

METRIC

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SUPERSEDING
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MILITARY SPECIFICATION

DIGITAL TERRAIN ELEVATION DATA (DTED)

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

1. SCOPE

1.1 Scope. This specification defines the requirements within Defense Mapping Agency's (DMA) Digital Terrain Elevation Data Base which supports various weapon and training systems.

1.2 Purpose. The purpose of this specification is to assure uniformity of treatment among all mapping and charting elements engaged in a coordinated production and maintenance program for this product.

1.3 Security. This specification is unclassified, but its resultant products can be up to SECRET.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

Military Standards

MIL-STD-600001

MC&G Accuracy Standard

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, Defense Mapping Agency, ATTN: PR, Stop A-13, 8613 Lee Highway, Fairfax, VA 22031-2137 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

AREA MCGT

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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

- a. "Map Projections-A Working Manual", U.S. Geological survey Professional Paper 1395.
- b. DIAM 65.18, Geopolitical Elements and Related Files.
- c. DMAINST 8660.10, Release, Distribution, Handling, and Storage of DMA Digital Mapping, Charting, and Geodesy (MC&G) Data.
- d. DMA C5231.1 MC&G Classification Managment program
- e. DMAM 5200.1, DMA information Security Program
- f. DMATR 8350.2-B, DMA Technical Report, "Supplement to Department of Defense World Geodetic System 1984 Technical Report: Part II-Parameters Formulas and Graphics for the Practical Application of WGS 84".
- g. TI/2DJ/001, DMA Technical Instructions and Quality Requirements for Printing and Finishing of Jewel Case Liners & Information Booklets (Inserts) for Mapping, Charting and Geodetic (MC&G) Compact Disk Storage Media.
- h. DoD 5200.1-R, Information Security Program Regulation.
- i. DoD 5220.22-M, Industrial Security for Safeguarding Classified Information.

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

- a. ANSI X3.27-1978, American National Standard Magnetic Tape Labels for Information Interchange.
- b. International Standard Organization (ISO) 9660: International Standard. Information Processing - Volume and file structure of CD-ROM for information interchange.

(Application for copies should be addressed to American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018).
- c. Phillips/Sony Red Book Specifications.
- d. Phillips/Sony Yellow Book Specifications.

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

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

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

3. REQUIREMENTS

3.1 Requirements DTED Level 1 and DTED Level 2.

3.1.1 Accuracy.

a. Absolute horizontal accuracy.

90% Circular Error (C.E.) World Geodetic System (WGS)
≤ 50 meters

b. Absolute vertical accuracy.

90% Linear Error (L.E.) Mean Sea Level (MSL)
≤ 30 meters

c. Relative accuracy. DMA does not have a formal requirement for relative accuracy of DTED. The following accuracies are included as program objectives only.

(1) Relative horizontal accuracy (point-to-point).

90% C.E. WGS
≤ 30 meters over a 1 degree cell

(2) Relative Vertical Accuracy.

90% L.E. MSL
20 meters over a 1 degree cell

3.2 Datum.

3.2.1 Horizontal datum. Horizontal Datum shall be the World Geodetic System (WGS 84). DTED shall be compiled to the current WGS datum or revised to be compatible with the current WGS datum.

3.2.2 Vertical datum. Vertical Datum shall be Mean Sea Level (MSL).

3.3 Product format.

a. A data file of DTED Level 1 is a 1° by 1° cell defined by whole degree latitude and longitude lines on WGS. A DTED Level 1 data file shall not cross whole degree latitude or longitude lines.

b. A data file of DTED Level 2 is a 1° by 1° cell defined by whole degree latitude and longitude lines on WGS. In special cases, a data file of

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DTED Level 2 may be less than a full 1° cell, in increments of 15' x 15'. In these cases the remainder of the cells elevations will be filled with null values (-32767). A DTED Level 2 data file shall not cross whole degree latitude or longitude lines.

3.3.1 Adjacent data files. Adjacent data files shall not have gaps between them and the only overlap that exists is along adjacent boundaries. All adjacent boundaries shall be coincident.

3.4 Standard format. The DMA Standard Terrain Format is DMA's standardized system of recording terrain elevation data. The format is normally on magnetic tape and intended for the purpose of production, storage and exchange of terrain elevation data. An alternate means of terrain elevation data exchange is by Compact Disc-Read Only Memory (CD-ROM). The additional characteristics of terrain elevation data on CD-ROM are described in 3.11.

3.4.1 Physical characteristics of magnetic tape. The physical characteristics of magnetic tape are as follows:

- a. Length: 2400 feet
- b. Width: .5 inch
- c. Nine track recording format.
- d. Odd parity.
- e. Inter-record gap: .6 inch (6250 Frames Per Inch (FPI): .3 inch).
- f. Physical end-of-tape markers at the beginning (beginning-of-tape marker) and end of the tape (end-of-tape marker).
- g. Density-recording methods.
 - (1) 1600 FPI/Phase encoded. This is preferred by DMA for storage and data exchange and will normally be expected from producers and provided to requestors.
 - (2) 6250 FPI/Group Coded Recording (GCR). Future preferred DMA dataexchange format (shall not be used unless agreed to by sender and receiver).

3.4.2 Type of Input/Output (I/O). The individual records contain no system dependent generated control words.

3.5 Record characteristics on Magnetic Tape.

3.5.1 Recorded labels. American National Standard Magnetic Tape Labels for Information Interchange X3.27-1978. Recorded in ASCII code.

3.5.2 Data records.

- a. Record size. Variable length, maximum 7214 frames, minimum 14 frames, modal (average) 2414 frames.
- b. Blocking factor. 1:1 (block size = record size).

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c. Record sequence.

VOL	1	(Volume Header Label)
HDR	1	(Header Label for file A)
UHL	1	(User Header Label for file A)
*		
DSI		(Data Set Identification Record for file A)
ACC		(Accuracy Description Record for file A)
DATA		(for file A)
*		
EOF	1	(End of File for file A)
UTL	1	(User Trailer Label for file A)
*		
HDR	1	(Header Label for file B)
UHL	1	(User Header Label for file B)
*		
DSI		(Data Set Identification Record for file B)
ACC		(Accuracy Description Record for file B)
DATA		(for file B)
*		
EOF	1	(End of File for file B)
UTL	1	(User Trailer Label for file B)
*		
*		

Note: In the above sequence a Tape mark (hardware end of file) is denoted by an "*".

3.6 File description. A data file of DTED is a cell defined by latitudes and longitudes of a geographic reference system. The terrain elevation information is expressed in meters. The elevation posts are defined by the intersections of rows and columns within a matrix. The required matrix intervals, defined in terms of geographic arc seconds, vary according to latitude (see TABLE I for DTED Level 1, II for DTED Level 2).

Note: All values in seconds are in terms of arc measure.

3.7 Logical characteristics.

3.7.1 Data file structure. Arranged in 1 degree by 1 degree geographic areas. Each data file shall contain data falling within a single one degree cell. The reference origin for each data file shall be the Southwest corner of the one degree cell. Multiple data files shall be arranged primarily by ascending latitude bands (90 degrees South to 89 degrees North), secondarily by ascending longitude (180 degrees West to 179 degrees East). NOTE: For DTED 2 - 1° cells may contain multiple data files in increments of 15' x 15'.

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TABLE I. Matrix intervals for DTED Level 1.

ZONE	LATITUDE		MATRIX INTERVAL				
			<u>latitude</u>		<u>longitude</u>		
I	0°	- 50°	North-South	3	X	3	seconds
II	50°	- 70°	North-South	3	X	6	seconds
III	70°	- 75°	North-South	3	X	9	seconds
IV	75°	- 80°	North-South	3	X	12	seconds
V	80°	- 90°	North-South	3	X	18	seconds

TABLE II. Matrix intervals for DTED Level 2.

ZONE	LATITUDE		MATRIX INTERVAL				
			<u>latitude</u>		<u>longitude</u>		
I	0°	- 50°	North-South	1	X	1	seconds
II	50°	- 70°	North-South	1	X	2	seconds
III	70°	- 75°	North-South	1	X	3	seconds
IV	75°	- 80°	North-South	1	X	4	seconds
V	80°	- 90°	North-South	1	X	6	seconds

3.7.2 Files extent. To provide overlap between adjacent data files, the degree cell coverage in this standard includes the integer degree values on all sides of the area. Each data record has one point of overlap with the cell above and one with the cell below (if the record extends to the degree cell limits). Entire data records lying on integer degree longitude values shall exist also in the adjacent degree cell. Data files will not cross integer degree latitude or longitude lines. Adjacent data files shall not have gaps between them and the only overlap that exists is along adjacent boundaries. All data files derived from coincident boundaries of adjacent cells shall be comprised of duplicate data records.

3.7.3 Terrain elevation intervals. The horizontal plane spacing of the elevation array will be in whole second intervals. (See TABLES I and II.)

3.7.4 Data value sequence. The elevations within a data record have a constant longitude value. The first data value is the southernmost known elevation and the last data value is the northernmost. No two data records shall have the same longitude value.

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3.7.5 Data record sequence. Within a data file, the data records are arranged by ascending (west to east) longitude.

3.7.6 Hash control total information. The last four frames of each data record contains a 32 bit value which is a checksum computed algebraically by summing all elevations and header words in that block, as 8 bit values using integer arithmetic. Each tape frame is considered as an unsigned 8-bit value for checksum calculation.

3.7.7 File structure diagram. (See TABLES III and IV.)

3.8 Data record characteristics.

3.8.1 Numeric value. All elevation values are signed magnitude binary integers, right justified, 16 bits (2 bytes). The sign is the high order position. Negative values are not complemented.

3.8.2 Elevation values. The numeric value identified in 3.1.8 will allow a theoretical range of elevations between $\pm 32,767$ meters; however in practice, the terrain elevation values shall not exceed + 9,000 meters or - 12,000 meters.

3.8.3 Null elevations. Unknown elevation data shall be represented by all "one" bits when the post is between known elevation data within the structure of a data record. This null elevation value of - 32,767 meters is used as a place holder in the data record. Null elevation values are allowed in 1 degree cells (i.e., partial cells) which have not been fully compiled. Null elevation values shall not be contained in 1 degree cells (i.e., full cells) issued from DMA to users as a standard product.

3.8.4 Missing Elevations.

- a. Elevation posts which are missing prior to the first known elevation are not represented. The location of the first known point is given by the latitude count field in the Data Record.
- b. Elevation posts which are missing past the last known elevation are not represented. The last known elevation is immediately followed by a checksum.
- c. Missing elevations are allowed in 1 degree cells (partial cells) which have not been fully compiled.
- d. Missing elevations are not contained in full 1 degree cells issued from DMA to users as a standard product.

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TABLE III. File structure diagram-Terrain example, (1 of 2).

FOUR 1° CELLS 12' LONGITUDE SPACING (NON STANDARD)			
DATA STRUCTURE SEQUENCE	DATA STRUCTURE TYPE	DATA STRUCTURE SEQUENCE	DATA STRUCTURE TYPE
1	VOL 1	32	HDR 1
2	HDR 1	33	UHL 1 31°N, 40°W
3	UHL 1 30°N, 40°W	34	*
4	*	35	DSI
5	DSI	36	ACC
6	ACC	37	Data Record 12
7	Data Record 1	38	Data Record 13
8	Data Record 2	39	Data Record 14
9	Data Record 3	40	Data Record 15
10	Data Record 4	41	Data Record 16
11	Data Record 5	42	Data Record 17
12	Data Record 6	43	*
13	*	44	EOF 1
14	EOF 1	45	UTL 1
15	UTL 1	46	*
16	*	47	HDR 1
17	HDR 1	48	UHL 1 31°N, 39°W
18	UHL 1 30°N, 39°W	49	*
19	*	50	DSI
20	DSI	51	ACC
21	ACC	52	Data Record 17
22	Data Record 6	53	Data Record 18
23	Data Record 7	54	Data Record 19
24	Data Record 8	55	Data Record 20
25	Data Record 9	56	Data Record 21
26	Data Record 10	57	Data Record 22
27	Data Record 11	58	*
28	*	59	EOF 1
29	EOF 1	60	UTL 1
30	UTL 1	61	*
31	*	62	*

Note: * = Tape Mark

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3.9 Description of record contents. The following Standard Terrain Format is unique to DTED distributed on magnetic tape. For each of the following records, an ASCII character requires one byte (8 binary bits).

a. Volume Header Label (VOL).

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
VOL	3	1	Recognition sentinel.
1	1	4	Fixed by standard.
	6	5	Reel Number. Six alphanumeric characters identifying the physical reel. (Requires leading alpha and trailing numeric.)
Blank or Nonblank	1	11	*Nonblank indicates restricted access, as the tape reel is privately owned.
Blanks	26	12	Unrequired available space.
Account Number	14	38	*Account number of owner of this tape reel. (DMA uses a maximum of 12 characters left-justified, space filled.)
Blanks	28	52	Fixed by standard.
1	1	80	Fixed by standard.

Note: *These fields, to be defined by the producer, may be left blank.

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b. File Header Label (HDR).

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
HDR	3	1	Recognition sentinel.
1	1	4	Fixed by standard.
Filename	17	5	*Left-justified filename The first 12 characters are referenced by the Executive System for comparison with the filename portion of the external filename.
UNIVAC	6	22	*Fixed as set identifier when referenced by system.
0001	4	28	*Reel sequence number within a file.
0001 - NNNN	4	32	*File sequence number within a reel.
0001	4	36	*Generation and version numbers which are fixed at 1 and 0.
00	2	40	
/BYDDDD	6	42	Creation date of tape. (A blank followed by two characters for the year, followed by three characters for the day (001 through 366) within the year date tape was written.)

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
/BYDDDD	6	48	*Expiration date of tape. Same format as creation date field. The date after which this tape reel may be considered as available for reallocation.
A space indicates unlimited access to this reel.	1	54	*Accessibility.
15 ₈ - This reel is catalogued (on tape).			
35 ₈ - This reel is catalogued with read key.			
55 ₈ - This reel is catalogued with write key.			
75 ₈ - This reel is catalogued with read and write key.			
Block Count	6	55	*Fixed at zeros.
Qualifier	13	61	*Used by the Executive Operating System. (DMA uses a maximum of 12 characters left-justified space filled.)
Blanks	7	74	Fixed by standard.

Note: *These fields, to be defined by the producer, may be left blank.

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c. User Header Label (UHL).

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
UHL	3	1	Recognition sentinel.
1	1	4	Fixed by standard.
DDMMSSH	8	5	Latitude of origin (lower left corner of data set; full degree value; leading zero(s) for all subfields: degrees, minutes and seconds). H is the Hemisphere of the data.
DDMMSSH	8	13	Longitude of origin (lower left corner of data set; full degree value; leading zero(s) for all subfields: (degrees, minutes and seconds). H is the Hemisphere of the data.
SSSS	4	21	Latitude data interval in seconds (decimal point is implied after third integer).
SSSS	4	25	Longitude data interval in seconds (decimal point is implied after third integer).
0000-9999 or NA	4	29	Absolute Vertical Accuracy in Meters. (With 90% assurance that the linear errors will not exceed this value relative to mean sea level (Right justified)).
T - Top Secret S - Secret C - Confidential U - Unclassified R - Restricted	3	33	Security Code. (Left justified)

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
Unique Reference	12	36	*Unique reference number (Provides Number pointer to file containing detailed file description).
Number of longitude lines	4	48	Count of the number of longitude (profiles) lines.
Number of latitude points	4	52	*Count of the number of latitude points per longitude line.
Multiple accuracy	1	56	0 - Single 1 - Multiple
Reserved	24	57	Unused portion for future use.

Note: *These fields, to be defined by producer, may be left blank.

- d. Data Set Identification (DSI) Record.
 Fixed Length = 648 ASCII Characters
 1 ASCII Character = 1 Byte = 8 Bits

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
DSI	3	1	Recognition Sentinel.
T - Top Secret S - Secret C - Confidential U - Unclassified R - Restricted	1	4	Security Classification Code.
	2	5	Security Control and Release Markings. For DoD use only (DIAM 65-19).
	27	7	Security Handling Description. Other security description. (Free text or blank filled).

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
	26	34	Reserved for future use. (Blank filled).
DTED1 or DTED2	5	60	DMA Series Designator for product level.
	15	65	Unique reference number. (For producing nations own use (free text <u>or</u> zero filled)).
	8	80	Reserved for future use. (Blank filled).
01-99	2	88	Data Edition Number.
A-Z	1	90	Match/Merge Version.
YYMM	4	91	Maintenance Date. (Zero filled until used.)
YYMM	4	95	Match/Merge Date. (Zero filled until used.)
0000	4	99	Maintenance Description Code. (All zero filled.)
CCAAABBB (Country - Free Text)	8	103	Producer Code. (DIA Country Codes used for first 2 characters).
	16	111	Reserved for future use. (Blank filled).
MILD89020	9	127	Military Specification Stock Number
00-99	2	136	Product Specification Amendment and Change Number.
YYMM	4	138	Product Specification Date
MSL	3	142	Vertical Datum (Mean Sea Level).

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
WGS84	5	145	Horizontal Datum Code (Current Version World Geodetic System).
	10	150	Digitizing Collection System. (Free text).
YYMM	4	160	Compilation Date. (Most descriptive month/year).
	22	164	Reserved for future use. (Blank filled).
DDMMSS.SH	9	186	Latitude of origin of data- leading zero for values less than 10; H is the hemisphere of the data.
DDMMSS.SH	10	195	Longitude of origin of data- leading zero for values less than 100; H is the hemisphere of the data.
DDMMSSH	7	205	Latitude of SW corner of data, bounding rectangle- leading zero for values less than 10; H is the hemisphere of the data.
DDMMSSH	8	212	Longitude of SW corner of data, bounding rectangle- leading zero for values less than 100; H is the hemisphere of the data.
DDMMSSH	7	220	Latitude of NW corner of data, bounding rectangle- leading zero for values less than 10; H is the hemisphere of the data.
DDMMSSH	8	227	Longitude of NW corner of data, bounding rectangle- leading zero for values less than 100; H is the hemisphere of the data.

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
DDMMSSH	7	235	Latitude of NE corner of data, bounding rectangle—leading zero for values less than 10; H is the hemisphere of the data.
DDMMSSH	8	242	Longitude of NE corner of data, bounding rectangle—leading zero for values less than 100; H is the hemisphere of the data.
DDMMSSH	7	250	Latitude of SE corner of data, bounding rectangle—leading zero for values less than 10; H is the hemisphere of the data.
DDMMSSH	8	257	Longitude of SE corner of data, bounding rectangle—leading zero for values less than 100; H is the hemisphere of the data.
DDMMSS.S	9	265	Clockwise orientation angle of data with respect to true North. (Will usually be all zeros for DTED.)
SSSS	4	274	Latitude interval in tenths of seconds between rows of elevation values. (Decimal point is implied after third integer.)
SSSS	4	278	Longitude interval in tenths of seconds between columns of elevation values. (Decimal point is implied after third integer.)

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
0000-9999	4	282	Number of Latitude lines, Actual count - Number of latitude points (rows that contain data).
0000-9999	4	286	Number of Longitude lines, Actual count - Number of longitude points (columns that contain data).
00 or 01-99	2	290	Partial Cell Indicator 00 = Complete 1° cell 01-99 = % of coverage completed.
	101	292	Reserved for DMA use only. (Blank filled.)
	100	393	Reserved for producing nation use only. (Free text or blank filled.)
	156	493	Reserved for future use. (Blank filled.)

e. Accuracy Description (ACC) Record.
Fixed Length = 2700 ASCII Characters
1 ASCII Character = 1 Byte = 8 Bits

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
ACC	3	1	Recognition Sentinel.
0000-9999 or NA	4	4	*Absolute Horizontal Accuracy of Product in meters.
0000-9999 or NA	4	8	*Absolute Vertical Accuracy of Product in meters.
0000-9999 or NA	4	12	*Random Horizontal Accuracy of Product in meters.

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
0000-9999 or NA	4	16	*Random Vertical Accuracy of Product in meters.
	4	20	Reserved for future use. (Blank filled.)
	1	24	Reserved for DMA use only.
	31	25	Reserved for future use. (Blank filled.)
00 or 02-09	2	56	Multiple Accuracy Outline Flag. 00 = No accuracy subregions provided. 02-09 = Number of accuracy subregions per 1° cell (maximum 9).

Note: *If Product has subregional accuracies, the overall accuracy of the product will be the worst accuracy.

Start of Accuracy Subregion Description. Repeat to maximum of nine times. Blank fill all unused accuracy subregions or unused coordinate pairs within a subregion. (1 Subregion = 284 ASCII Characters). Refer to 3.10.5.1 for accuracy subregion description.

0000-9999 or NA	4	58	Absolute Horizontal Accuracy of subregion in meters.
0000-9999 or NA	4	62	Absolute Vertical Accuracy of subregion in meters.
0000-9999 or NA	4	66	Random Horizontal Accuracy of subregion in meters.
0000-9999 or NA	4	70	Random Vertical Accuracy of subregion in meters.

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<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Character Start</u>	<u>Description</u>
03-14	2	74	Number of coordinates in accuracy subregion outline. (Maximum of 14 coordinate pairs. Coordinates are input clockwise. Implied closing from last to first coordinate pairs.)
Start of Coordinate Pair Description. Repeat to maximum of fourteen times to outline subregion. Blank fill all unused accuracy subregions and unused portions of subregions.			
DDMMSS.SH	9		Latitude-leading zero for values less than 10; H is the hemisphere of the data.
DDDMSS.SH	10		Longitude-leading zero for values less than 100; H is the hemisphere of the data.
End Coordinate Pair Description			
End Accuracy Subregion Description			
18		2614	Reserved for DMA use only.
69		2632	Reserved for future use.

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- f. Data Record Description. Each element is a true elevation referenced to mean sea level datum recorded to the nearest meter. The horizontal position is referenced to precise longitude-latitude locations in terms of the current World Geodetic System (WGS), determined for each file by reference to the origin at the Southwest corner. The elements are evenly spaced in latitude and longitude at the interval designated in the user header label in South to North profile sequence.

<u>Field Contents</u>	<u>Field Length In Bytes</u>	<u>Description</u>
252 ₀	1	Recognition Sentinel.
Data block count	3	Sequential count of the block within the file, starting with zero for the first block (Fixed Binary).
Longitude count	2	Count of the meridian. True longitude = longitude count x data interval + origin (SW corner longitude) (Fixed Binary).
Latitude count	2	Count of the parallel. True latitude = latitude count x data interval + origin (SW corner latitude) (Fixed Binary).
Elevation 1	2	True elevation value of point 1 of meridian in meters (Fixed Binary).
Elevation 2	2	True elevation value of point 2 of meridian in meters (Fixed Binary).
Elevation N	2	True elevation value of point N of meridian in meters (Fixed Binary).
Checksum	4	Algebraic addition of contents of block. Sum is computed as an integer summation of 8-bit values (Fixed

Note: Fixed Binary denotes signed magnitude, right-justified binary integers.

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g. File Trailer Label (EOF).

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Description</u>
EOF	3	Recognition Sentinel.
1	1	Fixed by standard.

Note: (See HDR for remainder of EOF fields.)

h. User Trailer Label (UTL)

<u>Field Contents</u>	<u>Field Length In Characters</u>	<u>Description</u>
UTL	3	Recognition Sentinel.
1	1	Fixed by standard.

Note: (See UHL for remainder of UTL fields.)

3.10 Explanation of records and fields (DTED).

3.10.1 Volume header label (VOL). This record is required for labeled tapes in accordance with American National Standards Institute (ANSI) standard X3.27-1978, Magnetic Tape Labels for Information Interchange.

3.10.2 File header label (HDR). This record is required for labeled tapes in accordance with ANSI standard X3.27-1978, Magnetic Tape Labels for Information Interchange.

3.10.3 User Header Label (UHL). ANSI standard allows an optional user header label in the first file of a labeled tape. Several computer manufacturers have implemented tape labeling in such a way that the user header label in the first file of the tape is inaccessible. This record is maintained for minimum impact to users not desiring to use the DSI record, but all information in it is in the DSI record as well.

3.10.3.1 Fields(UHL). The following are explanations of fields within the UHL.

- a. Longitude of Origin - Origin is always a full degree value even though the format allows values to be expressed to the second.
- b. Latitude of Origin - Origin is always a full degree value even though the format allows values to be expressed to the second.

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- c. Seconds Longitude Interval - A cell of DTED is North-South oriented with columns of elevation posts running from south to north. The longitude interval is the East-West distance between the columns expressed as tenths of seconds.
- d. Seconds Latitude Interval - The spacing between the elevation posts within a column (i.e., the distance between the rows) is the latitude interval expressed in tenths of a second.

3.10.4 Data Set Identification (DSI) Record. This record provides identification and security information relating to the DTED. The record is fixed length consisting of 648 ASCII characters. Each character is represented by 1 tape byte or 8 bits. Certain fields in the DSI record are duplicated in the UHL/UTL. These fields are required to match. Users may process the data using only the information in the DSI record if desired.

Note: Numeric values shall be right justified with leading zeros. Alpha and alphanumeric characters shall be left justified unless 'free text' is indicated in description.

3.10.4.1 Fields(DSI).

- a. Security control and release markings - This field may contain the two character codes from DIAM 65-19 or may be blank filled .
- b. DMA series designator - Five character code identifying the product in DMA Area Requirements and Product Status (ARAPS) file. DTED1 - Level 1, or DTED2 - Level 2.
- c. Unique reference number - Free text or zero filled.
- d. Data edition number - The number assigned to the data indicating either original compilation (Edition 1) or subsequent replacements of the data (Editions 2, 3, etc.) in the Data Base (DB) to achieve accuracy requirements (recompilation) or currency/specification requirements (revision).The data edition number does not reflect the number of replacements made to the data to effect boundary matches.
- e. Match/merge version - The number of times an edition of the data was changed to effect boundary continuity with adjacent data in the DB. Alphabetic Code A - Z designates data change for boundary continuity.

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- f. Maintenance date - YYYY (year and month); The date existing DB data was either revised (updated) to meet the currency requirements (or to effect specification changes), or recompiled to meet accuracy requirements. When the existing data is only revised (horizontal position or vertical values are not significantly changed) the maintenance date will reflect the date of the revision, but the compilation date will not be changed. It will continue to reflect the date of the original compilation. However, when the data is subjected to a major recompilation, the Compilation Date and the Maintenance Date will both be changed to reflect the date of the recompilation.
- g. Match/merge date - YYYY (year and month); The latest date the data in the database (DB) was changed to effect continuity with adjacent data. This data corresponds to the Match/Merge Version Code.
- h. Maintenance description code - Must be zero filled.
- i. Producer code - The first two characters (left justified) indicate the producing nation and are from DIAM 65-18 - Geopolitical Elements and Related Files. The last six characters are to be used at the discretion of the producer. Blanks are acceptable.
- | | | | |
|------------------|----|----------------|----|
| Belgium | BE | Netherlands | NL |
| France | FR | Norway | NO |
| Germany, Federal | | | |
| Republic of | GE | United Kingdom | UK |
| Italy | IT | United States | US |
- j. Military specification stock number - Identifies the military specification containing the compilation and accuracy requirements used to produce the data. Currently MILD89020.
- k. Military specification amendment and change number - Indicates the highest numbered amendment or change used to produce the data. The first character identifies the Amendment number and the second character identifies the Change Notice number. (Amendment 0, Change 1-01; Amendment 2, Change 2-22; etc.)
- l. Vertical datum code - Currently MSL.
- m. Horizontal datum code - Identifies the version of WGS to which the product is horizontally controlled. During original compilation DTED uses the WGS datum then in effect for DMA use. Upon transition to a new WGS datum the existing DTED can be:

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- (1) Recompiled from an original source; and therefore carry a new Edition number.
- (2) Recompiled by mathematically adjusting the elevation values; and therefore carry a new Edition number.
- (3) Revised by defining the same elevations as compatible with the new WGS datum within the accuracy evaluations quoted; and therefore carry the same Edition number but with a new Maintenance Date.
- n. Digitizing collection system - Identifies the equipment used to collect the elevation values from the source material used, i.e., AGDS, LIS, UNAMACE, AS11, etc.
- o. Compilation date - YYYY (year and month); The date the data was either originally compiled (Edition 1) or the date existing DB data was subjected to a major recompilation which involved significant changes to the horizontal positions and vertical values. (Edition 2, 3, 4, etc.)
- p. Latitude of origin - Expressed in degrees, minutes, seconds and tenths of seconds with N or S to indicate hemisphere.
- q. Longitude of origin - Expressed in degrees, minutes, seconds and tenths of seconds with E or W to indicate hemisphere.

3.10.5 Accuracy description record (ACC). The accuracy record provides accuracy information relating to the DTED. The record is fixed length consisting of 2700 ASCII characters. Each character is represented by 1 byte or 8 bits. The record allows for up to nine accuracy subregions within the product should the accuracies of various portions of this product differ. Each subregion may consist of up to fourteen coordinate pairs to accurately portray the outline. Coordinates are input clockwise. Unused coordinate pairs are blank filled.

Note: Numeric values shall be right justified with leading zeros. Alpha and alphanumeric characters shall be left justified.

3.10.5.1 Accuracy subregion description. A subregion description contains the subregion accuracies, the number of subregion coordinate pairs and the actual coordinate pairs which define the subregion area. Unused subregions and/or unused coordinate pairs within a subregion will be blank filled. The subregions will be organized as follows:

- a. The first coordinate pair of the first subregion must be the Southwest corner of the bounding rectangle.
- b. The first coordinate pair of each subregion must be the most southern and western point in the subregion.

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- c. The first coordinate pair of each sequential subregion must be arranged in a clockwise direction starting with the first subregion. Subregions which contain at least part of a degree line will take precedence and be numbered clockwise, starting in the SW corner and proceeding around the four bounding degree lines. Any remaining sub-regions will be numbered in a south to north, west to east manner based on initial point within each subregion.
- d. Coordinate pairs within a subregion must be arranged in a clockwise direction.
- e. Each subregion coordinate pair must be located on or within the bounding rectangle.
- f. Each coordinate pair in the bounding rectangle must be represented as a subregion coordinate pair.
- g. Subregion areas must not overlap or leave gaps. The entire area defined by the bounding rectangle must be covered by subregion areas.
- h. The first and last coordinate pairs of a subregion shall not be the same. Closure of the subregion area is implied.
- i. A subregion can only be generalized if all of the subregion descriptions have been used.
- j. Subregion format:

<u>Subregion Number</u>	<u>Field Length in Characters</u>	<u>Character Start</u>
1	284	58
2	284	342
3	284	626
4	284	910
5	284	1194
6	284	1478
7	284	1762
8	284	2046
9	284	2330

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3.11 DTED on Compact Disc-Read Only Memory (CD-ROM).

3.11.1 General.

3.11.1.1 CD-ROM content. The content of the DTED CD-ROM product includes, in addition to the DTED files, a Digital Mean Elevation Data (DMED) file, and zero or more Gazetteer files. The DMED file provides statistics about the elevations in each 15' x 15' area of each DTED cell. The Gazetteers provide the geographic coordinates for places, cities and other important landmark features. In addition, there are four text files that provide helpful information pertaining to the data on the DTED CD-ROM.

3.11.1.2 CD-ROM characteristics. The physical characteristics of the compact disc media are specified by the Philips/Sony Red Book. The digital data recording characteristics of the CD-ROM are specified by the Philips/Sony Yellow book. Logical formatting, file directory structure, and labeling of MC&G data on CD-ROM conforms to International Standard Organization (ISO) 9660, level 1.

3.11.2 Directories. Each DTED CD-ROM contains several hundred DTED cells, a gazetteer, a DMED file, a text file describing the disc contents including a user's guide, and a text file describing an ONC directory to access the DTED. A series of directories point to the above listed files resident on the CD-ROM. At the highest level, there are three directories (DTED, GAZETTE, and TEXT) and one file (DMED). Only the DTED directory contains subdirectories. Within the DTED directory, there is a subdirectory for each longitude containing cells. The subdirectory name format is: <E/W>DDD, where DDD is degrees. For example, the subdirectory name for DTED files contained between the meridians 127E and 128E would be : E127. The DTED cell file-name format is: <N/S>DD.DT1, where DD is degrees. For example, the file-name format for a DTED cell whose southwest corner is 38N and 127E would be: N38.DT1, or starting from the root directory, \DTED\E127\N38.DT1. FIGURE 1 in the Appendix is a Warnier diagram depicting the logical file structure.

3.11.3 DTED files. A DTED Level 1 cell is a single file containing the following information subset of the standard DMA DTED tape distribution format. The logical tape format/label records VOL1, HDR1, EOF1, UTL1, and hardware end of file marks are not included in the file, since the CD-ROM is logically formatted/labelled according to ISO 9660.

a. User Header Label (UHL: 80 bytes)	1
b. Data Set Identification Record (DSI: 648 bytes)	81
c. Accuracy Record (ACC: 2700 bytes)*	729

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d. Data Records (1201 records at 2414

3429,5843,

bytes/record)**

8257, etc.

* To meet current distribution security requirements of producing only unclassified CD DTED, when there are multiple accuracy subregions they are left blank (bytes 58-2613 of the ACC record) and the multiple accuracy outline flag is set to 10 (bytes 56-57 of the ACC record).

** The number of records is a function of the latitude. A count of 1201 is for cells between latitudes S50 and N49 degrees. There are no sparse cells. Elevations are two-byte integers, high order first, and negatives are signed magnitude. Users may have to switch the bytes and convert negatives to the complement they use. This can be done by putting the low order byte first, then turning off bit 15 (the high order bit), then multiplying by -1. For positive numbers, only the bytes are switched.

3.11.4 Digital Mean Elevation Data (DMED).

3.11.4.1 DMED file. The Digital Mean Elevation Data (DMED) file contains, for each 15' x 15' area of a 1°x1° cell, the minimum and maximum elevation, the mean elevation, and the standard deviation. The DMED file is a series of 394-byte records. The first record is a header giving the extremes of the minimum bounding rectangle (MBR) (in degrees) encompassing the cells on the CD. For example, the value: N30N36E020E032 followed by 380 spaces indicates that the MBR is 6° high and 12° wide. The next record has the data for the extreme southwest 1° cell in the MBR. The third record is for the 1° cell above that, and so forth, to the top of the MBR. Moving eastwardly, and until the edge of the MBR is reached, the next column of 1°x1° cells is added to the file with placement being from south to north. If a cell in the MBR is not included on the CD, its DMED record consists of its coordinates followed by 387 spaces (ASCII blanks).

3.11.4.2 Individual cell record. An individual cell record contains the geographic coordinates of the cell's southwest corner, the data edition number, the match/merge version of the cell from which the DMED is calculated and the following information about each 15' x 15' area of the cell: the minimum and maximum elevations, the mean elevation, and the standard deviation of the elevations. Data are all upper-case ASCII characters. Elevation values are to the nearest meter. In a 1° cell, the elevations in the three rows and three columns which divide the 15' x 15' areas from each other are counted in two areas. The order in which the 16 areas of a cell follow the header is:

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<u>Field Contents</u>	<u>Field Length in Characters</u>	<u>Start</u>	<u>Character Description</u>
N or S	1	1	Hemisphere
DD	2	2	Latitude of SW corner of cell
E or W	1	4	Hemisphere
DDD	3	5	Longitude of SW corner of cell
01-99	2	8	Data edition number
A-Z	1	10	Match/merge version
integer	6	11	Minimum elevation, in meters, of SW area. If negative, sign will be the next place left of most significant digit
integer	6	17	Maximum elevation of SW area
integer	6	23	Mean elevation of SW area
space	1	29	Not used
integer	5	30	Standard deviation about mean for SW area
integer	6	35	Minimum elevation of area 2
	41		Continue as for area 1
	24	59	Repeat for area 3
	24	83	Repeat for areas 4-16

4	8	12	16
3	7	11	15
2	6	10	14
1	5	9	13

<u>Field Contents</u>	<u>Field Length in Characters</u>	<u>Character Start</u>	<u>Description</u>
N or S	1	1	Hemisphere
DD	2	2	Latitude of SW corner of cell
E or W	1	4	Hemisphere
DDD	3	5	Longitude of SW corner of cell
01-99	2	8	Data edition number
A-Z	1	10	Match/merge version
integer	6	11	Minimum elevation, in meters, of SW area. If negative, sign will be the next place left of most significant digit.
integer	6	17	Maximum elevation of SW area
integer	6	23	Mean elevation of SW area
space	1	29	Not used

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integer	5	30	Std deviation about mean for SW area
integer	6	35	Minimum elevation of area 2
		41	Continue as for area 1
	24	59	Repeat for area 3
	24	83	Repeat for areas 4-16

3.11.5 Gazetteer.

3.11.5.1 Gazette directory. The gazette directory has files GAZETTE.KEY and GAZETTE.DIR, plus two files for each gazette (country) with the name convention <country>.GAZ and <country>.HSH. The country name may be abbreviated. If the minimum bounding rectangle of a CD touches any country, the entire gazetteer for that country is included, resulting possibly in coordinates extraneous to the geographic coverage.

3.11.5.2 Primary file. The primary file is <country>.GAZ. It consists of variable-length ASCII alpha-numeric records, one entry for each name. Alphabetic characters are upper case. Each record consists of a designation code in bytes 1-4, the latitude in bytes 5-11 (DDMMSSN/S), the longitude in bytes 12-19 (DDMMSSSE/W), a space in byte 20, and a variable length name field starting in byte 21. The name field contains a name, or a name followed by "SEE" followed by another name. The name field is followed by a carriage return (CR), a line feed (LF), then the next record. Even though most coordinates are rounded to the nearest minute, seconds are included in the format to accommodate future data. The seconds contain the digits 00. Entries are ordered by the ASCII collating sequence of the names.

Field	Field Length	Character		
<u>Contents</u>	<u>in Characters</u>	<u>Start</u>	<u>Description</u>	
alpha	4	1	Designation code	
integer	2	5	Degrees lat (00-90)	
integer	2	7	Minutes lat (00-59)	
integer	2	9	Seconds lat (00-59)	
alpha	1	11	Hemisphere (N or S)	
integer	3	12	Degrees lon (000-180)	
integer	2	15	Minutes lon (00-59)	
integer	2	17	Seconds lon (00-59)	
alpha	1	19	Hemisphere (E or W)	
alpha	1	20	Space	
alpha	var	21	Name field	
ASCII	2	var	CR LF, hex 0D 0A	

3.11.5.3 Hash file. The hash, or index, file is <country>.HSH. The hash file is a convenience for the user who wants a quick pointer into the primary file. It consists of four-byte records which are 32-bit integers (high byte first). It is based on the first three or four characters of the names in the primary file. Three characters are used for gazetteers with less than 50,000 entries, and four are used for larger ones. The binary integer in bytes 1-4 of the hash file tells how many characters were used. Characters considered for the computation are given in the following table along with the hexadecimal ASCII value and the decimal hash value. All other characters take the value of the space.

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<u>Character</u>	<u>ASCII</u>	<u>Hash</u>
space	20	0
`	27	1
,	2C	2
-	2D	3
.	2E	4
/	2F	5
A-Z	41-5A	6-31
grave	60	32
tilde ~	7E	33

3.11.5.4 GAZETTE.KEY. The key file is a dictionary of the 4-letter designation codes. It is a text file of variable length records with designation code in bytes 1-4, space in 5, variable length explanation, and CR LF.

3.11.5.5 GAZETTE.DIR. This text file gives the abbreviated country names, and expands them to their full length.

3.11.6 Textual information.

3.11.6.1 READ.ME. An ASCII text file named READ.ME contains a description of the disc contents including the geographic limits of the compact disc, a count of the cells, a location diagram (text array) showing which cells in the minimum bounding rectangle are resident on the disc, and a user's guide. An example of a READ.ME file is presented in the Appendix.

3.11.6.2 ONC.DIR. An ASCII file named ONC.DIR provides, via ONC tiles, a directory to the DTED cells on the CD-ROM.

3.11.7 User's responsibilities.

a. Procedures applicable for protection of classified data are contained in DMA Manuals: 5200.1, DMA Information Security Program; C5231.1, MC&G Classification Management Program; and DoD 5220.22-M, Industrial Security for Safeguarding Classified Information.

b. The CD-ROM is MC&G Property for purposes of the DFARS. Digital products produced by DMA in support of DoD requirements are Defense Information. While classification may not be required, the increasing size of the completed data bases represents a national resource. Therefore, DMA Instruction 8660.10, Release, Distribution, Handling, and Storage of Defense Mapping Agency (DMA) Digital Mapping, Charting, and Geodesy (MC&G) Data, establishes policies and procedures limiting unconstrained access. Receipts of DMA digital data must protect their holdings against misuse or loss. Whenever the digital products are not under supervision of authorized persons, the data must be secured in a container or vault that provides physical evidence of unauthorized tampering or forced entry.

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c. Reproduction for further distribution outside the primary recipient's organizational structure of any amount of DTED is not authorized without the written permission of the Defense Mapping Agency. Requests for such permission are to be sent to:

Director, Defense Mapping Agency
Attn: SOP
8613 Lee Highway
Fairfax, VA 22031-2137

d. Digital data derived from data produced by other nations under cooperative agreements may be subject to additional restrictions, copyrights, or classification. These restrictions must be honored when such digital data is distributed.

e. The data structure and information content of DMA's digital products are prescribed by DMA Product Specifications. Deletions, additions, or modifications to DMA's digital files by users become local transaction files (no longer DMA products) and are the responsibility of the user to control.

f. Destruction notice for DTED CD-ROMs:
Unclassified DTED CD-ROMs: Destroy by any method that will prevent disclosure of contents or reconstruction of the disc. Classified DTED CD-ROMs: Follow the procedures in DoD 5220.22-M, Industrial Security Manual, Section 11-19 or DoD 5200.1-R, Information Security Program Regulation, Chapter IX.

g. Correspondence concerning the quality of the CD-ROM shall be forwarded to:

Director, Defense Mapping Agency Aerospace Center
Attn: QA
3200 South Second Street
St. Louis, MO 63118-3399

3.12 Copyright.

a. Copyright protection is asserted for all products generated by these specifications which are distributed outside of the United States. No domestic copyright will be asserted.

b. The copyright notice states:

@ COPYRIGHT 19 (Date) BY THE UNITED STATES GOVERNMENT.
NO COPYRIGHT CLAIMED UNDER TITLE 17 U.S.C.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in a contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use their own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The

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Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure products and services conform to prescribed requirements.

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

4.1.2 Final product quality. Final product quality will reflect the quality elements expressed by each applicable Military Standard.

5. PACKAGING (CD-ROM)

5.1 General (packaging). Each CD-ROM will be labelled indicating the geographic contents of the CD-ROM, distribution/user information, stock number, and producer. Each CD-ROM will be distributed in a clear plastic case (also known as a "jewel box" or "jewel case"). The jewel box will contain a liner and an information booklet. The printing and finishing requirements are specified in DMA Technical Instructions TI/2DJ/001.

5.1.1 CD-ROM labelling. CD-ROM discs will be color coded to indicate the highest level of classification of the contents of the CD-ROM. UNCLASSIFIED CD-ROM discs will have a white background. Text and symbols will be overprinted in black. FIGURE 2 shows the label format for unclassified CD-ROMs.

5.1.2 Jewel-box liner. The jewel-box liner (also known as a tray card) includes the Location Diagram, which is a graphic depiction of the geographic location of the contents on the CD-ROM. FIGURE 3 shows the format of the jewel-box liner.

5.1.3 Information booklet. An information booklet will provide general information (similar to the READ.ME file) about the contents of the CD-ROM, handling instructions, distribution/user information, and DMA points of contact. Figure 4 shows the format for the information booklet covers.

6. NOTES

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

6.1 Intended use. This specification defines the content of Digital Terrain Elevation Data (DTED) which supports various weapon and training systems.

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6.2 Acquisition Requirements. When this specification is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (See 2.1.1 and 2.2).

6.3 Supersession. This specification supersedes MIL-D-890000 Military Specification for Digital Terrain Elevation Data Level 1, and MIL-D-89001 Military Specification for Digital Terrain Elevation data Level 2.

6.4 Definitions.

6.4.1 Accuracy. The degree of conformity with which horizontal position and vertical values are represented on a map, chart, or related product in relation to an established standard.

- a. Horizontal accuracy, absolute. The uncertainty in the horizontal position of a point with respect to the World Geodetic System caused by random and uncorrected systematic errors. The value is expressed as a circular error at the 90% confidence level.
- b. Horizontal accuracy, point-to-point. The uncertainty in horizontal position between two points caused by random errors. The value is expressed as a circular error at the 90% confidence level.
- c. Vertical accuracy, absolute. The uncertainty in the height of a point with respect to Mean Sea Level caused by random and systematic errors. The value is expressed as a linear error at the 90% confidence level.
- d. Vertical accuracy, point-to-point. The uncertainty in height between two points caused by random errors. The value is expressed as a linear error at the 90% confidence level.
- e. Random vertical accuracy. The uncertainty in the height of a point caused by random error only. The value is expressed as a linear error at the 90% confidence level. This value is what is input into the header as the relative vertical accuracy.

6.4.2 Cell. 1 degree by 1 degree area of coverage.

6.4.3 Circular error. An accuracy figure representing the stated percentage of probability that any point expressed as a function of two linear components (for example, latitude and longitude or northing and easting) will be within the given figure.

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6.4.4 DTED. A geographic matrix of terrain elevation data points converted into a numerical format for computer storage and analysis at precise increments of latitude and longitude. The precise increment depends upon the latitude. Elevation values are expressed in meters.

6.4.5 Inclusion condition. Conditions under which the feature/attribute(s) are required by the product.

- a. DTED Level 1 - Precise 3 arc second horizontal position referenced to the origin of the southwest corner, evenly spaced in latitude and longitude in a South to North profile sequence.
- b. DTED Level 2 - Precise 1 arc second horizontal position referenced to the origin of the southwest corner, evenly spaced in latitude and longitude in a South to North profile sequence.

6.4.6 Linear error. Linear error is the difference between the true or known value and the measured or derived value, and is normally expressed in terms of a percentage probability level. For example, LE 90% is the term used to express the linear error at 90% probability, which is the Map Accuracy Standard. This refers to the vertical accuracy of terrain elevations in the digital data base.

6.4.7 Mean Sea Level (MSL). The average height of the surface of the sea for all stages of the tide, used as a reference for elevations.

6.4.8 Nautical mile. 6076 feet; 1852 meters (international value).

6.4.9 Off-line digital data base. Magnetic media containing information in digital form including header information, geographic coordinates and descriptive information for planimetric features and terrain within a specific geographic area.

6.4.10 WGS (World Geodetic System). A consistent set of parameters describing the size and shape of the Earth, the positions of a network of points with respect to the center of mass of the Earth, transformations from major geodetic datums, and the potential of the Earth (usually in terms of harmonic coefficients).

6.5 International standardization agreements.

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

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6.5.1 International Standardization Agreements (STANAGs).

a. DTED Level 1 -

(1) STANAG 3809, "Digital Terrain Elevation Data Exchange Format".

(2) STANAG 2211, "Geodetic Datums, Spheroids, Grids and Grid References".

b. DTED Level 2 - This section is not applicable to this specification.

6.5.2 Quadripartite Standardization Agreements (OSTAGs).

6.5.2 Quadripartite Standardization Agreements (OSTAGs).

This section is not applicable to this specification.

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

This section is not applicable to this specification.

6.5.4 International MC&G agreements.

This section is not applicable to this specification.

6.5.5 Executive orders.

This section is not applicable to this specification.

6.5.6 Inter-Agency agreements.

This section is not applicable to this specification.

6.5.7 Other documentation.

This section is not applicable to this specification.

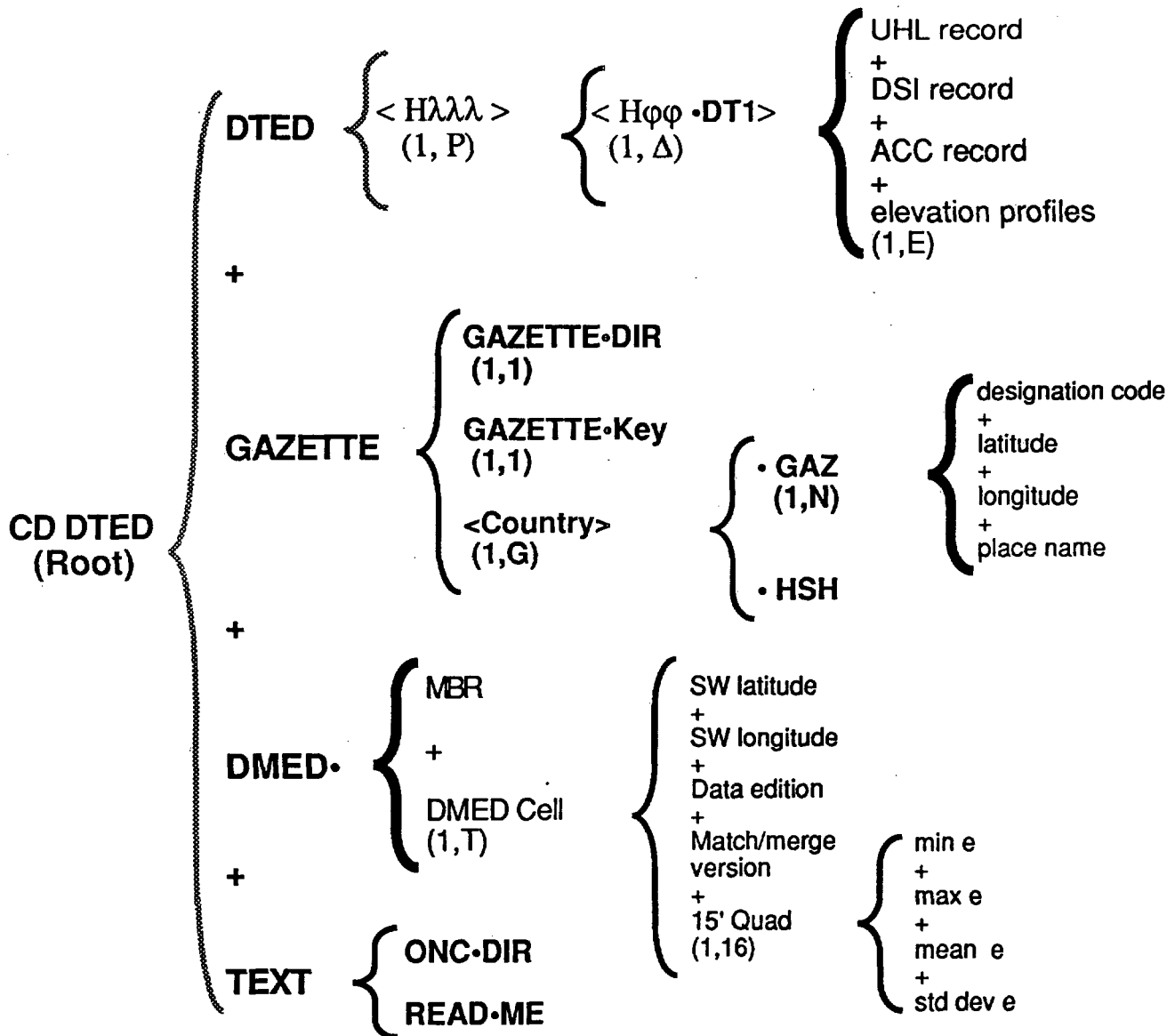
6.6 Subject term (key word) listing.

CD-ROM

FACS

1° by 1° cell

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$H\lambda\lambda\lambda$ - hemisphere (E or W) and longitude

$H\phi\phi$ - hemisphere (N or S) and latitude

P- number of 1° cell columns within the disc, a multiple of 6

Δ - number of 1° DTED cells within the columns, a multiple of 6

E - number of profiles per cell (latitude zone dependent, 1201 elevations per profile)

G - number of country/region gazettes on the disc

N - number of place names within the country/region gazette

T - total number of 1° cells on disc = $R \times \Delta$, a multiple of 6

FIGURE 1. DTED CD-ROM Logical Data File Structure.

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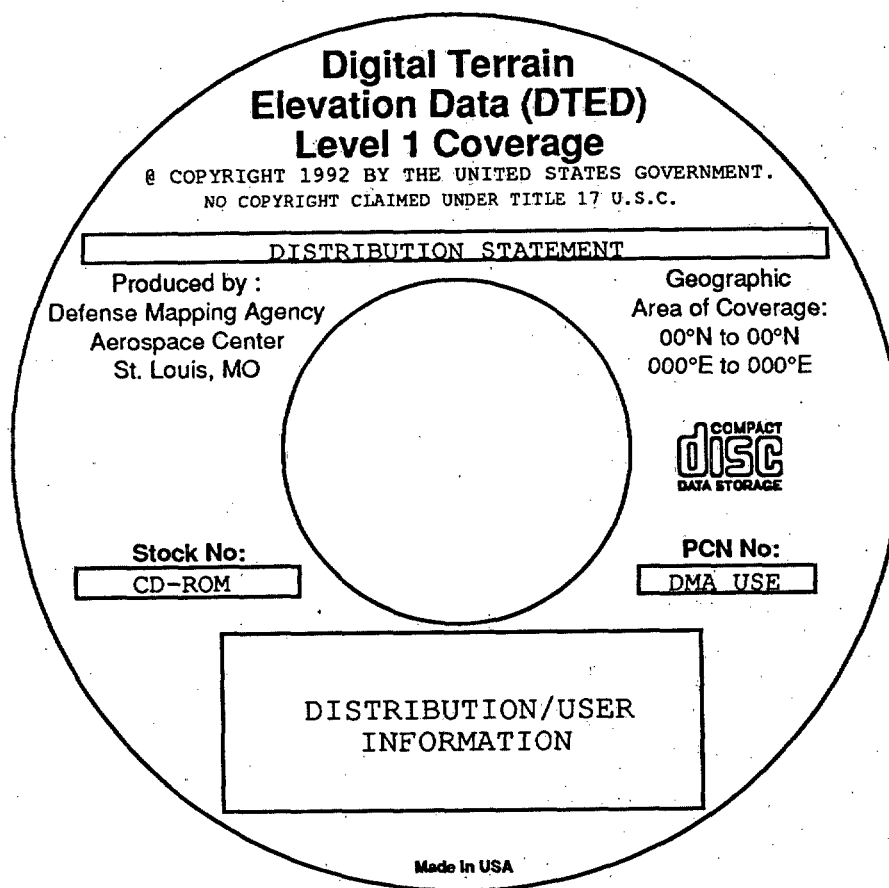


FIGURE 2. DTED CD-ROM label (UNCLASSIFIED).

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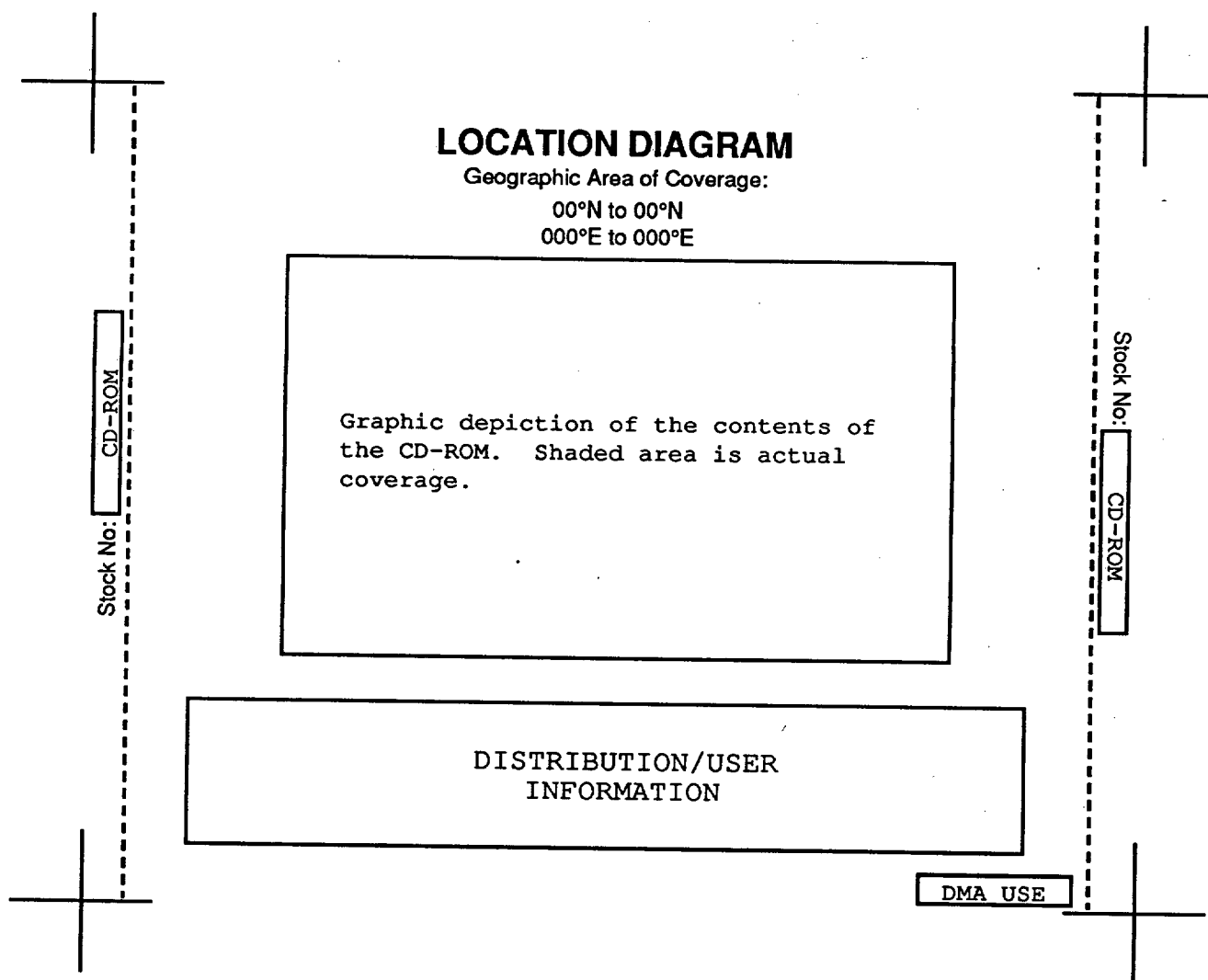
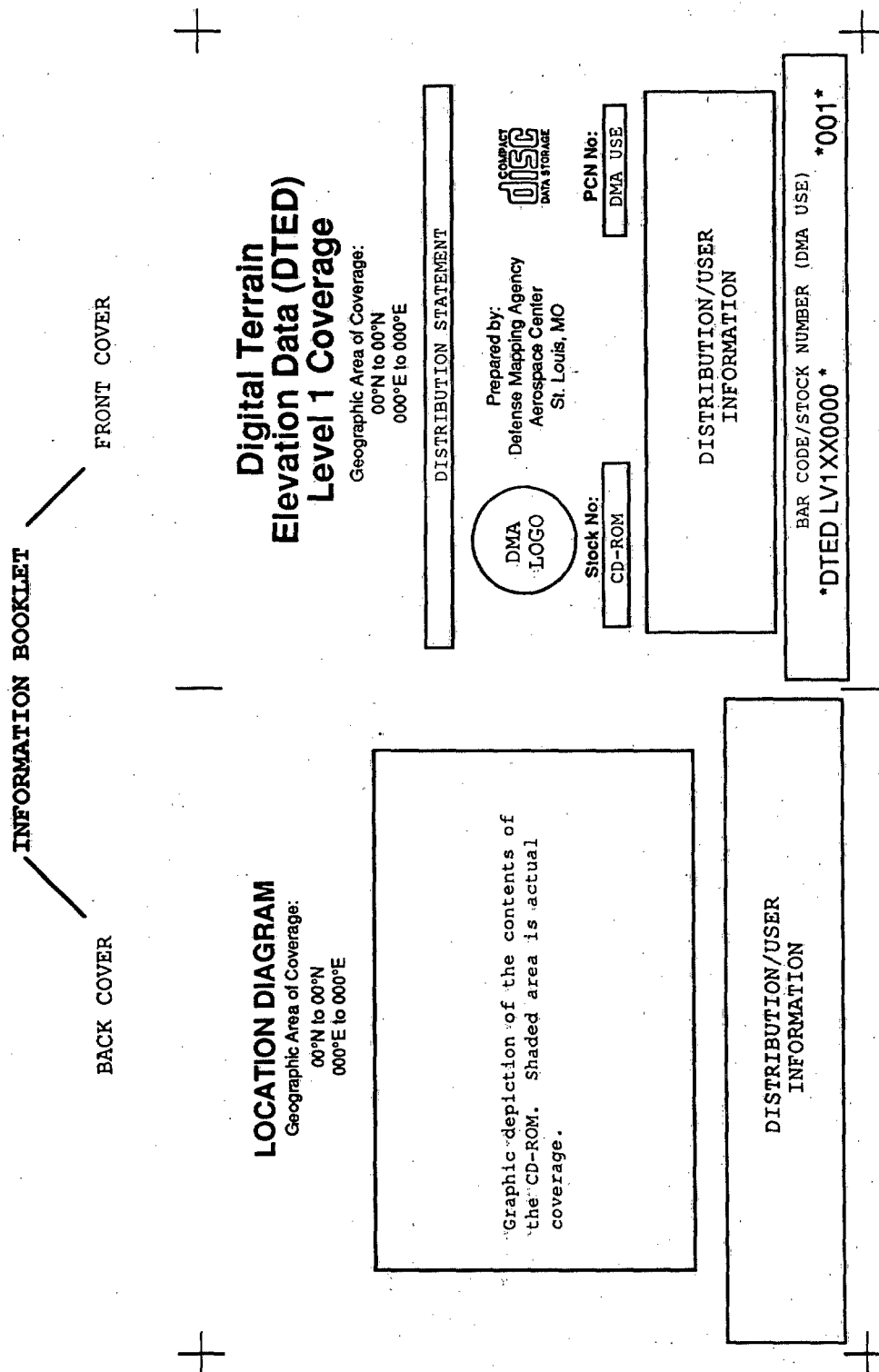


FIGURE 3. Jewel box liner.

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FIGURE 4. Information Booklet (UNCLASSIFIED).

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1. General:

A. This Compact Disc-Read Only Memory (CD-ROM) contains Level 1 Digital Terrain Elevation Data (DTED). Refer to the location diagram on the back cover of this booklet. Shaded area indicates the actual coverage of this CD-ROM. All cells are on the World Geodetic System 1984 (WGS 84).

B. Also included on this disc are a gazetteer, DMA Digital Mean Data (DMED) of the areas covered by the disc, a text file describing the disc contents, and a text file describing the ONC Directory for accessing the DTED. The gazetteer gives the user an opportunity to quickly define geo-coordinates for certain geographic features/place names. The geo-coordinates can be used to extract DTED information for the feature and vicinity. DMED provides a record which gives the south west corner of a cell and the following information about each 15' x15' area: minimum and maximum elevation, mean and standard deviation of the elevations. Please note that application software not included on this disc must be used to access each type of data.

C. The gazetteer information is the most current data available in computer form. However, it may not reflect recent changes in names and populated places.

D. Digital data derived from data produced by other nations under cooperative agreements may be used subject to additional restrictions, copyrights, or classification. These restrictions must be honored when such digital data is distributed.

E. The data structure and information content of DMA's digital products are prescribed by DMA Product Specifications. Deletions, additions, or modifications to DMA's digital files by users become local transaction files (no longer DMA products) and are the responsibility of the user to control.

F. Destruction notice for DTED CD-ROMs:
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Classified DTED CD-ROMs: Follow the procedures in DoD 5220.22-M, Industrial Security Manual, Section 11-19 or DoD 5200.1-R, Information Security Program Regulation, Chapter IX.

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II. Standards:

This CD-ROM uses the standard volume and file structure, ISO 9660.

III. Text Directory:

An ASCII text file named READ.ME contains a description of the disc contents including the geographic limits of the compact disc, a count of the cells, a location diagram (text array) showing which cells in the minimum bounding rectangle are resident on the disc, and a user's guide.

IV. User's Responsibility:

A. Procedures applicable for protection of classified data are contained in DMA Manuals: 5200.1, DMA Information Security Program and CS231.1, MC&G Classification Management Program or DoD 5220.22M, Industrial Security for Safeguarding Classified Information.

B. This CD-ROM is MC&G Property for purposes of the DFARS. Digital products produced by DMA in support of DoD requirements are Defense Information. While classification may not be required, the increasing size of the completed data bases represents a national resource. Therefore, DMA Instruction 8660.10, Release, Distribution, Handling, and Storage of Defense Mapping Agency (DMA) Digital Mapping, Charting, and Geodesy (MC&G) Data, establishes policies and procedures limiting unconstrained access. Recipients of DMA digital data must protect their holdings against misuse or loss. Whenever the digital products are not under supervision of authorized persons, the data must be secured in a container or vault that provides physical evidence of unauthorized tampering or forced entry.

C. Copyright protection is asserted for all DTED data distributed on CD-ROM distributed outside of the United States. No domestic copyright claim will be asserted. Reproduction for further distribution outside the primary recipient's organizational structure of any amount of DTED data is not authorized without the written permission of the Defense Mapping Agency. Requests for such permission are to be sent to:

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Fairfax, VA 22031-2137

APPENDIX

READ.ME FILE

10. SCOPE

10.1 Scope. This appendix provides an example of a READ.ME file, of the type typically found on a DTED CD-ROM. The appendix is not a mandatory part of the specification, but serves only to clarify the READ.ME file description presented in 3.11.6.1.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. EXAMPLE

This disc contains all of the level 1 DTED cells which fall within the rectangle bounded by 49N, 51N, 15E, and 17E.

There are 4 cells total.
 2 cells are 3X3 data.
 2 cells are 3X6 data.

Map of existing cells within the rectangle:

```
####
#XX#
#XX#
####
```

30.1 Organization of compact disc, and file structures.

a. Directory organization. At the highest level, there are three directories and one file. The directories are: DTED, GAZETTE, and TEXT. DTED is the only one containing subdirectories. The one file is DMED.

(1) Subdirectory naming. Within the DTED directory, there is a subdirectory for each longitude containing cells. The subdirectory name format is: <E/W>DDD where DDD is degrees. For example, the subdirectory name for DTED files contained between the meridians 127E and 128E would be: E127

(2) File naming. The DTED cell file name format is: <N/S>DD.DT1 where DD is degrees. For example, the file name for a DTED cell whose southwest corner is 38N and 127E would be:

N38.DT1, or starting from the root, \DTED\E127\N38.DT1 (DOS-based)
 /DTED/E127/N38.DT1 (UNIX-based)

b. DTED cell format. A Level 1 DTED cell is a single file containing the following information obtained from the standard DMA DTED distribution format with the following changes: VOL1, HDR1, EOF1, UTL1, and hardware end of file marks are not included in the file.

	Starting Byte
(1) User Header Label (UHL: 80 bytes)	1
(2) Data Set Identification Record (DSI: 648 bytes)	81
(3) Accuracy Record (ACC: 2700 bytes)*	729
(4) Data Records (1201 records at 2414 bytes/record)**	3429, 5843, 8257, etc.

* To meet current distribution security requirements of producing only unclassified CD DTED, when there are multiple accuracy subregions they are left blank (bytes 58-2613 of the ACC record) and the multiple accuracy outline flag is set to 10 (bytes 56-57 of the ACC record).

** The number of records is a function of the latitude. A count of 1201 is for cells between latitudes S50 and N49 degrees. There are no sparse cells. Elevations are two-byte integers, high order first, and negatives are signed magnitude. Users may have to switch the bytes and convert negatives to the complement they use. This can be done by putting the low order byte first, then turning off bit 15 (the high order bit), then multiplying by -1. For positive numbers, only the bytes are switched.

c. DMED File. \DMED. The Digital Mean Elevation Data (DMED) file is a series of 394-byte records. The first record is a header giving the extremes of the minimum bounding rectangle (MBR) (in degrees) encompassing the cells on the CD. For example, N30N36E020E032 followed by 380 spaces indicates that the MBR is 6 degrees high and 12 degrees wide. The next record has the data for the extreme southwest 1-degree cell in the MBR. The third record is for the 1-degree cell above that, and so forth, to the top of the MBR. Moving eastwardly, and until the edge of the MBR is reached, the next column of cells is added to the file, with placement being from south to north. If a cell in the MBR is not on the CD, its DMED record consists of its coordinates followed by 387 spaces (ASCII blanks). A record gives the cell's southwest corner, the data edition number and match/merge version of the cell from which the DMED is calculated, and the following information about each 15' x 15' area of the cell: minimum and maximum elevations, mean elevation and standard deviation of the elevations. Data are all upper-case ASCII characters. Elevation values are to the nearest meter. In a 1-degree cell, the elevations in the three rows and three columns which divide the 15' x 15' areas from each other are counted in two areas.

The order in which the 16 areas of a cell follow the header is:

```

4 8 12 16
3 7 11 15
2 6 10 14
1 5 9 13

```

Field Contents	Field Length in Characters	Character Start	Description
N or S	1	1	Hemisphere
DD	2	2	Latitude of SW corner of cell
E or W	1	4	Hemisphere
DDD	3	5	Longitude of SW corner of cell
01-99	2	8	Data edition number
A-Z	1	10	Match/merge version
integer	6	11	Minimum elevation, in meters of SW area. If negative, sign will be the next place left of most significant digit.
integer	6	17	Maximum elevation of SW area
integer	6	23	Mean elevation of SW area
space	1	29	Not used
integer	5	30	Std deviation about mean for SW area
integer	6	35	Minimum elevation of area 2
		41	Continue as for area 1
	24	59	Repeat for area 3
	24	83	Repeat for areas 4-16

d. Gazette directory. In the gazette directory are files GAZETTE.KEY and GAZETTE.DIR, plus two files for each gazette (country) with the name convention <country>.GAZ and <country>.HSH. The country name may be abbreviated. If the minimum bounding rectangle of a CD touches any country, the entire gazetteer for that country is included, resulting possibly in coordinates extraneous to the geographic coverage.

(1) <country>.GAZ. This is the primary file. It consists of variable length ASCII alphanumeric records, one entry for each name. Alphabetic characters are upper case. Each record consists of a designation code in bytes 1-4, the latitude in bytes 5-11 (DDMMSSN/S), the longitude in bytes 12-19 (DDDMMSSE/W), a space in byte 20, and a variable length name field starting in byte 21. The name field contains a name, or a name followed by "SEE" followed by another name. The name field is followed by a carriage return (CR), a line feed (LF), then the next record. Even though most coordinates are rounded to the nearest minute, seconds are included in the format to accommodate future data. The seconds contain the digits 00. Entries are ordered by the ASCII collating sequence of the names.

Field Contents	Field Length in Characters	Character Start	Description
alpha	4	1	Designation code
integer	2	5	Degrees latitude (00-90)
integer	2	7	Minutes latitude (00-59)
integer	2	9	Seconds latitude (00-59)
alpha	1	11	Hemisphere (N or S)
integer	3	12	Degrees longitude (000-180)
integer	2	15	Minutes longitude (00-59)
integer	2	17	Seconds longitude (00-59)
alpha	1	19	Hemisphere (E or W)

Field Contents	Field Length in Characters	Character Start	Description
alpha	1	20	Space
alpha	var	21	Name field
ASCII	2	var	CR LF, hex OD OA

(2) <country>.HSH. This is the hash, or index, file. The hash file is a convenience for the user who wants a quick pointer into the primary file. It consists of four-byte records which are 32-bit integers (high byte first). It is based on the first three or four characters of the names in the primary file. Three characters are used for gazetteers with less than 50,000 entries, and four are used for larger ones. The binary integer in bytes 1-4 of the hash file tells how many characters were used. Characters considered for the computation are given in the following table along with the hexadecimal ASCII value and the decimal hash value. All other characters take the value of the space.

Character	ASCII	Hash
space	20	0
`	27	1
,	2C	2
-	2D	3
.	2E	4
/	2F	5
A-Z	41-5A	6-31
grave	60	32
tilde	7E	33

Assuming a 4-character hash, to find a record in the primary file you compute the value of the first four characters of a geographic name, go to that record number in the hash file, read an address, and go to that byte number in the primary file. From there you read records sequentially until you find the desired place name. To compute the value of 4 characters, give each a value of 0-33 (see table on page 8), then multiply the first by $34^{**}3$, the second by $34^{**}2$, the third by 34, and the fourth by 1, then add the values and +2 together. EXAMPLE: WRAN = $28 \times 39304 + 23 \times 1156 + 6 \times 34 + 19 \times 1 + 2 = 1127325$. Assume that hash record number 1127325 is the integer 4023300. In the primary file read the record starting at byte 4023300, and read down the file by records until finding WRANGEL BAY, or one of the islands. The first byte of the file is byte one, not zero. In the 3-character scheme multiply the first three characters by $34^{**}2$, $34^{**}1$, and 1.

(3) GAZETTE.KEY. The key file is a dictionary of the 4-letter designation codes. It is a text file of variable length records with designation code in bytes 1-4, space in 5, variable length explanation, and CR LF.

(4) GAZETTE.DIR. This text file gives the abbreviated country names, and expands them to their full length.

e. Text Directory

(1) READ.ME. An ASCII text file named READ.ME, contains a description of the disc contents including the geographic limits of the compact disc, a count of the cells, a location diagram (text array) showing which cells in the minimum bounding rectangle are resident on the disc, and a user's guide.

(2) ONC.DIR. ONC.DIR is an ASCII file that provides, via ONC tiles, a directory to the DTED cells on the CD-ROM.

f. The data structure and information content of DMA's digital products are prescribed by DMA Product Specifications. Deletions, additions, or modifications to DMA's digital files by users become local transaction files (no longer DMA products) and are the responsibility of the user to control.

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h. Correspondence concerning the quality of the CD-ROM shall be forwarded to:

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3200 South Second Street
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30.2 User's responsibilities.

a. Procedures applicable for protection of classified data are contained in DMA Manuals: 5200.1, DMA Information Security Program; C5231.1, MC&G Classification Management Program; and DoD 5220.22-M, Industrial Security for Safeguarding Classified Information.

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Military Specification for Digital Terrain Elevation Data (DTED)

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