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STUDY PROJECT





# DEFENSE MAPPING AGENCY'S ROLE IN THE ARMY OF THE FUTURE

BY

PAULETTE WELLS



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future digital requirements and DMA's ability to fulfill those requirements is made. Products presently in development to prepare the Army for the future are described. Conclusions are drawn whether DMA can support the requirements of their role in the Army of the Future.

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# DEFENSE MAPPING AGENCY'S ROLE IN THE ARMY OF THE FUTURE

AN INDIVIDUAL STUDY PROJECT
INTENDED FOR PUBLICATION
by

PAULETTE WELLS

Michael Handel
Roger Wortman
Project Advisers



U.S. Army War College
Carlisle Barracks, Pennsylvania 17013
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## ABSTRACT

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# DEFENSE MAPPING AGENCY'S ROLE IN THE ARMY OF THE FUTURE

## INTRODUCTION

The U.S. Army's need for digital data to support future AirLand Battle Environment (ALBE) has presented a great challenge to the Defense Mapping Agency (DMA). Meeting that challenge through the extensive modernization efforts underway and incorporating Army requirements into an already overextended budget will be a demanding task for many years to come. Finding ways to "do more with less" is a cry heard throughout the Department of Defense (DOD) and permeates the U.S. government. Until recently the Army appeared to have lagged behind the other services in its use of digital data. Questions have arisen whether the Army really has a requirement for digital data or whether paper products are sufficient. Another point of concern is that digital data to the density that covers Army tactical requirements has not and is not readily available at the present time. All these factors working together have made it more difficult for the Army to advance into the new era of digital data.

Questions such as what is the Army's requirement for digital data and what is Defense Mapping Agency's role in supporting this requirement need to be answered.

## BACKGROUND

Defense Mapping Agency's (DMA's) "mission is to enhance national security and support our strategy of deterrence by producing and distributing to the Joint Chiefs of Staff, Unified and Specified Commands, Military Departments, and other Department of Defense users, timely and uniquely tailored mapping, charting and geodetic products, services and training; ensure our war-fighting forces have available to them effective mapping, charting and geodetic support should our strategy of deterrence fail; provide nautical charts and marine navigational data to worldwide merchant marine and private vessel operators; maintain liaison with civil agencies and other national and international scientific and other organizations engaged in mapping, charting and geodetic activities."[1]

U.S. Department of the Army's FM 100-5 states "Terrain and weather affect combat more significantly than any other physical factors. Battles are won or lost by the way in which combatants use the terrain to protect their own forces and to destroy those of the enemy."[2]

The Army's dependence on knowledge of terrain makes the support given to them by DMA very important. Clausewitz depicts "grasp of topography" as one of the attributes of a military genius.[3] DMA's role is to aid the capabilities of Army commanders to make decisions based on the most accurate and timely information possible.

The Army FM 5-105 states DMA's mission as follows:

> "Its mission is to provide MC&G support and services to the Secretary of Defense components through the production and worldwide distribution of maps, charts, precise positioning data, and digital MC&G data for strategic and tactical military operations and weapons systems. The agency also provides management and coordination of all DOD MC&G resources and activities. Its legal responsibility is to provide nautical charts and marine navigational data for use of all vessels of the United States.
>
> The Defense Mapping Agency (DMA) is a separate DOD agency under the direction, authority, and control of the Assistant Secretary of Defense for Command, Control, Communication, and Intelligence. The director is responsible to the Joint Chiefs of Staff (JCS) for operational matters within their cognizance, as well as for needs associated with the joint planning process. The chairman of the JCS is authorized to delegate and to communicate directly with the agency."[4]

DMA's mission to support DOD's MC&G requirements led to the production of computerized data - digital data - which is a representation of data by numerical digits.

Two major forms of digital data produced by DMA are Digital Terrain Elevation Data (DTED) (Appendix A) and Digital Feature Analysis Data (DFAD) (Appendix B). DTED is a uniform matrix of terrain elevation values that can be used to depict terrain elevation, slope, and/or surface roughness information.[5] DFAD is a "data base of selected natural and man-made planimetric features, type classified as point, line, or area features as a function of their size and composition," and "assigned an identification code and further described in terms of composition, height, length, and orientation."[6] Both types of data are used in simulators and navigation systems.[7]

## DMA'S PRESENT ROLE

The Army recognizes the importance of DMA support for topographic operations. FM 5-105 states "The goal of topographic operations is to ensure that timely, accurate, and sufficient knowledge of the battlefield terrain is provided to each commander throughout all phases of combat operations."[8]

"The DMA is the main supporter in battlefield topographic operations. This agency provides MC&G support to the US armed forces. The DMA responsibilities are to -

- Produce all standard topographical, aeronautical, and nautical products.
- Provide supply point distribution of theater-level MC&G stocks.
- Coordinate MC&G agreements with allied forces and host nations."[9]

DMA presently provides "all of the standard topographic and aeronautical products used in support of combat operations. Standard products commonly used include 1:50,000 and 1:250,000 scale maps, aeronautical charts, and terrain analysis data bases. Other commonly used products are trig lists, gazeteers, flight information publications (FLIPS), and digital data."[10]

The "peacetime requirements process enables the DMA to produce, maintain, and store, in map depots throughout the world, the bulk of standard MC&G products required during the first 60 days of combat. During combat, the DMA continues to provide the bulk of standard topographic products to fight the battle."[11] Digital data, geodetic data, and Point Positioning Data Bases are available from data bases and libraries maintained by DMA.

Terrain Analysis Data Bases have become a major product supplied to the Army by DMA. Terrain analysis is the "process of interpreting natural and man-made features of a geographic area and the influence of weather and climate on these features to predict their effect on military operations."[12] DMA produces two types - Planning Terrain Analysis Data Bases (PTADB) at 1:250,000 scale and Tactical Terrain Analysis Data Bases (TTADB) at 1:50,000 scale. They consist of a series of separate hardcopy overlays keyed to the appropriate scale topographic map. DMA overlays include vegetation, surface materials, surface drainage, surface configuration (slope), obstacles, and transportation features. DMA has produced approximately 500 of each of these data bases. The synthesis of this data produces such products as Cross Country Movement Maps and Transportation Maps. These data bases are not presently produced in a digital format by DMA, although digital prototypes were developed.[13]

Terrain analysis is the "focus of Army topographic operations. The terrain analyst uses DMA-produced data bases as the chief analytical tool consisting of a series of terrain factor overlays at 1:50,000 and 1:250,000 scales. The analyst modifies and updates the data bases using data collected from the field. The data collected includes information supported through host nations as well as current and all-source intelligence. All of this together allows the analyst to supply an up-to-date picture of the battlefield terrain."[14] These data bases are maintained by the terrain teams for their assigned areas. The terrain analysts in the team "are responsible for assisting the

G2, G3, and other staff elements to use the terrain to maximum advantage and keeping them constantly informed of the impact of terrain on the capabilities and limitations of friendly and enemy units."[15] Thus far, all synthesis of raw data into the data bases has been done manually by the terrain analysts.[16] This is a "slow tedious process at best." The present situation of factor overlays requires extensive time-consuming work to update and use. Use of automation will produce needed graphics in a fraction of the time and also increase the accuracy of the product (factoring out much of the possibility of human error with the use of standard machine-calculated algorithms and plotting techniques).[17]

A recent report states "the majority of the terrain support currently being provided is concentrated on template-like, support. It is almost all in the nature of long-range planning, with little or no support to operational customers' "real-time" support requirements."[18]

DMA provides digital data for Pershing and Firefinder guidance systems. With the advent of the INF Treaty, work done for Pershing has been eliminated, but Firefinder continues. Digital data has not been a major Army product, but recent studies show that "advanced battlefield surveillance, targeting, and weapon systems need digital topographic data to rapidly detect, identify, acquire, and engage the enemy."[19]

AirLand Battle Doctrine has made digital data even more important for Army's success in the battlefield. One of the elements of AirLand Battlefield Environment as described by

topographic engineers is "terrain, topography, soil, vegetation, hydrography, etc."[20]

The Army's FM 5-105 further emphasizes the need for digital products in AirLand Battle:

> "The ever-changing battlefield of the AirLand Battle may be a factor affecting the availability of topographic support. Forward-based combat units can be positioned several hundred kilometers away from rear-based support activities. Thus, it is important that these forward units have adequate topographic engineer support readily available, in order to reduce their reliance on rear-based support."[21]

> "In combat, the emphasis of topographic support changes. The focus of topographic support during battle is on providing the tactical commander with expedient, tailored, and updated products. Expedient responses, especially at division level, are necessary to properly and adequately inform commanders of the impact of terrain on the battle at hand."[22]

## DMA'S NEAR-FUTURE ROLE

The AirLand Battle Doctrine and AirLand Battle 2000 (Army 21) Concept are the Army's "response to the overwhelming numerical advantages presented by the threat forces."[23] The Army's AirLand Battle Doctrine emphasizes "agility, initiative, depth, and synchronization."[24] Use of terrain is included as one of the imperatives in the essence of AirLand Battle Doctrine.[25]

Terrain analysis is also a key factor in the intelligence preparation of the battlefield (IPB). This process is "a systematic and continuous process of analyzing and evaluating the terrain, weather, and enemy for a specific geographic area."[26] The second function of the IPB process is terrain analysis which

"identifies natural and man-made terrain features that could aid or inhibit combat by either friendly or enemy forces. The results of this analysis determine where the enemy can move, shoot, and communicate."[27]

"Another combat imperative with particular relevance for intelligence is the use of terrain and weather. The implications of this imperative affect the capability to conduct successful combat operations. The importance of terrain and weather is attested to by the following statement in FM 100-5 - Weather and terrain have more impact on battle than any other physical factor, including weapons, equipment, or supplies."[28]

Why such a major concern exists over the availability of terrain information seems to be an applicable question. An article in Military Intelligence states "Terrain can provide a distinct advantage; the resourceful and wise commander will study and use terrain to accomplish his intent. To help the commander use the terrain, the intelligence officer must conduct detailed terrain analysis which should occur during the IPB process. Keeping in mind the tenets of AirLand Battle Doctrine, the intelligence officer advises the commander how to use terrain effectively to defeat enemy forces."[29]

Not only does the Army have to prepare for overwhelming numerical advantages of the major threat force, but it must prepare for a global threat that can span the entire spectrum of conflict. Many questions arise when considering topographic support for such a major task.

How is the Army changing to meet these new challenges? A study by Science Technology Corporation indicates "the mission of topographic engineers has changed from the original mapping and production and distribution of standard maps and map products to that of supporting the needs of combat commanders with rapid topographic information and analysis."[30] The mention of the word "rapid" immediately infers "digital" or "automated" and deserves investigation into where and how the future Army will use computers to enhance their current topographic capabilities.

The Army's need for digital terrain data (DTD) surfaced in 1984 when a study identified "more than 70 weapon analysis and command, control and communications system requirements." Until this time Army personnel had obtained DTD on an ad hoc basis from any source available. No definite product standard was defined, many requirements were overstated, and the growing appetite for DTD was uncontrolled. No effort had been made to consolidate the growing requirements. The major impact was that the Army was paying for redundant data collection and software support.[31]

GEN Maxwell R. Thurman "emphasized a need for controlling and coordinating DTD requirements to ensure they were not overstated." The study and GEN Thurman's interest resulted in the Army Corps of Engineers receiving responsibility for coordinating all requirements and the organization of a new Concepts Analysis Division of U.S. Army Engineer Topographic Laboratories (ETL) to support this effort.[32]

ETL's Concepts and Analysis Division (CAD), created in October 1986, serves as the Army's center of technical expertise for all military applications of Digital Terrain Data. CAD works directly with DMA through the ODCSINT on technical aspects of requirements and products.[33]

CAD has now reduced the number of systems with DTD requirements from 70+ to 16 major systems:

Advanced Field Artillery Tactical Data Systems (AFATDS)
All Source Analysis System (ASAS)
Armored Family of Vehicles (AFV)
Battlefield Management System (BMS)
Communications Systems Control Element (CSCE)
Digital Topographic Support System (DTSS)
Forward Area Air Defense Command, Control, and Intelligence (FAADC2I)
Firefinder
Fiber Optic Guided Missile (FOG-M)
Joint Surveillance Target Attack Radar System (JSTARS)
Light Helicopter Experimental (LHX)
Maneuver Control System (MCS)
Mobile Subscriber Equipment (MSE)
Patriot Missile System (PATRIOT)
Position Location Reporting System/Joint Tactical Information Distribution System Hybrid (PJH)
Remotely Monitored Battlefield Sensor System (REMBASS)[34]

Current requirements for digital terrain data prompted the Army to approach DMA with a requirement for a new product - Tactical Terrain Data (TTD) (Appendix C). This product incorporates several products available in DMA's MARK 90.1 modernization program in digital format into one product. The products are DTED Level II, 1:50k Topographic Line Map, 1:50k Combat Chart, and Tactical Terrain Analysis Data Base with enhancements of urban area analysis, vertical obstacles, enhanced transportation network and changes in attribute values and ranges. TTD is the basic objective data set supporting future

land combat. It is envisioned as a joint product and is now being considered by the other services.[35]

ETL's TTD User's Guide defines TTD as the "basic Joint Services digital terrain data base for the 1990's and beyond, supporting many aspects of Close Air Support, Amphibious, and Land Combat operations. TTD will enable users to perform such diverse tasks as terrain visualization, mobility/countermobility planning, site/route selection, reconnaissance planning, fire planning, communication planning, navigation, and munitions guidance."[36]

TTD is also planned to be a "value-added" data base which will allow the topographic engineers/analysts the flexibility to add or update the TTD files with new information.[37]

ETL's Users's Guide also explains that TTD is essentially the "first synergistic product created out of DMA's MARK 90 standard product list. This means users have a data base that is expansive in nature, yet can be tailored to their individual needs with little or no modification. TTD extends the usefulness of a standard TTADB product or terrain elevation data product by combining the qualities inherent in many products into one digital data base."[38]

DMA's current MARK 90.1 modernization program will eventually produce all the required data collection necessary for TTD, but TTD was not a product that was originally baselined for production by the system. To baseline TTD now would complicate current contracts and could impact delivery dates. The initial operating capability (IOC) is presently scheduled for 1992, so

TTD will be baselined after the system is delivered. This means that software development for TTD production will be developed after that date. Therefore, TTD will be a post final operating capability (FOC) which will occur in 1995 and beyond. Production of any significant area coverage will be even later.

The first system to be fielded which will need TTD is the Digital Topographic Support System (DTSS). System designers claim that DTSS will be able to "put the speed and flexibility of automation to work for the terrain analyst."[39] ETL says "soldiers who man this system will use digital terrain data bases and terrain analysis software to produce complex terrain graphics. These graphics will help commanders map out their battle plans."[40]

An article in Military Intelligence states that DTSS "will provide engineer terrain teams an automated capability to store, update, create and process digital topographic data. Soldiers will be able to generate complex terrain analysis products which show commanders the effect of terrain on a variety of military operations." The article continues to describe the intervisibility and mobility models available through DTSS software that include such things as terrain profiles, masked area plots, perspective views, flight line masking graphics, cross-country movement models, aerial detection probability, etc. This software will supply much-needed products to commanders for tactical planning and decision making.[41]

DTSS will be used in connection with the Quick Response Multicolor Printer (QRMP) which will enable field units to copy

terrain graphics, maps, and other products. Hard-copy products can be printed directly from DMA's digital terrain data or from data created by the DTSS. This system will produce 75 multicolor or 225 monochrome copies per hour. The quality matches that of maps printed on the current lithographic presses which take up to eight hours to produce one graphic.[42]

With DTSS scheduled for the 1990-91 timeframe and TTD production capabilities beginning in 1995, ETL and DMA have been working together to devise a method to produce a product which can be used in the interim period. The method for "bridging the gap" between 1988 and 1995 is a product called Interim Terrain Data (ITD). DMA's ITD Specifications define the product as "an unsymbolized digital data set composed of the data content present in either the hard copy Tactical Terrain Analysis Data Base (TTADB) or the hard copy Planning Terrain Analysis Data Base (PTADB) provided in a standardized digital format. ITD is a product developed to satisfy the armed services short-term and mid-term requirement for digital terrain analysis data up until the time when MARK 90 digital production capabilities are realized."[43]

Concept Analysis Division (CAD) describes ITD as "a tactical-level digital product that will support Army's near-term (1988-1993+) tactical and analysis community requirement for digital terrain data sets. ITD is a finite program and will be produced to support systems before the emergence of DMA's Tactical Terrain Data (TTD) in volume."[44]

ITD Specifications indicate that production of ITD will be independent of the original production method but that the final product must meet the qualifications set forth in the specifications. DMA will use the following methods for ITD production:

1. Digitization and interactive feature-attribution of hard copy TTADBs and PTADBs.

2. Generation on Feature Extraction System (FE/S) using data collection software designed for Terrain Analysis.[45]

All ITD will then contain digital files of Surface Configuration (SLOPE), Surface Materials (SOILS), Surface Drainage, Obstacles, Vegetation, and Transportation. Digital Terrain Elevation Data (DTED Level I) will also be provided.[46]

As described above, DMA will scan, digitize, and process the approximately 500 existing hard copy PTADBs and 500 TTADBs into ITD format. Also, DMA will commence production of new ITD on the MARK 85 Feature Extraction System (FE/S) which already has Terrain Analysis software available.

Other requirements limit the number of ITDs DMA can produce. The current production schedule plans for 20 cells in 1989, 100 cells in 1990, 100 cells in 1991, then 150-200 per year through the 1994 timeframe. All initial requirements are in Germany and Korea, but these cannot be considered firm until the area requirements process is completed this summer.[47]

The earliest production for TTD appears to be in the 1994-95 timeframe. Requirements suggest 6000 cells (15'x15') over a 5-year production period.[48]

## ARMY 21

Having looked at DMA's role in the near future - the next ten years, what role does this portend for the years 2000 to 2020 - the years of Army 21?

Army 21 is a concept, not a doctrine. This concept replaces the AirLand Battle 2000 concept. It espouses an "Army capable of responding to worldwide threats" with offensive methods "which use mobility, firepower, initiative, speed, and synchronized effort to attack and destroy the enemy."[49] Army 21 is an "evolutionary extension of AirLand Battle"[50] and "addresses the need for Army preparedness to fight across the full spectrum of conflict - from low to high intensity - anywhere in the world."[51] This concept "describes land actions that are highly dependent on the U.S. Air Force and U.S. Navy for success, and recognizes the need to interact with allies."[52] The battlefield of the 21st century "is projected to be an extremely fluid, dangerous, integrated arena in which opponents wage war through the use of weapons of great range, pinpoint accuracy, and mass destruction."[53]

"The potential battlefields of the 21st century will be spread around the globe and will be saturated with high technology weapons. The aerospace over the battlefields will be saturated with aerial and space weapons, as well as surveillance, reconnaissance, and target acquisition systems...

If the Army is to fight and win on these highly lethal future battlefields, our soldiers and leaders must adapt to the environment and learn new ways to fight with highly sophisticated equipment designed to extend their capabilities."[54]

In the futurist report, A World 2010, one of the principal challenges to the U.S. national defense is "to recommend and obtain appropriate advanced weapon systems and other necessary means to support its national and military strategies ." The report also states that "the choice of the weapons and systems and the manner of their employment within the national and military strategies will be the surprise and key elements to the success of any US engagement with any adversary."[55]

Continuing into Alternative World Scenarios for Strategic Planning, all scenarios for the years 2005-2020 suggest continuation of the proliferation of conventional arms and nuclear weapons.[56] "Unlike 20th century threats to U.S. political interests which were predominantly military in character, those of the early decades of the 21st century are likely to be more economic in character."[57] "The notions of being armed, having modern high-tech weapons, and, for some nations, having nuclear weapons and a means to deliver them, remain psychologically attractive. These national attitudes shared by nations that are expressing a new self-directed economic individuality, create an environment of a world in 2020 filled with apprehension and anxieties where U.S. national security leadership must be alert and prepared to deter or terminate quickly conflicts that threaten U.S. interests."[58]

DMA's challenge in this era will be a global challenge - a collection of data spanning the globe with accuracies stringent enough to meet the needs of the high-tech weapon systems which will be developed. High-tech will be the "name of the game", and DMA will need to continually invest funds for new equipment to be able to support requirements for all the future military systems.

## CONCLUSIONS

This review of DMA's role in the Army clearly indicates the usefulness of terrain data to all levels of Army systems - from paper maps to the most accurate digital data. For accuracy, speed, and usefulness digital-formatted data is definitely the wave of the future.

The Army has made an effort to move into the new era of automation with their initial concept of Tactical Terrain Data. This concept, with the new systems being fielded, can completely modernize the topographic engineering field. With "value added" capabilities, TTD's contribution to the AirLand Battle Environment will be immeasurable.

The joint consolidation of requirements for TTD and the use of it as a standard product for systems throughout the services becomes a necessity if DMA is expected to fulfill requirement expectations. The Army's requirement for global coverage in the future creates a dilemma for DMA production processes. Army's requirements must compete in the priority process with requirements from other services, and historically Army

requirements have placed last in the priority system. Making TTD a "universal" data set used in myriad systems throughout the services would help overcome this problem.

The future possibility of combination of the services, the possibilities of a changing threat, the effect of arms control agreements, and the impacts of advanced technology are all considerations which could have variable impacts on DMA's role in the Army. All of these reduce to two major problems for DMA -priority requirement areas and production support.

DMA's role was defined earlier as support to DOD. As DOD's roles change, so will DMA's. Response to these changing roles in the future will be very slow and cumbersome. Like the Army, DMA's focus has been on one major part of the world due to requirement priorities. Time will be needed to recover from any major change in focus.

Arms control agreements that discard specialized data requirements, e.g. Pershing, could "free up" production resources for other requirements.

Advancing technology in space and weapons technology is a challenge for both DMA and the Army. The race to utilize the most current technology sometimes overcomes the necessity - oversciencing the process when the standard does not require it. Pertinent decisions will be necessary to determine exactly "how much is enough" in the world of strained resources.

TTD will not replace paper maps in the near future. The digital world will only augment and enhance the use and

production of paper products for many years to come. But, if DMA can support the TTD requirement, DMA will have succeeded in planning support for the Army of the future.

DMA's role in the Army of the future takes on new meaning when examined through the eyes of automation. The skeptics who assert that paper maps are sufficient may sit back and watch over the next 10-30 years as both DMA and the Army progress into a fast-moving, rapid-response digital world where computers and satellites provide possibilities man has never explored. The potential is boundless!

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54. Ibid., p. I-3.

55. Charles W. Taylor, A World 2010 - A Decline of Superpower Influence, Carlisle Barracks, PA, U.S. Army War College, p. 31.

56. Charles W. Taylor, Alternative World Scenarios for Strategic Planning, Carlisle Barracks, PA, U.S. Army War College, p. 12.

57. Ibid., p. 17.

58. Ibid., p. 18.

[redacted] DATA INFORMATION SHEET

The Defense Mapping Agency - October 1988

APPENDIX A

## DIGITAL TERRAIN ELEVATION DATA (DTED) - LEVEL 1

SUMMARY: A uniform matrix of terrain elevation values. Provides basic quantitative data for all military training, planning, and operating systems that require terrain elevation, slope, and/or surface roughness information.

PRODUCT SPECIFICATION: DMA Product Specifications for Digital Terrain Elevation Data, Second Edition, April 1986 (PS/1CD/200,PS/1CF/200).

DATA DENSITY: The information content is approximately equivalent to the contour information represented on 1:250,000 scale maps. Exploitation at larger scales must consider each individual cell's accuracy evaluation.

COORDINATE REFERENCE SYSTEM: Geographic

DATUM: Horizontal – World Geodetic System (WGS)
Vertical – Mean Sea Level (MSL)

CONTENT: Each cell header record provides identification, administrative data, and information (parameters) required for the application, maintenance, and verification of the elevation values. Each Elevation Data Record contains 1201 elevation values (meters) along a single meridian. A cell will have 201 to 1201 Elevation Data Records depending upon the appropriate latitude zone. Elevations are spaced in accordance with the following table:

| Zone | Latitude | Spacing Lat/Long |
|---|---|---|
| I | 0° – 50° N-S | 3 by 3 arc seconds |
| II | 50° – 70° N-S | 3 by 6 arc seconds |
| III | 70° – 75° N-S | 3 by 9 arc seconds |
| IV | 75° – 80° N-S | 3 by 12 arc seconds |
| V | 80° – 90° N-S | 3 by 18 arc seconds |

STRUCTURE: Matrix

FORMAT: ASCII labeled variable length records. (See product specifications for details.)

MEDIA: 9 track, 1600 or 6250 CPI, 1/2 inch magnetic tape.

[redacted]

For additional information contact:
Director
DMA Combat Support Center
ATTN: PMA
Washington, DC 20315-0010



[redacted]

AUTOVON: 287-24[redacted]
COM: (301) 227-24[redacted]
1-800-826-03[redacted]
Telex: 710-824-02[redacted]

STANDARD FILE SIZE: 1° by 1° geographic cell identified by its southwest corner coorainates.

ACCURACY:

Accuracy statements are individually calculated for every product and provided in the Accuracy Header Record. Using our best sources, the accuracy evaluations typically are in the following ranges:

| | |
|---|---|
| Absolute Horizontal | 25 to 35 meters at 90 percent circular error |
| Point-to-Point Horizontal | 15 to 30 meters at 90 percent circular error |
| Absolute Vertical | ± 25 to 30 meters at 90 percent linear error |
| Point-to-Point Vertical | ± 20 to 25 meters at 90 percent linear error |

DMA Product Specifications accuracy objectives for DTED-1 are:

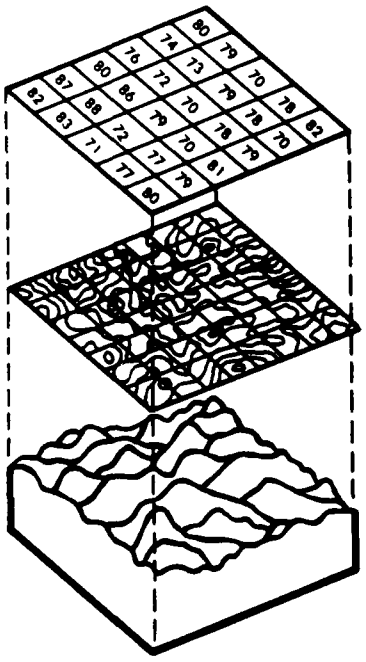
| | |
|---|---|
| Absolute Horizontal | 130 meters at 90 percent circular error |
| Absolute Vertical | ± 30 meters at 90 percent linear error |

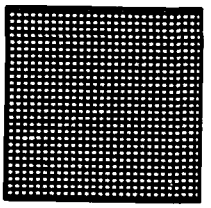
AREA COVERAGE: See DMA Catalog, Part 7 – Digital Data Products, Volume I – Terrain and Feature Data (CATP7V01). This volume is revised semiannually.

APPLICATIONS: DTED initially supported applications modeling the influence of terrain on radar line-of-sight and the appearance of radar return scenes. The success of this concept led to the widespread exploitation of DTED in virtually every type of aircraft flight simulator now in use.

Level 1 DTED are now accepted as the basic medium resolution elevation data source for all military activities and systems that require landform, slope, elevation, and/or terrain roughness information in a digital format. Within DMA, these same data can be exploited to support automated map and chart production activities.

DISTRIBUTION POLICY: DISTRIBUTION OF THESE DATA AND CATP7V01 IS LIMITED TO AGENCIES WITHIN THE EXECUTIVE BRANCH OF THE U.S. GOVERNMENT AND QUALIFIED CONTRACTORS.



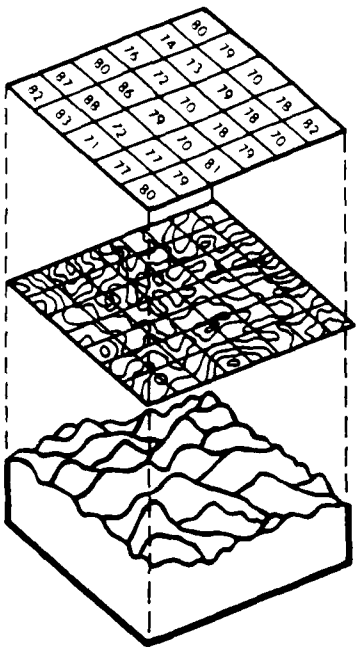


**DATA CONTENT = ELEVATIONS (METERS) LATITUDE/LONGITUDE**

**DATA FORMAT = MATRIX**

**DATA FILE = 1 DEGREE CELL**

**DATA RECORD = ELEVATIONS VALUES S TO N SAME LONGITUDE**

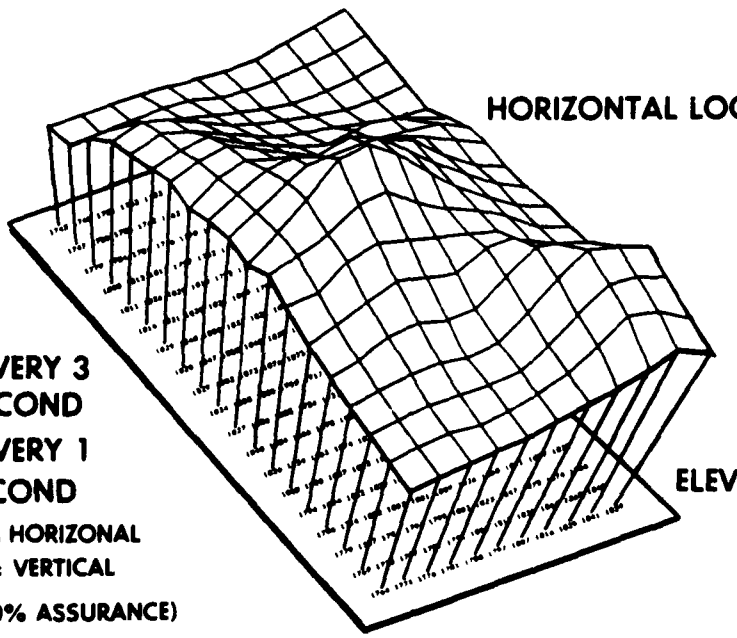


- LEVEL 1 - POST EVERY 3 ARC SECOND
- LEVEL 2 - POST EVERY 1 ARC SECOND

SPEC ACCURACY - 130 M HORIZONTAL
30 M ± VERTICAL

ABSOLUTE TO WGS - 72 (90% ASSURANCE)

# DIGITAL TERRAIN DATA




- LEVEL 1 - POST EVERY 3 ARC SECOND
- LEVEL 2 - POST EVERY 1 ARC SECOND

SPEC ACCURACY - 130 M HORIZONAL
30 ± VERTICAL

ABSOLUTE TO WGS - (90% ASSURANCE)

# DATA INFORMATION SHEET

The Defense Mapping Agency - October 1988

APPENDIX B

## DIGITAL FEATURE ANALYSIS DATA (DFAD) - LEVEL 1

SUMMARY: A data base consisting of selected natural and man-made planimetric features, type classified as point, line, or area features as a function of their size and composition. Each feature is assigned an identification code and further described (by microcoding) in terms of composition, height, length, and orientation. The data are stored in polygon format and segregated into 1° by 1° geographic cells. Primary applications are radar return simulation, navigation, and terrain obstruction studies.

PRODUCT SPECIFICATION: DMA Product Specifications for Digital Feature Analysis Data (DFAD), Second Edition, April 1986 (PS/1CE/200).

DATA DENSITY: The information content is approximately equivalent to those features found on a 1:250,000 scale map. The typical cell contains 3500 features.

COORDINATE REFERENCE SYSTEM: Geographic

DATUM: Horizontal – World Geodetic System (WGS)
Vertical – Not applicable

CONTENT: The product was developed to provide improved simulation of radar displays. Provides a very generalized representation of the predominent features. The Second Edition Specifications retain all features required by the First Edition and adds lines of communication (roads, railroads, streams, etc.).

STRUCTURE: Vector

FORMAT: Polygon – One data record for each feature. A record contains coded attributes and a coordinate string. (See product specifications for details.)

MEDIA: 9 track, 1600 or 6250 CPI, 1/2 inch magnetic tape.

STANDARD FILE SIZE: 1° by 1° geographic cell identified by its southwest corner coordinates.

ACCURACY: Accuracy statements are individually calculated for every product. Point-to-point accuracies refer to the relationship of features separated by nominal cell dimensions (approximately 60 nm). Using our best sources, the accuracy evaluations typically are in the following ranges:

| | |
|---|---|
| Absolute Horizontal | 80 to 90 meters at 90 percent circular error |
| Point-to-Point Horizontal | 50 to 60 meters at 90 percent circular error |

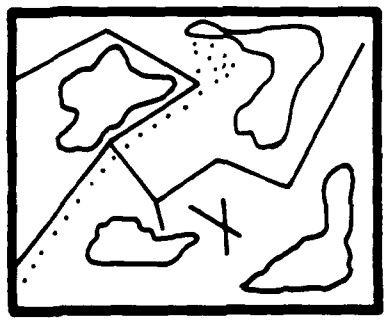
For additional information contact:
Director
DMA Combat Support Center
ATTN: PMA
Washington, DC 20315-0010

AUTOVON: 287-24
COM: (301) 227-24
1-800-826-03
Telex: 710-824-02

AREA COVERAGE: See DMA Catalog, Part 7 - Digital Data Products, Volume I - Terrain and Feature Data CATP7V01. This volume is revised semiannually.

APPLICATIONS: When combined with DTED, provides a digital off-line data base for use by weapon system flight simulators and other types of simulation, such as line of sight, obstruction, and perspective view development. Within DMA, these same data can be exploited to support automated map and chart production activities.

DISTRIBUTION POLICY: DISTRIBUTION OF THESE DATA AND CATP7V01 IS LIMITED TO AGENCIES WITHIN THE EXECUTIVE BRANCH OF THE U.S. GOVERNMENT AND QUALIFIED CONTRACTORS.



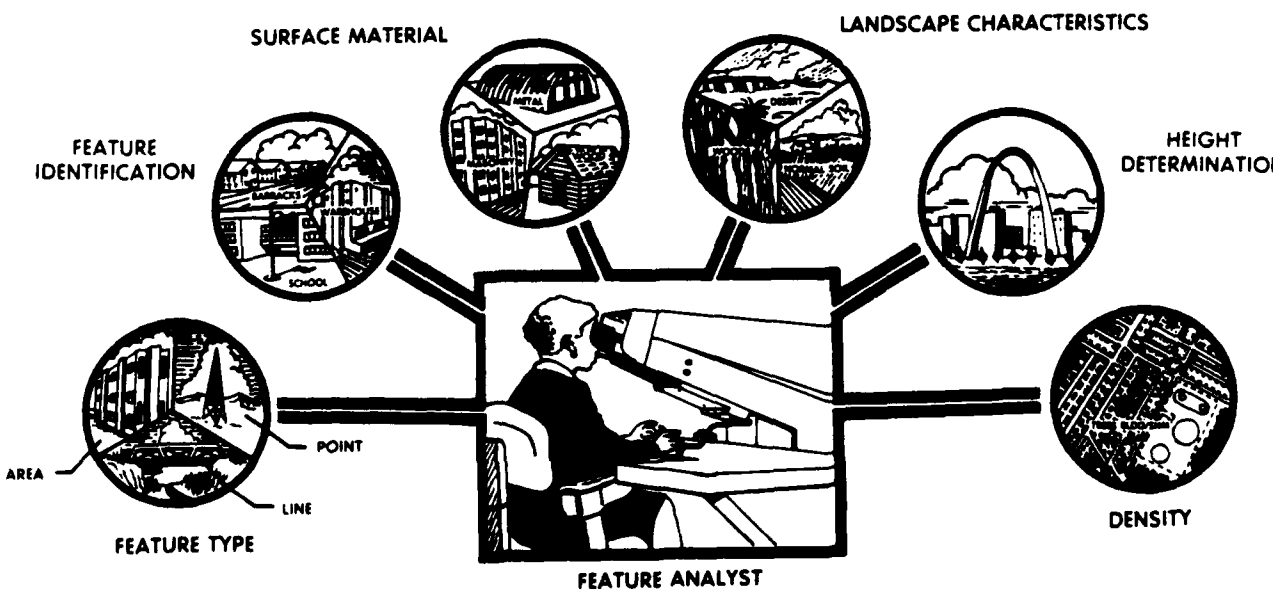
**DATA CONTENT = PLANIMETRIC FEATURES (POINTS, LINES, AREAS)**

**DATA FORMAT = VECTOR**

**DATA FILE = 1 DEGREE CELL**

**DATA RECORD = COORDINATES/ATTRIBUTES FOR 1 FEATURE**

## DESCRIPTIVE DATA



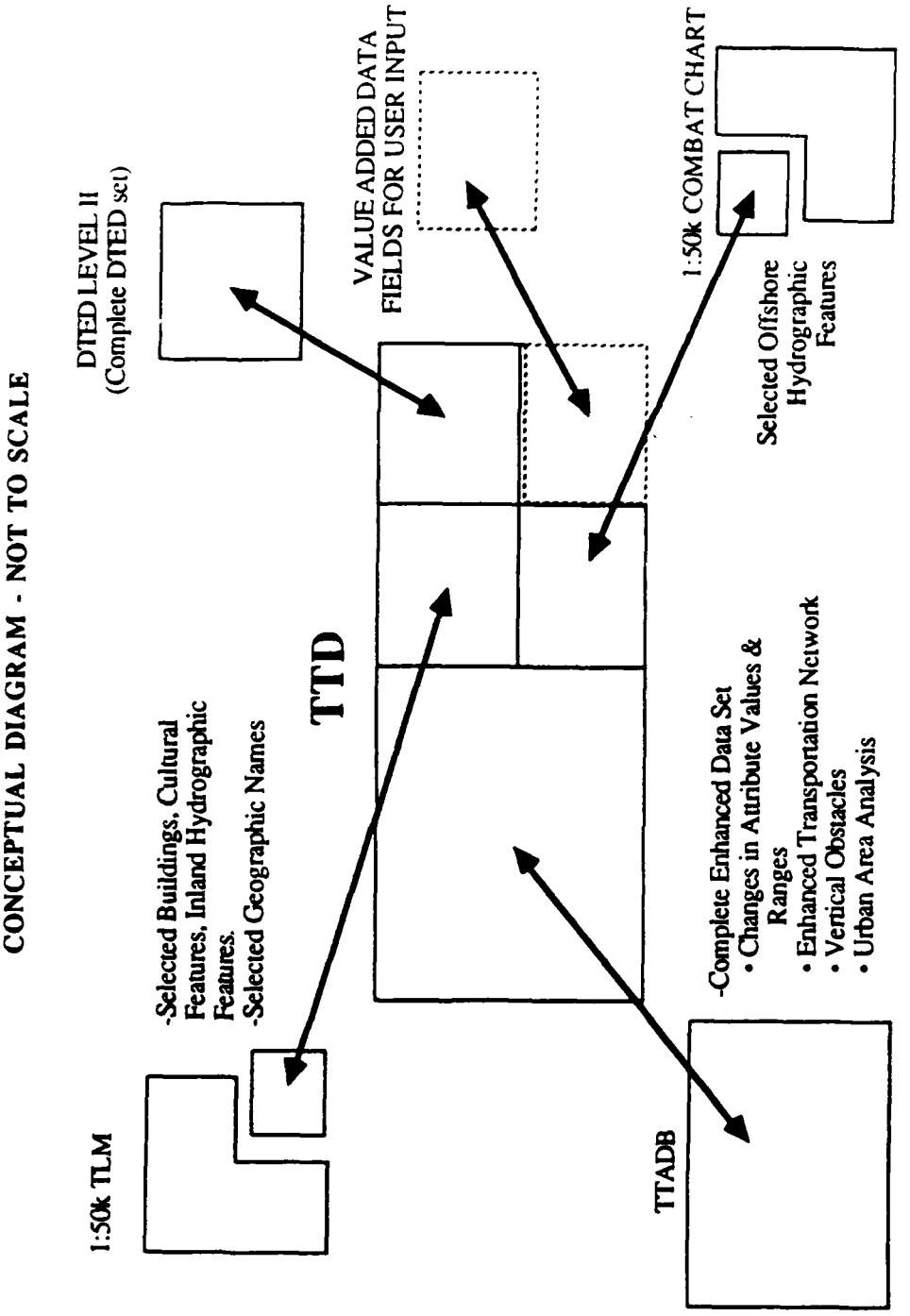



Figure 1. Tactical Terrain Data (TTD) Content