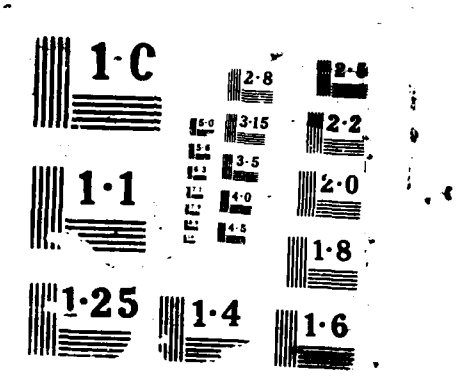
AD-A188 426 AIR-LAND BATTLEFIELD ENVIRONMENT (ALBE) DEMONSTRATION (U) ARMY ENGINEER TOPOGRAPHIC LABS FORT BELVOIR VA B A MANDEL 19 SEP 86 ETL-R186 1/1

UNCLASSIFIED F/G 15/6 NL


1·C
1·1
1·25
1·4
1·6
1·8
2·0
2·2
2·8
3·15
3·5
4·0
4·5

DTIC FILE COPY

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

(2)

REPORT DOCUMENTATIO

AD-A188 426

n Approved
B No. 0704-0188

DTIC ELECTE NOV 2 3 1987 S D

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	
2a. SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION / DOWNGRADI SCHEDULE	
4. PERFORMING ORGANIZATION RE T UMBER(S) R-106	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION USAETL	6b. OFFICE SYMBOL (*If applicable*) CEETL-LO
7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (*City, State, and ZIP Code*) Fort Belvoir, VA 22060-5546	7b. ADDRESS (*City, State, and ZIP Code*)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (*If applicable*)
9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (*City, State, and ZIP Code*)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (*Include Security Classification*)
AirLand Battlefield Environment (ALBE) Demonstration

12. PERSONAL AUTHOR(S)
BETTY A. MANDEL

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (*Year, Month, Day*)	15. PAGE COUNT
Technical	FROM _____ TO _____	19 SEP 86	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)
FIELD	GROUP	SUB-GROUP	Tactical Decision Aid (TDA) weather and terrain combat operations

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

The Corps of Engineers is responsible for the management of ALBE, a program designed to focus and coordinate Army technology base efforts in the areas of atmospheric, terrestrial and topogrpahic sciences. This program will develop, evaluate and demonstrate Tactical Decision Aid (TDA) software and products capable of integrating weather and terrain in the prediction of battlefield environmental effects. It will provide the decision making tools needed by field commanders to assess and exploit battlefield environmental conditions on a timely manner for tactical advantage. This paper will provide a summarized overview of the ALBE initiative with a description of the TDAs that will be incorporated in the system.

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION	
☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	UNCLASSIFIED	
22a. NAME OF RESPONSIBLE INDIVIDUAL F. DARLENE SEYLER	22b TELEPHONE (*Include Area Code*) 202-355-2647	22c OFFICE SYMBOL CEETL-LO

DD Form 1473, JUN 86 *Previous editions are obsolete.*

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

AIR-LAND BATTLEFIELD ENVIRONMENT (ALBE) DEMONSTRATION

Betty A. Mandel
U.S. Army Engineer Topographic Laboratories
Fort Belvoir, Virginia 22060-5546

ABSTRACT

The Corps of Engineers is responsible for the management of ALBE, a program designed to focus and coordinate Army technology base efforts in the areas of atmospheric, terrestrial and topographic sciences. This program will develop, evaluate and demonstrate Tactical Decision Aid (TDA) software and products capable of integrating weather and terrain in the prediction of battlefield environmental effects. It will provide the decision making tools needed by field commanders to assess and exploit battlefield environmental conditions on a timely manner for tactical advantage. This paper will provide a summarized overview of the ALBE initiative with a description of the TDAs that will be incorporated in the system.

INTRODUCTION

The effect of terrain and weather conditions on combat operations is more significant than any other physical factor. However, since the collection and analysis of terrain and weather information is a slow process, in most cases, substantive environmental intelligence products can not be generated with the speed needed to support continuous operations. Therefore, tactical decisions have to be made with limited knowledge of the battlefield environment, even though such factors can be detrimental to the performance of today's high technology Army systems. To address this problem the Army initiated the development and fielding of advanced technology systems like the All Source Analysis System (ASAS), Maneuver Control System (MCS), Digital Topographic Support System (DTSS) and Integrated Meteorological System (IMETS). These systems will provide the capability to acquire and process intelligence, maneuver, terrain and environmental information, respectively, in an efficient and timely manner. In addition, the Corps of Engineers, tasked with providing a synergistic approach to the efficient assesment and exploitation of the combined effects of the battlefield environment, has instituted the AirLand Battlefield Environment (ALBE) initiative.

ALBE will facilitate the acquisition, integration, assessment and exploitation of terrain, weather and other environmental information through the implementation of Tactical Decision Aids. The two major goals of ALBE are :

1. Provide Army material acquisition, training and doctrine activities with the capability of assessing and exploiting realistic battlefield environmental effects.

2. Provide the Army in the field with the capability to assess and exploit battlefield environmental effects for tactical advantage.

This paper is mainly concerned with the ALBE Demonstration and Evaluation Program, one of the Army's top twenty technology demonstrations being conducted in support of the latter goal. This program was implemented to provide a mechanism for demonstrating and evaluating Tactical Decision Aid (TDA) products developed under the Corps of Engineers' tech base efforts and to facilitate transitioning of these products to field Army systems. The main objectives of the Demonstration and Evaluation Program are:

1. Develop and refine TDA software and develop the methodology to provide TDA software and products to Army operational units.

2. Demonstrate the use of advanced sensor systems for collection of near-real-time battlefield environmental data and use of the data in the generation of TDA products.

3. Obtain the test data necessary to support integration of ALBE TDA software and products on soon-to-be fielded Army systems.

The Demonstration and Evaluation program consists of an ALBE Testbed System (ATS) in which the TDA software is being integrated and implemented. The system is being prepared for a series of field demonstrations and evaluations that will be conducted to gather data and develop methodologies that will facilitate transitioning of ALBE software and products to target field system. This system and the TDA software will be discused in more detail later.

BACKGROUND

The ALBE Demonstration and Evaluation program is being conducted under the auspices of the Corps of Engineers Directorate of Research and Development with the work being performed cooperatively by Corps of Engineers (COE) and Army Materiel Command (AMC) laboratories. Participating laboratories include the Corps: Cold Regions Research and Engineering Laboratory (CRREL), the Construction Engineering

Research Laboratory (CERL), the Engineer Topographic Laboratories (ETL), and the Waterways Experiment Station (WES); along with AMC's Atmospheric Sciences Laboratory (ASL). The TRADOC proponent for the ALBE Demonstration and Evaluation Program is the U.S. Army Intelligence Center and School (USAICS). The Army Development and Employment Agency (ADEA) will support the ALBE effort by: Facilitating the coordination necessary to execute the field demonstrations and evaluations with the appropriate FORSCOM and TRADOC elements, and assisting in the integration of ALBE software and products into the Army's SIGMA C^3I architecture. The U.S. Army 9th Infantry Division will also support the Demonstration and Evaluation Program by providing troops to operate and evaluate the ALBE software during Command Post Exercises and Field Training Exercises.

DEMONSTRATION SETUP: ALBE TESTBED SYSTEM

The main purpose of the ALBE Testbed System (ATS) is to provide a vehicle that can function in a realistic battlefield environment for conducting TDA software demonstrations, tests and evaluations. The ATS has being designed to be compatible with Army systems scheduled for fielding in the near future for which ALBE products are targeted, and to provide maximum flexibility (in terms of both hardware and system software architecture) in meeting the anticipated needs of the TDA developers. Graphics compatibility and portability, for example, will be provided by the Graphics Kernel System (GKS) graphics package.

To provide the support needed on the field the testbed system utilizes ruggedized hardware. The equipment is being installed into Integrated Command Post (ICP) type shelters mounted on Commercial Utility Cargo Vehicles (CUCVs) for transport during the ALBE demonstrations and evaluations. The equipment includes two ruggedized central processing units (CPUs) with VMS operating system for terrain (Figure 1) and weather (Figure 2)applications, respectively. Both units use multiple disk, tape drives, graphic and alphanumeric input and output devices, communication and COMSEC devices, and near real time environmental data. These units will be able to communicate with each other and with other related computer systems.

In addition to the TDA software, the ATS will contain operating system software, graphics libraries, user interface software, Geographic Information System (GIS) and Data Base Management System (DBMS); all integrated to provide a cohesive software package. It will also have FORTRAN 77, PASCAL, ADA and C compilers. Figure 3 illustrates the software architecture.

Acquisition and integration of the ATS hardware and

implementation of the system software is being accomplished under contract by Battelle Pacific Northwest Laboratories (PNL).

TACTICAL DECISION AIDS (TDA)

ALBE Tactical Decision Aids (TDAs) are software products that can relate the effects of the environment on equipment, weapons systems and operations. They are tools deviced to provide information useful in the formulation and execution of battle strategies. The inputs required to generate these products consist of digital terrain data (both feature and elevation data), historical climatological data and/or real and near-real-time environmental sensor data, and miscellaneous information such as data on military equipment, weapon system capabilities and characteristics, and operational parameters. This information will come from computer data bases that are prepared prior to combat, near-real-time information obtained from currently fielded environmental sensors and data from sensor systems developed under the ALBE program, and interactive input information.

Since Tactical Decision Aids cover the effects of both the current and forecast state of the environment, they lend themselves for simulations that enhance the ability to plan and execute operations in a dynamic tactical situation. For example, they can be used to evaluate weapon system effectiveness, determine the advantage of one system over another, and anticipate how operations will be degraded or improved during engagements.

There are six ALBE Tactical Decision Aid Categories. They are:

- o Army Aviation
- o Countermobility
- o Ground Mobility
- o Nuclear, Biological, Chemical
- o Weapon System Performance
- o Terrain and Atmospheric Utilities

Each category contains a number of modules, each with one or more products. The products of some categories can serve as input for those of another. A description of the TDA Categories follows.

Army Aviation

The Army Aviation Tactical Decision Aids (TDAs) will demonstrate the application of terrain and atmospheric models in the analysis of aircraft performance producing graphic plots and textual reports. It consists of three modules:

- o Weather Effects
- o Aircraft Vectoring
- o Aircraft Performance

The weather effects module provides information on weather hazards to helicopter flight. Five interactive models are provided which permit the user to analize different scenarios. Aircraft Vectoring enables the Army to assess, predict and plan various aircraft operations. Ten models generate data that describe the current status of selected aircraft instrumentation and analize the potential impact of environmental and terrain conditions. Aircraft Performance generates graphical displays and map overlays of density/altitute information for flight planning purposes. The input, either current or forecast meterological data is used to determine the areas were aircraft performance may be marginal or hazardous.

An example of the synergism of the ALBE program, this TDA exploits Digital Terrain Elevation Data (DTED), the ALBE Geographic Information System (GIS), and products from other TDAs such as the Intervisibility module from the Terrain and Atmospheric Utilities TDA.

Countermobility

The purpose of the Countermobility Tactical Decision Aid (TDA) Category is to make predictions of obstacle deployment and effectiveness considering the environment, troop and equipment assets, constraints on equipment operation and time required. Obstacles addressed include: minefields, wire, craters, rubble, ditches, log obstacles, and flood zones. The products developed allow the evaluation of alternative plans and reduce the time required to implement an integrated obstacle system. Three modules are included:

- o Minefield Deployment Effectiveness
- o Obstacle Deployments
- o Obstacle Systems

Minefield Deployment Effectiveness uses data from environmental sensors located in the area of interest to make real time predictions. Outputs will consist of map overlays illustrating deployment performance, effectiveness, sitings, and resource requirements. Site selection products are generated using mobility, gap crossing and line of sight predictions, which are products of other TDAs. A supporting model that addresses the impact of snow cover or frozen soil on the effectiveness of a minefield will also be implemented.

Obstacle Deployments predicts the effectiveness, location and logistics of obstacles other than minefields with a total of nine products. Finally, Obstacle Systems is a combination and enhancement of the previous two modules.

Ground Mobility

Ground Mobility products provide a comprehensive description of the capabilities of vehicles on roads and off roads. Graphic displays will describe the ability of vehicles and convoys to transport men and material over any type of terrain and under any weather conditions. The modules included are:

- Off Road Speed
- On Road Speed
- Bridge Evaluation
- Gap Crossing
- Formation Movement
- Route Cover and Concealment
- Integrated Mobility
- Road Usage

The Off Road Speed module is being designed to predict the "go/no go" and maximum speed performance of vehicles off the road reflecting terrain and environmental conditions. Predictions can be adjusted to either agree with long term weather forecasts or reflect near real time weather. Six modules and two supporting models are included: Soil Moisture Mapping, develops a spatially averaged soil moisture map used to indicate damage to terrain by vehicle mobility; and Travel in Shallow Snow, a realistic model of the performance of vehicles operating on hard surfaces having shallow snow cover. On Road Speed consists of seven products that provide similar capabilities for vehicles operating on undamaged segments of road.

Bridge Evaluation identifies the location and characteristics of fixed bridge sites and it can indicate suitability of a site for tactical bridging. Gap Crossing evaluates vehicle geometry and traction performance capability relative to gap characteristics and predicts the ability to cross at selected sites. It includes a supporting model: Winter Bridging, used to locate tactical bridging sites in cold weather environment.

Formation Movement is an interactive module designed to aid in the logistic problem of relocating manpower and resources. Route Cover and Concealment predicts the capability of vehicles to travelon the battlefield with minimum exposure time. The resulting products can be used in combination with others to plan routes that minimize risk. Integrated Mobility is a combination of previous modules. It can predict speed and/or travel time for vehicle movement either on road, off road, or across gaps; and it can generate route selection maps interactively.

The last module, Road Usage, predicts the influence of road usage (vehicle speeds, traffic volume, movement times) on road damage and repair. A supporting model: Resource Planning, incorporates Ground Mobility TDA applications into the Engineer Command and Control System (ECCS) for mission planning.

Nuclear, Biological, Chemical

The Nuclear, Biological and Chemical (NBC) products provide information on the location, extent and persistence of NBC hazards and smoke; the side effects of chemical protective clothing; and options for decontamination. Consists of four modules:

- o NBC Hazard
- o Smoke Generation
- o Tube Delivered Smoke
- o Chemical Decontamination

NBC Hazard automates reporting operations and provides the capability to display two and three dimensional nuclear fallout and chemical hazard areas on digital terrain map backgrounds. Smoke Generation automates the design of large area oil fog smoke screens to provide concealment and deception and to prevent operational use of various electro-optical systems; while Tube Delivered Smoke uses munitions delivered by howitzers and mortars for the same purpose. Finally, Chemical Decontamination provides the guidelines for NBC decontamination on the winter battlefield identifying, interactively, practical options for different types of equipment.

Weapon Systems Performance

Weapon Systems Performance considers the impact of environmental effects on the effectiveness of electro-optical and seismic/acoustic sensors and systems with four modules:

- o Electro-Optical Systems
- o Top Attack Self Contained Munition (SCM) Systems
- o Seismic/Acoustic Sensor Systems
- o Advanced Munitions

The output for Electro-Optical Systems will consist of tables depicting the effective ranges of devices used for target acquisition and map overlays displaying line of sight limitations on the terrain. Top Attack SCM systems will predict the performance of different target types, sensor logic and sensor scan characteristics and it will determine optimum terrain deployment sites for SCM/target engagements. Seismic/Acoustic Sensor Systems will provide techniques to detect, locate, and classify threat vehicles. Advanced

Munitions will predict the performance of automatic target recognition devices in current or forecast environmental conditions.

Terrain and Atmospheric Utilities

This TDA Category provides general supporting utilities which are used as input by others or as stand alone products. They offer a choice of graphics or text products that illustrate critical environmental effects on military operations. Consists of nine modules:

- o Intervisibility
- o Sensor Communication and Data Handling
- o Weather Effects Messages
- o Surface and Upper Air Data
- o Military Hydrology (MILHY)
- o Target Area Winds
- o Perspective View Shaded Relief
- o Support Utilities
- o Climatic Utilities

Intervisibility, a very popular utility for generating graphics, uses digital terrain elevation data (DTED) to generate terrain based products such as line of sight, radial terrain masked area, perspective view, target acquisition, path loss area contour, slope contour, and 3D shaded relief. Somewhat related to this module is Perspective View Shaded Relief, which generates a 3D perspective that allows the combination of digital terrain elevation values within an elevation data set and class data obtained from a satellite image.

The Sensor Communication and Data Handling module is the system's translator. It consists of software that can receive and ingest environmental data from any sensor and make it useful to the system.

Weather Effects Messages performs two functions. First, it scans the environmental data base for critical values and warns of the potential weather impact, and second, it simulates a scenario with a given set of climate/terrain values in order to determine critical considerations and effects to a number of military operations.

Surface and Upper Air Data integrates diverse environmental measurements into a coherent depiction of the current status of the weather aloft and at the surface. On a similar line, Target Area Winds uses DTED and upper level meteorological radio sound profiles to prepare estimates of wind throughout the division sector.

Military Hydrology generarates forecasts of water stage and

flow characteristics for user selected times and cross sections within an area based on physical watershed characteristics and precipitation as measured by ground sensors.

The last two modules generate text products. Support Utilities provides units conversion and almanac data for sun and moon rise and set. Climatic Utilities generates psychrometric calculations, standard atmosphere, surface wind climatology and the climatic data base.

CLOSING REMARKS

The ALBE program seeks to implement its TDA software and products on field Army systems in a timely fashion. The innovative implementation strategy used takes advantage of on-going life cycle developments while incorporating new capabilities developed in the Army laboratories. Demonstrating and evaluating software on a tech base demonstration system and then incorporating these capabilities into developing field Army systems should prove extremely timely and cost effective. If the ALBE products were to go through the normal life cycle process, their field implementation would be significantly delayed if not canceled. This would deprive battlefield commanders and their staff of terrain and environmental data which is vital to the decision making process.

END

DATE

FILMED

3 — 88

DTIC