

<b>NOTICE OF CHANGE</b>
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<b>METRIC</b>
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**MIL-STD-2411  
NOTICE 2  
16 AUG 2001**

**DEPARTMENT OF DEFENSE  
INTERFACE STANDARD  
RASTER PRODUCT FORMAT**

TO ALL HOLDERS OF MIL-STD-2411:

1. THE FOLLOWING PAGES OF MIL-STD-2411 HAVE BEEN REVISED  
AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDE PAGE	DATE
Cover	16 August 2001	Cover	6 October 1994
ii	16 August 2001	ii	6 October 1994
1	6 October 1994	1	REPRINTED WITHOUT CHANGE
2	16 August 2001	2	6 October 1994
3-4	16 August 2001	3-4	6 October 1994
15	16 August 2001	15	6 October 1994
16	17 January 1995	16	6 October 1994
31	17 January 1995	31	6 October 1994
32	6 October 1994	32	REPRINTED WITHOUT CHANGE
37-44	16 August 2001	37-44	6 October 1994
44a,b	16 August 2001		New Pages
57-58	16 August 2001	57-58	6 October 1994
58a,b	16 August 2001		New Pages
61	17 January 1995	61	6 October 1994
62	16 August 2001	62	6 October 1994

**AMSC N/A**

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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-2411 will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the standard is completely revised or canceled.

## Custodians:

Air Force -	09
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## Preparing activity:

NIMA -	MP
Agent:	AFMC

(Project MCGT-0339)

**METRIC**

**MIL-STD-2411**

**6 OCTOBER 1994**

**DEPARTMENT OF DEFENSE  
INTERFACE STANDARD  
RASTER PRODUCT FORMAT**



**ASMC N/A**

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**SUPERSEDES COVER OF MIL-STD-2411**

MIL-STD-2411

DEPARTMENT OF DEFENSE

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to NIMA Operational Help Desk: 1-800-455-0899; Commercial 314-263-4864; DSN 693-4864; or write to: Director, National Imagery and Mapping Agency, ATTN: DF, P-37, 4600 Sangamore Road, Bethesda MD 20816-5003.

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## 1. SCOPE

1.1 Scope. The Raster Product Format (RPF) is a standard data structure for geospatial databases composed of rectangular arrays of pixel values (e.g. in digitized maps or images) in compressed or uncompressed form. RPF is intended to enable application software to use the data in RPF format on computer-readable interchange media directly without further manipulations or transformation.

Each product category that represents a single instantiation of RPF, or a family of instantiations of RPF, shall be described in a separate product specification that makes appropriate reference to the RPF standard and its companion standard, MIL-STD-2411-1, which defines registered data values to be used with RPF files.

1.2 Purpose. The RPF is intended to define a common format for interchange of raster data between producers of such data in DoD and users of the data, to help facilitate interoperability among mission-critical system.

1.3 Application. The Military Departments, Office of the Secretary of Defense, Organizations of the Joint Chiefs of Staff, and the Defense Agencies of the Department of Defense (collectively know as DoD components) shall use the information in this standard in preparing and accessing digital geographic data required or specified to be in RPF.

1.4 Security. This standard is UNCLASSIFIED. The procedures and processes presented herein may be used for classified processing where appropriate security provisions are added.

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## 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 current Department of Defense Index of Specifications and Standards (DODISS) and the supplement thereto, cited in the solicitation (see 6.2).

MIL-A-89007	Military Specification: ARC Digitized Raster Graphics (ADRG)
MIL-A-89027	Prototype Specification for ARC Digital Raster Imagery (ADRI)
MIL-STD 2407	DoD Interface Standard, Vector Product Format (VPF)
MIL-STD-2400	Military Standard, Text Product Standard (TPS)
MIL-STD-2411-1	DoD Interface Standard, Registered Data Values for Raster Product Format, with Change Notice 1
MIL-STD-2411-2	DoD Interface Standard, Integration of Raster Product Format Files into the National Imagery Transmission Format

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. 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 the supplement thereto, cited in the solicitation (see 6.2)

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DMA TR 8350.2            Defense Mapping Agency World Geodetic System 84, 2<sup>nd</sup> Edition

DMA TM 8358.1            Defense Mapping Agency Datums, Ellipsoids, Grids, and Grid Reference Systems

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the National Imagery and Mapping Agency, ATTN: NIMA Customer Support/COD, Mail Stop P-38, 12310 Sunrise Valley Drive, Reston, VA 20191-3449.

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

ANSI 3.41-1974            American National Standards Institute: Code extension techniques for use with the 7-bit coded character set of American National Standard Code for Information Interchange

ANSI/IEEE 754-1985       Institute of Electrical and Electronic Engineers: IEEE Standard for Binary Floating Point Arithmetic

IEEE 1003.1              Institute of Electrical and Electronic Engineers: Portable Operating System Interface for Computer Environments

ISO/IEC 10149            International Organization for Standardization: Information technology -- Data interchange on read-only 120mm optical data disks (CD-ROM)

ISO/IEC 12247:1993       International Organization for Standardization: Information technology -- 4mm (3.81mm) wide  
Replaces 10777

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	magnetic tape cartridge for information interchange	
ISO/IEC 10089:1991	International Organization for Standardization: Information technology -- 130mm read-writeable optical media cartridge	
ISO/IEC 11319:1993	International Organization for Standardization: Information technology -- 8mm wide magnetic tape cartridge for information interchange Helical scan recording	
ISO/IEC 13346	International Organization for Standardization: Information technology -- volume and file structure of write-once and rewriteable media using non-sequential recording for information interchange	
TBD	CD-Recordable Standard	

(Application for copies of ANSI and ISO Documents should be addressed to the American National Standards Institute (ANSI) Inc., 1430 Broadway, New York, NY 10018 <http://www.ansi.org/> or <http://www.iso.ch/>)

(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 or specification sheets the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



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4.5.1.2 Erasable optical disk. The data shall be recorded using a continuous composite servo tracking method on 130mm (5.25-in.) erasable optical disks (EODS), as defined in ISO/IEC 10089.

The User Zone on each EOD shall be formatted as defined in ISO/IEC 10089, Section 16 and 17 with 512 bytes per sector.

4.5.1.3 8 mm Magnetic tape cartridge. The data shall be recorded on 8mm wide magnetic tape cartridges manufactured in accordance with ISO/IEC 11319.

4.5.1.4 4 mm Digital audiotape. The data shall be recorded on 4mm wide magnetic tape cartridges manufactured in accordance with ISO/IEC DIS 10777 (Draft International Standard 10777 withdrawn, replaced by ISO/IEC 12247:1993).

4.5.1.5 Compact Disk/Recordable (CD-R). The data shall be recorded on 120mm optical data disks as defined in TBD.

#### 4.5.2 Volume and file structures.

a. The volume and file structure for data recorded on CD-ROM and CD-R shall be as defined in ISO 9660.

Note: The nature of the ISO 9660 CD-ROM standard is such that platforms will present the files and directory names differently. As an example, although the files are written to the CD-ROM in upper case (as defined in the standard), some file systems will present the data in lower case letters. In addition, the following differences in the presentation of the file and directory names may also appear on various platforms:

- Filenames with extensions may be appended with a semicolon-1 (;1).
- Filenames without extensions may be appended by a single period (.) or with a period-semicolon-1 (.;1).

The table of contents file for RPF products includes the pathnames to the frame files. The pathnames and frame files in the table of contents file are written in upper case, and the directory delimiters are given as forward slashes (/). Developers of software for CADRG will be required to understand the format of the pathnames in the table of contents file, as defined in this section in order to properly use the table of contents file.

b. The preferred volume and file structure for data recorded on read-write and write-once/read-many random access media (i.e. disks) shall be the Non-Sequential Recording Format, as defined in ISO 13346.

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c. User data on sequential media (i.e. tapes) shall be formatted in accordance with the extended tar format, as defined in IEEE 1003.1, paragraph 10.1.1.

4.5.3 Directory structures. The overall format and structure of directories shall be in accordance with Section 5 of IEEE Standard 1003.1.

A given random access volume shall contain the following directory structure:

```
[rpf root directory] (unordered)
  {1} (unordered)
  [table of contents file]
  [lookup table directory] (0, 1)
    {2} (unordered)
    [external color/grayscale file] (1, ... many)
  {1} (unordered)
  [frame directory] (0, ... many)
    {2} (unordered)
    [frame file] (1, ... many)
    [subordinate directory] (0, ... many)(unordered)
```

4.5.4 File and directory naming convention. The unqualified name of each RPF file shall be in the industry standard "8.3" format: up to 8 alphanumeric characters, followed by a period. The unqualified name of each RPF directory shall be up to 8 alphanumeric characters.

4.5.4.1 Directories. Directories on RPF interchange volumes are intended to help locate the data on a given interchange volume. At the discretion of the implementor, receivers of the data may relocate the directory tree found on the interchange media anywhere within their own file system hierarchies for processing.

a. The [rpf root directory] on a given volume shall be named "RPF". Every RPF volume shall have an [rpf root directory] or [lookup table directory].

b. All [external color/grayscale file]s shall be stored on the interchange media in the "RPF/LOOKUP" directory.

c. [frame file]s shall be stored in a separate directory hierarchy under the RPF directory. The producer shall determine a strategy for choosing the hierarchical structure, the name of each directory at each level in the hierarchy in a given volume, and a method for assigning [frame file]s to specific directories. Each [subordinate frame directory] shall have the same structure as the [frame directory]. Each [frame directory] shall contain at least

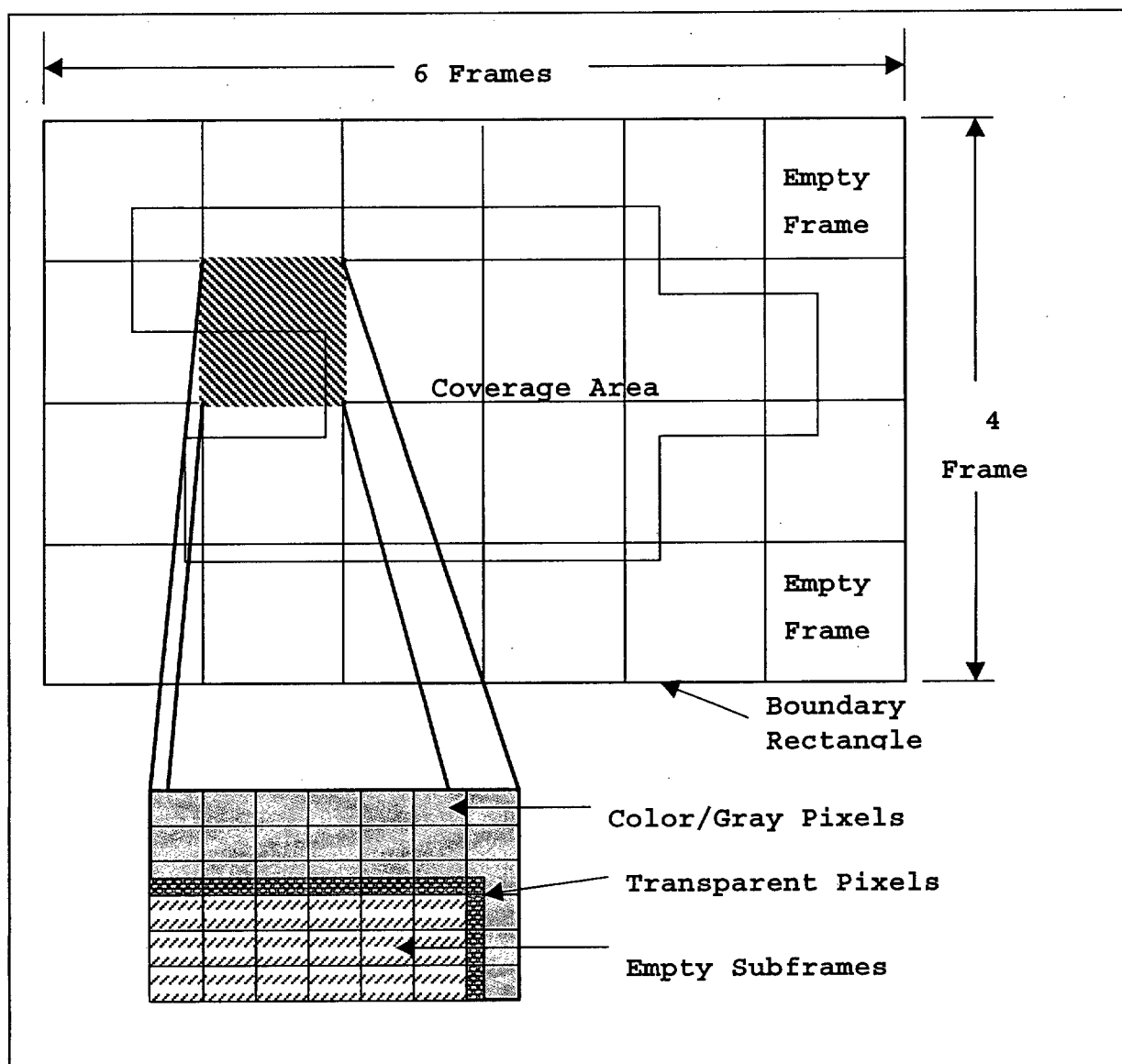
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resolution). A given record will also specify the dimensions of a rectangular "virtual matrix" of fixed-size frames of the given scale or resolution that fills the given boundary rectangle. The [frame file index section] will provide the identities of the subset of these frames that are actually recorded on the given interchange volume. If the [frame file index section] is omitted, then the [boundary rectangle section] shall be omitted. An example of a boundary rectangle is shown in FIGURE 1.

(4) The [frame file index section] will contain scales and data types for all [frame file]s in the given volume. Each entry will identify the boundary rectangle (named in the [boundary rectangle section]) where the frame is located, and it will specify the row and column in a "virtual matrix" of frames within the boundary rectangle where the specific frame is located. The information will enable the user to compute the coverage of the given frame, as specified in the corresponding [frame file].

The [pathname table] will show the pathname from the RPF directory of each [frame file] listed in the [frame file index table]. For example, for any [frame file] stored in directory RPF/CONC/CONCZ02, the pathname will be "/CONC/CONCZ02/". Since the [pathname table] entries will vary in length, the [frame file index record] for a given [frame file] provides the offset and length of the <pathname> field in the [pathname table] that pertains to the given [frame file]. The [frame file]s stored in the same directory will have the same <pathname>. The [frame file index record]s for these [frame file]s will be able to use a single [pathname record].

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FIGURE 1. Example of a boundary rectangle.

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(9) <component length> ::= a 4-byte unsigned integer indicating the length in bytes of the component named in the corresponding <component id> field.

(10) <component location> ::= a 4-byte unsigned integer defining the absolute address (i.e. byte number) of the first byte of the component measured from the beginning of this RPF [frame file] (counting the first byte of the file as 0). If the file is encapsulated in a NITF file, the first byte is as specified in MIL-STD-2411-2

(11) <component location record length> ::= a 2-byte unsigned integer  $\geq 10$  indicating the length in bytes of each [component location record]. (Intended for backward compatibility; see 5.1.8 above).

(12) <component location table offset> ::= a 4-byte unsigned integer indicating displacement, measured in bytes, between the beginning of the [location section] and the first byte of the [component location table] (counting the first byte of the [location section] as 0). (Intended for backward compatibility; see 5.1.8 above.)

(13) <compression ratio> ::= a 5-byte ASCII character string encoded as specified in MIL-STD-2411-1, section 5.2.2, defining the nominal compression ratio (e.g. "55:1", "12:1", "UNC") of the [frame file]s associated with this [boundary rectangle record] in human-readable form.

(14) <east-west/horizontal resolution> ::= a 8-byte real value specifying the nominal resolution, in the east-west or horizontal direction, for all data output pixel values derived from the data in the [frame file]s associated with the boundary rectangle identified in this [boundary rectangle record], measured in meters. If the exact geographic coordinates associated with the frame files in the [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value. NIMA requires 9s fill in the field.

(15) <external color/grayscale file name> ::= a 12-byte ASCII character field in the format defined in 4.5.4.3 above (i.e. "XXXX.LUT ") identifying an [external color/grayscale file] recorded in the RPF/LOOKUP directory on this volume.

(16) <file name> ::= a 12-byte ASCII character field  
 ::= "A.TOC " ::= the name of this [table of contents file], as specified in 4.5.4.2 above.

(17) <frame file index record length> ::= a 2-byte unsigned integer  $\geq 33$  indicating the length in bytes of each

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[boundary rectangle record]. (Intended for backward compatibility; see 5.1.8 above.)

(18) <frame file index table offset> ::= a 4-byte unsigned integer indicating displacement, measured in bytes, between the beginning of the [frame file index subsection] and the first byte of the [frame file index table] (counting the first byte of the [frame file index subsection] as 0). (Intended for backward compatibility; see 5.1.8 above.)

(19) <frame file name> ::= a 12-byte ASCII character field in the format defined in 4.5.4.4 above, identifying a [frame file] recorded on this volume.

(20) <frame file security classification> ::= a 1-byte ASCII character field coded to indicate the security level (e.g. unclassified, confidential, secret) of the indexed [frame file] as specified in MIL-STD-2411-1, section 5.1.8.

(21) <frame file security country/international code> ::= a 2-byte ASCII character string coded to indicate the originating country or international affiliation of the <security classification> of the indexed [frame file], as defined in MIL-STD-2411-1, section 5.1.9.

(22) <frame file security release marking> ::= a 2-byte ASCII character string coded to indicate any special handling or releasability restrictions assigned to the contents of the indexed [frame file], as defined in MIL-STD-2411-1, section 5.1.9.

(23) <frame location column number> ::= a 2-byte unsigned integer,  $0 \leq \text{<frame location row number>} \leq \text{<number of frames in east-west or left-right direction>} - 1$ , defining the east-west or left-right coordinate of the [frame file] identified in this [frame file index record], within the virtual matrix of [frame file]s that comprise the corresponding [boundary rectangle record]. <frame location column number>s shall be assigned in ascending order beginning at the westernmost or leftmost edge of the boundary rectangle

(24) <frame location row number> ::= a 2-byte unsigned integer,  $0 \leq \text{<frame location row number>} \leq \text{<number of frames in north-south or up-down direction>} - 1$ , defining the north-south or up-down coordinate of the [frame file] identified in this [frame file index record], within the virtual matrix of [frame file]s that comprise the corresponding [boundary rectangle record]. <frame location row number>s shall be assigned in ascending order beginning

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at the southernmost or lowest edge of the boundary rectangle.

(25) <geographic location> ::= a 6-byte ASCII character string defining the geographic location of the southwest or lower left corner of the [frame file] identified in this [frame file index record] in GEOREF notation, encoded as specified in DMA TM 8358.1, section 5-4.

(26) <governing standard date> ::= an 8-byte ASCII character string in the format YYYYMMDD defining the effective date of the standard (i.e. this document) to which the format of this [table of contents file] conforms.

(27) <governing standard number> ::= a 15-byte ASCII character string defining document number of this standard (i.e. this document) to which the format of this [table of contents file] conforms.

(28) <header section length> ::= a 2-byte unsigned integer  $\geq 48$  indicating the length of the [header section] in bytes (intended for backward compatibility; see 5.1.8 above).

(29) <highest security classification> ::= a 1-byte ASCII character field indicating the highest security classification assigned to any [frame file] indexed in this [frame file index section], as defined in MIL-STD-2411-1.

(30) <latitude/vertical interval> ::= an 8-byte real value specifying the nominal latitude interval between adjacent decompressed pixels in the [frame file]s associated with the boundary rectangle identified in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value. NIMA requires a 9s filled field.

(31) <little/big endian indicator> ::= a 1-byte Boolean field ::= (FF)H to indicate that this [table of contents file] is recorded in little endian format, and ::= (00)H to indicate that this [table of contents file] is recorded in big endian format. See 4.4.1 above.

(32) <location section length> ::= a 2-byte unsigned integer  $\geq 34$  indicating the length in bytes of the entire [location section].

(33) <location section location> ::= a 4-byte unsigned integer defining the absolute address (i.e. byte number) of the first byte of the [location section] relative to the beginning of the file.

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(34) <longitude/horizontal interval> ::= an 8-byte real value specifying the nominal longitude interval between adjacent output pixels in the [frame file]s associated with the boundary rectangle identified in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value. NIMA requires a 9s filled field.

(35) <new/replacement/update indicator> ::= a 1-byte unsigned integer ::=1, indicating that this is a new [table of contents file].

(36) <north-south/vertical resolution> ::= an 8-byte real value specifying the nominal resolution, in the north-south or vertical direction, for all data output pixels derived from the data in the [frame file]s associated with the boundary rectangle identified in this [boundary rectangle record], measured in meters. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value. NIMA requires a 9s filled field.

(37) <northeast/upper right latitude> ::= an 8-byte real value corresponding to the latitude of the northeast or upper right corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range -90° to +90°, Longitude values out of the range -180° to +180°). NIMA requires a 9s filled field.

(38) <northeast/upper right longitude> ::= an 8-byte real value corresponding to the longitude of the northeast or upper right corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range -90° to +90°, Longitude values out of the range -180° to +180°). NIMA requires a 9s filled field.

(39) <northwest/upper left latitude> ::= an 8-byte real value corresponding to the latitude of the northwest or upper left corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees.

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If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range  $-90^{\circ}$  to  $+90^{\circ}$ , Longitude values out of the range  $-180^{\circ}$  to  $+180^{\circ}$ ). NIMA requires a 9s filled field.

(40) <northwest/upper left longitude> ::= an 8-byte real value corresponding to the longitude of the northwest or upper left corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range  $-90^{\circ}$  to  $+90^{\circ}$ , Longitude values out of the range  $-180^{\circ}$  to  $+180^{\circ}$ ). NIMA requires a 9s filled field.

(41) <number of boundary rectangle records> ::= a 2-byte unsigned integer  $\geq 1$  defining the number of [boundary rectangle record]s in this [boundary rectangle section].

(42) <number of colortable index records> ::= a 2-byte unsigned integer  $\geq 1$  defining the number of [colortable index record]s in this [colortable index section]

(43) <number of component location records> ::= a 2-byte unsigned integer  $\geq 1$  indicating the number of [component location record]s in this [location section].

(44) <number of frame file index records> ::= a 4-byte unsigned integer  $\geq$  defining the number of [frame file index records] in this [frame file index section].

(45) <number of frames in east-west or left-right direction> ::= a 4-byte unsigned integer  $\geq 1$  specifying the number of frames in the east-west or left-right direction comprising the virtual geographic matrix of [frame file]s that are contained within the boundary rectangle whose corner coordinates are given in this [boundary rectangle record].

(46) <number of frames in north-south or up-down direction> ::= a 4-byte unsigned integer  $\geq 1$  specifying the number of frames in the north-south or up-down direction comprising the virtual geographic matrix of [frame file]s that are contained within the boundary rectangle whose corner coordinates are given in this [boundary rectangle record].

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(47) <number of pathname records> ::= a 2-byte unsigned integer  $\geq 1$  indicating the number of [pathname record]s in the [pathname table].

(48) <pathname> ::= a variable-length ASCII character string defining the pathname for a given [frame file] (e.g. "/CONC/CONCZ02/" for a [frame file] stored in the directory /RPF/CONC/CONCZ02/).

(49) <pathname length> ::= a 2-byte unsigned integer  $\geq 1$  indicating the length in bytes of the <pathname> field in this [pathname record].

(50) <pathname record offset> ::= a 4-byte unsigned integer defining the address (i.e. byte number) of the first byte of the [pathname record] containing the <pathname> associated with this [frame file index record], relative to the beginning of the [frame file index subsection] (counting the first byte of the [frame file index subsection] as 0).

(51) <producer> ::= a 5-byte ASCII character string encoded as specified in MIL-STD-2411-1 with Change Notice 1, section 5.2.1, identifying in human-readable form a designator for the organization (e.g. "NIMA", "SOCAF", "AFESC") that produced the [frame file]s associated with this [boundary rectangle record].

(52) <product data type> ::= a 5-byte ASCII character string encoded as specified in MIL-STD-2411-1, with Change Notice 1, section 5.1.6, defining the data type (e.g. "ADRG", "DTED") of the [frame file]s associated with this [boundary rectangle record] in human-readable form.

(53) <scale or resolution> ::= a 12-byte ASCII character coded string identifying in human-readable form the nominal scale (e.g. "1:1M", "1:12.5K") or nominal resolution (e.g. "100m" or "50m") that produced the [frame file]s associated with this [boundary rectangle record].

(54) <security classification> ::= a 1-byte ASCII character coded to indicate the security level (e.g. unclassified, confidential, secret) of this file, as specified in MIL-STD-2411-1, section 5.1.8.

(55) <security/country/international code> ::= 1 2-byte ASCII character string coded to indicate the originating country or international affiliation of the <security classification> of this file, as defined in MIL-STD-2411-1, section 5.1.7.

(56) <security release marking> ::= a 2-byte SCII character string coded to indicate any special handling or

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releasability restrictions assigned to the contents of this file, as defined in MIL-STD-2411-1, section 5.1.9.

(57) <southeast/lower right latitude> ::= an 8-byte real value corresponding to the latitude of the southeast or lower right corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range  $-90^{\circ}$  to  $+90^{\circ}$ , Longitude values out of the range  $-180^{\circ}$  to  $+180^{\circ}$ ). NIMA requires a 9s filled field.

(58) <southeast/lower right longitude> ::= an 8-byte real value corresponding to the longitude of the southeast or lower right corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range  $-90^{\circ}$  to  $+90^{\circ}$ , Longitude values out of the range  $-180^{\circ}$  to  $+180^{\circ}$ ). NIMA requires a 9s filled field.

(59) <southwest/lower left latitude> ::= an 8-byte real value corresponding to the latitude of the southwest or lower left corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range  $-90^{\circ}$  to  $+90^{\circ}$ , Longitude values out of the range  $-180^{\circ}$  to  $+180^{\circ}$ ). NIMA requires a 9s filled field.

(60) <southwest/lower left longitude> ::= an 8-byte real value corresponding to the longitude of the southwest or lower left corner of the boundary rectangle defined in this [boundary rectangle record], measured in decimal degrees. If the exact geographic coordinates associated with the frame files in this [boundary rectangle record] are unknown at the time of production, this field will contain an invalid value (i.e., Latitude values out of the range  $-90^{\circ}$  to  $+90^{\circ}$ , Longitude values out of the range  $-180^{\circ}$  to  $+180^{\circ}$ ). NIMA requires a 9s filled field.

(61) <zone> ::= a 1-byte ASCII character string encoded as specified in MIL-STD-2411-1, section 5.1.3, identifying in human-readable form the latitudinal zone described in

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the [frame file]s associated with this [boundary rectangle record].

### 5.2.2 Frame file.

a. The overall structure of the [frame file] shall be as follows:

```
[frame file]
    {1}
    [header section]
    [location section]
    [coverage section]  (0,1)
    [compression section]  (0,1)
    [color/grayscale section]  (0,1)
    [image section]
    [attribute section]  (0,1)
    [related images section]  (0,1)
    [replace/update section]  (0,1)
```

(1) The [header section] will contain information that enables the programmer to uniquely identify the [frame file] and process it further. (Note: the <location section location field is intended to facilitate backward compatibility. See 5.1.8 above.)

(2) The [location section] will show the programmer the beginning byte locations (addresses) of the remaining sections in the file, relative to the beginning of the file.

(a) The programmer will be able to read in and interpret the [location section] and immediately know where to find the data of interest, and calculate the length of each section.

(b) The [component location record]s in the [location section] will be stored in ascending sequence by <component id>.

(c) The <component aggregate length> field shall contain the sum of the <component length> fields in bytes in the [component locations record]s. The receiver will be able to compare the <component aggregate length> with the sum of the individual <component length>s to ensure that the [location section] has been found correctly and to verify its structural integrity.

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(3) If the [coverage section] is present it will describe the geographic coverage of the [frame file] in terms of latitude and longitude.

(4) The [compression section] will appear only in compressed file; it will contain algorithm identifiers, lookup tables, and other information that is specific to a given compression scheme. Each compression scheme, and the corresponding structure of the [compression section], will be described completely in the product specification for the compressed product.

(5) The [color/grayscale section] will appear only in [frame file]s that contain image or map data whose colors are not directly recorded in the [image section] of the given [frame file]. It will contain color and/or grayscale values for softcopy and hardcopy display, to be used for all the image data in the [frame file]. The [color/grayscale section] may contain multiple [color/grayscale table]s, and [color converter table]s that map the colors in one [color/grayscale table] into those of another.

(6) The [image section] will specify the compressed or uncompressed pixels that constitute the majority of the data volume in the file. Each frame will be tiled into one or more subframes for storage and processing.

(7) If the [attribute section] is present it will contain one or more attributes of the data described in the [image section], such as horizontal and vertical accuracy and datums. A listing of all registered attributes is given in MIL-STD-2411-1, with Change Notice 1, section 5.3.2.

(a) The [attribute table] will show the <parameter value>s of each attribute of the given [frame file]. Since the [attribute table] entries will vary in length, the receiver may compute the length of the nth entry by subtracting the <parameter offset> address of the nth entry in the [attribute offset table] from the <parameter offset> address in the  $(n + 1)^{th}$  entry in the [attribute offset table].

(b) In the special case of the last <parameter value> in the table, the length shall be equal to:

$$\text{length}(\text{last}) - \{ \text{<component location> for the [attribute subsection]} \} + \{ \text{<component length> for the [attribute subsection]} \} - \text{<parameter offset>}(\text{last}) + 1,$$

where the <component location> and <component length> are found in the [component location record] for the [attribute

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subsection].

(8) If the [related images section] is present it will provide a list of [frame file]s on this volume that are related in a product specific way to the image recorded in this [frame file]. For example, if a stereo pair of images are recorded, then each of the two images will be stored in a separate [frame file]; the [related images section]s of each will provide the file name and pathname of the other member of the pair.

(9) The [replace/update section] will identify previously produced [frame file]s that are replaced or updated by this [frame file]. A record will appear in the [replace/update table] for each previously produced [frame file] that is updated or superseded by the current [frame file]. The [replace/update section] shall appear only in [frame file]s that replace or update earlier editions. It shall not appear in the first complete edition of a given [frame file].

b. The detailed structure of the [frame file] shall be as shown in FIGURE 3.

c. The [frame file] shall contain the following logical elements, listed in alphabetical order. NOTE: logical elements added by Change Notice 2 to MIL-STD-2411 will be listed sequentially at the end of this section, out of alphabetical order.

(1) <areal coverage sequence number> ::= a 1-byte unsigned integer  $\geq 0$  that identifies the sequence number of an implicit or explicit areal coverage where the attribute defined in this [attribute offset record] applies. If <areal coverage sequence number> = 0, the given attribute applies (implicitly) to the entire geographic coverage of this frame file]. If <areal coverage sequence number> 0, then the areal coverage where the given attribute applies is defined in the corresponding [explicit areal coverage record] in the [explicit areal coverage table].

(2) <attribute id> ::= a 2-byte unsigned integer defining an attribute of the data in this [frame file], encoded as defined in MIL-STD-2411-1, with Change Notice 1, section 5.3.2.

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endian format, and ::= (00)H to indicate that this file is recorded in big endian format. See 4.4.1 above.

(52) <location section length> ::= a 2-byte unsigned integer ≥ 34 indicating the length in bytes of the entire [location section].

(53) <location section location> ::= a 4-byte unsigned integer defining the absolute address (i.e. byte number) of the first byte of the [location section] relative to the beginning of this RPF [frame file] (counting the first byte of the file as 0). If the file is encapsulated in a NITF file, the first byte is as specified in MIL-STD-2411-2.

(54) <long> ::= an 8-byte real value corresponding to the longitude of a vertex of a polygon in decimal degrees defining the areal extent of this attribute (see 5.1.12 above).

(55) <longitude/horizontal interval> ::= an 8-byte real value specifying the nominal longitude interval between adjacent decompressed pixels, measured in decimal degrees.

(56) <new file name> ::= a 12-byte ASCII character field, encoded as specified in 4.5.4.4. above, defining the file name of a [frame file] (i.e. the current [frame file] or one of its ancestors) that replaces or updates the [frame file] named in the <old file name> field in this [replace/update record]

(57) <new/replacement/update indicator> ::= a 1-byte unsigned integer encoded as follows:

      ::= 0 to indicate that this [frame file] contains original data that is not a replacement for a previous edition; an initial release of the data in this [frame file];

      ::= 1 to indicate that this [frame file] contains data that completely replaces all previous editions of the [frame file] for this data type, scale (or resolution), geographic coverage, and latitude zone.

      ::= 2 to indicate an update (i.e. a patch) to a previous edition of this [frame file] with the same data type, scale (or resolution), geographic coverage, and latitude zone.

      ::= 3 to indicate this is a user-defined value incorporated by the user's system. This user-defined update information will be described in attribute #24 Chart Update Information, parameters 1 through 7. As an example,

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use may indicate that the file has had Electronic Chart Update (ECHUM) items incorporated.

(58) <north-south/vertical resolution> ::= an 8-byte real value specifying the nominal resolution, measured in meters, in the north-south or vertical direction for all decompressed pixels represented in /image code/.

(59) <northeast/upper right latitude> ::= an 8-byte real value corresponding to the latitude of the northeast corner (upper right corner in an RPF [frame file] that is not oriented north-up, such as a polar ADRG map) of the frame.

(60) <northeast/upper right longitude> ::= an 8-byte real value corresponding to the longitude of the northeast corner (upper right corner in an RPF [frame file] that is not oriented north-up, such as a polar ADRG map) of the frame.

(61) <northwest/upper left latitude> ::= an 8-byte real value corresponding to the latitude of the northwest corner (upper left corner in an RPF [frame file] that is not oriented north-up, such as a polar ADRG map) of the frame.

(62) <northwest/upper left longitude> ::= an 8-byte real value corresponding to the longitude of the northwest corner (upper left corner in an RPF [frame file] that is not oriented north-up, such as a polar ADRG map) of the frame.

(63) <number of attribute offset records> ::= a 2-byte unsigned integer defining the number of [attribute offset record]s in this [attribute section].

(64) <number of color/grayscale offset records> ::= a 1-byte unsigned integer  $\geq 1$ , indicating the number of [color/grayscale offset record]s in the [colormap offset table].

(65) <number of color/grayscale records> ::= a 4-byte unsigned integer  $\geq 1$ , indicating the number of [color/grayscale record]s in the [color/grayscale table] identified in this [color/grayscale offset record] contains, and the number of [histogram record]s the [histogram table] contains.

(66) <number of color converter offset records> ::= a 1-byte unsigned integer indicating the number of [color converter offset record]s in the [color converter offset table].

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(67) <number of color converter records> ::= a 4-byte unsigned integer  $\geq 1$ , indicating the number of [color converter record]s in the [color converter table] identified by the <color converter table offset> in this [color converter offset record]. The <number of color converter records> in a given [color converter offset record] shall equal the <number of color/grayscale records> in the source [color/grayscale table], identified by the <source color/grayscale table offset> in this [color converter offset record].

(68) <number of component location records> ::= a 2-byte unsigned integer indicating the number of [component location record]s in this [location section].

(69) <number of compression lookup records> ::= a 4-byte unsigned integer  $\geq 1$ , indicating the number of [compression lookup record]s in each [compression lookup table].

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[related image description record](intended for backward compatibility; see 5.1.8 above).

(91) <related image description table offset> ::= a 4-byte unsigned integer indicating the displacement, measured in bytes, between the beginning of the [related images subsection] and the first byte of the [related image description table] (counting the first byte of the [related images subsection] as 0). (Intended for backward compatibility; see 5.1.8 above.)

(92) <related image file name> ::= a 12-byte ASCII character string in the format defined in 4.5.4.4 above, identifying a [frame file] recorded on this volume that is related to the [frame file] in a manner defined by the <relationship code> in this [related image description record].

(93) <related image pathname > ::= a variable-length ASCII character string defining the pathname for the directory containing a given [frame file], recorded on this volume for an image that is related to the image recorded in this [frame file], in accordance with the relationship defined in the corresponding <relationship code> in the [related image description record] for the related file. For example, if the image in [frame file] /RPF/CONC/CONCZ03/EFGH5678.ON3 is related to the image in this [frame file], the <related image pathname> ::= "/CONC/CONCZ03/" in the [related image pathname record], and the corresponding <related image file name> ::= "EFGH5678.ON3" in the appropriate [related image description record].

(94) <related image pathname length > ::= a 2-byte unsigned integer indicating the length in bytes of the <related image pathname> field for the [frame file] identified in this [related image description record].

(95) <related image pathname offset> ::= a 4-byte unsigned integer defining the displacement, measured in bytes, between the beginning of the [related images subsection] and the first byte of the record in the [related image pathname table] containing the pathname of the image file named in this [related image description record] (counting the first byte of the [related images subsection] as 0).

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(96) <relationship code> ::= a 4-byte unsigned integer defining the nature of the relationship (e.g. stereo pairs) between this [frame file] and the [frame file] identified in this [related image description record], encoded as specified in MIL-STD-2411-1, section 5.3.3.

(97) <replace/update record length> ::= 2-byte unsigned integer  $\geq 25$  indicating the length in bytes of each [replace/update record] (intended for backward compatibility; see 5.1.8 above).

(98) <replace/update status> ::= a 1-byte unsigned integer indicating the status of this [replace/update record]. encoded as follows"

::= 1 to indicate that the [frame file] identified in >new file name> field in this [replace/update record] updates one or more subframes in the [frame file] identified in the <old file name> field in this [replace/update record].

::= 2 to indicate that the [frame file] identified in <new file name> (which is intended to update a parent edition supersedes the [frame file] identified in the <old file name> field in this [replace/update record] (which also was intended to update the same parent edition).

::= 3 to indicate that the [frame file] identified in <new file name> field in this [replace/update record] replaces the entire [frame file] identified in the <old file name> field in this [replace/update record]/

(99) <replace/update table offset> ::= a 4-byte integer defining the displacement, measured in bytes, between the beginning of the [replace/update subsection] and the first byte of the [replace/update table], (counting the first byte of the [replace/update subsection] as 0).

(100) <security classification> ::= a 1-byte ASCII character coded to indicate the security level (e.g. unclassified, confidential, secret) of this file, as specified in MIL-STD-2411-1, section 5.1.8.

(101) <security country/international code> ::= a 2-byte ASCII character string coded to indicated the originating country or international affiliation of the <security classification> of this file, as defined in MIL-STD-2411-1 section 5.1.7.

(102) <security release marking> ::= a 2-byte ASCII character string coded to indicate any special handling or releasability restrictions assigned to the contents of this file as defined in MIL-STD-2411-1, section 5.1.9

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