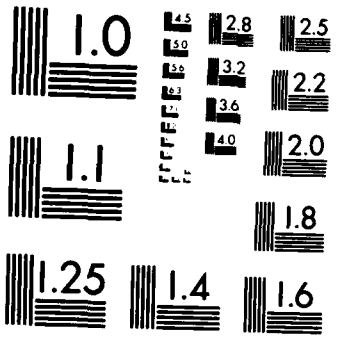
AD-A188 210 AIRLAND BATTLEFIELD ENVIRONMENT (ALBE) TACTICAL DECISION AID (TDA) DEMONSTRATION PROGRAM(U) ARMY ENGINEER TOPOGRAPHIC LABS FORT BELVOIR VA M J TOLSON 1/1

UNCLASSIFIED 29 JUL 87 ETL-R116 F/G 12/5 NL



DTIC FILE COPY

(2)

AD-A188 210

DTIC ELECTE NOV 24 1987 S D

DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): R-116	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)	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) TACTICAL DECISION AID(TDA) DEMONSTRATION PROGRAM

12. PERSONAL AUTHOR(S)
MICHAEL J. TOLSON

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
TECHNICAL	FROM _____ TO _____	29 JUL 87	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	integrating terrain, prediction of battlefield environmental effects.

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

Terrain and weather affect combat operations more significantly than any other physical factors on the battlefield. Historically, field commanders have not had the capability to fully exploit battlefield environmental effects for tactical advantage. The Corps of Engineers has initiated the ALBE program to develop and evaluate Tactical Decision Aid (TDA software and products capable of integrating terrain and other environmental factors in the prediction of battlefield environmental effects. The TDA's, when implemented on developmental systems, will provide the Army with an operational capability to assess and exploit battlefield environmental effects as a force multiplier in combat operations. A development strategy has been devised that involves assembling an ALBE Testbed, installing the TDA software, conducting field demonstrations and evaluations, and transferring the TDA software to various target systems currently in the life cycle development process. This innovative approach will facilitate fielding of ALBE software and products, and will provide battlefield commanders and their staff with the ability to better exploit the combined effects of terrain and environment in the decision-making process.

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

AIRLAND BATTLEFIELD ENVIRONMENT (ALBE) TACTICAL DECISION AID (TDA) DEMONSTRATION PROGRAM

Michael J. Tolson
U.S. Army Engineer Topographic Laboratories
Fort Belvoir, Virginia 22060-5546

ABSTRACT

Terrain and weather affect combat operations more significantly than any other physical factors on the battlefield. Historically, field commanders have not had the capability to fully exploit battlefield environmental effects for tactical advantage. The Corps of Engineers has initiated the ALBE program to develop and evaluate Tactical Decision Aid (TDA) software and products capable of integrating terrain and other environmental factors in the prediction of battlefield environmental effects. The TDA's, when implemented on developmental systems, will provide the Army with an operational capability to assess and exploit battlefield environmental effects as a force multiplier in combat operations. A development strategy has been devised that involves assembling an ALBE Testbed, installing the TDA software, conducting field demonstrations and evaluations, and transferring the TDA software to various target systems currently in the life cycle development process. This innovative approach will facilitate fielding of ALBE software and products, and will provide battlefield commanders and their staff with the ability to better exploit the combined effects of terrain and environment in the decision-making process.

AIRLAND BATTLEFIELD ENVIRONMENT (ALBE) TACTICAL DECISION AID (TDA) DEMONSTRATION PROGRAM

Michael J. Tolson
U.S. Army Engineer Topographic Laboratories
Fort Belvior, Virginia 22060-5546

INTRODUCTION

Terrain and weather environmental effects are arguably the most significant and limiting factors for a commander in combat operations. However, collection of this data is a slow process, and in most cases environmental intelligence products cannot 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. In addressing this problem the Army is initiating development and fielding of advanced technology systems such as 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 assessment and exploitation of environmental battlefield effects, 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. Two major goals of the ALBE initiative 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 will address the ALBE TDA Technology Demonstration program, one of the Army's top twenty technology demonstrations, which is being conducted to address goal two of the ALBE initiative. This program is designed to provide a mechanism for demonstrating and evaluating TDA products developed under the Corps of Engineers' tech base efforts and to facilitate transfer of these products to field Army systems. The primary objectives of the TDA Technology Demonstration 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 development strategy for the TDA Technology Demonstration program is to assemble an ALBE Testbed (ATB), which will be used as the vehicle for conducting the ALBE Demonstrations, implement and integrate the TDA software into the ATB, conduct a series of demonstrations and evaluations to gather data and develop methodologies for transitioning the TDA products to Army fielded systems, and transfer of the TDA software to material developers of the Army fielded systems.

BACKGROUND

The ALBE TDA Technology Demonstration 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 Waterways Experiment Station (WES), and the Engineer Topographic Laboratories; along with AMC's Atmospheric Sciences Laboratory (ASL). The TRADOC proponent for the ALBE Technology Demonstration program is the U.S. Army Intelligence School (UASICS). The Army Development and Employment Agency (ADEA) will support the ALBE effort by: (1) Facilitating the coordination necessary to execute the field demonstrations and evaluations with the appropriate FORSCOM and TRADOC element, and (2) Assisting in the integration of ALBE software and products into the Army's SIGMA C I architecture. The U.S. Army 9th Infantry

Division will also support the TDA Technology Demonstration program by providing troops to operate and evaluate the ALBE software during Command Post Exercises and Field Training Exercises.

ALBE Testbed (ATB)

The ATB is designed for maximum flexibility (both hardware and software) to satisfy TDA developer requirements and provide a suitable demonstration vehicle which can function in a realistic battlefield environment. The ATB hardware consists of two ruggidized central processing units (CPUs). One CPU will be dedicated to terrain applications while the other is dedicated to weather applications (Figures 1 and 2). Both units utilize multiple disk, tape drives, graphic and alphanumeric input and output devices, communication and COMSEC devices. The Terrain CPU will include an X/Y Digitizing input device and a CCD Mapping Camera. The Weather CPU will include an environmental sensor suite to detect surface and upper air meteorological data. Both CPUs will be able to communicate with each other and with other related computer systems.

In addition to the TDA software, the ATB will consist of: (1) Operating system software (Virtual Memory System-VMS), (2) Geographic Information System (GIS) software, (3) Data Base Management System (DBMS) software, (4) graphics libraries and, (5) user interface software. These components of the ATB system software architecture will be integrated into a cohesive software package where TDA software exploitation of terrain and weather data can be facilitated. The ATB software will also contain language compilers for FORTRAN 77. PASCAL, C, and ADA. Figure 3 illustrates the software architecture.

The ATB will be installed into Integrated Command Post (ICP) type shelters which are being mounted on Commercial Utility Cargo Vehicles (CUCVs) for transport during the ALBE demonstrations and evaluations. This configuration will be accomplished in October 1987.

Acquisition and integration of the ATB hardware and implementation of the system software is being accomplished under contract by Battelle Pacific Northwest Laboratories (PNL).

DEMONSTRATION AND EVALUATION

The ALBE demonstrations and evaluations will be conducted to obtain data to validate the effectiveness of ALBE products and facilitate transitioning of these products to Army development systems. This data will be used to

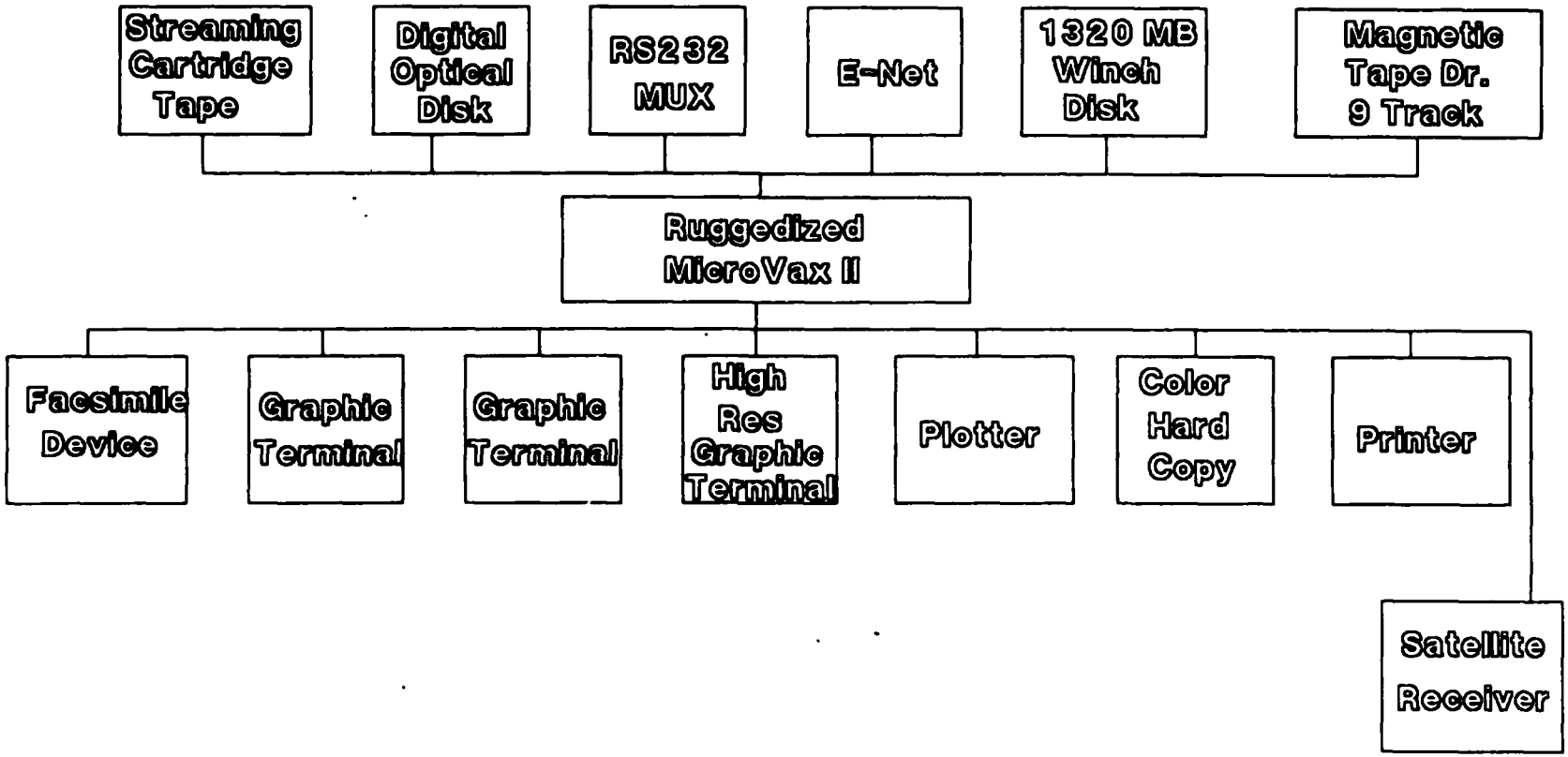


FIGURE 1:

Block Diagram of the Weather-Intensive ATS Processor

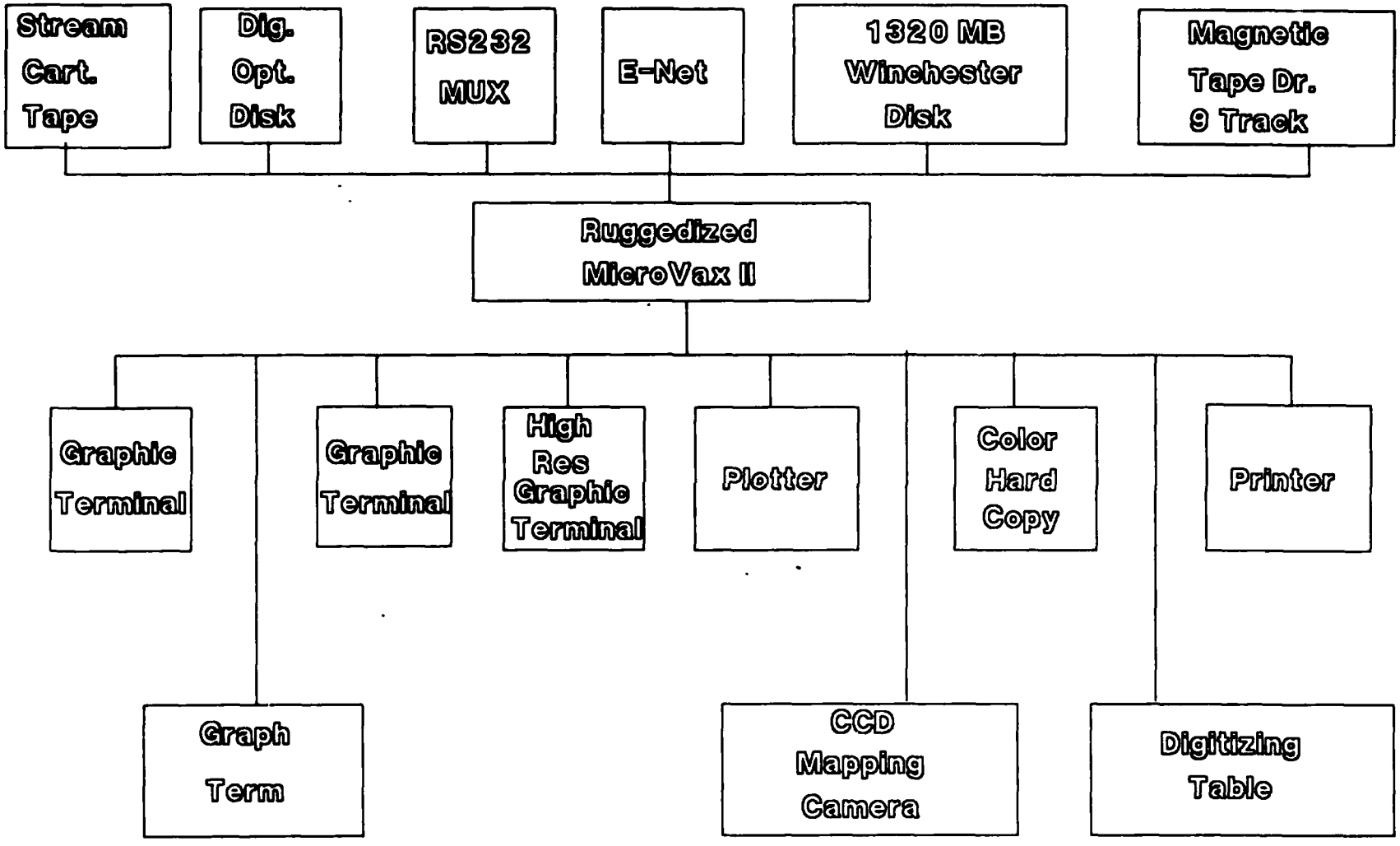


FIGURE 2:

Block Diagram of the Terrain Intensive ATS Processor

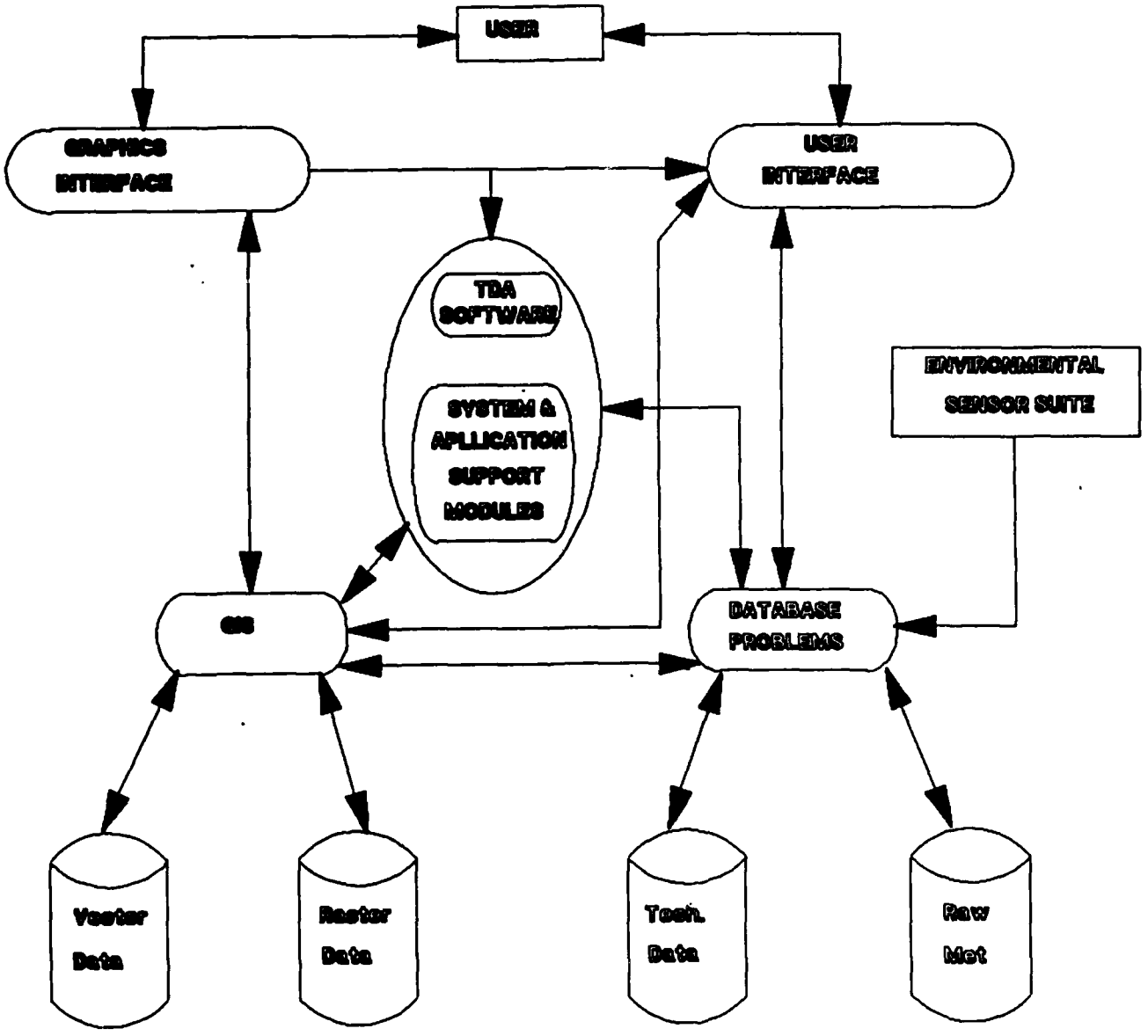


FIGURE 2: ALBE System Software Architecture

support Pre-Planned Product Improvements and/or Product Improvement Programs for software upgrades on Army development systems which will be recipients of ATB TDA software. The demonstrations and evaluations will be conducted in conjunction with the U.S. Army Development Agency (ADEA) with the support of the 9th Infantry Division (Motorized). ADEA is supporting the ALBE Technology Demonstration program by coordinating evaluations with FORSCOM and TRADOC, and by assisting in the integration of TDA software and products into the Army's tactical C(3)I architecture. ATB will be evaluated under the Army Tactical Command and Control System (ATCCS) Experimentation Site (AES) "umbrella plan" being conducted by the Commannd, Control, Communication and Intelligence C(3)I Division of ADEA. The current ALBE evaluation schedule is as follows:

Dec 87	Appraisal 1	Fort Lewis
Mar 89	Appraisal 2	Fort Lewis
Jul 90*	Evaluation 1	Fort Lewis
Jun 91*	Appraisal 3	Fort Lewis
FY92*	Evaluation 2	Fort Lewis
FY93*	Appraisal 4	Fort Lewis
FY94*	Evaluation 3	Fort Lewis

IMPLEMENTATION STRATEGY

The ALBE program seeks to implement its TDA software and products on field Army systems in a timely fashion. To accomplish this ALBE representatives will be working with TRADOC to facilitate the fielding of these new capabilities in the shortest time possible. The intent is to deliver a quality product that functions properly, meets the user's needs and is fully supportable during its life cycle by troops in the field. Since most of the ALBE software is somewhat specialized and requires extensive terrain and environmental data, as well as significant computational capability, not all systems will be able to implement the ALBE software. Some systems such as DTSS, ASAS and IMETs will have access to the required data as well as computational hardware and software architecture and may be primary generators as well as consumers of ALBE products. Other systems such as the Maneuver Control System and the Engineer Command and Control System may become primary consumers of ALBE products, provided the communication links are available and sufficient to support transfer of the products from the primary generators.

This innovative implementation strategy takes advantage of on-going life cycle developments while incorporating new capabilities developed in the Army laboratories. This approach of demonstrating and evaluating software on a tech base demonstration testbed 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 cancelled. This would deprive battlefield commanders and their staff of terrain and environmental data which is vital to the decision making process.

TACTICAL DECISION AIDS

The ALBE Tactical Decision Aids are software products which predict the effects of environment on both friendly and threat materiel, weapon systems, personnel and operations. The TDA's are not intended to render decisions, but rather to supplement the tactician's knowledge base and augment the decision making process by providing information useful in the formulation and execution of battlefield strategies. The inputs to generate these products consists of Digital Terrain Elevation Data (DTED), digitized (at Army labs) Tactical Terrain Analysis Data Base (TTADB) terrain feature data, historical climatological data, near-real-time meteorological data, and miscellaneous information such as vehicle and bridge parameter lists, data on military equipment, personnel, etc... The Defense Mapping Agency has agreed to produce DTD (digitized terrain feature data) as part of their Mark 90 program in response to a request by the Army for higher resolution data. The DTD data will serve as the terrain data base for the ATB and other Army advanced technology systems.

ALBE TDA's cover the effects of both the current and forecast state of the environment. They enable the tactical commander and his staff to evaluate weapon system effectiveness, determine the advantage of one system over another, and anticipate how operations will be degraded or improved during threat/U.S. engagements. The TDAs will enhance the ability to plan and execute operations in a dynamic tactical situation, and let commanders and their staff use weather and terrain as force multipliers in employing combat assets.

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

Army Aviation
Countermobility
Ground Mobility
Nuclear, Biological, Chemical (NBC)
Terrain and Atmospheric Utilities (TAU)
Weapon System Performance

Each TDA category contains a number of modules; and each module produces one or more TDA products. The products of some modules can serve as input for those of another category. TDA products generated through these processes will not merely reflect the effects of any single factor, such as terrain, weather or battle-induced conditions, but rather the combined synergistic effects of a number of factors.

Army Aviation

The Army Aviation TDAs will demonstrate the application of terrain and atmospheric models in analysis of aircraft performance as it contributes to the success or failure of an aviation mission. The TDA software generates both graphic plots and textual reports as output. The category consists of three modules;

Flight Weather
Aircraft Vectoring
Aircraft Performance

The Flight Weather module generates information on weather hazards to helicopter flight. Five interactive models allow the user to analyze different scenarios. Aircraft Vectoring allows the tactician to assess, predict and plan various aircraft operations. Ten interactive models allow the user to generate data that describes the current status of selected aircraft instrumentation and analyze the potential impact of environmental and terrain conditions. Aircraft Performance generates graphical displays and map overlays of density/altitude information for flight planning purposes. The input, either current or forecast meteorological data is used to determine the areas where aircraft performance may be marginal or hazardous.

Countermobility

The Countermobility TDA's will 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 generated allow the evaluation of alternative plans and reduce the time required to implement an integrated obstacle system. The category consists of three modules;

Minefield Deployment Effectiveness
Obstacle Deployments
Obstacle Systems

Minefield Deployments predicts the effectiveness and uses data from environmental sensors located in the area of interest to make real time predictions. This software allows the tactician to generate 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 Deployment software allows the tactician to generate a product(s) which predicts the effectiveness, location and logistics of obstacles other than minefields. Obstacle System software allows the tactician to generate overlays which show location, estimated threat force breaching times, movement restriction, time delay effectiveness and logistics. Obstacle System predictions will be available for winter conditions; ice, snow and frozen surfaces. The capability provided will enable the commander to plan tactical countermobility operations efficiently.

Ground Mobility

The Ground Mobility TDA software generates a comprehensive description of the ability of vehicles and vehicle convoys to transport men and material over virtually any type of terrain, on or off road, under nearly any weather conditions. Battlefield environmental conditions are described either on a projected or on a near real time bases. This will allow the tactician to use the products in either pre-battle planning or in battle decision making. The category consist of eight modules:

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 designed to predict the "GO / NO GO" and maximum speed performance of vehicles off the road considering the degrading effects of terrain and environmental conditions. Predictions can be adjusted to either agree with long term weather forecasts or reflect near real time weather. The tactician can generate map overlays including depiction of the ground vehicle "GO / NO GO" speeds, and speed performance both on an areal and a route selection basis, comparisons of off road speed

capabilities of different vehicles, and reasons for vehicle off road speed reductions and NO GOs. On Road Speed module products consider vehicles operating on undamaged segments of a road and provide similar capabilities as those for Off-Road module products.

Bridge Evaluation identifies the location and characteristics of fixed bridge sites and indicates the suitability of a site for tactical bridge deployment. 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 environments.

Formation Movement software is interactive and is designed to aid in the logistic problem of relocating manpower and resources. Route Cover and Concealment software predicts the capability of vehicles to travel on 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 all the previously described 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. Road Usage software 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, Chemical (NBC) software generates products which provide information on the location, extent and persistence of NBC hazards and smoke; the side effects of chemical protective clothing; and options for decontamination. The category consists of four modules:

NBC Hazard
Smoke Generation
Tube Delivered Smoke
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. Tube Delivered Smoke uses munitions delivered by howitzers and mortars for the same

purposes as Smoke Generation products. Chemical Decontamination provides the guidelines for NBC decontamination on the winter battlefield identifying, interactively, practical options for different types of equipment.

Terrain and Atmospheric Utilities

The Terrain and Atmospheric Utilities (TAU) software provides general supporting utilities which can generate stand alone products or feed data into other TDA software. The tactician can use this software to generate either graphic or textual reports of terrain and weather effects on varying military operations. The category consists of seven modules:

Intervisibility
Sensor Communication and Data Handling
Weather Effects Messages
Surface and Upper Air Data
Military Hydrology (MILHY)
Target Area Winds
3D Perspective View

Intervisibility software is interactive and allows the tactician to generate eight distinct terrain based products which predict the impact of line of sight (linear and radial) on mobile and aerial military operations. The Sensor Communication and Data Handling software is really ATB system level software which allows for the ingest of environmental data from any meteorological sensor and makes it useful for the TDAs. The Weather Effects software allows the tactician to either scan the environmental data base for parameters in excess of pre-determined critical values and warn of the potential weather impact or allows the tactician to simulate a scenario with a given set of climate/terrain values in order to determine critical considerations and effects to a number of operations.

Surface and Upper Air Data software integrates diverse environmental measurements into a coherent depiction of the current status of the weather aloft and at the surface. This software also allows the tactician to generate contour map overlays of specified met parameters in the area of interest. These products chiefly serve the interest of the Staff Weather Officer (SWO) personnel.

Military Hydrology software allows the tactician to forecast water stage and flow characteristics for selected times and cross sections within an area based on the physical watershed characteristics and the precipitation as measured by ground sensors. Target Area Winds software provides an accurate estimate of terrain influenced surface and upper level winds in target areas, ahead of the Forward

Line of Own Troops (FLOT) and in other data-silent areas. Knowledge of terrain influenced wind fields will produce more accurate chemical hazard and smoke screen predictions, and will aid in the proper placement of chemical alarm sensors and billeting of troops. The 3D Perspective View software allows the tactician to generate a shaded relief terrain perspective view product. The output can be used as a stand alone product to provide the commander with a realistic window to view the battlefield environment or as a background map onto which a time/event sequenced chemical or smoke generation product could be draped. The latter example would depict the influence of the terrain and wind field as the cloud plume disperses throughout the area of interest.

Weapon System Performance

The Weapon System Performance software considers the impact of environmental effects on the effectiveness of electro-optical and seismic/acoustic sensors and systems. The tactician can use the software to generate information for friendly and threat conditions, currently fielded and developmental imagers, lasers, and guidance devices such as used on the TOW; self contained munitions such as SADARM; advanced munitions such as FOG-M and AAWS-M; and aided target recognition (ATR) devices. The category consists of four modules:

Electro-Optical Systems
Top Attack Self Contained Munition (SCM) Systems
Seismic/Acoustic Sensor Systems
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 system software 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.

END

FILMED

MARCH, 1988

DTIC