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MIL-STD-1820
17 December 1992

MILITARY STANDARD

GENERIC TRANSFORMED DATA BASE DESIGN STANDARD

AMSC No N/A FSC 69GP

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DEPARTMENT OF DEFENSE
WASHINGTON DC 20301-8000

GENERIC TRANSFORMED DATA BASE DESIGN GUIDE

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FOREWORD

The Generic Transformed Data Base (GTDB) standard establishes the file, record, and field formats for digital geographic data bases to be used by real-time simulators.

The GTDB is one of two standard data base formats developed for training simulator use under Air Force Project 2851. The other, Standard Simulator Data Base Interchange Format (SIF), is documented in a separate military standard. The application of one or both of these standards during the acquisition of a training simulator system is expected to reduce the cost associated with data base development for that system, as well as systems which may follow in the future.

The document is structured in four sections, including the main body of the standard and three appendices.

The main standard defines the format of the GTDB as a hierarchy of files, records, and fields. All data bases identified as GTDBs must conform to this format.

Appendix A is a mandatory part of the standard, which gives the detailed definition of each GTDB data field, as an Ada type as well as a range of permissible values.

Appendix B is a mandatory part of the standard, which lists the Feature Descriptor Codes used within a GTDB.

Appendix C is a guidance-only section, which provides illustrative background information on the format defined in the main standard.

For the first-time GTDB user/implementer, it is recommended that Appendix C, "Rationale and Guidance", be studied carefully before reading the detailed design portions of the standard itself.

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1 SCOPE

1.1 **Scope.** This standard describes the detailed design of the data base identified as the Generic Transformed Data Base (GTDB) of the Project 2851 System, and defines the file, record, and field structure of the GTDB.

1.2 **Purpose.** The purpose of this document is to facilitate the production and utilization of Generic Transformed Data Bases.

2 APPLICABLE DOCUMENTS

2.1 **Government Documents.** Not applicable.

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 shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issues of the documents cited in the solicitation (see 6.2)

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI X3.27	Information Systems - File Structure and Labeling of Magnetic Tapes for Information Interchange
ANSI X3.4	Code for Information Interchange (ASCII)

(Application for copies should be addressed to American National Standards Institute, 11 West 42nd Street, New York NY 10036.)

DDM-2600-63220-90	National Imagery Transmission Format (NITF), Version 1 1

(Application for copies should be addressed to Defense Intelligence Agency, DIA/DM - 1A, 3100 Clarendon Boulevard, Arlington VA 22201-5317)

(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, specifications sheets, or MS standards), the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3 DEFINITIONS AND ACRONYMS

3.1 **Acronyms.** For the purpose of this standard, the following acronyms apply.

ANSI	American National Standards Institute
ASCII	American Standard Code Information Interchange
CDBTP	Common Data Base Transformation Program
CIG	Computer Image Generator
CM	Configuration Management
CMP	Configuration Management Program
COTS	Commercial Off-the-Shelf
CSCI	Computer Software Configuration Item
DB	Data Base
DBDD	Data Base Design Document
DBGMP	Data Base Generation/Modification Program
DBMS	Data Base Management System
DFAD	Digital Feature Analysis Data
DLMS	Digital Landmass System
DMA	Defense Mapping Agency
DRLMS	Digital Radar Landmass Simulator
DTED	Digital Terrain Elevation Data
EO	Electro-Optical
EOF	End of File
FAC	Feature Analysis Code Feature Attribute Code
FACS	Feature Attribute Coding Standard
FDC	Feature Descriptor Code
FID	Feature Identification Descriptor
FLIR	Forward-Looking Infrared
FP	Formatter Program
FPI	Frames per Inch
GB	Gigabyte(s)
GTDB	Generic Transformed Data Base
HVC	Hue-Value-Chroma
IG	Image Generator
I/O	Input/Output
IR	Infrared
KB	Kilobyte(s)
LOD	Level of Detail
LVT	Local Vertical Tangent
MB	Megabyte(s)
MBR	Minimum Bounding Rectangle
MC&G	Mapping, Charting, and Geodesy
MSL	Mean Sea Level
NOE	Nap of the Earth
QA	Quality Assurance
QC	Quality Control
RGB	Red-Green-Blue
SAR	Synthetic Aperture Radar
SDDD	Software Detailed Design Document
SLOD	Simulator Level of Detail
SMC	Surface Material Category
SNM	Square Nautical Miles
SSDB	Standard Simulator Data Base
S/W	Software

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UP	Utility Program
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VMS	Virtual Memory System
WGS	World Geodetic System
W/S	Workstation

4 GENERAL REQUIREMENTS

4.1 **Media.** Generic Transformed Data Bases shall be distributed on nine-track magnetic tape, recorded at 6250 bits per inch (BPI) in Group Coded Recording (GCR) format.

4.1.2 **Structure/Labeling.** Tape file structure and labeling shall be in accordance with ANSI X3.27.

4.1.3 **Multi-Volume Sets.** GTDBs shall be permitted to span tape volumes.

4.2 **Content.** It shall be possible to generate a valid GTDB which contains only a subset of the total information supported by this format. Those files, records, and fields which may be omitted are identified as "Optional" in Section 5 of this standard.

4.2.1 **Field Population.** Whenever a GTDB includes a particular record, all fields defined for that record shall be populated with either valid or default data.

4.2.1.1 **Valid Data.** Valid data (that is, information traceable back to a real-world source), shall be used to populate GTDB fields whenever such data exists in the Standard Simulator Data Base (SSDB).

4.2.1.2 **Default Data.** Default data (that is, synthetic information which is not traceable back to a real-world source), shall be used to populate fields for which valid data is unavailable. Default values to be used shall be as indicated in the appropriate subparagraphs under Section 5 of this standard.

4.2.2 **Content Specification.** The content of a specific GTDB shall be tailored, as specified by a number of user-provided parameters, specified in the following subparagraphs.

4.2.2.1 **Datum.** The datum of a GTDB shall be one of the following, as specified. If left unspecified, the default datum shall be WGS-84.

4.2.2.1.1 WGS-84

4.2.2 1.2 WGS-72

4.2.2.1.3 International Ellipsoid: Bogota Observatory, Chatham 1971, Chua Astro, Correego Alegre, European 1950, Geodeti Datum 1949, Hjorsey 1955, Hong Kong 1963, Provisional South American, Qornoq, Rome 1940, or South American 1969

4.2.2.1.4 Clark 1866 Ellipsoid: Bermuda 1957, Cape Canaveral, LC5 Astro, Luzon, North American 1927, or Old Hawaiian

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4.2.2.1.5 Clark 1880 Ellipsoid: Adindan, Arc 1950, Arc 1960, Liberia 1964, Mahe 1971, Merchich, Nahrnan, Oman, South East Island, or Viti Levu 1916.

4 2.2.1.6 Any user-defined datum.

4.2.2.2 **Coordinate System.** The coordinate system of the GTDB shall be one of the following, as specified. If left unspecified, the default shall be Geodetic.

4.2.2.2.1 Geodetic

4.2.2.2.2 Geocentric

4.2.2.2.3 Map Projection: UTM, Mercator, Transverse Mercator, Polar, Lambert Conformal Conic, or Local Vertical Tangent.

4.2.2.3 **Terrain Representation.** Terrain elevation data shall be represented in one or more of the following forms, as specified. There shall be no default form.

4 2 2.3.1 Polygonized from a source terrain data base, using the Dirichlet-Delauney tessellation algorithm

4.2.2.3.2 Gridded, with the grid post locations and values extracted directly from the source terrain data base

4.2.2.3.3 Gridded, with the grid post locations and values derived from a Dirichlet-Delauney tessellation of the source terrain data base.

4.2.2.4 **Vertex Normals.** If explicitly specified, GTDB polygons shall include vertex normals; otherwise, these shall be excluded.

4.2.2.5 **Synthetic Culture.** If explicitly specified, a GTDB shall exclude synthetic culture; otherwise, this shall be included.

4.2 2.6 **Boundary SLOD Matching.** If explicitly specified, terrain polygons at different SLODs within a GTDB shall match at the boundaries of adjacent area blocks; otherwise, this shall not be assured. If gridded terrain is specified, or if only one SLOD is specified, this shall not apply.

4.2.2.7 **Convex Polygons.** If explicitly specified, a GTDB shall include only convex culture and model polygons; otherwise, convexity shall not be assured.

4.2.2.8 **Edge Limit.** If explicitly specified, polygons within a GTDB shall be decomposed to meet a specified edge count limit; otherwise, no decomposition shall occur.

4.2.2.9 **Model References.** If explicitly specified, cultural features within a GTDB shall be replaced with model references pointers; otherwise, no replacement shall occur

4.2.2 10 **Expanded Lineals** If explicitly specified, all cultural lineal features within a GTDB shall be expanded into areal features; otherwise, no expansion shall occur.

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4.2.2.11 **Fragmented Point Light Strings.** If explicitly specified, all cultural point light string features within a GTDB shall be fragmented into individual point light features; otherwise, these shall remain represented as point light strings.

4.2.2.12 **Face Count Exception.** Should a cultural face count limit be exceeded during the transformation process, one of the following shall occur, as explicitly specified. If left unspecified, no GTDB shall be produced in this instance.

4.2.2.12.1 The face count shall exceed the parameter specified

4.2.2.12.2 Features specified in the keep-list shall be deleted

4.2.2.12.3 No GTDB shall be produced

4.2.2.13 **SLOD Parameters** The following characteristics shall be as specified for each Simulator Level of Detail (SLOD) within the GTDB.

4.2.2.13.1 **Keep-List.** If a keep-list is specified, the GTDB shall include all features listed therein, subject to the exception noted in paragraph 4.2.2.13.2.

4.2.2.13.2 **Delete-List.** If a delete-list is specified, the GTDB shall include none of the features listed therein.

4.2.2.13.3 **Level-List.** If a level-list is specified, terrain polygons in the GTDB shall be flat beneath those features listed therein, subject to the constraints implied in paragraph 4.2.2.15.5.

4.2.2.13.4 **Thinning Tolerance.** If a thinning tolerance is explicitly specified for areal and lineal culture features, vertices in each such feature shall be deleted to the extent that the resultant feature reflects the original feature within the specified error tolerance.

4.2.2.13.5 **Highest Level of Detail.** The culture data in each SLOD shall include features up to and including the highest level of detail specified for that SLOD.

4.2 2.14 **Area Block Parameters.** The following characteristics shall be as specified for each Area Block (AB) within a SLOD. These values shall vary from AB to AB, as specified.

4.2.2.14.1 **Area Block Dimensions.** ABs shall be of dimensions within the range of 0.001 arc-second to 15 arc-minutes, as specified. There shall be no default AB size.

4.2.2.14.2 **Face Count Limit.** If explicitly specified, the number of polygonal faces used to represent culture data within an area block shall fall within the specified limit; otherwise, there shall be no limit.

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4.2.2.14.3 **Model Reference Limit.** If explicitly specified, the number of model references within an AB shall fall within the specified limit; otherwise, there shall be no limit.

4.2.2.14.4 **Terrain Goodness-of-Fit.** If explicitly specified, terrain polygons within an AB shall conform to the specified goodness-of-fit tolerance, subject to the constraints implied by paragraph 4.2.2.15 5; otherwise, there shall be no goodness-of-fit imposed. This shall not apply to GTDBs for which only gridded terrain is specified.

4.2.2.14.5 **Number of Terrain Polygons.** If explicitly specified, the number of terrain polygons generated in an AB shall meet the minimum and/or maximum counts; otherwise, there shall be no minimum or maximum.

4.2.2.15 **Additional Islands.** If explicitly specified, additional SLOD Islands shall be included within the GTDB, in accordance with the user's dimensions.

4.3 **Data Formats.** The following formats shall be used to represent information within a GTDB.

4.3.1 **Non-Texture Data.** All data except texture shall be represented in the eight-bit American Standard Code for Information Interchange (ASCII), in accordance with ANSI X3.4.

4 3.1.1 **Field Format.** Data values within all fields shall be right-justified, and the leading bytes filled with the ASCII SPACE (hexadecimal '20') character.

4.3.1.2 **Inter-Field Separation** Adjacent fields shall be separated by the ASCII NULL (hexadecimal '00') character.

4.3.2 **Texture Data.** Texture data shall be represented in the National Imagery Transmission Format (NITF), Version 1.1, as amended by Section 5 of this standard.

5 DETAILED REQUIREMENTS

5 1 **Data Base Structure** This section describes the format in which the Generic Transformed Data Base products of the Project 2851 Data Base Facility shall be produced.

5.1.1 The general architecture of the GTDB shall be as illustrated in Figure 1.

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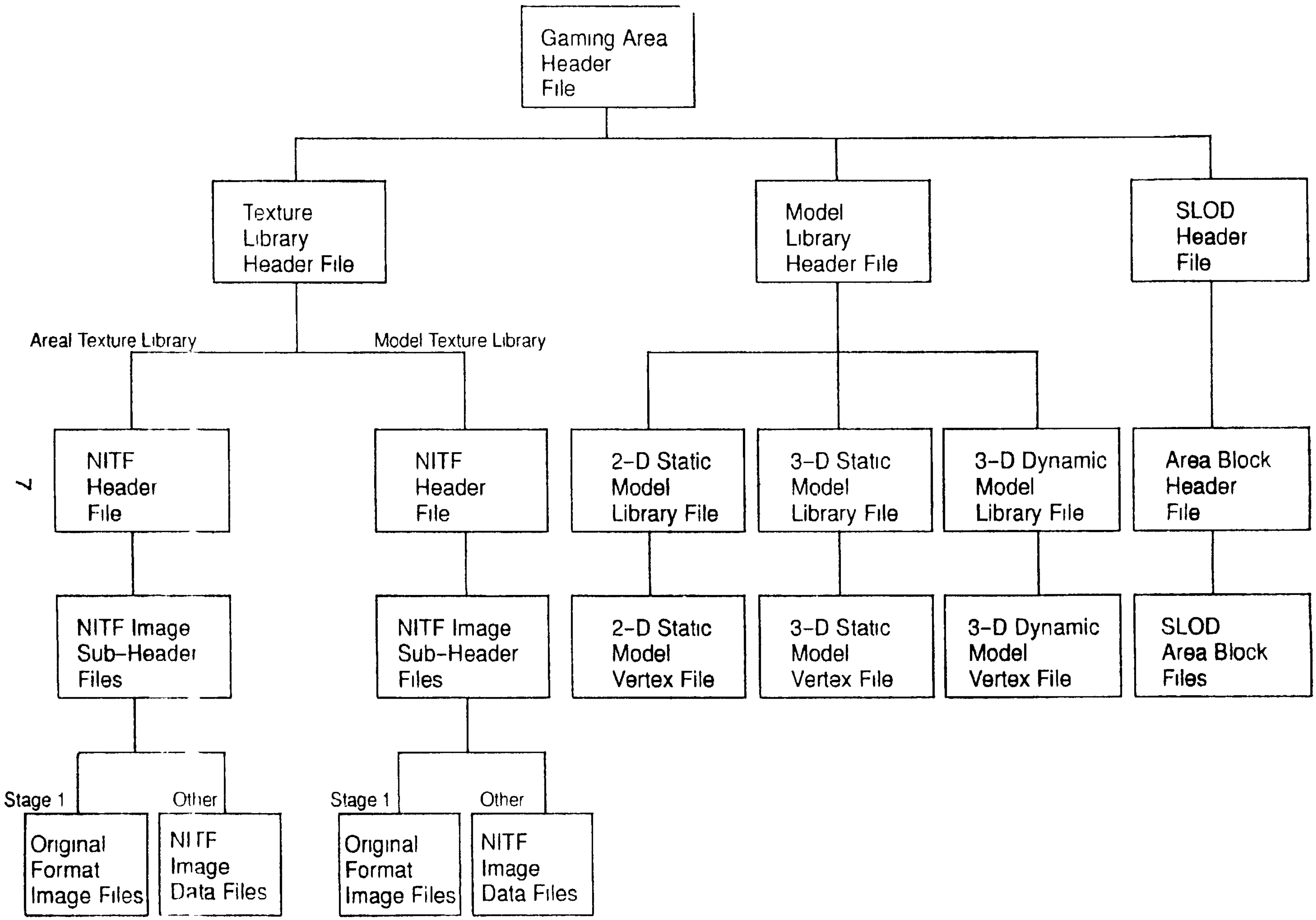

Figure 1 General Architecture of GTDB

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5.1.2 The following subparagraphs describe each of the GTDB files and the logical relationships among them. The file order on the GTDB tape shall be as follows:

```
Gaming Area Header (GAH) File
Model Library Header (MLH) File
SLOD Header (SLODH) File
Area Block Header (ABH) File
Texture Library Header (TLH) File
Two-Dimensional Static Model (2DSM) Library [optional]
Two-Dimensional Static Model Vertex (2DSMV) File [optional]
Three-Dimensional Static Model (3DSM) Library [optional]
Three-Dimensional Static Model Vertex (3DSMV) File [optional]
Three-Dimensional Dynamic Model (3DDM) Library [optional]
Three-Dimensional Dynamic Model Vertex (3DDMV) File [optional]

for each SLOD
   SLOD Area Blocks File

Areal Texture (AT) Library [optional]
   NITF Header File [optional]
   for each areal texture
      NITF Image Sub-Header File [optional]
      if texture is in Stage 1 then
         Original Format Image File(s) [optional]
      else
         NITF Image Data File [optional]
Model Texture (MT) Library [optional]
   NITF Header File [optional]
   for each model texture
      NITF Image Sub-Header File [optional]
      if texture is in Stage 1 then
         Original Format Image File(s) [optional]
      else
         NITF Image Data File [optional]
```

5.1.3 The record structure of each of these files shall be as described in the following sections.

5.2 **Gaming Area Header (GAH) File.** There shall be one Gaming Area Header File at the beginning of a GTDB.

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5.2.1 **GAH Record Order.** The record order of the GAH file shall be as follows:

GAH Identifier Record
File Name Record
Gaming Area Header Record
GTDB Parameter Record
Boundary Point Records
Model List Record(s) [optional]
for each SLOD
   SLOD Parameter Record
      Keep-List Record(s) [optional]
      Delete-List Record(s) [optional]
      Level-List Record(s) [optional]
      for each area block
         Area Block Parameter Record
for each island
   Island Record
      Island LOD Record(s)
      Island Boundary Point Records
Option Record
Affected AB Count Record
for each Affected Area Block
   Affected AB ID Record
Checksum Record

5.2.2 **GAH Field Structure.** The field structure of each of these records shall be as described below.

5.2.2.1 **GAH Identifier Record.** This record shall consist of the ASCII string 'GAH'.

5.2.2.2 **GAH File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnnGA.H', where "ss" is the security code and "nnnnnn" is the GTDB identifier.

5.2.2.3 **Gaming Area Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
GTDB Version Number Field
Last Update Date Field
Compilation Date Field
Security Level Field
Tape ID Field
Data Location Field
GTDB Directory Field

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5.2.2.4 **GTDB Parameters Record.** The field structure of this record shall be as follows:

Coordinate System Parameters Subrecord
Boundary Point Count Field
Terrain Polygons Flag Field
Terrain Grid Flag Field
Terrain Grid Source Flag Field
Match Terrain At SLODs Flag Field
Vertex Normals Flag Field
Synthetic Culture Flag Field
Fragment Culture Flag Field
Decompose Culture Flag Field
Maximum Number of Edges Field
Use Models Flag Field
Decompose Models Flag Field
Maximum Number of Model Polygon Edges Field
Separation Planes Flag Field
Expand Lineals Flag Field
Fragment Point Light Strings Flag Field
Model List Count Field
SLOD Count Field (Always one or greater)
Island Count Field
Specific Areal Texture Parameters Subrecord
Generic Areal Texture Parameters Subrecord
Specific Model Texture Parameters Subrecord
Generic Model Texture Parameters Subrecord
User Option Field

5.2.2.4.1 **Coordinate System Parameters Subrecord.** The field structure of this record shall be as follows:

Coordinate System Field
Datum ID Field
Eccentricity Field
Semi-Major Axis Field
Datum Shift Field
Elevation Reference Field
Longitudinal Origin Field
Latitudinal Origin Field
Origin of Eastings Field
Origin of Northings Field
Scale Factor Field
First Standard Parallel Field
Second Standard Parallel Field
Tangency Point Height Field

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5.2.2.4.2 **Specific Areal Texture Parameters Subrecord.** The field structure of this record shall be as follows:

Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
SMC/FDC Texture Existence Flag Field
Multispectral Texture Existence Flag Field
Processing Stage Field
Texture Format Field
Horizontal Block Size Field
Vertical Block Size Field
Number of Horizontal Blocks Field
Number of Vertical Blocks Field
Bits Per Texel Per Band Field
SMC/FDC Lookup-Table Existence Flag Field
Special Environmental Conditions Preference Field
Time Of Year Preference Subrecord
Image Capture Date Range Subrecord
Acceptable Percentage Of Cloud Cover Subrecord
Acceptable Percentage of Shadow Cover Subrecord

5.2.2.4.3 **Generic Areal Texture Parameters Subrecord.** The field structure of this record shall be as follows:

Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
Global-Based Mapping Flag Field
Face-Based Mapping Flag Field
Non-Mapped Flag Field
Texture Format Field
Horizontal Block Size Field
Vertical Block Size Field
Number of Horizontal Blocks Field
Number of Vertical Blocks Field
Bits Per Texel Per Band Field
Time Of Year Preference Subrecord

5.2.2.4.4 **Specific Model Texture Parameters Subrecord.** The field structure of this record shall be as follows:

Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
Multispectral Texture Existence Flag Field
Processing Stage Field
Model-Based Mapping Flag Field
Face-Based Mapping Flag Field
Vertex-to-Vertex Mapping Flag Field
Non-Mapped Flag Field
Texture Format Field
Horizontal Block Size Field
Vertical Block Size Field
Number of Horizontal Blocks Field
Number of Vertical Blocks Field
Bits Per Texel Per Band Field

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5.2.2.4.5 **Generic Model Texture Parameters Subrecord.** The field structure of this record shall be as follows:

Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
Model-Based Mapping Flag Field
Face-Based Mapping Flag Field
Non-Mapped Flag Field
Texture Format Field
Horizontal Block Size Field
Vertical Block Size Field
Number of Horizontal Blocks Field
Number of Vertical Blocks Field
Bits Per Texel Per Band Field

5.2.2.4.6 **Time of Year Preference Subrecord.** The field structure of this record shall be as follows:

Spring Flag Field
Summer Flag Field
Autumn Flag Field
Winter Flag Field

5.2.2.4.7 **Image Capture Data Range Subrecord.** The field structure of this record shall be as follows:

Start Date Field
End Date Field

5.2.2.4.8 **Acceptable Percentage of Cloud Cover Subrecord.** The field structure of this record shall be as follows:

Low Value Field
High Value Field

5.2.2.4.9 **Acceptable Percentage of Shadow Cover Subrecord.** The field structure of this record shall be as follows:

Low Value Field
High Value Field

5.2.2.5 **Boundary Point Record.** The number of Boundary Point Records shall correspond to the value in the Boundary Point Count Field in the parent GTDB Parameters Record. The first and last boundary points shall be identical, and boundary points shall be sequenced in counterclockwise order as viewed from above. Edges defined by boundary points shall lie parallel to the axes of the coordinate plane The field structure of this record shall be as follows.

Boundary Point Field

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5.2.2.6 Model List Record. The number of these records shall correspond to the value in the Model List Count Field in the parent GTDB Parameters record. The field structure of each record shall be as follows:

Model Library Type Field
Model Number Field
Specific Model Texture Parameters Subrecord
Generic Model Texture Parameters Subrecord

5.2.2.6.1 Specific Model Texture Parameters Subrecord. The field structure of this record shall be as follows:

Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
Multispectral Texture Existence Flag Field
Processing Stage Field
Model-Based Mapping Flag Field
Face-Based Mapping Flag Field
Vertex-to-Vertex Mapping Flag Field
Non-Mapped Flag Field
Texture Format Field
Horizontal Block Size Field
Vertical Block Size Field
Horizontal Blocks Field
Vertical Blocks Field
Bits Per Texel Per Band Field

5.2.2 6.2 Generic Model Texture Parameters Subrecord. The field structure of this record shall be as follows:

Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
Model-Based Mapping Flag Field
Face-Based Mapping Flag Field
Non-Mapped Flag Field
Texture Format Field
Horizontal Block Size Field
Vertical Block Size Field
Number of Horizontal Blocks Field
Number of Vertical Blocks Field
Bits Per Texel Per Band Field

5.2.2.7 SLOD Parameters Record. The number of Simulator Level of Detail Parameters Records shall correspond to the value in the Simulator Level of detail Count Field in the parent GTDB Parameters record. The field structure of this record shall be as follows:

Simulator Level of Detail ID Field
Number of Keep-List Entries Field
Number of Delete-List Entries Field
Number of Level-List Entries Field
Culture Resolution Field
Terrain Grid Source Simulator Level of Detail Field
Number of Area Blocks Field (Always one or greater)

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5.2.2.8 **Keep-List Record.** The number of these records shall correspond to the value in the Number of Keep-List Entries field in the parent Simulator Level of Detail Parameters record. The Ending FDC Code Field shall always have a value equal to or greater than that of the starting FDC Code Field. The field structure of each record shall be as follows:

Starting FDC Code Field
Ending FDC Code Field

5.2.2.9 **Delete-List Record.** The number of these records shall correspond to the value in the Number of Delete-List Entries field in the parent Simulator Level of Detail Parameters record. The Ending FDC Code Field shall always have a value equal to or greater than that of the starting FDC Code Field. The field structure of each record shall be as follows:

Starting FDC Code Field
Ending FDC Code Field

5.2.2.10 **Level-List Record.** The number of these records shall correspond to the value in the Number of Level-List Entries field in the parent Simulator Level of Detail Parameters record. The Ending FDC Code Field shall always have a value equal to or greater than that of the starting FDC Code Field. The field structure of each record shall be as follows:

Starting FDC Code Field
Ending FDC Code Field

5.2.2.11 **Area Block Parameters Record.** The number of Area Block Parameters Records shall correspond to the value in the Number of Area Blocks Field in the parent Simulator Level of Detail Parameters Record. The field structure of this record shall be as follows:

Area Block Number Field
Area Block Boundary Field
Goodness-of-Fit Field
Minimum Number of Terrain Polygons Field
Maximum Number of Terrain Polygons Field
Maximum Number of Culture Polygons Field
Maximum Number of Model References Field
Terrain LOD Field
Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
SMC/FDC Texture Existence Flag Field
Color Texture Resolution Field
Grayscale Texture Resolution Field
SMC/FDC Texture Resolution Field

5.2.2.12 **Island Record.** The number of Island Records shall correspond to the value in the Island Count Field in the parent GTDB Parameters Record. The field structure of this record shall be as follows

Island Number Field
Island Boundary Point Count Field

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5.2.2.13 **Island LOD Record.** Following each Island Record, there shall be an Island LOD record for each simulator level of detail in the GTDB. The field structure of this record shall be as follows:

SLOD ID Field
SSDB Culture LOD Field
Color Texture Existence Flag Field
Grayscale Texture Existence Flag Field
Color Texture Resolution Field
Grayscale Texture Resolution Field

5.2.2.14 **Island Boundary Point Record.** The number of Island Boundary Point Records shall correspond to the value in the Island Boundary Point Count Field in the parent Island Record. The edge formed by successive Island Boundary Points shall not cross the boundary of any other island in the GTDB. The first and last boundary points of an island shall be identical, and boundary points shall be sequenced in counter-clockwise order as viewed from above. The field structure of this record shall be as follows:

Island Number Field
Boundary Point Field

5.2.2.15 **Option Record.** The field structure of the record shall be as follows:

Tape Option Field

5.2.2 16 **Affected AB Count Record.** Populated only if the Tape Option defined above indicates update only; otherwise, it shall contain zero. The field structure of the record shall be as follows.

Number of Area Blocks Field

5.2.2.17 **Affected AB ID Record.** The number of these records shall correspond to the Number of Area Blocks field in the Affected AB Count Record. The field structure of the record shall be as follows:

SLOD ID Field
Area Block Number Field

5.2.2.18 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.3 **Model Library Header (MLH) File.** There shall be one Model Library Header File following the TLH

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5.3.1 **MLH Record Order.** The record order of the MLH file shall be as follows:

MLH Identifier Record
File Name Record
for each model library
   Model Library Header Record
   Culture Color Table Record(s)
   Light Color Table Record(s)
   for each model
      Model LOD Complexity Table Record
      for each model LOD
         Model Complexity Statistics Table Subrecord
Checksum Record

5.3.2 **MLH Field Structure.** The field structure of each of these records shall be as described below

5.3.2.1 **MLH Identifier Record.** This record shall consist of the ASCII string 'MLH'

5.3.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnnML.H', where "ss" is the security code and "nnnnnn" is the GTDB identifier.

5.3.2.3 **Model Library Header Record.** There shall be three Model Library Header records--one each for a 2-D Static Model Library, a 3-D Static Model Library, and a 3-D Dynamic Model Library. The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Model Library Type Field
Last Update Date Field
Number of Culture Color Tables Field
Number of Light Color Tables Field
Number of Models Field

5.3.2.4 **Culture Color Table Record.** The total number of records shall correspond to the value in the "Number of Culture Color Tables" field in the parent Model Library Header record. The field structure of each record shall be as follows.

Color ID Field
Color Name Field
Color (Hue, Chroma, Value, Color Calibration Entry) Field
Number of Color References Field

5.3.2.5 **Light Color Table Record.** The total number of records shall correspond to the value in the "Number of Light Color Tables" field in the parent Model Library Header record The field structure of each record shall be as follows:

Color ID Field
Color Name Field
Color (Hue, Chroma, Value, Color Calibration Entry) Field
Number of Color References Field

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5.3.2.6 Model LOD Complexity Table Record. The total number of these records shall correspond to the value in the "Number of Models" field in the parent Model Library Header record. The field structure of each record shall be as follows:

Model Number Field
Number of LODs Field

5.3.2.7 Model Complexity Statistics Table Record. The total number of these records shall correspond to the value in the "Number of LODs" field in the parent Model LOD Complexity Table record. The field structure of each record shall be as follows:

Model Number Field
Model LOD Field
Number of Polygons Field
Number of Separation Planes Field
Number of Texture References Field
Number of Collision Test Points Field
Correlation Priority Field

5.3.2.8 Checksum Record. The field structure of this record shall be as follows:

Checksum Field

5.4 Simulator Level of Detail Header (SLODH) File. There shall be one Simulator Level of Detail Header File following the MLH.

5.4.1 SLODH Record Order. The record order of the SLODH file shall be as follows:

SLODH Identifier Record
File Name Record
SLODH File Header Record
for each SLOD
  SLOD Header Record
  Feature Distribution Table Record
  Z-Density Distribution Table Record
  SMC Distribution Table Record
  Culture Color Table Record
  Light Color Table Record
Checksum Record

5.4.2 SLODH Field Structure. The field str cture of each of these records shall be as described below.

5.4.2.1 SLODH Identifier Record. This record shall consist of the ASCII string 'SLODH'.

5.4.2.2 File Name Record. This record shall consist of the ASCII string 'ssGnnnnnnSLOD.H', where "ss" is the security code and "nnnnnn" is the GTDB identifier.

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5.4.2.3 **SLODH File Header Record.** This record shall consist of a single field indicating the number of SLODs defined within the GTDB, as follows:

Number of SLODs Field

5.4.2.4 **SLOD Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
SLOD ID Field
Area Block Size Field
Last Update Date Field
Security Level Field
SLOD Polygon Density Statistics Table Subrecord
Number of Feature Distribution Tables Field
Number of Z-Density Distribution Tables Field
Number of SMC Distribution Tables Field
Number of Culture Color Tables Field
Number of Light Color Tables Field

5.4.2.4.1 **SLOD Polygon Density Statistics Table Subrecord.** The field structure of this record shall be as follows:

Maximum Terrain Polygons Field
Minimum Terrain Polygons Field
Maximum Areal Feature Polygons Field
Minimum Areal Feature Polygons Field
Maximum Linear Feature Segments Field
Minimum Linear Feature Segments Field
Maximum Point Features Field
Minimum Point Features Field
Maximum Point Light Features Field
Minimum Point Light Features Field
Maximum Point Light Strings Field
Minimum Point Light Strings Field
Maximum Model References Field
Minimum Model References Field
Maximum Texture References Field
Minimum Texture References Field
Maximum Model Polygons Field
Minimum Model Polygons Field
Maximum Total Elements Field
Minimum Total Elements Field

5.4.2.5 **Feature Distribution Table Record.** The total number of records shall correspond to the value in the "Number of Feature Distribution Tables" field in the parent Simulator Level of Detail Header record. The field structure of each record shall be as follows:

Feature Descriptor Code Field
Number of Feature Occurrences Field
Number of Fragments Field
Correlation Priority Field

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5.4.2.6 **Z-Density Distribution Table Record.** The total number of records shall correspond to the value in the "Number of Z-Density Distribution Tables" field in the parent Simulator Level of Detail Header record. The field structure of each record shall be as follows:

Number of Layers Above Terrain Polygon Field
Number of Occurrences Field

5.4.2.7 **SMC Distribution Record.** The total number of records shall correspond to the value in the "Number of SMC Distribution Tables" field in the parent Simulator Level of Detail Header record. The field structure of each record shall be as follows:

Surface Material Category Field
Surface Material Subtype Field
Number of Occurrences Field

5.4.2.8 **Culture Color Table Record.** The total number of records shall correspond to the value in the "Number of Culture Color Tables" field in the parent Simulator Level of Detail Header record. The field structure of each record shall be as follows:

Color ID Field
Color Name Field
Color (Hue, Chroma, Value, Color Calibration Entry) Field
Number of Color References Field

5.4.2.9 **Light Color Table Record.** The total number of records shall correspond to the value in the "Number of Light Color Tables" field in the parent Simulator Level of Detail Header record. The field structure of each record shall be as follows:

Color ID Field
Color Name Field
Color (Hue, Chroma, Value, Color Calibration Entry) Field
Number of Color References Field

5.4.2.10 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.5 **Area Block Header (ABH) File.** There shall be one Area Block Header File following the SLODH.

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5.5.1 **ABH Record Order.** The record order of the ABH file shall be as follows:

ABH Identifier Record
File Name Record
for each SLOD
  ABH File Header Record
  for each area block within SLOD
    Area Block Header Record
    Feature Distribution Table Record
    SMC Distribution Table Record
    Culture Color Table Record
    Light Color Table Record
    Areal Texture Table Record
Checksum Record

5 5.2 **ABH Field Structure.** The field structure of each of these records shall be as described below.

5.5.2.1 **ABH Identifier Record.** This record shall consist of the ASCII string 'ABH'.

5.5.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnnAB.H', where "ss" is the security code and "nnnnnn" is the GTDB identifier.

5.5.2.3 **ABH File Header Record.** This record shall consist of a single field indicating the number of area blocks defined within the SLOD, as follows·

Number of Area Blocks Field

5.5.2.4 **Area Block Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
SLOD ID Field
Area Block Number Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Polygon Density Statistics Table Subrecord
Terrain Roughness Statistics Table Subrecord
Area Block Existence Flags Subrecord
Number of Feature Distribution Tables Field
Number of SMC Distribution Tables Field
Number of Culture Color Tables Field
Number of Light Color Tables Field

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5.5.2.4.1 **Polygon Density Statistics Table Subrecord.** The field structure of this subrecord is as follows:

Number of Vertices Field
Number of Terrain Polygons Field
Number of Areal Feature Polygons Field
Number of Linear Feature Segments Field
Number of Point Features Field
Number of Point Light Features Field
Number of Point Light Strings Field
Number of Model References Field
Number of Texture References Field

5.5 2 4.2 **Terrain Roughness Statistics Subrecord.** These fields shall be populated when gridded terrain has been requested, and zero otherwise. The field structure of this record shall be as follows:

Maximum Elevation Field
Minimum Elevation Field
Terrain Roughness Index Field

5.5.2.4.3 **Area Block Existence Flags Subrecord.** The field structure of this record shall be as follows:

Areal Feature Area Block Flag (Always True)
Linear Feature Area Block Flag
Point Feature Area Block Flag
Point Light Feature Area Block Flag
Point Light String Feature Area Block Flag
Terrain Polygon Area Block Flag
Terrain Grid Area Block Flag
Model Reference Area Block Flag

5.5.2.5 **Feature Distribution Table Record.** The total number of records shall correspond to the value in the "Number of Feature Distribution Tables" field in the parent Area Block Header record. The field structure of each record shall be as follows:

Feature Descriptor Code Field
Number of Feature Occurrences Field
Number of Fragments Field
Correlation Priority Field

5.5.2.6 **SMC Distribution Record.** The total number of records shall correspond to the value in the "Number of SMC Distribution Tables" field in the parent Area Block Header record. The field structure of each record shall be as follows:

Surface Material Category Field
Surface Material Subtype Field
Number of Occurrences Field

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5.5.2.7 **Culture Color Table Record.** The total number of records shall correspond to the value in the "Number of Culture Color Tables" field in the parent Area Block Header record. The field structure of each record shall be as follows:

Color ID Field
Color Name Field
Color (Hue, Chroma, Value, Color Calibration Entry) Field
Number of Color References Field

5.5.2.8 **Light Color Table Record.** The total number of records shall correspond to the value in the "Number of Light Color Tables" field in the parent Area Block Header record. The field structure of each record shall be as follows:

Color ID Field
Color Name Field
Color (Hue, Chroma, Value, Color Calibration Entry) Field
Number of Color References Field

5.5.2.9 **Areal Texture Table Record.** The total number of records shall correspond to the value in the "Number of Texture References" field in the Polygon Density Statistics Table Subrecord within the parent Area Block Header record. The field structure of each record shall be as follows:

GTDB Texture Library Type Field
Texture ID Field

5.5.2.10 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.6 **Texture Library Header (TLH) File.** There shall be one Texture Library Header File following the GAH.

5.6.1 **TLH Record Order** The record order of the TLH file shall be as follows:

TLH Identifier Record
File Name Record
for each texture library (2)
   Texture Library Complexity Statistics Record
   Texture Library Header Record
   Texture Distribution Table Record(s)
   Stage 1 Texture File Association Record(s)
Checksum Record

5.6.2 **TLH Field Structure.** The field structure of each of these records shall be as described below.

5.6.2.1 **TLH Identifier Record.** This record shall consist of the ASCII string TLH .

5.6.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnnTL.H', where "ss" is the security code and "nnnnnn" is the GTDB identifier.

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5.6.2.3 **Texture Library Complexity Statistics Record.** There shall be two Texture Library Complexity Statistics records, one for an Areal Texture Library and one for a Model Texture Library, whether or not those optional libraries actually exist within the GTDB. The "GTDB Texture Library Type" field shall indicate which of the two libraries is being described. A value of zero in the "Number of Texture Images in Library" field shall indicate that there is no actual texture library of the given type within the GTDB. The field structure shall be as follows:

P2851 GTDB Catalog ID Field
GTDB Texture Library Type Field
Number of Texture Images in Library Field
Number of Stage 1 Texture File Associations Field
Number of Stage 1 Specific Textures Field
Stage 1 Specific Textures Storage Size Field
Number of Stage 2 Specific Textures Field
Stage 2 Specific Textures Storage Size Field
Number of Stage 3 Specific Textures Field
Stage 3 Specific Textures Storage Size Field
Number of Stage 4 Specific Textures Field
Stage 4 Specific Textures Storage Size Field
Number of Stage 5 Specific Textures Field
Stage 5 Specific Textures Storage Size Field
Number of Stage 3 Generic Textures Field
Stage 3 Generic Textures Storage Size Field
Number of Stage 4 Generic Textures Field
Stage 4 Generic Textures Storage Size Field
Number of Stage 5 Generic Textures Field
Stage 5 Generic Textures Storage Size Field
Number of Stage 3 SMC/FDC Textures Field
Stage 3 SMC/FDC Textures Storage Size Field
Number of Stage 4 SMC/FDC Textures Field
Stage 4 SMC/FDC Textures Storage Size Field
Number of Stage 5 SMC/FDC Textures Field
Stage 5 SMC/FDC Textures Storage Size Field

5.6.2.4 **Texture Library Header Record.** There shall be two Texture Library Header records, one for an Areal Photo Texture Library and one for a Model Photo Texture Library. The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
GTDB Texture Library Type Field
Security Level Field
Last Update Date Field

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5.6.2.5 **Texture Distribution Table Record.** The number of these records shall correspond to the value in the "Number of Texture Images in Library" field in the parent Texture Library Header record. The field structure of each record shall be as follows.

Texture ID Field
Processing Stage Field
Specific or Generic Texture Flag Field
Texture Type Field
Horizontal Resolution Field
Vertical Resolution Field
Storage Size Field
Texture Data Format Field
Number of Data Files Field

5.6.2.6 **Stage 1 Texture Field Association Record.** The number of these records shall be zero for all non-Stage 1 textures and (Number of Data Files - 1) for all Stage 1 textures. The field structure of each record shall be as follows:

Texture ID Field
File Name Field
Original File Name Field

5.6.2.7 **Checksum Record.** The field structure of this record shall be as follows·

Checksum Field

5.7 **2-D Static Model (2DSM) Library File.** There may be one 2-D Static Model Library File following the MPT. The 2DSM is optional in a GTDB

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5.7.1 **2DSM Record Order.** When included, the record order of the 2DSM file shall be as follows:

```
2DSM Identifier Record
File Name Record
2DSM (Model Library) Header Record
for each model
   Model Header Record
   for each model LOD
      LOD Header Record
      LOD Texture Reference Pointer Record(s) [optional]
      for each component
         Component Header Record
         Component Texture Reference Pointer Record(s) [optional]
         for each model polygon
            Model Polygon Record
            Microdescriptor Record(s) [optional]
            Vertex Pointer Records
            Polygon FACS Record(s) [optional]
            Polygon Texture Reference Pointer Record(s) [optional]
      Subsidiary Model References Record(s) [optional]
      for each point light string
         Point Light String Record(s) [optional]
         Point Light String FACS Record(s) [optional]
      Model FACS Record(s) [optional]
      Face-Based Texture Reference Record(s) [optional]
      Vertex-to-Vertex Texture Reference Record(s) [optional]
      Model-Based Texture Reference Record(s) [optional]
      Non-Mapped Texture Reference Record(s) [optional]
Checksum Record
```

5.7.2 **2DSM Field Structure.** The field structure of each of these records shall be as described below.

5.7.2.1 **2DSM Identifier Record.** This record shall consist of the ASCII string '2DSM'.

5.7.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnn2DS LIB', where "ss" is the security code, and "nnnnnn" is the GTDB identifier.

5.7.2.3 **2DSM Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Model Library Type Field
Security Level Field
Last Update Date Field
Number of Models Field

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5.7.2.4 **Model Header Record.** The number of these records shall correspond to the value contained in the Number of Models field in the parent 2DSM Header record. The field structure of this record shall be as follows:

Model Number Field
Model Name Field
Model Description Field
Generic Model Flag Field
Feature Descriptor Code Field
Number of Model LODs Field

5.7.2.5 **LOD Header Record.** The number of these records for a given model group shall correspond to the value contained in the Number of Model LODs field in the parent Model Header record. The field structure of this record shall be as follows:

Model Number Field
Model LOD Field
LOD Resolution Description Field
Sensor Types Supported Field
Source Simulator Field
Directivity Field
Radius Field
Predominant Height Field
Centroid Field
Base Polygon ID Field
Percentage of Texture Coverage Field
Number of Polygons Field
Number of LOD Texture Reference Pointers Field
Number of Components Field
Number of Subsidiary Model References Field
Number of Point Light Strings Field
Number of Model FACS Field
Number of Face-Based Texture References Field
Number of Vertex-to-Vertex Texture References Field
Number of Model-Based Texture References Field
Number of Non-Mapped Texture References Field
Number of Separation Planes Field [Always Zero]
Number of Collision Test Points Field [Always Zero]

5.7.2.6 **LOD Texture Reference Pointer Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of LOD Texture Reference Pointers Field in the parent LOD Header record. The field structure of this record shall be as follows:

Texture Mapping Type Field
Texture Reference e Table Index Field
Texture Mapping Set ID Field

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5.7.2.7 **Component Header Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of Components field in the parent LOD Header record. The field structure of this record shall be as follows:

Component ID Field
Number of Component Texture Reference Pointers Field
Number of Polygons Field

5.7.2.8 **Component Texture Reference Pointer Record.** The number of these records for a given component shall correspond to the value contained in the Number of Component Texture Reference Pointers field in the parent Component Header record. The field structure of this record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

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5.7.2.9 **Model Polygon Record.** The number of these records for a given component shall correspond to the value contained in the Number of Polygons field in the parent Component Header Record. The total number of these records for each model LOD shall correspond to the Number of Polygons field in the LOD Header Record. Each model polygon shall belong to exactly one component. The field structure of this record shall be as follows:

Polygon ID Field
Cluster ID Field
Component ID Field
Surface Material Category Field
Surface Material Subtype Field
Reflectance Field
Light Type Field
Specular Field
Polygon Non-Shadow Field
Polygon Normal Field
Transmissivity Field
Polygon Long Dimension Field
Polygon Short Dimension Field
Centroid Field
Diffuse Reflectance Field
Feature Onset Field
Layer Number (Radar) Field
Color Characteristics Field
Shading Type Field
Translucency Field
Polygon Non-Occulting Field
Cycle Rate Off Field
Cycle Rate On Field
Directionality Field
Light Horizontal Width Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Intensity Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Polygon Illumination Type Field
Polygon Landing Light Illumination Field
Absorptivity Field
Emissivity Field
Exitance Field
Self-Emitter Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Number of Microdescriptors Field
Number of Vertices Field (Always three or greater)
Number of Polygon Texture Reference Pointers Field
Number of Polygon FACS Field

5.7.2.10 **Model Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Model Polygon record. The field structure of each record shall be as follows.

Microdescriptor Type Field
Microdescriptor Value Field

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5.7.2.11 **Vertex Pointer Record.** The number of records shall correspond to the Number of Vertices field within the parent Model Polygon record. Polygons shall be closed implicitly, i e., the first vectex shall not be repeated as the last. The field structure of each record shall be as follows:

Vertex List Position Field
Normal List Position Field [Always Zero]
Correlation Priority Field

5.7.2.12 **Polygon FACS Record.** The number of these records shall correspond to the value in the Number of Polygon FACS field in the parent Model Polygon record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.7.2.13 **Polygon Texture Reference Pointer Record.** The number of these records shall correspond to the value of the Number of Polygon Texture Reference Pointer Field within the parent Model Polygon record. The field structure of each record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

5.7.2.14 **Subsidiary Model Reference Record.** The number of these records for a given model shall correspond to the value contained in the Number of Subsidiary Model References field in the parent Model record. The field structure of this record shall be as follows:

Referenced Model Library Type Field
Referenced Model Number Field
Referenced Model LOD Field
Translation Field
Scale Factor Field
Rotation Angles Field
Articulated Part Flag Field

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5.7.2.15 **Point Light String Record.** The number of Point Light String records shall correspond to the value in the Number of Point Light Strings field within the LOD Header record. The field structure of this record shall be as follows:

Length Field
Orientation Field
Shape Code Field
Width Field
Directionality Field
Light Type Field
Predominant Height Field
Surface Material Category Field
Color Characteristics Field
Layer Number Field
Absorptivity Field
Centroid Field
Cycle Rate Off Time Field
Cycle Rate On Time Field
Diffuse Reflectance Field
Directivity (Infrared) Field
Directivity (Radar) Field
Directivity Field
Emissivity Field
Exitance Field
Feature Onset Field
Internal Material Category Field
Internal Material Volume Field
Layer Number (Infrared) Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Light Intensity Field
Light Vertical Center Field
Light Vertical Fall Field
Light Vertical Width Field
Long Lineal Field
Low Level Effects Field
Object Volume Field
Radius Field
Reflectance Field
Self-Emitter Field
Surface Material Subtype Field
Texture Map Reflectance Field
Transmissivity Field
Visible Range Field
Number of FACS Table Entries Field
Number of Lights Field
for each light in the string
    Position Field

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5.7.2.16 **Point Light String FACS Record.** The number of these records shall correspond to the value in the Number of FACS Table Entries field in the parent Point Light String Record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.7.2.17 **Model FACS Record.** The number of these records shall correspond to the value in the Number of Model FACS field in the parent Model record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.7.2.18 **Face-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Face-Based Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Polygon Alignment Vector Field
Rotation About Texture Origin Field
Polygon Reference Point Field
Layer Number Field

5.7.2.19 **Vertex-to-Vertex Texture Reference Record.** The number of these records shall correspond to the value of the Number of Vertex-to-Vertex Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Layer Number Field
Number of Texture Pattern Coordinates Field
for each texture pattern vertex
   Texture Pattern Coordinates Field

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5.7.2.20 **Model-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Model-Based Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Orientation Vectors Field
Model Reference Point Field
Layer Number Field

5.7.2.21 **Non-Mapped Texture Reference Record.** The number of these records shall correspond to the value contained in the Number of Non-Mapped Texture References field in the parent Model Header record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field

5.7.2.22 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.8 **2-D Static Model Vertex (2DSMV) File.** Following the 2DSM file, there shall be one 2-D Static Model Vertex File. The 2DSMV shall be required if there is a 2DSM, but shall be omitted otherwise.

5.8.1 **2DSMV File Structure.** There shall be one pseudo-file for each model, containing the vertices used to define all the LODs of that model. These pseudo-files shall physically occur on the tape in the same sequence as their corresponding model definitions occur within the model library. Each pseudo-file shall be terminated by a special record indicating a pseudo-EOF (end of file). The pseudo-file structure within this file shall be as follows:

for each model in 2DSM
    2DSMV Pseudo-File

5.8.2 **2DSMV Record Structure.** The record structure of each 2DSMV pseudo-file shall be as defined in the following subsections.

5.8.2.1 **2-D Static Model Vertex Pseudo-Files.** There shall be one pseudo-file for each model, containing the vertices used to define all the LODs of that model.

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5.8.2.1.1 **2DSMV Pseudo-File Record Order.** The record order of each 2DSMV pseudo-file shall be as follows

2DSMV Identifier Record
File Name Record
for each model vertex in 2DSM
  Vertex Record
Pseudo-EOF Record
Checksum Record

5.8.2.1.2 **2DSMV Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.8.2.1.2.1 **2DSMV Identifier Record.** This record shall consist of the ASCII string '2DSMV'.

5.8.2.1.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnn2DS.VTX', where "ss" is the security code, and "nnnnnn" is the GTDB identifier.

5.8.2.1.2.3 **Vertex Record.** The field structure of this record shall be as follows:

Coordinate Field

5.8.2.1.2.4 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF MDL2DSnnnnn VTX', where 'nnnnn' is the number of the model described by this pseudo-file.

5.8.2.1.2.5 **Checksum Record.** The field structure of this record is as follows:

Checksum Field

5.9 **3-D Static Model (3DSM) Library File.** There may be one 3-D Static Model Library File following the 2DSMV. The 3-D Static Model Library File is optional in a GTDB.

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5.9.1 **3DSM Record Order.** When included, the record order of the 3DSM file shall be as follows:

```
3DSM Identifier Record
File Name Record
3DSM (Model Library) Header Record
for each model
   Model Header Record
   for each model LOD
      LOD Header Record
      LOD Texture Reference Pointer Record(s) [optional]
      for each component
         Component Header Record
         Component Texture Reference Pointer Record(s) [optional]
         for each model polygon
            Model Polygon Record
            Microdescriptor Record(s) [optional]
            Vertex Pointer Records
            Polygon FACS Records [optional]
            Polygon Texture Reference Pointer Record(s) [optional]
      Subsidiary Model References Record(s) [optional]
      for each point light string
         Point Light String Record(s) [optional]
         Point Light String FACS Record(s) [optional]
      Model FACS Record(s) [optional]
      Face-Based Texture Reference Record(s) [optional]
      Vertex-to-Vertex Texture Reference Record(s) [optional]
      Model-Based Texture Reference Record(s) [optional]
      Non-Mapped Texture Reference(s) [optional]
      Separation Plane Record(s) [optional]
Checksum Record
```

5.9.2 **3DSM Field Structure.** The field structure of each of these records shall be as described below.

5.9.2.1 **3DSM Identifier Record.** This record shall consist of the ASCII string '3DSM'.

5.9.2.2 **3DSM File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnn3DS.LIB', where "ss" is the security code, and "nnnnnn" is the GTDB identifier.

5.9.2.3 **3DSM Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Model Library Type Field
Security Level Field
Last Update Date Field
Number of Models Field

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5.9.2.4 Model Header Record. The number of these records shall correspond to the value contained in the Number of Models field in the parent 3DSM Header record. The field structure of this record shall be as follows:

Model Number Field
Model Name Field
Model Description Field
Generic Model Flag Field
Feature Descriptor Code Field
Number of Model LODs Field

5.9.2.5 **LOD Header Record.** The number of these records for a given model group shall correspond to the value contained in the Number of Model LODs field in the parent Model Header record. The field structure of this record shall be as follows.

Model Number Field
Model LOD Field
LOD Resolution Description Field
Sensor Types Supported Field
Source Simulator Field
Directivity Field
Radius Field
Predominant Height Field
Centroid Field
Base Polygon ID Field
Percentage of Texture Coverage Field
Number of Polygons Field
Number of LOD Texture Reference Pointers Field
Number of Components Field
Number of Subsidiary Model References Field
Number of Point Light Strings Field
Number of Model FACS Field
Number of Face-Based Texture References Field
Number of Vertex-to-Vertex Texture References Field
Number of Model-Based Texture References Field
Number of Non-Mapped Texture References Field
Number of Separation Planes Field
Number of Collision Test Points Field [Always Zero]

5.9.2.6 **LOD Texture Reference Pointer Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of LOD Texture Reference Pointers field in the parent LOD Header record. The field structure of this record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

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5.9.2.7 **Component Header Record** The number of these records for a given model LOD shall correspond to the value contained in the Number of Components field in the parent LOD Header record. The field structure of this record shall be as follows.

Component ID Field
Number of Component Texture Reference Pointers Field
Number of Polygons Field

5.9.2.8 **Component Texture Reference Pointer Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of Component Texture Reference Pointers field in the parent Component Header record. The field structure of this record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

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5.9.2.9 **Model Polygon Record.** The number of these records for a given model shall correspond to the value contained in the Number of Polygons field in the parent Component Header record. The field structure of this record shall be as follows:

Polygon ID Field
Cluster ID Field
Component ID Field
Surface Material Category Field
Surface Material Subtype Field
Reflectance Field
Light Type Field
Specular Field
Polygon Non-Shadow Field
Polygon Normal Field
Transmissivity Field
Polygon Long Dimension Field
Polygon Short Dimension Field
Centroid Field
Diffuse Reflectance Field
Feature Onset Field
Layer Number (Radar) Field
Color Characteristics Field
Shading Type Field
Translucency Field
Polygon Non-Occulting Field
Cycle Rate On Field
Cycle Rate Off Field
Cycle Rate Field
Directionality Field
Light Horizontal Width Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Intensity Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Polygon Illumination Type Field
Polygon Landing Light Illumination Field
Absorptivity Field
Emissivity Field
Exitance Field
Self-Emitter Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Number of Microdescriptors Field
Number of Vertices Field (Always three or greater)
Number of Polygon Texture Reference Pointers Field
Number of Polygon FACS Field

5.9.2.10 **Model Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Model Polygon record. The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.9.2.11 **Vertex Pointer Record.** The number of records shall correspond to the Number of Vertices field within the parent Model Polygon record. Polygons shall be closed implicitly, i.e., the first vertex shall not be repeated as the last. The Normal List Position Field is zero when vertex normals have not been requested. The field structure of each record shall be as follows:

Vertex List Position Field
Normal List Position Field
Correlation Priority Field

5.9.2.12 **Polygon FACS Record.** The number of these records shall correspond to the value in the Number of Polygon FACS field in the parent Model Polygon record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.9.2.13 **Polygon Texture Reference Pointer Record.** The number of these records for a given model polygon shall correspond to the value of the Number of Polygon Texture Reference Pointer field within the parent Model Polygon record. The field structure of each record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

5.9.2.14 **Subsidiary Model Reference Record.** The number of these records for a given model shall correspond to the value contained in the Number of Subsidiary Model References field in the parent Model record. The field structure of this record shall be as follows:

Referenced Model Library Type Field
Referenced Model Number Field
Referenced Model LOD Field
Translation Field
Scale Factor Field
Rotation Angles Field
Articulated Part Flag Field

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5.9.2.15 **Point Light String Record.** The number of Point Light String records shall correspond to the value in the Number of Point Light Strings field within the LOD Header record. The field structure of this record shall be as follows:

Length Field
Orientation Field
Shape Code Field
Width Field
Directionality Field
Light Type Field
Predominant Height Field
Surface Material Category Field
Color Characteristics Field
Layer Number Field
Absorptivity Field
Centroid Field
Cycle Rate Off Time Field
Cycle Rate On Time Field
Diffuse Reflectance Field
Directivity (Infrared) Field
Directivity (Radar) Field
Directivity Field
Emissivity Field
Exitance Field
Feature Onset Field
Internal Material Category Field
Internal Material Volume Field
Layer Number (Infrared) Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Light Intensity Field
Light Vertical Center Field
Light Vertical Fall Field
Light Vertical Width Field
Long Lineal Field
Low Level Effects Field
Object Volume Field
Radius Field
Reflectance Field
Self-Emitter Field
Surface Material Subtype Field
Texture Map Reflectance Field
Transmissivity Field
Visible Range Field
Number of FACS Table Entries Field
Number of Lights Field
for each light in the string
   Position Field

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5.9.2.16 **Point Light String FACS Record.** The number of these records shall correspond to the value in the Number of FACS Table Entries field in the parent Point Light String Record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.9.2.17 **Model FACS Record.** The number of these records shall correspond to the value in the Number of Model FACS field in the parent Model record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.9.2.18 **Face-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Face-Based Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Polygon Alignment Vector Field
Rotation About Texture Origin Field
Polygon Reference Point Field
Layer Number Field

5.9.2.19 **Vertex-to-Vertex Texture Reference Record.** The number of these records shall correspond to the value of the Number of Vertex-to-Vertex Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Layer Number Field
Number of Texture Pattern Coordinates Field
for each texture pattern vertex
Texture Pattern Coordinates Field

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5.9.2.20 **Model-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Model-Based Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Orientation Vectors Field
Model Reference Point Field
Layer Number Field

5.9 2.21 **Non-Mapped Texture Reference Record** The number of these records shall correspond to the value contained in the Number of Non-Mapped Texture References field in the parent LOD Header record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field

5.9.2.22 **Separation Plane Record.** The number of separation plane records for a given model shall correspond to the value contained in the Number of Separation Planes field in the parent LOD Header record. The separation plane records shall be stored in the order in which they were defined for the model. The field structure of this record shall be as follows:

Polygon ID Field
Separation Plane Number Field
Separation Plane Coefficients Field

5.9.2.23 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.10 **3-D Static Model Vertex (3DSMV) File.** Following the 3DSM file, there shall be one 3-D Static Model Vertex File. The 3DSMV shall be required if there is a 3DSM, but shall be omitted otherwise.

5.10 1 **3DSMV File Structure.** There shall be one pseudo-file for each model, containing the vertices used to define all the LODs of that model. Each pseudo-file shall be terminated by a special record indicating a pseudo-EOF (end of file). The pseudo-file structure within this file is as follows:

for each model in the 3DSM
   3DSMV Pseudo-File

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5.10.2 **3DSMV Record Structure.** The record structure of each 3DSMV pseudo-file shall be as defined in the following subsections.

5.10 2.1 **3DSMV Pseudo-Files.** There shall be one pseudo-file for each model, containing the vertices used to define all the LODs of that model. The pseudo-files shall physically occur on tape in the same sequence as their corresponding model definitions occur within the model library.

5.10.2.1.1 **3DSMV Pseudo-File Record Order.** The record order of each 3DSMV pseudo-file shall be as follows:

3DSMV Identifier Record
File Name Record
for each model vertex and vertex normal in 3DSM
   Vertex Record
Pseudo-EOF Record
Checksum Record

5.10.2.1.2 **3DSMV Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.10.2.1.2.1 **3DSMV Identifier Record.** This record shall consist of the ASCII string '3DSMV'.

5.10.2.1.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnn3DS.VTX', where "ss" is the security code, and "nnnnnn" is the GTDB identifier.

5.10.2.1.2.3 **Vertex Record.** The field structure of this record shall be as follows:

Coordinate Field

5.10.2.1.2.4 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF MDL3DSnnnnn.VTX , where 'nnnnn' is the number of the model described by this pseudo-file.

5.10.2.1.2.5 **Checksum Record.** The field structure of this record is as follows:

Checksum Field

5.11 **3-D Dynamic Model (3DDM) Library File.** There may be one 3-D Dynamic Model (3DDM) Library File following the 3DSMV. The 3-D Dynamic Model Library File is optional in a GTDB.

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5.11.1 3DDM Record Order. When included, the record order of the 3DDM file shall be as follows:

```
3DDM Identifier Record
File Name Record
3DDM (Model Library) Header Record
for each model
   Model Header Record
   for each model LOD
      LOD Header Record
      LOD Texture Reference Pointer Record(s) [optional]
      for each component
         Component Header Record
         Component Texture Reference Pointer Record(s) [optional]
         for each model polygon
            Model Polygon Record
            Microdescriptor Record(s) [optional]
            Vertex Pointer Records
            Polygon FACS Record(s) [optional]
            Polygon Texture Reference Pointer Record(s) [optional]
      Subsidiary Model References Record(s) [optional]
      for each point light string
         Point Light String Record(s) [optional]
         Point Light String FACS Record(s) [optional]
      Model FACS Record(s) [optional]
      Face-Based Texture Reference Record(s) [optional]
      Vertex-to-Vertex Texture Reference Record(s) [optional]
      Model-Based Texture Reference Record(s) [optional]
      Non-Mapped Texture Reference Record(s) [optional]
      Separation Plane Record(s) [optional]
      Collision Test Point Record(s) [optional]
Checksum Record
```

5.11.2 **3DDM Field Structure.** The field structure of each of these records shall be as described below.

5.11.2.1 **3DDM Identifier Record.** This record shall consist of the ASCII string '3DDM'.

5.11.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnn3DD.LIB', where "ss" is the security code, and "nnnnnn" is the GTDB identifier.

5.11.2.3 **3DDM Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Model Library Type Field
Security Level Field
Last Update Date Field
Number of Models Field

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5.11.2.4 **Model Header Record.** The number of these records shall correspond to the value contained in the Number of Models field in the parent 3DDM Header record. The field structure of this record shall be as follows:

Model Number Field
Model Name Field
Model Description Field
Generic Model Flag Field
Feature Descriptor Code Field
Number of Model LODs Field

5.11.2.5 **LOD Header Record.** The number of these records for a given model group shall correspond to the value contained in the Number of Model LODs field in the Parent Model Header record. The field structure of this record shall be as follows:

Model Number Field
Model LOD Field
LOD Resolution Description Field
Sensor Types Supported Field
Source Simulator Field
Directivity Field
Radius Field
Predominant Height Field
Centroid Field
Base Polygon ID Field
Percentage of Texture Coverage Field
Number of Polygons Field
Number of LOD Texture Reference Pointers Field
Number of Components Field
Number of Subsidiary Model References Field
Number of Point Light Strings Field
Number of Model FACS Field
Number of Face-Based Texture References Field
Number of Vertex-to-Vertex Texture References Field
Number of Model-Based Texture References Field
Number of Non-Mapped Texture References Field
Number of Separation Planes Field
Number of Collision Test Points Field
Placement Point Field (optional)

5.11.2.6 **LOD Texture Reference Pointer Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of LOD Texture Reference Pointers field in the parent LOD Header record. The field structure of this record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

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5.11 2.7 **Component Header Record.** The number of these records for a given model LOD shall correspond to the value contained in the **Number** of Components field in the parent LOD Header record. The field structure of this record shall be as follows:

Component ID Field
Number of Components Texture Reference Pointers Field
Number of Polygon Field

5.11.2.8 **Component Texture Reference Pointer Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of Component Texture Reference Pointers field in the parent Component Header record. The field structure of this record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

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5.11.2.9 **Model Polygon Record.** The number of these records for a given component shall correspond to the value contained in the Number of Polygons field in the parent Component Header record. The last polygon shall define the model footprint, referenced in the Base Polygon ID Field of the Parent Model Record. The field structure of this record shall be as follows:

Polygon ID Field
Cluster ID Field
Component ID Field
Surface Material Category Field
Surface Material Subtype Field
Reflectance Field
Light Type Field
Specular Field
Polygon Non-Shadow Field
Polygon Normal Field
Transmissivity Field
Polygon Long Dimension Field
Polygon Short Dimension Field
Centroid Field
Diffuse Reflectance Field
Feature Onset Field
Layer Number (Radar) Field
Color Characteristics Field
Shading Type Field
Translucency Field
Polygon Non-Occulting Field
Cycle Rate Off Field
Cycle Rate On Field
Cycle Rate Field
Directionality Field
Light Horizontal Width Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Intensity Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Polygon Illumination Type Field
Polygon Landing Light Illumination Field
Absorptivity Field
Emissivity Field
Exitance Field
Self-Emitter Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Number of Microdescriptors Field
Number of Vertices Field (Always three or greater)
Number of Polygon Texture Reference Pointers Field
Number of Polygon FACS Field

5.11.2.10 **Model Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Model Polygon record. The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.11.2.11 **Vertex Pointer Record.** The number of records shall correspond to the Number of Vertices field within the parent Model Polygon record. Polygons shall be closed implicity, i.e., the first vertex shall not be repeated as the last. The Normal List Position Field shall be zero if vertex normals have not been requested The field structure of each record is as follows:

Vertex List Position Field
Normal List Position Field [Always Zero]
Correlation Priority Field

5.11.2.12 **Polygon FACS Record.** The number of these records shall correspond to the value in the Number of Polygon FACS field in the parent Model Polygon record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.11 2.13 **Polygon Texture Reference Pointer Record.** The number of these records for a given model polygon shall correspond to the value of the Number of Polygon Texture Reference Pointer field within the parent Model Polygon record. The field structure of each record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

5.11.2.14 **Subsidiary Model Reference Record.** The number of these records for a given model shall correspond to the value contained in the Number of Subsidiary Model References field in the parent Model record. The field structure of this record shall be as follows:

Referenced Model Library Type Field
Referenced Model Number Field
Referenced Model LOD Field
Translation Field
Scale Factor Field
Rotation Angles Field
Articulated Part Flag Field

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5.11.2.15 **Point Light String Record.** The number of Point Light String records shall correspond to the value in the Number of Point Light Strings field within the LOD Header record. The field structure of this record shall be as follows:

Length Field
Orientation Field
Shape Code Field
Width Field
Directionality Field
Light Type Field
Predominant Height Field
Surface Material Category Field
Color Characteristics Field
Layer Number Field
Absorptivity Field
Centroid Field
Cycle Rate Off Time Field
Cycle Rate On Time Field
Diffuse Reflectance Field
Directivity (Infrared) Field
Directivity (Radar) Field
Directivity Field
Emissivity Field
Exitance Field
Feature Onset Field
Internal Material Category Field
Internal Material Volume Field
Layer Number (Infrared) Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Light Intensity Field
Light Vertical Center Field
Light Vertical Fall Field
Light Vertical Width Field
Long Lineal Field
Low Level Effects Field
Object Volume Field
Radius Field
Reflectance Field
Self-Emitter Field
Surface Material Subtype Field
Texture Map Reflectance Field
Transmissivity Field
Visible Range Field
Number of FACS Table Entries Field
Number of Lights Field
for each light in the string
  Position Field

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5.11.2.16 **Point Light String FACS Record.** The number of these records shall correspond to the value in the Number of FACS Table Entries field in the parent Point Light String Record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.11.2.17 **Model FACS Record.** The number of these records shall correspond to the value in the Number of Model FACS field in the parent Model record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.11.2.18 **Face-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Face-Based Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Polygon Alignment Vector Field
Rotation About Texture Origin Field
Polygon Reference Point Field
Layer Number Field

5.11.2.19 **Vertex-to-Vertex Texture Reference Record.** The number of these records shall correspond to the value of the Number of Vertex-to-Vertex Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Layer Number Field
Number of Texture Pattern Coordinates Field
for each texture pattern vertex
    Texture Pattern Coordinates Field

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5.11.2.20 **Model-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Model-Based Texture References field in the parent LOD Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Orientation Vectors Field
Model Reference Point Field
Layer Number Field

5.11.2.21 **Non-Mapped Texture Reference Record.** The number of these records shall correspond to the value contained in the Number of Non-Mapped Texture References field in the parent LOD Header record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field

5.11.2.22 **Separation Plane Record.** The number of these records for a given model LOD shall correspond to the value contained in the Number of Separation Planes field in the parent LOD record. The field structure of this record shall be as follows:

Polygon ID Field
Separation Plane Number Field
Separation Plane Coefficients Field

5.11.2.23 **Collision Test Point Record.** The number of these records shall correspond to the value in the Number of Collision Test Points field within the parent LOD Header record. The field structure of each record shall be as follows:

Vertex List Position Field

5.11.2.24 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.12 **3-D Dynamic Model Vertex (3DDMV) File.** Following the 3DDM file, there shall be one 3-D Dynamic Model Vertex File. The 3DDMV shall be required if there is a 3DDM, but shall be omitted otherwise.

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5.12.1 **3DDMV File Structure.** There shall be one pseudo-file for each model, containing the vertices used to define all the LODs of that model. Each pseudo-file shall be terminated by a special record indicating a pseudo-EOF (end of file). The pseudo-file structure within this file is as follows:

for each model in the 3DDM
  3DDMV Pseudo-File

5.12.2 **3DDMV Record Structure.** The record structure of each 3DDMV pseudo-file shall be as defined in the following subsections.

5.12.2.1 **3-D Dynamic Model Vertex Pseudo-Files.** There shall be one pseudo-file for each model, containing the vertices used to define all the LODs of that model. These pseudo-files shall physically occur on the tape in the same sequence as their corresponding model definitions occur within the model library.

5.12.2.1.1 **3DDMV Pseudo-File Record Order.** The record order of each 3DDMV pseudo-file shall be as follows:

3DDMV Identifier Record
File Name Record
for each vertex, vertex normal, and collision test point in 3DDM
  Vertex Record
Pseudo-EOF Record
Checksum Record

5.12.2.1.2 **3DDMV Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.12.2.1.2.1 **3DDMV Identifier Record.** This record shall consist of the ASCII string '3DDMV'.

5.12 2.1.2.2 **File Name Record.** This record shall consist of the ASCII string 'ssGnnnnnn3DD.VTX', where "ss" is the security code, and "nnnnnn" is the GTDB identifier.

5.12.2.1.2.3 **Vertex Record.** The field structure of this record shall be as follows:

Coordinate Field

5 12 2 1 2.4 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF MDL3DDnnnnn.VTX', where 'nnnnn' is the number of the model described by this pseudo-file.

5.12.2.1.2.5 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

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5.13 **Simulator Level of Detail Area Blocks File (SLAB).** There shall be one Simulator Level of Detail Area Blocks File (SLAB) for each Simulator Level of Detail (SLOD) in the GTDB. The number of SLABs shall correspond to the value contained in the Simulator Level of Detail Count Field in the GTDB Parameters Record of the Gaming Area Header File. The filename for each SLAB shall take the form "ssGnnnnnnVmmmmm.dd", where "ss" is the security code, "nnnnnn" is the GTDB identifier, "mmmmm" is the version number, and "dd" is the SLOD number.

5.13.1 **SLAB File Structure.** For each area block, there shall be one pseudo-file for each type of data needed to describe the contents of that area block. The pseudo-file structure of each SLAB shall be as follows:

```
for each area block in SLOD
   Vertex Area Block (VAB) Pseudo-File
   Areal Feature Area Block (AFAB) Pseudo-File
   Linear Feature Area Block (LFAB) Pseudo-File [optional]
   Point Feature Area Block (PFAB) Pseudo-File [optional]
   Point Light Feature Area Block (PLFAB) Pseudo-File [optional]
   Point Light String Feature Area Block (PLSFAB) Pseudo-File [opt.]
   Terrain Polygon Area Block (TPAB) Pseudo-File [optional]
   Terrain Grid Area Block (TGAB) Pseudo-File [optional]
   Model Reference Area Block (MRAB) Pseudo-File [optional]
   Area Block Pseudo-EOF Record
```

5.13.2 **SLAB Pseudo-File Record Structure.** The record structure of each of these pseudo-files shall be as described in the following subsections.

5.13.2.1 **Vertex Area Block (VAB) Pseudo-File.** For every area block in the data base (previously identified in the ABH), there shall be one Vertex Area Block Pseudo-File associated with it.

5.13.2.1.1 **VAB Pseudo-File Record Order.** The record order of the vertex area block pseudo-file shall be as follows:

```
VAB Identifier Record
File Name Record
Vertex Area Block Header Record
for each culture/terrain vertex and vertex normal in area block
   Vertex Record
Pseudo-EOF Record
Checksum Record
```

5.13.2.1.2 **VAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.1.2.1 **VAB Identifier Record.** This record shall consist of the ASCII string 'VAB'.

5.13.2.1.2.2 **File Name Record.** This record shall consist of the ASCII string "VABnnnnnnnnnn.ss", where "nnnnnnnnnn" is the area block number and "ss" is the SLOD number

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5.13.2.1.2.3 **Vertex Area Block Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Vertices Field (Always four or greater)
End Vertex ID Field

5.13.2.1.2.4 **Vertex Record.** The field structure of this record shall be as follows:

Vertex List Position Field
Coordinate Field

5.13.2.1.2.5 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF VABnnnnnnnnnn ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.1.2.6 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.2 **Areal Feature Area Block (AFAB) Pseudo-File.** For each area block in the data base, there shall be one Areal Feature Area Block Pseudo-File associated with it.

5.13.2.2.1 **AFAB Pseudo-File Record Order.** The record order of the AFAB pseudo-file shall be as follows:

AFAB Identifier Record
File Name Record
Feature Area Block Header Record
Face-Based Texture Reference Record(s) [optional]
Global-Based Texture Reference Record(s) [optional]
for each feature
   Areal Feature Record
   Microdescriptor Record(s) [optional]
   FACS Record(s) [optional]
   Vertex Pointer Records
   Non-Mapped Texture Reference Record(s) [optional]
   Mapped Texture Reference Pointer Record(s) [optional]
Pseudo-EOF Record
Checksum Record

5.13.2.2.2 **AFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.2.2.1 **AFAB Identifier Record.** This record shall consist of the ASCII string 'AFAB'.

5.13.2.2.2.2 **File Name Record.** This record shall consist of the ASCII string 'AFABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

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5.13.2.2.2.3 **Feature Area Block Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field
Number of Face-Based Texture References Field
Number of Global-Based Texture References Field

5.13.2.2.2.4 **Face-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Face-Based Texture References field in the parent Feature Area Block Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Polygon Alignment Vector Field
Rotation About Texture Origin Field
Polygon Reference Point Field
Layer Number Field

5.13.2.2.2.5 **Global-Based Texture Reference Record.** The number of these records shall correspond to the value of the Number of Global-Based Texture References field in the parent Feature Area Block Header Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific Or Generic Texture Flag Field
Texture Origin Field
Boundary ID Field
Mirror Field
Wrap Field
Wrap Type Field
Texture Scale Field
Orientation Vectors Field
Global Reference Point Field
Layer Number Field

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5.13.2.2.2.6 **Areal Feature Record.** The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record. The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code
Synthetic Data Flag Field
Correlation Priority Field
Reflectance Field
Predominant Height Field
Feature Fragment Flag Field
Superfeature Number Field
Surface Material Category Field
Surface Material Subtype Field
Specular Field
Number of Structures Field
Percent of Roof Coverage Field
Roof Type Field
Monitor Type Field
Polygon Normal Field
Percent of Tree Coverage Field
Shape Code Field
Centroid Field
Directivity (Radar) Field
Layer Number (Radar) Field
Diffuse Reflectance Field
Feature Onset Field
Low Level Effects Field
Absorptivity Field
Directivity (Visual) Field
Directivity (Infrared) Field
Emissivity Field
Exitance Field
Transmissivity Field
Color Characteristics Field
Self-Emitter Field
Translucency Field
Shading Type Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Radius Field
Blending Type Field
Polygon Illumination Type Field
Number of Microdescriptors Field
Number of Non-Mapped Texture References Field
Number of Mapped Texture Reference Pointers Field
Number of Culture Vertices Field (Always three or greater)
Number of FACS Field

5.13.2.2.2.7 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Areal Feature record. The field structure of each record shall be as follows.

Microdescriptor Type Field
Microdescriptor Value(s) Field

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5.13.2.2.2.8 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Areal Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.2.2.9 **Vertex Pointer Record.** The number of records shall correspond to the Number of Culture Vertices field within the parent Areal Feature record. Areal features shall be closed implicitly, i.e., the first vertex shall not be repeated as the last. Vertices shall be ordered in a counterclockwise direction, as viewed from above. The field structure of each record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.2.2.10 **Non-Mapped Texture Reference Record.** The number of these records shall correspond to the value of the Number of Non-Mapped Texture References field within the parent Areal Feature record. The field structure of each record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific or Generic Texture Flag Field

5.13.2.2.2.11 **Mapped Texture Reference Pointer Record.** The number of these records shall correspond to the value of the Number of Mapped Texture Reference Pointers field within the parent Areal Feature record. The field structure of each record shall be as follows:

Texture Mapping Type Field
Texture Reference Table Index Field
Texture Mapping Set ID Field

5.13.2.2.2.12 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF AFABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.2.2.13 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.3 **Linear Feature Area Block (LFAB) Pseudo-File.** For each area block which includes linear features, there shall be one Linear Feature Area Block Pseudo-File associated with it. The LFAB shall be included when an area block contains at least one linear feature.

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5.13.2.3.1 **LFAB Pseudo-File Record Order.** The record order of the LFAB pseudo-file shall be as follows:

LFAB Identifier Record
File Name Record
Feature Area Block Header Record
for each feature
  Linear Feature Record
  Microdescriptor Record(s) [optional]
  FACS Record(s) [optional]
  Vertex Pointer Records
  Non-Mapped Texture Reference Record(s) [optional]
Pseudo-EOF Record
Checksum Record

5.13.2.3.2 **LFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.3.2.1 **LFAB Identifier Record.** This record shall consist of the ASCII string 'LFAB'.

5.13.2.3.2.2 **File Name Record.** This record shall consist of the ASCII string 'LFABnnnnnnnnnn ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number

5.13.2.3.2.3 **Feature Area Block Header Record.** This record shall contain control information describing the file The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field

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5.13.2.3.2.4 **Linear Feature Record.** The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code Field
Synthetic Data Flag Field
Correlation Priority Field
Reflectance Field
Predominant Height Field
Feature Fragment Flag Field
Superfeature Number Field
Surface Material Category Field
Surface Material Subtype Field
Specular Field
Width Field
Diffuse Reflectance Field
Directivity (Radar) Field
Layer Number (Radar) Field
Feature Onset Field
Low Level Effects Field
Directivity (Visual) Field
Directivity (Infrared) Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Absorptivity Field
Emissivity Field
Exitance Field
Color Characteristics Field
Self-Emitter Field
Translucency Field
Radius Field
Blending Type Field
Centroid Field
Transmissivity Field
Number of Microdescriptors Field
Number of Non-Mapped Texture References Field
Number of Culture Vertices Field (Always two or greater)
Number of FACS Field

5.13.2.3.2.5 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Linear Feature record. The field structure of each record shall be as follows

Microdescriptor Type Field
Microdescriptor Value Field

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5.13.2.3.2.6 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Linear Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.3.2.7 **Vertex Pointer Record.** The number of records shall correspond to the Number of Culture Vertices field within the parent Linear Feature record. The field structure of each record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.3.2.8 **Non-Mapped Texture Reference Record.** The number of these records shall correspond to the value of the Number of Photo Texture References field within the parent Linear Feature record. The field structure of each record shall be as follows.

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific or Generic Texture Flag Field

5.13.2.3.2.9 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF LFABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5 13.2 3.2 10 **Checksum Record.** The field structure of this record is as follows:

Checksum Field

5.13.2.4 **Point Feature Area Block (PFAB) Pseudo-File.** For each area block which includes point features, there shall be one Point Feature Area Block Pseudo-File associated with it. The PFAB shall be included when an area block contains at least one point feature.

5.13.2.4.1 **PFAB Pseudo-File Record Order.** The record order of the PFAB pseudo-file shall be as follows:

PFAB Identifier Record
File Name Record
Feature Area Block Header Record
for each feature
  Point Feature Record
  Microdescriptor Record(s) [optional]
  FACS Record(s) [optional]
  Vertex Pointer Record(s)
  Non-Mapped Texture Reference Record(s) [optional]
Pseudo-EOF Record
Checksum Record

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5 13.2.4.2 **PFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.4.2.1 **PFAB Identifier Record.** This record shall consist of the ASCII string 'PFAB'.

5.13.2.4.2.2 **File Name Record.** This record shall consist of the ASCII string 'PFABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.4.2.3 **Feature Area Block Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field

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5.13.2.4.2.4 **Point Feature Record.** The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record. The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code Field
Synthetic Data Flag Field
Correlation Priority Field
Reflectance Field
Predominant Height Field
Feature Fragment Flag Field
Superfeature Number Field
Surface Material Category Field
Surface Material Subtype Field
Specular Field
Length Field
Width Field
Radius Field
Orientation Field
Shape Code Field
Directivity (Radar) Field
Diffuse Reflectance Field
Feature Onset Field
Low Level Effects Field
Long Lineal Field
Directivity (Visual) Field
Directivity (Infrared) Field
Absorptivity Field
Emissivity Field
Exitance Field
Transmissivity Field
Color Characteristics Field
Self-Emitter Field
Translucency Field
Blending Type Field
Centroid Field
Number of Microdescriptors Field
Number of Non-Mapped Texture References Field
Number of Culture Vertices Field
Number of FACS Field

5.13.2.4.2.5 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Point Feature record. The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.13.2.4.2.6 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Point Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.4.2.7 **Vertex Pointer Record.** The number of records shall correspond to the Number of Vertices field within the parent Point Feature record. The field structure of each record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.4.2.8 **Non-Mapped Texture Reference Record.** The number of these records shall correspond to the value of the Number of Photo Texture References field within the parent Point Feature record. The field structure of each record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture ID Field
Specific or Generic Texture Flag Field

5.13.2.4.2.9 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF PFABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.4.2.10 **Checksum Record.** The field structure of this record shall be as follows

Checksum Field

5.13.2.5 **Point Light Feature Area Block (PLFAB) Pseudo-File.** For each area block which includes point light features, there shall be one Point Light Feature Area Block Pseudo-File associated with it. The PLFAB shall be included when an area block contains at least one point light feature.

5.13.2.5.1 **PLFAB Pseudo-File Record Order.** The record order of the PLFAB pseudo-file shall be as follows:

PLFAB Identifier Record
File Name Record
Feature Area Block Header Record
for each feature
   Point Light Feature Record
   Microdescriptor Record(s) [optional]
   FACS Record(s) [optional]
   Vertex Pointer Record
Pseudo-EOF Record
Checksum Record

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5.13.2.5.2 **PLFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.5.2.1 **PLFAB Identifier Record.** This record shall consist of the ASCII string 'PLFAB'.

5.13.2.5.2.2 **File Name Record.** This record shall consist of the ASCII string 'PLABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.5.2.3 **Feature Area Block Header Record.** This record shall contain control information describing the file. The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field

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5.13.2.5.2.4 **Point Light Feature Record.** This record shall contain control fields and attributes describing a particular point light feature. The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record. The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code Field
Synthetic Data Flag Field
Correlation Priority Field
Absorptivity Field
Directivity (Infrared) Field
Emissivity Field
Exitance Field
Reflectance Field
Transmissivity Field
Color Characteristics Field
Predominant Height Field
Surface Material Category Field
Directivity (Visual) Field
Self-Emitter Field
Directionality Field
Cycle Rate Off Field
Cycle Rate On Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Light Intensity Field
Light Type Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Length Field
Width Field
Radius Field
Blending Type Field
Centroid Field
Orientation Field
Shape Code Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Visible Range Field
Number of Microdescriptors Field
Number of Texture References Field [N/A]
Number of Culture Vertices Field
Number of FACS Field

5.13.2.5.2.5 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Point Light Feature record. The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.13.2.5.2.6 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Point Light Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.5.2.7 **Vertex Pointer Record.** There shall be exactly one of these records defining the location of the point light feature. The value '1' shall be stored in the Number of Vertices field within the parent Point Light Feature record. The field structure of this record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.5.2.8 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF PLABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.5.2.9 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.6 **Point Light String Feature Area Block (PLSFAB) Pseudo-File.** For each area block which includes point light strings, there shall be one Point Light String Feature Area Block Pseudo-File associated with it. The PLSFAB shall be included when an area block contains at least one point light string feature.

5.13.2.6.1 **PLSFAB Pseudo-File Record Order.** The record order of the PLSFAB pseudo-file shall be as follows:

PLSFAB Identifier Record
File Name Record
Feature Area Block Header Record
for each feature
   Point Light String Feature Record
   Microdescriptor Record(s) [optional]
   FACS Record(s) [optional]
   Vertex Pointer Record(s)
Pseudo-EOF Record
Checksum Record

5.13.2.6.2 **PLSFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.6.2.1 **PLSFAB Identifier Record.** This record shall consist of the ASCII string 'PLSFAB'.

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5.13.2.6.2.2 **File Name Record.** This record shall consist of the ASCII string 'PSABnnnnnnnnnn ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.6.2.3 **Feature Area Block Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field

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5.13.2.6.2.4 **Point Light String Feature Record.** The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record. The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code Field
Synthetic Data Flag Field
Correlation Priority Field
Absorptivity Field
Directivity (Infrared) Field
Emissivity Field
Exitance Field
Reflectance Field
Transmissivity Field
Color Characteristics Field
Predominant Height Field
Surface Material Category Field
Directivity (Visual) Field
Self-Emitter Field
Feature Fragment Flag Field
Superfeature Number Field
Light String Shape Field
Number of Lights Field
Directionality Field
Cycle Rate Off Time Field
Cycle Rate On Time Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Orientation Field
Light Intensity Field
Light Type Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Blending Type Field
Centroid Field
Radius Field
Length Field
Width Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Light Delta Field
Visible Range Field
Number of Microdescriptors Field
Number of Texture References Field [N/A]
Number of Culture Vertices Field
Number of FACS Field

5.13.2.6.2.5 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Point Light String Feature record. The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.13.2.6.2.6 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Point Light String Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.6.2.7 **Vertex Pointer Record.** The number of Vertex Pointer records shall correspond to the Number of Vertices field within the parent Point Light String Feature record. The first record shall define the origin of the Point Light String. When the Light String Shape Field of the parent Point Light String Feature Record indicates that the lights fall within a straight line, there shall be no vertex pointer records other than the first. The field structure of each record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.6.2.8 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF PSABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.6.2.9 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5 13.2.7 **Terrain Polygon Area Block (TPAB) Pseudo-File.** For a GTDB which includes polygonized terrain, there shall be one Terrain Polygon Area Block Pseudo-File associated with each area block. The TPAB shall be included when polygonized terrain has been requested.

5.13.2.7.1 **TPAB Pseudo-File Record Order.** The record order of the TPAB pseudo-file shall be as follows:

TPAB Identifier Record
File Name Record
Terrain Area Block Header Record
for each terrain polygon
  Terrain Polygon Record
  Vertex List Pointer Records
  Culture Reference Record(s) [optional]
  Vertex-to-Vertex Texture Reference Record(s) [optional]
Pseudo-EOF Record
Checksum Record

5 13.2 7.2 **TPAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below

5.13.2.7.2.1 **TPAB Identifier Record.** This record shall consist of the ASCII string 'TPAB'.

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5.13.2.7.2.2 **File Name Record.** This record shall consist of the ASCII string 'TPABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.7.2.3 **TPAB Header Record.** The field structure of this record shall be as described below:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Terrain Type Field
Latitude Interval Field
Longitude Interval Field
Number of Terrain Polygons Field
Column Count Field (Always Zero)
Row Count Field (Always Zero)

5.13.2.7.2.4 **Terrain Polygon Record.** The number of these records shall correspond to the value in the Number of Terrain Polygons field within the parent TPAB Header Record. The field structure of this record shall be as follows:

Terrain Polygon ID Field
Shape Code Field
Polygon Normal Field
Number of Culture References Field
Number of Vertices Field (Always three or greater)
Number of Vertex-to-Vertex Texture References Field

5.13.2.7.2.5 **Vertex List Pointer Record.** The actual number of records shall correspond to the Number of Vertices field within the parent Terrain Polygon record. Vertices shall be ordered in a counterclockwise direction, as viewed from above. All polygons shall be closed implicitly. The Normal List Position Field shall be zero when vertex normals have not been requested. The field structure of each record shall be as follows:

Vertex List Position Field
Normal List Position Field
Correlation Priority Field

5.13.2.7.2.6 **Culture Reference Record.** The number of these records shall correspond to the value of the Number of Culture References field within the parent Terrain Polygon record. The field structure of each record shall be as follows:

Type of Reference Field
Feature Type Field
Feature Number Field
Model Library Type Field
Model Reference Number Field
Feature Descriptor Code Field
Layer Number Field

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5.13.2.7.2.7 **Vertex-to-Vertex Texture Reference Record.** There shall be one texture pattern vertex defined for each polygon vertex. The first texture pattern vertex shall map to the first polygon vertex. The number of these records shall correspond to the value of the Number of Vertex-to-Vertex Texture References field in the parent Terrain Polygon Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture Mapping Set ID Field
Texture ID Field
Specific or Generic Texture Flag Field
Layer Number Field
Number of Texture Pattern Coordinates Field
for each texture pattern vertex
    Texture Pattern Coordinates Field

5.13.2.7.2.8 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF TPABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.7.2.9 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.8 **Terrain Grid Area Block (TGAB) Pseudo-File.** For a GTDB which includes gridded terrain, there shall be one Terrain Grid Area Block Pseudo-File associated with every area block identified as being part of a SLOD The TGAB shall be included when gridded terrain has been requested

5.13.2.8.1 **TGAB Pseudo-File Record Order.** The record order of the TGAB pseudo-file shall be as follows:

TGAB Identifier Record
File Name Record
Terrain Area Block Header Record
for each terrain grid post
    Terrain Post Record
Pseudo-EOF Record
Checksum Record

5.13.2.8.2 **TGAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.8.2.1 **TGAB Identifier Record.** This record shall consist of the ASCII string 'TGAB'.

5.13.2.8.2.2 **File Name Record.** This record shall consist of the ASCII string 'TGABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

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5.13.2.5.2 **PLFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.5.2.1 **PLFAB Identifier Record.** This record shall consist of the ASCII string 'PLFAB'.

5.13.2.5.2.2 **File Name Record.** This record shall consist of the ASCII string 'PLABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.5.2.3 **Feature Area Block Header Record.** This record shall contain control information describing the file. The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field

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5.13.2.5.2.4 **Point Light Feature Record.** This record shall contain control fields and attributes describing a particular point light feature. The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record. The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code Field
Synthetic Data Flag Field
Correlation Priority Field
Absorptivity Field
Directivity (Infrared) Field
Emissivity Field
Exitance Field
Reflectance Field
Transmissivity Field
Color Characteristics Field
Predominant Height Field
Surface Material Category Field
Directivity (Visual) Field
Self-Emitter Field
Directionality Field
Cycle Rate Off Field
Cycle Rate On Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Light Intensity Field
Light Type Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Length Field
Width Field
Radius Field
Blending Type Field
Centroid Field
Orientation Field
Shape Code Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Visible Range Field
Number of Microdescriptors Field
Number of Texture References Field [N/A]
Number of Culture Vertices Field
Number of FACS Field

5.13.2.5.2.5 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Point Light Feature record. The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.13.2.5.2.6 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Point Light Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.5.2.7 **Vertex Pointer Record.** There shall be exactly one of these records defining the location of the point light feature. The value '1' shall be stored in the Number of Vertices field within the parent Point Light Feature record. The field structure of this record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.5.2.8 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF PLABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.5.2.9 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.6 **Point Light String Feature Area Block (PLSFAB) Pseudo-File.** For each area block which includes point light strings, there shall be one Point Light String Feature Area Block Pseudo-File associated with it. The PLSFAB shall be included when an area block contains at least one point light string feature.

5.13.2.6.1 **PLSFAB Pseudo-File Record Order.** The record order of the PLSFAB pseudo-file shall be as follows:

PLSFAB Identifier Record
File Name Record
Feature Area Block Header Record
for each feature
  Point Light String Feature Record
  Microdescriptor Record(s) [optional]
  FACS Record(s) [optional]
  Vertex Pointer Record(s)
Pseudo-EOF Record
Checksum Record

5.13.2.6.2 **PLSFAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5 13.2.6.2.1 **PLSFAB Identifier Record.** This record shall consist of the ASCII string 'PLSFAB'.

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5.13.2.6.2.2 **File Name Record.** This record shall consist of the ASCII string 'PSABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.6.2.3 **Feature Area Block Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Features Field

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5.13.2.6.2.4 **Point Light String Feature Record.** The total number of these records shall correspond to the value contained in the Number of Features field in the parent Feature Area Block Header record. The field structure of this record shall be as follows:

Feature Number Field
FID Code Field
Feature Descriptor Code Field
Synthetic Data Flag Field
Correlation Priority Field
Absorptivity Field
Directivity (Infrared) Field
Emissivity Field
Exitance Field
Reflectance Field
Transmissivity Field
Color Characteristics Field
Predominant Height Field
Surface Material Category Field
Directivity (Visual) Field
Self-Emitter Field
Feature Fragment Flag Field
Superfeature Number Field
Light String Shape Field
Number of Lights Field
Directionality Field
Cycle Rate Off Time Field
Cycle Rate On Time Field
Light Horizontal Center Field
Light Horizontal Fall Field
Light Horizontal Width Field
Orientation Field
Light Intensity Field
Light Type Field
Light Vertical Width Field
Light Vertical Center Field
Light Vertical Fall Field
Blending Type Field
Centroid Field
Radius Field
Length Field
Width Field
Layer Number (Visual) Field
Layer Number (Infrared) Field
Light Delta Field
Visible Range Field
Number of Microdescriptors Field
Number of Texture References Field [N/A]
Number of Culture Vertices Field
Number of FACS Field

5.13.2.6.2.5 **Microdescriptor Record.** The number of these records shall correspond to the value in the Number of Microdescriptors field in the parent Point Light String Feature record The field structure of each record shall be as follows:

Microdescriptor Type Field
Microdescriptor Value Field

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5.13.2.6.2.6 **FACS Record.** The number of these records shall correspond to the value in the Number of FACS field in the parent Point Light String Feature record. The field structure of each record shall be as follows:

FACS Class Field
FACS Attribute Code Field
Synthetic Data Flag Field
Source ID Number Field
Sensors Supported Field
Length of Attribute Field
Attribute Value Field

5.13.2.6.2.7 **Vertex Pointer Record.** The number of Vertex Pointer records shall correspond to the Number of Vertices field within the parent Point Light String Feature record. The first record shall define the origin of the Point Light String When the Light String Shape Field of the parent Point Light String Feature Record indicates that the lights fall within a straight line, there shall be no vertex pointer records other than the first. The field structure of each record shall be as follows:

Vertex List Position Field
Correlation Priority Field

5.13.2.6.2.8 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF PSABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.6.2.9 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.7 **Terrain Polygon Area Block (TPAB) Pseudo-File.** For a GTDB which includes polygonized terrain, there shall be one Terrain Polygon Area Block Pseudo-File associated with each area block. The TPAB shall be included when polygonized terrain has been requested.

5.13.2.7.1 **TPAB Pseudo-File Record Order.** The record order of the TPAB pseudo-file shall be as follows:

TPAB Identifier Record
File Name Record
Terrain Area Block Header Record
for each terrain polygon
   Terrain Polygon Record
   Vertex List Pointer Records
   Culture Reference Record(s) [optional]
   Vertex-to-Vertex Texture Reference Record(s) [optional]
Pseudo-EOF Record
Checksum Record

5.13.2.7.2 **TPAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.7.2.1 **TPAB Identifier Record.** This record shall consist of the ASCII string 'TPAB'.

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5.13.2.7.2.2 **File Name Record.** This record shall consist of the ASCII string 'TPABnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13 2.7.2.3 **TPAB Header Record.** The field structure of this record shall be as described below:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Terrain Type Field
Latitude Interval Field
Longitude Interval Field
Number of Terrain Polygons Field
Column Count Field (Always Zero)
Row Count Field (Always Zero)

5.13.2.7.2.4 **Terrain Polygon Record.** The number of these records shall correspond to the value in the Number of Terrain Polygons field within the parent TPAB Header Record. The field structure of this record shall be as follows:

Terrain Polygon ID Field
Shape Code Field
Polygon Normal Field
Number of Culture References Field
Number of Vertices Field (Always three or greater)
Number of Vertex-to-Vertex Texture References Field

5.13.2.7.2.5 **Vertex List Pointer Record.** The actual number of records shall correspond to the Number of Vertices field within the parent Terrain Polygon record. Vertices shall be ordered in a counterclockwise direction, as viewed from above. All polygons shall be closed implicitly. The Normal List Position Field shall be zero when vertex normals have not been requested. The field structure of each record shall be as follows:

Vertex List Position Field
Normal List Position Field
Correlation Priority Field

5.13.2.7.2.6 **Culture Reference Record.** The number of these records shall correspond to the value of the Number of Culture References field within the parent Terrain Polygon record. The field structure of each record shall be as follows:

Type of Reference Field
Feature Type Field
Feature Number Field
Model Library Type Field
Model Reference Number Field
Feature Descriptor Code Field
Layer Number Field

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5.13.2.7.2.7 **Vertex-to-Vertex Texture Reference Record.** There shall be one texture pattern vertex defined for each polygon vertex. The first texture pattern vertex shall map to the first polygon vertex. The number of these records shall correspond to the value of the Number of Vertex-to-Vertex Texture References field in the parent Terrain Polygon Record. The field structure of this record shall be as follows:

Texture Reference Table Index Field
GTDB Texture Library Type Field
Texture Mapping Set ID Field
Texture ID Field
Specific or Generic Texture Flag Field
Layer Number Field
Number of Texture Pattern Coordinates Field
for each texture pattern vertex
  Texture Pattern Coordinates Field

5.13.2.7.2.8 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF TPABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.7.2.9 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.8 **Terrain Grid Area Block (TGAB) Pseudo-File.** For a GTDB which includes gridded terrain, there shall be one Terrain Grid Area Block Pseudo-File associated with every area block identified as being part of a SLOD. The TGAB shall be included when gridded terrain has been requested.

5.13.2.8.1 **TGAB Pseudo-File Record Order.** The record order of the TGAB pseudo-file shall be as follows.

TGAB Identifier Record
File Name Record
Terrain Area Block Header Record
for each terrain grid post
  Terrain Post Record
Pseudo-EOF Record
Checksum Record

5.13.2.8.2 **TGAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below.

5.13.2.8.2.1 **TGAB Identifier Record.** This record shall consist of the ASCII string 'TGAB'.

5.13.2.8.2.2 **File Name Record.** This record shall consist of the ASCII string 'TGABnnnnnnnnnn.ss', where 'nnnnnnnnnn' is the area block number and 'ss' is the SLOD number.

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5.13.2.8.2.3 **TGAB Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Terrain Type Field
Latitude Interval Field
Longitude Interval Field
Number of Terrain Polygons Field (Always Zero)
Column Count Field
Row Count Field

5.13.2.8.2.4 **Terrain Post Record.** The total number of these records shall be equal to the product of the values in the Column Count and Row Count fields within the TGAB Header Record. Elevation posts shall be sequenced from the southwest corner of the area block to the northeast, incrementing in latitude within each increment in longitude, at intervals specified in the parent TGAB Header Record. The field structure of each record shall be as follows:

Coordinate Field

5.13.2.8.2.5 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF TGABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.8.2.6 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.9 **Model Reference Area Block (MRAB) Pseudo-File.** For every area block in which a model reference is present, there shall be one Model Reference Area Block Pseudo-File. The MRAB shall be included when there is at least one model reference within an area block.

5.13.2.9.1 **MRAB Pseudo-File Record Order.** The record order of the MRAB pseudo-file shall be as follows:

MRAB Identifier Record
File Name Record
Model Reference Area Block Header Record
for each model reference
    Model Reference Record
Pseudo-EOF Record
Checksum Record

5.13.2.9.2 **MRAB Pseudo-File Field Structure.** The field structure of each of these records shall be as described below

5.13.2.9.2.1 **MRAB Identifier Record.** This record shall consist of the ASCII string 'MRAB'.

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5.13.2.9.2.2 **File Name Record.** This record shall consist of the ASCII string 'MRABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.9.2.3 **MRAB Header Record.** The field structure of this record shall be as follows:

Project 2851 GTDB Catalog ID Field
Area Block ID Field
Lat/Long SW Corner Field
Lat/Long NE Corner Field
Last Update Date Field
Security Level Field
Number of Model References Field

5.13.2.9.2.4 **Model Reference Record.** The number of these records shall correspond to the Number of Model Referenced Field in the MRAB header record. The field structure of this record shall be as follows:

Model Library Type Field
Model Number Field
Feature Number Field
Superfeature Number Field
Offset Vector Field
Orientation Angle Field
Rotation Field
Translation Field
Scale Factor Field
Correlation Priority Field
Terrain Polygon Overlap Flag Field

5.13.2.9.2.5 **Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF MRABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

5.13.2.9.2.6 **Checksum Record.** The field structure of this record shall be as follows:

Checksum Field

5.13.2.10 **Area Block Pseudo-EOF Record.** This record shall consist of the ASCII string 'EOF ABnnnnnnnnnn.ss', where 'nnnnnnnnn' is the area block number and 'ss' is the SLOD number.

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5.14 **Areal Texture (AT) Library.** The Areal Texture (AT) Library is optional in a GTDB. The AT shall consist of files in the National Imagery Transmission Format (NITF), or their native format. All NITF files shall follow the format described in the NITF Version 1.1 document dated 1 March 1989 and the NITF Change Notice Number 2 dated 23 May 1990.

5.14.1 **AT File Structure.** When included, the file order of the AT library shall be as follows:

```
NITF Header File
for each areal texture
   NITF Image Sub-Header File
   if texture is in Stage 1 then
      Original Format Image File(s) [optional]
   else
      NITF Image Data File [optional]
   end if
```

5.14.2 **AT File Record Structures** The record structure of each of these files shall be as described below.

5.14.2.1 **NITF Header File.** The NITF Header File shall be included in every AT Library. The NITF Header File shall contain field labels on odd-numbered lines and field values (corresponding to the immediately preceding field label) on even-numbered lines. Each field label line shall be in all capital letters. Each line shall be terminated with an ASCII Carriage Return/Line Feed pair. The file shall be terminated with an ASCII end-of-file (CNTRL Z) character.

5.14.2.1.1 **Filename.** The ANSI filename for this file shall be 'ssGnnnnnnNITFi.HDR', where "ss" is the security code, "nnnnnn" is the GTDB identifier, and "i" is "A" for the areal texture library or "M" for the model texture library.

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5.14.2.1.2 **File Format.** Valid data shall be provided in all fields for all texture types. The file format shall be as follows:

Label	Field
MHDR	Message Type & Version Field
STYPE	System Type Field
OSTAID	Originating Station ID Field
MDT	Message Date & Time Field
MTITLE	Message Title Field
MSCLAS	Message Security Classification Field
MSCODE	Message Codewords Field
MSCTLH	Message Control & Handling Field
MSREL	Message Releasing Instructions Field
MSCAUT	Message Classification Authority Field
MSCTLN	Message Security Control Number Field
MSDWNG	Message Security Downgrade Field
MSDEVT	Message Downgrading Event Field
MSCOP	Message Copy Number Field
MSCPYS	Message Number of Copies Field
ENCRYP	Encryption Field
ONAME	Originator's Name Field
OPHONE	Originator's Phone Number Field
ML	Message Length Field
HL	NITF Header Length Field
NUMI	Number of Images Field
LISH001	Length of 1st Image Sub-Header Field
LI001	Length of 1st Image Field
....	
LISHnnn	Length of Nth Image Sub-Header Field
LInnn	Length of Nth Image Field
NUMS	Number of Symbols Field [always 0]
NUML	Number of Labels Field [always 0]
NUMT	Number of Text Files Field [always 0]
NUMA	Number of Audio Segments Field [always 0]
NUMF	Number of Non-Static Presentations Field [always 0]
UDHDL	GTDB User Defined Header Data Length Field
	GTDB User Defined Header Data Fields
XHDL	Extended Header Data Length Field [always 0]
XHD	Extended Header Data Field [reserved]

5.14.2.1.2.1 **GTDB User Defined Header Data.** The GTDB User Defined Header Data format shall be as follows:

Label	Field
UDHD	Data Base Sentinel Field [always "GTDB"]

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5.14.2.1.2.1.1 **Image Tie Point Data.** Valid data shall be provided in NUMGTP, GTPID, NUMGTPR, GTEXLIB, and GTEXID for Stage 1 and Stage 2 Areal Texture only. Valid data shall be provided in the remaining fields for model texture only. Zeroes shall be provided otherwise.

NUMGTP	Number of Geographic Tie Points Field
	for each geographic tie point
GTPID	Geographic Tie Point ID Field
NUMGTPR	Number of Tie Point References Field
	for each tie point reference
GTEXLIB	GTDB Texture Library Field
GTEXID	GTDB Texture ID Field
NUMMTP	Number of Model Tie Points Field
	for each model tie point
MTPID	Model Tie Point ID Field
NUMMTPR	Number of Tie Point References Field
	for each tie point reference
GTEXLIB	GTDB Texture Library Field
GTEXID	GTDB Texture ID Field

5.14.2.1.2.1.2 **Generic Texture Association Data.** Valid data shall be provided for Generic Texture. Zeroes shall be provided for all other texture types

NUMGTS	Number of Generic Texture Sets Field
	for each generic texture set
GTSNAME	Generic Texture Set Name Field
OMTF	Object or Material Texture Flag Field
NUMGT	Number of Generic Textures In Set Field
	for each generic texture
GTEXID	GTDB Texture ID Field

5.14.2.2 **NITF Image Sub-Header File.** This file shall be included if areal texture is provided. The NITF Image Sub-Header File shall contain field labels on odd-numbered lines and field values (corresponding to the immediately preceding field label) on even-numbered lines. Each field label line shall be in all capital letters. Each line shall be terminated with an ASCII Carriage Return/Line Feed pair. The file shall be terminated with an ASCII end-of-file (CNTRL Z) character. Coordinate system names shall be spelled out. Image Geographic Location Coordinates shall specify the Southwest and Northeast corners of the image in thousandths of arc-seconds. Color data shall be stored directly in the NITF Image Data File. For SMC/FDC data, Look-up Table entries shall be 7-byte ASCII strings. All model textures shall be in a local cartesian coordinate system in units of meters. All generic textures shall be in units of meters, whether they be intended for models or geographic areas. All areal, or geographic, texture in Stages 1 and 2 shall be in the native source coordinate system. Areal textures in Stage 3 shall be in the geodetic coordinate system, while areal textures in Stages 4 and 5 shall be in the coordinate system as specified by the GTDB parameter set.

5.14.2.2.1 **Filename.** The ANSI filename for this file shall be 'ssGnnnnnnTEXitttttt.HDR', where "ss" is the security code, "nnnnnn" is the GTDB identifier, 'i' is "A" for the areal texture library or "M" for model texture library, and "ttttt" is the texture image number

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5.14.2.2.2 **File Format.** **Valid data shall be provided in all fields for all texture types, with the exception of the ICORDS and IGEOLO fields. For these two fields, valid data shall be provided for all Areal, SMC/FDC, and Model Texture Types only.** Zeroes shall be provided for all other types. The file format shall be as follows:

Label	Field
IM	Message Part Type Field
IID	Image (Texture) ID Field
IDATIM	Image Date & Time Field
TGTID	Target ID Field
ITITLE	Image Title (Texture Name) Field
ISCLAS	Image Security Classification Field
ISCODE	Image Codewords Field
ISCTLH	Image Control & Handling Field
ISREL	Image Releasing Instructions Field
ISCAUT	Image Classification Authority Field
ISCTLN	Image Security Control Number Field
ISDWNG	Image Security Downgrade Field
ISDEVT	Image Downgrading Event Field
ENCRYP	Encryption Field
ISORCE	Image Source Field
ICORDS	Image Coordinate System Field
IGEOLO	Image Geographic Location Field
NICOM	Number of Image Comments Field
	for each image comment
ICOMn	Image Comment Field n
IC	Image Compression Field
COMRAT	Compression Rate Code Field
NBANDS	Number of Bands Field
	for each band
ITYPEn	Image Type Field n
IFCn	Image Filter Condition Field n
IMFLTn	Standard Image Filter Code Field n
NLUTSn	Number of LUTs Field [always 0 or 1]
	for each LUT
NELUT1	Number of LUT Entries Field
	for each LUT entry e
LUTDe	LUT Entry Data
ISYNC	Image Sync Code Field
IMODE	Image Mode Field
NBPR	Number of Blocks Per Row Field
NBPC	Number of Blocks Per Column Field
NPPBH	Number of Pixels Per Block Horizontal Field
NPPBV	Number of Pixels Per Block Vertical Field
NBPP	Number of Bits Per Pixel Per Band Field
DLVL	Display Level Field [reserved]
ALVL	Attachment Field [reserved]
ILOC	Image Location Field [reserved]
IMAG	Image Magnification Field
UDIDL	GTDB User Defined Image Data Length Field
	GTDB User Defined Image Data Fields
XSHDL	Extended Sub-Header Data Length Field
XSED	Extended Sub-Header Data Field [reserved]

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5.14.2.2.2.1 GTDB User Defined Image Data. The GTDB User Defined Image Data format shall be as follows:

Label	Field
UDID	Data Base Sentinel Field [always "GTDB"]

5.14.2.2.2.1.1 General Processing Data. Valid data shall be provided for all texture types, with the following exceptions: MSTF, NRF, ORF, HRF, SMF, IICEF, ITICEF, 2GCF, 3GCF, ICAPDT, PAST, and GEOLOC shall contain valid data for all specific Areal and Model textures; MSTF, ICAPDT, PAST, and GEOLOC shall contain valid data for SMC/FDC texture; GTSNAME shall contain valid data for generic texture; otherwise, these fields shall be zero, FALSE, or blank as appropriate.

GTEXLIB	GTDB Texture Library Field
GTEXID	GTDB Texture ID Field
STAGE	Processing Stage Field
SGFLAG	Specific or Generic Texture Flag Field
TTYPE	Texture Type Field
TEXDES	Texture Description Field
HRES	Horizontal Resolution Field
VRES	Vertical Resolution Field
HSIZE	Horizontal Size Field
VSIZE	Vertical Size Field
MSTF	Modified Specific Texture Flag Field
NRF	Noise Removal Flag Field
ORF	Occlusion Removal Flag Field
HRF	Haze Removal Flag Field
SMF	Shadow Minimization Flag Field
IICEF	Inner Image Contrast Enhancement Flag Field
ITICEF	Image-to-Image Contrast Enhancement Flag Field
2GCF	Two-D Geometric Correction Flag Field
3GCF	Three-D Geometric Correction Flag Field
IQC	Image Quality Comment Field
IQR	Image Quality Rating Field
ICAPDT	Image Capture Date and Time Field
IFCRDT	Image File Creation Date and Time Field
LMDT	Last Maintenance Date and Time Field
PAST	Positional Accuracy Standards Field
GEOLOC	Geographic Location Name Field
GTSNAME	Generic Texture Set Name Field

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5.14.2.2.2.1.2 **Source Data.** Valid source data shall be provided in all fields for all texture types, except for the SEID, SETYPE, and SENAME Fields. For these three fields, valid data shall be provided for stage 1 and stage 2 Areal and Model Texture only, and be zero otherwise. The PAST field shall contain valid data for all types except generic, for which it shall contain zero.

NUMDS	Number of Data Source Table Entries Field
	for each data source
SOID	Source ID Field
SOTYPE	Source Type Field
SONAME	Source Name Field
SOAP	Source Agency/Project Field
SODATE	Source Date Field
SEID	Sensor ID Field
SETYPE	Sensor Type Field
SENAME	Sensor Name Field
REDA	Reliability of Data Field
PAST	Positional Accuracy Standards Field
COLSYS	Collection System Field
CODATE	Compilation Date Field
SYNDF	Synthetic Data Flag Field
COMCRI	Compilation Criteria Field
ICAPDT	Image Capture Date and Time Field

5.14.2.2.2.1.3 **Environmental Conditions Data.** Valid data shall be provided for all Specific Areal and Model Texture. Zeroes and blanks shall be provided for all other texture types. Valid data shall also be provided for SMC/FDC texture in the SPENVC field.

SPENVC	Special Environmental Conditions Field
PERCC	Percent of Cloud Cover Field
PERSC	Percent of Shadow Cover Field

5.14.2.2.2.1.4 **Texture Footprint Data.** Valid data shall be provided as follows: PERTT and PERST - Stage 3 through Stage 5 Areal and Model Texture, SMC/FDC texture; NUMBOU, BOUNDID, SOID, NUMBP, BPID, and ICO - All Areal and Model Texture, SMC/FDC texture; LATLON - Areal and SMC/FDC texture; RELCO - Model Texture. Fields shall contain zeroes, blanks, and FALSE values otherwise.

PERTT	Percent of Texture in Tile Field
PERST	Percent of Specific Texture Field
NUMBOU	Number of Boundaries Field
	for each boundary
BOUNDID	Boundary ID Field
SOID	Source ID Field
NUMBP	Number of Boundary Points Field
	for each boundary point
BPID	Boundary Point ID Field
LATLON	Latitude/Longitude Field (for Areal)
RELCO	Relative Coordinates Field (for Model)
ICO	Image Coordinates Field

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5.14.2.2.2.1.5 **Neighbor Texture Association Data.** Valid data shall be provided in NOTNID, SOTNID, EATNID and WETNID Fields for SMC/FDC and Stage 3 through Stage 5 Areal Texture. Valid data shall be provided in ABTNID, BETNID, RITNID and LETNID Fields for Stage 3 through Stage 5 Model Texture. Fields shall be blank otherwise.

NOTNID	North Tile Neighbor ID Field
SOTNID	South Tile Neighbor ID Field
EATNID	East Tile Neighbor ID Field
WETNID	West Tile Neighbor ID Field
ABTNID	Above Tile Neighbor ID Field
BETNID	Below Tile Neighbor ID Field
RITNID	Right Tile Neighbor ID Field
LETNID	Left Tile Neighbor ID Field

5.14.2.2.2.1.6 **Model Association Data.** Valid data shall be provided for all specific model texture. Zero and blank fields shall be provided for all other texture types.

NUMMI	Number of Models in Image Field
	for each model
MODLIB	Model Library Type Field
MODNUM	Model Number Field
MODNAME	Model Name Field
MODVIEW	Model View Description Field

5.14.2.2.2.1.7 **Image Control Data.** Valid data shall be provided in these fields as follows: NUMCP, CPID, CPNAME, SOID and ICO(C) - Stage 1 and Stage 2 Areal and Model Texture; LATLON - Stage 1 and Stage 2 Areal Texture; RELCO, NUMMTP, MTPID, ICO(M), MODLIB, and MODNUM - Stage 1 and Stage 2 Model Texture; NUMGTP, GTPID and ICO(G) - Stage 1 and Stage 2 Areal Texture.

NUMCP	Number of Control Points Field
	for each control point
CPID	Control Point ID Field
CPNAME	Control Point Name Field
SOID	Source ID Field
LATLON	Latitude/Longitude Field (for Areal)
RELCO	Relative Coordinates Field (for Model)
ICO(C)	Image Coordinates Field (Control Point)
NUMGTP	Number of Generic Tie Points Field
	for each geographic tie point reference
GTPID	Geographic Tie Point ID Field
ICO(G)	Image Coordinates Field (Geographic Tie Point)
NUMMTP	Number of Model Tie Points Field
	for each model tie point reference
MTPID	Model Tie Point ID Field
ICO(M)	Image Coordinates Field (Model Tie Point)
MODLIB	Model Library Type Field
MODNUM	Model Number Field

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5.14.2.2.2.1.8 **Sensor Image Descriptor Data.** Valid data shall be provided for all Stage 1 and Stage 2 Specific Areal and Specific Model Texture. Zero, blank, and FALSE values shall be provided for all other texture types.

NUMSEN	Number of Sensors Field
	for each sensor
SEID	Sensor ID Field
FILMQ	Film Quality Field
SUNAZ	Sun Azimuth Field
SUNEL	Sun Elevation Field
NUMSTM	Number of Stereo Mates Field
	for each stereo mate
GTEXID	GTDB Texture ID Field
SCANID	Scanner ID Field
SCRES	Scanner Resolution Field
SCFID	Scanner Filter ID Field
LLCOR	LL Corner X/Y Image Coordinates Field
ULCOR	UL Corner X/Y Image Coordinates Field
URCOR	UR Corner X/Y Image Coordinates Field
LRCOR	LR Corner X/Y Image Coordinates Field
CALFL	Calibrated Focal Length Field
CALPPO	Calibrated Principal Point Offset Field
CALPSO	Calibrated Point of Symmetry Offset Field
NUMFID	Number of Fiducial Coordinates Field
	for each fiducial coordinate
CALRIC	Calibrated Report Image Coordinates Field
MEAIC	Measured Image Coordinates Field
OMEGA	Omega Field
PHI	Phi Field
KAPPA	Kappa Field
RECTIF	Rectification Field
CAMPLL	Camera Position in Lat/Lon Field
CAMPH	Camera Position in Height Field
MSEOPK	Mean Square Error Omega/Phi/Kappa Field
MSELLH	Mean Square Error Lat/Lon/Height Field
HCAPTS	Horizontal Captured Texel Size Field
VCAPTS	Vertical Captured Texel Size Field

5.14.2.3 **Original Format Image File(s).** This file shall be included if Stage 1 Areal Texture is provided. Data shall be provided in its native format.

5.14.2.3.1 **Filename.** The ANSI filename for this file shall be "ssGnnnnnnOFIitttttt.y", where "ss" is the security code, "nnnnnn" is the GTDB identifier, "i" is "A" for the Areal Texture Library or "M" for the Model Texture Library, "ttttt" is the texture image number, and "y" is an alphabetic character assigned sequentially.

5.14.2.4 **NITF Image Data File.** The NITF Image Data File shall be included if non-Stage 1 Areal Texture is provided. Image data shall be formatted as stated in the NITF standard document

5.14.2.4.1 **Filename** The ANSI filename for this file shall be "ssGnnnnnnTEXitttttt.DAT", where "ss" is the security code, "nnnnnn" is the GTDB identifier, "i" is "A" for the Areal Texture Library or "M" for the Model Texture Library, and "ttttt" is the texture image number.

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5.14.2.4.2 **File Format.** The format of this file shall be as follows:

```
if Image Mode is Band Sequential (BSQ)
   for each band
      for each block
         for each row from top to bottom
            for each column from left to right
               Texel Value

elseif Image Mode is Band Interleaved (BIL)
   for each block
      for each band
         for each row from top to bottom
            for each column from left to right
               Texel Value
```

5.15 **Model Texture (MT) Library.** The Model Texture (MT) Library is optional in a GTDB. The MT shall consist of files in the National Imagery Transmission Format (NITF) and files in their original native format. All NITF files shall follow a format as that described in the National Imagery Transmission Format (NITF) Version 1.1 document dated 1 March 1989 and the NITF Change Notice Number 2 dated 23 May 1990.

5.15.1 **MT File Structure.** The file order of the MT library shall be as follows:

```
NITF Header File
for each model texture
   NITF Image Sub-Header File
   if texture is in Stage 1 then
      Original Format Image File(s) [optional]
   else
      NITF Image Data File [optional]
   end if
```

5.15.2 **MT File Record Structures.** The record structure of each of these files shall be as described in the following subsections.

5.15.2.1 **NITF Header File.** This file shall be included if model texture is provided. The format for this file shall be identical to that in the AT Library.

5.15.2.2 **NITF Image Sub-Header File.** This file shall be included if model texture is provided The format for this file shall be identical to that in the AT Library.

5.15.2.3 **Original Format Image File(s).** This file shall be included if Stage 1 Areal Texture is provided. This data shall be provided in its native format.

5.15.2.4 **NITF Image Data File.** This file shall be included if non-Stage 1 Areal Texture is provided The format for this file in the MT Library is identical to that in the AT Library

5.16 **Microdescriptors.** All microdescriptors included within a GTDB shall conform to the following format

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5.16.1 **GTDB Microdescriptor Records.** The code in parentheses is the attribute identifier which shall appear in the Microdescriptor Type field of a GTDB Microdescriptor Record.

5.16.1.1 **Homogeneous Area Microdescriptor Record (HA).** The attributes defined by this microdescriptor shall be as listed below.

(HA 01) Length of Individual Unit of Primary Field
(HA 02) Width of Individual Unit of Primary Field
(HA 03) SMC of Background Field

5.16.1.2 **Pattern Distribution Microdescriptor Record (PM).** The attributes defined by this microdescriptor shall be as listed below.

(PM 01) 1-D Separation Field
(PM 02) 2-D Length Portion Field
(PM 03) Angular Spatial (Radial) Field
(PM 04) Cartesian Orientation of Grid Field
(PM 05) Dimensionality Field
(PM 06) Distribution Field
(PM 07) Geometry Field
(PM 08) Radial Origin of Grid Field
(PM 09) Regularity of Grid Field
(PM 10) Width of Cell (Other) Field

5.16.1.3 **Drainage Microdescriptor Record (TTAD).** The attributes defined by this microdescriptor shall be as listed below.

(TTAD01) Bank Vegetation Field
(TTAD02) Bottom Material Field
(TTAD03) Gap Width Field
(TTAD04) Height, Left Bank, Field
(TTAD05) Height, Right Bank, Field
(TTAD06) Slope, Left Bank, Field
(TTAD07) Slope, Right Bank, Field
(TTAD08) SMC, Left Bank, Field
(TTAD09) SMC, Right Bank, Field
(TTAD10) Water Depth Field
(TTAD11) Water Velocity Field

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5.16.1.4 **Transportation Microdescriptor Record (TTAT).** The attributes defined by this microdescriptor shall be as listed below.

(TTAT01) Bridge Bypass Condition Field
(TTAT02) Bridge Construction Material Field
(TTAT03) Bridge Horizontal Clearance Field
(TTAT04) Bridge Movement Field
(TTAT05) Bridge Overhead Clearance Field
(TTAT06) Bridge Type Field
(TTAT07) Depth of Overburden Field
(TTAT08) Highway Shoulder SMC Field
(TTAT09) Highway Shoulder Width Field
(TTAT10) Highway SMC Depth Field
(TTAT11) Highway Type Field
(TTAT12) Length Field
(TTAT13) Length of Spans Field
(TTAT14) Maximum Weight Field
(TTAT15) Minimum Horizontal Clearance Field
(TTAT16) Minimum Vertical Clearance Field
(TTAT17) Number of Spans Field
(TTAT18) Railroad Capacity Field
(TTAT19) Railroad Passing Tracks Field
(TTAT20) Railroad Type Field
(TTAT21) Reliability of Information Field
(TTAT22) Tracked Classification Field
(TTAT23) Transportation Qualifier Field
(TTAT24) Tunnel Height Field
(TTAT25) Underbridge Clearance Field
(TTAT26) Wheeled Classification Field
(TTAT27) Width Field

5.16.1 5 **Vegetation Microdescriptor Record (TTAV).** The attributes defined by this microdescriptor shall be as listed below.

(TTAV01) Cone Index Field
(TTAV02) Crown Diameter Field
(TTAV03) Depth of Bedrock Field
(TTAV04) Height of Lowest Branches Field
(TTAV05) Roughness Index, Foot Troops, Field
(TTAV06) Roughness Index, Large Tracked, Field
(TTAV07) Roughness Index, Large Wheeled, Field
(TTAV08) Roughness Index, Small Tracked, Field
(TTAV09) Roughness Index, Small Wheeled, Field
(TTAV10) SMC Depth Field
(TTAV11) Soil Qualifier Field
(TTAV12) Soil State Field
(TTAV13) Soil Type Field
(TTAV14) Stem Diameter Field
(TTAV15) Stem Spacing Field
(TTAV16) Summer Canopy Cover Field
(TTAV17) Vegetation Roughness Field
(TTAV18) Winter Canopy Cover Field

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5.16.1.6 **Vertically Composite Microdescriptor Record (VC).** The attributes defined by this microdescriptor shall be as listed below.

(VC 01) Construction Type Code Field
(VC 02) Height of Elevated Portion Field
(VC 03) Length/Radius of Elevated Portion Field
(VC 04) Placement Code Field
(VC 05) Shape Code of Elevated Portion Field
(VC 06) SMC for Elevated Portion of Feature Field
(VC 07) Width of Elevated Portion Field

5.16.2 **Temporal Effects Microdescriptor Records.** Temporal effects microdescriptors shall conform to the following format. The Microdescriptor Type Field shall contain the value specified in parentheses in the subparagraphs.

Microdescriptor Type Field
Temporal Condition Field
Number of Attributes Affected Field

5.16.2 1 **Weather Effects Microdescriptor Record (TEW).** The temporal conditions defined by this microdescriptor shall be as listed below.

(TEW 01) Alternate Temperature Threshold Field
(TEW 02) Alternate Precipitation Condition Field
(TEW 03) Alternate Cloud Cover Condition Field

5.16.2.2 **Seasonal Effects Microdescriptor Record (TES).** The temporal conditions defined by this microdescriptor shall be as listed below.

(TES 01) Alternate Season Field

5.16.2.3 **Time of Day Microdescriptor Record (TET).** The temporal conditions defined by this microdescriptor shall be as listed below.

(TET 01) Alternate Time of Day Threshold Field

5.16.2.4 **Ground Conditions Microdescriptor Record (TEG).** The temporal conditions defined by this microdescriptor shall be as listed below.

(TEG 01) Alternate Ground Condition Field

5.16.2.5 **Alternate Attributes Record (TEAA).** One or more TEAA records shall follow each occurrence of a TEW, TES, TET, or TEG record. The number of TEAA records shall correspond to the Number of Attributes Affected field within the parent temporal effects record. The fields within this microdescriptor record shall be as listed below.

Microdescriptor Type Field (always 'TEAA ')
Affected Attribute Code Field (e g , 'TTAD10')
Alternate Attribute Value Field

5.17 **Feature Codes and Attributes.** Features included in a GTDB shall conform to modified version of the DMA FACS standard, as defined in Appendix B of this standard.

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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 standard is intended to be used for the interpretation of the format of the Generic Transformed Data Base.

6.2 **Acquisition Requirements.** Acquisition documents must specify the following:

a. Title, number, and date of the specification.

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).

6.3 **Subject term (key word) listing.**

Data Base

6.4 **Referenced documents.** The following documents were used as references, in preparation of this DBDD.

ANSI/MIL-STD-1815A, Ada Programming Language.

Defense Mapping Agency Digital Landmass System Product Specification, First Edition, July 1977.

Defense Mapping Agency Digital Landmass System Product Specification, Second Edition, April 1983.

Defense Mapping Agency Product Specifications for a Prototype Data Base to Support High Resolution Sensor Simulation, First Edition, December 1979.

Defense Mapping Agency Prototype High Resolution Data Base Product Specification, First Edition, August 1980.

Defense Mapping Agency Level X Product Specification, First Edition, June 1983.

Defense Mapping Agency Feature File Product Specification, First Edition, August 1984.

Defense Mapping Agency Standard Linear Format Product Specification, First Edition

Defense Mapping Agency (DMA) High Resolution Data (Level X) Specification for B-1B Simulator.

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DMA Standard Supporting Mark 90, Section 100, Glossary of Feature/Attribute Definitions, Second Edition, June 1988, revised December 1988.

CUSTODIANS:
Army - PT
Navy - TD
Air Force - 11

PREPARING ACTIVITY:
Air Force - 11

(Project Nr. 69GP-0101)

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APPENDIX A

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DATA DICTIONARY

10 **SCOPE.** This appendix is an alphabetical data dictionary defining every field which occurs within a GTDB.

20 APPLICABLE DOCUMENTS

This section does not apply.

30 DEFINITIONS AND ACRONYMS

This section does not apply.

40 GENERAL REQUIREMENTS

40.1 This Appendix shall be a mandatory part of the standard. The information contained herein is intended for compliance.

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50 DETAILED REQUIREMENTS

50.1 . Each dictionary entry includes the following items of information:

- fieldname, as listed in the GTDB record definitions in section 3.3 of the GTDB DBDD;
- data type, indicating whether the data value is represented logically as an integer, a real number, a Boolean, an Ada enumerated type, a text string, or a composite record of subsidiary fields;
- length of the field, in ASCII characters;
- range of valid values;
- a brief narrative description of the field.

50.2 All fields on a GTDB tape are encoded in ASCII character format, except for those in the NITF Image Data Files and the Original Format Image Files. The logical interpretation of the ASCII characters varies with the information contained under "Type" and "Length". Table A-I is a key to the abbreviations contained under "Type" and to the format of the ASCII strings contained in the various types of fields for non-NITF files.

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TABLE I

Type	Length	Meaning	ASCII Format
B	1	Boolean, True/False	'T' or 'F'
E	any	Ada Enumerated Type	alphanumeric text
H	N	Hexidecimal number of N characters	hhhhhhhhhh etc. for N characters
I	2	Integer, 1 digit	sn, where 's' is a minus sign (or blank) and 'n' is a digit
I	4	Integer, 3 digits	snnn, where 's' is the sign and 'n' is a digit
I	6	Integer, 5 digits	snnnnn
I	7	Integer, 6 digits	snnnnnn, where 's' is a minus sign (or blank) and 'n' is a digit
I	11	Integer, 10 digits	snnnnnnnnnn
R6	12	Real, 6 significant digits	sn.nnnnnEsee, where 'ee' is the exponent
R10	16	Real, 10 significant digits	sn.nnnnnnnnnEsee
I2D	L	Integer pair	two integers separated by ASCII null characters; each integer has a length of the maximum number of digits plus 1 for the sign, thus, the total length L = L1 + L2 + 1 where L1 and L2 are the maximum lengths of the first and second integers, respectively.

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TABLE I

Type	Length	Meaning	ASCII Format
I3D	L	Integer triplet	three integers separated by ASCII null characters; each integer has a length of the maximum number of digits plus 1 for the sign; thus, the total length L = L1 + L2 + L3 + 2 where L1, L2, and L3 are the maximum lengths of the first, second, and third integers, respectively.
I4D	L	Integer quad	four integers separated by ASCII null characters; each integer has a length of the maximum number of digits plus 1 for the sign; thus, the total length L = L1 + L2 + L3 + L4 + 3 where L1, L2, L3, and L4 are the maximum lengths of the first, second, third, and fourth integers, respectively.
R2D6	25	Real pair, 6 significant digits	two real numbers of the R6 type separated by ASCII null characters
R3D6	38	Real triplet, 6 significant digits	three real numbers of the R6 type separated by ASCII null characters
R4D6	51	Real quad, 6 significant digits	four real numbers of the R6 type separated by ASCII null characters
R2D10	33	Real pair, 10 significant digits	two real numbers of the R10 type separated by ASCII null characters
R3D10	50	Real triplet, 10 significant digits	three real numbers of the R10 type separated by ASCII null characters
S	any	Text String	alphanumeric text

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50.2.1 Note that the size of each ASCII field is fixed to contain enough character positions to hold the largest valid value for that field, including a sign for all numerics. Data values within all fields will be right-justified, with blank padding to the left for text.

50.2.2 Within a record in a non-NITF file, all fields are separated from each other by an ASCII null character. This makes it possible to process specific fields without knowledge of the format and length of intervening fields. Users are encouraged to make use of this feature, as it isolates the user from changes to the format of fields not relevant to the user's application.

50.2.3 NITF files follow the NITF format rules, where every field with a value is preceded by a field with a field label for that value. Field separators for these files are defined by NITF as a carriage return character followed by a line feed character. Three main differences between the types of the NITF files and the types of the non-NITF files are that (1) NITF Boolean Types are spelled out ("TRUE", "FALSE") while the non-NITF files simply use "T" and "F"; (2) the NITF Integer Types are of a length equal to the maximum length number, including a sign character only if the number can be negative, while the non-NITF Integer types have a fixed set of lengths that always include a character for the sign, regardless of whether that specific field can be negative; and (3) for composite fields (fields with multiple data items), the intra-field separator is the ASCII blank character, not the ASCII null character used in non-NITF files in a GTDB. The following tables are a key to the abbreviations contained under "Type" and to the format of the ASCII strings contained in the various types of fields for NITF files.

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TABLE II

Type	Length	Meaning	ASCII Format
B	5	Boolean, True/False	'TRUE' or 'FALSE'
E	any	Ada Enumerated Type	alphanumeric text
I	L	Integer	sN, where 's' is optional and if it is there, it is a minus sign, and N is a series of digits where the number of digits is the maximum number required to specify the largest possible number in the valid range. If not all the digits are required, the integer is padded with zeroes to the left.
R6	12	Real, 6 significant digits	sn.nnnnnEsee, where 'ee' is the exponent
R10	16	Real, 10 significant digits	sn.nnnnnnnnnEsee
I2D	L	Integer pair	two integers separated by ASCII blank characters; each integer has a length of the maximum number of digits; thus, the total length L = L1 + L2 + 1 where L1 and L2 are the maximum lengths of the first and second integers, respectively.

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TABLE II

Type	Length	Meaning	ASCII Format
I3D	L	Integer triplet	three integers separated by ASCII blank characters; each integer has a length of the maximum number of digits; thus, the total length L = L1 + L2 + L3 + 2 where L1, L2, and L3 are the maximum lengths of the first, second, and third integers, respectively.
R2D6	25	Real pair, 6 significant digits	two real numbers of the R6 type separated by ASCII blank characters
R3D6	38	Real triplet, 6 significant digits	three real numbers of the R6 type separated by ASCII blank characters
R4D6	51	Real quad, 6 significant digits	four real numbers of the R6 type separated by ASCII blank characters
R2D10	33	Real pair, 10 significant digits	two real numbers of the R10 type separated by ASCII blank characters
R3D10	50	Real triplet, 10 significant digits	three real numbers of the R10 type separated by ASCII blank characters
S	any	Text String	alphanumeric text
BIN	--	Binary for texel values	--

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TABLE A-III

Fieldname	Type	Length	Range	Description
Above Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring model specific image above the current image.
Absorptivity	R6	12	0.0 .1.0	Ratio of radiant (thermal) energy absorbed by a feature to the energy incident upon it. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Area Block Boundary	I2D, I2D	43	-324000000.. 324000000, -648000000.. 648000000; -324000000.. 324000000, -648000000. 648000000	A pair of latitude/longitude coordinates defining the southwest and northeast corners of an area block. See definitions for Lat/Long SW Corner and Lat/Long NE Corner. The coordinates are separated by ASCII null characters
Area Block Category	E	18	AREAL, LINEAR, POINT, POINT_LIGHT, POINT_LIGHT_STRING, MODEL_REF, TERRAIN_GRID, TERRAIN_POLY, VERTEX	Type of data contained within an area block pseudo-file.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Area Block ID	I, I, E	34	1..16; 1..2147483647; AREAL, LINEAR, POINT, POINT_LIGHT, POINT_LIGHT_STRING, MODEL_REF, TERRAIN_GRID, TERRAIN_POLY, VERTEX	A unique identifier for an area block, consisting of a SLOD ID, an Area Block Number, and an Area Block Category
Area Block Number	I	11	1..2147483647	Ten-digit sequence number used to uniquely identify an area block within a GTDB.
Area Block Size	I2D	21	-324000000.. 324000000, -648000000.. 648000000	The dimensions of an area block, expressed in thousandths of seconds of relative latitude and longitude. See definitions for Relative Latitude and Relative Longitude. The two fields are separated by an ASCII null character.
Areal Feature Area Block Flag	B	1	T, F	Boolean flag indicating whether an Areal Feature Area Block (AFAB) pseudo-file exists within the given area block.
Articulated Part Flag	B	1	T, F	Indicates whether the referenced model is an articulated part.
Attachment (NITF)	I	3	0..998	Display level to which a new object is to be attached for editing purposes

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TABLE A-III

Fieldname	Type	Length	Range	Description
Attribute Value	--	--	--	The value assigned to a FACS code This value will differ based on the type of FACS code. The following list shows the values that can be assigned: one byte integer, two byte integer, four byte integer, real (six significant digits), long real (ten significant digits), integer pair (2 - four byte integers), integer triplet (3 - 4 byte integers), real pair (2 real numbers with six significant digits), real triple (3 real numbers with six significant digits), long real pair (2 real numbers with ten significant digits), long real triple (3 real numbers with ten significant digits), string, enumerated, boolean (flag), or null value, the length values are.

Class	Length
INT1	4
INT2	6
INT4	11
INT2D	23
INT3D	35
REAL6	12
REAL10	16
REAL2D6	25
REAL2D10	33
REAL3D6	38
REAL3D10	50
FLAG	5
STR	up to 80
ENUM	up to 80
NONE	0

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TABLE A-III

Fieldname	Type	Length	Range	Description
Base Polygon ID	I	11	0..2147483647	Polygon ID of a polygon within a model which also serves to define the footprint of that model on the ground.
Below Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring model specific image below the current image.
Bits Per Texel Per Band	I	4	1..64	The number of data bits for each texel for each band in the image before compression. For multi-band images treated as a single image, the number of bits per texel is identical for each band. Standard values include 1, 8, and 16 for intensity, color, or other multispectral textures; 56 for SMC/FDC textures, and 16 or 24 for terrain. Same as Number of Bits Per Pixel Per Band for NITF data.
Blending Type	I	6	0 .32767	Indicates type of color blending to apply to a feature. (TBD)
Boundary ID (non-NITF)	I	6	0..32767	A unique identifier for a terrain or texture footprint.
Boundary ID (NITF)	I	5	0 .32767	A unique identifier for a terrain or texture footprint.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Boundary Point	I2D	21	-324000000.. 324000000, -648000000.. 648000000	A latitude/longitude coordinate defining a point on the boundary of the gaming area, or of an island within the gaming area. See definitions for Latitude and Longitude. The two values are separated by an ASCII null
Boundary Point ID (NITF)	I	5	0..32767	A unique identifier for a point that is located on a terrain or texture footprint.
Boundary Point Count	I	11	5..2147483647	The number of Boundary Point records used to define the boundaries of the gaming area
Calibrated Focal Length (NITF)	R10	16	10.0..10000.0	An adjusted value of the focal length computed to equalize the positive and negative values of lens distortion over the entire focal plane (expressed in millimeters)
Calibrated Point of Symmetry Offset (NITF)	R10	16	-1.0..1.0	The adjusted position which gives the best symmetry of radial lens distortion. The indicated principal point is formed by the intersection of lines connecting the fiducial marks. The calibrated point of symmetry offset is the difference between these two points (expressed in meters).

TABLE A-III

Fieldname	Type	Length	Range	Description
Calibrated Principal Point Offset (NITF)	R10	16	-1.0..1.0	The foot of the perpendicular from Offset the interior perspective center to the focal plane. The indicated principal point is formed by the intersection of lines connecting the fiducial marks. The calibrated principal point offset is the difference between these points (expressed in meters).
Calibrated Report Image Coordinates (NITF)	R2D10	33	-1.0..1.0, -1.0..1.0	The position of the fiducial marks as determined by a laboratory calibration of the camera (expressed in meters).
Camera Position in Height (NITF)	R10	16	0.0.. 9.999999999E+99	Height of the camera above mean sea level expressed in meters
Camera Position in Lat/Lon (NITF)	S	24	HDDMMSSSSSb HDDDMMSSSSS	Geographic location of the sensor used to capture the data expressed in thousandths of arc seconds in absolute coordinates; H = hemisphere, DD or DDD = degrees, MM = minutes, SSSSS = thousandths of seconds, and b = blank character (' ")
Centroid	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A coordinate defining the center of a circumscribing circle or sphere for a feature, model, or model polygon, or the center of curvature for a point light string. The internal format of this field varies with the user-specified coordinate system for the GTDB.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25, 1.93428E+25	

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TABLE A-III

Fieldname	Type	Length	Range	Description
Checksum	I	6	0..32767	The logical sum of all characters contained within a file or pseudo-file in a GTDB, used to verify that data have been correctly read from the input medium.
Chroma	I	6	0..32767	The chroma component of a color defined by the Hue-Chroma-Value model. P2851 normalizes Chroma to a range of 0 (grey) to 32767 (color) instead of the familiar 0-100 percent saturation range. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Cluster ID (Model Cluster ID)	H	32	0..F (32 times)	In a model, a number identifying a set of polygons which have been grouped by definition of separation planes. It is a 32-digit hexadecimal number, supporting 128 separation planes in a model.
Collection System (NITF)	S	10	--	ID of the system used to collect data.
Color	I4D	25	0 .32676, 0..32767, 0..32767, 0..127	Numerical representation of color in terms of hue, chroma, and value, along with an index into a P2851 Color Calibration Table. See definitions for Hue, Chroma, Color Value, and Color Calibration Entry ID. The four values will be separated by ASCII nulls.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Color Calibration Entry ID	I	4	1..127	An index to an entry in the P2851 Color Calibration Table, based on relative position of the entry.
Color Characteristics				Same as Color.
Color ID	I	4	0..255	Code designating an approximate color, based on a limited standard palette. A value of '0' indicates unknown.
Color Name	E	6	RED, ORANGE, YELLOW, GREEN, BLUE, INDIGO, VIOLET	Common color name approximating the color represented numerically in the Color field.
Color Table Index	I	11	0..2147483647	The name of the color table file included with SIF/HDI models or SIF/HDI culture data.
Color Texture Existence Flag	B	1	T, F	The flag indicating the existence of color texture within an area block or an island LOD.
Color Texture Resolution	R6	12	0.0..1.93428e+25	Resolution of color texture in thousandths of arc-seconds/texel for geodetic textures and meters/texel for all other textures.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Color Value	I	6	0..32767	The value component of a color defined by the Hue-Chroma-Value model. P2851 normalizes Value to a range of 0 (black) to 32767 (white) instead of the familiar 0-100 percent lightness range. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Column Count	I	7	1 .108000	The number of Terrain Column records used to store elevation values within a TGAB.
Compilation Criteria (NITF)	S	160	--	Description of data capture criteria.
Compilation Date (NITF, non-NITF)	S	6	YYMMDD	The date on which a GTDB was generated Any succeeding subarea updates will leave this field unchanged but will be reflected in the Last Update Date.
Component ID	I	7	0..1000	Unique ID number assigned to components of a model

TABLE A-III

Fieldname	Type	Length	Range	Description
Compression Rate Code (NITF)	S	4	"C0 ", "C1 ", "C2 ", "NC "	A code indicating the compression rate for the image. If Image Compression = C0, the code is user defined. If Image Compression = C1, the codes are as follows: 1D = 1 Dimensional Coding; 2DS = 2 Dimensional Coding Standard Vertical Resolution, K=2; 2DH = 2 Dimensional Coding High Vertical Resolution, K=4. If Image Compression = C2, the Compression Rate Code is given in the form n.nn, representing the average number of bits per pixel over the image after compression Valid codes are 0.75, 1.40, 2.30, and 4.50. Omitted if Image Compression is NC.
Control Point ID (NITF)	I	5	0..32767	Numeric identifier of a specific control point.
Control Point Name (NITF)	S	40	--	Field used to associate a textual name with a control point.
Coordinate	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A representation of a point in 2D space used to define model vertices.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A representation of a point in 3D space used to define model vertices.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Coordinate	R3D10	50	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99. 9.999999999E+99	A representation of a point in longitude, latitude, and elevation. Longitude and latitude are in thousandths of arc seconds when the coordinate system is GEODETIC_FLOAT; otherwise, they are in meters. Elevation is always in meters. Used to define terrain posts in gridded terrain and vertices in polygonized terrain and culture.
Coordinate System	E	14	GEODETIC_FLOAT, GEOCENTRIC, MERCATOR, TRANS_MERC, LAMBERT, POLAR, LOCAL	User-defined CDBTP parameter specifying which of the allowable coordinate systems should be used to represent terrain and culture vertices within the GTDB.
Correlation Priority	I	4	0 .127	A number indicating the relative importance of a feature or vertex for maintaining correlation among GTDBs generated to support different simulators. Higher numbers indicate greater priority.
Correlation Priority (Vertex List Pointer Record)	I	2	0..9	A number indicating the relative importance of a model vertex for maintaining correlation among GTDBs generated to support different simulators. Higher numbers indicate greater priority.

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Fieldname	Type	Length	Range	Description
Culture Resolution	R10	16	-9.999999999E+99.. 9.999999999E+99	User-defined CDBTP parameter giving the maximum perpendicular error to be introduced by the culture thinning process. A value of 0.0 indicates that thinning should not be performed
Cycle Rate Off Time	I	11	0..2147483647	The period of time which a light remains in the off state, expressed in thousandths of seconds.
Cycle Rate On Time	I	11	0..2147483647	The period of time which a light remains in the on state, expressed in thousandths of seconds.
Data Base Sentinel (NITF)	S	4	"GTDB"	P2851 Data Base type identifier used with NITF data
Data Location	E	8	ON_LINE, OFF_LINE	Indicator used by P2851 software for configuration management. The field may be ignored by users.

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Fieldname	Type	Length	Range	Description
Datum ID	E	26	WGS_84, WGS_72, NONE, BOGOTA_OBSERVATORY, CHATHAM_1971, CHUA_ASTRO, CORREGO_ALEGRE, EUROPEAN_1950, GEODETIC_DATUM_1949, HJORSEY_1955, HONG_KONG_1963, PROVISIONAL_SOUTH_AMERICAN, QORNOQ, ROME_1940, SOUTH_AMERICAN_1969, BERMUDA_1957, CAPE_CANAVERAL, L_C_5_ASTRO, LUZON, NORTH_AMERICAN_1927, OLD_HAWAIIAN, ARINDAN, ARC_1950, ARC_1960, LIBERIA_1964, MAHE_1971, MERCHICH, NAHRWAN, OMAN, SOUTH_EAST_ISLAND, VITI_LEVU_1916	A user-defined CDBTP parameter indicating the geodetic datum to be used for coordinate transformations.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Datum Shift	R3D10	50	-9.999999999E+99. 9.999999999E+99, -9.999999999E+99. 9.999999999E+99, -9.999999999E+99. 9.999999999E+99	A user-defined CDBTP parameter indicating the datum shift values to be applied during coordinate transformations. (Only applies if Datum ID is NONE.)
Decompose Culture Flag	B	1	T, F	User-defined CDBTP parameter indicating whether concave areal features (i.e., those having one or more exterior angles less than 180 degrees) should be decomposed into convex polygons none of whose exterior angles are less than 180 degrees.
Diffuse Reflectance	R6	12	0.0..1.0	Radar backscatter coefficient, expressed as a ratio. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Directionality	R10	16	0.0..361.0	Angle from north from which a point light feature is visible. A value of '361.0' indicates the light is omni-directional.
Directivity (Infrared)	E	4	UNI, BI, OMNI	Indicator of shape of the planar response curve of a feature to infrared sensors. Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.

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Fieldname	Type	Length	Range	Description
Directivity (Radar)	E	4	UNI, BI, OMNI	Indicator of shape of the planar response curve of a feature to radar sensors. Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.
Directivity (Visual)	E	4	UNI, BI, OMNI	Indicator of shape of the planar response curve of a feature to visual sensors Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.
Directivity				Same as Directivity (Visual)
Display Level (NITF)	I	3	0..999	Unique graphic display level of an image relative to other message components in a composite. A higher number means that the item is to be displayed in front of other items with lower display level values.
East Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring areal specific image to the east.
Eccentricity	R10	16	-9.999999999E+99 . 9.999999999E+99	A user-defined CDBTP parameter applied during coordinate transformations. (Only applies if Datum ID is NONE.)
Elevation Reference	E	9	GEOID, ELLIPSOID	A user-defined CDBTP parameter indicating the reference level relative to which all elevation values are to be expressed.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Emissivity	R6	12	0.0..1.0	Ratio of the rate of infrared radiation from a feature or model as a consequence of its temperature only, to the corresponding rate of emission from a blackbody at the same temperature.
Encryption (NITF)	I	1	0..1	Flag that indicates whether an image is encrypted. 0 = no encryption, 1 = encrypted.
End Vertex ID	I	11	0..2147483647	The highest number assigned to a vertex within a Vertex Area Block pseudo-file.
Ending FDC Code	S	5	--	The Feature Descriptor Code used to define the end of a range of FDCs within various parameters of the CDBTP.
Exitance	R6	12	0.0..1.93428E+25	Rate of flow of infrared radiation from a feature or model polygon per unit of surface area.
Expand Lineals Flag	B	1	T, F	User-defined CDBTP parameter indicating whether linear features should be replaced by areal representations.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Extended Header Data (NITF)	--	--	--	Reserved for future use.
Extended Header Data Length (NITF)	I	5	0 .99999	The length in bytes of the Extended Header Data Record.
Extended Sub-Header Data (NITF)	--	--	--	Reserved for future use.
Extended Sub-Header Data Length (NITF)	I	5	0..99999	The length in bytes of the Extended Sub-Header Data Record.
Face-Based Mapping Flag	B	1	T, F	Parameter indicating the existence of face-based mapping parameters for texture
FACS Attribute Code	S	6	See Section 6.1	A code uniquely identifying an attribute type, based on codes defined in the DMA Feature Attribute Coding Standard.

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TABLE A-III

Fieldname	Type	Length	Range	Description
FACS Class	E	8	INT1, INT2, INT4, INT2D, INT3D, REAL6, REAL10, REAL2D6, REAL2D10, REAL3D6, REAL3D10, STR, ENUM, FLAG, NONE	Specifies the data type based on which a FACS code is defined. INT1 represents integer type of one byte INT2 represents integer type of two bytes. INT4 represents integer type of four bytes. INT2D represents a 2-D integer pair where the elements are of INT4 type. INT3D represents a 3-D integer triplet where the elements are of INT4 type. REAL6 represents real type with six significant digits. REAL10 represents real type with ten significant digits. REAL2D6 represents a 2-D real pair where the elements are of REAL6 type REAL2D10 represents a 2-D real pair where the elements are of REAL10 type. REAL3D6 represents a 3-D real triplet where the elements are of REAL6 type. REAL3D10 represents a 3-D real triplet where the elements are of REAL10 type. STR represents string type. ENUM represents enumerated type. FLAG represents boolean type. NONE indicates that the user-defined FACS has no associated value.
Feature Descriptor Code	S	5	See section 6.1	Alphanumeric code assigned to classify a feature within a set of hierarchical categories, based on the DMA FACS as extended by P2851.
Feature Fragment Flag	B	1	T, F	Boolean flag indicating whether a feature has been clipped along an area block or terrain polygon boundary.

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Fieldname	Type	Length	Range	Description
Feature Number	I	11	1..2147483647	Numeric ID unique to every feature within an area block.
Feature Onset	B	1	T, F	Indicator for changing radar backscatter coefficients. Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.
Feature Type	E	18	AREAL, LINEAR, POINT, POINT_LIGHT, POINT_LIGHT_STRING	Classifies a feature as areal, linear, point, point light, or point light string.
FID Code	S	6	NONE, FID101, FID102, FID103, FID104, FID105, FID106, FID110, FID111, FID112, FID113, FID114, FID115, FID116, FID120, FID121, FID122, FID130, FID135, FID136, FID137, FID138, FID145, FID146, FID150, FID151, FID152, FID153, FID154, FID155, FID156, FID160, FID161, FID162,	DMA FID for feature, if input from DMA DFAD source. For details of the meanings of these codes, refer to "DMA Product Specifications for DLMS Data Base", 2nd Edition, 1983.

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Fieldname	Type	Length	Range	Description
FID Code	S	6	FID163, FID164, FID165, FID166, FID170, FID171, FID172, FID173, FID174, FID180, FID181, FID182, FID183, FID184, FID185, FID186, FID187, FID188, FID189, FID190, FID201, FID202, FID203, FID204, FID205, FID206, FID207, FID208, FID209, FID220, FID221, FID222, FID223, FID224, FID230, FID231, FID232, FID233, FID234, FID235, FID236, FID237, FID238, FID239, FID240, FID244, FID245, FID250, FID251, FID252, FID253, FID254, FID255, FID260, FID261, FID262, FID263, FID264, FID265, FID267, FID270, FID271, FID272, FID273, FID274, FID275, FID276, FID277, FID280, FID281, FID282, FID283, FID290, FID301, FID302, FID303,	DMA FID for feature, if input from DMA DFAD source. For details of the meanings of these codes, refer to "DMA Product Specifications for DLMS Data Base", 2nd Edition, 1983.

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TABLE A-III

Fieldname	Type	Length	Range	Description
FID Code	S	6	FID304, FID305, FID320, FID321, FID322, FID323, FID324, FID325, FID330, FID331, FID332, FID334, FID340, FID341, FID343, FID344, FID350, FID352, FID401, FID402, FID403, FID420, FID421, FID430, FID433, FID434, FID435, FID436, FID450, FID451, FID501, FID511, FID512, FID520, FID521, FID530, FID531, FID532, FID535, FID536, FID540, FID541, FID542, FID543, FID544, FID560, FID561, FID601, FID602, FID603, FID604, FID605, FID606, FID610, FID620, FID621, FID622, FID630, FID631, FID632, FID640, FID641, FID650, FID680, FID681, FID682, FID683, FID684, FID701, FID702, FID703, FID704, FID705, FID706, FID707, FID710,	DMA FID for feature, if input from DMA DFAD source. For details of the meanings of these codes, refer to "DMA Product Specifications for DLMS Data Base", 2nd Edition, 1983.

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TABLE A-III

Fieldname	Type	Length	Range	Description
FID Code	S	6	FID163, FID164, FID165, FID166, FID170, FID171, FID172, FID173, FID174, FID180, FID181, FID182, FID183, FID184, FID185, FID186, FID187, FID188, FID189, FID190, FID201, FID202, FID203, FID204, FID205, FID206, FID207, FID208, FID209, FID220, FID221, FID222, FID223, FID224, FID230, FID231, FID232, FID233, FID234, FID235, FID236, FID237, FID238, FID239, FID240, FID244, FID245, FID250, FID251, FID252, FID253, FID254, FID255, FID260, FID261, FID262, FID263, FID264, FID265, FID267, FID270, FID271, FID272, FID273, FID274, FID275, FID276, FID277, FID280, FID281, FID282, FID283, FID290, FID301, FID302, FID303,	DMA FID for feature, if input from DMA DFAD source. For details of the meanings of these codes, refer to "DMA Product Specifications for DLMS Data Base", 2nd Edition, 1983.

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Fieldname	Type	Length	Range	Description
FID Code	S	6	FID926, FID927, FID928, FID929, FID930, FID931, FID932, FID933, FID934, FID940, FID941, FID942, FID943, FID944, FID945, FID946, FID947, FID948, FID949, FID950, FID951, FID952, FID953, FID954, FID955, FID956, FID960, FID961, FID962, FID963, FID964, FID965, FID966, FID967, FID980	DMA FID for feature, if input from DMA DFAD source. For details of the meanings of these codes, refer to "DMA Product Specifications for DLMS Data Base", 2nd Edition, 1983.
File Name	S	80	--	The name of a data file which is located on the GTDB tape
Film Quality (NITF)	S	20	--	Quality of film used to capture the image.
First Standard Parallel	R10	16	-90.0..90.0	A user-defined CDBTP parameter indicating a first standard parallel to be applied during projection transformations
Fragment Culture Flag	B	1	T, F	User-defined CDBTP parameter indicating whether areal and linear features should be clipped along the boundaries of underlying terrain polygons.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Fragment Point Light Strings Flag	B	1	T, F	User-defined CDBTP parameter indicating whether point light string features should be fragmented into individual point light features.
Generic Model Flag	B	1	T, F	Indicates whether the model is generic.
Generic Texture Set Name (NITF)	S	20	--	Textual identifier identifying a set of generic textures that represent the same entity where each member of the set has a different size and/or resolution
Geographic Location Name (NITF)	S	40	--	A textual name associated with an areal specific image or SMC/FDC image.
Geographic Tie Point ID (NITF)	I	10	0 .2147483647	A unique identifier of a geographic tie point.
Global-Based Mapping Flag	B	1	T, F	Parameter indicating the existence of global-based mapping parameters for texture.
Global Reference Point	R2D10	33	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	A point on culture/terrain which corresponds to the origin of the texture being mapped

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TABLE A-III

Fieldname	Type	Length	Range	Description
Goodness-of-Fit	R10	16	-9.999999999E+99.. 9 999999999E+99	User-defined CDBTP parameter specifying the maximum allowable difference between any source elevation value and the corresponding elevation as represented by the surface of a GTDB terrain polygon. This parameter may be specified on a per area block basis
Grayscale Texture Existence Flag	B	1	T, F	The flag indicating the existence of grayscale (or intensity) texture within an area block or an island LOD.
Grayscale Texture Resolution	R6	12	0 0..1.93428e+25	Approximate resolution of grayscale (or intensity) texture in units of Meters/texel.
GTDB Directory	S	80	--	Logical name of the P2851 VAX/VMS directory used in GTDB creation. This field is used by P2851 for configuration management and may be ignored by the user.
GTDB Texture ID (NITF)	I	10	0..2147483647	ID number assigned to a texture; unique within a GTDB texture library.
GTDB Texture Library (NITF)	E	5	AREAL, MODEL	ID of one of two GTDB texture libraries
GTDB Texture Library Type	E	5	AREAL, MODEL	Same as GTDB Texture Library
GTDB User Defined Header Data Length (NITF)	I	5	00000..99999	Length in bytes of data defined specifically for the GTDB that is not part of the standard NITF data.

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Fieldname	Type	Length	Range	Description
GTDB User Defined Image Data Length (NITF)	I	5	00000..99999	Length in bytes of data defined specifically for the P2851 GTDB but not defined in the standard NITF Image Sub-Header.
GTDB Version Number	I	6	1. 99999	The version number of a given GTDB, incremented each time it is updated or extended. A GTDB over the same gaming area but created from scratch would be considered a new GTDB rather than a new version of the previous GTDB.
Haze Removal Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether haze has been removed from an image.
High Value Field	R	6	0 0..100.0	Percentage.
Horizontal Captured Texel Size (NITF)	R10	16	0.0.. 9.999999999E+99	Approximate ground distance for a texel (expressed in meters) in the horizontal x-direction.
Horizontal Resolution (NITF, non-NITF)	R6	12	0.0..1.93428e+25	Horizontal length of a texel in meters, (e.g., 1.0 M/texel)
Horizontal Size (NITF)	R6	12	0 0 1.93428e+25	The horizontal size of the entire image, e.g., 1000.0 Meters
Horizontal Tile Block Size	I	1[illegible]	0..2147483647	The number of texels in the horizontal direction (row) in a texture block A texture is divided into a whole number of blocks, each consisting of the same dimensions.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Hue	I	6	0 .32767	The hue component of a color defined by the Hue-Chroma-Value model. P2851 normalizes Hue to a range of 0 (blue) to 10922 (red) to 21845 (green) and back to 32767 (blue), instead of the familiar 360-degree color wheel, which turns from 0 (blue) to 120 (red) to 240 (green) back to 360 (blue). Synthetic default values are generated by P2851 software as a random function of Surface Material Category
Image Capture Date and Time (NITF)	S	12	YYMMDDHHMMSS	The date and time of day that an SSDB image was captured, where YYMMDD = Year, Month and Day, and HHMMSS = Hours (0..24), Minutes and Seconds.
Image Capture Date Range (NITF)	S, S	13	YYMMDD, YYMMDD	Parameter indicating the preferred range of dates in which an image was captured for a texture.
Image Classification Authority (NITF)	S	20	--	The identity of the classification authority for an image. The code shall be in accordance with the regulations governing the appropriate security channels

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TABLE A-III

Fieldname	Type	Length	Range	Description
Image Codewords (NITF)	S	40	--	Security compartments associated with an image. Digraphs in accordance with DIAM 65-19 and its supplements, trigraphs not contained in DIAM 65-19, and complete codewords or project numbers may be used. The selection of a relevant set of codewords is implementation specific. The individual values are separated by single spaces.
Image Comment Field n (NITF)	S	80	--	Field to be used for free form comments. May be used for image specific information. If the comment is classified, then it will be preceded by the classification, including codeword(s). Omitted if Number of Image Comments is zero.
Image Compression Field (NITF)	S	2	"NC", "C0, "C1", "C2"	If the image is transmitted in a compressed form, the letter C followed by a number between 0 and 2 is used to indicate the compression scheme used (C0 = compressed with a user specified algorithm, C1 = one bit, C2 = ARIDPCM). Given as NC if the image is not compressed.
Image Control & Handling (NITF)	S	40	--	Security handling instructions associated with an image.
Image Coordinate System (NITF)	S	1	"G", "N"	Coordinate system of the image where G = geodetic, N = None. While NITF allows other values, P2851 has restricted the range of this field.

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Fieldname	Type	Length	Range	Description
Image Coordinates (NITF)	INT2D	11	0..99999, 0..99999	X and Y location within an image
Image Date & Time (NITF)	S	14	DDHHMMSSZMONYY	Time (Zulu) of acquisition of the image where DD is the day of the month, HH is the hour, MM is the minute, SS is the second, the character Z, MON is the first three characters of the month, and YY is the year.
Image Downgrading Event (NITF)	S	40	--	If the Image Security Downgrade equals "999998" then this field must be present and must specify the event.
Image File Creation Date and Time (NITF)	S	12	YYMMDDHHMMSS	The date and time of day that an SSDB image was created, where YYMMDD = Year, Month and Day, and HHMMSS = Hours (0..24), Minutes and Seconds.
Image Filter Condition Field (NITF)	S	1	"N"	Other values are reserved for future use.

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Fieldname	Type	Length	Range	Description
Image Geographic Location (NITF)	S	91	DDMMSSSSSXb DDDMMSSSSSY (4 times)	Geographic location of the image in geodetic, UTM, or geocentric coordinates. Geodetic coordinates are given as the latitude and longitude of the four corners in clockwise order beginning with the top left corner of the image as it is transmitted, where DDMMSSSSSX represents degrees, minutes, and thousandths of seconds of latitude with X= N or S for north or south, and DDDMMSSSSSY represents degrees, minutes, and thousandths of seconds of longitude with Y = E or W for east or west. For non-geodetic images, these coordinates are expressed in meters. b = blank (" "). Omitted if Image Coordinate System equals None.
Image ID (NITF)	S	10	--	Textual identification of the image; unique across entire GTDB.
Image Location (NITF)	S	10	RRRRRCCCCC	An ordered pair defining the location in cartesian coordinates where the first pixel of the first line of the image is to be located, where RRRRR is the row and CCCCC is the column where the upper left corner of the image is to be located.
Image Magnification (NITF)	S	4	--	The magnification (or reduction) factor of the transmitted image relative to the original source image.

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Fieldname	Type	Length	Range	Description
Image Mode (NITF)	S	1	"S, "I"	Flag indicating band sequential ("S") or band interleaved ("I") transmission format.
Image Quality Comment (NITF)	S	80	--	Free text comment field to include information pertaining to the quality of the image.
Image Quality Rating (NITF)	E	9	EXCELLENT, GOOD, FAIR, POOR	Rating of the quality of the image based on clarity and content of the image
Image Releasing Instructions (NITF)	S	40	--	A list of countries and/or groups of countries to which the data are authorized for release
Image Security Classification (NITF)	S	1	"T", "S","C", "R", "U"	Classification of the image and image sub-header. T = Top Secret, S = Secret, C = Confidential, R = Restricted, U = Unclassified.
Image Security Control Number (NITF)	S	20	--	Security control numbers associated with the image. The format is in accordance with the regulations governing the appropriate security channel(s).
Image Security Downgrade (NITF)	S	6	--	An indicator which designates the point in time at which a declassification or downgrading action is to take place.

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Fieldname	Type	Length	Range	Description
Image Source (NITF)	S	80	--	Description of the source of the image. If the source is classified, then it will be preceded by the classification, including codeword(s).
Image Sync Code (NITF)	I	1	0, 4	A field that indicates whether a synchronization code has been provided for uncompressed or ARIDPCM compressed data.
Image Title (NITF)	S	80	--	Title of the image.
Image-to-Image Contrast Enhancement Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether contrast enhancements have been performed between images.
Image Type (NITF)	S	8	--	The type of image, such as BW for black and white, TV, SAR, XRAY, MS for multispectral, FAX for facsimile, or IR. Multispectral may be further denoted by TM7 for Thematic Mapper band 7.
Inner Image Contrast Enhancement Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether contrast enhancements have been performed within an image.
Internal Material Category	I	4	1..127	Category code for material internal to an object.
Internal Material Volume	R6	12	0.0..1.9342 e+25	Amount of material internal to an object, in liters.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Island Boundary Point Count	I	11	4..2147483647	The number of Boundary Point records used to define the boundaries of an island within the gaming area.
Island Count	I	11	1..2147483647	The number of islands of culture detail defined for a GTDB.
Island Number	I	11	1..2147483647	A sequence number used to uniquely identify an island within a GTDB
Kappa (NITF)	R6	12	0.0..360.0	A rotation angle around the z-axis. A positive angle rotates the x-axis toward the y-axis (expressed in degrees).
Last Maintenance Date and Time (NITF)	S	12	YYMMDDHHMMSS	The last date and time of day that a GTDB image was modified, where YYMMDD = Year, Month and Day, and HHMMSS = Hours (0..24), Minutes and Seconds.
Last Update Date	S	6	YYMMDD	The date of the most recent subarea update to the GTDB. If no updates have occurred, the date is equal to the Compilation Date

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TABLE A-III

Fieldname	Type	Length	Range	Description
Lat/Long NE Corner	I2D	21	-324000000.. 324000000, -648000000.. 648000000	A geographic coordinate defining the northeast corner of a geographic rectangle, such as an areal photo texture map. The coordinate consists of a latitude and a longitude, separated by an ASCII null character. See field definitions for Latitude and Longitude.
Lat/Long NW Corner	I2D	21	-324000000.. 324000000, -648000000.. 648000000	A geographic coordinate defining the northwest corner of a geographic rectangle, such as an areal photo texture map. The coordinate consists of a latitude and a longitude, separated by an ASCII null character. See field definitions for Latitude and Longitude.
Lat/Long SE Corner	I2D	21	-324000000.. 324000000, -648000000.. 648000000	A geographic coordinate defining the southeast corner of a geographic rectangle, such as an areal photo texture map. The coordinate consists of a latitude and a longitude, separated by an ASCII null character. See field definitions for Latitude and Longitude.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Lat/Long SW Corner	I2D	21	-324000000.. 324000000, -648000000.. 648000000	A geographic coordinate defining the southwest corner of a geographic rectangle, such as an areal photo texture map. The coordinate consists of a latitude and a longitude, separated by an ASCII null character. See field definitions for Latitude and Longitude.
Latitude	I	10	+-324000000	Geographic latitude expressed in thousandths of seconds of arc above or below the equator.
Latitude Interval	E	18	ONE_METER, TEN_METERS, THIRTY_METERS, ONE_HUNDRED_METERS	In a TGAB, the nominal latitude interval used to space terrain elevation matrix positions, from a list of valid values. In a TPAB, the interval in the SSDB grid used to generate the terrain polygons.
Latitude/Longitude (NITF)	S	22	HDDMMSSSSSb HDDDMMSSSSS	Actual ground location that is being used for an image control point or a boundary point on an areal texture footprint, where H = hemisphere DD or DDD = degrees and SSSSS = thousandths of seconds, and b = blank (" "). Location is in absolute coordinates.
Latitudinal Origin	R10	16	-90.0..90.0	A user-defined CDBTP parameter indicating the latitudinal origin to be applied during coordinate transformations.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Layer Number (Infrared)	I	11	0..2147483647	A relative priority number indicating the sequence in which overlapping culture features, model polygons, or textures should be rendered for infrared simulation. Higher values indicate higher priority.
Layer Number (Radar)	I	11	0..2147483647	A relative priority number indicating the sequence in which overlapping culture features, model polygons, or textures should be rendered for radar simulation. Higher values indicate higher priority.
Layer Number (Visual)	I	11	0..2147483647	A relative priority number indicating the sequence in which overlapping culture features, model polygons, or textures should be rendered for visual simulation. Higher values indicate higher priority.
Layer Number				Same as Layer Number (Visual).
Left Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring model specific image to the left of the current image.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Length	R10	16	-9.999999999E+99.. 9.999999999E+99	The long dimension of a point feature.
Length of 1st Image (NITF)	I	10	0..1073741824	Length in bytes of the first image. If the image is compressed, the length after compression is given. The value of zero indicates that the length of the first image is not currently known and should be computed from the decompressed sizes given in the image sub-header.
Length of 1st Image Sub-Header (NITF)	I	6	000000..111000	Length in bytes of the sub-header of the first image.
Length of Attribute	I	3	0..80	Indicates the size (number of character positions) of the field used to store the value of an attribute in a FACS Record.
Length of Nth Image (NITF)	I	10	0..1073741824	Length in bytes of the Nth image. If the image is compressed, the length after compression is given. The value of zero indicates that the length of the Nth image is not currently known and should be computed from the decompressed sizes given in the image sub-header. N is the image number.
Length of Nth Image Sub-Header (NITF)	I	6	000000..111000	Length in bytes of the sub-header of the Nth image. N is the image number.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Light Delta (Point Light String Delta)	R3D10	50	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	Distance between lights in a point light string, expressed as a vector using relative coordinates. The coordinates are longitude and latitude, represented in thousandths of seconds when the coordinate system is GEODETIC_FLOAT, and otherwise in meters; and elevation, always represented in meters.
Light Horizontal Center	R10	16	0.0..359.9999999	Angular offset to center of light lobe, in degrees.
Light Horizontal Fall	R10	16	0.0..359.9999999	Angle at which light intensity falls off, in degrees.
Light Horizontal Width	R10	16	0.0..359.9999999	Half angle of lobe width from lobe center, in degrees.
Light Intensity	I	6	0..32767	Candlepower of light.
Light String Shape	E	11	LINEAR, CURVILINEAR	General shape of a point light string.
Light Type	E	11	RUNWAY, APPROACH, VASI, TAXI, BEACONS, STROBES, OBSTRUCTION, CULTURAL, AIRCRAFT, OTHER, NONE	Code indicating functional type for a point light or point light string feature.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Light Vertical Center	R10	16	0.0..359.9999999	Angular offset to center of light lobe, in degrees.
Light Vertical Fall	R10	16	0.0..359.9999999	Angle at which light intensity falls off, in degrees.
Light Vertical Width	R10	16	0.0..359.9999999	Half angle of lobe width from lobe center, in degrees.
Linear Feature Area Block Flag	B	1	T, F	Boolean flag indicating whether a Linear Feature Area Block (LFAB) pseudo-file exists within the given area block.
LL Corner X/Y Image Coordinates (NITF)	I2D	15	-999999..999999, -999999..999999	X/Y cartesian coordinates of the lower left corner of the image.
LOD Resolution Description	S	80	--	Textual description of a model LOD resolution (e.g., in meters, number of polygons, etc.).
Long Lineal	B	1	T, F	Boolean flag indicating whether a point feature may be portrayed as a linear feature when viewed by radar.
Longitude	I	10	-648000000.. 648000000	Geographic longitude expressed in thousandths of seconds of arc on either side of the Prime Meridian.
Longitude Interval	E	18	ONE_METER, TEN_METERS, THIRTY_METERS, ONE_HUNDRED_METERS	The interval of longitude used to space terrain elevation matrix positions in a TGAB. In a TPAB, the interval of the SSDB grid used to generate the terrain polygons.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Longitudinal Origin	R10	16	-9.999999999E+99.. 9.999999999E+99	A user-defined CDBTP parameter indicating the longitudinal origin to be applied during coordinate transformations.
Low Level Effects	B	1	T, F	When true, indicates normalcy to the terrain plate, and therefore is an indication of higher radar backscatter. Default values are generated synthetically by P2851 software as a function of Feature Descriptor Code.
Low Value Field	R	6	0.0..100.0	Percentage.
LR Corner X/Y Image Coordinates (NITF)	I2D	15	-999999..999999, -999999..999999	X/Y cartesian coordinates of the lower right corner of the image.
LUT Entry Data (NITF)	S	7	--	Value within a lookup table for SMC/FDC texture. The NITF limit of 1 byte is extended here for P2851 purposes to 7 bytes. This value uses ASCII alphanumeric characters rather than binary data. The first two characters represent the SMC code (00-15) while the next five characters represent the FDC value.
Match Terrain At SLODS Flag	B	1	T, F	True Value means that terrain polygons from adjacent area blocks in different SLODs merge smoothly by virtue of the fact that the vertices along the shared boundary are identical in both area blocks.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Maximum Areal Feature Polygons	I	11	0..2147483647	The largest number of areal feature polygons occurring in any area block within a SLOD.
Maximum Elevation	I	7	-120000..100000	The highest terrain elevation value contained within a TGAB.
Maximum Linear Feature Segments	I	11	0..2147483647	The largest number of linear feature segments occurring in any area block within a SLOD.
Maximum Model Polygons	I	6	0..32767	The largest number of referenced model polygons occurring in any area block within a SLOD.
Maximum Model References	I	11	0..2147483647	The largest number of model references occurring in any area block within a SLOD.
Maximum Number of Culture Polygons	I	11	0..2147483647	User-defined CDBTP parameter indicating an upper limit on the number of areal feature polygons allowed in a given area block.
Maximum Number of Edges	I	6	0..20000	User-defined CDBTP parameter indicating an upper limit on the number of edges used to define an areal feature polygon.
Maximum Number of Model References	I	11	0..2147483647	User-defined CDBTP parameter indicating an upper limit on the number of model references allowed in a given area block.
Maximum Number of Model Polygon Edges	I	6	0..20000	The maximum number of edges allowed in a model polygon. 0 represents no limit.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Maximum Number of Terrain Polygons	I	11	0..2147483647	User-defined CDBTP parameter indicating an upper limit on the number of terrain polygons allowed in a given area block.
Maximum Point Features	I	11	0..2147483647	The largest number of point features occurring in any area block within a SLOD.
Maximum Point Light Features	I	11	0..2147483647	The largest number of point light features occurring in any area block within a SLOD.
Maximum Point Light Strings	I	11	0..2147483647	The largest number of point light strings occurring in any area block within a SLOD.
Maximum Terrain Polygons	I	11	0..2147483647	The largest number of terrain polygons occurring in any area block within a SLOD.
Maximum Texture References	I	11	0..2147483647	The largest number of texture references occurring in any area block within a SLOD.
Maximum Total Elements	I	11	0..2147483647	The largest number of total data base elements occurring in any area block within a SLOD. Elements counted include areal feature polygons, linear feature segments, point features, point lights, point light strings, model references, model polygons, terrain polygons, and photo texture references.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Mean Square Error Lat/Lon/ Height (NITF)	S, S, R10		DDDMMSSSSS, DDDMMSSSSS, 0.0.. 9.999999999E+99	A measure of accuracy which includes both bias squared and variance. DDD = degrees, MM = minutes, SSSSS = thousandths of seconds, and the REAL10 value is in meters squared.
Mean Square Error Omega/Phi/ Kappa (NITF)	S, S, R10, S		DDDMMSSSSS, DDDMMSSSSS, 0.0.. 9.999999999E+99, DDDMMSSSSS	A measure of accuracy which includes both bias squared and variance; DDD = degrees, MM = minutes, SSSSS = thousandths of seconds, and the REAL10 value is in meters squared.
Measured Image Coordinates (NITF)	R6	12	-1.0..1.0	The position of the fiducial marks as measured by a comparator on a particular photograph (expressed in meters).
Message Classification Authority (NITF)	S	20	--	The identification of the classification authority for the message. The code shall be in accordance with the regulations governing the appropriate security channel(s).
Message Codewords (NITF)	S	40	--	Security compartments associated with the message.
Message Control & Handling (NITF)	S	40	--	Security handling instructions associated with the message.
Message Copy Number (NITF)	I	5	0..99999	Copy number of the message.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Message Date & Time (NITF)	S	14	DDHHMMSSZMONYY	Time (Zulu) of of origination of the message, where DD is the day of the month, HH is the hour, MM is the minute, SS is the second, the character Z, MON is the first three characters of the month, and YY is the year.
Message Downgrading Event (NITF)	S	40	--	If the Message Security Downgrade equals "999998" then this field must be present and must specify the event.
Message Length (NITF)	I	12	0..999999999999	The length in bytes of the entire message including all headers, sub-headers and data.
Message Number of Copies (NITF)	I	5	0..99999	Total number of copies of the message.
Message Part Type (NITF)	S	2	"IM"	Given as "IM" to identify the sub-header as an image sub-header.
Message Releasing Instructions (NITF)	S	40	--	A list of countries and/or groups of countries to which the data are authorized for release.
Message Security Classification (NITF)	S	1	"T", "S", "C", "R", "U"	Classification of the entire message, where T = Top Secret, S = Secret, C = Confidential, R = Restricted, U = Unclassified.
Message Security Control Number (NITF)	S	20	--	Security control number associated with the message.

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Fieldname	Type	Length	Range	Description
Message Security Downgrade (NITF)	S	6	--	An indicator which designates the point in time at which a declassification or downgrading action is to take place.
Message Title (NITF)	S	80	--	Title of message.
Message Type & Version (NITF)	S	9	NITFNN.NN	A character string which indicates this message is using version NN.NN of NITF.
Microdescriptor Type	E	20	HOMOGENEOUS_AREA, DRAINAGE, PATTERN_DISTRIBUTION, TRANSPORTATION, VEGETATION, WEATHER_EFFECTS, SEASONAL_EFFECTS, TIME_OF_DAY, GROUND_CONDITIONS, ALTERNATE_ATTRIBUTES, VERTICALLY_COMPOSITE, TEMPORAL_EFFECTS	Designates the specific micro-descriptor and attribute being described, from a standard list of microdescriptor formats.
Microdescriptor Value(s)	S	80	--	One or more data values associated with a given microdescriptor attribute. When more than one value is required, they will be separated by ASCII null characters.
Minimum Areal Feature Polygons	I	11	0..2147483647	The smallest number of areal feature polygons occurring in any area block within a SLOD.
Minimum Elevation	I	7	-120000..100000	The lowest terrain elevation value contained within a TGAB.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Minimum Linear Feature Segments	I	11	0..2147483647	The smallest number of linear feature segments occurring in any area block within a SLOD.
Minimum Model Polygons	I	6	0..32767	The smallest number of referenced model polygons occurring in any area block within a SLOD.
Minimum Model References	I	11	0..2147483647	The smallest number of model references occurring in any area block within a SLOD.
Minimum Number of Terrain Polygons	I	11	0..2147483647	User-defined CDBTP parameter indicating a lower limit on the number of terrain polygons generated in a given area block.
Minimum Point Features	I	11	0..2147483647	The smallest number of point features occurring in any area block within a SLOD.
Minimum Point Light Features	I	11	0..2147483647	The smallest number of point light features occurring in any area block within a SLOD.
Minimum Point Light Strings	I	11	0..2147483647	The smallest number of point light strings occurring in any area block within a SLOD.
Minimum Terrain Polygons	I	11	0..2147483647	The smallest number of terrain polygons occurring in any area block within a SLOD.
Minimum Texture References	I	11	0..2147483647	The smallest number of texture references occurring in any area block within a SLOD.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Minimum Total Elements	I	11	0..2147483647	The smallest number of total data base elements occurring in any area block within a SLOD. Elements counted include areal feature polygons, linear feature segments, point features, point lights, point light strings, model references, model polygons, terrain polygons, and photo texture references.
Mirror	B, B, B, B	7	T, F; T, F; T, F; T, F	Flag indicating whether a texture map can be mirrored along the left, right, top, and bottom edges.
Model Description	S	80	--	Description of a model.
Model Library Type (NITF, non-NITF)	E	15	TWO_D_STATIC, THREE_D_STATIC, THREE_D_DYNAMIC	Distinguishes among the three types of P2851 model libraries -- 2-D Static, 3-D Static, and 3-D Dynamic.
Model List Count	I	11	0..2147483647	The number of models specifically requested by the user for inclusion in the GTDB.
Model LOD	E	5	LOD_0, LOD_1, LOD_2, LOD_3, LOD_4, LOD_5, LOD_6, LOD_7, LOD_8	Designates the level of detail category for a given version of a given model.
Model Name (NITF, non-NITF)	S	65	--	A descriptive textual name for a model.
Model Number (Non-NITF)	I	11	1..99999	A number which uniquely identifies a model within a P2851 model library.
Model Number (NITF)	I	10	1..99999	A number which uniquely identifies a model within a P2851 model library.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Model Reference Area Block Flag	B	1	T, F	Boolean flag indicating whether a Model Reference Area Block (MRAB) pseudo-file exists within the given area block.
Model Reference Number	I	11	0..2147483647	The Model Number of a model referenced by a terrain polygon.
Model Reference Point	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	The location of a point on a 2D model that is used to reference model-based texture application; corresponds to the texture origin.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	The location of a point on a 3D model that is used to reference model-based texture application; corresponds to the texture origin.
Model Tie Point ID (NITF)	I	10	0..2147483647	A unique identifier of a model tie point.
Model View Description (NITF)	S	60	--	Textual description of the view of a model presented within an image, i.e., "Right Side of Truck".
Model-Based Mapping Flag	B	1	T, F	Parameter indicating the existence of model-based mapping parameters for texture.
Modified Specific Texture Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether a specific texture has been modified with synthetic data.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Monitor Type	E	12	NO_MONITOR, LONGITUDINAL, TRANSVERSE, MODIFIED	Describes raised portion of roof.
NITF Header Length (NITF)	I	6	000000..276380	The length in bytes of the NITF header.
Noise Removal Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether noise removal operations have been performed on the image.
Normal List Position	I	11	1..2147483647	An index into a coordinate list, identifying a vector used as a normal to a polygon or vertex.
North Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring areal specific image to the north.
Number of Area Blocks	I	11	1..2147483647	The number of area blocks within a SLOD.
Number of Areal Feature Polygons	I	11	0..2147483647	The number of areal feature polygons occurring within an area block.
Number of Audio Segments (NITF)	I	3	000	Not currently supported within NITF, therefore, this value is always 0.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Number of Bands (NITF)	I	1	1..9	The number of bands of image data in the message. Used for color imagery, pseudocolor or multispectral images. The sequence of bands shall be determined by examining the Band Image Type Field. For single band images, the Number of Bands shall be 1.
Number of Bits Per Pixel Per Band (NITF)	I	2	01..64	The number of data bits for each texel for each band in the image before compression. For multi-band images treated as a single image, the number of bits per texel is identical for each band. Standard values include 1, 8, and 16 for intensity, color, or other multispectral textures; 56 for SMC/FDC textures, and 16 or 24 for terrain. Same as Bits Per Texel Per Band for non-NITF data.
Number of Blocks Per Column (NITF)	I	4	1..9999	The number of image blocks in a column in the vertical direction. (P2851 has relaxed the NITF restriction of one block per column).
Number of Blocks Per Row (NITF)	I	4	1..9999	The number of image blocks in a row or line in the horizontal direction. (P2851 has relaxed the NITF restriction of one block per row).
Number of Boundaries (NITF)	I	5	0..32767	The total number of outlines required to specify the coverage or "footprint" of the area being transmitted.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Number of Boundary Points (NITF)	I	5	0..32767	The total number of coordinates that define an outline around an area of data that is being transmitted.
Number of Collision Test Points	I	4	0..255	The number of collision test point vertices defined for a given model.
Number of Color References	I	11	1..2147483647	The number of occurrences of a given color within a given unit of the data base.
Number of Component Texture Reference Pointers	I	6	0..65535	Number of textures referenced by a model component at the component level.
Number of Components	I	6	0..1000	Number of components in a model.
Number of Control Points (NITF)	I	5	0..32767	The total number of control points.
Number of Culture Color Tables	I	11	0..2147483647	The number of Culture Color Table records associated with a model library, SLOD, or area block. Each record contains a single entry in a distribution table of colors used in models and features.
Number of Culture References	I	11	0..2147483647	The number of culture features lying on a given terrain polygon.
Number of Culture Vertices	I	11	0..2147483647	The number of coordinate vertices used to define culture features within a given area block.

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Fieldname	Type	Length	Range	Description
Number of Data Files	I	6	2..32767	The number of data files used for a given texture. All Stage 1 textures have 2 or more data files; all other textures have exactly two data files: the NITF Image Sub-Header File and the NITF Image Data File.
Number of Data Source Table Entries (NITF)	I	4	0..1000	Number of data sources in a data source table.
Number of Delete-List Entries	I	11	0..2147483647	The number of Delete-List records associated with a SLOD. Each record contains a user-defined range of feature FDCs which should be omitted from the GTDB.
Number of Face-Based Texture References	I	11	0..2147483647	The number of texture references using the face-based texture mapping method. Used by models and areal features in area blocks.
Number of FACS	I	4	0..255	The number of FACS records associated with a given feature.
Number of FACS Table Entries	I	11	0..2147483647	Number of entries in a FACS table.
Number of Feature Distribution Tables	I	11	0..2147483647	The number of Feature Distribution Table records associated with a SLOD or area block. Each record contains a single entry in a distribution table of Feature Descriptor Codes.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Number of Feature Occurrences	I	11	0..2147483647	The number of occurrences of features with a given Feature Descriptor Code within a given unit of the GTDB.
Number of Features	I	11	0..2147483647	The number of features of a given type occurring in a given area block.
Number of Fiducial Coordinates (NITF)	I	5	0..32767	Total number of fiducial coordinates associated with an image.
Number of Fragments	I	11	0..2147483647	The number of features of a given type occurring in a given area block, after features have been fragmented along underlying terrain boundaries. Each fragment is counted individually.
Number of Generic Texture Sets (NITF)	I	10	0..2147483647	The total number of generic texture sets in a texture transmittal, where a generic texture set is a set of generic textures that represent the same entity, and each member of the set has a different size and/or resolution.
Number of Generic Textures in Set (NITF)	I	10	0..2147483647	The number of generic textures included within a generic texture set.
Number of Geographic Tie Points (NITF)	I	10	0..2147483647	The total number of tie points for an areal texture map.

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Fieldname	Type	Length	Range	Description
Number of Global-Based Texture References	I	11	0..2147483647	The number of texture references using the global-based texture mapping method. Used by areal features in area blocks.
Number of Horizontal Blocks Field	I	11	0..2147483647	The number of horizontal blocks in a texture.
Number of Image Comments (NITF)	I	1	0..9	The number of free form image comments.
Number of Images (NITF)	I	3	000..999	The number of separate images included in the message.
Number of Keep-List Entries	I	11	0..2147483647	The number of Keep-List records associated with a SLOD. Each record contains a user-defined range of feature FDCs which must be included in the GTDB.
Number of Labels (NITF)	I	3	000..999	The number of separate labels included in the message.
Number of Layers Above Terrain Polygon	I	11	0..2147483647	The maximum number of layers of overlapping culture features over a given terrain polygon.
Number of Level-List Entries	I	11	0..2147483647	The number of Level-List records associated with a SLOD. Each record contains a user-defined range of feature FDCs under which the terrain must be level in the GTDB.

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Fieldname	Type	Length	Range	Description
Number of Light Color Tables	I	11	0..2147483647	The number of Light Color Table records associated with a model library, SLOD, or area block. Each record contains a single entry in a distribution table of colors used in point light features.
Number of Lights	I	4	1..255	The number of individual lights in a point light string.
Number of Linear Feature Segments	I	11	0..2147483647	The number of linear feature line segments occurring within an area block.
Number of LOD Texture Reference Pointers	I	6	0..65535	Number of textures referenced by a model LOD at the LOD level.
Number of LODs	I	2	1..9	The number of versions of a given model in a model library, where the different versions represent different levels of detail.
Number of LUT Entries (NITF)	I	5	00001..65536	The number of entries in each of the look-up tables for a band of an image.
Number of LUTs (NITF)	I	1	0..4	The number of look-up tables used in displaying a band of an image.
Number of Mapped Texture Reference Pointers	I	11	0..2147483647	The number of texture references associated with a cultural areal feature for texture that has been mapped to that feature.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Number of Microdescriptors	I	4	0..255	The number of microdescriptor records associated with a given feature, model, or model polygon.
Number of Model-Based Texture References	I	11	0..2147483647	The number of texture references using the model-based texture mapping method. Used by models.
Number of Model FACS	I	4	0..255	The number of Model FACS records associated with a given model.
Number of Model LODs	I	2	1..9	The number of versions of a given model available in the model library, where each version represents a different level of detail.
Number of Model References	I	11	0..2147483647	The number of model reference records occurring within an area block.
Number of Model Tie Points (NITF)	I	10	0..2147483647	The total number of tie points for a model texture map.
Number of Models	I	11	0..2147483647	The number of models, not counting different LODs of the models, in a model library.
Number of Models in Image (NITF)	I	3	0..999	The number of models that are represented in some manner within an image.
Number of Non-Mapped Texture References	I	11	0..2147483647	The number of texture references associated with a culture feature or a model LOD for texture that has not been mapped.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Number of Non-Static Presentations (NITF)	I	3	000	The number of non-static presentation information files included in the message.
Number of Occurrences	I	11	0..2147483647	The number of occurrences of a given data condition within a given unit of the GTDB.
Number of Pixels Per Block Horizontal (NITF)	I	5	00001..99999	The number of pixels horizontally in each block.
Number of Pixels Per Block Vertical (NITF)	I	5	00001..99999	The number of pixels vertically in each block.
Number of Point Features	I	11	0..2147483647	The number of point features occurring within an area block.
Number of Point Light Features	I	11	0..2147483647	The number of point light features occurring within an area block.
Number of Point Light Strings	I	11	0..2147483647	The number of point light strings occurring within an area block.
Number of Polygon FACS	I	4	0..255	The number of Polygon FACS records associated with a given polygon within a given model.
Number of Polygon Texture Reference Pointers	I	6	0..65535	Number of textures referenced by a polygon in a model.
Number of Polygons	I	6	0..32767	The number of polygons making up a given LOD of a given model.
Number of Sensors (NITF)	I	3	0..127	Number of sensors used to form a composite processed image.

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Fieldname	Type	Length	Range	Description
Number of Separation Planes	I	6	0..32767	The number of Separation Plane records associated with a given model.
Number of SLODs	I	11	1..2147483647	The number of Simulator Levels of Detail defined for terrain and culture data within the GTDB. This is a user-defined value.
Number of SMC Distribution Tables	I	11	0..2147483647	The number of SMC Distribution Table records associated with a SLOD or area block. Each record contains a single entry in a distribution table of Surface Material Categories.
Number of Stage 1 Specific Textures	I	11	0..2147483647	The total number of Stage 1 Specific Texture maps included within a GTDB database.
Number of Stage 1 Texture File Associations	I	11	0..2147483647	The total number of Stage 1 Texture files (originating from another source) where the file name from the original source has been associated with a new GTDB file name included within a GTDB database. Every Stage 1 original source data file shall have such an association.
Number of Stage 2 Specific Textures	I	11	0..2147483647	The total number of Stage 2 Specific Texture maps included within a GTDB database.
Number of Stage 3 Generic Textures	I	11	0..2147483647	The total number of Stage 3 Generic Texture maps included within a GTDB database.

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Fieldname	Type	Length	Range	Description
Number of Stage 3 SMC/FDC Textures	I	11	0..2147483647	The total number of Stage 3 SMC/FDC Texture maps included within a GTDB database.
Number of Stage 3 Specific Textures	I	11	0..2147483647	The total number of Stage 3 Specific Texture maps included within a GTDB database.
Number of Stage 4 Generic Textures	I	11	0..2147483647	The total number of Stage 4 Generic Texture maps included within a GTDB database.
Number of Stage 4 SMC/FDC Textures	I	11	0..2147483647	The total number of Stage 4 SMC/FDC Texture maps included within a GTDB database.
Number of Stage 4 Specific Textures	I	11	0..2147483647	The total number of Stage 4 Specific Texture maps included within a GTDB database.
Number of Stage 5 Generic Textures	I	11	0..2147483647	The total number of Stage 5 Generic Texture maps included within a GTDB database.
Number of Stage 5 SMC/FDC Textures	I	11	0..2147483647	The total number of Stage 5 SMC/FDC Texture maps included within a GTDB database.
Number of Stage 5 Specific Textures	I	11	0..2147483647	The total number of Stage 5 Specific Texture maps included within a GTDB database.
Number of Stereo Mates (NITF)	I	3	0..127	Number of images that overlap a given image.

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Fieldname	Type	Length	Range	Description
Number of Structures	I	11	0..2147483647	Approximate number of structures per square kilometer contained within an areal feature. Synthetic default values are generated for non-DMA data by P2851 software as a random function of Feature Descriptor Code.
Number of Subsidiary Model References	I	11	0..2147483647	The number of Subsidiary Model Reference records associated with a given model.
Number of Symbols (NITF)	I	3	000..999	The number of separate symbols included in the message.
Number of Terrain Polygons	I	11	0..2147483647	The number of terrain polygons generated within an area block.
Number of Text Files (NITF)	I	3	000..999	The number of separate text files that are included in the message.
Number of Texture Images in Library	I	11	0..2147483647	The number of photo texture image maps within a photo texture library.
Number of Texture Pattern Coordinates	I	6	0..65535	Total number of coordinates associated with an image used to warp the image onto a model using vertex to vertex mapping techniques.
Number of Texture References	I	11	0..2147483647	Number of entries in a texture reference table. Also, the number of textures associated with a model polygon or a culture feature; the number of texture references for all features within an area block.

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Fieldname	Type	Length	Range	Description
Number of Tie Point References (NITF)	I	10	0..2147483647	The number of texture maps that share a specific tie point.
Number of Vertex-to-Vertex Texture References	I	6	0..32767	The number of texture references using the vertex-to-vertex texture mapping method. Used by model polygons and terrain polygons.
Number of Vertical Blocks Field	I	11	0..2147483647	The number of vertical blocks in a texture.
Number of Vertices	I	11	0..2147483647	The number of unique coordinates defined to represent culture and polygonized terrain within an area block.
Number of Vertices (Model Polygon Record)	I	6	0..65534	The number of unique coordinates defined to represent a model polygon.
Number of Z-Density Distribution Tables	I	11	0..2147483647	The number of Z-Density Distribution Table records associated with a SLOD. Each record contains a single entry in a distribution table of levels of culture layering.
Object Or Material Texture Flag (NITF)	E	8	OBJECT, MATERIAL	Flag indicating whether a generic texture is applied to a certain object or if it is representative of a material (e.g., generic texture for a certain tree or a road would be classified as OBJECT; texture for tree bark or asphalt would be classified as MATERIAL).

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Fieldname	Type	Length	Range	Description
Object Volume	R6	12	0.0..1.9342 e+25	The internal volume of an object, in liters.
Occlusion Removal Flag (NITF)	B	5	TRUE, FALSE	A flag indicating whether occluding objects have been removed from an image.
Offset Vector	R3D10	50	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	The coordinates defining the position of a model within an area block. The name of this field is somewhat misleading, as the location is expressed in absolute rather than relative coordinates. The coordinates are longitude and latitude, represented in thousandths of seconds when the coordinate system is GEODETIC_FLOAT, and in meters otherwise; and elevation, always represented in meters.
Omega (NITF)	R6	12	0.0..360.0	A rotation angle around the x-axis. A positive angle rotates the y-axis toward the z-axis (expressed in degrees).
Orientation	R10	16	0.0..359.9999999	Orientation of a feature relative to north, in degrees. Synthetic default values are generated by P2851 software using a random function.
Orientation Angle	R10	16	0.0..359.9999999	Orientation of a model reference relative to north, in degrees.

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Fieldname	Type	Length	Range	Description
Orientation Vectors	R2D10, R2D10	67	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99; -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	For 2D models or 2D culture, two vectors aligning the x and the y axes of a texture to be mapped with 2D model space or world space; used for mapping onto a model using model-based texturing or onto culture using global-based texturing.
	R3D10, R3D10	101	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99; -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	For 3D models, 3D culture, or 3D terrain polygons, two vectors aligning the x and the y axes of a texture to be mapped with 3D model space or world space; used for mapping onto a model using model-based texturing or onto terrain/culture using global-based texturing.
Origin of Eastings	R10	16	-9.999999999E+99.. 9.999999999E+99	A user-defined CDBTP parameter indicating the origin of eastings to be applied during coordinate transformations.
Origin of Northings	R10	16	-9.999999999E+99.. 9.999999999E+99	A user-defined CDBTP parameter indicating the origin of northings to be applied during coordinate transformations.
Original File Name	S	80	--	The original source's data file name for an image file stored on a GTDB tape as texture.

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Fieldname	Type	Length	Range	Description
Originating Station ID (NITF)	S	10	--	Identification code of the originating system (terrain or texture).
Originator's Name (NITF)	S	27	--	Name of the operator who originated the message.
Originator's Phone Number (NITF)	S	18	--	Phone number of the operator who originated the message.
P2851 GTDB Catalog ID	S	7	Gnnnnnn	The unique identifier of a GTDB within the P2851 system. The letter G is followed by a 6-digit sequence number.
Percent of Cloud Cover (NITF)	I	3	0..100	Percentage of the image which is covered by clouds.
Percent of Roof Coverage	R6	12	0.0..100.0	Percentage of the surface of an areal feature consisting of roofs. Synthetic default values are generated by P2851 software as a random function of Feature Descriptor Code.
Percent of Shadow Cover (NITF)	I	3	0..100	Percentage of the image which is covered by shadows.
Percent of Specific Texture (NITF)	I	3	0..100	Percentage of an image that is specific to the geographic location that it is being placed at.
Percent of Texture in Tile (NITF)	I	3	0..100	Percentage of a Stage 3 texture tile that has been filled with actual texture (i.e., some void areas may exist within a texture tile.

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Fieldname	Type	Length	Range	Description
Percent of Tree Coverage	R6	12	0.0..100.0	Percentage of the surface of an areal feature consisting of trees. Synthetic default values are generated by P2851 software as a random function of Feature Descriptor Code.
Percentage of Texture Coverage	R6	12	0.0..100.0	The percentage of texture covering a model LOD.
Phi (NITF)	R6	12	0.0..360.0	A rotation angle around the y-axis. A positive angle rotates the z-axis toward the x-axis (expressed in degrees).
Placement Point	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	Point on a 2D model used for easy placement of the model.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	Point on a 3D model used for easy placement of the model.
Point Feature Area Block Flag	B	1	T, F	Boolean flag indicating whether a Point Feature Area Block (PFAB) pseudo-file exists within the given area block.

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Fieldname	Type	Length	Range	Description
Point Light Feature Area Flag	B	1	T, F	Boolean flag indicating whether a Block Point Light Feature Area Block (PLFAB) pseudo-file exists within the given area block.
Point Light String Feature Block Flag	B	1	T, F	Boolean flag indicating whether a Area Point Light String Feature Area Block (PLSFAB) pseudo-file exists within the given area block.
Polygon Alignment Vector	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	Vector lying on the plane of the polygon and aligned in the direction of the x-axis of the texture map before the Rotation About Texture Origin value is applied; dimension is determined by the dimension of the polygon.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	
Polygon ID	I	11	1..2147483647	Unique identifying number assigned to each polygon in a model.
Polygon Illumination Type	E	19	SELF_LUMINOUS, SUN_ILLUMINATION, NO_SUN_ILLUMINATION	Indicates how to calculate illumination effects for a feature or model polygon. Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.
Polygon Landing Light Illumination	B	1	T, F	Indicates whether a model polygon are illuminated by landing lights.

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Fieldname	Type	Length	Range	Description
Polygon Long Dimension	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A coordinate representing the vector giving the longest distance between polygon vertices.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	
Polygon Non-Occulting	B	1	T, F	When true, indicates that the color of a model polygon is additive with the background.
Polygon Non-Shadow	I	6	0..32767	The amount of shadow a model polygon presents when illuminated or irradiated.
Polygon Normal	R3D10	50	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	A coordinate representing the vector perpendicular to the surface of a terrain or culture polygon.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A coordinate representing the vector perpendicular to the surface of a model polygon.

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Fieldname	Type	Length	Range	Description
Polygon Reference Point	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A point on a 2D model polygon which corresponds to the origin of the texture being mapped.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A point on a 3D model polygon which corresponds to the origin of the texture being mapped.
	R2D10	33	-9.999999999E+99.. 9.999999999E+99, -9.999999999E+99.. 9.999999999E+99	A point on a 2D or 3D culture polygon or a 3D terrain polygon which corresponds to the origin of the texture being mapped. The point is given in relative longitude/ latitude coordinates, represented in thousandths of seconds when the coordinate system is GEODETIC_FLOAT, and in meters otherwise.
Polygon Short Dimension	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A coordinate representing the vector giving the shortest distance between polygon vertices.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	

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Fieldname	Type	Length	Range	Description
Position	R2D6	25	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A coordinate representing the position of a light in a point light string in a model.
	R3D6	38	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	
Positional Accuracy Standards (NITF)	S	80	--	Description of standard used in positioning texture on geographic areas or models.
Predominant Height	R10	16	-9.999999999E+99.. 9.999999999E+99	Height of a feature above the terrain surface, at its longest vertical axis. Synthetic default values are generated by P2851 software as a random function of Feature Descriptor Code. (meters)
Processing Stage (NITF, non-NITF)	E	3	I, II, III, IV, V	Level of processing performed on a texture. (Stage I = original, raw image with control points and sensor information, if available; Stage II = image with noise removal, contrast enhancement, occlusion removal; Stage III = geometrically corrected, mosaicked textures; Stage IV = Stage III texture in projection other than geodetic (areal) or local cartesian (model); Stage V = Stage III or IV texture mapped onto polygons.)

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Fieldname	Type	Length	Range	Description
Radius	R10	16	0.0.. 9.999999999E+99	Radius of curvature for a point light string; also, the radius of a circumscribing circle for a feature, model, or model polygon. (meters)
Rectification (NITF)	S	20	"RECTIFIED", "EPIPOLAR", "NONE", etc.	Definition of the type of rectification process used on an image.
Referenced Model Library Type	E	15	TWO_D_STATIC, THREE_D_STATIC, THREE_D_DYNAMIC	The model library that a referenced model belongs to.
Referenced Model LOD	E	5	LOD_0, LOD_1, LOD_2, LOD_3, LOD_4, LOD_5, LOD_6, LOD_7, LOD_8	The LOD of a model being referenced as a subsidiary model by another model.
Referenced Model Number	I	11	1..99999	The ID number of a model being referenced as a subsidiary model by another model.
Referencing Model LOD	E	5	LOD_0, LOD_1, LOD_2, LOD_3, LOD_4, LOD_5, LOD_6, LOD_7, LOD_8	The LOD of a model that is referencing another model as a subsidiary model.
Referencing Model Number	I	11	1..99999	The ID number of a model that is referencing another model as a subsidiary model.
Reflectance	R6	12	0.0..1.0	Ratio of radiant energy reflected by a feature or model, to the energy incident upon it. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.

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Fieldname	Type	Length	Range	Description
Relative Coordinates (NITF)	R3D6		-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	Model coordinates (x,y,z) used as control points or texture footprint boundary points for tying a texture to a model; each coordinate corresponds to an Image Coordinate; if the model is 2D, then z = 0.0.
Relative Latitude	I	11	-324000000.. 324000000	Geographic latitude expressed in thousandths of seconds of arc relative to a reference latitude.
Relative Longitude	I	11	-648000000.. 648000000	Geographic longitude expressed in thousandths of seconds of arc relative to a reference longitude.
Reliability of Data (NITF)	I	3	0..100	The degree of reliability of the data.
Right Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring model specific image to the right of the current image.
Roof Type	E	8	FLAT, SHED, DECK, GABLE, HIPPED, GAMBREL, MANSARD, SAWTOOTH, CURVED, CONICAL, NONE	Indicates shape of roof.

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Fieldname	Type	Length	Range	Description
Rotation	R3D6	38	0.0..360.0, 0.0..360.0, 0.0..360.0	A set of vectors indicating how a model should be rotated in 3-D space when placed on a specific model reference location. The internal format of this field varies with the user-specified coordinate system for the GTDB.
Rotation About Texture Origin	R6	12	0.0..360.0	Rotation angle of a texture when applying it to a polygon; rotation is applied after the texture has been placed on the polygon using the other mapping parameters.
Rotation Angles	R3D6	38	0.0..360.0, 0.0..360.0, 0.0..360.0	Rotation angles about a subsidiary model's x, y, and z axes in its local coordinate system (right-handed).
Row Count	I	7	1..108000	The number of latitude "rows" of terrain elevation values contained within a Terrain Column record or a TGAB.
Scale Factor	R10	16	0.0.. 9.999999999E+99	A user-defined CDBTP parameter indicating the scale factor to be applied during coordinate transformations.
Scale Factor (Model References)	R3D10	50	0.0.. 9.999999999E+99, 0.0.. 9.999999999E+99, 0.0.. 9.999999999E+99	A set of three scale factors to be applied to the three axes of a model for a given instance of that model.

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Fieldname	Type	Length	Range	Description
Scale Factor (Subsidiary Model Reference)	R2D6	25	0.0..1.93428E+25, 0.0..1.93428E+25	A set of 2 for 2-D, or 3 for 3-D scale factors to be applied to the axes of a subsidiary model for a given instance of that subsidiary model.
	R3D6	38	0.0..1.93428E+25, 0.0..1.93428E+25, 0.0..1.93428E+25	
Scanner Filter ID (NITF)	E	5	MONO, RED, GREEN, BLUE	Filter used when scanning a hardcopy image.
Scanner ID (NITF)	S	20	--	Identifier or name of the device used to scan an image.
Scanner Resolution (NITF)	S	10	--	The distance which is represented by a pixel in image space dimensions. The range is 0.1 micron to 1 mm in image dimensions.
Second Standard Parallel	R10	16	-90.0..90.0	A user-defined CDBTP parameter indicating a second standard parallel to be applied during projection transformations.
Security Level	S	2	--	The security classification for the GTDB or a file within the GTDB.
Self-Emitter	B	1	T, F	Flag indicating whether a feature or model polygon has self-heating characteristics. Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.

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Fieldname	Type	Length	Range	Description
Semi-Major Axis	R10	16	-9.999999999E+99.. 9.999999999E+99	A user-defined CDBTP parameter indicating the semi-major axis to be employed during projection transformations.
Sensor ID (NITF)	I	10	0..2147483647	A unique identifier of a sensor within a GTDB texture transmittal.
Sensor Name (NITF)	S	20	--	Name of the sensor used to capture the image, e.g., "LANDSAT-2 RBV" or "MINOLTA 7S-II".
Sensor Type (NITF)	E	18	FRAME, MECHANICAL_SCANNER, PANORAMIC, PUSHBROOM, STRIP, OTHER	Type of sensor used to capture the image (e.g., any ordinary camera or a metric camera would be FRAME, SPOT satellite would be PUSHBROOM, and LANDSAT satellite would be MECHANICAL_SCANNER).
Sensor Types Supported	B, B, B	5	T, F; T, F; T, F	A set of three Boolean flags indicating whether a model or a FACS attribute can be used for specific sensor simulations. The flags are given in the order (radar, visual, infrared), and are separated by ASCII nulls.
Sensors Supported	B, B, B	5	T, F; T, F; T, F	Same as Sensor Types Supported.

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Fieldname	Type	Length	Range	Description
Separation Plane Coefficients	R4D6	51	-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	The A, B, C, and D coefficients of the separating plane equations of the form Ax+By+Cz+D=0. Each coefficient is a 12-character Real number, separated from the other coefficients by an ASCII null.
Separation Plane Number	I	6	1..32767	The unique identifying number of a separation plane within a model.
Separation Planes Flag	B	1	T, F	A user-defined CDBTP parameter indicating whether separation planes are to be included with the models.
Shading Type	E	6	FIXED, FLAT, SMOOTH	Indicates type of shading to be used when rendering a polygon.
Shadow Minimization Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether operations to minimize the effects of shadows within an image have been performed.
Shape Code (Point Light String)	E	26	CYLINDER, RECTANGULAR_ PARALLELEPIPED, SPHERE_ HEMISPHERE, PYRAMID, CONE, OTHER	General 3-D shape of a feature.
Shape Code (Terrain Polygon Record)	E	8	TRIANGLE	Shape of terrain polygon.

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Fieldname	Type	Length	Range	Description
SLOD Count	I	3	1..16	The number of Simulator Levels of Detail defined for the GTDB.
SLOD ID	I	3	0..16	The unique identifying number for a Simulator Level of Detail (SLOD) within a GTDB.
SMC/FDC Look Up Table Existence Flag	B	1	T, F	Parameter flag indicating the existence of a look up table for the values in SMC/FDC textures. When this flag is true, SMC/FDC textures file shall contain pointers into a look up table.
SMC/FDC Texture Existence Flag	B	1	T, F	The flag indicating the existence of SMC/FDC texture within an area block.
SMC/FDC Texture Resolution	R6	12	0.0..1.93428e+25	Approximate resolution of SMC/FDC texture in units of Meters/texel.
Source Agency/Project (NITF)	S	16	--	Name of the agency or project that created the digital source, e.g., "SOFATS", "P2851", etc.
Source Date (NITF)	S	6	YYMMDD	Date the digital source was created, where YY = Year, MM = Month, DD = Day.
Source ID (NITF)	I	10	0..2147483647	Unique identifier of an entry in the data source table.
Source ID Number	I	6	0..32767	The unique identifying number of a data source used to populate the SSDB.
Source Name (NITF)	S	20	--	Name of the original source, e.g., "EOSAT", "General Electric", etc.

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Fieldname	Type	Length	Range	Description
Source Simulator	S	4	--	Identifies the particular simulator for which a model was created, if not generic.
Source Type (NITF)	E	1	H, S	Flag indicating hardcopy ("H") or softcopy ("S") source.
South Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring areal specific image to the south.
Special Environmental Conditions (NITF)	S	80	--	Textual description about any special conditions associated with an image.
Special Environmental Conditions Preference	S	80	--	Textual description about any preference for special conditions associated with an image.
Specific or Generic Texture Flag (NITF, non-NITF)	E	16	SPECIFIC_TEXTURE, GENERIC_TEXTURE	Flag indicating whether a texture is specific (derived from actual photo or satellite image) or generic (synthetic)
Specular	B	1	T, F	Flag indicating whether a feature or model polygon has the quality of being mirror-like. Synthetic default values are generated by P2851 software as a function of Feature Descriptor Code.
SSDB Culture LOD	E	5	LOD_0, LOD_1, LOD_2, LOD_3, LOD_4, LOD_5	The culture Level of Detail in the SSDB from which the GTDB culture is to be extracted.
Stage 1 Specific Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 1 Specific Textures in a GTDB database.

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Fieldname	Type	Length	Range	Description
Stage 2 Specific Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 2 Specific Textures in a GTDB database.
Stage 3 Generic Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 3 Generic Textures in a GTDB database.
Stage 3 SMC/FDC Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 3 SMC/FDC Textures in a GTDB database.
Stage 3 Specific Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 3 Specific Textures in a GTDB database.
Stage 4 Generic Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 4 Generic Textures in a GTDB database.
Stage 4 SMC/FDC Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 4 SMC/FDC Textures in a GTDB database.
Stage 4 Specific Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 4 Specific Textures in a GTDB database.
Stage 5 Generic Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 5 Generic Textures in a GTDB database.
Stage 5 SMC/FDC Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 5 SMC/FDC Textures in a GTDB database.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Stage 5 Specific Textures Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for all Stage 5 Specific Textures in a GTDB database.
Standard Image Filter Code n (NITF)	S	3	--	This field is reserved for future use.
Starting FDC Code	S	5	--	The Feature Descriptor Code used to define the beginning of a range of FDCs within various parameters of the CDBTP.
Storage Size	R10	16	0.. 9.999999999E+99	The total number of bytes for a single texture file.
Sun Azimuth (NITF)	R6	12	0.0..360.0	The clockwise angle measured in the horizontal plane, at the observer, between due north and the vertical projection of the center of the sun onto the horizon (expressed in degrees).
Sun Elevation (NITF)	R6	12	-90.0..90.0	The angle measured in a vertical plane, at the observer, between the horizon and the center of the sun, where negative values are below the horizon (expressed in degrees).
Superfeature Number	I	11	0..2147483647	The Feature Number of the original feature of which the current feature was a part prior to fragmentation.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Surface Material Category	I	4	1..14	Categorization of features based on the predominant material(s) making up the surface of the feature. Codes as defined by DMA in its DLMS Product Specification, Second Edition.
Surface Material Subtype	I	4	0..255	Codes available to further refine the Surface Material Category into subtypes.
Synthetic Culture Flag	B	1	T, F	User-defined CDBTP parameter indicating whether SSDB culture features marked as synthetic should be included in the GTDB.
Synthetic Data Flag (Features)	E	15	SYNTHETIC, REAL, EXPANDED_LINEAR	Flag indicating whether and what types of SSDB culture features marked as synthetic have been included within the given area block.
Synthetic Data Flag (FACS Attribute Record)	B	1	T, F	Flag indicating whether the FACS record consists of synthetic data.
Synthetic Data Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether the image source consists of synthetic data.
System Type (NITF)	S	6	--	Reserved for future use.
Tangent Point Height	R10	16	-9.999999999E+99.. 9.999999999E+99	A user-defined CDBTP parameter indicating the tangent point height to be applied during projection transformations.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Tape ID	S	10	--	A GTDB tape identifier used by P2851 software for archival configuration management. This ID does not refer to the tape on which a GTDB is distributed.
Tape Option	E	12	EVERYTHING, UPDATES_ONLY	Indication of whether the GTDB tape contains all area blocks of just those updated or added since the previous GTDB version.
Target ID (NITF)	S	17	BBBBBBBBBBFFFFFCC	The identification of the target, consisting of 10 characters of Basic Encyclopedia (BE), 5 characters of functional category code, and the 2 character country code as specified by FIPS-PUB 10-3.
Terrain Grid Area Block Flag	B	1	T, F	Boolean flag indicating whether a Terrain Grid Area Block (TGAB) pseudo-file exists within the given area block.
Terrain Grid Flag	B	1	T, F	User-defined CDBTP parameter indicating whether gridded terrain is desired in this GTDB.
Terrain Grid Source Flag	I	2	0..2	User-defined CDBTP parameter indicating whether the elevation values in the TGAB should be derived from the SSDB or from the terrain polygons in a TPAB being concurrently generated by the CDBTP. (0 = SSDB; 1 = GTDB 1; 2 = GTDB 2)

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TABLE A-III

Fieldname	Type	Length	Range	Description
Terrain Grid Source SLOD	I	3	0..16	User-defined CDBTP parameter indicating, when the Terrain Grid Source Flag is set to > 0, from which SLOD the terrain polygons should be used to generate the terrain grid.
Terrain LOD	E	5	LOD_0, LOD_1, LOD_2, LOD_3, LOD_4	User-defined CDBTP parameter indicating which terrain LOD of the SSDB should be used as the terrain data source for a given area block.
Terrain Polygon Area Block Flag	B	1	T, F	Boolean flag indicating whether a Terrain Polygon Area Block (TPAB) pseudo-file exists within the given area block.
Terrain Polygon ID	I	11	1..2147483647	The unique identifying number for a terrain polygon within an area block.
Terrain Polygon Overlap Flag	B	1	T, F	A flag set to indicate that a model overlaps a terrain polygon boundary.
Terrain Polygons Flag	B	1	T, F	User-defined CDBTP parameter indicating whether polygonized terrain is desired in this GTDB.
Terrain Roughness Index	R6	12	0.0..1.93428E+25	A metric indicating the variability of the terrain within an area block.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Terrain Type	S	1	--	For generic terrain, a code indicating the general nature of the terrain (e.g., flat, rolling).
Texel Value (NITF)	BIN	--	--	The value in binary format of a given texel (texture element) within an NITF Image Data File; the number of bits in the value is determined by "Number of Bits Per Pixel".
Texture Data Format	S	80	--	Description of the texture data format used for a given texture in a GTDB. For most textures, the value "NITF" shall be used; for all Stage 1 textures not in NITF format, a description of the source format shall be provided here.
Texture Description (NITF)	S	80	--	Textual description of texture.
Texture Format	E	17	BAND_SEQUENTIAL, BAND_INTERLEAVED,	The ordering of the texture data by bands and pixels (texels).
Texture ID	I	11	0..2147483647	Unique ID number assigned to a texture within a GTDB texture library (same as GTDB Texture ID used by NITF).
Texture Map Reflectance	R6	12	0.0..1.0	Reflectance value assigned to a texture map.
Texture Mapping Set ID	I	11	0..2147483647	ID number identifying a set of textures used together when mapping (e.g., a summer texture set and a winter texture set may exist).

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TABLE A-III

Fieldname	Type	Length	Range	Description
Translation (Subsidiary Model Ref.)	R2D6		-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	A set of coordinates defining vectors for local offset of a subsidiary model from its nominal position.
	R3D6		-1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25, -1.93428E+25.. 1.93428E+25	
Translucency	R6	12	0.0..100.0	The degree to which a surface is transparent to visible light, expressed as a percentage. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Transmissivity	R6	12	0.0..1.0	Ratio of radiant energy transmitted by a feature or model to the energy incident upon it. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Two-D Geometric Correction Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether a texture has been positioned/corrected (geopositioned) in 2D space.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Texture Mapping Type	E	16	GLOBAL_BASED, MODEL_BASED, FACE_BASED, VERTEX_TO_VERTEX, NON_MAPPED	Method used in mapping texture onto terrain, culture, and models.
Texture Origin	I2D	13	0..99999, 0..99999	Location designated as the origin within a texture.
Texture Pattern Coordinates	I2D	13	0..99999, 0..99999	Positions within an image that are to be tied to the vertices of a model polygon when performing a vertex-to-vertex texture mapping.
Texture Reference Table Index	I	6	0..65535	A pointer to a texture reference in a texture reference table.
Texture Scale	R2D6	25	0.0..1.93428E+25, 0.0..1.93428E+25	Scale parameters applied to a texture map.
Texture Type (NITF)	E	14	RGB, INTENSITY, MULTI_SPECTRAL, SMC_FDC	The type of a texture.
Three-D Geometric Correction Flag (NITF)	B	5	TRUE, FALSE	Flag indicating whether a texture has been positioned/corrected (orthorectified) in 3D space.
Translation (Model Reference)	I2D		-324000000.. 324000000, -648000000.. 648000000	A set of coordinates defining vectors for local offset of a model from its nominal position.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Type of Reference	E	7	FEATURE, MODEL	When culture has been fragmented onto terrain, indicates whether a particular culture reference record represents a feature or a model.
UL Corner X/Y Image Coordinates (NITF)	I2D	15	-999999.. 999999, -999999, 999999	X/Y cartesian coordinates of the upper left corner of the image.
UR Corner X/Y Image Coordinates (NITF)	I2D	15	-999999.. 999999, -999999, 999999	X/Y cartesian coordinates of the upper right corner of the image.
Use Models Flag	B	1	T, F	User-defined CDBTP parameter indicating whether model references should replace culture features, wherever an applicable model is available in the SSDB.
User Option	E	18	VIOLATE_FACE_COUNT, MEET_FACE_COUNT, ABORT_RUN	User-defined CDBTP parameter indicating the desired action if there is a conflict between user-specified parameters for culture selection and for maximum culture polygon count.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Value	I	6	0..32767	The value component of a color defined by the Bue-Chroma-Value model. P2851 normalizes Value to a range of 0 (black) to 32767 (white) instead of the familiar 0-100 percent lightness range. Synthetic default values are generated by P2851 software as a random function of Surface Material Category.
Vertex List Position	I	11	0..2147483647	An index into a coordinate list, identifying a coordinate used as a model, terrain, or culture vertex.
Vertex Normals Flag	B	1	T, F	User-defined CDBTP parameter indicating whether vertex normals should be calculated for terrain polygons.
Vertex-to-Vertex Mapping Flag	B	1	T, F	Parameter indicating the existence of vertex-to-vertex mapping parameters for texture.
Vertical Captured Texel Size (NITF)	R10	16	0.0.. 9.999999999E+99	Approximate ground distance for a texel (expressed in meters) in the vertical y-direction.
Vertical Resolution (NITF, non-NITF)	R6	12	0.0..1.93428e+25	Vertical length of a texel in meters, (e.g., 1.0 M/texel)
Vertical Size (NITF)	R6	12	0.0..1.93428e+25	The vertical size of the entire image, e.g., 1000.0 Meters.

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TABLE A-III

Fieldname	Type	Length	Range	Description
Vertical Tile Block Size	I	11	0..2147483647	The number of texels in the vertical direction (column) in a texture block. A texture is divided into a whole number of blocks, each consisting of the same dimensions.
Visible Range	I	11	0..2147483647	Distance that a lignt feature can be seen, expressed in ten thousandths of arc seconds.
West Tile Neighbor ID (NITF)	I	10	0..2147483647	The identifier of the neighboring areal specific image to the west.
Width	R10	16	0.0.. 9.999999999E+99	The short dimension of a linear, point, point light, or point light string feature.
Wrap	B; B; B; B;	7	T, F; T, F; T, F; T, F	Flag indicating whether a texture pattern can be wrapped along its left, right, top and bottom edges while maintaining a "seamless" appearance.
Wrap Type	E	7	NO_WRAP, NORMAL, MIRROR	Flag indicating type of texture wrapping performed (for NORMAL, right edge aligned with left edge or top edge aligned with bottom edge; for MIRROR, each texture instance is mirrored from the previous texture instance).

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APPENDIX B

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FEATURE DESCRIPTOR CODES

10 **SCOPE**. This appendix identifies all Feature Descriptor Codes (FDCs) used within a Generic Transformed Data Base.

20. APPLICABLE DOCUMENTS

This section does not apply.

30. DEFINITIONS AND ACRONYMS

This section does not apply.

40. GENERAL REQUIREMENTS

40.1 **Feature Descriptor Codes.** Cultural features represented within the GTDB will be classified using a Feature Descriptor Code (FDC) that is an extension of the Defense Mapping Agency's Feature Attribute Coding Standard (FACS). The FACS uses a hierarchical system of five-character alphanumeric feature type codes. The first two characters are used to categorize a feature within a hierarchy of types. The last three characters are used to distinguish specific instances of the general type. The GTDB will use FACS codes as FDCs wherever an appropriate FACS code has been defined. In a few cases, it has been necessary to invent FDCs for feature types required by the GTDB but not presently defined by FACS.

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40.1.1 FDC Categories Defined In DMA FACS. The following is a list of GTDB feature categories defined in FACS.

1	<u>Culture</u>
1A	Extraction
1B	Disposal
1C	Processing Industry
1D	Power Generation
1F	Associated Industrial Structures
1H	Institutional/Governmental
1I	Residential
1J	Agriculture
1K	Recreational
1L	Miscellaneous Features
1M	Storage
1N	Transportation R/R
1P	Transportation/Roads
1Q	Associated Transportation
1R	Air Traffic Services
1T	Communication/Transportation
1U	Airports
2	<u>Hydrography</u>
2A	Coastal Hydro
2B	Ports and Harbors
2C	Navaids
2D	Dangers and Underwater Features
2E	Depth Information
2F	Bottom Features
2G	Tide and Current Information
2H	Inland Water
2I	Miscellaneous Inland Water
2J	Snow/Ice
3	<u>Hypsography</u>
3A	Relief Portrayal

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4	Physiography
4A	Exposed Surface Material
4B	Landforms
4C	Cross Country Movement
5	Vegetation
5A	Cropland
5B	Rangeland
5C	Woodland
5D	Wetlands
5E	Miscellaneous Vegetation
6	Demarcation
6A	Boundaries/Limits/Zones (Topographic)
6C	Boundaries/Limits/Zones (Hydrographic)
9	General
9B	Control Points
9C	Magnetic Variation Info
9D	Miscellaneous

40.1.2 **FDC Categories Defined By GTDB.** The following is a list of GTDB feature categories not defined in FACS. By convention, these categories use three-character designators rather than two. This was done to clearly differentiate GTDB-specific FDCs from FACS codes.

	GTDB Specific Codes
MOD	Model Specific Features
LGT	Lighting Features
ANT	Antenna Features
AIR	Miscellaneous Airport Features
MIS	Miscellaneous Features

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40.1.3 **List of Supported FDCs.** The following is a list of Feature Descriptor Codes (FDCs) supported by GTDB. In most cases, the specific codes are taken directly from the DMA FACS Glossary. The GTDB includes FDCs for features which are not presently defined in FACS.

1	<u>Culture</u>
1A	<u>Extraction</u>
1A000	Extraction (General)
1A010	Mine
1A030	Quarry
1A031	Quarry Sheer-Wall
1A040	Rig/Superstructure
1A050	Well
1B	<u>Disposal</u>
1B000	Disposal Site/Waste Pile
1B010	Wrecking Yard/Scrap Yard
1C	<u>Processing Industry</u>
1C000	Processing Plant/Treatment Plant
1C010	Blast Furnace
1C020	Catalytic Cracker
1C030	Settling Basin/Sludge Pond
1D	<u>Power Generation</u>
1D010	Power Plant
1D020	Solar Panel
1D030	Substation/Transformer Yard
1F	<u>Associated Industrial Structures</u>
1F000	Associated Industrial Structures
1F010	Chimney/Smokestack
1F020	Conveyor
1F030	Cooling Tower
1F040	Crane
1F050	Dredge,Powershovel,Dragline
1F060	Engine Test Cell
1F070	Flare Pipe
1F080	Hopper

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1H	<u>Institutional/Governmental</u>
1H020	Battery
1H050	Fort
1H075	Firing Range
1I	<u>Residential</u>
1I020	Mobile Home, Mobile Home Park
1J	<u>Agriculture</u>
1J030	Feed Lot
1J050	Windmill/Windmotor
1K	<u>Recreational</u>
1K000	Recreational
1K020	Amusement Park Attraction
1K030	Amusement Park
1K040	Athletic Field
1K060	Campground/Campsite
1K070	Drive-In Theater
1K080	Drive-In Theater Screen
1K090	Fairgrounds
1K100	Golf Course
1K110	Grand Stand
1K115	Outdoor Theater/Amphitheater
1K120	Park
1K130	Race Track
1K140	Recreational Vehicle Area
1K150	Ski Jump
1K160	Stadium/Amphitheater
1K170	Swimming Pool
1K180	Zoo

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1L	<u>Miscellaneous Features</u>
1L005	Animal Sanctuary
1L015	Building
1L018	Building Superstructure Addition
1L020	Built-up Area
1L025	Cairn
1L030	Cemetery
1L040	Cliff Dwelling
1L050	Display Sign
1L060	Dragon (Tiger) Teeth
1L070	Fence
1L073	Flagstaff/Flagpole
1L075	Gallery
1L085	Geophysical Prospecting Grid
1L095	Homogeneous Radar Significant Area
1L100	Hut
1L105	Intelligence Annotation
1L110	Light Standard
1L115	Miscellaneous Vertical Obstruction
1L120	Missile Site
1L130	Monument
1L135	Native Settlement
1L140	Nuclear Accelerator
1L155	Overhead Obstruction Location
1L160	Pipeline/Pipe
1L165	Pipeline/Pipe Crossing Point
1L170	Plaza/City Square
1L180	Pumping Station
1L200	Ruins
1L208	Shantytown
1L210	Snow Shed/Rock Shed
1L215	Special Area
1L220	Steeple
1L228	Tent Dwellings
1L240	Tower (Non-Communication)
1L250	Underground Dwelling
1L260	Wall

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1M	Storage
1M101	Depot (Storage)
1M020	Grain Bin
1M030	Grain Elevator
1M040	Mineral Pile
1M050	Silo
1M060	Storage Bunker/Storage Mound
1M070	Tank
1M080	Water Tower
1N	Transportation R/R
1N010	Railroad Track
1N050	R R Siding/R R Spur
1N075	R R Turntable
1N080	R R Yard
1N090	Tramway/Incline Railway
1P	Transportation/Roads
1P010	Cart Track
1P020	Interchange
1P030	Road
1P050	Trail

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1Q	<u>Associated Transportation</u>
1Q010	Aerial Cableway Line/Ski Lift Line
1Q020	Aerial Cableway Pylon/Ski Lift Pylon
1Q040	Bridge/Overpass/Viaduct
1Q045	Bridge Span
1Q050	Bridge Superstructure
1Q058	Constriction
1Q060	Control Tower
1Q065	Culvert
1Q068	Drop Gate/Rolling Block
1Q070	Ferry Crossing
1Q080	Ferry Site/Ferry Slip
1Q100	Distance Marker
1Q110	Mooring Mast
1Q111	Prepared Raft or Float Bridge Site
1Q115	Rest Area/Vehicle Stopping Area
1Q116	Route Marker
1Q118	Sharp Curve
1Q131	Tunnel
1Q132	Tunnel Entrance-Exit
1Q140	Vehicle Storage/Vehicle Parking
1R	<u>Air Traffic Services</u>
1R005	Air Obstruction Light
1R010	Airspace
1R030	Navaids (Aeronautical)
1R035	Radar Reflector
1R050	Route (Air)
1R060	Waypoint
1T	<u>Communication/Transportation</u>
1T005	Cable
1T010	Disk/Dish
1T020	Early Warning Radar Site
1T030	Power Transmission Line
1T040	Power Transmission Pylon
1T045	Radar Transmitter
1T050	Station (Communication)
1T060	Telephone Line/Telegraph Line
1T070	Telephone Pylon/Telegraph Pylon
1T080	Tower (Communication)

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1U	Airports
1U025	Aircraft Landing Pad
1U030	Aircraft Facility
1U040	Aircraft Facility Beacon
1U045	Aircraft Facility Reference Point
1U050	Approach Lighting
1U060	Apron/Hardstand
1U070	Arresting Gear
1U080	Blast Barrier
1U120	Launch Pan
1U130	Overrun/Stopway
1U150	Revetment (Airfield)
1U160	Runway
1U190	Seaplane Landing or Take-Off Area
1U200	Taxiway
2	Hydrography
20000	Hydrography
2A	Coastal Hydro
2A010	Coastal Shoreline
2A020	Foreshore
2A040	Open Water (except inland)

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2B	<u>Ports and Harbors</u>
2B010	Anchorage
2B020	Berth
2B030	Bollard
2B040	Breakwater
2B050	Calling-In Point
2B080	Dolphin
2B090	Dock
2B100	Fishery/Fish Stakes
2B105	Fishing Harbor
2B110	Fish Trap/Fish Weir
2B115	Gridiron
2B140	Jetty
2B150	Landing Place
2B155	Maritime Station
2B160	Mooring Ring
2B170	Offshore Loading Facility
2B180	Oyster or Cultivated Shellfish Bed
2B190	Pier, Wharf
2B220	Ramp
2B230	Sea Wall
2B240	Slipway
2C	<u>Navaids</u>
2C000	Navaids
2C010	Buoy
2C020	Clearing Line
2C030	Electronic Beacon
2C040	Leading Line
2C050	Light
2C055	Marker
2C060	Visual Beacon

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2D	Dangers and Underwater Features
2D000	Miscellaneous Underwater Features
2D010	Breakers
2D020	Crib
2D030	Discolored Water
2D040	Eddies
2D050	Foul Ground
2D060	Kelp
2D080	Overfalls/Tide Rips
2D090	Perches/Stakes
2D100	Piling
2D110	Platform
2D120	Reef
2D125	Reef Pool
2D130	Rock
1D140	Snag/Stump
2D180	Wreck
2E	Depth Information
2E010	Depth Curve
2E015	Depth Contour
2E020	Sounding
2E030	Track Line
2E040	Track Swath
2F	Bottom Features
2F010	Bottom Characteristics
2G	Tide and Current Information
2G010	Current Arrow/Flow Arrow
2G020	Tide Gauge
2G030	Tide Data Point
2G040	Current Diagram

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2H	<u>Inland Water</u>
2H000	Inland Water
2H010	Aqueduct
2H020	Canal
2H030	Ditch
2H040	Filtration/Aeration Beds
2H050	Fish Hatchery
2H060	Flume
2H070	Ford
2H075	Inland Shorline
2H080	Lake/Pond
2H090	Land Subject to Inundation
2H095	Miscellaneous Surface Drainage Feature
2H100	Moat
2H110	Penstock
2H120	Rapids
2H130	Reservoir
2H140	River/Stream
2H145	River or Stream Vanishing Point
2H150	Salt Evaporator
2H160	Sebkha
2H170	Spring/Water-Hole
2H180	Waterfall
2I	<u>Miscellaneous Inland Water</u>
2I010	Cistern
2I020	Dam
2I030	Lock
2I040	Sluice Gate
2I050	Water Intake Tower
2J	<u>Snow/Ice</u>
2J000	Snow/Ice
2J020	Glacial Moraine
2J030	Glacier
2J040	Ice Cliff
2J060	Ice Peak, Nunatak
2J065	Ice Shelf
2J070	Pack Ice
2J080	Polar Ice
2J100	Snow Field/Ice Field
2J110	Tundra

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3	Hypsography
3A	Relief Portrayal
3A010	Contour (Land)
3A020	Ridge Line
3A030	Spot Elevator
4	Physiography
4A	Exposed Surface Material
4A005	Asphalt Lake
4A010	Ground Surface
4A015	Cleared Way
4A020	Salt Pan
4A030	Surficial Material
4B	Landforms
4B000	Landforms
4B010	Bluff/Cliff, Escarpment
4B030	Cave
4B060	Crevice/Crevasse
4B070	Cut
4B071	Cut Line
4B080	Depression
4B090	Embankment
4B100	Esker
4B110	Fault
4B115	Geothermal Feature
4B135	Island
4B145	Miscellaneous Obstacle
4B150	Mountain Pass
4B155	Ravine/Gorge/Canyon
4B160	Rock Strata, Rock Formation
4B170	Sand Dune/Sand Hill
4B176	Slope Category
4B180	Volcano
4B190	Volcano Dike
4C	Cross Country Movement
4C010	Cross Country Movement Speed Range

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5	<u>Vegetation</u>
50000	Vegetation
5A	<u>Cropland</u>
5A010	Cropland (Cultivated)
5A020	Hedgerow
5A030	Nursery
5A040	Orchard/Plantation
5A050	Vineyard/Hops
5B	<u>Rangeland</u>
5B010	Grassland
5B020	Scrub/Brush
5C	<u>Woodland</u>
5C010	Bamboo/Cane
5C015	Firebreak
5C020	Oasis
5C030	Trees
5D	<u>Wetlands</u>
5D010	Bog
5D020	Hummock
5D030	Swamp
5D040	Marsh
5E	<u>Miscellaneous Vegetation</u>
5E010	Land Use/Land Cover (Vegetation)

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6	Demarcation
6A	Boundaries/Limits/Zones (Topographic)
6A000	Administrative Boundary
6A010	(Omitted)
6A020	Armistice Line
6A030	Cease-Fire line
6A040	Claim Line
6A050	Convention Line/Mandate Line
6A060	Defacto Boundary
6A070	Demilitarized Zone
6A090	(Omitted)
6A110	International Date Line
6A140	(Omitted)
6A170	Zone of Occupation
6C	Boundaries/Limits/Zones (Hydrographic)
6C020	Colregs Demarcation Line
6C030	Customs Boundary
6C040	Dredged Channel/Dredged Area
6C070	Harbor Limit
6C075	Inshore Traffic Zone
6C090	Maritime Limit
6C100	Measured Distance Line
6C110	Mine Danger Area (Hydro Limit)
6C120	Prohibited Area (Hydro Only)
6C130	Radar Reference Line
6C150	Restricted Area (Hydro Only)
6C160	Roundabout
6C165	Route
6C170	Safety Fairway
6C175	(Omitted)
6C177	Swept Area
6C180	Traffic Separation Scheme
6C210	Work in Progress Area

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9	General
9B	Control Points
9B030	Boundary Monument
9B035	Control Point
9B040	Diagnostic Point
9B045	Elevation Point
9B070	Precise Radar Significant Location
9C	Magnetic Variation Info
9C040	Magnetic Disturbance Area
9D	Miscellaneous
9D005	Area of RSPS Accuracy Limitations
9D015	Point of Change
9D020	Void Collection Area
9D022	Homogeneous Aggregate Feature
9D020	Dissimilar Aggregate Feature

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	Model Specific Features
MOD01	Aircraft, (Static, On Ground)
MOD02	Armored Personnel Carriers (Static)
MOD03	Artillery
MOD04	Bomber Aircraft (Enemy, Static)
MOD05	Bomber Aircraft (Friendly, Static)
MOD06	Fighter Aircraft (Enemy, Static)
MOD07	Fighter Aircraft (Friendly, Static)
MOD08	Ground Vehicles (Enemy, Static)
MOD09	Ground Vehicles (Friendly, Static)
MOD10	Gun
MOD11	Helicopter (Enemy, Static)
MOD12	Helicopter (Friendly, Static)
MOD13	Missile (Static)
MOD14	Missile Transporter
MOD15	Mobile Anti-Aircraft Artillery
MOD16	Mobile Rocket Launcher (SAM Launcher)
MOD17	Radar Antenna, Vehicle Mounted (Static)
MOD18	Single Tree
MOD19	Surface Ship (Enemy)
MOD20	Surface Ship (Friendly)
MOD21	Tank (Vehicle, Static)
MOD22	Tents
MOD23	Transport/Tanker Aircraft (Enemy, Static)
MOD24	Transport/Tanker Aircraft (Friendly, Static)
MOD25	Truck
MOD26	Weapon Delivery Systems (General)

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LGT	<u>Lighting Features</u>
LGT01	Airport Boundary Lighting
LGT02	Approach Light Framework
LGT03	Athletic Field Light
LGT04	Boundary Light
LGT05	Fishing Light
LGT06	Flood Lights
LGT07	Leading Light, Lights in Line
LGT08	Lighted Wind Indicator
LGT09	Obstruction Light
LGT10	Private Light
LGT11	Runway Centerline Light
LGT12	Runway Overrun Lighting
LGT13	Street Lamp
LGT14	Taxiway Light
LGT15	Terminal Light
LGT16	Threshold Light
LGT17	Touchdown Zone Lighting
ANT	<u>Antenna Features</u>
ANT01	Airport Surveillance Radar
ANT02	American Forces Radio Station Antenna
ANT03	Commercial Broadcasting Antenna
ANT04	Direction Finder
ANT05	Flight Service Station (FSS) Antenna
ANT06	Ground Control Intercept Antenna
ANT07	Radar Antenna with Radome
ANT08	Radar Antenna, Tower Mounted with Radome
ANT09	Radio Relay Mast
ANT10	Remote Communications Outlet (RCO) Antenna
ANT11	Stick Mast
ANT12	Telemetry Antenna
ANT13	U.S. Weather Station Antenna
AIR	<u>Miscellaneous Airport Features</u>
AIR01	Fuel Handling Facility
AIR02	Refueling Units
AIR03	Runway Distance Remaining Marker
AIR04	Runway Markings
AIR05	U.S. Weather Station
AIR06	Wind Indicator

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MIS	Miscellaneous Features
MIS01	Cinder Cones
MIS02	Farm Cluster
MIS03	Oil Storage Pit
MIS04	Outfalls
MIS05	Pump Out Facility
MIS06	Regional Feature
MIS07	Sludge Gate
MIS08	Watering Place
UNKWN	Unknown

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APPENDIX C

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FIGURES

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RATIONALE AND GUIDANCE

(This appendix is not a mandatory part of this standard. The information contained herein is intended for guidance only.)

10 SCOPE

10.1 Scope/Background

10.1.1 The Generic Transformed Data Base (GTDB) is intended to serve as a data base which will support real-time visual/infrared and radar sensor simulator systems. The single GTDB format documented in this data base design document is a superset of data base features contained in the visual/infrared data bases, as well as radar data bases. This single format is expected to reduce software development and maintenance costs among users of the GTDB.

10.1.2 It should be emphasized that, even though there is a single format for a GTDB, there can be great variation in content from GTDB to GTDB. A GTDB generated for a radar simulator may continue to be significantly different from a GTDB for a visual system in terms of feature content, levels of detail, and terrain representation. However, one long-term advantage of a common format is that, as image generator technology advances make it feasible, the GTDB will be able to support integrated multi-sensor simulations from a common data base.

10.1.3 The GTDB will be generated as needed from current terrain, culture, model, and photo texture data maintained within the DoD Standard Simulator Data Base (SSDB). The software subsystem which transforms standard simulator data base data into a GTDB is designated the Common Data Base Transformation Program (CDBTP). A highly parameterized common data base transformation program has been implemented which will permit tailoring of GTDBs to the special requirements of a particular simulator or training mission, as well as the sensor and platform being simulated.

10.1.4 This tailoring of GTDBs is intended to minimize the complexity of user-written Formatter Programs (FPs) which will filter and format a GTDB for execution on a particular simulator system.

10.1.5 In addition to real data, the GTDB supports the extensive use of default values and synthetically generated data. The philosophy here is to have the GTDB supply common synthetic data to maintain correlation among training systems, rather than to deliver blank fields and have each training system independently assign its own defaults. Default values associated with particular fields are documented in Appendix A of this standard.

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10.2 **Purpose.** Air Force Project 2851, also known as Standard DoD Simulator Digital Data Base/Common Transformation Program, is a Tri-Service program to develop standardized data bases and transformation software to be used by all future DoD training simulator applications. Currently, each simulator subsystem purchased by the DoD is delivered with its own data base and transformation program. This not only costs the Government in terms of recurring development costs associated with the "re-invention" of similar, if not identical products, but also results in proliferation of non-standard, incompatible data bases and software, all of which must be maintained by DoD. The Project 2851 effort is intended to improve this situation by developing common standards to be utilized throughout DoD.

10.2.1 Another major problem being addressed by Project 2851 is the lack of correlation between different sensor simulators (radar, infrared, out-the-window visuals) within a training system, as well as among training systems in a network. The lack of correlation can result in poor training or limit the scope of training programs. By developing standard data bases and software, Project 2851 is intended to improve simulator data base correlatability.

20 APPLICABLE DOCUMENTS

This section does not apply.

30 DEFINITIONS AND ACRONYMS

30.1 **Definitions.** For the purpose of this appendix, the following definitions apply.

30.1.1 Accuracy: degree of conformity of values in a data base to an established standard. Accuracy relates to the quality of the result of a measurement, and is distinguished from precision which relates to the quality of the operation by which the result was obtained.

30.1.2 Anomaly: (1) an entry in a data base that deviates from the expected norm. (2) In geodesy, a deviation of an observed value from a theoretical value due to a corresponding irregularity in the earth's structure at the area of observation.

30.1.3 Area Block: the fundamental physical unit of a gaming area data base, used to subdivide a large gaming area into manageable quantities of data. The size of an area block may vary from data base to data base and even between Simulator Levels of Detail (SLODs) within a data base.

30.1.4 Areal Feature: a cultural object represented within a data base as a polygon.

30.1.5 Areal Photo Texture: a two-dimensional array of data, typically from a digitized photograph, used to modulate the appearance of an areal feature across its surface.

30.1.6 Aspect Change: variations in the appearance of an object viewed by radar from varying directions due to changes in the effective reflecting area of the object.

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30.1.7 Associated Feature: a feature or group of features which correspond(s) to another feature at a lower level of detail (LOD).

30.1.8 Base Map: a map or chart of known or assumed accuracy used as a reference for positioning additional data.

30.1.9 Cartesian Coordinates: a coordinate system in which locations of points in space are expressed by reference to three mutually perpendicular planes.

30.1.10 Cartographic: refers to the art and science of expressing graphically, by maps and charts, the known physical features of the earth.

30.1.11 Cartographic Displacement: the horizontal shifting of the plotted position of a map feature from its true position, caused by required adherence to prescribed line weights and symbol sizes to promote readability.

30.1.12 Cell: the basic unit of geographic data coverage for terrain and culture within the SSDB. By convention, a typical cell represents a 1x1 degree area bounded by whole degrees of latitude and longitude.

30.1.13 Centerline: the continuous center of a linear feature such as a highway.

30.1.14 Central Meridian: the line of longitude at the center of a projection.

30.1.15 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.

30.1.16 Clipping: the process of cutting and closing off line and areal features along some defined boundary. With areal features, the clipping process introduces an artificial line segment in order to close the feature and maintain structural integrity.

30.1.17 Collision Test Point: a special vertex in a 3-D dynamic (moving) model used to detect a collision of that model with terrain or other models situated within a simulator scene.

30.1.18 Common Data Base Transformation Program (CDBTP): the software subsystem within the Project 2851 System that processes data from the Standard Simulator Data Base (SSDB) and converts it into a format (GTDB) that is usable by simulators with a minimal amount of additional processing.

30.1.19 Configuration Management Data Base (CMDB): a collection of Project 2851 data base status and configuration information maintained by the Project 2851 Configuration Management Program (CMP).

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30.1.20 Configuration Management Program (CMP): the software subsystem within the Project 2851 System that will track the configuration and status of the SSDB and the GTDBs.

30.1.21 Convex Feature: an areal feature all of whose vertices form exterior angles equal to or greater than 180 degrees.

30.1.22 Coordinate: an ordered set of real numbers specifying a point in two-dimensional (2-D) or three-dimensional (3-D) space.

30.1.23 Coordinate Conversion: the process of changing coordinate values from one representation (e.g., geographic lat/long) to another (e.g., UTM).

30.1.24 Coordinate System: a consistent scheme for designating relative locations of a set of points within a reference space.

30.1.25 Coordinate Transformation: a mathematical or graphic process of obtaining a modified set of coordinates, as in a map projection, by some combination of rotation of coordinate axes at their point of origin, translocation of the point of origin, modification of scale along coordinate axes, or change of the size or geometry of the reference space.

30.1.26 Correlated Data Bases: multiple simulator data bases which, by their structure and content, support an acceptable degree of correlation among multiple simulator displays.

30.1.27 Correlation: the correspondence and synchronization of multiple simulator sensor displays (e.g., visual and radar) over the same gaming area. At a minimum, correlation implies the absence of conflicting information across multiple displays.

30.1.28 Cue: any sensory perception which provides information that can be of use in maneuvering or operating an aircraft, vehicle, or weapon system.

30.1.29 Culture: strictly speaking, objects on the terrain that have been constructed by man; in practice, the term is often used synonymously with "feature," indicating natural as well as man-made objects.

30.1.30 Culture Decomposition: the process of breaking up a nonconvex areal feature into multiple convex features.

30.1.31 Culture Fragmentation: the process of breaking up a line or areal feature at the boundaries of underlying terrain polygons.

30.1.32 Data Base Generation/Modification Program (DBGMP): the software subsystem within the Project 2851 System that creates and maintains the Standard Simulator Data Base (SSDB), using digital and nondigital input products, interactive editing, and algorithmic processes.

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30.1.33 Datum: in general, any numerical or geometric quantity or set of such quantities which are designated as a reference or base for other quantities. Within data bases of earth features such as the Project 2851 SSDB and GTDBs, horizontal and vertical datums are needed to position coordinates in 3-D space.

30.1.34 Digital Feature Analysis Data (DFAD): a standard data base product of the Defense Mapping Agency containing generalized, but rigidly specified, description and portrayal of cultural or planimetric data, expressed at different levels of feature density. Level 1 is roughly equivalent to the detail that could be derived from a map with a scale of one inch equals four miles (1: 250,000). Level 2 is roughly equivalent to a map scale of 1:50,000. Higher-resolution prototype and special versions of DFAD exist for very limited areas of coverage.

30.1.35 Digital Landmass System (DLMS): a standard DMA-produced data base containing feature (DFAD) and terrain elevation (DTED) data representing the landmass of the earth.

30.1.36 Digital Radar Landmass Simulator (DRLMS): a device which uses digital data bases to create simulations of real-beam radar returns.

30.1.37 Digital Terrain Elevation Data (DTED): a standard data base of terrain elevations produced by the Defense Mapping Agency. Level 1 DTED contains discrete elevations expressed at intervals of three arc-seconds of latitude (roughly 100 meters). Level 2 DTED is not regularly produced by DMA but is specified at intervals of one arc-second of latitude (roughly 30 meters).

30.1.38 DMA Feature File (DMAFF): a feature data coding standard drafted by DMA which has been superseded by FACS.

30.1.39 Drainage: all features associated with water, such as shorelines, rivers, lakes, marshes, etc.

30.1.40 Edge: a straight line segment connecting two vertices.

30.1.41 Elevation: a vertical distance from a datum, e.g., mean sea level.

30.1.42 Face: a polygonal surface represented within a graphic data base.

30.1.43 Feathering: the process of smoothing out the transition between adjoining or overlapping patches of feature data of differing densities.

30.1.44 Feature: a natural or man-made object of sufficient importance to express as an entity in a simulator data base.

30.1.45 Feature Attribute Coding Standard (FACS): a highly structured coding system developed by the Defense Mapping Agency for assigning alpha-numeric codes to describe a feature and its attributes.

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30.1.46 **Feature Classes**: generic groupings of cultural and natural objects which can be further classified into sub-features providing more complete descriptors.

30.1.47 Filtering: the selective elimination of some data from a set of data.

30.1.48 Formatter Program (FP): a simulator-specific transformation program to convert a Project 2851 GTDB into the on-line format unique to the hardware.

30.1.49 Gaming Area: the geographic area of coverage of a GTDB or simulator on-line data base, representing the geographic boundaries of training simulations which can be supported with the data base.

30.1.50 Generic Radar Data Base (GRDB): a GTDB created to support radar simulation.

30.1.51 Generic Transformed Data Base (GTDB): (1) a sensor-specific gaming area data base generated by the CDBTP by transforming selected SSDB data into a form more readily usable by a simulator system. (2) Also, the software subsystem of the Project 2851 System that provides GTDB data handling functions.

30.1.52 Generic Visual/Infrared Data Base (GVIDB): a GTDB created to support visual and/or infrared simulation.

30.1.53 Geocentric Coordinates: a coordinate system which defines the position of points relative to the center of the earth.

30.1.54 Geodetic: refers to the science which deals with the determination of the size and figure of the earth.

30.1.55 Geodetic Coordinates: the quantities of latitude, longitude, and height, used to define the position of a point on the surface of the earth with respect to the reference spheroid.

30.1.56 Geographic Coordinates: the quantities of latitude and longitude used to define the position of a point on the surface of the earth with respect to the reference spheroid.

30.1.57 Goodness of Fit: a parameter or measure of degree of correspondence between polygonized terrain and the original elevation matrix values.

30.1.58 Gray Scale: a scale of tones ranging from white to black.

30.1.59 Ground Resolution: the minimum distance which can be detected between two adjacent features, or the minimum size of a feature expressed in size of objects or distances on the ground.

30.1.60 Homogeneous Area: an area of uniform radar reflectance.

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30.1.61 Horizontal Datum: a set of geodetic parameters used to specify the shape of a reference ellipsoid to which positional coordinates are referenced. Due to the irregular shape of the earth (as well as to political and historical factors), different datums are commonly used in different parts of the world. For a worldwide data base such as the SSDB, a unified world datum (WGS84) will be used.

30.1.62 Image Generator (IG): a device for producing computer-generated scenes, capable of simulating real-time movement through the scene.

30.1.63 Instantaneous Field of View (IFOV): the portion of a large visual scene (e.g., as in a dome display) where an observer is actually looking at a moment in time. Some simulators use head or eye tracking devices to concentrate scene density within the IFOV.

30.1.64 Island: an area within a GTDB defined via transformation parameters as having data content or density characteristics different from the surrounding area; islands may be defined within other islands but may not overlap.

30.1.65 Lambert Conformal Conic: a map projection commonly used in aeronautical charting, on which geographic meridians are represented by straight lines which meet at a common point outside the limits of the map, and geographic parallels are represented by a series of arcs of circles having this common point for a center.

30.1.66 Level of Detail (LOD): a discrete level within a range of levels of SSDB content density, used to store alternate representations of any given area of coverage.

30.1.67 Linear Feature: a cultural object represented within a data base as one or more connected line segments.

30.1.68 Manuscript: a physical subdivision of an SSDB cell. Manuscripts cannot overlap each other.

30.1.69 Microdescriptors: a special class of multi-attribute data structures developed by the DMA to encode complex attributes in its high-resolution (e.g., Level V DFAD) digital cartographic data bases.

30.1.70 Model: a graphical or mathematical representation of an object.

30.1.71 Model Instancing: the placement of multiple references to a common model throughout a data base, as opposed to replicating the model at every location.

30.1.72 Model Photo Texture: a two-dimensional array of data, typically from a digitized photograph, used to modulate the appearance of a model surface.

30.1.73 Occultation: the hiding from view of one feature or surface by the interposition of another feature or surface along the line of sight.

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30.1.74 Origin: the reference point relative to which all coordinates within a coordinate set are defined.

30.1.75 Paneling: the process of reconciling data along the boundary between feature or terrain data sets; also referred to as "edge matching" or "border matching."

30.1.76 Photo Texture: a technique for modifying the characteristics of a graphic feature surface based on information typically stored in a two-dimensional array of data, such as from a digitized photograph. The application of photo texture to areal culture or model polygons permits greatly increased feature detail and realism without additional complexity in the culture or model geometry.

30.1.77 Pixel: a contraction of the term, "picture element"; an element in a gridded representation of 2-D space.

30.1.78 Point Feature: a cultural object whose location within a data base is represented as a single point, or as a set of points.

30.1.79 Point Light Feature: a light-emitting object represented within a data base as a single point.

30.1.80 Point Light String Feature: a light-emitting object represented within a data base as a set of points.

30.1.81 Quadrangle: a rectangular, or nearly so, area covered by a map, usually bounded by given meridians of longitude and parallels of latitude.

30.1.82 Radar Correlation: the process of electronically relating real-time radar images with stored digital data on the position and radar reflectance of terrain and features, used for navigation and guidance.

30.1.83 Radar Target: an object which reflects a sufficient amount of a radar signal to produce an echo signal on the radar screen.

30.1.84 Real Time: in computer systems, the capability to detect, display, and/or react to an event as it actually occurs.

30.1.85 Real-World Data: data, such as DMA DFAD and DTED, derived from imagery or other sources known to represent actual real-world conditions.

30.1.86 Resolution: a measure of the ability to distinguish detail, as applied to the power of a sensing system, the sharpness of an image, or the level of detail in a data base.

30.1.87 Ridge Line: a graphic representation of a long narrow land elevation, typically used to represent terrain forms significant for low altitude radar prediction.

30.1.88 Roll In: the process of transferring a data file from off-line storage media to on-line storage.

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30.1.89 Roll Out: the process of transferring a data file from on-line storage media to off-line storage.

30.1.90 Separation Plane: a geometric entity used to simplify dynamic resolution of visual rendering priorities of polygons within a 3-D model.

30.1.91 Simulator Level of Detail (SLOD): a discrete level within a range of levels of GTDB content density used to store alternate views of any given area of coverage and representing the effects of changes in proximity, sensor range, gain, or aspect angle.

30.1.92 Standard Linear Format (SLF): a feature data format developed by DMA for intermediate product exchange among its various production systems. It employs a link-node structure to describe feature planimetry, in which shared segments are digitized only once and referenced by multiple features, thus avoiding the slivers-and-gaps problems of the older polygonal DFAD format.

30.1.93 Standard Simulator Data Base (SSDB): (1) the central repository of validated standard digital feature, elevation, model, and photo texture data within the Project 2851 System. (2) Also, the software subsystem of the Project 2851 System that provides SSDB data handling functions.

30.1.94 Synthetic Breakup: the automatic or semi-automatic decomposition of large areal features into more detailed component point, line, areal, point light, and/or point light string synthetic features to support more realistic-looking simulation.

30.1.95 Synthetic Data: data derived algorithmically (e.g., by interpolation or synthetic enhancement), by manual enhancement, or from other sources without regard or reference to actual real-world conditions.

30.1.96 Synthetic Enhancement: the automatic or semi-automatic augmentation of existing low-resolution data with synthetic higher-resolution data to support more realistic-looking simulation, in the absence of real-world high-resolution data.

30.1.97 Temporal Effects: changes to cultural characteristics based on time of day, season, weather, or other conditional situations.

30.1.98 Terrain: the spatial configuration of the surface of the earth in 3-D space, typically represented in simulator data bases as a grid of terrain elevation posts or as a network of terrain polygons.

30.1.99 Terrain Leveling: the process of forcing terrain data to be "flat" (i.e., of uniform elevation) wherever the terrain corresponds to surface features which logically should be portrayed as level surfaces (e.g., lakes).

30.1.100 Terrain Polygon: a polygon situated in 3-D space, used to represent the slope of an area of the earth's surface.

30.1.101 Terrain Post: a single data element within a grid of terrain elevation values.

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30.1.102 Tessellation: the process of forming a mosaic pattern using fundamental units or patterns of data.

30.1.103 Texture Mapping: the process of applying digital patterns or photographic images upon a graphic face to create a more realistic or detailed rendering of an object.

30.1.104 Thinning: the systematic reduction of the number of points defining a line or areal feature for purposes of simplification.

30.1.105 Topography: the configuration of the surface of the earth, including its relief (hypsography), drainage (hydrography), man-made features (culture), and vegetation.

30.1.106 Transformation Parameter: any of many control data values entered into the CDBTP at time of execution to tailor the resulting GTDB(s). Parameters may represent basic identification and control information, selections from a set of options, input variables used by numerical algorithms, or indications of relative priorities to control trade-off algorithms.

30.1.107 Transition Band: a limited area of data base coverage in which the data density is gradually changed to smooth the transition from high-detail data on one side of the band to low-detail data on the other.

30.1.108 Universal Transverse Mercator (UTM): a military grid coordinate system based on the transverse Mercator projection.

30.1.109 Utility Program (UP): the software subsystem within the Project 2851 System that provides utility services and common functions for the rest of the system.

30.1.110 Vector Format: a format whereby features in a data base are expressed as a series of connected lines or curves; the counterpart of "raster" format wherein discrete portions of the feature are expressed as data along a scan line.

30.1.111 Vertex: an ordered triplet (x,y,z) of real numbers specifying a point in 3-D space.

30.1.112 Vertical Datum: a level surface used as a reference from which to reckon elevation values. The Project 2851 data bases use Mean Sea Level.

30.1.113 World Geodetic System (WGS): a unified world geodetic datum based on a combination of all available astrogeodetic, gravimetric, and satellite tracking observations; especially significant in calibration and operations of an inertial guidance system for air-breathing and orbital platforms. The datum is periodically updated as warranted by new data, with the current datum designated as WGS84.

30.1.114 2-D Static Model: a planar graphic representation of a cultural object, used by simulators to render point, line, or areal surface features.

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30.1.115 <u>3-D Dynamic Model</u>: a three-dimensional graphic representation of a cultural object, used by simulators to render point, line, or areal features having height and capable of motion within the simulated scene.

30.1.116 <u>3-D Static Model</u>: a three-dimensional graphic representation of a cultural object, used by simulators to render point, line, or areal features having height.

3.2 **Acronyms**. For the purpose of this appendix, the following acronyms apply.

ANSI	American National Standards Institute
ASCII	American Standard Code Information Interchange
CDBTP	Common Data Base Transformation Program
CIG	Computer Image Generator
CM	Configuration Management
CMP	Configuration Management Program
COTS	Commercial Off-the-Shelf
CSCI	Computer Software Configuration Item
DB	Data Base
DBDD	Data Base Design Document
DBGMP	Data Base Generation/Modification Program
DBMS	Data Base Management System
DFAD	Digital Feature Analysis Data
DLMS	Digital Landmass System
DMA	Defense Mapping Agency
DRLMS	Digital Radar Landmass Simulator
DTED	Digital Terrain Elevation Data
EO	Electro-Optical
EOF	End of File
FAC	Feature Analysis Code
	Feature Attribute Code
FACS	Feature Attribute Coding Standard
FDC	Feature Descriptor Code
FID	Feature Identification Descriptor
FLIR	Forward-Looking Infrared
FP	Formatter Program
FPI	Frames per Inch
GB	Gigabyte(s)
GTDB	Generic Transformed Data Base
HVC	Hue-Value-Chroma
IG	Image Generator
I/O	Input/Output
IR	Infrared
KB	Kilobyte(s)
LOD	Level of Detail
LVT	Local Vertical Tangent
MB	Megabyte(s)
MBR	Minimum Bounding Rectangle
MC&G	Mapping, Charting, and Geodesy
MSL	Mean Sea Level
NOE	Nap of the Earth
QA	Quality Assurance
QC	Quality Control
RGB	Red-Green-Blue
SAR	Synthetic Aperture Radar
SDDD	Software Detailed Design Document

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SLOD	Simulator Level of Detail
SMC	Surface Material Category
SNM	Square Nautical Miles
SSDB	Standard Simulator Data Base
S/W	Software
UP	Utility Program
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VMS	Virtual Memory System
WGS	World Geodetic System
W/S	Workstation

40 GENERAL REQUIREMENTS

40.1 **Media.** At the time of the initial publication of this standard (1992), all GTDBs are being distributed exclusively on nine-track tape. It is envisioned that, in the future, alternative media will be supported, such as eight millimeter tape or electro-optical disk; the DoD Simulator Data Base Facility will keep the user community apprised of such changes as they occur. In either case, nine-track tape will continue to be supported as long as it remains an industry-standard medium.

40.1.1 **Structure/Labeling.** Data units called "files" will be delineated as ANSI-standard tape files, as implemented under VAX/VMS. Data "records" within a file will be delineated as ANSI-standard variable-length tape records, blocked at 2048 bytes. Records will not span blocks.

40.1.2 **Multi-Volume Sets.** Pseudo-files, as well as physical files, will be allowed to span volumes.

40.2 **Content.** As a format-only standard, GTDB requires only a minimum amount of mandatory information, The content of a specific GTDB is not dependent on requirements defined in the standard, but rather on two other factors: (a) that information which is available in the data set from which the GTDB is derived, i.e., the SSDB; and (b) that information which is requested by the recipient of the GTDB.

40.2.1 **Field Population.** One of the few content restrictions imposed by the GTDB standard is that all eligible fields be populated whenever their parent records are included in a data set. This corresponds to factor (a) of paragraph 40.2, above.

40.2.1.1 **Valid Data.** Whenever a GTDB contains a particular field (based upon the above criteria), and the SSDB contains the information necessary to populate that field, the value of the field will contain that SSDB value (or a corresponding GTDB value). This rule will ensure that pertinent information is always made available to the application.

40.2.1.2 **Default Data.** In cases in which a GTDB contains a field which does not have a corresponding SSDB value, the field will be assigned a predetermined default value.

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40.2.2 **Content Specifications.** Corresponding to factor (b) of paragraph 40.2, above, the content of a GTDB is dependent on the user's specifications. These specifications take the form of a number of transformation parameters, which are used to extract and manipulate SSDB information to generate a GTDB tailored to the intended application. These parameters are described in the following subparagraphs.

40.2.2.1 **Datum.** This identifies the horizontal reference for geodetically-based GTDBs.

40.2.2.2 **Coordinate System.** The user may select geodetic, geocentric, or projected coordinates.

40.2.2.3 **Terrain Representation.** There are three choices of terrain representation available in the GTDB. One of these is just a simple extraction of the grid-post values stored in the SSDB. The second is a mesh of polygons generated from these posts. The third is a hybrid of the previous two: it is a grid which has been generated by interpolating post values from a polygon mesh, which has in turn been generated from the SSDB posts. A GTDB can contain one or more of these three representations.

40.2.2.4 **Vertex Normals.** Some polygon-based image generators require the provision of normal vectors at each vertex in the polygonized data set. This boolean parameter specifies whether or not these should be generated during the polygonization process.

40.2.2.5 **Synthetic Culture.** Certain information in the SSDB is not derived from real-world source material, but is created by algorithmic means. This information may be either included or excluded from a GTDB, depending on the user's needs.

40.2.2.6 **Boundary SLOD Matching.** In GTDBs containing multiple Simulator Levels of Detail (SLODs) which are not geographically concident, there can be mismatches at the boundaries between SLODs, resulting in disconcerting anomalies in the terrain model. Specification of this parameter forces the transformation process to make the terrain models at different SLODs match up correctly, to avoid such effects.

40.2.2.7 **Convex Polygons.** This boolean parameter, when set to true, forces the transformation process to fragment model and culture polygons to eliminate convex edges.

40.2.2.8 **Edge Limit.** This parameter allows the user to specify the maximum number of edges permissible in a single polygon.

40.2.2.9 **Model References.** The user can specify the substitution of model references for culture features in the GTDB being generated. This results in a connecting link between the culture and model libraries, which are completely independent in the SSDB.

40.2.2.10 **Expanded Lineals.** If desired, the user can request that lineal features in the culture data set be replaced with polygons, the widths of which are determined by the "width" attributes of the SSDB lineal features.

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40.2.2.11 **Fragmented Point Light Strings.** Many light features in the SSDB are not stored as individual features, but as components of strings containing N identical lights. If specified, this parameter allows the user to request that such features be broken into N individual light features, each independently stored and attributed.

40.2.2.12 **Face Count Exception.** The transformation from SSDB into GTDB will sometimes generate a conflict between a polygon count limit and a requirement for mandatory features. In the event that these two goals conflict, the user can specify one of three courses of action: ignore the limit on face count (which will yield a GTDB having more faces than the simulator can potentially handle), delete some of the features which were previously identified as being mandatory (resulting in the omission of some potentially important cues), or simply give up and abort the transformation run.

40.2.2.13 **SLOD Parameters.** Within a GTDB, there can be any number of user-defined SLODs. The following parameters are specified for each individual SLOD.

40.2.2.13.1 **Keep-List.** This identifies all of those features which are to be retained during the transformation from SSDB to GTDB. This list is necessary in those cases for which data base culling or filtering is anticipated, in order to retain those features which are important for a specific application. If a keep-list is not specified, features will be eliminated at random in order to avoid exceeding the specified face-count limit.

40.2.2.13.2 **Delete-List.** This is analogous to the keep-list, but with the opposite function; it identifies those features which are <u>not</u> wanted in the GTDB, and so these features are always deleted.

40.2.2.13.3 **Level-List.** This identifies those features which are required to be situated on level terrain, such as lakes; this parameter is used to force the terrain polygonization algorithm to flatten the terrain model under such features.

40.2.2.13.4 **Thinning Tolerance.** Often, features contain too many vertices for an image generator to handle. (This problem arises from the fact that, when a feature is broken down into convex polygons, the number of polygons which result is directly proportional to the number of vertices in the feature.) Thus, it is usually necessary for the transformation process to thin, or remove points from, a complex feature. This parameter specifies the amount of thining permissible in a given GTDB, as a function of the error it introduces into the shape of the resulting feature.

40.2.2.13.5 **Highest Level of Detail.** This is used to map SSDB LODs into GTDB SLODs. The SLOD will contain features extracted from SSDB levels up to and including the level specified.

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40.2.2.14 **Area Block Parameters.** Within each SLOD, the data is comprised of a set of tiles or Area Blocks (ABs). Certain parameters can be specified for each individual area block within a SLOD, to allow for a non-homogeneous data base, even below the SLOD level. This can be used to concentrate the bulk of the transformation processing in only those areas of high interest, such as targets and corridors. The parameters which can be specified for each area block are described in the following subparagraphs.

40.2.2.14.1 **Area Block Dimensions.** This is used to specify the size of each individual area block, in 1/1000 arc-second increments up to 15 arc-minutes square. Adjacent area blocks must have identical corner coordinates on the shared edge.

40.2.2.14.2 **Face Count Limit.** If specified, this gives a maximum limit to the number of faces which can be generated for an area block.

40.2.2.14.3 **Model Reference Limit.** As with the face count, this limits the number of faces which can be generated for an area block.

40.2.2.14.4 **Terrain Goodness-of-Fit.** This parameter applies only to those GTDBs with polygonized terrain. It defines the maximum allowable deviation from the original terrain data from which the polygons are generated. In effect, this drives the number of terrain polygons generated; the tighter the tolerance, the more polygons. It should be noted, also, that the Project 2851 terrain polygonization algorithm generated irregularly-shaped triangles, and their density varies as a function of the terrain roughness.

40.2.2.14.5 **Number of Terrain Polygons.** This parameter can be used to specify the minimum and/or maximum number of terrain polygons to be generated for the area block. If it should conflict with the goodness-of-fit specified, the maximum number of terrain polygons discussed in paragraph 40.2.2.14.4 shall take precedence.

40.2.2.15 **Additional Islands.** A GTDB can contain any number of user-defined "islands", which are regions of nested SLODs. The coordinates of these can be specified independently.

40.3 **Data Formats.** Self-explanatory.

40.3.1 **Non-Texture Data.** Self-explanatory.

40.3.1.1 **Field Format.** Self-explanatory.

40.3.1.2 **Inter-Field Separation.** Self-explanatory.

40.3.2 **Texture Data.** Self-explanatory.

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50 DETAILED REQUIREMENTS

(The information provided herein serves as a guide to the interpretation of requirements specified in Section 5 of this standard.)

50.1 Data Base Structure.

50.1.1 The following subparagraphs describe the detailed logical record and field structure of the GTDB files, as they would appear on a GTDB tape created by the Project 2851 software.

50.1.1.1 Data units called 'pseudo-files' have been defined for collections of records which should logically be treated as independent files but which, for performance reasons, have been physically grouped with other pseudo-files within a larger physical file. In earlier versions of the GTDB design, the proliferation of relatively small physical files was found to cause highly inefficient use of the magnetic tape medium (due to the inter-file gaps), as well as inordinate I/O processing overhead. The grouping of pseudo-files into fewer physical files has been found to improve I/O performance dramatically.

50.1.1.2 Data 'fields' are logical data units occurring at predefined locations within a record. Fields maintained internally as non-ASCII data (such as integers, floating point, Boolean, and Ada enumerated types) will be converted to ASCII during GTDB generation. The size of each ASCII field is fixed and will contain enough character positions to hold the largest valid value for the field, including a sign for numerics. Adjacent fields are separated by NULL characters to permit simple extraction of individual fields based on relative field position without consideration for the length of intervening fields. Fields may be made up of sub-fields, which are also delimited by NULL characters. The format and meaning of individual fields, as well as default values, are defined in Appendix A to this standard.

50.1.1.3 Texture image data will not be converted to ASCII. This data will be either in its original image file format or in the NITF file format, depending on the type of texture requested. All original source data will follow its own formatting conventions. All NITF data will follow NITF formatting conventions. NITF files use carriage-return and line-feed characters as inter-field separators and a blank character as inter-item separator.

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50.1.2 Section 5 of this standard describes the architecture of the GTDB. Using the nomenclature specified in DI-MCCR-80028, the data base is described as a set of 'files', which in turn consist of a set of 'records', which in turn consist of a set of 'fields', which may further consist of a set of 'items'.

50.1.2.1 There may be as many as 16 distinct physical files within a GTDB. These files form a logical hierarchy of pointers and information.

50.1.2.2 Starting at the top, a GTDB begins with a Gaming Area Header File which describes the general characteristics of the entire data base. A gaming area is simply the geographic area of data base coverage over which simulated operations are to be supported. If a radar GTDB is being concurrently generated with a visual GTDB, their gaming areas are not required to coincide (or even, from a software standpoint, to relate to each other in any way). For example, it would be possible to specify a larger gaming area for the radar GTDB to reflect the greater sensor range.

50.1.2.3 At the next level of the hierarchy, there are header files describing and pointing to three major classes of data within the GTDB. The Simulator Level of Detail (SLOD) Header File and the Area Block Header File point to terrain and culture data; the Model Library Header File points to model libraries; and the Texture Library Header File points to texture libraries.

50.1.2.4 SLOD Header Files define the general characteristics of each of the SLODs defined for the particular GTDB. A SLOD is a distinct level within a range of levels of data base terrain/culture content density and/or complexity. Different SLODs may be used to simulate variations in proximity, sensor range, sensor gain, and field of view. Typically, each SLOD will cover the entire gaming area, but this is not required by the GTDB or CDBTP.

50.1.2.5 It is also not required that the data density be consistent throughout a SLOD. Within each SLOD, the CDBTP will allow the user to specify a hierarchy of "islands" of coverage within which the culture data may be of higher detail than surrounding areas. Different levels of terrain detail may be specified on an area block basis. (See the Software Detailed Design Document (SDDD) for the CDBTP for a detailed description of SLOD specification options and constraints.) The CDBTP is parameterized to permit highly tailored definitions of the number and content of SLODs within any given GTDB.

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50.1.2.6 Within each simulator level of detail, the area covered by the gaming area may be subdivided into rectangular area blocks, defined by arcs of latitude and longitude. The area blocks are the units of data dynamically loaded and transformed by a real-time simulator. Due to differences in data density between different Simulator Levels of Detail (SLODs), the area block size will normally vary from simulator level of detail to simulator level of detail within a GTDB. Typically, the area block size will be constant within a simulator level of detail, but this is not a restriction of the GTDB or common data base transformation program. The only restrictions imposed by the CDBTP are that a side of an area block may not exceed 15 minutes of arc, and that the shared boundaries between neighboring area blocks must be mutually identical (i.e., an area block cannot share a boundary with two smaller area blocks).

50.1.2.7 The terrain and culture data within any given area block are categorized and stored in as many as nine types of area block pseudo-files. These are shown in Figure C-1. Two of the pseudo-files are mandatory in every area block. The Areal Feature Area Block (AFAB) Pseudo-File will always be present because, by convention, there will always be at least one areal feature in any area block (i.e., the background feature). The Vertex Area Block (VAB) Pseudo-File contains the vertex coordinates used to define the spatial boundaries of features (as well as terrain, when polygonized) and, hence, will always be present to define the background feature at a minimum. The presence of the other pseudo-files in a particular GTDB (or in any particular simulator level of detail and area block of the GTDB) is optional, depending on the availability of data and on the requirements of the target simulator and training mission. The Area Block Header File identifies those lower-level area block pseudo-files which are present for any given area block within a SLOD.

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Figure C-1.

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50.1.2.8 Terrain data can be represented within the GTDB either as a continuous network of surface polygons in three dimensions, or as a systematically spaced grid matrix of elevation posts. The user has the option of requesting one or the other representation, or both within the same GTDB, or neither if terrain is not desired.

50.1.2.9 If gridded terrain is requested, the user may select the terrain post density from available LODs stored in the Standard Simulator Data Base (SSDB). The standard simulator data base has been designed to store terrain data, if available, at nominal post spacings of 100m (3 arc seconds of latitude/longitude), 30m (1 arc second), 10m (0.3 arc seconds), and 1m (0.03 arc seconds).

50.1.2.10 If polygons are requested, the user may specify common data base transformation program transformation parameters controlling the trade-off between polygon budgets and a goodness-of-fit criterion. Project 2851 has selected the public-domain Dirichlet tesselation and Delauney polygonization algorithms to achieve maximum terrain fidelity and correlation capability, given variable polygon budget constraints. These algorithms produce variable-density triangles, allocated to provide more polygons in areas of relatively greater terrain roughness. (Refer to the common data base transformation program software detailed design document for details on these algorithms.) Although the common data base transformation program generates only triangles, the GTDB data structure could support more complex polygons.

50.1.2.11 If correlation is desired between a GTDB using polygonized terrain and another (or the same) GTDB using gridded terrain, a user-specified option will cause the common data base transformation program to derive equivalent gridded post values from the polygonized terrain rather than use the originally compiled standard simulator data base values.

50.1.2.12 Culture data will include both spatial and descriptive information about individual features which lie upon the terrain. Both natural and man-made features are included. The general data architecture for culture data is an expansion of standards and conventions established by the Defense Mapping Agency (DMA). Spatially, features will be represented as discrete points, lines, or surface polygons in two-dimensional space. The height of an object above the terrain (if applicable) is encoded as an attribute of the feature along with many other attributes useful for generating simulated scenes. Some of the attributes have obvious direct value for scene depiction, e.g., reflectance, directivity, and Surface Material Category (SMC). Attributes such as percent of tree coverage are required to predict radar masking effects. Other attributes (e.g., Feature Descriptor Code, Roof Type) provide semantic detail about features which may be helpful to simulators in selecting models, texture, or other means for realistic rendering of culture objects. Still other attributes (e.g., maximum load-bearing capacity of a bridge, temporal characteristics) may be useful to support realistic training scenario content.

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50.1.2.13 As noted above, the spatial coordinates describing the boundary vertices of a feature will normally be in two-dimensional (x,y) space, as they are stored in the SSDB. Selection of a common data base transformation program option for fragmenting culture along the boundaries of underlying terrain polygons will result in culture vertices being placed in 3-D (x,y,z) space, such that all features will be coplanar with the underlying terrain.

50.1.2.14 As is the case with terrain, culture data may be selected from the various Levels of Detail (LODs) of the Standard Simulator Data Base (SSDB), as data are available. Culture LODs have been defined in the standard simulator data base to correspond roughly to feature resolutions of 300m, 100m, 30m, 10m, 3m, and 1m. The previously described "island" specifications are used by the common data base transformation program to allocate culture detail where it is most needed for the training application.

50.1.2.15 If correlation between a radar GTDB and a visual GTDB is desired, features typically not associated with radar data bases (e.g., models and texture) may optionally be included in the radar GTDB, so that radar effects can be correlated with visual/infrared scenes. On the other hand, the need to correlate with a visual system can have a limiting effect on the radar GTDB. Typically, the computational demands on visual image generators are significantly greater than on radar image generators. As a result, visual systems tend to be more limited in the number of features or surfaces they can portray compared to radar systems. This means that when correlation is a requirement, some radar-significant features may have to be eliminated from the radar scene.

50.1.2.16 The Project 2851 GTDBs have a provision for carrying correlation priority codes indicating which features are more or less important to retain for correlation. When populated, these priority codes may be used to guide the filtering process whenever features have to be eliminated to meet image generator processing constraints.

50.1.2.17 The model libraries contain the identification and descriptive information for computer-graphic models of various generic (e.g., a 'typical' house) and specific (e.g., a C-130 transport) objects which must be displayed with more realism and detail than is possible with simple 2-D surface culture polygons. It should be emphasized that all models in a GTDB will be polygonal (surface-based) models, even though models are represented in the standard simulator data base using Constructive Solid Geometry (CSG). Together with the CSG definition of the basic model, the standard simulator data base will store instructions for automatically converting the single generic model into various polygonal representations more suitable for use on particular real-time image generators. These instructions are executed by the Common Data Base Transformation Program (CDBTP) when selecting models for inclusion in a GTDB.

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50.1.2.18 Like terrain and culture, models may be described at multiple levels of detail to allow trade-offs between rendering detail and system performance considerations. The model library will initially contain three levels of detail, designated as high, medium, and low. Medium-detail models will define surfaces and components at roughly 1-meter resolution and are intended for nominal viewing ranges. High-detail models are intended for close-up viewing and will resolve components at sub-meter resolutions. Low-detail models are intended for far-scene or low-fidelity displays and will always consist of 20 or fewer polygons, regardless of component resolution.

50.1.2.19 Each of the model libraries has associated with it a model vertex file, containing a list of coordinate vertices defining the geometry of the models. Each model vertex file is organized as a set of pseudo-files, one per model. Each pseudo-file contains the vertices used to define all LODs of a model.

50.1.2.20 Models introduce further problems in the area of correlation between GTDBs. The concept is to supply generic models which will support correlation by providing a common geometry, or at least reasonably compatible geometries, across sensors and LODs. Since models tend to be highly specific to the vendor's architecture and also are a major focus of product differentiation and improvement, it may not be practical or desirable to force vendors to always use the generic models. However, the generic models may take precedence when correlation is a higher priority than absolute rendering quality.

50.1.2.21 The texture libraries contain descriptive information and digital image files which may be applied to a terrain/culture or model surface to gain greatly increased realism and detail without increasing the complexity of the underlying geometry. Two texture libraries are supported: areal and model. Both of these libraries support supplying textures processed at a variety of stages and resolutions, a choice of specific or generic texture, and texture types including color and grayscale. Areal texture libraries support an additional texture type of SMC/FDC codes for non-visual simulation (e.g., radar or infra-red). Naturally, areal texture applies to terrain and culture, while model texture is used only for models.

50.1.2.21.1 Specific texture is specific to a certain geographic area for areal texture and specific to a certain object for model texture. Specific texture is an image generally derived from satellite imagery, aerial photography, or hand-held ground photography. Generic texture is an image that can be generated from specific texture or from synthetic pattern generation. Generic texture is a small tile of texture that can be repeated to simulate the true view without using the large amounts of memory and I/O processing necessary with specific texture. An example of areal generic texture would be a field pattern that is repeated over and over again to achieve the view of a very large field. An example of model generic texture would be a brick wall pattern that could be repeated along the side of a building.

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50.1.2.21.2 To accommodate the many needs of the simulation community, the GTDB supports texture processed at any one of five stages. Stage 1 texture is the original digital image provided by the source. The texture is in its original native format as that provided by the source. The GTDB will provide with it descriptive information such as ground control points, tie points to other images, percentage of cloud cover, geographic location, and image capture date and time. Naturally, this stage applies only to specific texture. Stage 1 processing is available for both areal and model texture.

50.1.2.21.3 Unlike Stage 1 texture, Stage 2 texture is provided in National Imagery Transmission Format (NITF) (Version 1.1, 1 March 1989, and NITF Change Notice No. 2, 23 May 1990). This is a DOD standard for images. The content of the image may have changed due to the "clean up" operations performed at this stage. Noise removal, occlusion removal with hole fill-in, shadow minimization, haze removal, and contrast enhancement are examples of processing done to produce a Stage 2 texture. Once again, Stage 2 processing applies only to specific texture. Since this is the first stage where the original image's source format is not used, many of the GTDB texture parameters apply here. For instance, the user can specify, the number of bits per texture pixel (texel), and a texture format (Band-Sequential, or Band-Interleaved). The texture image and all descriptive information is supplied in NITF. It is available for both areal and model texture. The NITF standard is used at this stage.

50.1.2.21.4 Stage 3 texture is geometrically corrected, i.e., it is geopositioned and orthorectified. Areal texture is placed in equal arc spacing at this stage, while model texture is placed in a local Cartesian coordinate system. At this stage, image-to-image radiometric corrections have been performed. Most GTDB parameters apply at this stage. Stage 3 can apply to both specific and generic texture. It is available for both areal and model texture.

50.1.2.21.5 Stage 4 texture is simply Stage 3 texture transformed to a user-specified coordinate system other than geodetic for geographic areal texture (which is supplied in Stage 3). The NITF standard is used at this stage. This stage applies to both specific and generic texture. It is used only for areal texture, since model texture is always in a local Cartesian coordinate system that need not be transformed.

50.1.2.21.6 Finally, Stage 5 texture includes polygon mapping control information so that the texture is already mapped to the polygons. Thus, Stage 5 consists of Stage 3 or Stage 4 textures with this control information. Specific areal textures are mapped to terrain polygons through vertex-to-vertex mapping. Generic areal textures are mapped to culture polygons using global-based and face-based mapping. Specific model textures are mapped to model polygons using the vertex-to-vertex, face-based, and model-based mapping schemes. Generic model textures are mapped to model polygons using the face-based and model-based mapping methods. Once again, the NITF standard is used. Stage 5 processing can be done with either specific or generic texture.

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50.1.2.21.7 For non-visual simulation systems, the GTDB supports texture maps containing a grid of Surface Material Categories (SMC) and Feature Descriptor Codes (FDC). Such a map provides a finer resolution of surface information than can be provided by vector data bases. These SMC/FDC textures are provided in the Areal Texture Library when requested. They are treated as specific areal textures. They can be produced at Stages 3, 4, or 5.

50.1.2.21.8 Textures are linked to terrain/culture in a number of ways. First, the Area Block Header File may have a table of pointers to specific textures for each area block. These textures can be at any of Stages 1 through 4 of processing. Second, each terrain polygon within an area block may have texture references for the actual texture mapping. This method would be used for Stage 5 texture mapping of specific areal texture. This data can be found in the Terrain Polygon Area Block Pseudo-File. Third, for geographic areas where specific areal texture is not available, generic texture can be used. Each areal feature within the Areal Feature Area Block Pseudo-File may have a pointer to a generic texture pattern that can be used in lieu of specific texture. Fourth, the Areal Feature Area Block Pseudo-File may also have the mapping information for Stage 5 generic textures.

50.1.2.21.9 Textures are linked to models in a number of ways. Models have texture references for non-mapped textures. This would pertain to Stages 1, 2, and 3. Stage 4 does not apply to models. Models have three other types of texture references, each for texture mapping at Stage 5. Vertex-to-vertex, face-based, and model-based mapping schemes all support specific texture while only the latter two can be used for generic texture. All of this data can be found in the Model Library Files. Under this design, the GTDB offers much flexibility to the user in the ways that texture can be requested for customized usage.

50.1.2.22 The design for the Project 2851 System permits a high degree of tailoring of GTDBs to match a specific simulator and training mission. For this reason, various combinations of data files described in this data base design document are possible. For example, it will be possible to request a GTDB in which all linear features have been converted to areals, eliminating the need for a Linear Feature Area Block File. In addition, the specific contents of the files may also vary considerably based on the transformation parameters specified. For example, a highly restrictive maximum polygon density would result in features being left out of a GTDB that would otherwise be represented. Under any circumstance, all GTDBs will conform to the logical architecture as specified herein.

50.1.3 The following subsections describe each of the GTDB files. Note that the subsection numbers correspond to those of Section 5 of this standard, for easy reference.

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50.2 **Gaming Area Header (GAH) File.** The purposes of the GAH are to: (1) identify the GTDB; (2) describe general gaming area characteristics; and (3) document the Project 2851 parameters used to generate the GTDB. GTDB identifiers will include a Project 2851 catalog number, date of creation, and security level. Gaming area descriptors will include coordinates specifying the geographic boundaries of the gaming area. GTDB production parameters will document the Project 2851 transformation parameters specified to create this particular GTDB. Specific parameter options are documented in the design of the Common Data Base Transformation Program (CDBTP).

50.2.1 **GAH Record Order.** Self-explanatory.

50.2.2 **GAH Field Structure.** Self-explanatory.

50.2.2.1 **GAH Identifier Record.** Self-explanatory.

50.2.2.2 **GAH File Name Record.** Self-explanatory.

50.2.2.3 **Gaming Area Header Record.** Self-explanatory.

50.2.2.4 **GTDB Parameters Record.** This record is mandatory and contains a list of all Common Data Base Transformation Program (CDBTP) transformation parameters used to generate this particular GTDB. (See Appendix A, Volume I, to the CDBTP software detailed design document for specifications of the meaning of the individual parameters.)

50.2.2.4.1 **Coordinate System Parameters Subrecord.** This subrecord contains GTDB parameters defining the coordinate system in which all terrain and culture spatial data are expressed. The parameters specifically define control information used to perform coordinate conversions, projection transformations, and/or datum shifts required to transform geodetically expressed standard simulator data base data into a user-specified GTDB coordinate space.

50.2.2.4.2 **Specific Areal Texture Parameters Subrecord.** This subrecord contains GTDB parameters used to generate a particular set of specific areal textures for a GTDB. Other parameters dealing with specific areal texture are at the Area Block level within the GAH.

50.2.2.4.3 **Generic Areal Texture Parameters Subrecord.** This subrecord contains GTDB parameters used to generate a particular set of generic areal textures for a GTDB. Other parameters dealing with generic areal texture are at the SLOD level within the GAH.

50.2.2.4.4 **Specific Model Texture Parameters Subrecord.** This subrecord contains GTDB parameters used to generate a particular set of specific model textures for a GTDB. These parameters apply to all models referenced by culture. Texture parameters for explicitly requested models are provided at the model level. All available model texture resolutions are automatically provided.

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50.2.2.4.5 **Generic Model Texture Parameters Subrecord.** This subrecord contains GTDB parameters used to generate a particular set of generic model textures for a GTDB. These parameters apply to all models referenced by culture. Texture parameters for explicitly requested models are provided at the model level. All available model texture resolutions are automatically provided.

50.2.2.4.6 **Time of Year Preference Subrecord.** Self-explanatory.

50.2.2.4.7 **Image Capture Data Range Subrecord.** Self-explanatory.

50.2.2.4.8 **Acceptable Percentage of Cloud Cover Subrecord.** Self-explanatory.

50.2.2.4.9 **Acceptable Percentage of Shadow Cover Subrecord.** Self-explanatory.

50.2.2.5 **Boundary Point Record.** This record contains a geographic coordinate used to define a point on the boundary of the gaming area covered by the GTDB. The arc between each successive pair of points defines an edge of the gaming area. By software detailed design document convention, the shape of a gaming area may be irregular, but each edge must be parallel to one of the axes of the coordinate plane. The gaming area boundary will be closed explicitly; i.e., the first boundary point will be explicitly listed again as the last point. Thus, there will always be at least five Boundary Point Records. The boundary point records for a gaming area will be sequenced in counterclockwise order as viewed from above.

50.2.2.6 **Model List Record.** This optional record contains the ID of a model which has been explicitly requested for inclusion in the GTDB. The model list is intended to be used to select models (e.g., aircraft) in addition to any used for culture substitution. (Models which are referenced within the Model Reference Area Block File as substitutes for culture will automatically be included in the GTDB model libraries, whether or not they appear in the model list.)

50.2.2.6.1 **Specific Model Texture Parameters Subrecord.** This subrecord contains GTDB parameters used to generate a particular set of specific model textures for an explicitly specified model within the GTDB. All available model texture resolutions are automatically provided.

50.2.2.6.2 **Generic Model Texture Parameters Subrecord.** This subrecord contains GTDB parameters used to generate a particular set of generic model textures for an explicitly specified model within the GTDB. All available model texture resolutions are automatically provided

50.2.2.7 **SLOD Parameters Record.** This record and its subsidiary records contain the common data base transformation program transformation parameters used to generate a particular Simulator Level of Detail (SLOD) within the GTDB. There will always be at least one simulator level of detail in a GTDB.

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50.2.2.8 **Keep-List Record.** This optional record contains starting and ending values defining a range of Project 2851 Feature Descriptor Codes (FDCs). All standard simulator data base features whose FDCs fall within the given range are candidates for inclusion in the GTDB. The Project 2851 FDCs are extensions of DMA's FACS (Feature Attribute Coding Standard) feature codes.

50.2.2.9 **Delete-List Record.** This optional record contains starting and ending values defining a range of Project 2851 Feature Descriptor Codes (FDCs). All standard simulator data base features whose FDCs fall within the given range will be excluded from the GTDB. The Project 2851 FDCs are extensions of DMA's FACS (Feature Attribute Coding Standard) feature codes.

50.2.2.10 **Level-List Record.** This optional record contains starting and ending values defining a range of Project 2851 Feature Descriptor Codes (FDCs). All standard simulator data base features whose FDCs fall within the given range will be used to level (flatten) the underlying terrain in the GTDB. The Project 2851 FDCs are extensions of DMA's FACS (Feature Attribute Coding Standard) feature codes.

50.2.2.11 **Area Block Parameters Record.** This record contains the common data base transformation program transformation parameters used to generate a particular Area Block within a simulator level of detail of a GTDB. There will always be at least one area block per simulator level of detail in a GTDB. Texture parameters are specified here for specific texture.

50.2.2.12 **Island Record.** This record is used to define the existence of an "island" within the GTDB. An island is an area within the gaming area (or within a larger island) having assigned levels of culture resolution at various SLODs. Islands are used to control the allocation of culture detail so that high-interest areas (e.g., airfields or targets) can be modeled with much greater scene detail than areas of lesser importance. Figure C-2 illustrates the island concept. By convention, the entire gaming area constitutes the first, largest island. Any subsequent islands will define sub-areas of previously-defined islands. The common data base transformation program will not allow island boundaries to overlap.

50.2.2.13 **Island LOD Record.** This record is used to define the levels of culture resolution to be applied within an island at the various SLODs. This record specifies which culture LOD within the standard simulator data base is to be used to extract data for inclusion within this island at the given SLOD. Texture parameters are specified here for generic texture.

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Figure C-2

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50.2.2.14 **Island Boundary Point Record.** This record contains a geographic coordinate used to define a point on the boundary of an island within the gaming area covered by the GTDB. The arc between each successive pair of points defines an edge of the island. By common data base transformation program convention, the shape of an island may be an irregular closed contour. Unlike gaming area boundaries, island boundaries do not require that each edge be parallel to one of the axes of the coordinate plane. Each island will be closed explicitly; i.e., the first boundary point of the island will be explicitly listed again as the last point. Thus, there will always be at least three Island Boundary Point Records per island. The boundary point records for each island will be sequenced in counterclockwise order as viewed from above.

50.2.2.15 **Option Record.** This record contains an option value which indicates whether the GTDB tape contains all area blocks or just those added or updated since the previous GTDB version.

50.2.2.16 **Affected AB Count Record.** This record contains a count of the area blocks added or updated since the previous GTDB version.

50.2.2.17 **Affected AB ID Record.** This record identifies an area block added or updated since the previous GTDB version.

50.2.2.18 **Checksum Record.** This record contains the checksum value for the Gaming Area Header File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

50.3 **Model Library Header (MLH) File.** The Model Library Header (MLH) File is mandatory in a GTDB. The MLH identifies model libraries (if any) contained within the GTDB. The MLH will exist whether or not a GTDB contains any model libraries. The purposes of the MLH are to: (a) identify any model libraries which do exist; and (b) provide data base statistics useful for planning and decision making during use of the model libraries. Model libraries will be identified as a 2-D Static Model Library, a 3-D Static Model Library, or a 3-D Dynamic Model Library. Each of these libraries is optional and will exist only when there are models of the given type being passed in the GTDB. There will be a maximum of one of each type of model library in a GTDB. Data base statistics will give user-created Formatter Programs (and human data base modelers) a means for planning and optimizing the selection of models for the target simulator. The types of statistics to be provided will include model-specific measures of polygon/face complexity and color distribution.

50.3.1 **MLH Record Order.** Self-explanatory.

50.3.2 **MLH Field Structure.** Self-explanatory.

50.3.2.1 **MLH Identifier Record.** Self-explanatory.

50.3.2.2 **File Name Record.** Self-explanatory.

50.3.2.3 **Model Library Header Record.** The "Model Library Type" field indicates which of the three libraries is being described. A value of zero in the "Number of Models" field indicates that there is no actual model library file of the given type within the GTDB.

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50.3.2.4 **Culture Color Table Record.** This record contains a single element in a distribution table of colors used in the model library.

50.3.2.5 **Light Color Table Record.** This record contains a single element in a distribution table of light-emitter colors used in the model library.

50.3.2.6 **Model LOD Complexity Table Record.** This record contains a count of the number of LODs that exist for a given model in the model library.

50.3.2.7 **Model Complexity Statistics Table Record.** This record contains complexity statistics for each LOD version of a model.

50.3.2.8 **Checksum Record.** This record contains the checksum value for the Model Library Header File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

50.4 **Simulator Level of Detail Header (SLODH) File.** The Simulator Level of Detail Header (SLODH) File is mandatory in a GTDB. The SLODH identifies all of the SLODs contained within the GTDB. The purposes of the SLODH are to: (a) identify the SLODs contained within the data base; and (b) provide data base statistics useful for planning and decision making during use. A minimum of one SLOD is required for a valid GTDB, but a typical GTDB is expected to have several SLODs. A SLOD is a distinct level of data base detail and/or density. Different SLODs may be used to simulate variations in proximity, sensor range, sensor gain, and field of view. Each simulator level of detail may be logically subdivided into area blocks as defined in the Area Block Header File. Data base statistics will give user-created Formatter Programs (and human data base modelers) a means for planning and optimizing the selection and filtering of SLODs for the target simulator. The types of statistics to be provided include measures of feature and polygon density, feature type distribution, SMC distribution, and color distribution.

50.4.1 **SLODH Record Order.** Self-explanatory.

50.4.2 **SLODH Field Structure.** Self-explanatory.

50.4.2.1 **SLODH Identifier Record.** Self-explanatory.

50.4.2.2 **File Name Record.** Self-explanatory.

50.4.2.3 **SLODH File Header Record.** Self-explanatory.

50.4.2.4 **SLOD Header Record.** This record contains control information describing a particular SLOD.

50.4.2.4.1 **SLOD Polygon Density Statistics Table Subrecord.** This subrecord contains statistics on maximum and minimum densities of data base elements on a per-area-block basis within the SLOD.

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50.4.2.5 **Feature Distribution Table Record.** This record contains a single element in a distribution table of types of culture features present within a simulator level of detail, categorized and sorted by Feature Descriptor Code.

50.4.2.6 **Z-Density Distribution Table Record.** This record contains a single element in a distribution table of the numbers of layers of culture occurring above terrain polygons within a SLOD. These records will be omitted when the GTDB does not include polygonized terrain, or if the culture has not been fragmented on the terrain.

50.4.2.7 **SMC Distribution Record.** This record contains a single element in a distribution table of surface material codes present within a simulator level of detail, categorized and sorted by Surface Material Category and Surface Material Subtype.

50.4.2.8 **Culture Color Table Record.** This record contains a single element in a distribution table of colors used in the SLOD.

50.4.2.9 **Light Color Table Record.** This record contains a single element in a distribution table of light-emitter colors used in the SLOD.

50.4.2.10 **Checksum Record.** This record contains the checksum value for the Simulator Level of Detail Header File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

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50.5 **Area Block Header (ABH) File.** The Area Block Header (ABH) File is mandatory in a GTDB. The ABH identifies all area blocks contained within all SLODs in the gaming area. The purposes of the ABH are to: (a) identify the area blocks contained within the data base; and (b) provide data base statistics useful for planning and decision making during use. Area blocks are predefined rectangular subdivisions of the gaming area, defined by arcs of latitude and longitude. A minimum of one area block per simulator level of detail is required for a valid GTDB, but a typical GTDB is expected to have many area blocks per SLOD. Each area block will be identified by a unique ID code, as well as by two corner coordinates specifying the geographic boundaries of the block. These coordinate pairs define the southwest and northeast corners of the area block. Data base statistics will give user-created Formatter Programs (and human data base modelers) a means for planning and optimizing the selection and filtering of area blocks for the target simulator. The types of statistics to be provided include measures of feature and polygon density, feature type distribution, surface material distribution, color distribution, and terrain roughness. The ABH will contain flags indicating which of the possible set of terrain and culture area block data pseudo-files are present for this area block in the GTDB. These pseudo-files may include a Vertex Area Block (VAB) Pseudo-File, an Areal Feature Area Block (AFAB) Pseudo-File, a Linear Feature Area Block (LFAB) Pseudo-File, a Point Feature Area Block (PFAB) Pseudo-File, a Point Light Feature Area Block (PLFAB) Pseudo-File, a Point Light String Feature Area Block (PLSFAB) Pseudo-File, a Terrain Polygon Area Block (TPAB) Pseudo-File, a Terrain Grid Area Block (TGAB) Pseudo-File, and a Model Reference Area Block (MRAB) Pseudo-File. Only the VAB and the AFAB are required in every GTDB. The exact configuration of area blocks in any given GTDB will depend on the transformation parameters used, and on the availability of the various types of data within the SSDB. The area block data pseudo-files for all area blocks in the data base are contained in Simulator Level of Detail Area Blocks (SLAB) File(s), which will follow the photo texture and model library files.

50.5.1 **ABH Record Order.** Self-explanatory.

50.5.2 **ABH Field Structure.** Self-explanatory.

50.5.2.1 **ABH Identifier Record.** Self-explanatory.

50.5.2.2 **File Name Record.** Self-explanatory.

50.5.2.3 **ABH File Header Record.** Self-explanatory.

50.5.2.4 **Area Block Header Record.** The Area Block Header record contains control information describing a particular area block within a SLOD.

50.5.2.4.1 **Polygon Density Statistics Table Subrecord.** This subrecord contains counts of data base elements within the area block.

50.5.2.4.2 **Terrain Roughness Statistics Subrecord.** This subrecord contains statistics indicating the roughness (i.e., variability) of the terrain within the area block. These fields will be populated with real data whenever terrain (either gridded or polygonized, or both) has been requested.

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50.5.2.4.3 **Area Block Existence Flags Subrecord.** This subrecord consists of a series of boolean flag fields indicating whether an area block of a particular type exists within this SLOD. Each flag will contain a "T" or "F" to indicate existence or non-existence, respectively.

50.5.2.5 **Feature Distribution Table Record.** This record contains a single element in a distribution table of types of culture features present within an area block, categorized and sorted by Feature Descriptor Code.

50.5.2.6 **SMC Distribution Record.** This record contains a single element in a distribution table of surface material codes present within an area block, categorized and sorted by Surface Material Category and Surface Material Subtype.

50.5.2.7 **Culture Color Table Record.** This record contains a single element in a distribution table of colors used in the area block.

50.5.2.8 **Light Color Table Record.** This record contains a single element in a distribution table of light-emitter colors used in the area block.

50.5.2.9 **Areal Texture Table Record.** This record contains a single element in a distribution table of areal textures used in the area block. The areal textures are sorted by Texture ID. This record can reference specific areal texture in any one of Stages 1 through 4 and SMC/FDC texture in either Stages 3 or 4. (There is no SMC/FDC texture in Stages 1 and 2.)

50.5.2.10 **Checksum Record.** This record contains the checksum value for the Area Block Header File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

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50.6 **Texture Library Header (TLH) File.** The Texture Library Header (TLH) File is mandatory in a GTDB. The TLH identifies photo texture libraries (if any) contained within the GTDB. The TLH will exist whether or not a GTDB contains any photo texture image libraries. The purposes of the TLH are to: (a) identify any photo texture libraries which do exist; and (b) provide data base statistics useful for planning and decision making during use of the texture libraries. Photo texture libraries will be identified as either an Areal Photo Texture Library or a Model Photo Texture Library. Each of these libraries is optional and will exist only when there are texture maps of the given type being passed in the GTDB. There will be a maximum of one of each type of photo texture library in a GTDB. Data base statistics will give user-created Formatter Programs (and human data base modelers) a means for planning and optimizing the selection of texture maps for the target simulator. The types of statistics to be provided will include the number of textures for each stage of specific, generic, and SMC/FDC textures, and storage size requirements for each of those classifications.

50.6.1 **TLH Record Order.** Self-explanatory.

50.6.2 **TLH Field Structure.** Self-explanatory.

50.6.2.1 **TLH Identifier Record.** Self-explanatory.

50.6.2.2 **File Name Record.** Self-explanatory.

50.6.2.3 **Texture Library Complexity Statistics Record.** Self-explanatory.

50.6.2.4 **Texture Library Header Record.** The "Texture Library Type" field indicates which of the two libraries is being described. A value of zero in the "Number of Texture Images in Library" field indicates that there is no actual texture library file of the given type within the GTDB.

50.6.2.5 **Texture Distribution Table Record.** This record contains control data for a texture image in the texture library. This record contains control data for a texture image in the texture library. The number of these records will correspond to the value in the "Number of Texture Images in Library" field in the parent Texture Library Complexity Statistics record. Thus, there is a set of these records for each texture library. The "Texture Data Format" field shall contain the value "NITF" for all textures other those in Stage 1; for those Stage 1 textures, the field shall accurately describe the source format. The "Number of Data Files" field value shall always be 2 for a non-Stage 1 texture: the NITF Image Sub-Header File and the NITF Image Data File. For Stage 1 textures, the "Number of Data Files" field value shall be 2 or greater, depending on the number of Original Format Image Files from the source. A Stage 1 texture shall always have an NITF Image Sub-Header File to include P2851-specific data.

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50.6.2.6 **Stage 1 Texture Field Association Record.** This optional record contains a Stage 1 texture file name and its associated original file name. All GTDB texture file names can be automatically derived; however, for Stage 1 texture data, a file's original name assigned by the source may have value to a GTDB user. This name is associated with the current GTDB texture file name here for the user's convenience.

50.6.2.7 **Checksum Record.** This record contains the checksum value for the Texture Library Header File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

50.7 **2-D Static Model (2DSM) Library File.** The 2DSM is optional in a GTDB. When present, it contains all the 2-D static models referenced within the GTDB or explicitly requested during GTDB generation. The geometry of each model is represented as a set of surface polygons in 2-D space. The perimeter of each polygon is described by a set of coordinates or vertices. Each set of coordinates is identified by its position in a list of values stored in a separate 2-D Static Model Vertex File, allowing each coordinate set to be used repeatedly. By convention, all GTDB model polygons will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly listed again as the last vertex. Each surface or polygon may have descriptive and rendering attributes associated with it. A wide range of fields are available to describe attributes specific to radar, visual, and infrared simulation, as well as general attributes applicable to all three. Each polygon may reference any number of photo texture maps from the Model Photo Texture Library. The model library structure also supports composite models in which one model references another as a component. The 2DSM supports storage of models for any given object at multiple levels of detail. This will permit selection of models at a level of complexity that balances the desire for realism and the resolution of the simulated sensor with the processing capacity of the image generator and the overall complexity of the scene.

50.7.1 **2DSM Record Order.** Self-explanatory.

50.7.2 **2DSM Field Structure.** Self-explanatory.

50.7.2.1 **2DSM Identifier Record.** Self-explanatory.

50.7.2.2 **File Name Record.** Self-explanatory.

50.7.2.3 **2DSM Header Record.** This mandatory record contains control information describing this file.

50.7.2.4 **Model Header Record.** This record identifies a model group, which can consist of one or more actual model geometries representing a given object at varying LODs.

50.7.2.5 **LOD Header Record.** This record describes a particular LOD version of a model. (Fields designated "Always Zero" are not applicable to 2-D static models. They have been included for consistency of format across all model libraries.) The Placement Point Field will be supported through the use of FACS codes.

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50.7.2.6 **LOD Texture Reference Pointer Record.** This record provides pointers to the texture references for a model LOD.

50.7.2.7 **Component Header Record.** This record describes a particular component within a model LOD.

50.7.2.8 **Component Texture Reference Pointer Record.** This record provides pointers to the texture references for a component.

50.7.2.9 **Model Polygon Record.** This record describes the attributes of a polygon within a particular model. The last polygon record will always define the model "footprint" as referenced by the Base Polygon ID field in the parent Model record. This polygon is not meant to be displayed during a simulation but is supplied to aid the user in placing additional instances of the model.

50.7.2.10 **Model Microdescriptor Record.** This optional record contains a microdescriptor associated with a model polygon. The types of microdescriptors supported by Project 2851 are listed in Section 5.16 of this standard.

50.7.2.11 **Vertex Pointer Record.** This record is used to associate a model polygon with a vertex record within the Two-Dimensional Static Model Vertex (2DSMV) File. There will be three or more of these records defining the geometry of each model polygon. By convention, a model polygon will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly referenced again as the last vertex.

50.7.2.12 **Polygon FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a model polygon.

50.7.2.13 **Polygon Texture Reference Record.** This optional record is used to associate a model polygon with a Photo Texture Image Header record within the Model Photo Texture Library File.

50.7.2.14 **Subsidiary Model Reference Record.** This optional record is used to designate another model within the model libraries as a subcomponent of this model.

50.7.2.15 **Point Light String Record.** This optional record is used to define each point light string within a model. It can be used to represent a single light by indicating that the number of lights is one. Point lights are light emitting objects represented spatially by a single coordinate within a model (e.g., a headlight on an automobile). They contain several attributes necessary for describing a light emitter such as the light lobe parameters, cycle rate, light type, and intensity. Point light strings are a sequence of discrete but logically connected light emitters (e.g., runway lights).

50.7.2.16 **Point Light String FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a point light string as a whole.

50.7.2.17 **Model FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a model as a whole (as opposed to a polygon within the model).

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50.7.2.18 **Face-Based Texture Reference Record.** This optional record is used to define one method of placing a texture pattern on a polygon. It associates a model polygon with a texture in the Model Texture Library. The data contained in this record defines the transformation required to place a texture pattern on a polygon. All referenced textures will be Stage 3 specific model or generic textures.

50.7.2.19 **Vertex-to-Vertex Texture Reference Record.** This optional record is used to define another method of placing a texture pattern on a polygon. It associates the polygon with a texture in the Model Texture Library. This entails the mapping of texture pattern vertices to polygon vertices. There will be one texture pattern vertex defined for each polygon vertex. The first texture pattern vertex will map to the first polygon vertex. All referenced textures will be Stage 3 specific model or generic textures.

50.7.2.20 **Model-Based Texture Reference Record.** This optional record is used to define a method of placing a texture pattern as a single entity on a model. It associates the model with a texture in the Model Texture Library. This type of texturing can be conceptualized as the texture being "shrink-wrapped" onto the model. All referenced textures will be Stage 3 specific model or generic textures.

50.7.2.21 **Non-Mapped Texture Reference Record.** This record identifies a reference for a texture that is not directly mapped to the model. It associates a texture with a model.

50.7.2.22 **Checksum Record.** This record contains the checksum value for the 2-D Static Model Library File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

50.8 **2-D Static Model Vertex (2DSMV) File.** The 2DSMV will consist of one or more 2DSMV Pseudo-files, corresponding to the number of models in the 2DSM. Each 2DSMV pseudo-file contains a list of the vertex coordinates used to define all LODs for a given model. These vertices are referenced from within the model definitions in the 2DSM, in order to define model polygons and vertex normals. The user will be able to associate a vertex pseudo-file with its model via a file naming convention. Each vertex pseudo-file name will take the form MDL2DSnnnnn.VTX, where 'nnnnn' corresponds to the unique model ID number. These pseudo-files will physically occur on the tape in the same sequence as their corresponding model definitions occur within the model library.

50.8.1 **2DSMV File Structure.** Self-explanatory.

50.8.2 **2DSM Record Structure.** Self-explanatory.

50.8.2.1 **Two-Dimensional Static Model Vertex Pseudo-Files.** These pseudo-files contain all coordinate vertices used to define models within the 2-D Static Model Library (2DSM) File.

50.8.2.1.1 **2DSMV Pseudo-File Record Order.** Self-explanatory.

50.8.2.1.2 **2DSMV Pseudo-File Field Structure.** Self-explanatory.

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50.8.2.1.2.1 **2DSMV Identifier Record.** Self-explanatory.

50.8.2.1.2.2 **File Name Record.** Self-explanatory.

50.8.2.1.2.3 **Vertex Record.** Each Vertex record contains a coordinate used to define a model vertex within the 2DSM. The value in the Vertex List Position field is used as an index by a model referencing a vertex. The internal format of the Coordinate field will vary depending on the coordinate system selected for a particular GTDB. (Valid formats are defined within the Representation Dictionary in Appendix A to the DBDD.)

50.8.2.1.2.4 **Pseudo-EOF Record.** Self-explanatory.

50.8.2.1.2.5 **Checksum Record.** This record contains the checksum value for the Two-Dimensional Static Model Vertex Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.9 **3-D Static Model (3DSM) Library File.** The 3-D Static Model Library File is optional in a GTDB. When present, it contains all the 3-D static models referenced within the GTDB or explicitly requested during GTDB generation. The geometry of each model is represented as a set of surface polygons in 3-D space. The perimeter of each polygon is described by a set of coordinates or vertices. Each set of coordinates is identified by its position in a list of values stored in a separate 3-D Static Model Vertex File, allowing each coordinate set to be used repeatedly. By convention, all GTDB model polygons will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly listed again as the last vertex. Each surface or polygon may have descriptive and rendering attributes associated with it. A wide range of fields are available to describe attributes specific to radar, visual, and infrared simulation, as well as general attributes applicable to all three. Each polygon may reference any number of photo texture maps from the Model Photo Texture Library. The model library structure also supports composite models in which one model references another as a component. The 3DSM supports storage of models for any given object at multiple levels of detail. This will permit selection of models at a level of complexity that balances the desire for realism and the resolution of the simulated sensor with the processing capacity of the image generator and the overall complexity of the scene. The 3DSM includes a provision for identification of separation planes in three-dimensional space. These planes may be built between different objects within the model or they may be polygons which describe the model and, due to their position within it, also act as separating planes. It will also be possible to store 3-D models without separation planes.

50.9.1 **3DSM Record Order.** Self-explanatory.

50.9.2 **3DSM Field Structure.** Self-explanatory.

50.9.2.1 **3DSM Identifier Record.** Self-explanatory.

50.9.2.2 **3DSM File Name Record.** Self-explanatory.

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50.9.2.3 **3DSM Header Record.** This mandatory record contains control information describing this file.

50.9.2.4 **Model Header Record.** This record identifies a model group, which can consist of one or more actual model geometries representing a given object at varying LODs.

50.9.2.5 **LOD Header Record.** This record describes a particular LOD version of a model. (Fields designated "Always Zero" are not applicable to 3-D static models. They have been included for consistency of format across all model libraries.)

50.9.2.6 **LOD Texture Reference Pointer Record.** This record provides pointers to the texture references for a model LOD.

50.9.2.7 **Component Header Record.** This record describes a particular component within a model LOD.

50.9.2.8 **Component Texture Reference Pointer Record.** Self-explanatory.

50.9.2.9 **Model Polygon Record.** This record describes the attributes of a polygon within a particular model. The last polygon record will always define the model "footprint" as referenced by the Base Polygon ID field in the parent Model record. This polygon is not meant to be displayed during a simulation but is supplied to aid the user in placing additional instances of the model. In addition to a unique Polygon ID, each polygon may have a Cluster ID which associates the polygon with a group of polygons which have been logically separated from the rest of the model by a separation plane. The Cluster ID also identifies a polygon's position relative to any of the separation planes defined by the Separation Plane Records associated with the model. See paragraph 50.9.2.20 for an explanation of the relationship between clusters and separation planes.

50.9.2.10 **Model Microdescriptor Record.** This optional record contains a microdescriptor associated with a model polygon. The types of microdescriptors supported by Project 2851 are listed in Section 5.16 of this standard.

50.9.2.11 **Vertex Pointer Record.** This record is used to associate a model polygon with a Vertex record within the Three-Dimensional Static Model Vertex File. There will be three or more of these records defining the geometry of each model polygon. By convention, a model polygon will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly referenced again as the last vertex. The Vertex List Position and Correlation Priority fields apply to the coordinate defining a polygon vertex. The Normal List Position field points to a separate 3DSMV coordinate defining a vertex normal vector. This field will be populated with meaningful data only when vertex normals have been requested.

50.9.2.12 **Polygon FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a model polygon.

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50.9.2.13 **Polygon Texture Reference Record.** This optional record is used to associate a model polygon with a Photo Texture Image Header record within the Model Photo Texture Library File.

50.9.2.14 **Subsidiary Model Reference Record.** This optional record is used to designate another model within the model libraries as a subcomponent of this model.

50.9.2.15 **Point Light String Record.** Self-explanatory.

50.9.2.16 **Point Light String FACS Record.** Self-explanatory.

50.9.2.17 **Model FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a model as a whole (as opposed to a polygon within the model).

50.9.2.18 **Face-Based Texture Reference Record.** Self-explanatory.

50.9.2.19 **Vertex-to-Vertex Texture Reference Record.** Self-explanatory.

50.9.2.20 **Model-Based Texture Reference Record.** Self-explanatory.

50.9.2.21 **Non-Mapped Texture Reference Record.** Self-explanatory.

50.9.2.22 **Separation Plane Record.** This optional record is used to define a separation plane within a model. Separation planes are used to divide a 3-dimensional model into distinct clusters of model polygons, which provide a basis for efficient display-priority resolution when the model is rendered on a graphics device.

50.9.2.22.1 A Separation Plane Number indicates the position of a separating plane within a binary separating plane (BSP) tree. An example of a BSP tree is illustrated below. At every level of the tree, the left child of a parent tree node represents the "true" (i.e., visible) half-space, or side, of the plane, while the right child represents the false side of the plane.

50.9.2.22.2 In the example, the root node (SP 1) of the BSP tree by itself divides the entire model into two half-spaces or clusters. The root node is shown having a left child and a right child. The left child divides the true cluster of the root node plane into two more clusters. The right child plane does the same to the false cluster of the root node plane. Finally, the right child plane has a left child of its own, dividing that plane's true cluster into two more clusters.

```
          SP 1
         /    \
        /      \
    SP 2        SP 3
                 /
                /
            SP 6
```

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50.9.2.22.3 As mentioned above, each node, or plane, has an identifying separation plane number which represents its position in the BSP tree. This number is determined by counting from top to bottom within the tree, from the left-most node to the right-most node at each level, as if the tree were complete (i.e., with all levels filled). This explains why the lowest node in the example is numbered 6 and not 4.

50.9.2.22.4 Note that the order of creation of the planes may be partially independent of the position of the planes in the tree, and hence of the separation plane numbers. Of course, the very first separation plane created for a model would have to be the root node and be assigned plane number 1. At lower levels, however, the nodes could be defined in any order, so long as any given node's parent has been previously defined. Within a model, the separation plane records will be physically ordered not by separation plane number but by the order in which the planes were created.

50.9.2.22.5 This order is important when determining Cluster IDs associated with every Model Polygon Record. The Cluster ID may be used to determine a polygon's position relative to the separation planes. A polygon can be on the true side of a plane, the false side, or in a "don't care" position. (This requires that polygons intersecting the plane be cut to lie entirely on one side or the other.) The "don't care" case occurs when a polygon has already been eliminated from the area of concern of a separating plane by a previously placed plane. A Cluster ID is a string of binary digits in which, if a polygon lies to the true side of the nth plane in the ordered list of planes, then the nth low-order bit is set to '1'; otherwise, the bit is set to '0'.

50.9.2.22.6 Continuing our example BSP tree, and assuming that the separating planes were defined in the order 1,2,3,6, the assigned Cluster IDs are shown below.

```
              SP 1
             /    \
            /      \
        SP 2        SP 3
         / \         / \
        /   \       /   \
    0011   0001   SP 6   0000
                   / \
                  /   \
               1100   0100
```

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50.9.2.22.7 Note that in this example the list is ordered such that plane numbers are always increasing. As previously noted, this need not always be the case. Consider adding another plane at this point which would be the left child of plane number 2. This newest plane would have a plane number of 4 based on its position in the BSP tree, but it would be treated as the fifth plane in the sequence of separation planes for purposes of generating cluster IDs. The resulting BSP tree and Cluster IDs would be as follows.

```
                    SP 1
                   /    \
                  /      \
            SP 2          SP 3
             / \           / \
            /   \         /   \
        SP 4   00001   SP 6   00000
         / \            / \
        /   \          /   \
   10011  00011     01100  00100
```

50.9.2.22.8 For further details on Project 2851 model separating planes, consult the modeling software documentation.

50.9.2.23 **Checksum Record.** This record contains the checksum value for the 3-D Static Model Library File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

50.10 **Three-Dimensional Static Model Vertex (3DSMV) File.** This file consists of a series of pseudo-files containing all coordinate vertices used to define models within the Three-Dimensional Static Model Library File. Each 3DSMV pseudo-file contains a list of the vertex coordinates used to define all LODs for a given model. These vertices are referenced from within the model definitions in the 3DSM, in order to define model polygons, vertex normals, and separation planes. The user will be able to associate a vertex pseudo-file with its model via a file naming convention. Each vertex pseudo-file name will take the form MDL3DSnnnnn.VTX, where 'nnnnn' corresponds to the unique model ID number. These pseudo-files will physically occur on the tape in the same sequence as their corresponding model definitions occur within the model library.

50.10.1 **3DSMV File Structure.** Self-explanatory.

50.10.2 **3DSM Record Structure.** Self-explanatory.

50.10.2.1 **3DSMV Pseudo-Files.** These pseudo-files contain all coordinate vertices used to define models within the Three-Dimensional Static Model (3DSM) Library File.

50.10.2.1.1 **3DSMV Pseudo-File Record Order.** Self-explanatory.

50.10.2.1.2 **3DSMV Pseudo-File Field Structure.** Self-explanatory.

50.10.2.1.2.1 **3DSMV Identifier Record.** Self-explanatory.

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50.10.2.1.2.2 **File Name Record.** Self-explanatory.

50.10.2.1.2.3 **Vertex Record.** Each Vertex record contains a coordinate used to define a model vertex or a vertex normal within the 3DSM. The value in the Vertex List Position field is used as an index by a model referencing a vertex. The internal format of the Coordinate field will vary depending on the coordinate system selected for a particular GTDB. (Valid formats are defined within the Representation Dictionary in Appendix A of this standard.)

50.10.2.1.2.4 **Pseudo-EOF Record.** Self-explanatory.

50.10.2.1.2.5 **Checksum Record.** This record contains the checksum value for the Three-Dimensional Static Model Vertex Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.11 **3-D Dynamic Model (3DDM) Library File.** The 3-D Dynamic Model Library File is optional in a GTDB. When present, it contains all the 3-D dynamic models referenced within the GTDB or explicitly requested during GTDB generation. The geometry of each model is represented as a set of surface polygons in 3-D space. The perimeter of each polygon is described by a set of coordinates or vertices. Each set of coordinates is identified by its position in a list of values stored in a separate 3-D Dynamic Model Vertex File, allowing each coordinate set to be used repeatedly. By convention, all GTDB model polygons will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly listed again as the last vertex. Each surface or polygon may have descriptive and rendering attributes associated with it. A wide range of fields are available to describe attributes specific to radar, visual, and infrared simulation, as well as general attributes applicable to all three. Each polygon may reference any number of photo texture maps from the Model Photo Texture Library. The model library structure also supports composite models in which one model references another as a component. The 3DDM supports storage of models for any given object at multiple LODs. This will permit selection of models at a level of complexity that balances the desire for realism and the resolution of the simulated sensor with the processing capacity of the image generator and the overall complexity of the scene. From a data structure standpoint, three-dimensional static models and three-dimensional dynamic models in the GTDB are identical, except that the dynamic models identify coordinates which may be used for collision detection tests.

50.11.1 **3DDM Record Order.** Self-explanatory.

50.11.2 **3DDM Field Structure.** Self-explanatory.

50.11.2.1 **3DDM Identifier Record.** Self-explanatory.

50.11.2.2 **File Name Record.** Self-explanatory.

50.11.2.3 **3DDM Header Record.** This mandatory record contains control information describing this file.

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50.11.2.4 **Model Header Record.** This record identifies a model group, which can consist of one or more actual model geometries representing a given object at varying LODs.

50.11.2.5 **LOD Header Record.** This record describes a particular LOD version of a model.

50.11.2.6 **LOD Texture Reference Pointer Record.** This record provides pointers to the texture references for a model LOD.

50.11.2.7 **Component Header Record.** This record describes a particular component within a model LOD.

50.11.2.8 **Component Texture Reference Pointer Record.** Self-explanatory.

50.11.2.9 **Model Polygon Record.** This record describes the attributes of a polygon within a particular model. The last polygon record will always define the model "footprint" as referenced by the Base Polygon ID field in the parent Model record. This polygon is not meant to be displayed during a simulation but is supplied to aid the user in placing additional instances of the model. In addition to a unique Polygon ID, each polygon may have a Cluster ID which associates the polygon with a group of polygons which have been logically separated from the rest of the model by a separation plane. The Cluster ID also identifies a polygon's position relative to any of the separation planes defined by the Separation Plane Records associated with the model. See paragraph 50.9.2.20 for an explanation of the relationship between clusters and separation planes.

50.11.2.10 **Model Microdescriptor Record.** This optional record contains a microdescriptor associated with a model polygon. The types of microdescriptors supported by Project 2851 are listed in Section 5.16 of this standard.

50.11.2.11 **Vertex Pointer Record.** This record is used to associate a model polygon with a Vertex record within the Three-Dimensional Dynamic Model Vertex (3DDMV) File. There will be three or more of these records defining the geometry of each model polygon. By convention, a model polygon will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly referenced again as the last vertex. The Vertex List Position and Correlation Priority fields apply to the coordinate defining a polygon vertex. The Normal List Position field points to a separate 3DDMV coordinate defining a vertex normal vector. This field will be populated with meaningful data only when vertex normals have been requested.

50.11.2.12 **Polygon FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a model polygon.

50.11.2.13 **Polygon Texture Reference Record.** This optional record is used to associate a model polygon with a Photo Texture Image Header record within the Model Photo Texture Library File.

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50.11.2.14 **Subsidiary Model Reference Record.** This optional record is used to designate another model within the model libraries as a subcomponent of this model.

50.11.2.15 **Point Light String Record.** Self-explanatory.

50.11.2.16 **Point Light String FACS Record.** Self-explanatory.

50.11.2.17 **Model FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a model as a whole (as opposed to a polygon within the model).

50.11.2.18 **Face-Based Texture Reference Record.** Self-explanatory.

50.11.2.19 **Vertex-to-Vertex Texture Reference Record.** Self-explanatory.

50.11.2.20 **Model-Based Texture Reference Record.** Self-explanatory.

50.11.2.21 **Non-Mapped Texture Reference Record.** Self-explanatory.

50.11.2.22 **Separation Plane Record.** This optional record is used to define a separation plane within a model. (See section 50.9.2.20 of this standard for an extended discussion of the separation plane record.)

50.11.2.23 **Collision Test Point Record.** This optional record is used to designate a Vertex record within the Three-Dimensional Dynamic Model Vertex (3DDMV) File as a collision test point for a model.

50.11.2.24 **Checksum Record.** This record contains the checksum value for the 3-D Dynamic Model Library File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the file. The checksum does not include those characters contained in the Checksum record itself.

50.12 **Three-Dimensional Dynamic Model Vertex (3DDMV) File.** This file consists of a series of pseudo-files containing all coordinate vertices used to define models within the Three-Dimensional Dynamic Model (3DDM) Library File. The 3DDMV will consist of one or more 3DDMV Pseudo-files, corresponding to the number of models in the 3DDM. Each 3DDMV pseudo-file contains a list of the vertex coordinates used to define all LODs for a given model. These vertices are referenced from within the model definitions in the 3DDM, in order to define model polygons, vertex normals, separation planes, and collision test points. The user will be able to associate a vertex pseudo-file with its model via a file naming convention. Each vertex pseudo-file name will take the form MDL3DDnnnnn.VTX, where 'nnnnn' corresponds to the unique model ID number. These pseudo-files will physically occur on the tape in the same sequence as their corresponding model definitions occur within the model library.

50.12.1 **3DDMV File Structure.** Self-explanatory.

50.12.2 **3DDMV Record Structure.** Self-explanatory.

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50.12.2.1 **3-D Dynamic Model Vertex Pseudo-Files.** These pseudo-files contain all coordinate vertices used to define models within the Three-Dimensional Dynamic Model (3DDM) Library File.

50.12.2.1.1 **3DDMV Pseudo-File Record Order.** Self-explanatory.

50.12.2.1.2 **3DDMV Pseudo-File Field Structure.** Self-explanatory.

50.12.2.1.2.1 **3DDMV Identifier Record.** Self-explanatory.

50.12.2.1.2.2 **File Name Record.** Self-explanatory.

50.12.2.1.2.3 **Vertex Record.** Each Vertex record contains a coordinate used to define a model vertex, a vertex normal, or a collision test point, within the 3DDM. The value in the Vertex List Position field is used as an index by a model referencing a vertex. The internal format of the Coordinate field will vary depending on the coordinate system selected for a particular GTDB. (Valid formats are defined within the Representation Dictionary in Appendix A to this standard.)

50.12.2.1.2.4 **Pseudo-EOF Record.** Self-explanatory.

50.12.2.1.2.5 **Checksum Record.** This record contains the checksum value for the Three-Dimensional Dynamic Model Vertex Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13 **Simulator Level of Detail Area Blocks File (SLAB).** This mandatory file contains all applicable terrain and culture area blocks defined for a given Simulator Level of Detail (SLOD). There may be one or more Simulator Level of Detail Area Blocks File in a valid GTDB. The data within each SLAB are organized by area block, and within each area block as a collection of pseudo-files, each containing a particular type of data for that area block. There are nine varieties of pseudo-files possible per area block. The exact configuration of pseudo-files for a given simulator level of detail or area block will depend on the transformation parameters used and on the availability of specific types of data in the Standard Simulator Data Base. Each of the pseudo-file types is described in the following subsections, in the sequence in which they would occur on a GTDB tape. Each SLAB file is structured as a collection of pseudo-files, separated by pseudo-EOF records. The pseudo-files are organized to describe each area block making up the simulator level of detail in sequence, with an Area Block Pseudo-EOF Record separating the area blocks.

50.13.1 **SLAB File Structure.** Self-explanatory.

50.13.2 **SLAB Pseudo-File Record Structure.** Self-explanatory.

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50.13.2.1 **Vertex Area Block (VAB) Pseudo-File.** The VAB contains a list of the vertex coordinates used to define all culture features within a given area block. In addition, when polygonized (as opposed to gridded) terrain has been requested, the vertex area block will also contain the vertex coordinates used to define the terrain polygons and terrain vertex normals. The vertices in the vertex area block are referenced from within the AFAB, LFAB, PFAB, PLFAB, PLSFAB, TPAB, and MRAB pseudo-files, as defined below. There will always be at least four vertices defined for an area block, since there will always be at least one areal feature (the background feature) in an area block. Each vertex coordinate is expressed in 3-D space, having x, y, and z components in the context of the selected coordinate system. However, the z-component for culture vertices will be zero except in two user-specified circumstances: (a) when the culture has been fragmented on the underlying terrain polygons, or (b) if the coordinate system is geocentric. The vertex area block for the first area block within a simulator level of detail will be the first pseudo-file in the SLAB. The vertex area block file for succeeding area blocks (if any) will follow the MRAB file of the preceding area block. The vertex records in this file are referenced by the various feature and terrain pseudo-files defined for a particular area block.

50.13.2.1.1 **VAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.1.2 **VAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.1.2.1 **VAB Identifier Record.** Self-explanatory.

50.13.2.1.2.2 **File Name Record.** Self-explanatory.

50.13.2.1.2.3 **Vertex Area Block Header Record.** This mandatory record contains a count of the number of vertices in the area block and the Vertex ID of the last vertex.

50.13.2.1.2.4 **Vertex Record.** Each Vertex record contains a coordinate used to define a culture or terrain vertex or vertex normal within the area block. The value in the Vertex List Position field is used as an index by feature and terrain files referencing a vertex. The internal format of the Coordinate field will vary depending on the coordinate system selected for a particular GTDB. (Valid formats are defined within the Representation Dictionary in Appendix A to this standard.)

50.13.2.1.2.5 **Pseudo-EOF Record.** Self-explanatory.

50.13.2.1.2.6 **Checksum Record.** This record contains the checksum value for the vertex area block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

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50.13.2.2 **Areal Feature Area Block (AFAB) Pseudo-File.** The Areal Feature Area Block Pseudo-File is mandatory for every area block in a GTDB. The AFAB contains all areal features included within an area block. This is a required file, as there will always be at least one areal feature (the background feature) in an area block. The AFAB will follow the vertex area block for the area block. Generally, there will be many areal features in a block. Each feature will have a unique number associated with it. An option available to the GTDB user will cause areal features to be replaced by model references where suitable models have been defined within the SSDB. When model substitution occurs, the areal feature will be eliminated from the AFAB, and a model reference will be inserted in the MRAB. Another transformation option available to the user will cause areal features to be fragmented along the underlying terrain polygon boundaries. When such fragmentation occurs, each fragment becomes an individual areal feature with a unique feature number. At the same time, a fragmentation flag will be set, and a common "superfeature number" will be assigned to the fragments, so that the complete feature can be reconstructed if desired. The geometry of each feature will be described by vertex pointers describing its shape and location within the area block. The "footprint" of each areal feature will be defined by three or more vertices in the coordinate space of the area block. The vertices will be listed in counterclockwise order as viewed from above. By convention, all areal features will be closed implicitly rather than explicitly; i.e., the first vertex of the feature will not be explicitly listed again as the last vertex. Individual vertices are reusable and stored as coordinate triplets in the Vertex Area Block Pseudo-File, where they are referenced by their list position. This sharing of common vertices helps ensure spatial consistency of terrain and culture data elements, and also saves storage space. Each feature may be described by numerous attributes, some of which have general applicability, and others of which apply to specific sensors. As applicable, a feature may have a wide variety of FACS attributes and microdescriptors. FACS attributes are supplementary attributes not contained among the "core" descriptors. Microdescriptors are a specialized class of feature attribution mechanisms which support specification of complex sub-detail. An areal feature may also have any number of texture codes associated with it to indicate which areal photo-texture maps from the areal photo-texture library will be applied to it in real-time simulation. Each texture code is associated with a pattern origin which indicates where the mapping starts.

50.13.2.2.1 **AFAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.2.2 **AFAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.2.2.1 . **AFAB Identifier Record.** Self-explanatory.

50.13.2.2.2.2 **File Name Record.** Self-explanatory.

50.13.2.2.2.3 **Feature Area Block Header Record.** This record contains control information describing the file.

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50.13.2.2.2.4 **Face-Based Texture Reference Record.** This optional record is used to define a method of placing a texture pattern on an areal feature polygon. The record associates an areal feature polygon with a texture in the Areal Texture Library. The data contained in this record defines the transformation required to place a texture on the polygon. This record supports generic texture in Stage 5 where the texture is mapped to polygons. Stage 5 is simply Stage 3 or 4 with polygon mapping information.

50.13.2.2.2.5 **Global-Based Texture Reference Record.** This optional record is used to define a method of placing a texture pattern as a single entity on a homogeneous cultural area made up of one or more culture features. The record associates these homogeneous areal features with a texture in the Areal Texture Library. This type of texturing can be conceptualized as the texture being "shrink-wrapped" onto the features. This record supports generic texture in Stage 5 where the texture is mapped to polygons. Stage 5 is simply Stage 3 or 4 with polygon mapping information.

50.13.2.2.2.6 **Areal Feature Record.** This record contains control fields and attributes describing a particular areal feature.

50.13.2.2.2.7 **Microdescriptor Record.** This optional record contains a microdescriptor associated with a feature. The types of microdescriptors supported by the GTDB are listed in Section 5.16 of this standard.

50.13.2.2.2.8 **FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a feature.

50.13.2.2.2.9 **Vertex Pointer Record.** This record is used to associate a feature with a Vertex record within the Vertex Area Block Pseudo-File. There will be three or more of these records defining the geometry of each areal feature. By convention, an areal feature will be closed implicitly rather than explicitly; i.e., the first vertex of a feature will not be explicitly referenced again as the last vertex.

50.13.2.2.2.10 **Non-Mapped Texture Reference Record.** This optional record is used to associate a feature with a generic texture within the Areal Texture Library. This record supports generic texture in Stages 3 and 4 where the texture is not mapped to any polygons. (Generic texture does not exist at Stages 1 and 2.)

50.13.2.2.2.11 **Mapped Texture Reference Pointer Record.** This optional record is used to point to a texture reference for an areal feature. This record supports generic texture in Stage 5 where the texture is mapped to polygons. (Generic texture does not exist at Stages 1 and 2.)

50.13.2.2.2.12 **Pseudo-EOF Record.** Self-explanatory.

50.13.2.2.2.13 **Checksum Record.** This record contains the checksum value for the Areal Feature Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

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50.13.2.3 **Linear Feature Area Block (LFAB) Pseudo-File.** The Linear Feature Area Block Pseudo-File contains all linear features included within an area block. Options available to the GTDB user will cause linear features to be replaced by areal features and/or model references where alternate representations have been defined within the SSDB. When feature substitution occurs, the linear feature will be eliminated from the LFAB, and an alternate will be inserted in the AFAB or MRAB. When present, the LFAB will follow the AFAB for the area block. A linear feature will be described by many of the same types of descriptive attributes as areal features. Unlike areals, however, each linear feature's spatial position will be described by a series of connected coordinate vertices which do not have to form a closed polygon. To save storage space, vertices are reusable and stored as coordinate triplets in the Vertex Area Block Pseudo-File, where they are referenced by their list position.

50.13.2.3.1 **LFAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.3.2 **LFAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.3.2.1 **LFAB Identifier Record.** Self-explanatory.

50.13.2.3.2.2 **File Name Record.** Self-explanatory.

50.13.2.3.2.3 **Feature Area Block Header Record.** Self-explanatory.

50.13.2.3.2.4 **Linear Feature Record.** This record contains control fields and attributes describing a particular linear feature.

50.13.2.3.2.5 **Microdescriptor Record.** This optional record contains a microdescriptor associated with a feature. The types of microdescriptors supported by the GTDB are listed in Section 5.16 of this standard.

50.13.2.3.2.6 **FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a feature.

50.13.2.3.2.7 **Vertex Pointer Record.** This record is used to associate a feature with a Vertex record within the Vertex Area Block Pseudo-File. There will be two or more of these records defining the geometry of each linear feature.

50.13.2.3.2.8 **Non-Mapped Texture Reference Record.** This optional record is used to associate a feature with a Photo Texture Image Header record within the Areal Photo Texture Library File. This optional record is used to associate a feature with a generic texture within the Areal Texture Library. This record supports generic texture in Stages 3 and 4 where the texture is not mapped to any polygons. (Generic texture does not exist at Stages 1 and 2.) While textures cannot be mapped to linear features, they are provided here in order to aid the GTDB user who might expand a linear feature into an areal feature.

50.13.2.3.2.9 **Pseudo-EOF Record.** Self-explanatory.

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50.13.2.3.2.10 **Checksum Record.** This record contains the checksum value for the Linear Feature Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13.2.4 **Point Feature Area Block (PFAB) Pseudo-File.** The Point Feature Area Block Pseudo-File contains all point features included within an area block. An option available to the GTDB user will cause point features to be replaced by model references where suitable models have been defined within the SSDB. When model substitution occurs, the point feature will be eliminated from the PFAB, and a model reference will be inserted in the MRAB. When present, the PFAB will follow the LFAB for the area block. Point features will be described by many of the same types of descriptive attributes as areal and linear features. However, a point feature's spatial position will normally be specified by a single coordinate. To be consistent with a convention established by the Defense Mapping Agency (DMA), the PFAB will also be used to store features consisting of a sequence of physically discrete points (e.g., a string of transmission towers). To save storage space, vertices are reusable and stored as coordinate triplets in the Vertex Area Block Pseudo-File, where they are referenced by their list position.

50.13.2.4.1 **PFAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.4.2 **PFAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.4.2.1 **PFAB Identifier Record.** Self-explanatory.

50.13.2.4.2.2 **File Name Record.** Self-explanatory.

50.13.2.4.2.3 **Feature Area Block Header Record.** This mandatory record contains control information describing the file.

50.13.2.4.2.4 **Point Feature Record.** This record contains control fields and attributes describing a particular point feature.

50.13.2.4.2.5 **Microdescriptor Record.** This optional record contains a microdescriptor associated with a feature. The types of microdescriptors supported by the GTDB are listed in Section 5.16 of this standard.

50.13.2.4.2.6 **FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a feature.

50.13.2.4.2.7 **Vertex Pointer Record.** This record is used to associate a feature with a Vertex record within the Vertex Area Block Pseudo-File. There will be one or more of these records defining the geometry of each point feature. (Although a true point feature can be defined by a single coordinate, by convention a point feature may consist of a collection of related but non-connected points, each member of which will be designated as a vertex.)

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50.13.2.4.2.8 **Non-Mapped Texture Reference Record.** This optional record is used to associate a feature with a generic texture within the Areal Texture Library. This record supports generic texture in Stages 3 and 4 where the texture is not mapped to any polygons. (Generic texture does not exist at Stages 1 and 2.) While textures cannot be mapped to point features, they are provided here in order to aid the GTDB user who might expand a point feature into an areal feature.

50.13.2.4.2.9 **Pseudo-EOF Record.** Self-explanatory.

50.13.2.4.2.10 **Checksum Record.** This record contains the checksum value for the Point Feature Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13.2.5 **Point Light Feature Area Block (PLFAB) Pseudo-File.** The Point Light Feature Area Block Pseudo-File contains all point light features included within an area block. An option available to the GTDB user will cause point light features to be replaced by model references where suitable models have been defined within the SSDB. When model substitution occurs, the point light feature will be eliminated from the PLFAB, and a model reference will be inserted in the MRAB. When present, the PLFAB will follow the PFAB for the area block. Point light features will be described by many of the same types of descriptive attributes as regular point features, along with additional attributes describing the light emitter. To save storage space, vertices are reusable and stored as coordinate triplets in the Vertex Area Block Pseudo-File, where they are referenced by their list position.

50.13.2.5.1 **PLFAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.5.2 **PLFAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.5.2.1 **PLFAB Identifier Record.** Self-explanatory.

50.13.2.5.2.2 **File Name Record.** Self-explanatory.

50.13.2.5.2.3 **Feature Area Block Header Record.** Self-explanatory.

50.13.2.5.2.4 **Point Light Feature Record.** Self-explanatory.

50.13.2.5.2.5 **Microdescriptor Record.** This optional record contains a microdescriptor associated with a feature. The types of microdescriptors supported by the GTDB are listed in Section 5.16 of this standard.

50.13.2.5.2.6 **FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a feature.

50.13.2.5.2.7 **Vertex Pointer Record.** This record is used to associate a feature with a Vertex record within the Vertex Area Block Pseudo-File.

50.13.2.5.2.8 **Pseudo-EOF Record.** Self-explanatory.

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50.13.2.5.2.9 **Checksum Record.** This record contains the checksum value for the Point Light Feature Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13.2.6 **Point Light String Feature Area Block (PLSFAB) Pseudo-File.** The Point Light String Feature Area Block Pseudo-File contains all point light string features included within an area block. An option available to the GTDB user will cause point light string features to be fragmented into a series of individual point light features. When fragmentation occurs, the PLSFAB will be eliminated from the GTDB, and the new point light features will be inserted in the PLFAB. When present, the PLSFAB will follow the PLFAB for the area block. Point light string features will be described by many of the same types of descriptive attributes as point light features, along with additional attributes describing the shape and orientation of the string of lights. To save storage space, vertices are reusable and stored as coordinate triplets in the Vertex Area Block Pseudo-File, where they are referenced by their list position.

50.13.2.6.1 **PLSFAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.6.2 **PLSFAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.6.2.1 **PLSFAB Identifier Record.** Self-explanatory.

50.13.2.6.2.2 **File Name Record.** Self-explanatory.

50.13.2.6.2.3 **Feature Area Block Header Record.** This mandatory record contains control information describing the file.

50.13.2.6.2.4 **Point Light String Feature Record.** This record contains control fields and attributes describing a particular point light string feature.

50.13.2.6.2.5 **Microdescriptor Record.** This optional record contains a microdescriptor associated with a feature. The types of microdescriptors supported by the GTDB are listed in Section 5.16 of this standard.

50.13.2.6.2.6 **FACS Record.** This optional record contains a FACS (Feature Attribute Coding Standard) value associated with a feature.

50.13.2.6.2.7 **Vertex Pointer Record.** This record is used to associate a feature with a Vertex record within the Vertex Area Block Pseudo-File. There will be one or more of these records defining the location of each point light within the point light string feature. The first record will always define the origin of the point light string. Any subsequent records will define succeeding points in the string. Vertex Pointer records will not be used to define points other than the origin when the Light String Shape Field within the parent Point Light String Feature record indicates that the pattern of lights in the string is a regular straight line. In that case, the Number of Lights and Light Delta fields should be used to determine the position of succeeding points in the string.

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50.13.2.6.2.8 **Pseudo-EOF Record.** Self-explanatory.

50.13.2.6.2.9 **Checksum Record.** This record contains the checksum value for the Point Light String Feature Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13.2.7 **Terrain Polygon Area Block (TPAB) Pseudo-File.** The TPAB contains all terrain polygons included within an area block. The choice of terrain polygons versus a terrain grid is up to the user. (Optionally, the user may request a GTDB containing both polygonized and gridded terrain, or may choose to omit terrain altogether.) This is a required file when polygonized terrain has been requested, but it will be omitted when only gridded terrain has been requested. When present, the TPAB will follow the PLSFAB for the area block. The TPAB will describe a continuous network of polygons representing the surface of the terrain within an area block. The type and density of terrain polygons is not limited by the data base design but will be specifiable by the user only within the allowable range of Project 2851 transformation parameters. (The common data base transformation program limits the polygon shape to triangles. Details of the terrain polygonization algorithm supported by Project 2851 are described in the software detailed design document for the common data base transformation program.) Each terrain polygon will be defined by its vertices in three-dimensional space. The vertices will be listed in counterclockwise order as viewed from above. By convention, all polygons will be closed implicitly rather than explicitly; i.e., the first vertex of the polygon will not be explicitly listed again as the last vertex. Vertices are reusable and stored as coordinate triplets in the Vertex Area Block File, where they may be referenced by their list position. Each terrain polygon record will have a surface normal vector included within it. At the requestor's option, a vertex normal vector will be calculated and associated with each terrain polygon vertex. These vertex normal vectors will also be stored as coordinate triplets in the Vertex Area Block File and referenced from the TPAB. (The vertex normal references will actually always be present but will be set to the value '0,0,0' when not specifically requested via the transformation parameters.) When culture fragmentation is requested, each terrain polygon will have associated with it a list of culture features and model references which lie upon it. These will be pointers to specific records in the various culture area block pseudo-files (AFAB, LFAB, PFAB, PLFAB, PLSFAB, and MRAB).

50.13.2.7.1 **TPAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.7.2 **TPAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.7.2.1 **TPAB Identifier Record.** Self-explanatory.

50.13.2.7.2.2 **File Name Record.** Self-explanatory.

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50.13.2.7.2.3 **TPAB Header Record.** This mandatory record contains control information describing the TPAB. The field structure of this record is given below. (Fields identified "Always Zero" are applicable to gridded rather than polygonized terrain. They have been included for consistency of format between the TPAB and TGAB area block headers. The Latitude Interval and Longitude Interval fields are used to describe the intervals in the standard simulator data base grid used to generate the TPAB.)

50.13.2.7.2.4 **Terrain Polygon Record.** Each Terrain Polygon record describes a single terrain polygon.

50.13.2.7.2.5 **Vertex List Pointer Record.** This record is used to associate a terrain polygon with a Vertex record within the Vertex Area Block (VAB) Pseudo-File. There will be three of these records defining the geometry of each terrain polygon. (The common data base transformation program limits the polygon shape to triangles; however, the Project 2851 data structure supports more complex polygons.) By convention, a terrain polygon will be closed implicitly rather than explicitly; i.e., the first vertex of a polygon will not be explicitly referenced again as the last vertex. The vertex list pointer records for a terrain polygon will be sequenced in counterclockwise order as viewed from above. The Vertex List Position and Correlation Priority fields apply to the coordinate defining a polygon vertex. The Normal List Position field points to a separate vertex area block coordinate defining a vertex normal vector. This field will be populated with meaningful data only when vertex normals have been requested.

50.13.2.7.2.6 **Culture Reference Record.** This record is used to associate a terrain polygon with a feature record within the AFAB, LFAB, PFAB, PLFAB, or PLSFAB pseudo-files, or with a model reference record in the MRAB pseudo-file. Each record indicates that a particular feature or model lies upon a particular terrain polygon.

50.13.2.7.2.7 **Vertex-to-Vertex Texture Reference Record.** This optional record is used to define the placement of a texture pattern on a polygon. It associates the polygon with a texture in the Areal Texture Library. This entails the mapping of texture pattern vertices to polygon vertices. This record supports specific areal texture and SMC/FDC texture for Stage 5. Stage 5 is simply Stage 3 or 4 with polygon mapping information.

50.13.2.7.2.8 **Pseudo-EOF Record.** Self-explanatory.

50.13.2.7.2.9 **Checksum Record.** This record contains the checksum value for the Terrain Polygon Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

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50.13.2.8 **Terrain Grid Area Block (TGAB) Pseudo-File.** The TGAB contains all terrain grid posts included within an area block. (Optionally, the user may request a GTDB containing both polygonized and gridded terrain, or may choose to omit terrain altogether.) This is a required file when gridded terrain has been requested, but it will be omitted when only polygonized terrain has been requested. When present, the TGAB will follow the TPAB for the area block. The TGAB will represent the terrain within the area block as a systematically spaced grid of elevation values. The resolution (spacing) of the terrain posts will be specifiable by the user from among the available terrain LODs in the SSDB. The standard simulator data base has been designed to store terrain data, if available, at nominal post spacings of 100m, 30m, 10m, and 1m along x and y. The common data base transformation program will attempt to retrieve terrain data from the standard simulator data base LOD specified by the user for an area block. If such data do not exist, the common data base transformation program will select the best (highest resolution) lower LOD terrain which does exist in the SSDB. (A GTDB will not be created if standard simulator data base terrain data does not exist at all within the area block.) Where the standard simulator data base has only partial coverage at a requested resolution within an area block, such data will be used, with the remainder of the area block derived from lower resolution data. The TGAB will contain a complete grid at the user-specified post spacing, regardless of which standard simulator data base LODs are used as the source. The common data base transformation program will use linear interpolation to fill the grid if necessary. The TGAB is logically a standalone file within the GTDB, containing no pointers or references to other files.

50.13.2.8.1 **TGAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.8.2 **TGAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.8.2.1 **TGAB Identifier Record.** Self-explanatory.

50.13.2.8.2.2 **File Name Record.** Self-explanatory.

50.13.2.8.2.3 **TGAB Header Record.** This mandatory record contains control information describing the TGAB. (Fields identified "Always Zero" are applicable to polygonized rather than gridded terrain. They have been included for consistency of format between the TPAB and TGAB area block headers.)

50.13.2.8.2.4 **Terrain Post Record.** Each of these records contains a single terrain elevation value from the grid of elevations making up the area block. The elevation posts are sequenced from the southwest corner of the area block to the northeast corner, with latitude intervals given from bottom to top along each longitude interval. The actual latitude and longitude intervals used are given in the parent TGAB Header record. Each elevation value will be represented as a coordinate in 3-D space. Coordinate triplets are given, rather than only elevation values, because elevation posts are located in the user-specified coordinate system, which may be different from geographic latitude/longitude.

50.13.2.8.2.5 **Pseudo-EOF Record.** Self-explanatory.

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50.13.2.8.2.6 **Checksum Record.** This record contains the checksum value for the Terrain Grid Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13.2.9 **Model Reference Area Block (MRAB) Pseudo-File.** The Model Reference Area Block Pseudo-File contains all model references included within an area block. The presence of the MRAB is optional depending on whether the user has requested models and whether available models are applicable to the area block. When present, the MRAB will follow the TGAB for the area block. Every model reference includes a model number which uniquely identifies a model within the model libraries. For audit trail purposes, each model reference also includes a feature number identifying the standard simulator data base feature which the model replaced. Each model is positioned within the area block by a coordinate defining the location of the model centroid. Each model reference also includes orientation angle, rotation, and scale factor descriptors. Project 2851 does not move culture to ensure that a model will not overlap a terrain polygon boundary. Such an overlap condition may cause difficulties for some image generators. Therefore, in GTDBs for which the user has requested culture fragmentation on terrain, a flag will be set in the model reference record to indicate the existence of an overlap, so that the user's Formatter Program can move the model if necessary.

50.13.2.9.1 **MRAB Pseudo-File Record Order.** Self-explanatory.

50.13.2.9.2 **MRAB Pseudo-File Field Structure.** Self-explanatory.

50.13.2.9.2.1 **MRAB Identifier Record.** Self-explanatory.

50.13.2.9.2.2 **File Name Record.** Self-explanatory.

50.13.2.9.2.3 **MRAB Header Record.** This mandatory record contains control information describing the file. It also contains a count of the individual model reference records which follow.

50.13.2.9.2.4 **Model Reference Record.** Self-explanatory.

50.13.2.9.2.5 **Pseudo-EOF Record.** Self-explanatory.

50.13.2.9.2.6 **Checksum Record.** This record contains the checksum value for the Model Reference Area Block Pseudo-File. This checksum is computed using a linear addition of the binary representations of all the ASCII characters contained in the pseudo-file. The checksum does not include those characters contained in the Checksum record itself.

50.13.2.10 **Area Block Pseudo-EOF Record.** It indicates that all pseudo-files describing a particular area block have been processed.

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50.14 **Areal Texture (AT) Library.** There may be one Areal Texture Library (AT) following the SLAB. The AT is optional. When present, it contains all the areal textures referenced within the GTDB or explicitly requested by the user during GTDB generation. The AT begins with the NITF Header File. Following it are a set of files for each areal texture. If the texture is in Stage 1, then the files shall consist of the NITF Image Sub-Header (NITFISH) File and one or more files in the original format. These Original Format Image (OFI) Files may contain descriptive header-type data or the image itself, depending on the format and convention of the original source. The NITFISH File is used in this case to supplement this data with standard data that may be needed by the GTDB user (e.g., ground control points and tie points linking several images). For all other textures (those in a stage other than Stage 1), the files consist only of the NITFISH and the NITF Image Data (NITFID) File. The NITFISH is identical in format to the one used for Stage 1 textures; however, the fields that are required to hold valid data differs between the two. Naturally, the NITFID contains the binary image data itself. The AT contains all areal texture images included within the GTDB. The AT consists of files in the National Imagery Transmission Format (NITF) and files in their original native format. A description of NIFT can be found in the National Imagery Transmission Format, Version 1.1. (Application for copies may be addressed to Defense Intelligence Agency, DIA/DM - 1A, 3100 Clarendon Boulevard, Arelingon VA 22201-5317.) For ease of implementation, the AT format is identical to that of the Model Texture (MT) Library.

50.14.1 **AT File Structure.** Self-explanatory.

50.14.2 **AT Record Structure.** Self-explanatory.

50.14.2.1 **NITF Header File.** There shall be exactly one NITF Header (NITFH) File within the AT. While it is optional within a GTDB since the AT is optional, it is mandatory within the AT itself. It contains data used to identify the entire set of areal textures in the GTDB as well as a count of the number of areal textures and their individual sizes. Included in the standard NITFH data are fields for security. The file consists of both a standard NITF section as well as a GTDB-specific section. The NITF Header (NITFH) File is optional in a GTDB but mandatory in the AT Library. It exists in the AT if any areal texture is requested. The file contains information used to identify the entire set of areal images in the GTDB as well as a count of the number of areal images (textures) and their individual sizes. The format of this file is the same as that in the NITF standard. It is provided here for completeness and convenience. Each field has a label consisting of one to seven alphanumeric characters.

50.14.2.1.1 **Filename.** Self-explanatory.

50.14.2.1.2 **File Format.** Self-explanatory.

50.14.2.1.2.1 **GTDB User Defined Header Data.** The GTDB User Defined Header Data within the NITFH consists of GTDB- specific control data for texture. It follows the same conventions as the rest of the NITFH (i.e., field labels and end-of-line terminators).

50.14.2.1.2.1.1 **Image Tie Point Data.** Self-explanatory.

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50.14.2.1.2.1.2 **Generic Texture Association Data.** Self-explanatory.

50.14.2.2 **NITF Image Sub-Header File.** There shall be exactly one NITF Image Sub-Header (NITFISH) File for each texture within the AT. It provides identification and descriptive information such as texture type, format, geographic location, environmental conditions, percentage of cloud cover, image quality ratings, resolution, bands, data sources, control points, tie points between images, footprints, neighbor texture identification, and sensor data. The file consists of both a standard NITF section as well as a GTDB-specific section. The NITF Image Sub-Header (NITFISH) File is optional in a GTDB but mandatory in the AT Library. It exists in the AT if any areal texture is requested. The file contains formatting control and other descriptive information for the texture following this file. The GTDB implementation of the NITF standard for the GTDB has some exceptions to the standard. These differences affect the Image Coordinate System Field, the Image Geographic Location Field, the use of Look Up Tables, and the image size. These modifications are explained here. While the NITF Image Coordinate System can be Universal Transverse Mercator (UTM), geodetic/geographic, geocentric, or none, the GTDB Image Coordinate System can be any of those as well as others. In the GTDB implementation, the coordinate systems can be any of the following: Geocentric, Mercator, Universal Transverse Mercator, Lambert, Polar, Local, Geodetic Float, Local Cartesian, or None. While NITF specifies a single character for this field, the GTDB implementation shall use the entire coordinate system name to specify it. The Image Geographic Location is limited in NITF to the nearest second in latitude and longitude. This may not be good enough for very high-resolution imagery, since one arc second spacing represents roughly 30 meters of ground resolution. Therefore, the format of the Image Geographic Location field has been changed, from NITF's four corner coordinates expressed to the nearest arc second, to four coordinates expressed in units of thousandths of arc seconds. It should be noted that the units may not be in geodeic coordinates, but rather metric units, if any projection other than geodetic is used. In this case, eleven digits are used (e.g. 1.234567890E+12). The exact outline is found in the Texture Footprint Data in the GTDB User Defined Image Data of the NITFISH. NITF supports the use of Look Up Tables (LUTs) with one byte of binary data per entry for image data. For visual texture, i.e., color or intensity data, the GTDB NITFISH shall not use LUTs. All such data shall be directly stored in the NITF Image Data File. This is fully compliant with NITF since the number of LUTs can be zero. For SMC/FDC data, LUTs may or may not be used, depending on the user's preference; however, if LUTs are used, the LUT entry shall be entirely in ASCII with a length of seven bytes. The first two bytes represent the SMC (0 - 15), while the following five bytes represent the ASCII FDC value. NITF limits the number of pixels per image to 4096 in the horizontal direction and 7700 in the vertical, with a maximum of 16 bits per pixel per band. In order to more fully support GTDB users, the GTDB will not observe this limitation. The image size will have no logical limitation. The format of this file is the same as that in the NITF standard. It is provided here for completeness and convenience. Each field has a label consisting of one to seven alphanumeric characters.

50.14.2.2.1 **Filename.** For example, the first areal NITF Image Sub-Header File would be named 'TEXA00001.HDR'.

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50.14.2.2.2 **File Format.** Self-explanatory.

50.14.2.2.2.1 **GTDB User Defined Image Data.** The GTDB User Defined Image Data within the NITFISH contains formatting control and other descriptive information for the image following the GTDB User Defined Image Data Record. This set of fields is defined specifically for the GTDB and supplements the standard fields provided in the NITF Image Sub-Header Record. The GTDB User Defined Image Data follows the same conventions as the rest of the NITFISH (i.e., field labels and end-of-line terminators).

50.14.2.2.2.1.1 **General Processing Data.** Self-explanatory.

50.14.2.2.2.1.2 **Source Data.** Self-explanatory.

50.14.2.2.2.1.3 **Environmental Conditions Data.** Self-explanatory.

50.14.2.2.2.1.4 **Texture Footprint Data.** Self-explanatory.

50.14.2.2.2.1.5 **Neighbor Texture Association Data.** Self-explanatory.

50.14.2.2.2.1.6 **Model Association Data.** Self-explanatory.

50.14.2.2.2.1.7 **Image Control Data.** Self-explanatory.

50.14.2.2.2.1.8 **Sensor Image Data Descriptor Data.** The usefulness of this data is dubious. Until experience is gained in its use, the value will remain questionable. It may be found that this data should be removed because it is too difficult to acquire, or because sensors are too varied to standardize on a set of parameters to describe 5Bem4.2.3 **Original Format Image File(s).** For each Stage 1 areal texture, there will be one or more Original Format Image (OFI) Files following the NITFISH. The OFI is mandatory for a Stage 1 texture image. When present, it contains the original identification, descriptive information, and image itself in its original native format for a specific Stage 1 texture. The OFI files are the original source files provided. Their content and format are source dependent. Their filenames are modified, while their original source filenames are provided in the TLH. The Original Format Image (OFI) File is optional in a GTDB. It exists if the texture requested is Stage 1 areal texture. The OFI consists of the original data provided by an image source such as EOSAT. The OFI includes all descriptive header information as well as the imagery provided by the source in its original format. The header information and the image itself are not altered in the GTDB. Since the structure of the file(s) is source-dependent, there is no description of such files in this document. The original filename has been replaced by a filename following GTDB conventions in order to ensure uniqueness of filenames within a GTDB. The original filename is associated with GTDB filename within the TLH.

50.14.2.3.1 **Filename.** For example, assume three files existed for a single Stage 1 texture (image) which was the first areal texture within the GTDB. The three OFI Files would be named, in order of their appearance within the GTDB, 'OFIA00001.A', 'OFIA00001.B', and 'OFIA00001.C'.

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50.14.2.4 **NITF Image Data File.** There shall be exactly one NITF Image Data (NITFID) File for each texture not in Stage 1 following the NITFISH within the AT. It provides the actual image data itself. While NITF supports the use of Look-Up Tables (LUTs), the GTDB implementation shall store the texel values directly in the image data without the use of LUTs for all visual color and intensity texture; however, for SMC/FDC data, LUTs may be used depending on the GTDB parameters. The GTDB will use the future multi-block image format outlined in the NITF standard; while it is not currently supported by NITF, it should be adopted in the future. Its current adoption will enable the GTDB to offer great formatting flexibility. The NITF file supports storage of texture images at any resolution and at any rectangular size. These shall be determined by GTDB parameters. Image compression is supported by NITF, but will not be initially implemented in the GTDB. With the user defined fields, the NITF will support all coordinate systems currently supported in the GTDB. The NITF Image Data File is optional within a GTDB. It exists if the texture requested is non-Stage 1 areal texture. Images may contain RGB, grayscale, or SMC/FDC data. The future multiblock image format presented in that document has been implemented in this record. Under this format, image data may be formatted on a pixel-by-pixel, line-by-line, or block-by-block basis with bands either sequential or interleaved between pixels, lines, or blocks. "Image data within a block shall be formatted on a row by row basis, from left to right along each row or line, and from the top of the block to the bottom, down the rows. Data shall begin with the N bits of pixel (0,0) (the first row, first column) of the first block." The NITF image coordinate system starts with (0,0) at the upper left corner of the image, with the first coordinate increasing from top to bottom, and the second coordinate increasing from left to right. "The N bits of each pixel shall be in order beginning with the most significant bit (MSB) and ending with the least significant bit (LSB). This is followed by the N bits of data for pixel (0,1), which is the first row, second column of the first block. The N bits of data for pixel (1,0) (the first column of the second row) of the first block shall follow the last pixel of the first row of the first block. The MSB of data for the first pixel of the first line of the second block shall follow the LSB of data for the last pixel of the last line of the preceding block. The end of the image data shall be LSB of the N bits of the last pixel, last row, last block of the last band." "In Sequential Image Mode (i.e., Band Sequential), all of the blocks of the first band are followed by all of the blocks by the second band, and so on. Thus, the first block of the first band is followed by the data for the second block of the first band. The last block of the first band is then followed by the first block of the second band. In Interleaved Image Mode (i.e., Band Interleaved or Pixel Interleaved), the first block of the first band is followed by the first block of the second band which is then followed by the first block of each subsequent band. The first block of the last band is followed by the second block of the first band, and so on."

50.14.2.4.1 **Filename.** For example, the NITF Image Data File corresponding to the first areal texture (and thus, to the first areal NITF Image Sub-Header File) would be named 'TEXA00001.DAT'.

50.14.2.4.2 **File Format.** Self-explanatory.

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50.15 **Model Texture (MT) Library.** There may be one Model Texture Library (MT) following the AT. The MT is optional. When present, it contains all the model textures referenced within the GTDB or explicitly requested by the user during GTDB generation. The MT begins with the NITF Header File. Following it are a set of files for each model texture. The files and their usage are identical to that of the AT. The MT contains all model texture images included within the GTDB. A description of each of the NITF files follows; for more details, one should consult the NITF document(s). A description of files in their original native format can be found in the appropriate documentation. For ease of implementation, the MT format is identical to that of the Areal Texture (AT) Library.

50.15.1 **MT File Structure.** Self-explanatory.

50.15.2 **MT Record Structure.** Self-explanatory.

50.15.2.1 **NITF Header File.** There shall be exactly one NITF Header (NITFH) File within the MT. While it is optional within a GTDB since the MT is optional, it is mandatory within the MT itself. The file format is identical to that in the AT. The differences between the AT NITFH and the MT NITFH are in which fields are required to contain valid real data and which fields contain null data. The NITF Header (NITFH) File is optional in a GTDB but mandatory in the MT Library. It exists in the MT if any model texture is requested. The file contains information used to identify the entire set of model images in the GTDB as well as a ccunt of the number of model images (textures) and their individual sizes.

50.15.2.2 **NITF Image Sub-Header File.** There shall be exactly one NITF Image Sub-Header (NITFISH) File for each texture within the MT. The file format is identical to that in the AT. The differences between the AT NITFH and the MT NITFH are in which fields are required to contain valid real data and which fields contain null data. The NITF Image Sub-Header (NITFISH) File is optional in a GTDB but mandatory in the MT Library. It exists in the MT if any model texture is requested. The file contains formatting control and other descriptive information for the texture following this file.

50.15.2.3 **Original Format Image File(s).** For each Stage 1 model texture, there will be one or more Original Format Image (OFI) Files following the NITFISH. The OFI is mandatory for a Stage 1 texture image. When present, it contains the original identification, descriptive information, and image itself in its original native format for a specific Stage 1 texture. The OFI files are the original source files provided. Their content and format are source dependent. Their filenames are modified, while their original source filenames are provided in the TLH. The Original Format Image (OFI) File is optional in a GTDB. It exists if the texture requested is Stage 1 model texture. The OFI consists of the original data provided by an image source such as EOSAT. The OFI includes all descriptive header information as well as the imagery provided by the source in its original format. The header information and the image itself are not altered. Since the structure of the file(s) is source-dependent, there is no description of such files in this document.

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50.15.2.4 **NITF Image Data File.** There shall be exactly one NITF Image Data (NITFID) File for each texture not in Stage 1 following the NITFISH within the MT. It provides the actual image data itself. The file format is identical to that in the AT. It supports all of the general capabilities supported by the NITFID in the AT. The NITF Image Data File is optional within a GTDB. It exists if the texture requested is non-Stage 1 areal texture. Images may contain RGB, grayscale, or SMC/FDC data. The future multiblock image format presented in that document has been implemented in this record. Under this format, image data may be formatted on a pixel-by-pixel, line-by-line, or block-by-block basis with bands either sequential or interleaved between pixels, lines, or blocks.

50.16 **Microdescriptors.** Microdescriptors are a special class of data structures developed by the Defense Mapping Agency (DMA) to encode complex attributes in its digital cartographic data bases. Their use has so far been limited to prototype data bases (such as Level V Digital Feature Analysis Data (DFAD)). However, they offer a potentially useful way to capture complex information which would be very useful for high-resolution simulation. Microdescriptors have been specified for three general classes of data: (a) They can be used to provide additional details on the subcomposition of large or composite features without going through the effort of digitizing and individually attributing the subdetail. Microdescriptors of this type which will be supported by Project 2851 include the Homogeneous Area Microdescriptor, the Pattern Distribution Microdescriptor, and the Vertically Composite Microdescriptor. These microdescriptors support simulation of low altitude radar returns by providing a pattern of structures for modeling of vertical reflecting surfaces and culture masking effects. This type of microdescriptor could be useful in multi-sensor simulator applications by supporting more realistic and better correlated synthetic breakup, model design, and selection of areal photo texture. (b) Microdescriptors can also be used to associate data of a functional or operational nature with culture features. Microdescriptors of this type to be supported by the GTDB include the Drainage Microdescriptor, the Transportation Microdescriptor, and the Vegetation Microdescriptor. This type of microdescriptor could be useful in simulator applications to support more realistic models and scenario effects. Some of the attributes (e.g., SMC of river banks) are important for low altitude radar simulation. (c) For the GTDB, a new class of microdescriptors for the purpose of encoding temporal effects. This Temporal Effects Microdescriptor will support descriptions of how culture characteristics will change based on time of day, season, weather, and other conditional situations. This type of microdescriptor could support more realistic and better correlated scenario effects. One possible application in radar simulation would be establishing local seasonal and climate thresholds for changes in water body states. In the following subparagraphs, each type of microdescriptor supported by the GTDB is described using the classic record and field structure. This convention is used for clarity in describing the microdescriptors and for consistency with normal applications of microdescriptors. However, the GTDB will actually store each microdescriptor attribute as an individual record within a microdescriptor record-type. This means that a Homogeneous Area (HA) microdescriptor, for example, would be stored as three records, one for each attribute field associated with the HA microdescriptor. The general structure of the microdescriptor records stored within a GTDB is to have a Microdescriptor Type Field, which identifies the microdescriptor and the particular attribute being

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described, followed by a data field which contains the data value for that particular microdescriptor attribute. This approach was taken to give the GTDB the flexibility to accommodate new or modified microdescriptors in the future without changing the data base design. An additional benefit is that storage space is used only for attributes for which values have been captured.

50.16.1 **GTDB Microdescriptor Records.** Self-explanatory.

50.16.1.1 **Homogeneous Area Microdescriptor Record (HA).** The Homogeneous Area Microdescriptor describes the basic size and material of a standard subunit of a culture feature captured as one homogeneous area.

50.16.1.2 **Pattern Distribution Microdescriptor Record (PM).** The Pattern Distribution Microdescriptor provides parameters describing the distribution of subfeatures within a larger areal feature. This microdescriptor may be used to support automated algorithms for synthetic breakup.

50.16.1.3 **Drainage Microdescriptor Record (TTAD).** The Drainage Microdescriptor provides operationally useful information about rivers.

50.16.1.4 **Transportation Microdescriptor Record (TTAT).** The Transportation Microdescriptor provides operationally useful information about bridges, highways, and railroads.

50.16.1.5 **Vegetation Microdescriptor Record (TTAV).** The Vegetation Microdescriptor provides operationally useful information about soil and undergrowth conditions.

50.16.1.6 **Vertically Composite Microdescriptor Record (VC).** The Vertically Composite Microdescriptor describes the vertical components of a structure which has been captured as a single culture feature but which in fact consists of objects of interest stacked on top of other objects of interest.

50.16.2 **Temporal Effects Microdescriptor Records.** The Temporal Effects Microdescriptors provide situation-dependent alternate attributes for a feature which has been described in the data base as it would appear under nominal conditions. The GTDB storage structure for these microdescriptors is the same as for the other microdescriptors, except that one additional field has been added to count the number of attributes which are affected by the temporal condition. Several specific microdescriptor types have been defined to address various temporal conditions affecting simulation. These formats are described below.

50.16.2.1 **Weather Effects Microdescriptor Record (TEW).** The TEW record is used to describe weather conditions which trigger changes to one or more attributes describing a feature or model.

50.16.2.2 **Seasonal Effects Microdescriptor Record (TES).** The TES record is used to describe a season which triggers changes to one or more attributes describing a feature or model.

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50.16.2.3 **Time of Day Microdescriptor Record (TET).** The TET record is used to describe a time-of-day threshold which triggers changes to one or more attributes describing a feature or model.

50.16.2.4 **Ground Conditions Microdescriptor Record (TEG).** The TEG record is used to describe ground conditions which trigger changes to one or more attributes describing a feature or model.

50.16.2.5 **Alternate Attributes Record (TEAA).** Each TEAA record is used to describe the alternate value of an attribute describing a feature or model.

50.17 **Feature Codes and Attributes.** The Feature Attribute Coding Standard (FACS) is being developed by the Defense Mapping Agency (DMA) to standardize data collection and attribution guidelines in its digital cartographic data bases. The use of FACS in current DMA products has so far been limited, but DMA has made a commitment to the adoption of FACS in future products currently under development. A standard such as FACS is clearly necessary if various data bases dealing with geographic/cartographic data are to be successfully integrated for advanced applications. The GTDB will use FACS standards in two general ways: (a) First, it will use the hierarchical feature categories defined in FACS to identify what a feature is. These identifiers will be stored in a field called the Feature Descriptor Code (FDC) present in every feature record. The FACS feature categories are generally a superset of categories used by older DMA standards such as Digital Feature Analysis Data (DFAD). However, there are some feature types used in the training simulation community which are not presently included in FACS. The GTDB has defined additional FACS-like FDCs to represent these features. A complete list of FDCs supported by the GTDB is given in the separately-bound Appendix B to this standard. (b) Second, the GTDB has adopted a FACS-like approach to feature attribution as a technique which will allow the future addition of an indefinite number of new attributes without having to modify the data base structure. Every feature file in the data base contains an optional record type called a FACS Record. Each occurrence of a FACS Record will be a feature attribute not contained among the "core" attributes already defined in the feature records. The internal field structure of the FACS Record has been generalized so that it contains an attribute identifier, as well as an attribute value. Thus, as new attribution requirements are identified, the additional attributes can be given unique attribute identifiers and stored sequentially among the FACS records.

60 NOTES

60.1 **Intended use.** This appendix is intended to be used as a guide for the interpretation of the content of this Generic Transformed Data Base standard.

60.3 **Subject term (key word) listing.**

Data Base

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60.4 **Referenced documents.** The following documents were used as references, in preparation of this standard.

ANSI/MIL-STD-1815A, Ada Programming Language.

Defense Mapping Agency Digital Landmass System Product Specification, First Edition, July 1977.

Defense Mapping Agency Digital Landmass System Product Specification, Second Edition, April 1983.

Defense Mapping Agency Product Specifications for a Prototype Data Base to Support High Resolution Sensor Simulation, First Edition, December 1979.

Defense Mapping Agency Prototype High Resolution Data Base Product Specification, First Edition, August 1980.

Defense Mapping Agency Level X Product Specification, First Edition, June 1983.

Defense Mapping Agency Feature File Product Specification, First Edition, August 1984

Defense Mapping Agency Standard Linear Format Product Specification, First Edition.

Defense Mapping Agency (DMA) High Resolution Data (Level X) Specification for B-1B Simulator.

DMA Standard Supporting Mark 90, Section 100, Glossary of Feature/Attribute Definitions, Second Edition, June 1988, revised December 1988

60.5 **Design Notes.** The following is an overview of design features of the GTDB.

60.5.1 For configuration management and data base verification purposes, the design includes storage of all transformation parameters used to generate the GTDB in the Gaming Area Header File.

60.5.2 The GTDB includes a class of header data records to provide data base statistics for the user. These statistics include measures of data density and distribution for different area blocks and simulator levels of detail (SLODs) within a GTDB. These statistics are intended to be helpful to users in planning and optimizing the exploitation of GTDBs.

60.5.3 When polygonized (rather than gridded) terrain is requested, there are optional fields which will associate each terrain polygon with all culture features lying upon it. If culture fragmentation along terrain polygon boundaries is requested during transformation, then the individual fragments will be tied to the terrain polygons

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60.5.4 As originally designed, the GTDB carried a security level attribute all the way down to the individual feature and model level. Although the Project 2851 data base concept continues to anticipate that a GTDB may be created from data of varying security levels, it is impractical to expect GTDB recipients to control secure data within an integrated data base at extreme levels of granularity. Therefore, the effective security level was changed to the file level within the GTDB. If any data within a GTDB file is classified, then the entire file is classified to the highest level of any data within it. Technically, a GTDB may consist of some files which are classified and some which are not, but the actual classification will be dependent upon operational implementation.

60.5.5 There will be users who wish to maintain a high level of correlation between two separate GTDBs built to support two different simulators; e.g., between radar and visual displays, or among networked simulators. Perfect correlation between dissimilar simulators systems is not always possible. However, Project 2851 has included design features which will help maximize correlation. First, fields have been added which may be used to flag and prioritize data base features which are particularly significant for correlation. Second, for users who require gridded terrain, there is an option for deriving the grid values from the polygonized terrain of related (or the same) GTDB.

60.5.6 A class of culture microdescriptors has been designed specifically to encode temporal characteristics. These new microdescriptors can be used to help standardize simulator rendering of seasonal, weather, time-of-day, and conditional effects.

60.5.7 Attributes which may be sensor-specific (e.g., directivity) are carried as dual attributes (e.g., radar directivity and infrared directivity). Attributes which do not vary with the sensor (e.g., height or surface material category) are included only once.

60 5 8 The sequence of files within the GTDB has been designed to minimize the probable volume of processing by a user's Formatter Program (FP). As a general rule, referenced data items are presented prior to their being referenced.

60.5.9 The GTDB currently has all data represented in the ASCII character set rather than in VAX numeric formats or Ada data types. This makes the tapes more universally readable without special programming for system-specific data conversions. Due to the fact that ASCII data sets tend to become quite large, however, this may be changed at some future date.

60.5.10 Each file within the GTDB begins with a file identifier record and a filename record.

60.5.11 Consolidated vertex files have been defined to reduce redundant specification of coordinates. There are consolidated terrain/culture vertex file on a per area block basis.

60.5.12 Vertex normals can be included as a data base option. These normals apply to polygonized terrain and models.

60.5.13 Data fields are separated by the ASCII null character.

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60.5.14 An effort has been made to reduce the number of separate physical files used to store the GTDB data. Data units called 'pseudo-files' have been defined for collections of records which can logically be treated as independent files but which, for performance reasons, have been physically grouped with other pseudo-files within a larger physical file. The grouping of psuedo-files into fewer physical files has been found to improve I/O performance dramatically.

60.5.15 The Culture Reference Record within the Terrain Polygon Area Block Pseudo-File has been designed to make it possible to associate model references, as well as culture feature references, with a given terrain polygon.

60.5.16 Within the Terrain Grid Area Block Pseudo-File, terrain elevation post values are stored one post per record. This approach reflects the wide variation possible in area block sizes.

60.5.17 Restrictions on area block size are that no side may exceed 15 minutes of arc, and that neighboring area blocks must share mutually identical boundaries.

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