

Introduction

Throughout history, the knowledge and physical effects of terrain have played a dominant role in the development of society during both peace and war. Terrain is a portion of the earth's surface that includes man-made and natural features. Terrain analysis is the process of analyzing and interpreting these features and the influence of weather and climate on them. Terrain data (or information) is raw data in any form about a segment of terrain. Knowledge of the battlefield terrain is extremely important during all phases and levels of military planning.

Analysis is the process of interpreting natural and man-made features of a geographic area to determine their effects on military operations. Terrain analysis support during battle provides the combat 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.

Terrain intelligence is thus one aspect of operational intelligence. Terrain analysts produce terrain intelligence for use at the tactical and strategic levels of operation. Operational intelligence, however, is important at all levels, so commanders at higher headquarters may use products produced at lower levels.

Terrain analysis is still important during the postbattle stage. The battle will significantly alter the terrain, requiring updating of previously performed terrain analysis. The terrain analyst may also need to update completed products that have potential value for the next battle.

RESPONSIBILITIES

Analysts

Data base assembly

All terrain teams get as much terrain data as possible for their respective areas of interest. The Defense Mapping Agency (DMA) is responsible for producing the standard planning terrain analysis data base (PTADB) and the tactical terrain analysis data base (TTADB) used by the terrain analysts to support the maneuver commander's needs. In those areas of the world where coverage is not available, the terrain analysis team must

prepare these data bases and dedicate much of its peacetime operation to this effort. The terrain analysis data base contains information from any source the terrain analyst supervisor at division, corps, or echelon above corps (EAC) level considers appropriate.

The process of extracting, reducing, and recording data is very time-consuming. To make it faster and easier to manage, analysts divide terrain data bases into two areas: area-specific and general data. They catalog area-specific data by geographic area and subject being portrayed; examples are roads, soils, and vegetation. General data files include books, scientific writings, technical literature, and other pertinent data that does not fall into area-specific files. Analysts catalog these files using a manual or automated system or both. The files might include card files, personal computers, or microfiche.

The first step in generating terrain intelligence and producing special-purpose products is to reduce data contained in various source materials to a uniform scale and format. The process of extracting essential elements of terrain information (EETI) from available sources is the most laborious and time-consuming step in the production cycle. Standard formats and legends are outlined in DMA product specifications for the hardcopy TTADB.

This highly important data base supports the intelligence preparation of the battlefield (IPB). IPB is a systematic and continuous approach to analyzing the enemy, environmental effects, and terrain in a specific geographic area. The process plays a primary role in prebattle support. In providing terrain support to friendly forces, the G2 ensures that IPB assesses the terrain for both enemy and friendly operations.

Part Two explains the concept of formatting data in the form of standard factor overlays. Analysts produce and maintain the overlays on acetate or mylar that will accept ink or pencil and permit erasing. After final working copies are completed, cartographic and reproduction support is required to produce final overlays for terrain-analysis databases.

Evaluation

Terrain analysts must analyze the influence of weather and climate on the natural and man-made features of a geographic area by organizing various source materials into a single graphic manuscript. Terrain analysts will extract information from maps, aerial photographs, nonphotographic imagery, and literature and then reduce the data to a uniform scale and format.

In order to determine the effect of terrain on the general courses of action available to both friendly and enemy forces, analysts evaluate terrain in terms of its military aspects of terrain, or observation and fields of fire, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA). Terrain teams conduct special studies, used in analyzing the area of operations to support the intelligence effort.

Before they can analyze the military aspects of terrain, analysts must first know the mission of the unit, type of operation, level of command, composition of the forces involved, and weapons and equipment involved. They will get all necessary information from the commander at the time of the request and research available topographic products that may fulfill all of his needs. They will also help define the problem and design and produce a product for the commander's specific needs, if no such products are available. The following is a partial list of questions to ask the commander in order to produce a usable product:

1. What is the operation to be planned or executed?
2. Who is being supported by this operation?
3. What type of operation is being conducted?
4. When will the operation take place?
5. Where will the operation take place?
6. How can a terrain analysis product help--
 - a. Show movement route?
 - b. Show places to avoid?
 - c. Show what to expect for terrain, materials, and trafficability?
 - d. Show where to hide?
 - e. Show where the enemy is likely to be hiding or moving?
 - f. Show where to site facilities, antennas, supplies, and so forth?
7. Who will use the product?
8. How many are required?
9. When will the product be needed?
10. Where will the product be used?
11. In what environment will the product be used?
12. Where will the product be delivered?

Analysis

Analysts combine information from two or more overlays. Using weather data and working parameters for tactical equipment, they provide commanders with an analysis of the expected effects of terrain and weather on trafficability for future operations. Equipment will vary, depending on the work to be done and the teams the analysts are in.

Division Terrain Teams

- Split-Stage Light Table
- Zoom Stereoscope
- Zoom Transfer Scope
- Quality Processing System (Planimeter)
- Facsimile Transmission and Receiving Device (used to transmit and receive geographic material)
- Diazo Printer

Terrain Analysis Support at Corps Topographic Company

All Sections:

Cartographic techniques
 Single-color lithographic presses
 Contact film equipment

MGI Element:

Collection Section
 Facsimile transmission and Receiving Device, (used to transmit and receive geographic material)

Analysis Section
Analytical Photogrammetric Positioning System (APPS)
Geographic Plotter
Microscan Light Table

Synthesis Section
Vertical Reflecting Projector
Quality Processing System (Planimeter)

Information Section
Plain Paper Copier
Thermographic Copy Machine
Diazo Printer

Equipment Under Development

To provide rapid terrain analysis support to the commander, the Digital Topographic Support System (DTSS), along with the Digital Features Analysis Data (DFAD), will incorporate the current military geographic information (MGI) into a digital computer data base.

Analysts use several resource materials to analyze the area of operations. These materials include terrain studies prepared by engineers. Examples of such studies are soil analyses; obstacle, route, avenues of approach, cover and concealment, and trafficability information; technical reports, maps and imagery, and reports of ground and aerial reconnaissance; national and intelligence surveys; and local studies and periodicals.

Engineers and intelligence analysts work together. For example, topographic terrain units must maintain direct contact with intelligence sections, specifically the all-source analysis section. This contact ensures that intelligence materials required by terrain analysts are available.

The intelligence officer coordinates production of the terrain analysis for the area of operations, based on an established deduced mission. When he receives the actual mission, he reevaluates his analysis in terms of the commander's areas of interest and influence. He must revise his analysis upon receiving changes or additional information.

An analysis of the area of operations deals with the effects of that area on the courses of action that enemy and friendly forces may adopt. It covers weather conditions, relief and drainage systems, vegetation, surface materials, man-made features, military aspects of the area, and OCOKA. Other factors include sociology, politics, economics, religion, transportation, and hydrology.

See FM 101-5 for an example of the format for an area of operations analysis.

Interpretation

The data collected for data bases includes information reported through host nations as well as current and all-source intelligence. Using an adequate data base, the analyst can supply an up-to-date picture of the battlefield terrain.

Terrain analysts must be thoroughly proficient in topographic map interpretation. Almost as important is interpreting photographic and other remote-sensed imagery. This

skill includes using formulas and measuring techniques on photographs, maps, and the ground. Analysts should also know how to do basic overlay drafting and should be able to write clear, factual reports.

Integration

Terrain analysts produce intelligence for use at the tactical and strategic levels of operation. Since it may be useless or even dangerous to warfighting commanders unless it is current, its production and revision must be never-ending. This occurs through the repeating terrain intelligence cycle, which includes planning to collect data, collecting the data, processing the data into intelligence, and disseminating the intelligence.

Coordination

Theater army terrain support elements must pass data base information between all terrain support elements having business in that area of operation. Terrain support elements must also pass database information among themselves and the theater army terrain. This ensures a more comprehensive data base, time saving in data-base development, and a cross-check of information. These materials include aerial photography, target locations, enemy order of battle, and weather data.

Engineer and intelligence analysts work together. For example, the topographic company at corps level must maintain direct contact with the corps all-source analysis section. This contact ensures that intelligence materials required by terrain analysts, such as aerial photography, target locations, enemy order of battle, and weather data, are available.

Units

All topographic units within a theater of operations are part of the topographic battalion. Detachments and companies from this battalion may be at division, corps, and EAC to provide rapid-response, standard, and special-purpose topographic products to aid the tactical commander.

Corps and higher headquarters normally prepare a written analysis in planning projected operations. In division headquarters, the intelligence officer may prepare a written analysis for projected operations, such as airborne, amphibious, and airmobile. In most division operations, however, he will use the corps analysis supplemented to the division.

Division Terrain Teams

The direct support section (DSS), which provides MGI, helps the division terrain team produce rapid-response terrain analysis products. The division terrain team is an eight-person unit that provides direct support to each division. The team includes a terrain analysis warrant officer, three noncommissioned officer (NCO) terrain analysts, and four enlisted terrain analysts. The E6 NCO from the terrain team should be physically located in the office of the assistant division engineer as a liaison to the division team. The remainder of the division terrain team will normally be located with the G2 staff.

Terrain Analysis Support at Corps Topographic Company

A battalion topographic company provides direct support to each supported corps. This company includes a technical control section, two terrain squads, the MGI element, and a DSS.

The technical control section includes a terrain analysis warrant officer, one NCO, and two enlisted terrain analysts. This section coordinates division terrain support and all topographic support for the corps.

The two terrain squads each include two NCOs and four enlisted personnel. They are available to support the corps G2 and supported elements.

The MGI element includes four sections, each with its own function. The collection section provides a focal point for supervision of topographic operations and communications systems. The analysis section provides for interpretation, evaluation, and update of MGI. The synthesis section provides graphic and textual terrain analysis. The information section catalogs, stores, and maintains the MGI.

Topographic Battalion at Echelons Above Corps (EAC)

The topographic battalion at EAC provides all functional support to theater army assets. A terrain analysis team assigned to the battalion is available, based on one of the four variations of the battalion table(s) of organization and equipment (TOE), to support different theater requirements. In addition, cellular teams may be assigned to the battalion to meet specific needs.

The terrain analysis support team at EAC is organic to the battalion and supports terrain requirements from theater army headquarters and its supporting units. It is the primary repository for information in the theater area. In addition, this team coordinates battalion efforts to collect data from other friendly organizations that collect terrain data, such as recon elements, engineer combat and combat heavy units, military police, and aviation. The theater army team supports corps terrain analysis with information, coordinates collection activities among corps terrain analysis support, and provides liaison with the terrain activities of other topographic agencies.

PRODUCTS

In addition to other products, terrain analysis products may include those listed below.

Military Aspects of Terrain (OCOKA)	Elements of Terrain Information	Examples of Terrain Analysis Products
Observation and fields of fire	<ul style="list-style-type: none"> • Vegetation (summer and winter) • Surface configuration • Battlefield environmental effects on terrain • Urban areas 	<ul style="list-style-type: none"> • Horizontal line-of-sight for direct-fire weapons and radar • Emplacement suitability and performance ratings for ground surveillance
Cover and concealment	<ul style="list-style-type: none"> • Vegetation (summer and winter) 	<ul style="list-style-type: none"> • Cover potential from direct and indirect fire (good/fair/poor)

Cover and concealment (cont.)	<ul style="list-style-type: none"> • Surface configuration • Battlefield environmental effects on terrain • Urban areas 	<ul style="list-style-type: none"> • Concealment potential from horizontal and vertical observations (good/fair/poor)
Obstacles	<ul style="list-style-type: none"> • Vegetation (summer and winter) • Surface configuration • Drainage characteristics • Natural and man-made • Micro relief • Surface materials (wet and dry) • Urban areas 	<ul style="list-style-type: none"> • Location of existing natural and man-made obstacles • Mobility potential on the battlefield expressed in GO, SLOW-GO, and NO-GO for tracked and wheeled vehicles
Key Terrain	<ul style="list-style-type: none"> • Urban areas • Lines of communication and supply • Surface configuration • Drainage characteristics 	<ul style="list-style-type: none"> • Location of key terrain features, both natural and man-made. Examples are landslide areas, bridges, chokepoints, high ground, and key military installations.
Avenues of approach	<ul style="list-style-type: none"> • Vegetation (summer and winter) • Urban areas • Surface configuration • Surface materials (wet and dry) • Drainage characteristics • Lines of communication and supply 	<ul style="list-style-type: none"> • Identification of areas where movement of friendly and enemy forces may occur • Speed prediction • Drop zones • Landing zones • Landing beaches • NOE navigation

Analysts

Terrain analysis is the focus of Army topographic operations. Graphics, data tables, and textual evaluations and descriptions are characteristics of prebattle and postbattle responses. Most responses during battle, particularly at division level, may be verbal.

The terrain analyst uses DMA-produced data bases (TTADB or PTADB) consisting of a series of terrain factor overlays at 1:50,000 and 1:250,000 scales. The standard DMA factor overlays used in studying the terrain are vegetation, surface configuration (slope), surface drainage, surface materials, obstacles, transportation, concealment, key terrain, and water resources for specific areas.

Terrain Teams

Terrain teams prepare their findings in several forms: oral, graphic, tabular, or textual, depending on the immediacy of the commander's needs. Terrain teams normally provide terrain analysis products in limited quantities for staff use. Geographic material may include maps, photographs, line drawings, printed or typed material, or handwritten messages. Facsimile copies are usually single-color, limited now to 8½ by 11 inches in size. They are necessary for only a few products, as in rapid-response terrain analysis.

Topographic Units

Topographic units use cartographic and copying techniques to produce map-based graphics. However, analysts should use cartographic techniques only when time is not critical. Topographic units located at division, corps, and EAC add to the DMA's efforts by compiling data from various sources into special-purpose topographic products.

USAF Weather Teams

Weather information is provided by the United States Air Force (USAF) Air Weather Service (AWS) through weather teams (WETMs), small units of weather observers and forecasters located at tactical operations centers at echelons above corps, divisions, separate brigades, armored cavalry regiments, Pershing Brigade, ranger regiments, and special forces group headquarters and forward-operating bases. Weather forecasting teams are also located with the aviation brigade tactical operations center in each division and at selected airfields. In addition to their weather-observing and -forecasting responsibilities, these teams assist the engineer and intelligence analysts with the IPB. The WETMs consist of two types of personnel. Weather observers are enlisted personnel trained to observe weather conditions visually and with instruments and record and transmit these observations. Weather forecasters are specially trained enlisted personnel and officers trained to analyze and forecast weather conditions. The senior member of the weather team is the staff weather officer (SWO) to the supported army unit and is the point of contact for all weather services.

Weather support procedures are governed by AR 115-10 and AR 115-12. See Appendix B for additional information.

In areas where data base coverage is not available, the terrain analysis teams must prepare data bases and dedicate much of its peacetime operations to this effort. They should compile this data to meet DMA product specifications as much as possible, and provide a listing of these products to the DMA (Defense Mapping Agency Hydrographic/Topographic Center, ATTN: SD, Washington DC 20315) as possible source material for subsequent products.