PERFORMANCE 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 National Imagery and Mapping Agency's (NIMA) Digital Terrain Elevation Data Base which supports various weapon and training systems. This edition includes the Shuttle Radar Topography Mission (SRTM) DTED Level 1 and Level 2 requirements.

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 Classification. Digital Terrain Elevation Data (DTED) is produced at three different levels of detail. The three classes of DTED are known as DTED Level 0, DTED Level 1; and DTED Level 2.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are needed to meet the requirements specified in sections 3, 4, and 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all requirements documents cited in sections 3, 4, and 5 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, National Imagery and Mapping Agency, ATTN: Doctrine and Force Development/DF (P-37), 12310 Sunrise Valley Drive, Reston, Va. 20191-3449, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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

2.2   Government documents.

2.2.1 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).

STANDARDS

FEDERAL INFORMATION PROCESSING STANDARDS

FIPS 10-4   Countries. Dependencies. Areas
                                 Of Special Sovereignty, and
                                 Their Principal Administrative
                                 Divisions

DEPARTMENT OF DEFENSE

MIL-STD-600001   - MC&G Accuracy Standard

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-9660   - DoD Produced CD-ROM Products

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the DoD Single Stock Point (DODSSP), 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Copies of Federal Information Processing Standards (FIPS) are available to Department of Defense activities from the DoD Single Stock Point (DODSSP). Others must request copies from the National Information Services, 5285 Port Royal Road, Springfield, VA 22161-2171.)

2.2.2   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.   NIMA TR 8350.2, Third Edition, 4 July 1997, Department of Defense World Geodetic System 1984, It's Definition and Relationships with Local Geodetic Systems.

b.   NIMA Instruction 8955.1, Guidelines for Labeling The National Imagery and Mapping Agency's CD-ROMs, and Printing and Finishing of Jewel Case Liners/Cardboard Sleeves, and Information Booklets.

c.   NIMA Instruction 5200.1, Information Security, 8 May 1998.

d.   NIMA Instruction 5220.1, Industrial Security, 10 February 1999.

(Copies of the above publication are available from the National Imagery and Mapping Agency, Interoperability Standards Division (SES), Mail Stop P-24, 12310 Sunrise Valley Drive, Reston, VA 20191-3449.)

e. DMA INST 8660.10, Procedures for Request, Release, Handling, and Distribution of Defense Mapping Agency (DMA) Mapping, Charting, and Geodesy (MC&G) Digital Products(U), 10 April 1990.

(Copies of legacy policies can be requested from the National Imagery and Mapping Agency, National Imagery and Geospatial Policy Office (NP), Customer Service Division at (301) 227-7477, DSN 287-7477.)

2.3 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise speci-fied, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise speci-fied, 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. First Edition, 1988.

(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).

(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.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

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) as determined by the Earth Gravitational Model (EGM) 1996.

3.3 Accuracy. Individual DTED cells have an accuracy calculated based on collection and production methods and stored in the ACC record. The individual calculated DTED cell accuracies are usually better than those cited below.

3.3.1 <u>DTED Level 1 accuracy.</u>

3.3.1.1 <u>Absolute accuracy</u>.

3.3.1.1.1 <u>Absolute horizontal accuracy</u>.

    90% Circular Error (C.E.) World Geodetic System (WGS) $\leq$ 50 meters

3.3.1.1.2 <u>Absolute vertical accuracy</u>.

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

3.3.1.2 <u>Relative vertical accuracy (point-to-point)</u>.

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

3.3.2 <u>DTED Level 2 accuracy.</u>

3.3.2.1 <u>Absolute accuracy</u>.

3.3.2.1.1 <u>Absolute horizontal accuracy</u>.

    90% Circular Error (C.E.) World Geodetic System (WGS) ≤ 23 meters

3.3.2.1.2 <u>Absolute vertical accuracy</u>.

    90% Linear Error (L.E.) Mean Sea Level (MSL) ≤ 18 meters

3.3.2.2 <u>Relative vertical accuracy (point-to-point)</u>.

    90% L.E. MSL ≤ 12 meters over a 1° cell for low and medium relief terrain (0 to 20% predominant slope).

    90% L.E. MSL ≤ 15 meters over a 1° cell for high relief terrain (greater than 20% predominant slope).

3.4 <u>Security</u>.

3.4.1 <u>Security Classification.</u> The security classification of the products generated by the use of these specifications will be the lowest practicable. When it is necessary to assign a security classification to the product, it shall be in accordance with established national security procedures.

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

3.5 <u>Product description</u>.

3.5.1 <u>One-degree cell</u>. A data file of DTED Level 0, DTED Level 1 or DTED Level 2 is a 1° by 1° cell defined by whole degree latitude and longitude lines on WGS. A DTED file shall not cross whole degree latitude or longitude lines.

3.5.2 <u>Adjacent one-degree data files</u>. Adjacent one-degree data files shall not have gaps between them and the only overlap that exists is along adjacent boundaries. All adjacent boundaries shall be coincident.

3.5.3 <u>DTED Surface characteristics</u>.

3.5.3.1 <u>Water</u>

3.5.3.1.1 <u>Flattened water bodies</u>. Elevation values within a lake with a diameter equal to or greater than 1200 meters for DTED Level 1 or with a diameter equal to or greater than 600 meters for DTED Level 2 must be identical. Sea or ocean elevation values for DTED Level 1 or DTED Level 2 shall be zero.

3.5.3.1.2 <u>Double-line drains</u>. Drains with a width equal to or greater than 183 meters shall be visible in the DTED data.

3.5.3.2 <u>Land</u>.

3.5.3.2.1 <u>Shorelines and coastlines</u>. The land elevation values shall be higher than the adjacent water elevations. Extremely shallow land just interior to coastlines shall have + 1 meter elevation to force proper land boundary portrayal.

3.5.3.2.2 <u>Islands</u>. Islands with the major axis equal to or greater than 600 meters for DTED Level 1 or 300 meters for DTED Level 2 shall be included in the DTED data. Smaller islands shall be included in the DTED data if the relief is equal to or greater than 15 meters above the water level.

3.5.3.3 <u>Below mean sea level</u>. All land or water bodies below mean sea level shall have negative elevations.

3.5.4 <u>DTED Level 0</u>. A data file of DTED Level 0 is produced from DTED Level 1 or VMAP 0. The DTED Level 0 accuracy record is copied from the DTED Level 1 accuracy record or will contain NA (Not Available) when produced from VMAP 0. DTED Level 0 is produced with only full one-degree cells with no voids. DTED Level 0 downloaded from the NIMA Gateway does not contain null elevations.

3.5.5 <u>DTED Level 1</u>. DTED Level 1 CD-ROMs are produced with only full one-degree cells with no voids. Only DTED Level 1 full one-degree cells with no voids can be downloaded from the NIMA Gateway.

3.5.6 <u>DTED Level 2</u>. DTED Level 2 CD-ROMs are produced with partial one-degree cells with voids. DTED Level 2 partial one-degree cells with voids can be downloaded from the NIMA Gateway. DTED Level 2 partial cells will contain null elevations.

3.6 <u>Standard format</u>. NIMA has two methods of recording terrain elevation data depending on the recording media. One method is available on Compact Disc-Read Only Memory (CD-ROM) and from the NIMA Gateway. The original Standard Terrain Format is still available on 8mm tape or and nine(9) track magnetic tape.

3.6.1 <u>Physical characteristics of CD-ROM.</u>

3.6.1.1 <u>CD-ROM characteristics</u>. 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 Standards Organization (ISO) 9660, level 1.

3.6.2 <u>Physical characteristics of magnetic tape</u>.

3.6.2.1 <u>Nine (9) Track Tape</u>. The physical characteristics of Nine (9) track magnetic tape are as follows:

      a. Length: 2400 feet (maximum).

      b. Width: .5 inch.

      c. Nine track recording format.

      d. Odd parity.

      e. Inter-record gap: .6 inch for 1600 bits per inch (BPI) Tapes; .3 inch for 6250 BPI Tapes.

      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 BPI/Phase encoded.

        (2) 6250 BPI/Group Coded Recording (GCR). Preferred NIMA data exchange format (shall not be used unless agreed to by sender and receiver).

3.6.2.2   <u>Eight millimeter (8mm) Tape</u>. The physical characteristics of Eight millimeter (8mm) magnetic tape cartridges are as follows:

      a. Length: 112 meters (maximum).

      b. Width: 8 mm.

      c. Helical recording format.

      d. Physical end-of-tape markers at the beginning (beginning-of-tape marker) and end of the tape (end-of-tape marker).

      e. Density-recording methods. 5, 7, 10, 14 GB per data cartridge.

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

3.7   <u>Record characteristics on Magnetic Tape</u>.

3.7.1 <u>Recorded labels</u>. American National Standard Magnetic Tape Labels for Information Interchange X3.27-1978. Recorded in ASCII code.

3.7.2 <u>Data records</u>.

      a. Record size. Variable length, maximum 7214 bytes, minimum 14 bytes, modal (average) 2414 bytes.

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

3.8   NIMA Gateway. Digital Terrain Elevation Data can be accessed through the NIMA Gateway via the World-Wide-Web (WWW), the Open Source Information System (OSIS), Secure Internet Protocol Router Network (SIPRNET) or the Joint Worldwide Intelligence Communication System (JWICS). DTED Level 0 can be downloaded from the WWW, OSIS, SIPRNET and JWICS. DTED Level 1 and Level 2 can be downloaded from the OSIS, SIPRNET and JWICS. The DTED files are encapsulated and compressed into one file for downloading. Detailed instructions for downloading and decompression are available on the webpages.

3.9   DTED File descriptions on CD-ROM or from the Gateway. The three classes of DTED are known as DTED Level 0, DTED Level 1, and DTED Level 2. Each DTED class consists of a different set of files.

DTED File Types

DTED Level 0 consists of six file types.	DTED Level 1 consists of eight file types.	DTED Level 2 consists of four file types.
onc.dir	onc.dir	onc.dir
<xxx>.dt0	<xxx>.dt1	<xxx>.dt2
<xxx>.avg	Read.me	Read.me
<xxx>.min	dmed.	dmed.
<xxx>.max	gazetteer directory	
dmed.	<country>.gaz	
	<country>.hsh	
	Gazette.dir	
	Gazette.key	

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3.9.1 <u>The onc.dir file.</u> An ASCII file named ONC.DIR provides, via ONC tiles, a directory to the DTED cells on the CD-ROM or when downloaded from the NIMA Gateway.

3.9.2 <u>The <xxx>.dt0, .dt1, .dt2 files.</u> The .dt0, .dt1, and .dt2 are the terrain elevation data files for DTED Level 0, DTED Level 1 and DTED Level 2, respectively. 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 locations of 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 0, TABLE II for DTED Level 1 and TABLE III for DTED Level 2). Each terrain elevation data file consists of the User Header Label(UHL), Data Set Identification(DSI) Record, Accuracy Description Record(ACC) and the Data records. (See 3.12 for details of the terrain elevation data files.)

Note: In the tables below, all values in seconds are in terms of arc measure.

TABLE I. <u>Matrix intervals for DTED Level 0.</u>

ZONE	LATITUDE	MATRIX		INTERVAL	
		latitude		longitude	
I	0° – 50° North-South	30	x	30	seconds
II	50° – 70° North-South	30	x	60	seconds
III	70° – 75° North-South	30	x	90	seconds
IV	75° – 80° North-South	30	x	120	seconds
V	80° – 90° North-South	30	x	180	seconds

TABLE II. <u>Matrix intervals for DTED Level 1.</u>

ZONE	LATITUDE	MATRIX		INTERVAL	
		latitude		longitude	
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 III. <u>Matrix intervals for DTED Level 2.</u>

ZONE	LATITUDE	MATRIX		INTERVAL	
		latitude		longitude	
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

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3.9.3 <u>The <xxx>.avg, .min, .max files</u>. The .avg, .min and .max data files are unique to DTED Level 0. They contain the average, minimum and maximum terrain elevation value associated with each DTED Level 0 elevation value. The average, minimum and maximum values are calculated from DTED Level 1. Each 30" x 30" area of DTED1 (11 posts x 11 posts) are searched for the minimum and maximum value; while the average is calculated from the 121 values. Notice therefore that the row and columns of posts that divide each 30"x 30" area are included in the calculations for two of the values. The .avg, .min, and .max files are composed of a Motorola (i.e., SUN) Format two (2) byte integer structure. Each data file consists of the User Header Label(UHL), Data Set Identification(DSI) Record, Accuracy Description Record(ACC) and the Data records. The .avg, .min, and .max files are referenced by the subcell's center coordinate pair. A subcell of DTED Level 0 is defined as equal to thirty (30") arc second by thirty (30") arc second. The latitude spacing will always be consistent based upon the DTED level of the data, whereas the longitude spacing is dependent upon the level of the data and geographic zone (See Table I). This file shall not cross whole degree latitude and longitude lines.

3.9.4 <u>The Read.me file</u>. 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.

3.9.5 <u>The DMED. file</u>. The Digital Mean Elevation Data (DMED) file is an ASCII text file. It 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).

3.9.5.1 <u>Individual cell record</u>. 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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4    8   12  16
3    7   11  15
2    6   10  14
1    5    9  13
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Field Contents	Field Length in Characters	Start	Character Description

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H	1	1	Hemisphere (N or S)
DD	2	2	Latitude of SW corner of cell
H	1	4	Hemisphere (E or W)
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
	18	41	Continue as for area 1
	24	59	Repeat for area 3
	24	83	Repeat for areas 4-16

3.9.6 The Gazetteer file. The Gazetteer file is only on the DTED Level 1 CD-ROM.

3.9.6.1 Gazetteer 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.

3.9.6.2 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 (DDMMSSH), the longitude in bytes 12-19 (DDDMMSSH), 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 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

3.9.6.3 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

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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.

ASCII Character	Hex	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

3.9.6.4 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.

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

3.10 Logical file characteristics.

3.10.1 Data file structure. Arranged in 1° by 1° geographic areas.
Each data file shall contain data falling within a single one degree cell.
The reference origin for all data files shall be the southwest corner of the
one degree cell. Multiple data files shall be arranged primarily by ascending
latitude bands (90° South to 89° North), secondarily by ascending longitude
(180° West to 179° East).

3.10.2 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.

3.10.3 Terrain elevation intervals. The latitude and longitude grid
spacing will be in whole second intervals. Latitude spacing will always be
consistent based upon the level of the data. Longitude spacing is dependent
upon the level of the data and the geographic zone. (See TABLES I, II and
III.)

3.10.4 Data value sequence. The elevations with 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.

3.10.5 <u>Data record sequence</u>. Within a data file, the data records are arranged by ascending (west to east) longitude.

3.10.6 <u>Data Block Checksum</u>. The last four bytes of each data record contains a 32-bit checksum value. The checksum is computed algebraically using integer arithmetic by summing all header and elevation bytes contained in the record as 8-bit values. Each byte is considered an unsigned, 8-bit value for checksum calculation.

3.10.7 <u>DTED on Compact Disc-Read Only Memory (CD-ROM)</u>.

3.10.7.1 <u>CD-ROM content</u>. 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. Additional information concerning CD-ROMs can be found in the DoD Military Handbook titled, MIL-HDBK-9660 DoD-Produced CD-ROM Products.

3.10.7.2 <u>Directories</u>. 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 Operational Navigation Chart (ONC) directory to access the DTED (see Table IV). 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 sub-directories. Within the DTED directory, there is a sub-directory for each longitude containing cells. The sub-directory name format is: <E/W>DDD, where DDD is degrees. For example, the sub-directory name for DTED files contained between the meridians 127E and 128E would be : E127. The DTED cell file-name format is: <N/S>DD.dtX, where DD is degrees and X is the DTED data level. For example, the file-name format for a DTED Level 1 cell whose southwest corner is 38N and 127E would be: N38.dt1, or starting from the root directory, \DTED\E127\N38.dt1. FIGURE 1 is a Warnier diagram depicting the logical file structure for a DTED Level 1 cell(page 40).

3.10.7.3 <u>CD ROM labeling and packaging.</u> CD ROM labeling, and labeling on the cardboard sleeve, or jewel case liner/information booklet, as applicable, shall be in accordance with NIMA PI 813-102, Guidelines for Labeling The National Imagery and Mapping Agency's CD-ROMs, and Printing and Finishing of Jewel Case Liners/ Cardboard Sleeves, and Information Booklets. Method of packaging (cardboard sleeves or jewel case) shall be specified in the contract (see 5.1).

3.10.7.3.1 <u>CD labeling</u>. Labeling of DTED CDs shall be in accordance with standard elements identified in the reference figures in NIMA Instruction 8955.1.
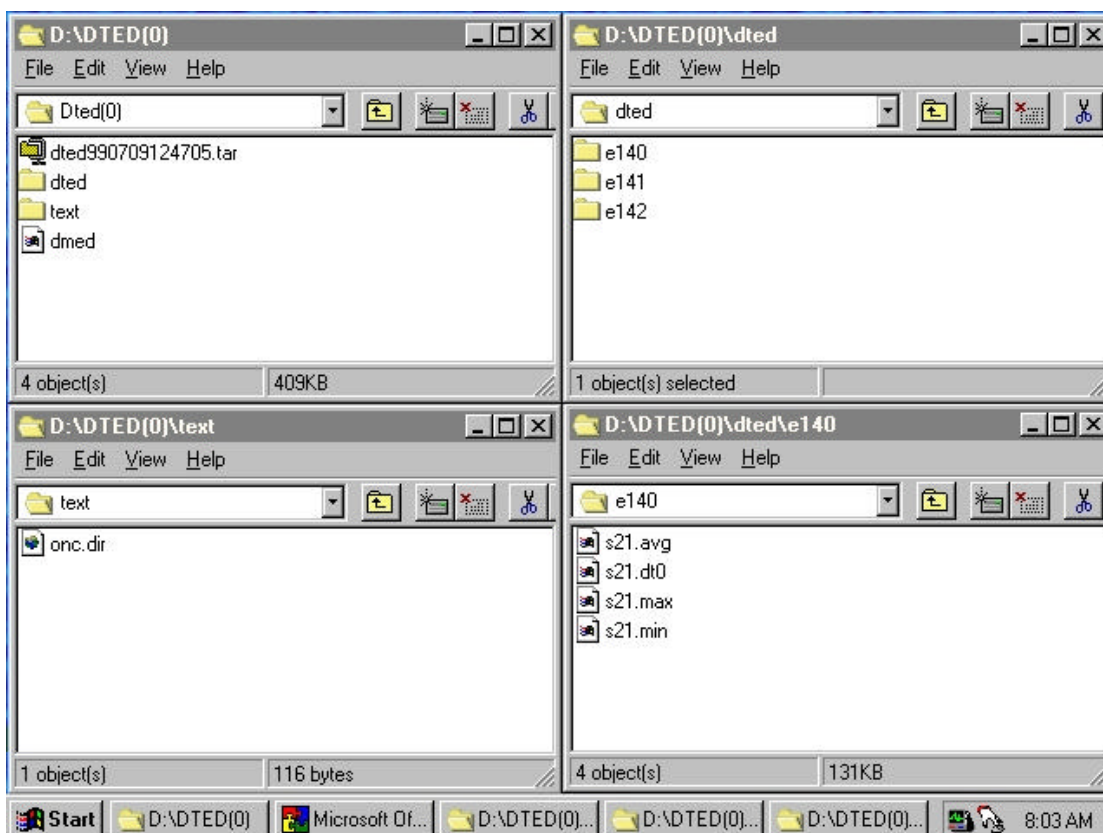
Table IV.
File Structure Diagram - DTED Level 0 Example

3.10.7.4 DTED files. A DTED cell is a single file containing the following information. The CD-ROM is logically formatted/labeled according to ISO 9660.

3.10.7.4.1 DTED Level 1.

		Record starts at byte
a.	User Header Label (UHL: 80 bytes)	1
b.	Data Set Identification Record (DSI: 648 bytes)	81
c.	Accuracy Record (ACC: 2700 bytes)	729
d.	Data Records (Each data record is 2414 bytes)*	3429
		5843
		8257
		etc

3.10.7.4.2 DTED Level 2.

		Record starts at byte
a.	User Header Label (UHL: 80 bytes)	1
b.	Data Set Identification Record (DSI: 648 bytes)	81
c.	Accuracy Record (ACC: 2700 bytes)	729
d.	Data Records (Each data record is 7214 bytes)*	3429
		10643
		17857
		etc

* The number of records is a function of the DTED level and latitude. A count of 1201 is for a DTED Level 1 cell and a count of 3601 is for a DTED Level 2 cell between latitudes 50°S and 50°N. Elevations are two-byte integers, high

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order first, and negatives are signed magnitude. Users may have to swap the
bytes and/or 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.

3.10.8 Magnetic Tape File structure diagram. The original Standard
Terrain Format is only available on magnetic tape. The following records

a. Volume Header Label (VOL)
b. File Header Label (HDR)
c. File Trailer Label (EOF)
d. User Trailer Label (UTL)

are only used on magnetic tape. (See TABLES VI and VII)

3.10.9 Shuttle Radar Topography Mission (SRTM) DTED The STS-99 Space
Shuttle using C-band Interferometric Synthetic Aperture Radar (IFSAR) will
collect DTED over 80 percent of the Earth's land mass (between 60° N and 57°
S).

3.10.9.1 Voids. The SRTM DTED Level 1 and Level 2 data cells may
contain voids. The void areas will contain null values (-32,767) in lieu of
the terrain elevations. The Partial Cell Indicator in the DSI record will
identify the percentage of data coverage.

3.10.9.2 SRTM Data Set Identification (DSI) Record contents. In the
DSI record
a.   The "Digitizing Collection System" field contains "SRTM".
b.   The "Compilation Date" field contains the STS-99 SRTM launch date.
c.   The "Partial Cell Indicator" will identify the percentage of data
      coverage.

3.10.9.3 SRTM Accuracy Description (ACC) Record contents. In the ACC
record
a.   Byte 24 "Reserved for NIMA Use" will contain a "X"
b.   Sub-region source codes will contain an "X"

3.10.9.4 SRTM Accuracies. The SRTM DTED Level 2 has a system design 16
meter absolute vertical height accuracy, 10 meters relative vertical height
accuracy and 20 meter absolute horizontal circular accuracy. All accuracies
are at the 90% level. Individual SRTM DTED Level 2 cells have an accuracy
recorded in the ACC record calculated from the collection parameters. These
values will differ from the system design accuracies.

3.10.9.5 SRTM DTED reflective surface. The SRTM DTED elevations are
defined with respect to the reflective surface computed from the IFSAR returns
from the Earth features. DTED data will include cultural features (manmade)
and vegetation canopy elevations. SRTM surface portrayal is consistent for
all areas of SRTM derived data.

3.10.9.6 SRTM DTED waterbodies. The location of waterbodies in the SRTM
DTED are derived from a combination of LANDSAT and SRTM Orthorectified Image
Mosaic imagery and incorporated into the DTED.

3.11 Data record characteristics.

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

Note: Elevations are two-byte integers, high order first, and negatives are signed magnitude. Users may have to swap the bytes and/or 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.

3.11.2   Elevation values. The numeric value identified in 3.11.1 will allow a theoretical range of elevations between ± 32,767 meters; however in practice, the terrain elevation values shall not exceed + 9,000 meters or – 12,000 meters.

3.11.3   Partial cells. Partial cells may contain null values and/or may have missing elevations. Partial cells are issued as standard NIMA DTED Level 2. DTED Level 1 partial one-degree cells may be distributed to customers by special request. The Partial Cell Indicator in the DSI record will identify the percentage of data coverage.

3.11.3.1 Null elevations. Unknown elevations along a scan line, which are bounded by known elevation values, will contain the null value. The null value is represented by data values with all bits set to 1> bits within the structure of a data record. This null elevation value of – 32,767 meters is used as a placeholder in the data record. Null elevation values are allowed in 1° cells (i.e., partial cells) which have not been fully compiled. Null elevation values shall not be contained in 1° cells (i.e., full cells) issued from NIMA to users as a standard product.

3.11.3.2 Missing Elevations.

3.11.3.2.1 Missing elevations on CD-ROM. A DTED cell on CD-ROM always has the full array of data. Any missing elevation data is represented by the null value.

a. Elevation posts, which are missing prior to the first known elevation, are represented with the null value.

b. Elevation posts, which are missing past the last known elevation, are represented with the null value

3.11.3.2.2 Missing elevations on magnetic tape. A partial DTED cell on magnetic tape does not have a full array of terrain data.

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° cells (partial cells) which have not been fully compiled.
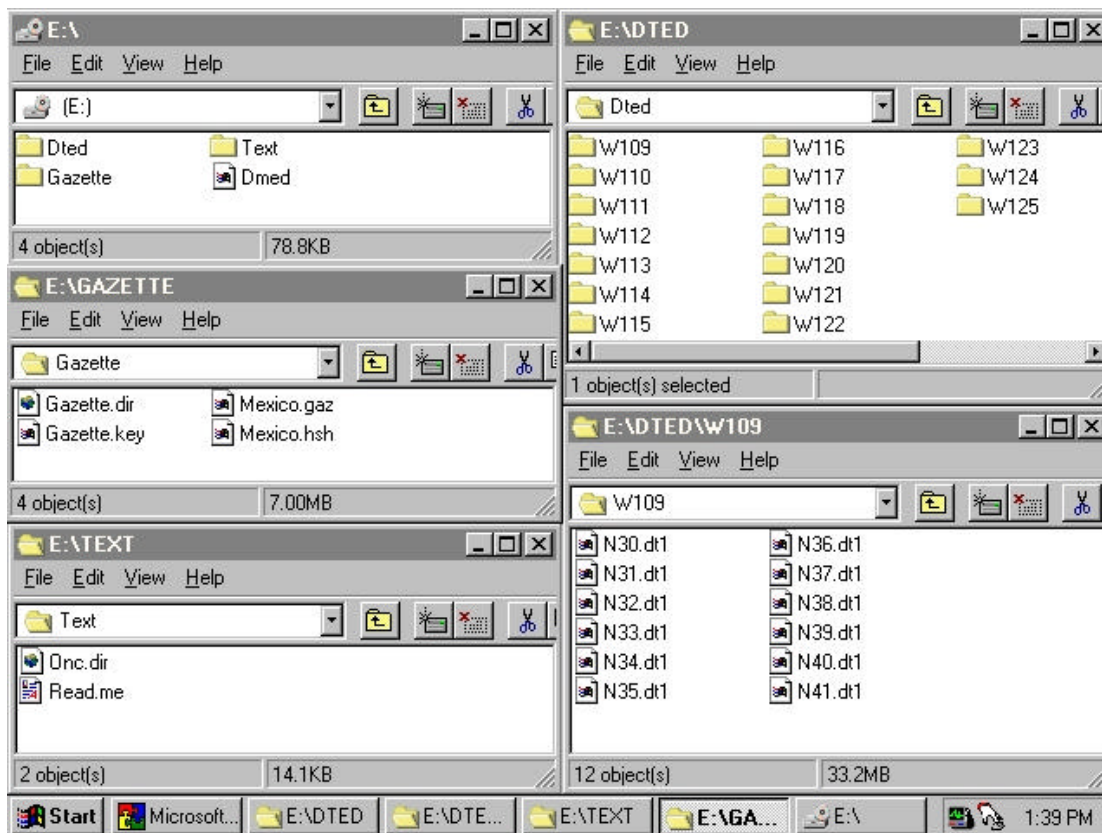
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Table V. TCD_DTED128 CD-ROM
File Structure Diagram - DTED Level 1 Example

3.11.4 The <xxx>.avg, .min and .max Data Record Characteristics. All elevation values are Motorola format binary integers, right justified, 16 bits (2 bytes) and similar to the DTED Level 1 and 2 layout. A count of 121 is for complete DTED Level 0 cells between latitudes of 50° S and 50° N (See Table 1). The average, minimum and maximum values are referenced to the central location of the DTED Level 1 (30" x 30") subcell so that a direct comparison can be made back to the DTED Level 0 data.

3.11.4.1 The <xxx>.avg, .min, and .max data values. The algorithm calculates the .min (minimum), .max (maximum) and average value for the entire subcell (including the elevation values contained in the adjacent rows and columns of adjacent subcells).

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TABLE VI. Magnetic Tape File Structure diagram-Terrain example.

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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TABLE VII. Magnetic Tape File structure diagram-terrain example.

```
            Cell 3                        Cell 4
 32°N +   .    .    .    .    +    +    .    .    .    .    +

      .
      12   13   14   15   16   17   17   18   19   20   21   22
      .    .    .    .    .    .    .    .    .    .    .    .
    Record Record Record Record Record Record Record Record Record Record Record Record
      .    .    .    .    .    .    .    .    .    .    .    .
    Data Data Data Data Data Data Data Data Data Data Data Data
      .    .    .    .    .    .    .    .    .    .    .    .
 31°N+   .    .    .    .    +    +    .    .    .    .    +

 31°N+ 6 . 12 . 18 . 24 . 30 +36 +    .    .    .    .    +
      . 5
      .    .    .    .    .    .    .    .    .    .    .    .
      1    2    3    4    5    6    6    7    8    9    10   11
      . 4  .    .    .    .    .    .    .    .    .    .    .
    Record Record Record Record Record Record Record Record Record Record Record Record
      3
    Data Data Data Data Data Data Data Data Data Data Data Data
      . 2  .    .    .    .    .    .    .    .    .    .    12'
 30°N + 1 . 7 . 13 . 19 . 25 +31 +    .    .    .    .12'  +
      40°W     Cell 1            39°W 39°W     Cell 2      38°W
```

Notes: (1) In the above example (non-standard 12' latitude/longitude spacing), each data Record contains 6 elevations.

        a. DTED Level 1 - A 3" standard 1° cell data record contains 1201 elevatons.

        b. DTED Level 2 - A 1" standard 1° cell data record contains 3601 elevatons.

    (2) Elevations along 1° boundaries are repeated for each 1° cell.

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3.12 <u>Description of record contents</u>.

For each of the following records,
- an ASCII character requires one byte (8 binary bits).
- b is a blank.
- DDD is 000 – 180 degrees.
- MM is 00 – 59 minute.
- SS is 00 – 59 seconds.
- H is the hemisphere, N,S,E or W.
- YY is the last two digits of the year.
- MM is the month 01 – 12.

a. Volume Header Label (VOL). The VOL is used for magnetic tape only.

Field Contents	Field Length In Characters	Character Start	Description
VOL	3	1	Recognition sentinel.
1	1	4	Fixed by standard.
	6	5	Reel Number. Six alpha-numeric characters identifying the physical reel. (Requires leading alpha and trailing numeric.)
Blank or Non blank	1	11	Non blank 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. (NIMA 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). The HDR is used for magnetic tape only.

Field Contents	Field Length In Characters	Character Start	Description
HDR	3	1	Recognition sentinel.
1	1	4	Fixed by standard.
Filename	17	5	*Left-justified filename
System Name	6	22	*Name of system creating tape (e.g., DPDW1, DPDW2, DCAFE, IEC).
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
00	2	40	numbers which are fixed at 1 and 0.
bYYDDD	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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Field Contents	Field Length In Characters	Character Start	Description
bYYDDD	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. 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.	1	54	*Accessibility.
Block Count	6	55	*Fixed at zeros.
	13	61	*
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). The UHL is used for magnetic tape and CD-ROM.

Field Contents	Field Length In Characters	Character Start	Description
UHL	3	1	Recognition sentinel.
1	1	4	Fixed by standard.
DDDMMSSH	8	5	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.
DDDMMSSH	8	13	Latitude of origin (lower left corner of data set; full degree value; leading zero(s) for all sub fields: (degrees, minutes and seconds). H is the Hemisphere of the data.
SSSS	4	21	Longitude data interval in tenths of seconds.
SSSS	4	25	Latitude data interval in tenths of seconds.
0000-9999 or Not Available (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)).
S - Secret C - Confidential U - Unclassified R - Restricted	3	33	Security code. (Left Justified)

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Field Contents	Field Length In Characters	Character Start	Description
Unique Reference	12	36	*Unique reference number
Number of longitude lines	4	48	Count of the number of longitude (profiles) lines for a full one-degree cell. Count is based on the Level of DTED and the latitude zone of the cell. (See Table I, II and III).
Number of latitude points	4	52	Count of the number of latitude points per longitude line for a full one-degree cell. (e.g. 1201 for DTED1, 3601.for DTED2).
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. The DSI is used for magnetic tape and CD-ROM.
        Fixed Length = 648 ASCII Characters

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

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Field Contents	Field Length In Characters	Character Start	Description
	26	34	Reserved for future use. (Blank filled).
DTED0, DTED1 or DTED2	5	60	NIMA Series Designator for product level.
	15	65	Unique reference number. (For producing nations own use (free text or 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 or ANNN	4	99	Maintenance Description Code. (Zero filled until used.)
CCAAABBB	8	103	Producer Code.(Country - Free Text) (FIPS 10-4 Country Codes used for first 2 characters).
	16	111	Reserved for future use. (Blank filled).
AAAAAAAAA	9	127	Product Specification. (Alphanumeric field)
00-99	2	136	First digit is Product Specification Amendment Number and second digit is the Change Number.
YYMM	4	138	Date of Product Specification.
MSL, E96	3	142	Vertical Datum

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Field Contents	Field Length In Characters	Character Start	Description
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 year/month).
	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.
DDDMMSS.SH	10	195	Longitude of origin of data— leading zeroes 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.
DDDMMSSH	8	212	Longitude of SW corner of data, bounding rectangle— leading zeroes 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.
DDDMMSSH	8	227	Longitude of NW corner of data, bounding rectangle— leading zeroes for values less than 100; H is the hemisphere of the data.

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Field Contents	Field Length In Characters	Character Start	Description
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.
DDDMMSSH	8	242	Longitude of NE corner of data, bounding rectangle— leading zeroes 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.
DDDMMSSH	8	257	Longitude of SE corner of data, bounding rectangle— leading zeroes for values less than 100; H is the hemisphere of the data.
DDDMMSS.S	9	265	Clockwise orientation angle of data with respect to true North. (Will usually be all zeros.)
SSSS	4	274	Latitude interval in tenths of seconds between rows of elevation values.
SSSS	4	278	Longitude interval in tenths of seconds between columns of elevation values.

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Field Contents	Field Length In Characters	Character Start	Description
0000-9999	4	282	Number of Latitude lines. For magnetic tape, this is the actual count of the number of latitude points (rows that contain data). For CD-ROM, this is the count of the number of latitude points in a full one-degree cell. (e.g. 1201 for DTED1, 3601 for DTED2.
0000-9999	4	286	Number of Longitude lines. For magnetic tape, this is the actual count of the number of longitude points (columns that contain data). For CD-ROM, this is the count of the number of longitude points in a full one-degree cell. The count is based on the level of DTED and the latitude zone of the cell. (See Table II and III).
00 or 01-99	2	290	Partial Cell Indicator 00 = Complete 1° cell 01-99 = % of data coverage.
	101	292	Reserved for NIMA use only. (Free text or Blank filled.)
	100	393	Reserved for producing nation use only. (Free text or blank filled.)
	156	493	Reserved for free text comments. (Free text or Blank filled.)

e. **Accuracy Description (ACC) Record.** The ACC is used for magnetic tape and CD-ROM.

Fixed Length = 2700 ASCII Characters

Field Contents	Field Length In Characters	Character Start	Description
ACC	3	1	Recognition Sentinel.
0000-9999 or Not Available (NA)	4	4	*Absolute Horizontal Accuracy of Product in meters
0000-9999 or Not Available (NA)	4	8	*Absolute Vertical Accuracy of Product in meters
0000-9999 or Not Available (NA)	4	12	*Relative (Point-to-Point) Horizontal Accuracy of Product in meters.

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Field Contents	Field Length In Characters	Character Start	Description
0000-9999 or Not Available (NA)	4	16	*Relative (Point-to-Point) Vertical Accuracy of Product in meters.
	4	20	Reserved for future use. (Blank filled.)
	1	24	Reserved for NIMA 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 Sub region Description. Repeat to maximum of nine times. Only the number of subregions defined in the Multiple Accuracy Outline Flag are populated. Blank fill all unused coordinate pairs within a subregion. (1 Sub region = 284 ASCII Characters). Refer to 3.13.5.1 for accuracy subregion description.
0000-9999 or Not Available (NA)	4	58	Absolute Horizontal Accuracy of Sub region in meters
0000-9999 or Not Available (NA)	4	62	Absolute Vertical Accuracy of Sub region in meters.
0000-9999 or Not Available (NA)	4	66	Relative (Point-to-Point) Horizontal Accuracy of Sub region in meters.
0000-9999 or Not Available (NA)	4	70	Relative (Point-to-Point) Vertical Accuracy of Subregion in meters.

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Field Contents	Field Length In Characters	Character Start	Description
03-14	2	74	Number of coordinates in accuracy sub region outline. (Maximum of 14 coordinate pairs. The first coordinate is the most southwestern. 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.
DDDMMSS.SH	10		Longitude—leading zero for values less than 100; H is the hemisphere of the data.

End Coordinate Pair Description

End Accuracy Sub region Description

	18	2614	Reserved for NIMA use only.
	69	2632	Reserved for future use.

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f. Data Record Description. The Data Record is used for magnetic tape and CD-ROM.

Each elevation is a true value as determined by the Earth Gravity Model (EGM) 1996 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 elevations are evenly spaced in latitude and longitude at the interval designated in the user header label in South to North profile sequence.

Field Contents	Field Length In Bytes	Description
252_8	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 (Offset from the SW corner longitude) (Fixed Binary).
Latitude count	2	Count of the parallel. True latitude = latitude count x data interval + origin (Offset from the 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 Binary).

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

g.   File Trailer Label (EOF). The EOF is used for magnetic tape.

Field Contents	Field Length In Characters	Description
EOF	3	Recognition Sentinel.
1	1	Fixed by standard.

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

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h.   User Trailer Label (UTL).   The UTL is used for magnetic tape.

Field Contents	Field Length In Characters	Description
UTL	3	Recognition Sentinel.
1	1	Fixed by standard.

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

3.13   Explanation of records and fields (DTED).

3.13.1   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.

3.13.2   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.

3.13.3   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.

3.13.3.1   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.

        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.

        e.   Number of longitude lines - The number of longitude lines field always reflects a full DTED cell in the UHL. This value is based on the level of DTED and the latitude zone of the cell (see Table I, II, and III).

        f.   Number of latitude points - The number of latitude points field always reflects a full DTED cell in the UHL. (DTED Level 0 = 121, Level 1 = 1201, and Level 2 = 3601)

3.13.4   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.

   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.

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3.13.4.1 <u>Fields(DSI)</u>.

a. Security control and release markings - This field may contain the two character codes or may be blank filled

b. NIMA series designator - Five character code to uniquely identify a product. DTED0 for Level 0, DTED1 for Level 1, or DTED2 for 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 denotes original release of the edition, B - Z designates data change for boundary continuity.

f. Maintenance date - YYMM (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 - YYMM (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 - Zero filled until used.

i. Producer code - The first two characters (left justified) indicate the producing nation and are from FIPS 10-4 Countries, Dependencies, Areas of Special Sovereignty and Their Principal Administrative Divisions. The last six characters are to be used at the discretion of the producer. Blanks are acceptable. Example codes:

Belgium	BE	Norway	NO
France	FR	Spain	SP
United Germany	GE	United Kingdom	UK
Italy	IT	United States	US
Netherlands	NL		

j. Product specification - Identifies the product specification containing the compilation and accuracy requirements used to produce the data. Data produced to this specification will contain PRF89020B.

k. Product 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. Date of product specification - Identifies the published date of the product specification used to produce the data

m. Vertical datum code - MSL or E96.

n. 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 NIMA use. Upon transition to a new WGS datum the existing DTED can be:

(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.

o. Digitizing collection system - Identifies the equipment used to collect the elevation values from the source material used, e.g., AGDS, LIS, UNAMACE, AS11, DE/S, PG/S, SRTM etc.

p. Compilation date - YYMM (year and month); The date the data was either originally compiled (Edition 1) or the date existing data was subjected to a major recompilation which involved significant changes to the horizontal positions and vertical values. (Edition 2, 3, 4, etc.)

q. Latitude of origin - Expressed in degrees, minutes, seconds and tenths of seconds with N or S to indicate hemisphere (always a full degree value even though the format allows value to be expressed to tenths of seconds).

r. Longitude of origin - Expressed in degrees, minutes, seconds and tenths of seconds with E or W to indicate hemisphere (always a full degree value even though the format allows value to be expressed to tenths of seconds).

s. Number of latitude lines - The number of latitude lines field for a DTED cell in the CD-ROM format always reflects a full cell (DTED Level 1 = 1201, Level 2 = 3601). CD-ROM format always has a full array of data. (See 3.11.3.2.1)
The number of latitude lines for a DTED cell on magnetic media reflects the actual count of rows that contain valid elevation values. DTED partial cells on magnetic media do not always have a full array of data. (See 3.11.3.2.2.)

t. Number of longitude lines - The number of longitude lines field for a DTED cell in CD-ROM format always reflects a full cell in the DSI. This value is based on the level of the DTED cell and the latitude zone the cell falls within (See Table II, and III). This is due to the CD-ROM format always having a full array of data.
The number of longitude lines field for a DTED cell on magnetic media reflects the actual count of longitude columns that contain valid elevation values DTED partial cells on magnetic media do not always have a full array of data. (See 3.11.3.2.2)

3.13.5 <u>Accuracy description record (ACC)</u>. The accuracy record provides accuracy information relating to the DTED. The record is fixed length

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consisting of 2700 ASCII characters. Each character is represented by 1 byte
or 8 bits. The record allows for up to nine accuracy sub regions within the
product should the accuracies of various portions of this product differ.
Each sub region 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.

   3.13.5.1 <u>Accuracy sub region description</u>. A sub region description
contains the sub region accuracies, the number of sub region coordinate pairs
and the actual coordinate pairs which define the sub region area. Unused sub
regions and/or unused coordinate pairs within a sub region will be blank
filled. The sub regions will be organized as follows:

      a. The first coordinate pair of the first sub region must be the
southwest corner of the bounding rectangle.

      b. The first coordinate pair of each sub region must be the most
southern and western point in the sub region. Southern takes precedence over
western.

      c. The first coordinate pair of each sequential sub region must
be arranged in a clockwise direction starting with the first sub region. Sub
regions 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. Remaining sub regions will be numbered in a south
to north, west to east manner based on initial point within each sub region.

      d. Coordinate pairs within a sub region must be arranged in a
clockwise direction.

      e. Each sub region coordinate pair must be located on or within
the bounding rectangle.

      f. Each coordinate pair in the bounding rectangle must be
represented as a sub region coordinate pair.

      g. Sub region areas must not overlap or leave gaps. The entire
area defined by the bounding rectangle must be covered by sub region areas
(i.e. the sum of the sub regions must equal the 1° product area).

      h. The first and last coordinate pairs of a sub region shall not
be the same. Closure of the sub region area is implied.

      i. A sub region can only be generalized if all of the sub region
descriptions have been used.

      j. Sub region format:

Sub region Number	Field Length in Characters	Character Start
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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3.14 <u>User's responsibilities</u>.

a. Procedures applicable for protection of classified data are contained in NIMA Instructions:
5200.1, Information Security, 8 May 1998.
5220.1, Industrial Security, 10 February 1999.

b. The DTED on CD-ROM or magnetic tape is MC&G Property for purposes of the Defense Federal Acquisition Regulations (DFARS). Digital products produced by NIMA 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 NIMA 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. 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 National Imagery Mapping Agency. Requests for such permission are to be sent to:

Director, National Imagery and Mapping Agency
Attn: Customer Support/DF (P-37)
12310 Sunrise Valley Drive
Reston VA 20191-3499

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 NIMA's digital products are prescribed by NIMA Product Specifications or Military Specifications. Deletions, additions, or modifications to NIMA's digital files by users become local transaction files (no longer NIMA 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 NIMA 5220.1, Industrial Security, 10 February 1999 or NIMA 5200.1, Information Security, 8 May 1998.

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

Director
NIMA Dissemination Services Requirements Department
Attn:IS/DSNR, MS J-70
3200 South Second St.
St. Louis, MO 63118-3399

3.15 <u>Copyright</u>.

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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 (with year of production inserted)states:

© COPYRIGHT (year of production) BY THE UNITED STATES GOVERNMENT.
NO COPYRIGHT CLAIMED UNDER TITLE 17 U.S.C.

3.16 CD-ROM labeling. See NIMA Instruction 8955.1 for guidelines for labeling National Imagery Mapping Agency CD-ROMs, and printing and finishing of jewel case liners/cardboard sleeves, and information booklets.

3.16.1 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 NIMA points of contact.

4.   VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 First article inspection. When a first article inspection is required (see 3.1), it shall be examined as specified in 4.3.1, and tested as specified in 4.3.2.

4.3 Conformance inspection. Quality conformance inspection shall include the examination of 4.3.1 and the tests of 4.3.2.

4.3.1 Examination. The database shall be examined for compliance with the requirements specified in section 3. Unless a waiver has been granted non compliance with any of the specified requirements shall constitute cause for rejection.

4.3.2 Tests. A sample determined by the contracting officer shall be read back after generation to ensure that the requirements specified in section 3 have been met.

4.4 Government furnished material. The contractor shall not duplicate, copy, or otherwise reproduce the MC&G property for purposes other than those necessary for performance of the contract.

4.5 Government property surplus. At the completion of performance of the contract, the contractor, as directed by the contracting officer, shall either destroy or return to the Government all government-furnished MC&G property not consumed in the performance of the contract.

5.   PACKAGING

5.1 Packaging. For acquisitions purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or

Defense Agency, or within the Military Department's Systems Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

      6.   NOTES.

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

      6.1   <u>Intended use</u>. This specification defines the content of Digital Terrain Elevation Data (DTED) which supports military weapon and training systems. The data covered by this specification is military unique because it is not releasable to the public and restricted to DoD users and contractors.

      6.2   <u>Acquisition Requirements</u>. When this specification is used in acquisition, the applicable issue of the Department of Defense Index of Specifications and Standards (DODISS) must be cited in the solicitation (See 2.1 and 2.2).

      6.3   <u>Supersession</u>. This specification supersedes MIL-PRF-89020A Performance Specification for Digital Terrain Elevation Data, 19 April 1996 with Amendment 1, 27 April 1999.

      6.4   <u>Definitions</u>.

      6.4.1 <u>Accuracy</u>.   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, relative or 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 uncorrected systematic errors. The value is expressed as a linear error at the 90% confidence level.

         d. Vertical accuracy, relative or 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.

      6.4.2 <u>Cell</u>. 1° by 1° area of coverage.

      6.4.3 <u>Circular error</u>. 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.

      6.4.4 <u>DTED</u>. 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 and the DTED level. Elevation values are expressed in meters.

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a. DTED Level 0 - Precise 30 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 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.

c. 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.

6.4.5 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.

6.4.6 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.

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

6.4.8 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.

6.4.9 WGS (World Geodetic System). A geodetic reference system consisting of a set of parameters describing the size and shape of the Earth, an Earth-center Earth-fixed coordinate reference system, the positions of a network of points with respect to the center of mass of the Earth, and the gravitational model of the Earth (usually in terms of harmonic coefficients), a global geoid.

6.4.10   VMAP0. DTED Level 0 data derived from VMAP0 terrain contours is identified in the DSI record.

6.4.11   TAR file. A Unix Tape Archive format. A single file which encapsulates and compresses a number of other files.

6.5   Subject term (key word) listing.

CD-ROM
1 degree by 1 degree (1^O by 1^O cell) cell

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

6.6.1 International Standardization Agreements (STANAGs).

a. DTED Level 1 and DTED Level 2 -

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

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

6.7   Changes from previous issue. The margins of this specification are marked with side bars to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever from any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content, irrespective of the marginal notations and relationship to the last previous issue.

6.8   Y2K century logic. For this product, the year is represented by a two-character year field. Implementers of this product should use a century logic that is consistent with the fact that the first data set for this product was produced in 1977.

6.9   NIMA Customer Help Desk.

For questions concerning this or other NIMA Products or Services, please telephone the NIMA Customer Help Desk, at 1-800-455-0899, Commercial 314-263-4751, or DSN 693-4751.

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DTED { < **Hlll** >
(1, **P**) { < **Hjj** ·DT1 >
(1, **D**) {
UHL record
+
DSI record
+
ACC record
+
elevation profiles
(1,E)

+

GAZETTE {
GAZETTE·DIR
(1,1)

GAZETTE·Key
(1,1)

<Country>
(1,G) {
· GAZ
(1,N) {
designation code
+
latitude
+
longitude
+
place name

· HSH

+

DMED· {
MBR

+

DMED Cell
(1,T) {
SW latitude
+
SW longitude
+
Data edition
+
Match/merge
version
+
15' Quad
(1,16) {
min e
+
max e
+
mean e
+
std dev e

+

TEXT {
ONC·DIR

READ·ME
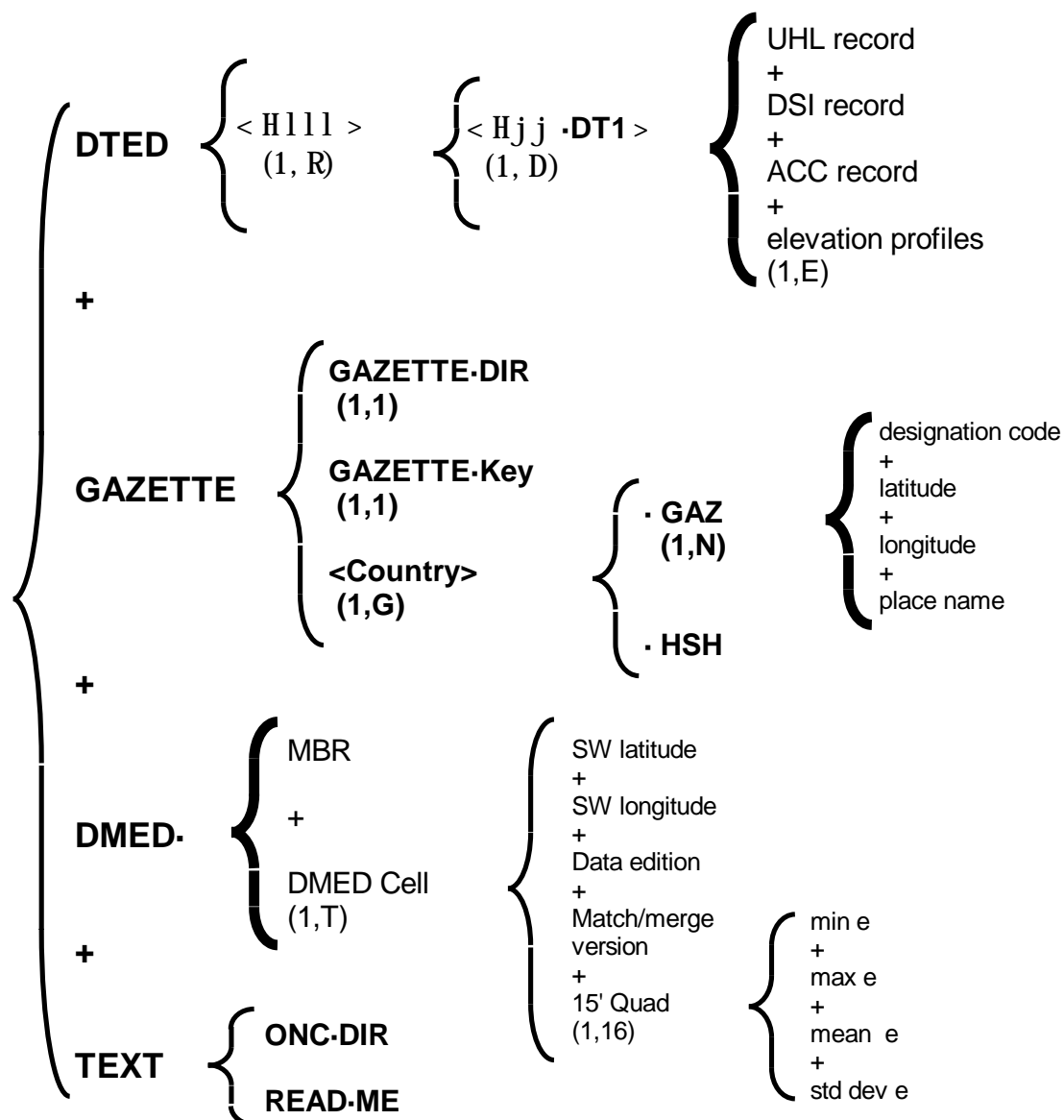
$H\lambda\lambda\lambda$ hemisphere (E or W) and longitude
$H\phi\phi$ hemisphere (N or S) and latitude
P - number of 1° cell columns within the disc, a multiple of 6
Δ - number of 1° DTED cells within the columns, a multiple of 6
E - number of profiles per cell (latitude zone dependent,
     1201 elevations 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 = P x **D**, a multiple of 6

FIGURE 1.   DTED Level 1 CD-ROM logical data file structure.

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Concluding Material

Custodian: Preparing Activity
Army - TI   NIMA - MP
Air Force - 09
Navy - NO
Marine Corps - MC
DISA - DC2

Review Activities: (Project MCGT - 354)
Air Force - 33
Army - AV, CE2
Coast Guard - CG
DIA - DI
DLA - DH
Marine Corps - MC
NORAD - US
NSA - NS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

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

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-89020B	2. DOCUMENT DATE (YYMMDD) 00/05/23

3. DOCUMENT TITLE
Digital Terrain Elevation Data (DTED)

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

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

8. PREPARING ACTIVITY

a. NAME National Imagery and Mapping Agency	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (703) 264-3106 570-3106
c. ADDRESS (Include ZIP Code) National Imagery and Mapping Agency ATTN: Doctrine and Force Development /DF, Mail Stop P-37 12310 Sunrise Valley Drive Reston, VA 20191-3449	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: DLSC-LM 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, VA 22060-6879

DD Form 1426, OCT 89   *Previous editions are obsolete.*