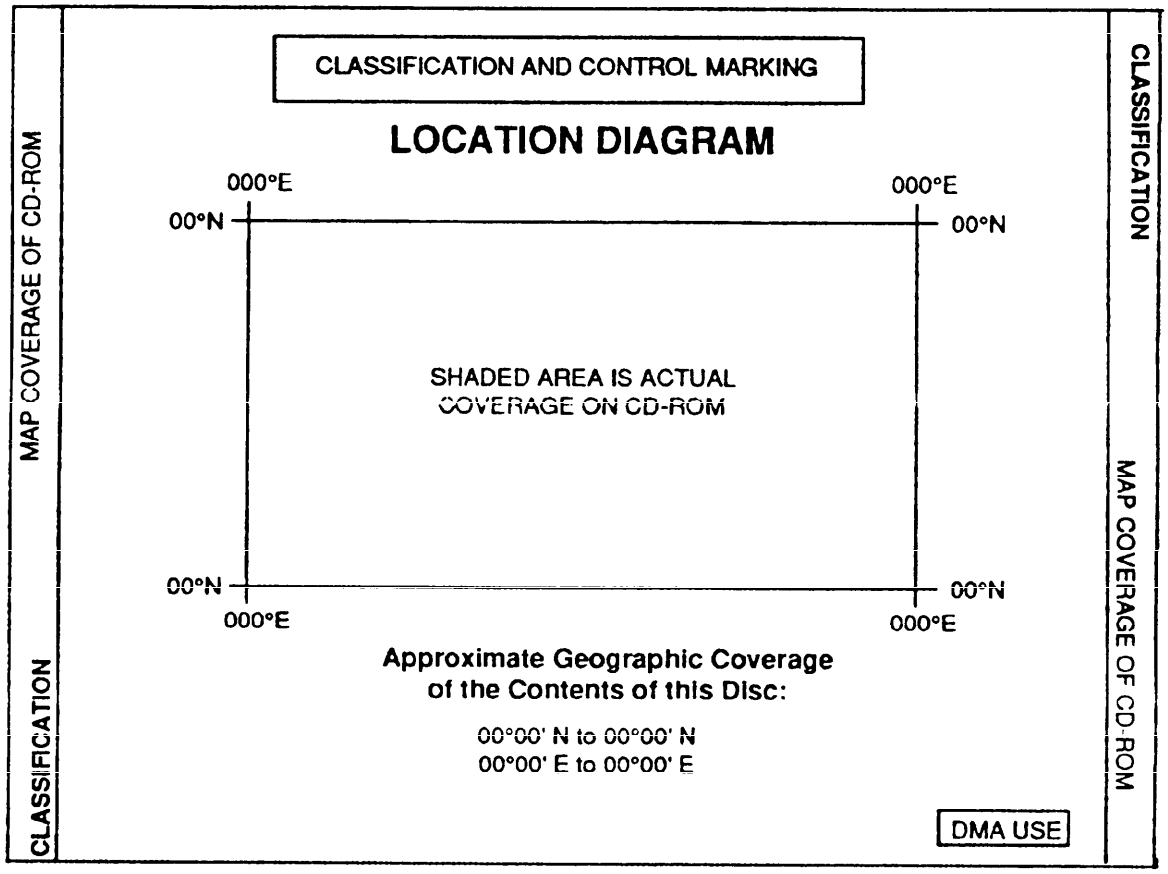


FIGURE 3. Jewel case liner.

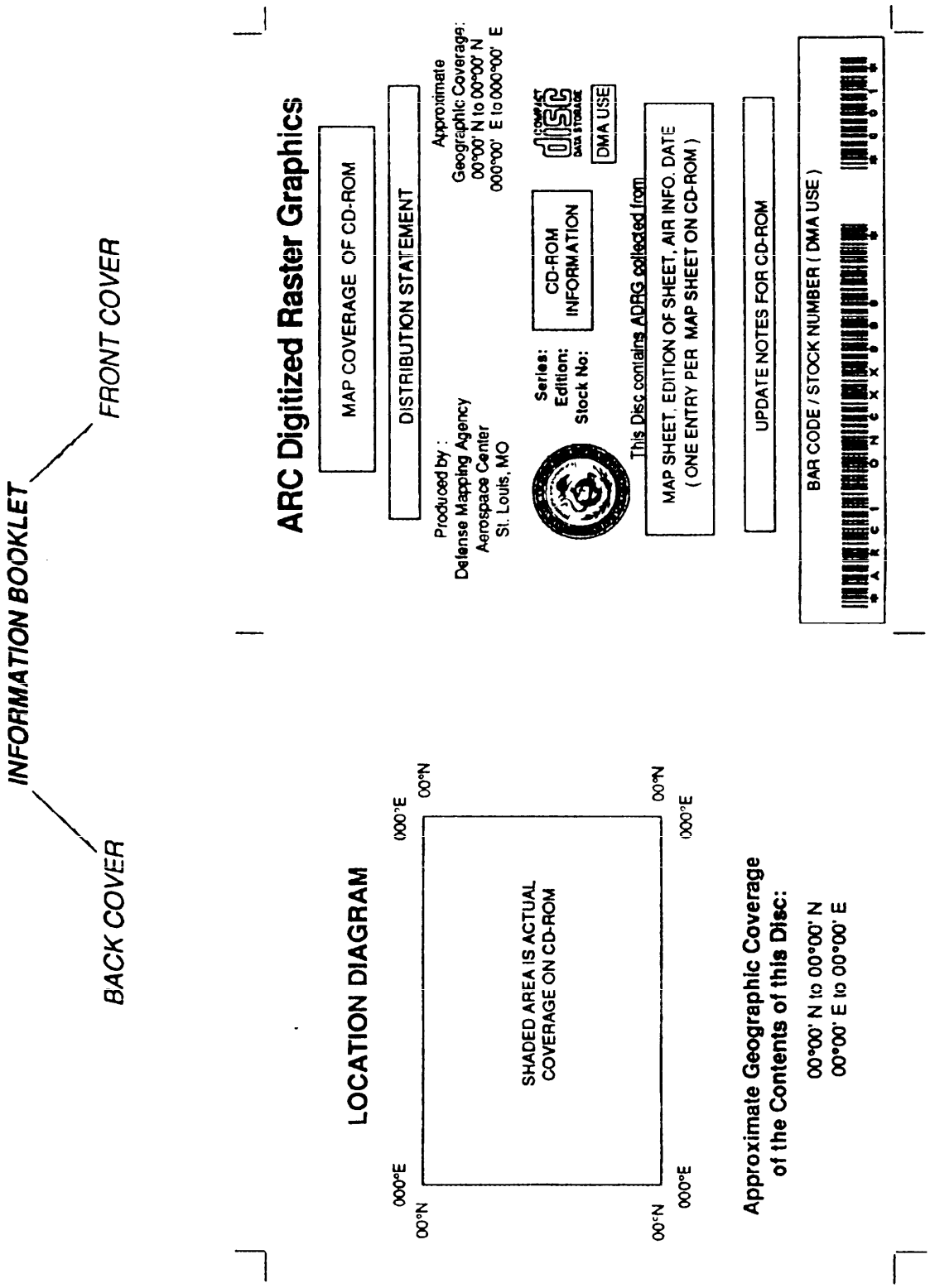


FIGURE 4. Information Booklet (UNCLASSIFIED).

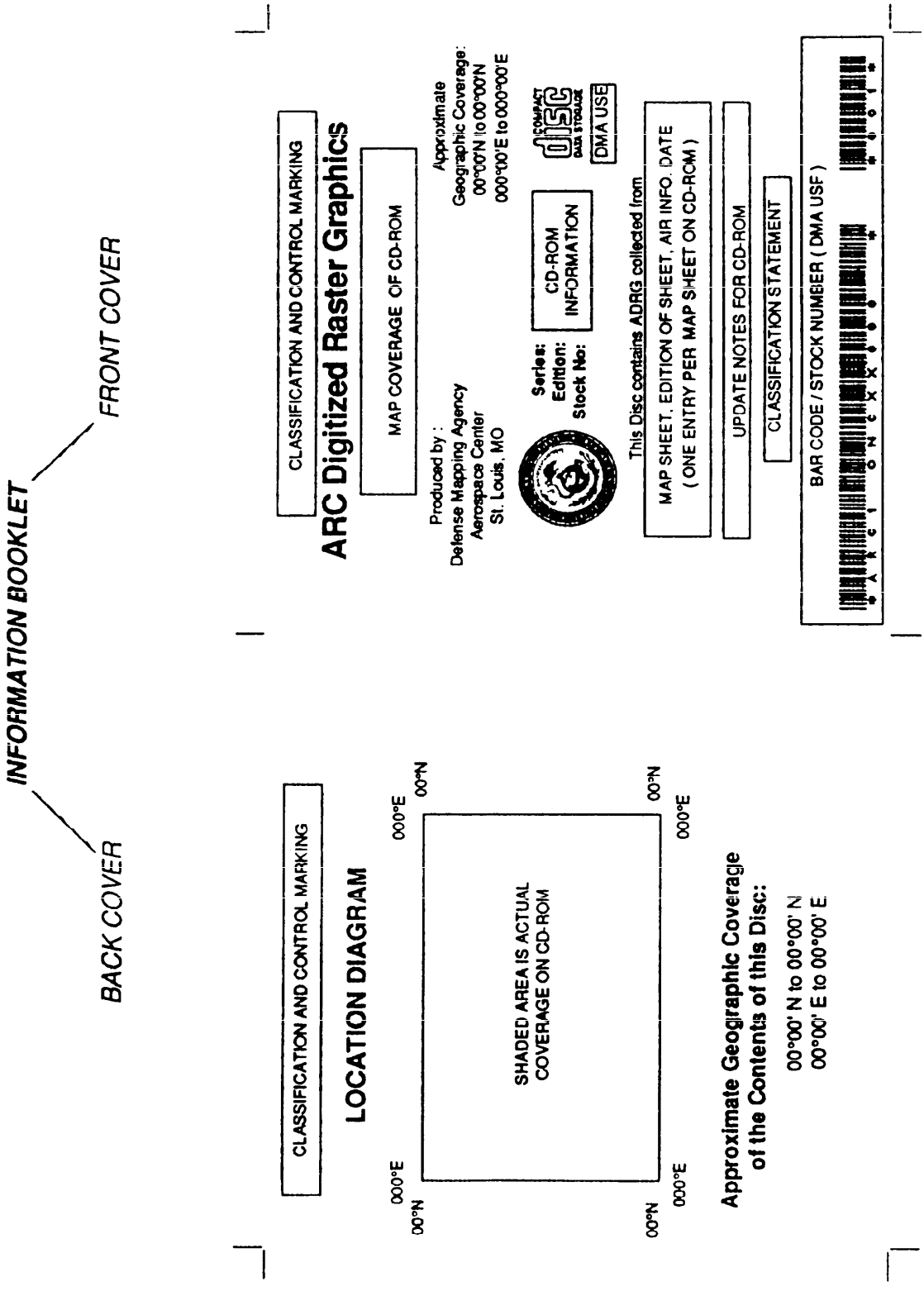


FIGURE 5. Information Booklet, (CLASSIFIED).

6.3.2 Acronyms.

ADRG	ARC Digitized Raster Graphics
ARC	Equal Arc-Second Raster Chart/Map
ASCII	American Standard Code for Information Interchange
C3I	Command, Control, Communications, and Intelligence
CD-ROM	Compact Disk - Read Only Memory
CHUM	Chart Updating Manual
CIE	Commission Internationale de L'Eclairage
DGIWG	Digital Geographic Information Working Group
DMA	Defense Mapping Agency
DR	Distribution Rectangle
ECMA	European Computer Manufacturer's Association
FIPS	Federal Information Processing Standards
FIPSPUB	FIPS Publication
ISO	International Organization for Standardization
MBR	Minimum Bounding Rectangle
MC&G	Mapping, Charting, and Geodesy
MEF	Maximum Elevation Figure
MSD	Metric Support Data
MTE	Maximum Terrain Elevation
NATO	North Atlantic Treaty Organization
OADR	Originating Agency's Determination Required
OCCB	Operational Configuration Control Board
RFC	Request for Change
RGB	Red-Green-Blue
TDLS	Topographic Data Library System
WGS	World Geodetic System
ZDR	Zone Distribution Rectangle

6.3.3 ASCII encoded. Data where numeric information is presented in equivalent formatted character form as ASCII codes.

6.3.4 Band sequential form. Storage of RGB image data as three successive, full, single color images (Red, then Green, then Blue).

6.3.5 Black pixel. Pixel with zero value for each of the Red, Green, and Blue components.

6.3.6 Chart. A special-purpose map, generally designed for navigation or other particular purposes, in which essential map information is combined with various other data critical to the intended use.

6.3.7 Chart Updating Manual (CHUM). The DMA Aeronautical Chart Updating Manual is a semi-annual publication with monthly supplements which provides textual and/or graphic additions, deletions, or modifications of cartographic data to published aeronautical charts. Changes appearing in the CHUM are generally considered to be critical to flight safety.

6.3.8 Datum (horizontal). A geodetic datum is uniquely defined by five quantities. Latitude (ϕ), longitude (λ), and geoid height (N) are defined at the

datum origin. The adoption of specific values for the geodetic latitude and longitude implies specific deflections of the vertical at the origin. A geodetic azimuth is often cited as a datum parameter, but the azimuth and longitude are precisely related by the Laplace condition so there is no need to define both. The other two quantities define the reference ellipsoid: the semimajor axis and flattening or the semimajor axis and semiminor axis. Also called horizontal geodetic datum.

6.3.9 Datum (vertical). A level surface to which elevations are referred, usually mean sea level, but may also include mean low water, mean lower low water, or an arbitrary starting elevation(s).

6.3.10 Distribution Rectangle (DR). The minimum bounding rectangle (MBR) in geographic coordinates encompassing an ADRG image. A DR may consist of one or more Zone Distribution Rectangles.

6.3.11 Ellipsoid. A surface whose plane sections (cross sections) are all ellipses or circles, or the solid enclosed by such a surface.

6.3.12 Inset. A separate map positioned within the neatline of a larger map. Two forms are recognized: (1) External Inset, which is an area geographically outside a sheet but included therein for convenience of publication, usually at the same scale; (2) Internal Inset, which is a portion of a map or chart, usually representing a highly congested area, in which a decongested version of the area is depicted on the same sheet, but in a different area of the sheet from the congested version. Internal insets may be at a different scale from the scale of the host graphic.

6.3.13 Logical sector (CD-ROM). The 2048-byte user data field of a sector.

6.3.14 Map. A graphic representation, usually on a plane surface and at an established scale, of natural and artificial features on the surface of a part or the whole of the Earth or other planetary body. The features are positioned relative to a coordinate reference system.

6.3.15 Micron. One millionth of a meter.

6.3.16 Neatlines. The lines that bound the body of a map, usually parallels and meridians, but may be conventional or arbitrary grid lines. Also called sheet lines.

6.3.17 Overview image. A reduced-resolution image of a distribution rectangle.

6.3.18 Path name. A fully-specified directory or file path name is a series of names, beginning with the Root Directory and passing through successive directory names in the hierarchical structure, and terminating with the directory or file name of interest. The series of names are separated with a slash (/). Examples: the TRANSMITTAL_HEADER_FILE has the path name /TRANSH01.THF.

6.3.19 Pixel. Picture element.

6.3.20 Projection. A systematic presentation of intersecting coordinate lines on a flat surface.

6.3.21 RGB data. Data representing full color images, where each pixel has separate values for its Red, Green, and Blue components.

6.3.22 Round(x). Mathematical function giving the nearest, whole integer to the (possibly non-integer) value x. (For example, round (1.7) = 2, round (-1.3) = -1 and round (-1.7) = -2)

6.3.23 Row and column coordinates. In an ADRG image, rows of pixels are numbered from the top row to the bottom, and columns from left to right. The top row is row 0; the leftmost column is column 0.

6.3.24 Sector (CD-ROM). The smallest addressable part of the recorded area on a CD-ROM that can be accessed independent of other addressable parts of the recorded area.

6.3.25 Tile. An array of 128 rows of 128 pixels each; stored in band sequential form.

6.3.26 Zone Distribution Rectangle (ZDR). That part of a DR covering a single zone (or overlap), stored as a single raster image. For storage the ZDR is padded and divided into tiles.

6.4 International standardization agreements .

"Certain provisions of this specification are subject of international standardization agreement. When amendment, revision, or cancellation of this specification is proposed that will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations."

6.4.1 International Standardization Agreements (STANAGs) .

STANAG 2211, "Geodetic Datums, Spheroids, Grids, and Cell References".

6.4.2 Quadripartite Standardization Agreements (QSTAGs).

This section is not applicable to this specification.

6.4.3 Air Standardization Coordinating Committee Agreements (ASCC AIR STDs/ STDs/ADV PUBs).

This section is not applicable to this specification.

6.4.4 International MC&G agreements .

This section is not applicable to this specification.

6.4.5 Executive orders.

This section is not applicable to this specification.

6.4.6 Inter-Agency agreements .

This section is not applicable to this specification.

6.4.7 Other documentation.

This section is not applicable to this specification.

APPENDIX

ADRG FORMATS

10. SCOPE

10.1 Scope. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS

This section is not applicable to this Appendix.

30. COORDINATE TRANSFORMATIONS

30.1 References for the ARC system projection equations.

30.1.1 Non-polar zone equations. Non-polar zone equations are based on the Equirectangular projection, which is described in *Map Projections - A Working Manual,* U.S.G.S. Professional Paper 1395, First Edition, 1987, page 90.

30.1.2 Polar zone equations. Polar zone equations are based on the Azimuthal Equidistant projection, polar aspect, spherical form, which is described in *Map Projections - A Working Manual,* U.S.G.S. Professional Paper 1395, First Edition, 1987, page 191.

30.1.3 Value adjustments. Latitude (ϕ) values in formulas should be in the range $-90 \le \phi \le 90$. Longitude (λ) values in formulas should be in the range $-180 \le \lambda \le 180$. Values outside this range should be adjusted by ±360, as appropriate.

30.2 Latitude and longitude (ϕ_{84}, λ_{84}) of a ZDR pixel at (r, c).

30.2.1 Parameters used.

Parameter	Description	Subfield
(r,c)	Row and column of the ZDR pixel	-
(ϕ_0, λ_0)	WGS 84 coordinates of the (0,0) ZDR pixel	PSO, LSO
A_{sz}	East-West pixel spacing at scale 1:S in zone Z	ARV
B_s	North-South pixel spacing at scale 1:S	BRV

30.2.2 Non-polar case.

$$\phi = \phi_0 - (360\ r / B_s)$$
$$\lambda = \lambda_0 + (360\ c / A_{sz})$$

30.2.3 North polar case. (See figure 32.)

a. ARC system Coordinates (x_0, y_0) at (ϕ_0, λ_0)

$$x_0 = (B_s/360)\ (90° - \phi_0)\ \sin(\lambda_0)$$
$$y_0 = -(B_s/360)\ (90° - \phi_0)\ \cos(\lambda_0)$$

b. ARC system coordinates (x,y) at (r,c).

$x = x_0 + c$
$y = y_0 - r$

c. WGS 84 coordinates $(\phi_{84}, \lambda_{84})$ at (x, y)

$\phi = 90° - [x^2 + y^2]^{1/2} / (B_s/360)$
$\lambda = \arccos [-y / (x^2 + y^2)^{1/2}]$ if $x \geq 0, y \neq 0$
$\lambda = - \arccos [-y / (x^2 + y^2)^{1/2}]$ if $x < 0$
$\lambda = 0°$ if $x = y = 0$

where $0° \leq \arccos [-y/(x^2 + y^2)^{1/2}] \leq 180°$

30.2.4 South polar case. (See figure 26.)

a. ARC system coordinates (x_0, y_0) at (ϕ_0, λ_0)

$x_0 = (B_s/360) (90° + \phi_0) \sin (\lambda_0)$
$y_0 = (B_s/360) (90° + \phi_0) \cos (\lambda_0)$

b ARC system coordinates (x, y) at (ϕ, λ)

$x = x_0 + c$
$y = y_0 - r$

c. WGS 84 coordinates $(\phi_{84}, \lambda_{84})$ at (x, y)

$\phi_{84} = -90° + [x^2 + y^2]^{1/2} / (B_s/360)$
$\lambda_{84} = \arccos [y / (x^2 + y^2)^{1/2}]$ if $x > 0, y \neq 0$
$\lambda_{84} = - \arccos [y / (x^2 + y^2)^{1/2}]$ if $x \leq 0$
$\lambda_{84} = 0°$ if $x = y = 0$

where $0° \leq \arccos [y/(x^2 + y^2)^{1/2}] \leq 180°$

30.3 ZDR pixel coordinates (r, c) of a geographic point $(\phi_{84}, \lambda_{84})$.

30.3.1 Parameters used.

Parameter	Description	Subfield
(ϕ, λ)	WGS 84 coordinates of the geographic point	-
(ϕ_0, λ_0)	WGS 84 coordinates of the (0,0) ZDR pixel	PSO, LSO
A_{sz}	East-West pixel spacing at scale 1:S in zone Z	ARV
B_s	North-South pixel spacing at scale 1:s	BRV

30.3.2 Non-polar case.

$r = round (\phi_0 - \phi_{84}) (B_s/360)$
$c = round ((abs(\lambda_{84} - \lambda_0) \bmod 360) (A_{sz}/360))$

30.3.3 North polar case. (See figure 26.)

a. ARC system coordinates (x_0, y_0) at (ϕ_0, λ_0)

$$x_0 = (B_s/360)\ (90° - \phi_0)\ \sin\ (\lambda_0)$$
$$y_0 = -(B_s/360)\ (90° - \phi_0)\ \cos\ (\lambda_0)$$

b. ARC system coordinates (x, y) at $(\phi_{84}, \lambda_{84})$

$$x = (B_s/360)\ (90° - \phi_{84})\ \sin\ (\lambda_{84})$$
$$y = -(B_s/360)\ (90° - \phi_{84})\ \cos\ (\lambda_{84})$$

c. ZDR pixel coordinates (r, c) at (x, y)

$$r = round\ (y_0 - y)$$
$$c = round\ (x - x_0)$$

30.3.4 South polar case. (See figure 26.)

a. ARC system coordinates (x_0, y_0) at (ϕ_0, λ_0)

$$x_0 = (B_s/360)\ (90° + \phi_0)\ \sin\ (\lambda_0)$$
$$y_0 = (B_s/360)\ (90° + \phi_0)\ \cos\ (\lambda_0)$$

b. ARC system coordinates (x, y) at $(\phi_{84}, \lambda_{84})$

$$x = (B_s/360)\ (90° + \phi_{84})\ \sin\ (\lambda_{84})$$
$$y = (B_s/360)\ (90° + \phi_{84})\ \cos\ (\lambda_{84})$$

c. ZDR pixel coordinates (r, c) at (x, y)

$$r = round\ (y_0 - y)$$
$$c = round\ (x - x_0)$$

30.4 Overview Image pixel and geographic coordinates. An overview image is treated exactly the same as a ZDR, using the equations and parameters shown in paragraphs 30.2 and 30.3 to translate between pixel and geographic coordinates.

30.5 Source graphic datum coordinates $(\phi_{src}, \lambda_{src})$ from WGS 84 coordinates.

a. Parameters used.

Parameter	Description	Subfield
ϕ_{84}, λ_{84}	Latitude and longitude on WGS 84 datum	---
a,	Coefficients of the polynomial for latitude ϕ, i = 1..7	AX1..AX7
b	Coefficients of the polynomial for longitude λ, i = 1..7	BX1..BX7

Parameter	Description	Subfield
S_ϕ	Latitude normalizing scale factor	TSF
S_λ	Longitude normalizing scale factor	GSF
ϕ_{off}	Latitude normalizing offset	TTT
λ_{off}	Longitude normalizing offset	GTT

b. Normalized WGS 84 coordinates (ϕ_1, λ_1) at $(\phi_{84}, \lambda_{84})$.

$$\phi_1 = S_\phi \ (\phi_{84} - \phi_{off})$$
$$\lambda_1 = S_\lambda \ (\lambda_{84} - \lambda_{off})$$

c. Normalized source graphic datum coordinates (ϕ_2, λ_2) at (ϕ_1, λ_1).

$$\phi_2 = a_1 + a_2\phi_1 + a_3\lambda_1 + a_4\phi_1\lambda_1 + a_5\lambda_1^2 + a_6\phi_1\lambda_1^2 + a_7\lambda_1^3$$

$$\lambda_2 = b_1 + b_2\phi_1 + b_3\lambda_1 + b_4\phi_1\lambda_1 + b_5\lambda_1^2 + b_6\phi_1\lambda_1^2 + b_7\lambda_1^3$$

d. Denormalized source datum coordinates $(\phi_{src}, \lambda_{src})$ at (ϕ_2, λ_2).

$$\phi_{src} = \phi_2/s_\phi + \phi_{off}$$
$$\lambda_{src} = \lambda_2/s_\lambda + \lambda_{off}$$

30.6 Source graphic projection coordinates (N,E) from source graphic datum coordinates $(\phi_{src}, \lambda_{src})$.

a. Parameters used.

Parameter	Description	Subfield
$(\phi_{src}, \lambda_{src})$	Latitude and longitude on source datum	---
c_i	Coefficients of the polynomial for Northing, i = 1...10	CX1..CXA
d_i	Coefficients of the polynomial for Easting, i = 1...10	DX1..DXA
S_ϕ	Latitude normalizing scale factor	TSF
S_λ	Longitude normalizing scale factor	GSF
ϕ_{off}	Latitude normalizing offset	TTT
λ_{off}	Longitude normalizing offset	GTT
S_N	Northing normalizing scale factor	NSF
S_E	Easting normalizing scale factor	ESF
N_{off}	Nothing normalizing offset	NTT
E_{off}	Easting normalizing offset	ETT

b. Normalized source graphic datum coordinates (ϕ_2, λ_2) at $(\phi_{src}, \lambda_{src})$.

Note: (ϕ_2, λ_2) may be derived from WGS 84 coordinates as indicated in paragraph 30.4.

$$\phi_2 = S_\phi \ (\phi_{src} - \phi_{off})$$
$$\lambda_2 = S_\lambda \ (\lambda_{src} - \lambda_{off})$$

c. Normalized Northing and Easting (N_n, E_n) at (ϕ_2, λ_2)

$$N_n = c_1 + c_2\phi_2 + c_3\lambda_2 + c_4\phi_2^2 + c_5\phi_2\lambda_2 + c_6\lambda_2^2 + c_7\phi_2^3 + c_8\phi_2^2\lambda_2 + c_9\phi_2\lambda_2^2 + c_{10}\lambda_2^3$$

$$E_n = d_1 + d_2\phi_2 + d_3\lambda_2 + d_4\phi_2^2 + d_5\phi_2\lambda_2 + d_6\lambda_2^2 + d_7\phi_2^3 + d_8\phi_2^2\lambda_2 + d_9\phi_2\lambda_2^2 + d_{10}\lambda_2^3$$

d. Denormalized Northing and Easting (N, E) at (N_n, E_n)

$$N = N_n / S_N - N_{off}$$
$$E = E_n / S_E - E_{off}$$

Note: Northings and Eastings computed here pertain only to the source graphic's geograpnic projection graticule, and do not provide values related to any grid which may be printed on the chart.

APPENDIX

40. LEGEND IMAGES

40.1 General (legend images). Legend images are rectangular patches scanned from the margin of the source graphic. A legend image is designed to capture data not easily captured as text. In addition, legend data is unique to the source graphic.

40.2 Predefined legends. Certain types of legends which commonly occur on charts have been predefined. When present on a chart these legends will be captured. The predefined legends are:

Legend type	Legend code
Interchart relationship	IN
Elevation/depth tint chart	EL
Slope diagram	SL
Boundary diagram	BN
Horizontal accuracy diagram	HA
Vertical accuracy diagram	VA
Combined accuracy diagram	AC
Geographic reference diagram	GE
Grid reference diagram	GR
Glossaries	GL
Landmark features symbols	LS
Non-transformable inset	IT

40.3 Examples.

a. The interchart relationship diagram (figure 6) shows the approximate geographical position of the graphic and its relationship to other graphics in the region.

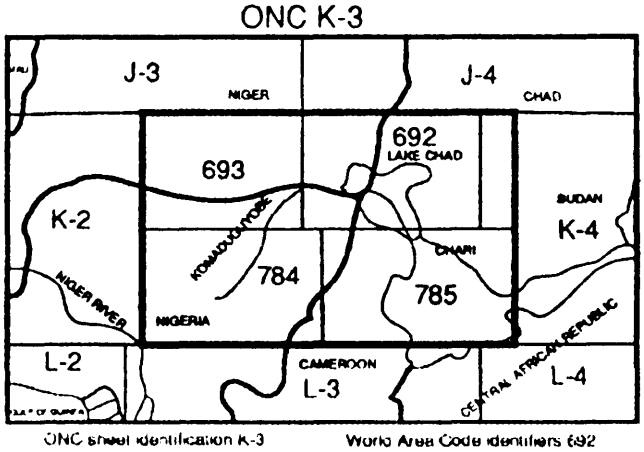


FIGURE 6. Interchart relationship.

b. The elevation/depth tint diagram (figure 7) is a multi-color graphic depicting the colors and/or tints used to represent different elevation or depth bands on the printed map/chart.

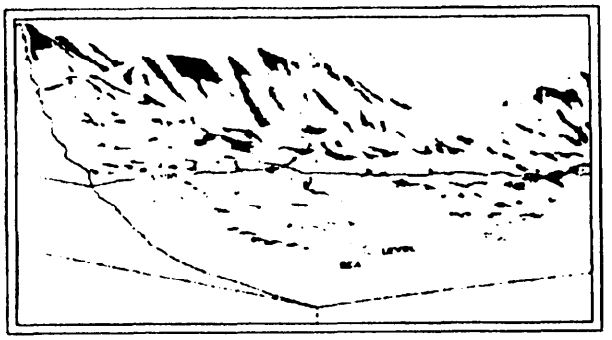


FIGURE 7. Elevation/depth tint diagram.

c. A slope diagram (figure 8) is a graphic representation of the percent and degree slope appearing in slope bands.

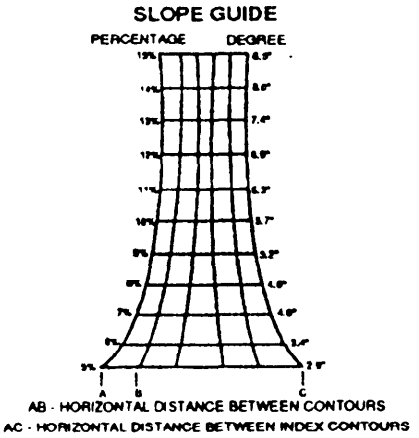
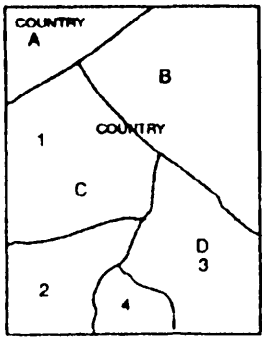


FIGURE 8. Slope diagram.

d. The boundary diagram (figure 9) is a graphical depiction of the geopolitical boundaries included on the map/chart.



THE REPRESENTATION OF INTERNATIONAL BOUNDARIES IS NOT NECESSARILY AUTHORITATIVE.
COUNTRY
A. First-order
COUNTRY
B. First-order
C. First-order
1. Second-order
2. Second-order
D. First-order

FIGURE 9. Boundary diagram.

e. Accuracy diagrams (figure 10) depict the horizontal and vertical accuracies of selected map/chart areas.

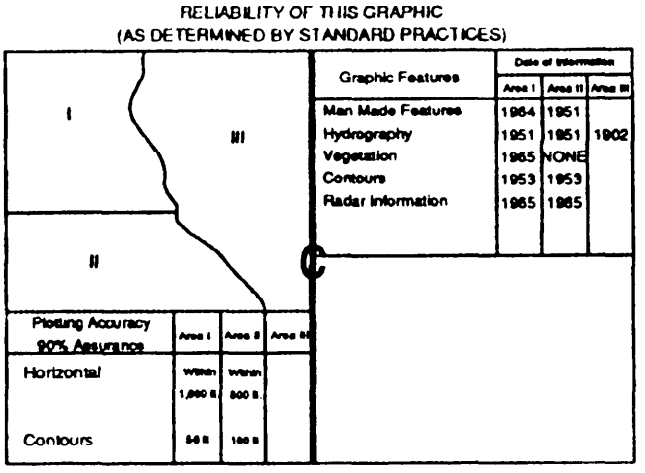


FIGURE 10. Accuracy diagram.

f. The geographic reference diagram (figure 11) depicts appropriate positioning information as referenced to the World Geographic Reference System.

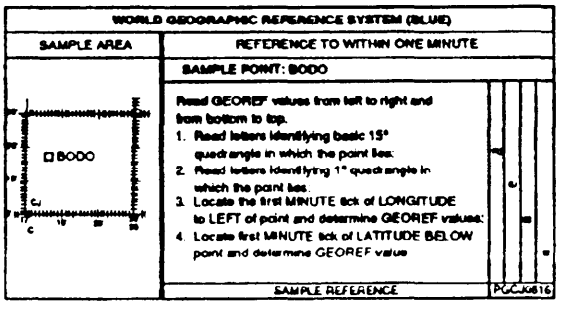


FIGURE 11. Geographic reference diagram.

g. The grid reference diagram (figure 12) indicates specific information needed for positional determination with reference to a particular grid system.

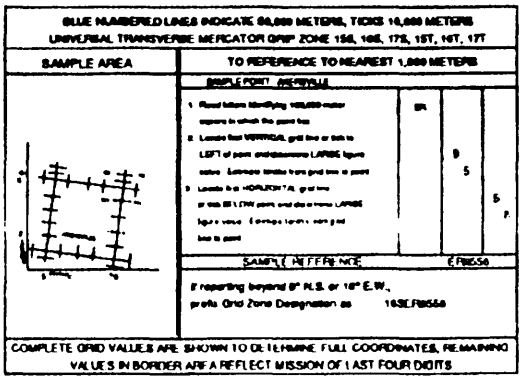


FIGURE 12. Grid reference diagram.

h. Glossaries (figure 13) are brief lists of foreign geographical names appearing on the map/chart with their English-language equivalents.

GLOSSARY

Bir	well
bahr	wadi
Éché	wadi
Hoséré	hill
Hosere	hill
Lac	lake
Massif	mountains
Mayo	stream
Monts	mountains
Ouadi	wadi
Plateau	plateau
Souli	well
Vallée	wadi

FIGURE 13. Glossary.

i. Landmark feature symbols (figure 14) are used to indicate navigationally-prominent entities. Landmark feature symbols legend category is used to capture legends that combine symbols and glossaries.

LANDMARK FEATURE SYMBOLS

Castle .....
Chimney .....
Church .....
Factory .....
Lighthouse .....

Monument .....
Prominent .....
Slag pile .....
Tower .....

FIGURE 14. Landmark feature symbols.

j. A non-transformable map inset (figure 15) is used to capture an inset which contains geographic coverage of an area related to the specific base map but which is not producible as a specific source graphic. This category will be used to capture insets that cannot be accurately transformed to the ARC system.

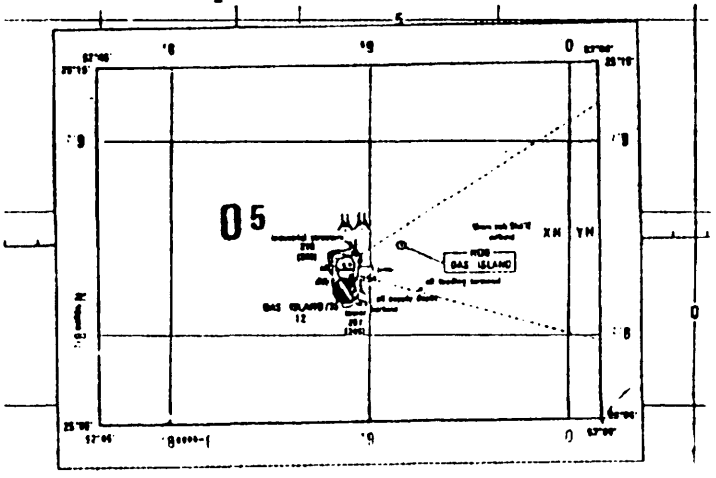


FIGURE 15. Non-transformable map inset.

APPENDIX

50. SUPPLEMENTAL TEXT DATA

50.1 General (supplemental text data). Supplemental text records are used to provide textual data not included in the ZDR or legend images. This includes information printed in the margins or on the back of the chart.

50.2 SUPPLEMENTAL_TEXT_FIELD subfield descriptions.

50.2.1 TRY subfield. This subfield will contain a code identifying the supplemental text type. The following types have been defined:

Type	Description
CONV	Convergence table information
CPYZ	Extended copyright notice
DATM	Datum subregion identifier (the subfield DCD in the SOURCE_FIELD of the SOURCE_RECORD in the SOURCE_FILE contains the first three characters of the datum code)
MISC	Miscellaneous
NOTE	Textual CHUM notes

50.2.2 TRI subfield. For the text types defined above this subfield will be blank.

50.2.3 TXT subfield. This variable length subfield will contain information as described in 50.2.1.

APPENDIX

60. CODES

60.1 Date codes.

Code	Description
000	Unknown
001	Aerial photography
002	Air information
003	Approximate
004	Field classification
005	Compilation
006	Copyright
007	Creation
008	Digitizing
009	Distribution/Dispatching
010	Downgrading
011	Drafting/Scribing/Drawing
012	Edition
013	Field examination
014	Intelligence
015	Date interpretable
016	Processing
017	Print/publication
018	Receipt
019	Source
020	Earliest date of source
021	Latest date of source
022	Specifications
023	Survey
024	Up-to-dateness/Revision
025	Map edit
026	Information as of -
999	Other

60.2 Datum codes.

60.2.1 Geodetic datum codes used with this specification.

Code	Name (Region)
ADIM	Adindan (Mean value: Ethiopia and Sudan)
ADIA	Adindan (Ethiopia)
ADIB	Adindan (Sudan)
ADIC	Adindan (Mali)
ADID	Adindan (Senegal)
AFG	Afgooye (Somalia)
AIN	Ain el Abd 1970 (Bahrain Island)
ANO	Anna 1 Astro (Cocos Islands)
ARFM	Arc 1950 (Mean value: Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, and Zimbabwe)

APPENDIX

Code	Name (Region)
ARFA	Arc 1950 (Botswana)
ARFB	Arc 1950 (Lesotho)
ARFC	Arc 1950 (Malawi)
ARFD	Arc 1950 (Swaziland)
ARFE	Arc 1950 (Zaire)
ARFF	Arc 1950 (Zambia)
ARFG	Arc 1950 (Zimbabwe)
ARSM	Arc 1960 (Mean value: Kenya, Tanzania)
ARSA	Arc 1960 (Kenya)
ARSB	Arc 1960 (Tanzania)
ASC	Ascension Island 1958 (Ascension Island)
ATF	Astro Beacon "E" (Iwo Jima Island)
TRN	Astro Tern Is. 1961 (Tern Island, Hawaii)
SHB	Astro Dos 71/4 (St. Helena Island)
ASQ	Astro. Station 1952 (Marcus Island)
AUA	Australian Geod. 1966 (Australia and Tasmania Is.)
AUG	Australian Geod. 1984 (Australia and Tasmania Is.)
IBE	Bellevue (IGN) (Efate and Erromango Islands)
BER	Bermuda 1957 (Bermuda Islands)
BOO	Bogota Observatory (Colombia)
BUR	Bukit Rimpah (Bangka & Belitum Islands, Indonesia)
CAZ	Camp Area Astro (Camp McMurdo Area, Antartica)
CAI	Campo Inchauspe (Argentina)
CAO	Canton Astro 1966 (Phoenix Islands)
CAP	Cape (South Africa)
CAC	Cape Canaveral (Mean value:Florida and Bahama Islands)
CGE	Carthage (Tunisia)
CHI	Chatham 1971 (Chatham Island, New Zealand)
CHU	Chua Astro (Paraguay)
COA	Corrego Alegre (Brazil)
BAT	Djakarta (Batavia) (Sumatra Island, Indonesia)
GIZ	DOS 1968 0230 (Gizo Island, New Georgia Islands)
EAS	Easter Island 1967 (Easter Island)
EUR	European 1950 (Mean value)
EURM	European 1950 (Mean value: Austria, Belgium, Denmark, Finland, France, Federal Republic of Germany,Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, & Switzerland)
EURA	European 1950 (Western Europe: Austria, Denmark, France, Federal Republic of Germany, Netherlands, and Switzerland)
EURB	European 1950 (Greece)
EURC	European 1950 (Norway and Finland)
EURD	European 1950 (Portugal and Spain)
EURE	European 1950 (Cyprus)
EURF	European 1950 (Egypt)
EURH	European 1950 (Iran)
EURI	European 1950 (Sardinia)
EURJ	European 1950 (Sicily)

APPENDIX

Code	Name (Region)
EURK	European 1950 (England, Channel Islands, Ireland, Northern Ireland, Scotland, Shetland Islands, and Wales)
EUQ	European 1979 (Mean value: Austria, Finland, Netherlands, Norway, Spain, Sweden, and Switzerland)
GAA	GAN Datum (Addu Atoll, Republic of Maldives)
GEO	Geodetic Datum 1949 (New Zealand)
GUA	Guam 1963 (Guam Island)
GSE	Genung Segara (Kalimantan Island, Indonesia)
DOB	GUX 1 Astro (Guadacanal Island)
HEN	Herat (North Afganistan)
HJO	Hjorsey 1955 (Iceland)
HKD	Hong Kong 1963 (Hong Kong)
HTN	Hu-Tzu-Shan (Taiwan)
INDA	Indian (Thailand and Vietnam)
INDB	Indian (Bangladesh, India, and Nepal)
IRL	Ireland 1965 (Ireland and Northern Ireland)
IST	ISTS 073 Astro 1969 (Diego Garcia)
JOH	Johnston Island 1961 (Johnston Island)
KAN	Kandawala (Sri Lanka)
KEG	Kerguelen Island 1949 (Kerguelen Island)
KEA	Kertau 1948 (West Malaysia and Singapore)
LCF	L.C. 5 Astro 1961 (Cayman Brac Island)
LIB	Liberia 1964 (Liberia)
LUZA	Luzon (Philipines except Mindanao Island)
LUZB	Luzon (Mindanao Island)
MIK	Mahe 1971 (Mahe Island)
MAR	Marco Astro (Salvage Islands)
MAS	Massawa (Eritrea, Ethiopia)
MER	Merchich (Morocco)
MID	Midway Astro 1961 (Midway Island)
MIN	Minna (Nigeria)
NAHA	Nahrwan (Masirah Island, Oman)
NAHB	Nahrwan (United Arab Emirates)
NAHC	Nahrwan (Saudi Arabia)
NAP	Naparima (BWI Trinidad and Tobago)
NAS	North American 1927 (Mean value)
NASC	North American 1927 (Mean value: CONUS)
NASA	North American 1927 (Eastern US)
NASB	North American 1927 (Western US)
NASD	North American 1927 (Alaska)
NASQ	North American 1927 (Bahamas, except San Salvador Island)
NASR	North American 1927 (San Salvador Island)
NASE	North American 1927 (Mean value: Canada)
NASF	North American 1927 (Alberta and British Columbia)
NASG	North American 1927 (Newfoundland, New Brunswick, Nova Scotia, and Quebec)
NASH	North American 1927 (Manitoba and Ontario)

APPENDIX

Code	Name (Region)
NASI	North American 1927 (Northwest Territories and Saskatchewan)
NASJ	North American 1927 (Yukon)
NASO	North American 1927 (Canal Zone)
NASP	North American 1927 (Caribbean, Barbados, Caicos Islands, Cuba, Dominican Republic, Grand Cayman, Jamaica, Leeward Islands, and Turks Islands)
NASN	North American 1927 (Central America - Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua)
NAST	North American 1927 (Cuba)
NASU	North American 1927 (Hayes Peninsula, Greenland)
NASL	North American 1927 (Mexico)
NAR	North American 1983 (Mean Value: Alaska, Canada, CONUS, Mexico, and Central America)
FLO	Observatorio 1966 (Corvo and Flores Islands, Azores)
OEG	Old Egyptian (Egypt)
OHAM	Old Hawaiian (Mean value)
OHAA	Old Hawaiian (Hawaii)
OHAB	Old Hawaiian (Kauai)
OHAC	Old Hawaiian (Maui)
OHAD	Old Hawaiian (Oahu)
FAH	Oman (Oman)
OGBM	Ord. Survey G.B. 1936 (Mean value: England, Isle of Man, Scotland, Shetland, and Wales)
OGBA	Ord. Survey G.B. 1936 (England)
OGBB	Ord. Survey G.B. 1936 (England, Isle of Man, and Wales)
OGBC	Ord. Survey G.B. 1936 (Scotland and Shetland Islands)
OGBD	Ord. Survey G.B. 1936 (Wales)
PLN	Pico de las Nieves (Canary Islands)
PIT	Pitcairn Astro 1967 (Pitcairn Island)
HIT	Prov. S. Chilean (S. Chile, 53 S.)
PRPM	Prov. S. Amer. 1956 (Mean value: Bolivia, Chile, Colombia,Ecuador, Guyana, Peru, & Venezuela)
PRPA	Prov. S. Amer. 1956 (Northern Chile near 19 degrees south)
PRPC	Prov. S. Amer. 1956 (Southern Chile near 43 degrees south)
PRPD	Prov. S. Amer. 1956 (Columbia)
PRPE	Prov. S. Amer. 1956 (Ecuador)
PRPF	Prov. S. Amer. 1956 (Guyana)
PRPG	Prov. S. Amer. 1956 (Peru)
PRPH	Prov. S. Amer. 1956 (Venezuela)
PUR	Puerto Rico (Puerto Rico and Virgin Islands)
QAT	Qatar National (Qatar)
QUO	Qornoq (South Greenland)
REU	Reunion (Mascarene Island)
MOD	Rome 1940 (Sardinia Island)
SAE	Santo (DOS) 1965 (Espirito Santo Island)

APPENDIX

Code	Name (Region)
SAO	Sao Braz (Sao Miguel, Santa Maria Islands, Azores)
SAP	Sapper Hill 1943 (East Falkland Islands)
SCK	Schwarzeck (Namibia)
SANM	South American 1969 (Mean value: Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, and Venezuela)
SANA	South American 1969 (Argentina)
SANB	South American 1969 (Bolivia)
SANC	South American 1969 (Brazil)
SAND	South American 1969 (Chile)
SANE	South American 1969 (Columbia)
SANF	South American 1969 (Ecuador)
SANG	South American 1969 (Guyana)
SANH	South American 1969 (Paraguay)
SANI	South American 1969 (Peru)
SANK	South American 1969 (Trinidad and Tobago)
SANL	South American 1969 (Venezuela)
SOA	South Asia (Southeast Asia, Singapore)
POS	SE Base (Porto Santo) (Porto Santo & Madeira Islands)
GRA	SW Base (Faial, Graciosa, Pico, Sao Jorge, and Terceira Island, Azores)
TAN	Tananarive Obsv. 1925 (Madagascar)
TIL	Timbali 1948 (Brunei and East Malaysia - Sarawak and Sabah)
*TOK	Tokyo (Mean value)
TOYM	Tokyo (Mean value: Japan, Korea, and Okinawa)
TOYA	Tokyo (Japan)
TOYB	Tokyo (Korea)
TOYC	Tokyo (Okinawa)
TDC	Tristan Astro 1968 (Tristan da Cunha)
UND	Undetermined (processed as if WGS 84)
MVS	Viti Levu 1916 (Viti Levu Island, Fiji Islands)
ENW	Wake-Eniwetok 1960 (Marshall Islands)
WGC	World Geodetic System 1972
WGE	World Geodetic System 1984
YAC	Yacare (Uruguay)
ZAN	Zanderij (Surinam)

*Code used by previous ADRG specification.

60.2.2 Sounding datum codes.

Code	Description
MHW	Mean High Water
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MHHW	Mean Higher High Water
MLW	Mean Low Water
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MLLW	Mean Lower Low Water

60.2.3 Vertical reference system codes.

Code	Description
MSL	Mean Sea Level (All elevations in the data set are referenced to the geoid of the specified datum.)
GEOD	Geodetic (All elevations in the data set are referenced to the ellipsoid of the specified datum.)

60.3 Ellipsoid codes.

Code	Description
AAY	Airy
AUN	Australian National
BES	Bessel 1841
bes	Bessel 1841 (Namibia)
CLK	Clarke 1866
CLJ	Clarke 1880
EVE	Everest
FM	Fischer 1960
FC	Fischer 1968
RE	Geodetic Reference System 1967
GRS	Geodetic Reference System 1980
HE	Helmert 1906
HO	Hough
INT	International
KRA	Krasovsky
AAM	Modified Airy
EVM	Modified Everest
FA	Modified Fischer 1960 (South Asia)
SA	South American 1969
WGA	World Geodetic System 1960
WGB	World Geodetic System 1966
WGC	World Geodetic System 1972
WGE	World Geodetic System 1984

60.4 Grid codes.

Code	Description
AD	Aden Zone
AF	Afghanistan Gauss-Krueger Grid
AG	Air Defense Grid
AI	Air Support Grid
AJ	Alabama Coordinate System
AK	Alaska Coordinate System
AL	Algeria Zone
AM	Albania Bonne Grid

APPENDIX

Code	Description
AN	Alpha-Numeric (Atlas) Grid
AO	Arbitrary Grid
AP	American Samoa Coordinate System
AQ	Argentine Gauss-Krueger Conformal Grid
AR	Artillery Referencing System
AS	Arizona Coordinate System
AU	Australia Belts
AV	Arkansas Coordinate System
AW	Australian Map Grid
AX	Azores Gauss Conformal Grid
AZ	Azores Zone
BA	Baku 1927 Coordinate System
BB	Bavaria Solder Coordinate System
BC	Belgium Lambert Grid
BE	Belgium Bonne Grid
BF	Brazil Gauss Conformal Grid
BO	Borneo Rectified Skew Orthomorphic Grid
BW	British West Indies Grid
CB	California Coordinate System
CD	Canada British Modified Grid
CE	Ceylon Belt (Transverse Mercator)
CF	Canary Islands (Spanish) Lambert Grid
CG	Chile Gauss Conformal Grid
CH	China Belt
CI	Canary Islands Zone
CJ	China Lambert Zone
CK	Colorado Coordinate Zone
CM	Connecticut Coordinate System
CN	Caspian Zone
CO	Costa Rica Lambert Grid
CQ	Crimea Grid
CR	Crete Zone
CT	Cuba Lambert Grid
CU	Caucasus Zone
CV	Cape Verde Islands Zone
CW	British Cassini Grid
CX	Czechoslovak Uniform Cadastral Coordinate System
CY	Cyprus Grid
CZ	Czechoslovak Military Grid
DA	Danube Zone
DB	Dahomey Belt
DC	Denmark General Staff Grid
DD	Delaware Coordinate System
DE	Dominican Lambert Grid
DJ	Denmark Geodetic Institute System 1934
DK	Cape Verde Peninsula Grid
EA	East Africa Belt
EB	English Belt
ED	Egypt Gauss Conformal Grid

APPENDIX

Code	Description
EE	El Salvador Lambert Grid
EF	Estonian Grid
EP	Egypt Purple Belt
ER	Egypt Red Belt
ET	Egypt 35 Degree Belt
FA	Fernando Poo Gauss Grid
FB	Fiji Grid
FC	Florida Coordinate System
FD	French Bonne Grid
FE	French Guiana Gauss Grid
FF	French Somaliland Gauss-LaBorde Grid
FI	French Indochina Grid
FJ	Franz Josef Land Zone
FL	French Lambert Grid
FO	Formosa (Taiwan) Gauss-Schreiber Coordinate System
FS	French Equatorial Africa Grid
GA	Gabon Belt
GB	Italy Gauss-Boaga Grid (Transverse Mercator)
GD	Gabon Gauss Conformal Grid
GE	World Geographic Reference System (GEOREF)
GF	Guadeloupe Gauss-LaBorde Grid
GG	Colombia Gause Conformal Grid
GH	Sweden Gauss-Hannover Grid
GI	Georgia Coordinate System
GK	Gauss-Krueger Grid (Transverse Mercator)
GL	Greece Azimuthal Grid
GN	German Army Grid (DHG)
GO	Ghana National Grid
GP	Greece Bonne Grid
GQ	Greece Conical Mecklenburg Coordinates
GR	Greece Conical Mecklenburg Coordinate (New Numbering)
GT	Greenland Lambert Grid
GU	Guinea Zone
GV	Guam Coordinate System
GW	Guatemala Lambert Grid
GY	Guyana Transverse Mercator Grid
HB	Haiti Lambert Grid
HC	Hawaii Coordinate System
HD	Hawaii Grid
HE	Honduras Lambert Grid
HF	Hong Kong New System Cassini Grid
HG	Hungary Stereographic Grid
HK	Hong Kong Colony Grid
IA	Idaho Coordinate System
IB	Illinois Coordinate System
IC	Indiana Coordinate System
ID	Indonesia Mercator Grid
IE	Indonesia Polyhedric Grid
IF	Iowa Coordinate System

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Code	Description
IG	Ivory Coast Azimuthal Grid
IH	Irish Cassini Grid
IJ	Ivory Coast Belt
IK	Irish Transverse Mercator Grid
IL	Iceland New Lambert Zone
IN	India Zone
IP	Iberian Peninsula Zone
IQ	Iraq Zone
IR	Iraq National Grid
IT	Italy Zone
IY	Ivy - Found on an HA in Marshall Islands
IZ	Iceland Zone
JA	Jamaica Foot Grid
JB	Japan Plane-Rectangular Coordinate System
JC	Japan Gauss-Schreiber Grid
JO	Johore Grid
KA	Austria Gauss-Krueger Grid
KB	Bulgaria Gauss-Krueger Grid
KC	Katanga Grid
KD	Kansas Coordinate System
KE	Kentucky Coordinate System
KF	Finland Gauss-Kreuger Grid
KG	German Gauss-Kreuger Grid
KH	Kenya Colony Grid
KJ	Korea Gauss-Schreiber Coordinate System
KK	Louisiana Coordinate System
KL	Lithuania Gauss-Kreuger Grid
KN	Kwantung Province Grid
KT	Turkey Gauss-Kreuger Grid
KW	Kwangsi Province Grid
KX	Luxembourg Gauss-Kreuger Grid
LC	Lambert Conformal Conic Grid
LD	Latvia Coordinate System
LE	Levant Zone
LF	Levant Stereographic Grid
LG	Liberia Rectified Skew Orthomorphic Grid
LI	Libya Zone
LL	Sirte (Libya) Lambert Grid
MA	Malaya Grid
MB	Malta Belt
MC	Maldive-Chagos Belt
MD	Madiera Zone
ME	Mediterranian Zone
MF	Maine Coordinate System
MG	Malaya Rectified Skew Orthomorphic (Yard) Grid
MH	Martinique Gauss Grid
MI	Maryland Coordinate System
MJ	Massachusetts Coordinate System
MK	Mexican Lambert Grid
ML	Michigan Coordinate System

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Code	Description
MM	Mecca-Muscat Zone
MN	Minnesota Coordinate System
MO	Madagascar Grid (Laborde)
MP	Mississippi Coordinate System
MQ	Morocco Zone
MT	Missouri Coordinate System
MU	Mauritius Zone
MV	Montana Coordinate System
MW	Mozambique Lambert Grid
MX	Mozambique Polyconic Grid
NA	Northwest Africa Zone
NC	Nigeria Colony Belt
ND	National Grid of Great Britain
NE	Northern European Zone
NF	Nebraska Coordinate System
NG	Numeric Grid
NI	Niger Zone
NJ	Netherlands Stereographic Grid (Old Numbering)
NK	North Korea Gauss-Kreuger Grid
NL	Netherlands Stereographic Grid (New Numbering)
NM	Netherlands East Indies Equatorial Zone British Metric Grid (Lambert)
NO	Nord de Guerre Zone
NP	Nevada Coordinate System
NQ	New Sierra Leone Colony Grid
NR	New York Coordinate System
NS	Netherlands East Indies Southern Zone
NT	New Zealand National Grid
NU	Nicaragua Lambert Grid
NV	Niger Belt
NW	North Carolina Coordinate System
NX	North Dakota Coordinate System
NY	Netherlands East Indies Equatorial Zone U.S. Yard Grid
NZ	New Zealand Belt
OA	Northern Malaya Grid
OB	Norway Gauss-Kreuger Grid
OD	Ohio Coordinate System
OE	Oklahoma Coordinate System
OR	Orange Report Net
OS	Oregon Coordinate System
PA	Palestine Belt
PB	Panama Lambert Grid
PC	Palestine Civil Grid (Cassini)
PD	Paraguay Gauss-Kreuger Grid
PE	Peiping Coordinate System of 1954
PF	Pennsylvania Coordinate System
PI	Peru Polyconic Grid
PJ	Philippine Plane Coordinate System
PK	Poland Gauss-Kreuger Grid

APPENDIX

Code	Description
PL	Poland Quasi-Stereographic Grid
PP	Philippine Polyconic Grid
PQ	Portugal Bonne Grid, Old
PR	Portugal Bonne Grid, New
PS	Portugal Gauss Grid
PT	Puerto Rico Coordinate System
PU	Puerto Rico Lambert Grid
QA	Qatar Grid
QU	Qatar Peninsula Grid
RB	Russian Belt
RC	Reunion Gauss Grid
RD	Rhode Island Coordinate System
RE	Rumania Bonne Grid
RF	Soviet Coordinate System of 1942
RH	Rumania Lambert-Cholesky Grid
RI	Rumania Stereographic Grid
RT	Pulkovo Coordinate system of 1932
SA	South Africa Belt
SB	Senegal Gauss Conformal Grid (Belt)
SD	South Africa Coordinate System (Republic of South Africa)
SE	Senegal Belt
SF	South Carolina Coordinate System
SH	Sahara Zone
SI	South Dakota Coordinate System
SJ	South Libya Zone
SK	Sarawak Grid
SL	Spain Lambert Grid
SN	Southern New Guinea Grid
SQ	South Georgia Lambert Grid
SR	South Syria Lambert Grid
SS	Spanish North-Morocco Lambert Grid
SV	Svalbard Gauss-Kreuger Grid
SX	Svobodny 1935 Coordinate System
SY	Seychelles Belt
SZ	Spitzbergen Zone
TA	Tanganyika Territorial Grid
TB	Tashkent 1875 Coordinate System
TC	Tennessee Coordinate System
TD	Texas Coordinate System
TE	Tobago Grid
TF	Trinidad Grid
TG	Trucial Coast Cassini Grid
TH	Trucial Coast Transverse Mercator Grid
TI	Turkey Bonne Grid
TN	Tunisia Zone
UA	Uganda Cassini Coordinate System
UB	Unidentified Grid
UC	Uruguay Gauss-Kreuger Grid
UD	Utah Coordinate System

APPENDIX

Code	Description
UP	Universal Polar Stereographic System
US	U.S. Polyconic Grid System
UT	Universal Transverse Mercator Grid
VA	Vermont Coordinate System
VB	Virginia Coordinate System
VE	Venezuela Modified Lambert Grid
VI	Viet Nam Azimuthal Grid
WA	West Malaysia Rectified Skew Orthomorphic(Metric)Grid
WB	Switzerland Bonne Grid
WC	Switzerland Conformal Oblique Cylindrical Grid
WD	West Virginia Coordinate System
WE	Wisconsin Coordinate System
WF	Wyoming Coordinate System
WP	World Polyconic System
YA	Yugoslavia Gauss-Kreuger Grid (Not Reduced)
YG	Yugoslavia Reduced Gauss-Kreuger Grid
YU	Yunnan Province Grid

60.5 Chart series codes.

Code	Description
AT	Series 200 Air Target Chart (ATC) 1:200,000
GN	Global Navigation Chart (GNC) 1:5,000,000
JA	Joint Operations Graphic-Air (JOG-A) 1:250,000
JC	Joint Operations Graphic-Combined (JOG-C) 1:250,000
JG	Joint Operations Graphic-Ground (JOG-G) 1:250,000
JN	Jet Navigation Chart (JNC) 1:2,000,000
JR	Joint Operations Graphic-RADAR (JOG-R) 1:250,000
ON	Operational Navigation Chart (ONC) 1:1,000,000
TC	Topographic Line Map (TLM 100) 1:100,000
TL	Topographic Line Map (TLM 50) 1:50,000
TP	Tactical Pilotage Chart (TPC) 1:500,000

60.6 Units of measure codes.

Code	Description
000	Unknown
001	Meters (Length, Area, Volume)
002	Kiloponds (Weight)
003	Seconds (Of Time)
004	Meters/Second (Speed)
005	Cubic Meters/Second (Flow)
006	Volt (Electrical Potential)
007	Watt (Ten to the Sixth (Electrical Power)
008	Hertz (Frequency)

Code	Description
009	± DDD MM SS.S (Angular)
010	± HH MM SS.S (Time)
011	International Nautical Mile (1852 meters)
012	Knot
013	Nautical Mile/Day
014	Feet
015	Fathom
016	Micrometers (Microns)
017	Mils
018	Seconds of arc
019	Minutes of arc
020	Degrees of arc
999	Other

60.7 Navigation systems codes.

Code	Description
000	Unknown
001	Circular Radio Beacon
002	CONSOL
003	DECCA
004	Radio Direction Finding
005	Directional Radio Beacon
006	Distance Finding
007	Long Range Air Navigation System (LORAN)
008	OMEGA
009	
010	Radar Responder Beacon (RACON)
011	Radar
012	Radio
013	Radio Telephone
014	
015	TV
016	Microwave
017	Non-Directional Radio Beacon (NCB)
018	Non-Directional Beacon/Distance Measuring Equipment (NDB/DME)
019	Radio Range (RNG)
020	VHF Omni Directional Radio Range (VOR)
021	VHF Omni Directional (VOR/DME)
022	VHF Omni Directional (VORTAC)
023	Tactical Air Navigation Equipment (TACAN)
024	Instrument Landing System (ILS)

APPENDIX

Code	Description
025	(ILS/DME)
026	Localizer (LOC)
027	Localizer/Distance Measuring Equipment (LOC/DME)
028	Simplified Directional Facility (SDF)
029	Landing Distance Available (LDA)
030	Microwave Landing System (MLS)
031	Fan Marker
032	Bone Marker
033	Radio Telegraph
034	Ground Controlled Approach (GCA)
035	Radar Antenna
036	
037	Precision Approach Radar(PAR)
038	Aeronautical Radio
039	
040	Radio Beacon
041	Rotating Loop Radio Beacon
042	Visual Flight Rules (VFR) Test Signal Maker
043	
044	Consol Radio Beacon
045	Aeronautical Radio Rance
046	Radar Station
047	Hifix
048	Hyperfix
999	Other

APPENDIX

60.8 Projection codes and parameters.

TABLE II. Projection codes and parameters.

Name	Code	Parameters			
		1	2	3	4
Albers Equal Area	AC	Central Meridian	Std. Parallel Nearest to Equator	Std. Parallel Farthest from Equator	Latitude of Origin
Azimuthal Equal Area	AK	not currently supported		-	-
Azimuthal Equal Distant	AL	Longitude of Tangency	Latitude of Tangency	-	-
Gnomonic	GN	not currently supported		-	-
Hotine Oblique Mercator	RB	Longitude of Great Circle	Latitude of Great Circle	Azimuth of Great Circle	-
Lambert Conformal Conic	LE	Central Meridian	Std. Parallel Nearest to Equator	Std. Parallel Farthest from Equator	Latitude of Origin
Lambert Equal Area	LJ	not currently supported	-	-	-
Mercator	MC	Central Meridian	Latitude of True Scale	-	-
Oblique Mercator	OC	Longitude of Great Circle	Latitude of Great Circle	Azimuth of Great Circle	-
Orthographic	OD	Longitude of Tangency	Latitude of Tangency	-	-
Polar Stereographic	PG	Central Meridian	Latitude of True Scale	Latitude of Origin	Longitude of Origin
Polyconic	PH	Central Meridian	Latitude of Origin	-	-
Transverse Mercator	TC	Central Meridian	Meridian of True North	Central Scale Factor	-
Universal Transverse Mercator	UT	Central Meridian	-	-	-

APPENDIX

70. COMPUTATION OF ARC SYSTEM DATA

70.1 ARC system data for scale 1:1,000,000. Pixel spacing constants and spacing intervals for all zones at the scale 1:1,000,000 are shown in table III below.

TABLE III. ARC system parameter values at scale 1:1,000,000.

Zone Limits[1]					Nominal Pixel Spacing[2]	
Zone Number	Equator-ward	Pole-ward	A	B	Lon (microns)	Lat (microns)
1,10	0	32	369664	400384	99.9	99.9
2,11	32	48	302592	400384	99.9	99.9
3,12	48	56	245760	400384	100.0	99.9
4,13	56	64	199168	400384	99.9	99.9
5,14	64	68	163328	400384	99.7	99.9
6,15	68	72	137216	400384	99.7	99.9
7,16	72	76	110080	400384	99.8	99.9
8,17	76	80	82432	400384	100.0	99.9
9,18	80	90	400384	400384	99.9	99.9

Notes:
1. Latitudes are shown unsigned for convenience.
2. Measured at the latitude which gives equal stretch and shrink at zone limits on the WGS 84 ellipsoid.

70.2 Computing zone data for scale 1:S. Pixel Spacing constants A_{ss} and B_s for a graphic at scale 1:S in zone Z are determined using the A and B values for scale 1:1,000,000 in zone Z with the real scale factor N

$$N = \frac{1{,}000{,}000}{S}.$$

The A and B values for 1:1,000,000 are multiplied by N and the results rounded up to the next multiple of 512 to give the values A_{ss} and B_s.

Note: The A_{ss} and B_s values provided with the ADRG image data are already adjusted for the scale and zone of the image data.

70.3 Stretch and shrink values for zones. The maximum stretch at the poleward limit (or shrink at the equatorward limit) for each zone is shown in table IV. Also indicated is the latitude ("mid") at which nominal pixel spacing is defined. These values apply for all scales of data.

APPENDIX

TABLE IV. Mid-latitude and maximum stretch and/or shrink (exclusive of overlap).

Zone	Latitude (degrees)			Maximum Stretch or Shrink (%)
	Equatorward	mid	Polewards	
1, 10	0	22.94791772	32	8.54
2, 11	32	41.12682127	48	12.53
3, 12	48	52.28859923	56	9.36
4, 13	56	60.32378942	64	12.92
5, 14	64	66.09421768	68	8.17
6, 15	68	70.10896259	72	10.09
7, 16	72	74.13230145	76	13.01
8, 17	76	78.17283750	80	18.03
9, 18	80	-------	90	-------

70.4 ZDR and overview image tiling. The global tiling of ZDR and overview images permits simple merging of adjacent ZDRs or overviews from a common ADRG zone into larger, seamless images without re-tiling or transforming the data.

70.4.1 Tiling. A tiling is defined for each separate scale of data, using the applicable ADRG projection origin as the origin of the tiling. For each ZDR or overview, padding by Black pixels is included on the top and left edges of the image so that the upper-left pixel (<column, row> = <0,0>) of the (padded) image is at a distance from the projection origin which is an integral multiple of 128 pixels in each of the row and column directions. (See figures 25 and 26.)

a. Distances (in pixels) from the origin for a specific pixel are based on the ARC system coordinates associated with the pixel and the A_{zz} and B_s values for that ZDR or overview. The distances from the origin are computed using the rectangular projection coordinates. The pixel distances are then derived by multipling projection distances by the applicable factor: $A_{zz}/360$ for longitude (or *X*) direction, or $B_s/360$ for latitude (or *Y*) direction.

b. The ARC system origin for a non-polar zone is the prime meridian at the equator ($\phi = 0$, $\lambda = 0$) in the Equirectangular projection, WGS 84.

c. The ARC system origin for a polar zone is at the pole ($Y = 0$, $X = 0$) in the appropriate Polar Azimuthal Equidistant projection, polar aspect, spherical form.

d. Each tile in a ZDR or overview image has the property that its upper-left (<0,0>) pixel is at a distance from the ARC system origin for its zone which is an integral multiple of 128 pixels in each of the row and column directions.

e. Note that the tiling is uniform over any one zone at any one scale of data. The tiling differs in the East-West (or *X*, or column) direction for different zones.

70.4.2 Adjoining tiles. Corresponding tiles along the common edge of adjoining ZDRs or overview images from any one ADRG zone may be merged pixel-by-pixel into single, seamless tiles. For each such tile, pairs of corresponding pixels (one from each tile) are examined, and the non-Black pixel (if any) is selected for the merged tile. Since Black pixels have zero value, this selection process can be implemented by adding or "or-ing" the pixel component values, although this will result in an artifact which is one pixel wide where the adjacent images share a single row or column of common image data lying on a chart or map neat line next to the image padding. (See figure 28.)

70.4.3 East-West tiling. There are always an even number of tiles circling the globe East-West in a non-polar zone. The number of tiles East-West across a non-polar zone for a given scale of data may be found by dividing the appropriate ADRG A_{xx} value by 128.

70.5 Relationship between a pixel and its geographic coordinates. Each pixel in a ZDR is associated with one and only one geographic location on the WGS 84 datum, as defined in Appendix, section 30. When a pixel is displayed, covering an area on the display media surface (e.g. on a video display), the pixel's associated geographic applies to all points within that area. If a computed point geographic falls in between geographics associated with ZDR pixels, a pixel corresponding to that point should be selected by choosing the nearest of the 4 neighboring pixels.

APPENDIX

80. ADDITIONAL FIGURES

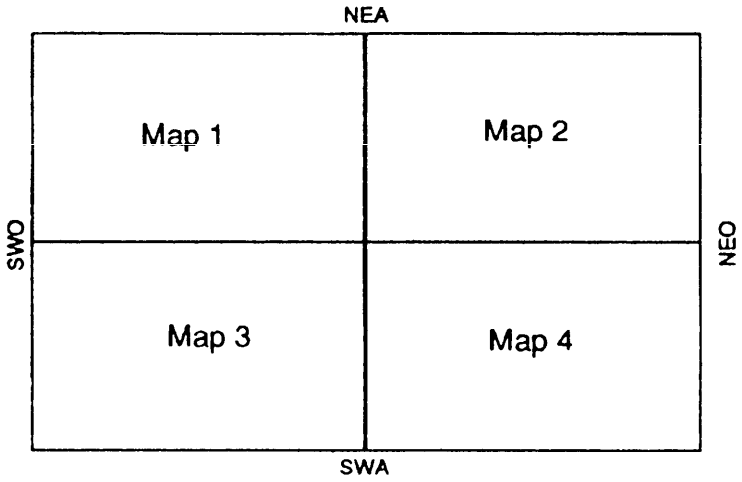


FIGURE 18. Seamless four-map DR.

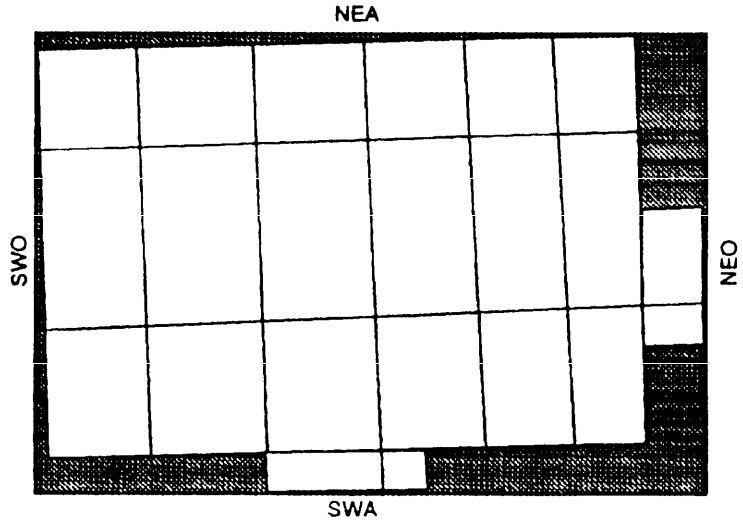
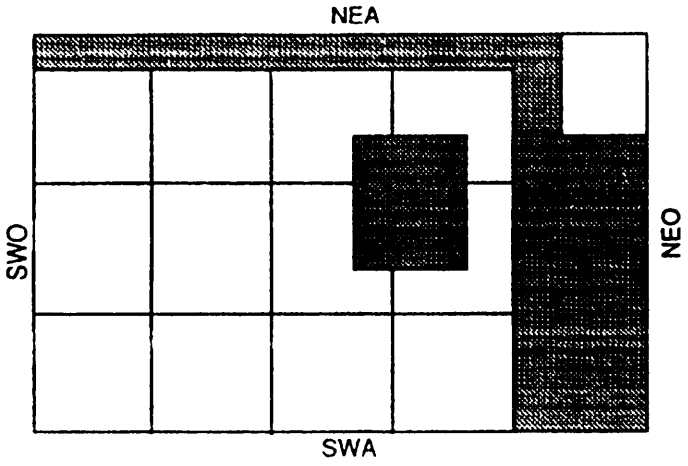


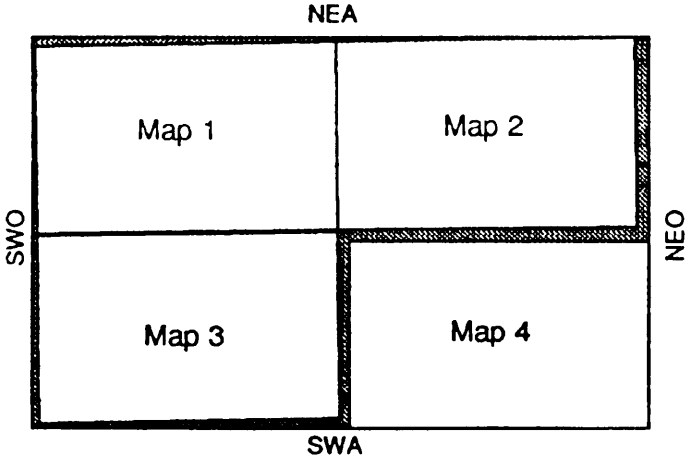
FIGURE 19. DR for source graphic with outsets.

APPENDIX



A DR formed by a map and its inset. The inset is an external inset at the same scale as the main map. The inset is placed at the correct geographic area in the ADRG image, and the inset area on the main graphic is blacked out.

FIGURE 20. Map and inset DR.



Four maps in a distribution rectangle. Maps 1,2 and 3 are on the same datum, while map 4 is on a different datum. The difference between the two datums causes a gap in the DR. The size of the gap depends on the datums and scale involved. The larger the scale, the larger the gap (in pixels).

FIGURE 21. Four map DR.

APPENDIX

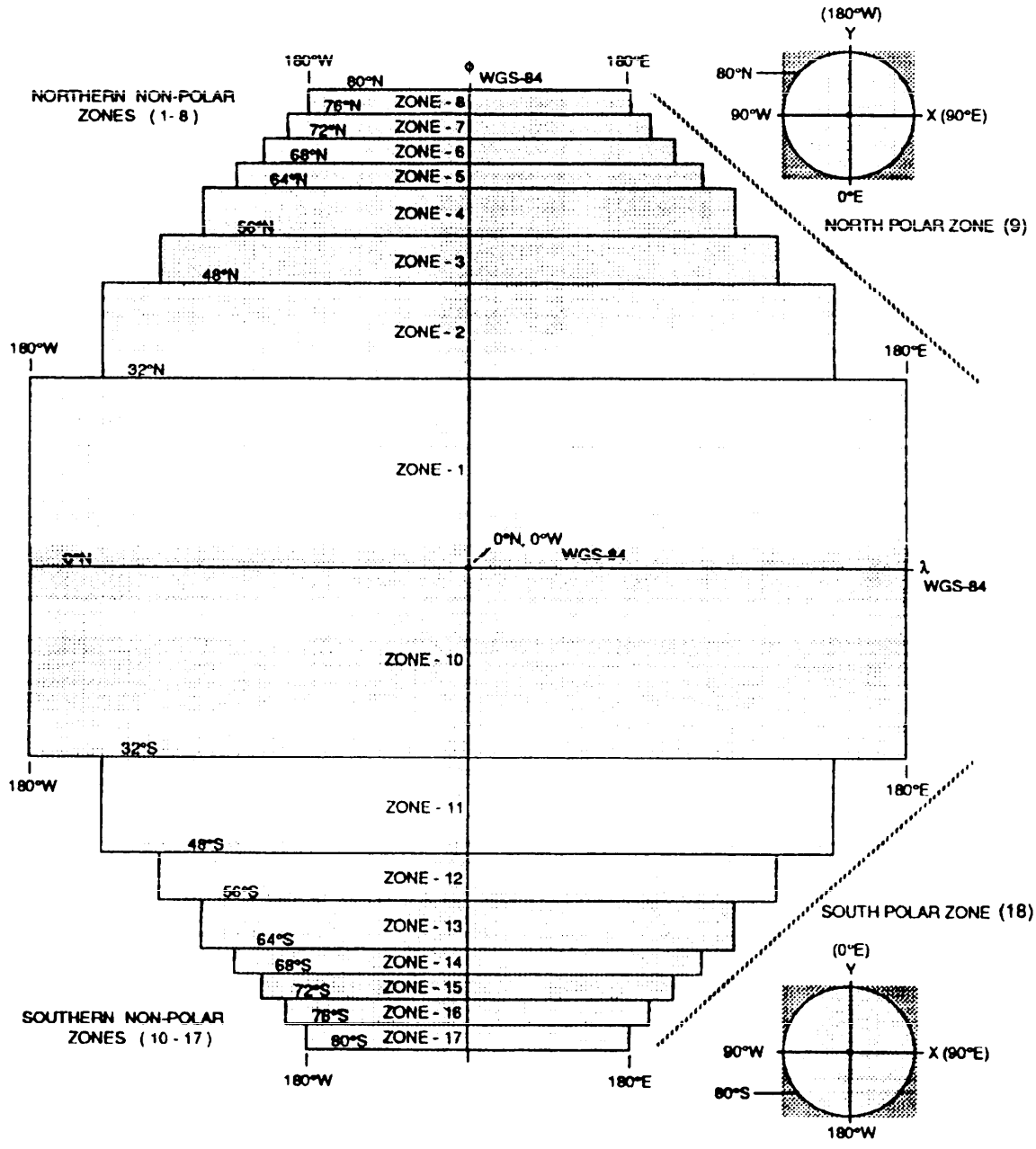


FIGURE 22. ARC system zone layout.

APPENDIX

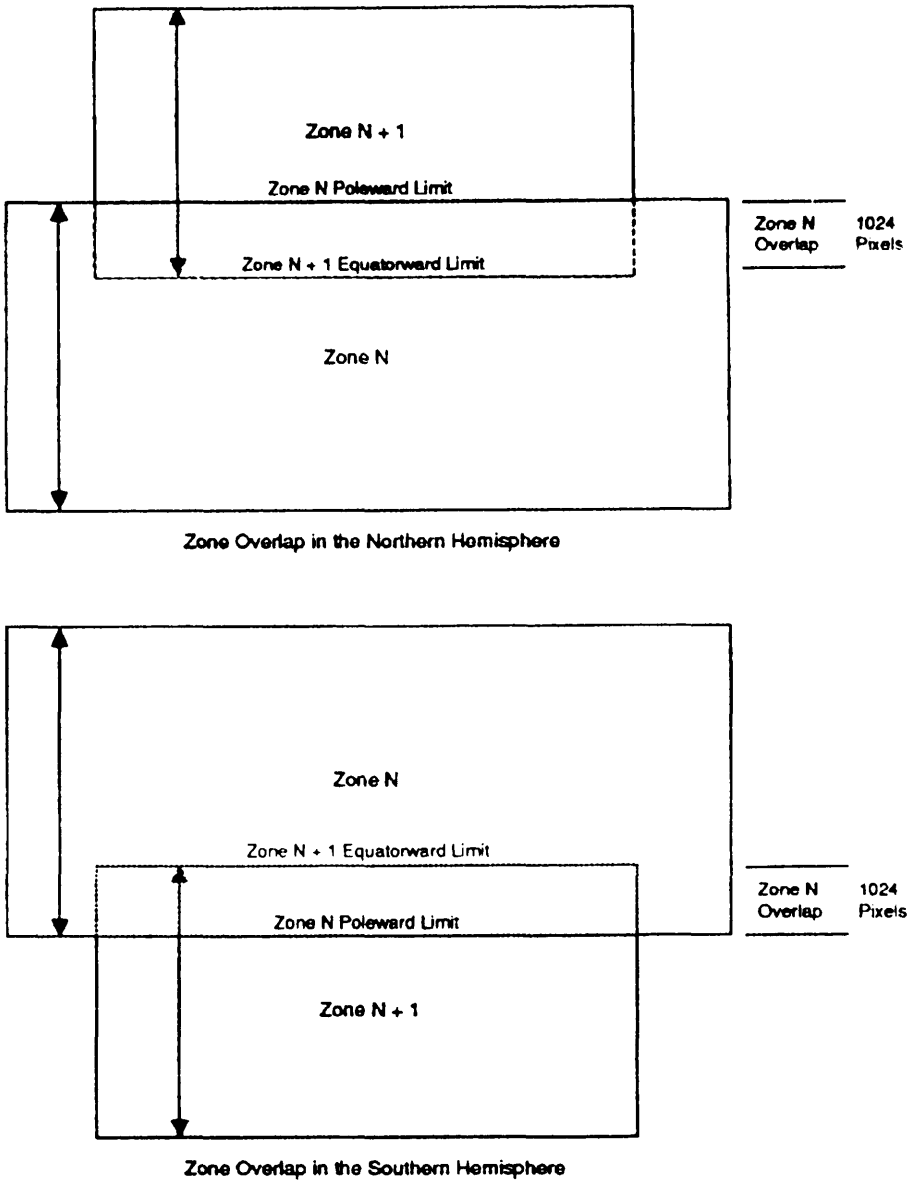


FIGURE 23. ARC system zone overlap.

APPENDIX

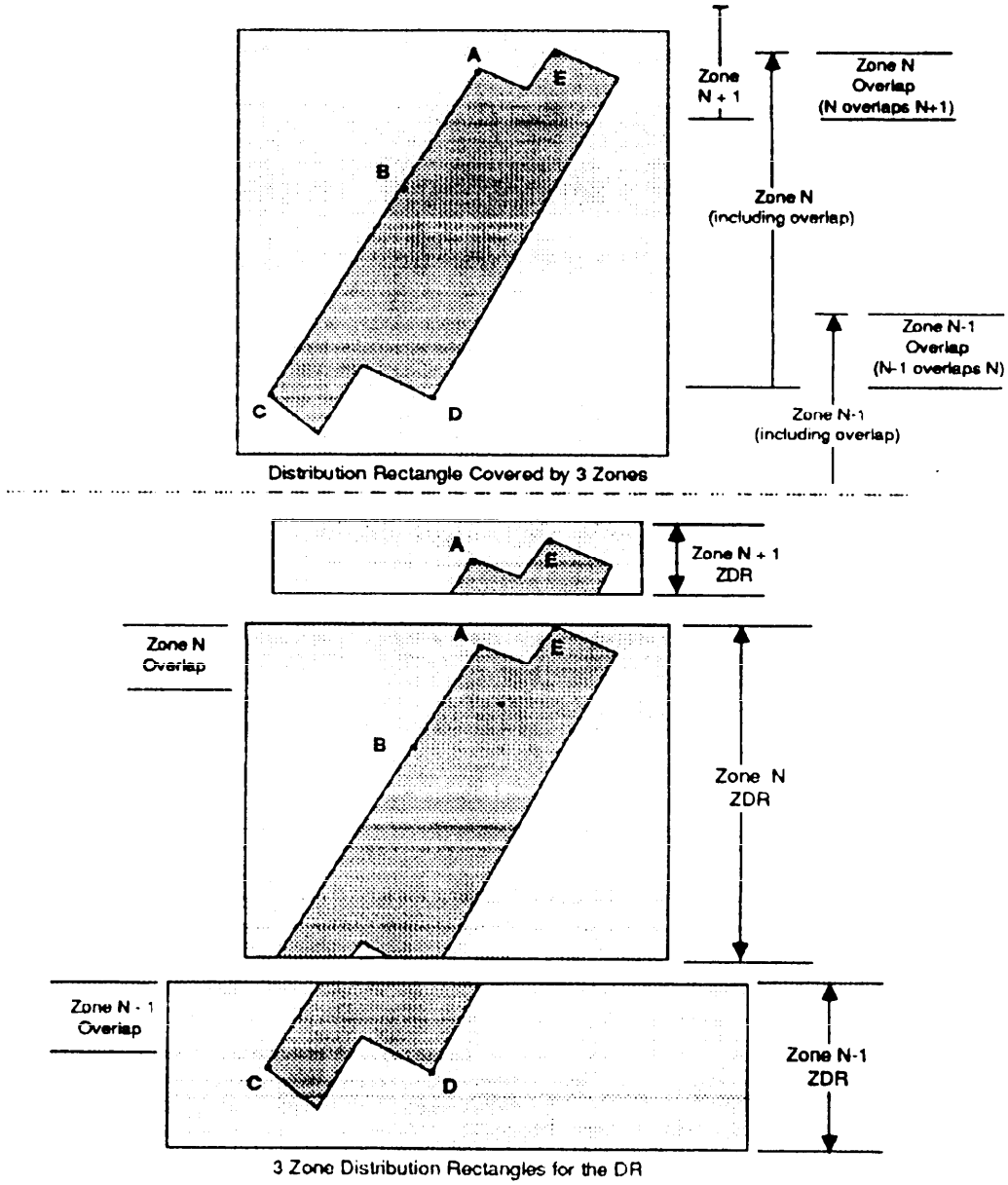


FIGURE 24. A multi-zoned DR divided into component ZDRs (northern hemisphere).

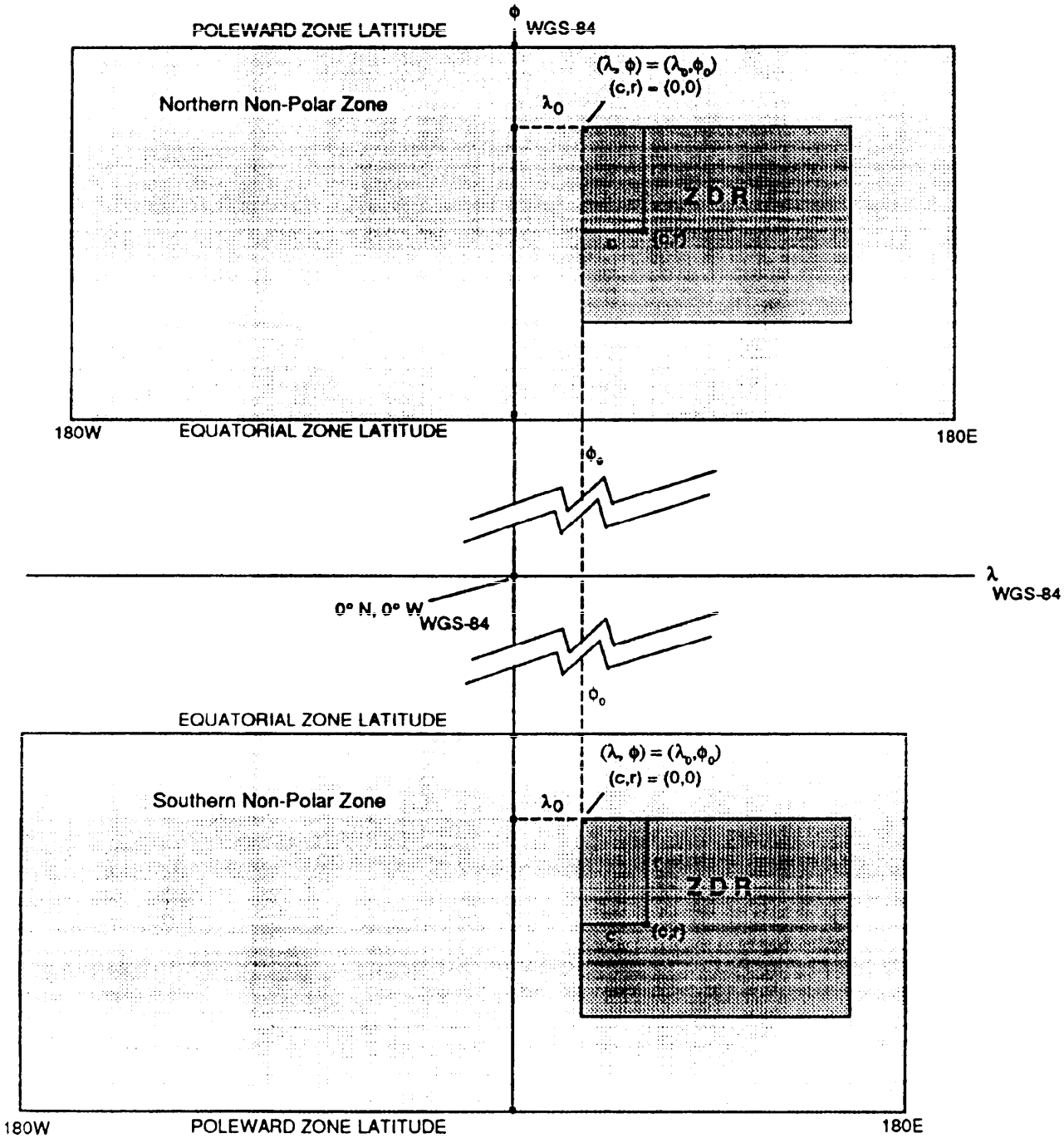


FIGURE 25. Non-polar ZDR coordinates.

APPENDIX

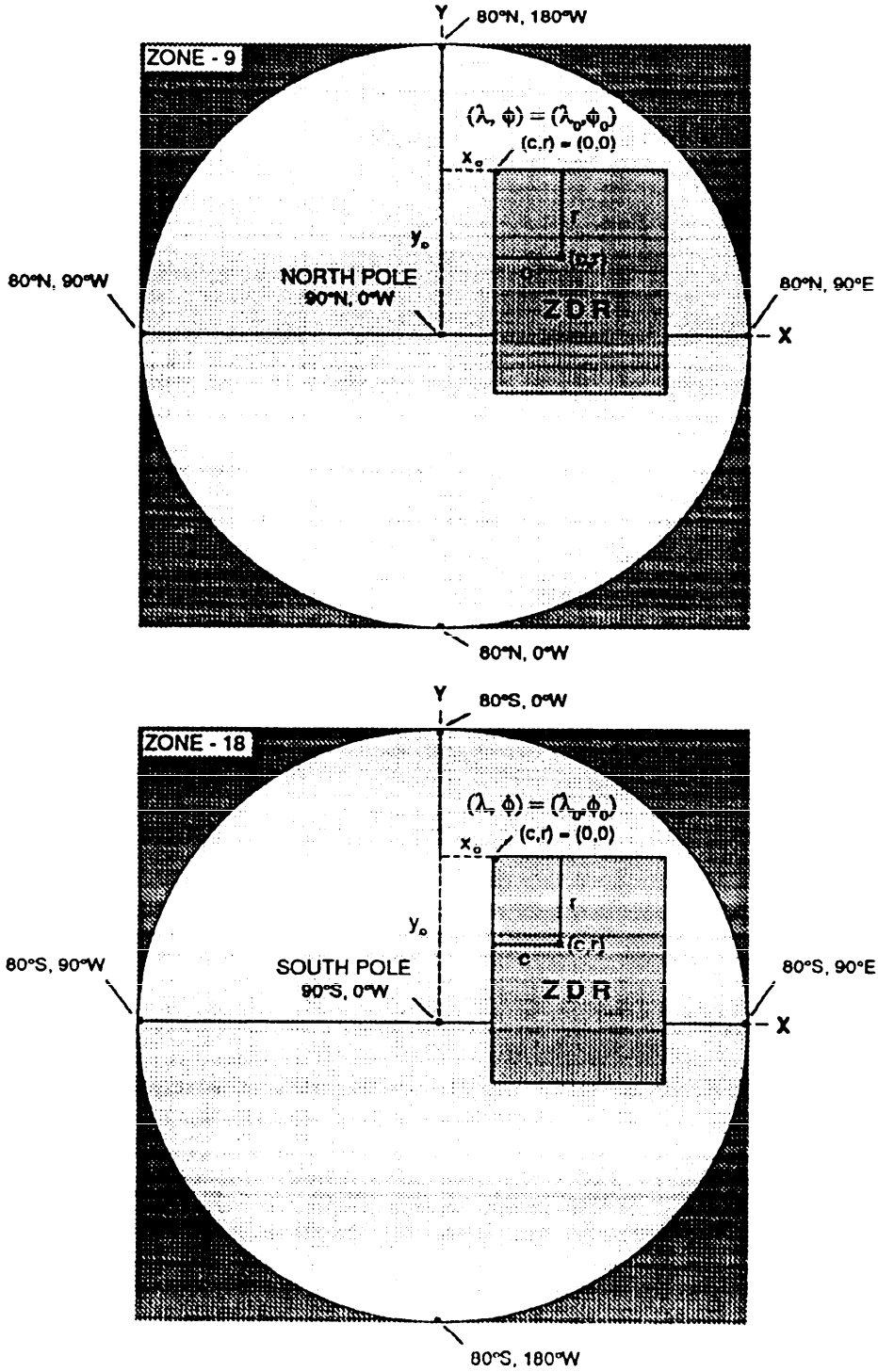
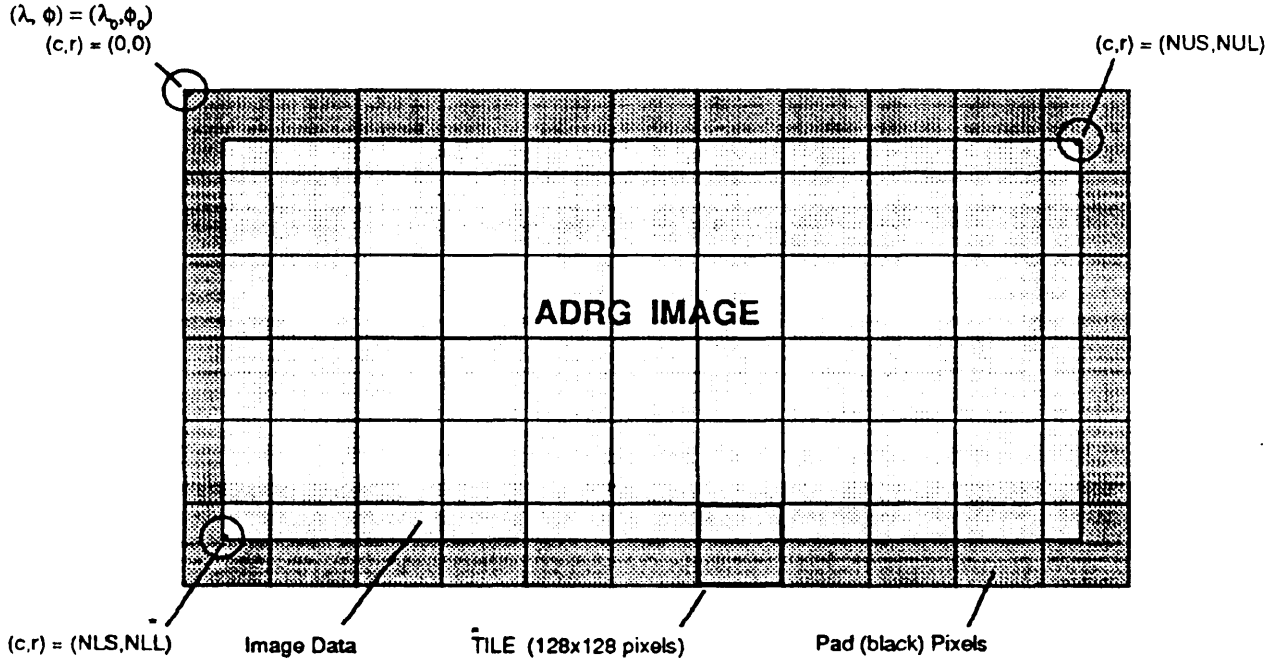


FIGURE 10. Polar ZDR coordinates.



*Note: The subfield values NUS, NUL, NLS and NLL are image coordinates given in the DATA_SET_PARAMETERS_FIELD, SPR.

The subvield values LSO and PSO are image origin coordinates given in the GENERAL_INFORMATION_FIELD, GEN, for the ZDR image, or the OVERVIEW_INFORMATION_FIELD, OVI, for the overview image.

FIGURE 27. ADRG image tile structure.

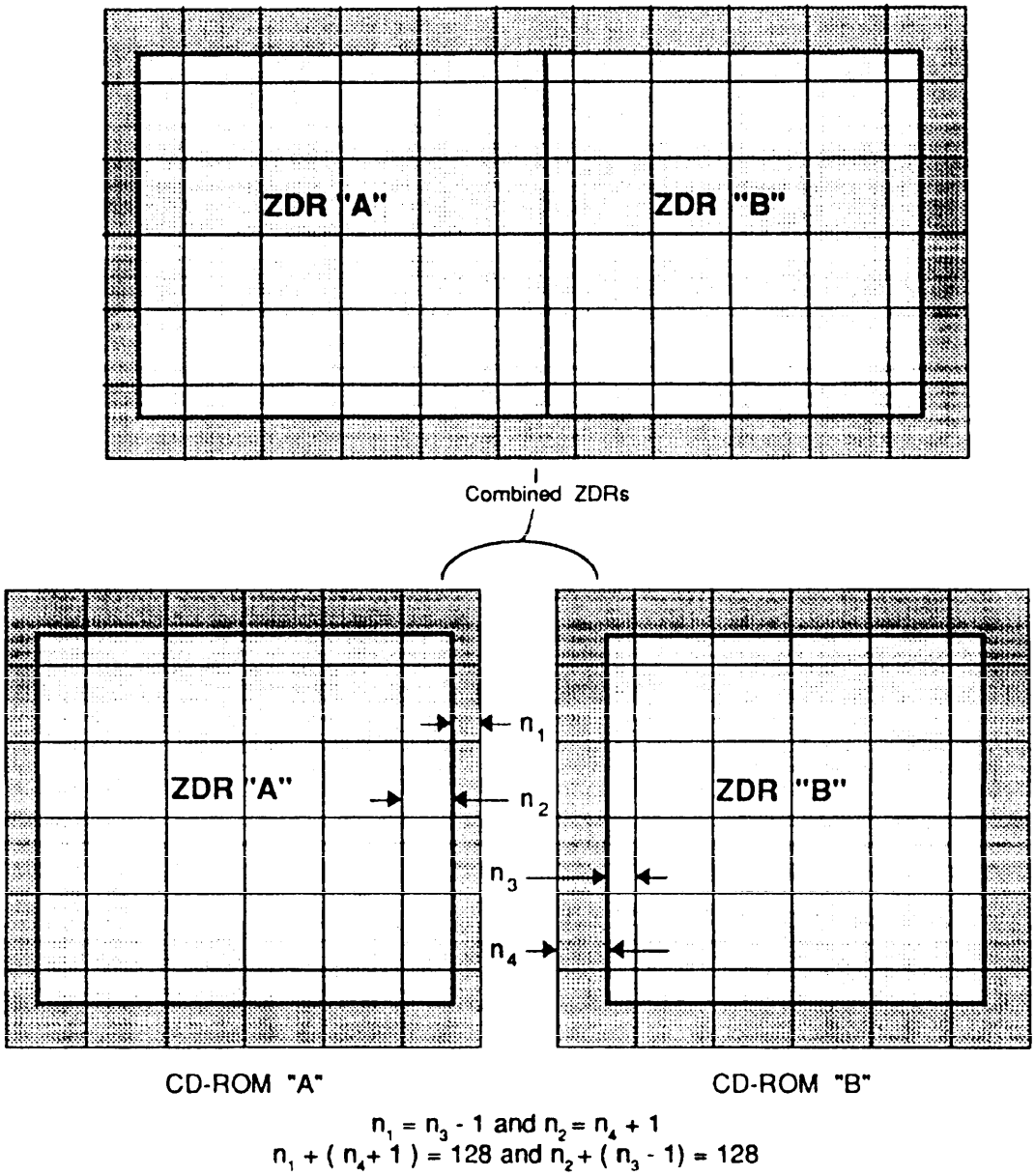


FIGURE 28. Tile compatibility for contiguous ZDRs.

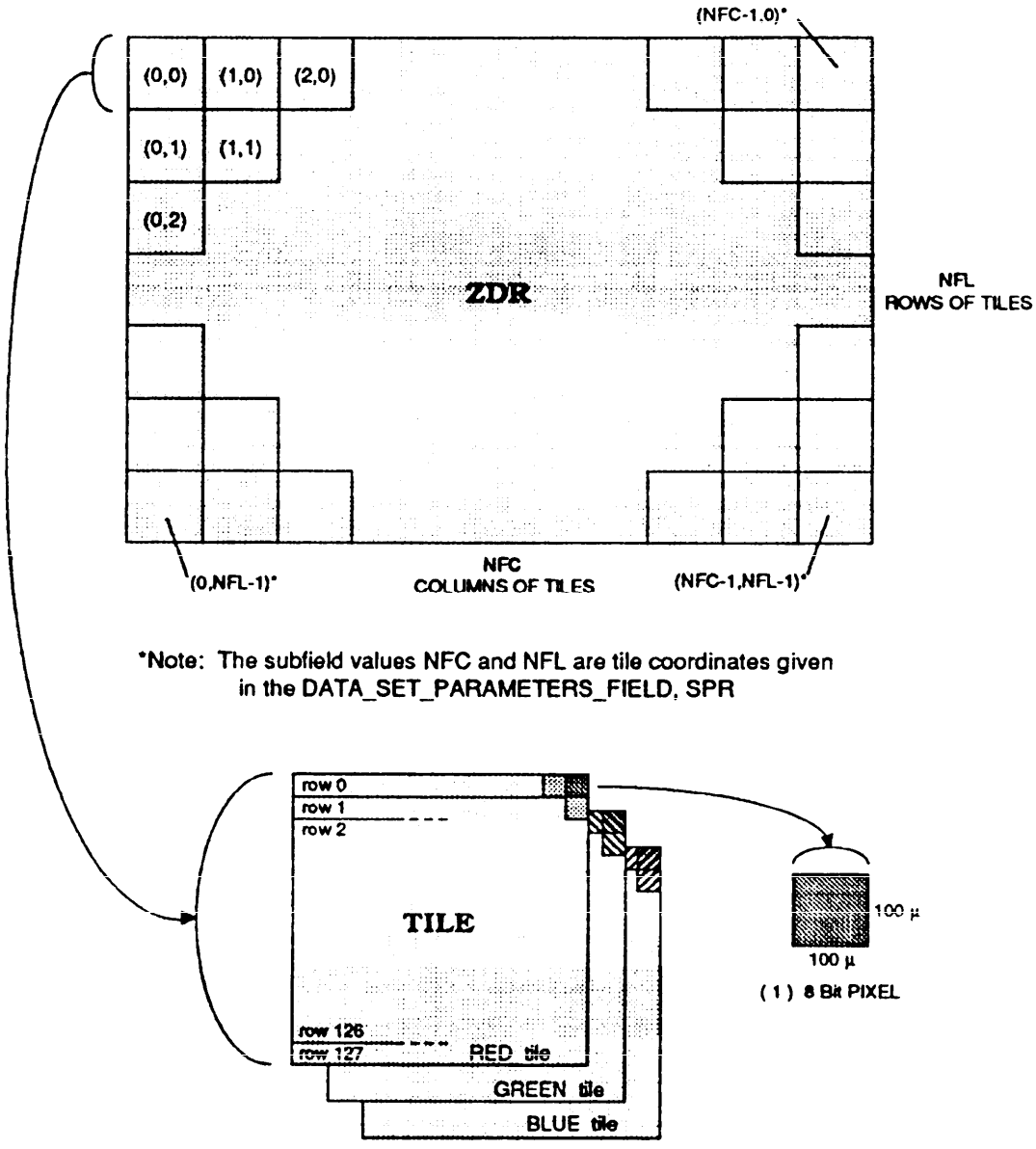
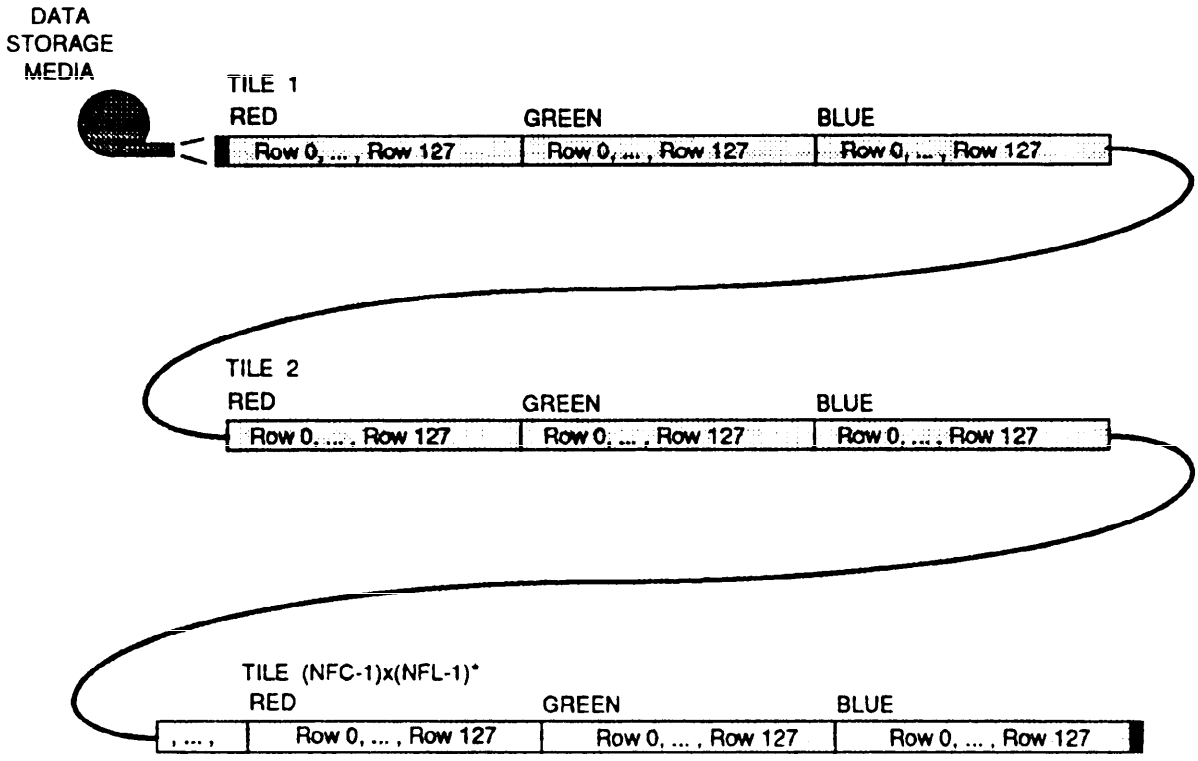
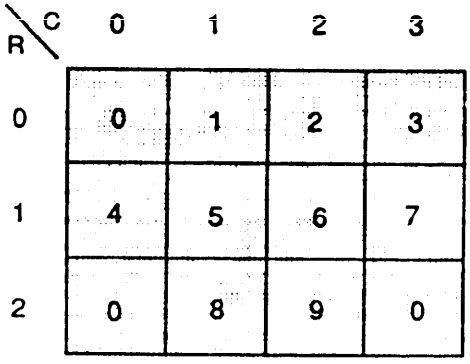


FIGURE 29. Tile structure sequence for ADRG RGB data.

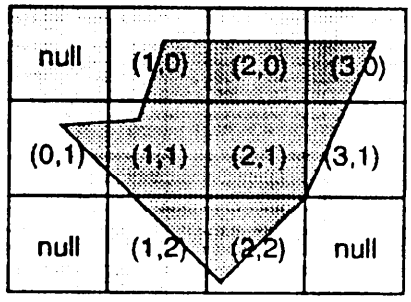


*Note: The subfield values NFC and NFL are tile coordinates given in the DATA_SET_PARAMETERS_FIELD, SPR.

FIGURE 30. Band sequential layout for ADRG RGB data.



Tile Index Map showing the tile sequence on a CD-ROM.



ZDR Tiles

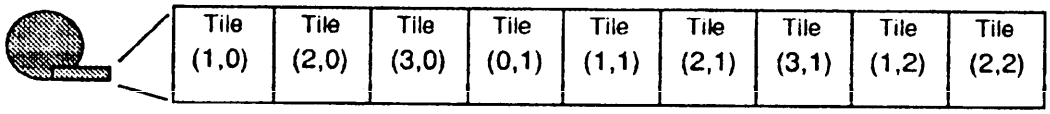
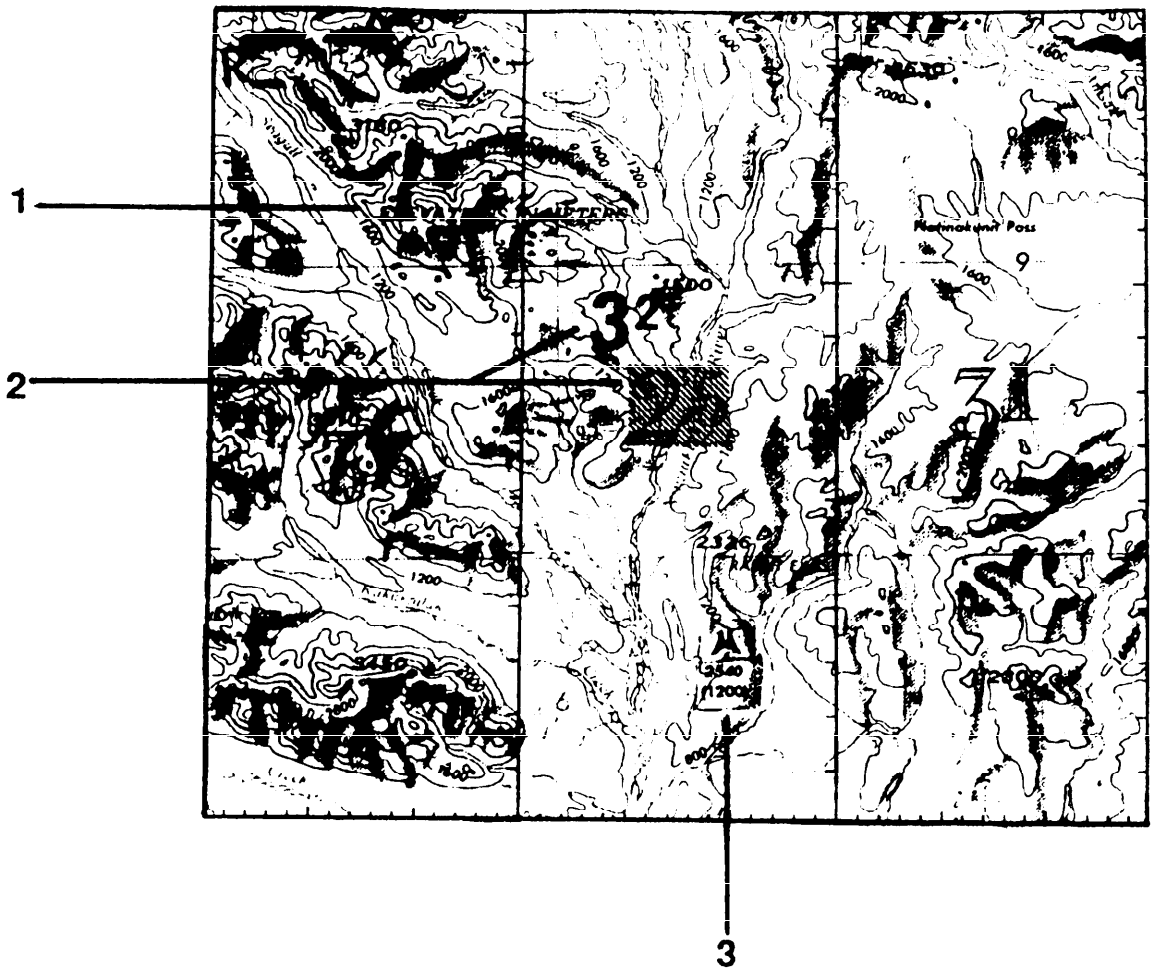


Image File on the CD-ROM

FIGURE 31. Tile index map example with null tiles.

APPENDIX



Item 1: Indicates that elevations and contour values on this product are in meters.
The ELEVATIONS IN METERS note is in red.

Item 2: Shows a Maximum Terrain Elevation (MTE) value crossed out and replaced with a Maximum Elevation Figure (MEF). The cross-hatching and new value are in black, to distinguish the added features from the blue color normally used to portray these features when published. The black cross-hatching pattern will be used to indicate any deleted or erroneous feature that is derived from DMA maintenance publications.

Item 3: Shows a multiple vertical obstruction symbol and it's Above Ground Level and Above Mean Sea Level values in feet. This added feature is also in black to distinguish it as an added feature.

Note: The corrections added to this chart are fictitious, and are used for demonstration purposes only.

FIGURE 32. Added feature symbology.

APPENDIX

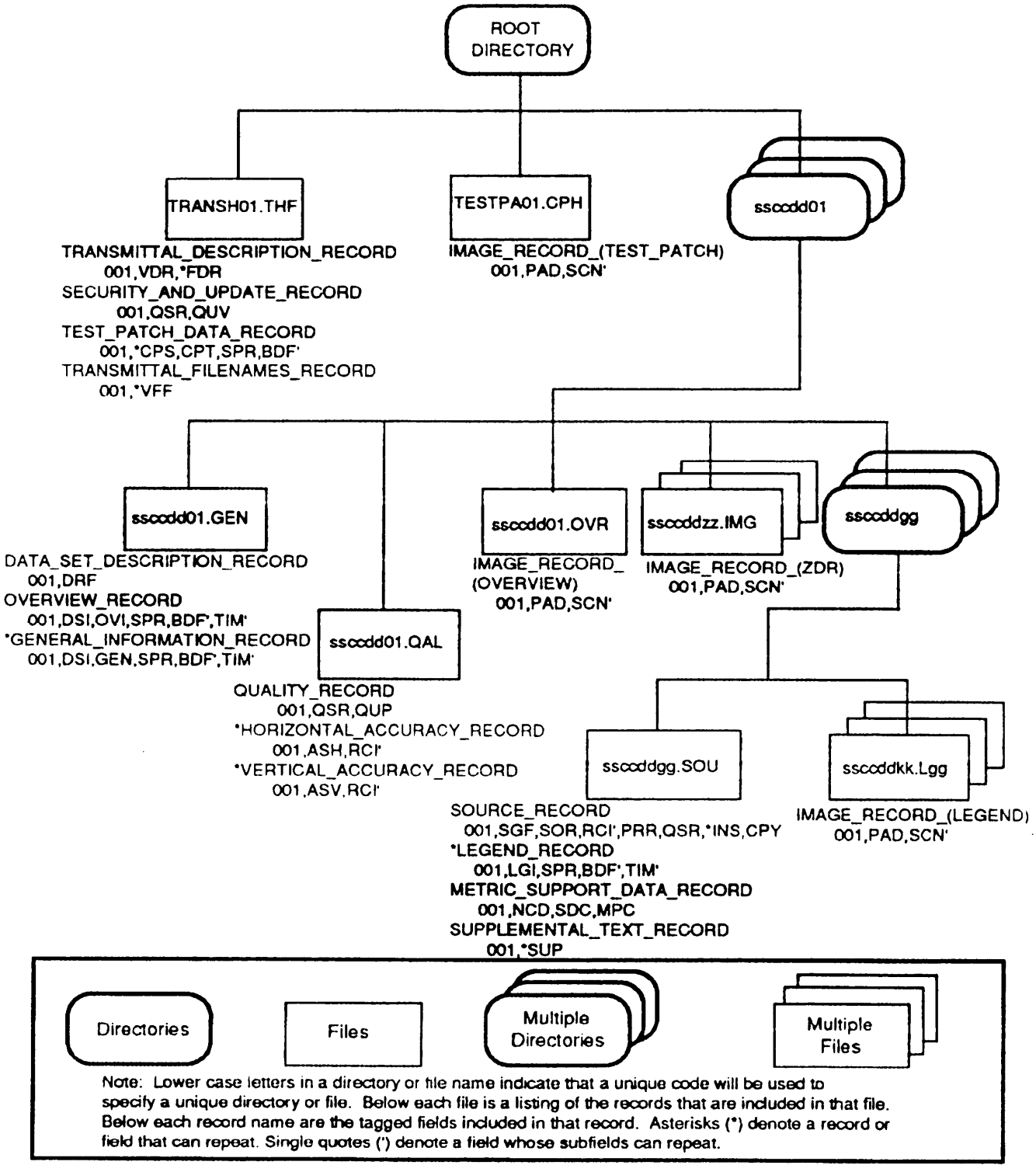


FIGURE 33. ADRG hierarchical structure.

INDEX

CONCLUDING MATERIAL

Custodians:
DMA-MP

Review activities:
Air Force-09
Army-PO
Navy-NO

User activities:
Army
Navy
Air Force

Preparing activity:
DMAAC-MP

(Project MCGT-0010)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-A-89007	2. DOCUMENT DATE (YYMMDD) 22 February 1990

3. DOCUMENT TITLE
ARC DIGITIZED RASTER GRAPHICS (ADRG)

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Defense Mapping Agency	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON
c. ADDRESS (Include Zip Code) 8613 Lee Highway Fairfax, VA 22031-2137	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: