Research Product 94-05

Evaluation of the AirLand Battle Management Advanced Technology Demonstration Prototype Version 1.2: Knowledge Base Assessment of the Location Analysis Applications

March 1994

Field Unit at Fort Leavenworth, Kansas
Manpower and Personnel Research Division

U.S. Army Research Institute for the Behavioral and Social Sciences

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Department of the Army

March 1994

Army Project Number
2Q263007A793

Human Factors in Training and Operational Effectiveness

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	1994, March	Final Aug 92 - Mar 93

4. TITLE AND SUBTITLE
Evaluation of the AirLand Battle Management Advanced Technology Demonstration Prototype Version 1.2: Knowledge Base Assessment of the Location Analysis Applications

5. FUNDING NUMBERS
MDA903-92-D-0039
63007A
793
1122
C01

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8. PERFORMING ORGANIZATION REPORT NUMBER
--

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Research Institute for the Behavioral and Social Sciences
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Bldg. 90, McClellan Avenue
Fort Leavenworth, KS 66027-0347

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
ARI Research Product 94-05

11. SUPPLEMENTARY NOTES See also Riedel, S. L., McKeown, P. E., Flanagan, J. P., and Adelman, L. (In preparation). Evaluation of the ALBM ATD Prototype Version 1.2: Knowledge Base Assessment of the Avenue of Approach Comparison Tool. ARI Research
(Continued)

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE
--

13. ABSTRACT *(Maximum 200 words)*

This report documents subject matter experts' assessments of the usability of the Location Analysis Applications (LAAs), a module of the AirLand Battle Management (ALBM) Advanced Technology Demonstration (ATD) decision aid prototype version 1.2. This is one of a series of assessments of the ALBM ATD prototype conducted during its development. The LAAs include 19 automated terrain analysis applications to assist in the analysis of the area of operations for Army division-level tactical planning. Four applications were rated highly or rather usable and 4 were rated as unusable, with the remaining 11 falling between rather usable and somewhat unusable. Specific recommendations for improvements are provided.

14. SUBJECT TERMS
Command and control
ALBM ATD
Tactical planning aids
Decision aids
Decision aid evaluation
Knowledge base assessment

15. NUMBER OF PAGES
76

16. PRICE CODE
--

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

U.S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction of the Deputy Chief of Staff for Personnel

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Research accomplished under contract
for the Department of the Army

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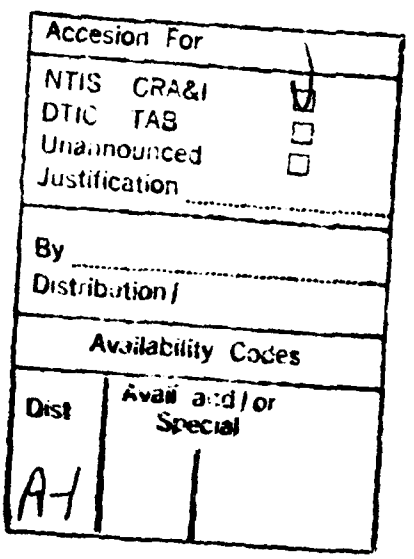

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11. SUPPLEMENTARY NOTES (Continued)

Product 94-09. Contracting Officer's Representatives, Jon J. Fallesen and Sharon L. Riedel

FOREWORD

This document contains the results of an early assessment of the Location Analysis Applications, a module of the AirLand Battle Management (ALBM) Advanced Technology Demonstration (ATD) prototype, version 1.2. ALBM ATD is a program to develop decision aid prototypes to support Army division-level tactical planning. This assessment is one of a series of life cycle assessments of ALBM ATD being conducted by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) during the development of the system. The results will be used by the developer and government sponsors of ALBM ATD to guide further development of the system.

The research was conducted under the ARI research task entitled "Support for Command Control Research." The assessment was in support of the Combined Arms Command (CAC), the program's user representative. A Memorandum of Agreement was in effect with the Combined Arms Combat Developments Activity, "Development and Implementation of the Future Battle Laboratory," dated 30 June 1989. The results of this review were briefed to personnel from the Battle Command Battle Laboratory, Combined Arms Command; Communications and Electronics Command; Lockheed; and MITRE on 7 January 1993. Brigadier General Anderson, Deputy Commanding General for Combat Developments, Combined Arms Center, was briefed on the findings presented in this report on 25 January 1993.

EDGAR M. JOHNSON
Director

EVALUATION OF THE AIRLAND BATTLE MANAGEMENT ADVANCED TECHNOLOGY DEMONSTRATION PROTOTYPE VERSION 1.2: KNOWLEDGE BASE ASSESSMENT OF THE LOCATION ANALYSIS APPLICATIONS

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EVALUATION OF THE AIRLAND BATTLE MANAGEMENT ADVANCED TECHNOLOGY DEMONSTRATION PROTOTYPE VERSION 1.2: ASSESSMENT OF THE LOCATION ANALYSIS APPLICATIONS

Summary

In this assessment, subject matter experts (SMEs) judged the usability of the Location Analysis Applications (LAAs), a component of the AirLand Battle Management Advanced Technology Demonstration (ALBM ATD). The study was performed as a part of the Army Research Institute's (ARI) support of the Battle Command Battle Laboratory.

Six SMEs participated in individual assessment sessions. Following a description of the LAAs by the evaluator, SMEs completed a written questionnaire. In addition, SMEs were encouraged to ask questions and make verbal comments that were recorded and used in subsequent data analyses.

Nineteen LAAs were evaluated for their operational usability. The results from this study showed that

- four applications were rated highly or rather usable,
- four applications were rated rather usable to borderline usable,
- seven applications were rated as having borderline usability,
- four applications were rated as unusable.

SME suggestions for improvement stressed consistent presentation of legends with clear definitions of displayed data, clearer delineation of multiple features being displayed, and increased selectivity of features to be displayed. The SMEs felt that if these suggestions were implemented, the overall usability of the applications would increase considerably.

It is concluded that 4 of the 19 LAAs are usable in their current form, although improvements would be worthwhile. An additional 11 applications would be usable if suggested improvements were made to the LAA functions. It is recommended that LAA functions be improved before being provided to units for operational use.

Introduction

Overview

This report documents one of six assessments of version 1.2 of the Airland Battle Management (ALBM) Advanced Technology Demonstration (ATD) prototype conducted by the U.S. Army Research Institute (ARI). The assessments are part of a set of life cycle evaluations being conducted on the ALBM ATD prototype as it is being developed. The purpose of the life cycle evaluations is to provide user and subject matter expert feedback to the government sponsor and contractor developer in order to guide the design and development of the system and to provide information for management decisions. In this way, it is hoped that the final operational system will have capabilities that will improve user performance.

The six assessments conducted on the version 1.2 prototype include knowledge base reviews of four applications, a human factors assessment of the interface, and a user and SME review of demonstrated prototype capabilities. In addition to this report, these assessments are documented in separate ARI reports (Flanagan, 1993; McKeown, 1993a; Riedel, McKeown, Flanagan, & Adelman; Rappold, & Flanagan 1993; Riedel, Flanagan, Van Hemel, & Rappold, 1993). This report contains the results of an early review of the Location Analysis Applications, one module of the ALBM ATD prototype.

Description of ALBM ATD

ALBM ATD is a Training and Doctrine Command (TRADOC) and Army Materiel Command (AMC) program. Its purpose is to develop decision aid prototypes based on advanced technologies and transition them to the Army Tactical Command and Control System (ATCCS). The decision aids are intended to support corps, division and brigade level commanders and their staffs in tactical planning operations. The Communications and Electronics Command at Fort Monmouth is responsible for the overall management of the program; the Combined Arms Command, Combat Developments at Fort Leavenworth is the users' representative responsible for functional requirements, knowledge elicitation with subject matter experts, and the operational evaluations; and the Program Executive Office for Command and Control Systems (PEO-CCS) is responsible for integration with the Army Tactical Command and Control System (ATCCS).

Two Force Level Control (FLC) Advisors are currently under development as part of the ALBM ATD system - MET4 and FITE. MET4 (Mission, Enemy, Terrain, Troops and Time Available Applications) is intended to aid commanders and their staffs from brigade through corps to analyze the area of operations and to assess the enemy and friendly capabilities. FITE (Force Interactive Tactical Evaluator) interacts with MET4 to aid commanders and their staffs to develop, wargame, and compare COAs.

MET4 has four basic components.

- Battlefield Area (BA) Component assists commanders and staff to analyze the terrain and develop and analyze avenues of approach.

- The Enemy and Situation Capabilities (ESC) Component interacts with the other MET4 components to aid commanders and staffs to anticipate enemy operations. Its principal focus is on probable enemy courses of action.

- Friendly and Situation Capabilities (FSC) Component interacts with other MET4 components to assist commanders and staffs to analyze missions received from higher headquarters to assess the friendly situation and to determine the general ability of the unit to accomplish its assigned mission. The focus is on projecting friendly unit readiness and capabilities.

- The Execution Monitor (EM) Component interacts with ATCCS components, FITE, other MET4 components, and other decision aids to aid commanders and staffs to monitor current operations. It alerts commanders and staffs when the current operation deviates from the Operations Order (OPORD), aids commanders and staffs to determine when orders should be issued to implement new phases or branches provided for in the current plan, and when modifications of the current plan or replanning are necessary.

The second ALBM ATD module, FITE, interacts with MET4 to aid commanders and staffs to develop, wargame, and compare Courses of Action (COAs). It also aids commanders and staffs to properly synchronize operations of subordinate and supporting units in order to concentrate combat power at the critical place and time to accomplish the commanders intent. Its principal focus is on COA development, preparation of the COA sketch, COA analysis (wargaming) and comparison, and on an execution synchronization matrix.

Description of Location Analysis Applications

The set of LAAs a component of MET4. It contains the following terrain analysis applications:

Terrain Overlays for
- Elevation Bands
- Vegetation
- Drainage
- Obstacles
- Surface Configuration
- Surface Materials
- Transportation

- Cross Country Mobility
- Cover (26-50%, 51-75%, 76-100%)
- Mobility Arrows

Query for Line-of-Sight

Query for Distance Along a Path
Query for Elevation at a Point
Location Analysis (i.e Tactical Assembly Area)
Query for Terrain Attributes (points and areas)
Query for Built-up Area
Query for Slopes > 10%
Query for Dense/Old Forest
Query for NO-GO Gaps

Appendix B contains screen images of these applications.

Assessment

It is beyond the scope of this study to evaluate the completeness and accuracy of the data bases which provide the 19 LAAs (i.e., the Engineering Topographic Laboratory (ETL) and the Defense Mapping Agency (DMA) data bases). Also, there are no algorithms for processing the data; rather, the data are extracted from the data bases for graphic presentation to the user. Therefore, a single key issue was used to evaluate the nineteen LAAs:

Is the module usable, in terms of information content and format?

This study involved obtaining, recording, and analyzing feedback from SMEs on the current usability of LAAs. The procedure for conducting the study centered on obtaining reactions to the existing application, rather than on obtaining suggestions on how LAAs should function. There was no attempt to elicit design suggestions, although some were volunteered and recorded during the study. As a result, this study present problems, deficiencies, and omissions in the functionality of LAAs, without always presenting approaches for overcoming these problems. It is hoped that system engineers and system designers will be able to review the results contained herein, and develop appropriate enhancements or corrections to the current design of the LAAs.

Method

Subject Matter Experts

Six subject matter experts participated in the assessment. They had the following qualifications:

- Rank of Major or Lieutenant Colonel.
- Worked regularly in a division G2 section.
- Performed Intelligence Preparation of the Battlefield and Terrain Analysis functions at division/corps level.
- Graduated from the Command and General Staff Officer Course (CGSOC).
- Possessed a working familiarity with FM 5-33, "Terrain Analysis", July 1990; FM 34-130, "Intelligence Preparation of the Battlefield", May 1989; and ST 100-9, "The Command Estimate Process", Chapter 7, "Intelligence Preparation of the Battlefield", July 1992.

Appendix D describes the individual SMEs in more detail.

Documentation of LAA Procedures and Products

Descriptions of the LAA procedures and products were obtained from Software User's Manual for the ALBM ATD Force Level Control Advisor System (Lockheed, 30 May 1992), examination of LAA displays and features, and personal communication with developer personnel.

Materials

Briefing materials and questionnaires were developed as part of this study. The briefing materials provided a uniform, repeatable presentation to the SMEs (see Appendix A). They include an explanation of the ALBM ATD program, the role of this study within the ALBM ATD program, and an overview of the nineteen LAAs.

To illustrate the LAAs process, color prints of the ALBM ATD workstation screen were obtained showing the various LAAs (see Appendix B for black and white versions of the color prints). Color prints were used in lieu of the actual workstation to separate the soldier-machine interface function and system performance aspects of the ALBM ATD system from the underlying usability of each application. In this way, biases regarding other functional aspects of the ALBM ATD system would not influence the results of this study.

A questionnaire was developed based on the key issue identified earlier. The questionnaire required ratings of each

application, and invited written comments. Also, a questionnaire was developed to obtain demographic information on each SME, and a release form was signed by each SME regarding video-taping of the session and participation in the study. These materials are contained in Appendix C.

Procedure

This study was conducted in combination with a knowledge base assessment of a related ALBM ATD module, AA Generation (see McKoewn, 1993). Each participant took part in both assessments. The LAA assessment was conducted after the AA Generation assessment and took approximately 1 to 1½ hours to complete. All sessions were conducted at the ARI Field Unit Laboratory at Fort Leavenworth, Kansas.

The following is a chronological listing of activities performed during each session.

- Description of the laboratory and building facilities.
- Release form (see Appendix C) regarding participation in the study and video-taping of the session administered. Demographic questionnaire administered.
- Presentation of briefing (see Appendix A) explaining the study purpose, doctrinal background, and overview of LAAs. Questions and comments made by the SME are recorded manually by the researcher.
- Presentation of color prints of each application (see Appendix B), which illustrate the knowledge base of AA Generation. Questions and comments from the SME are recorded manually by the researcher.
- With the color prints of the application available, the SME completes the Usability Questionnaire. Questions and comments from the SME are recorded manually by the researcher.

Data Analysis

Due to the limited number of SMEs available for this study, no statistical analyses were performed on the data. Instead, responses were analyzed to assess the SME's subjective appraisal of the LAAs in ALBM ATD.

Comments concerning the LAAs' function as a whole were treated separately in the analysis. Verbal comments duplicating a written comment by the same SME were discarded. Verbal and written comments that exactly or closely replicated comments made by another SME were retained and categorized to indicate a degree of consensus on a topic.

Results

The data were compiled and categorized to facilitate analysis and clear presentation of results. The results consist of usability ratings of each of the nineteen LAAs, comments that apply generally to all of the LAAs, and comments that pertain to individual LAAs.

Usability Ratings

Included in Appendix E are SME ratings of the LAAs plus written and verbal comments. Examination of this data shows the degree of consensus by the SMEs on the usability of the LAAs. For fifteen of the LAAs, the consensus was good. Four of the LAAs had ratings that were not consistent. These four LAAs are:

- Slopes over 10%,
- Dense/Old Forest,
- Built-up Areas, and
- Terrain Attributes in an Area.

To summarize the relative usability of the LAAs, a mean rating was calculated for each application. These mean ratings are shown in the form of a horizontal bar graph in Figure 1, ordered from the most usable to the least usable LAAs. The horizontal lines in Figure 1 represent LAAs in terms of perceived usability.
As can be seen, applications with mean ratings of rather usable or higher were:

- Distance Along a Path
- Elevation Bands
- Elevation at a Point
- Cross-Country Mobility

The NO-GO Gaps application was rated the lowest with a mean score less than Somewhat Unusable.

General Suggestions

This section provides a summary of data collected from SMEs that applies to a broad range of applications.

Legend with Description. Many of the current displays have legends, but several do not. All SMEs wanted legends on all displays. They felt that many of the current legend descriptions were vague or missing. Many of the legend displays were large, tending to obliterate the overlay.

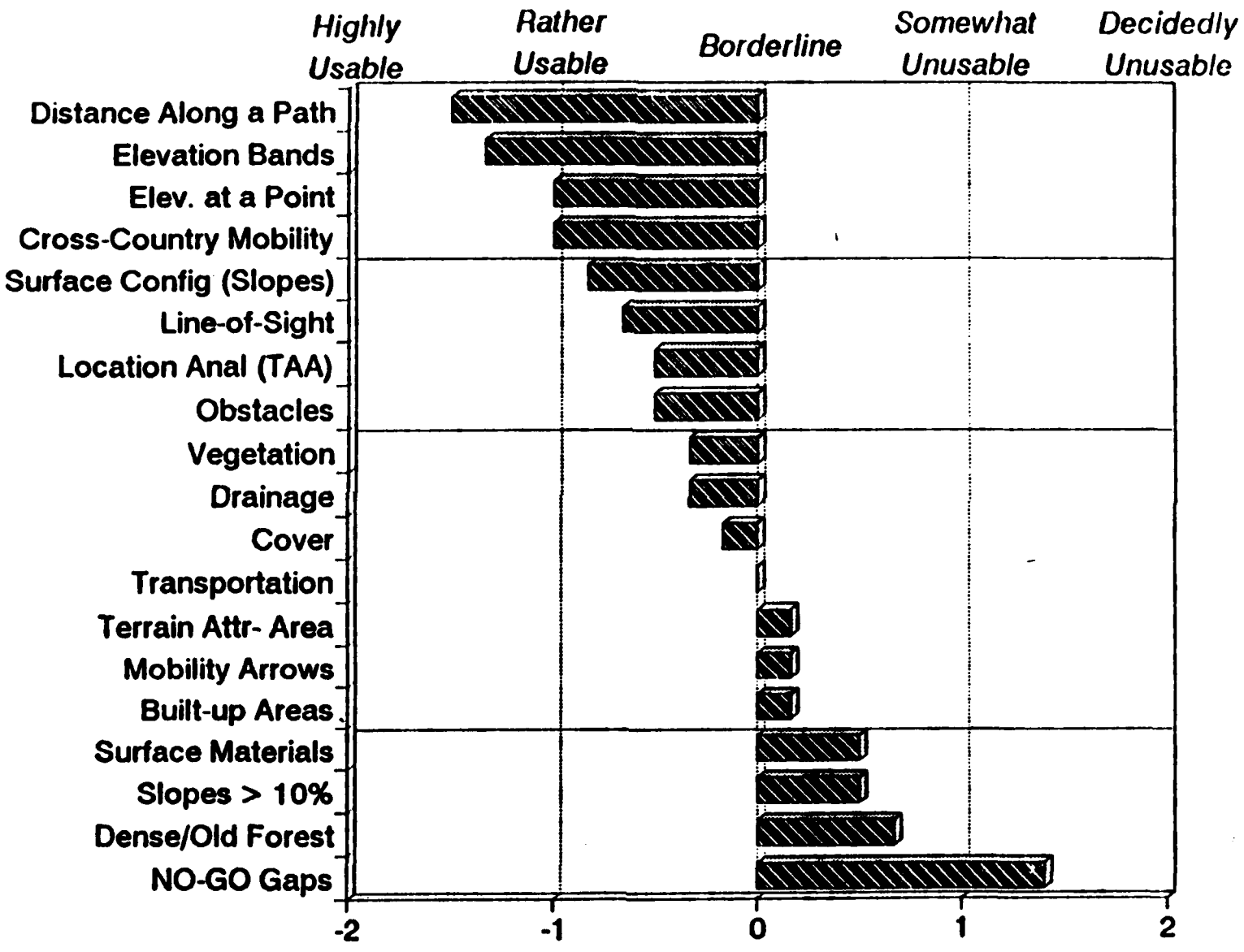

Figure 1. Mean usefulness ratings of Local Analysis Applications.

Outlining of Polygons. Some of the displays consist of areas filled with a pattern, without a perimeter boundary. Some of the colors and patterns were difficult to distinguish, particularly when viewed over the background EMAP. The SMEs felt that displaying terrain attributes with translucent colors and then outlining the areas would be preferable to the current display.

Selectivity of Display Features. Many of the displays contain multiple features (e.g., the transportation network which contains several classes of roads, the vegetation overlay which includes several forms of vegetation). The SMEs wanted the ability to select which of those features to include in the display. For example, the user may want to display only the high-speed and secondary roads, but not forest trails. Similarly, the user may want to display only slopes of 30% - 45%, and over 45%, without displaying any of the other slope bands.

Ability to Easily Distinguish Between Multiple Features. The SMEs felt that many of the displays were presented in a fashion that made it hard to discern the differences between multiple features contained in one display. It was suggested that use of translucent colors would improve the ability to distinguish different features. If translucent colors were not possible, then solid colors with the ability to toggle the overlay on and off would be acceptable. Also, the ability to quickly click with the mouse on a feature (i.e., without going through menus) and receive a short description of the selected feature was suggested for inclusion in the system.

Combining of Applications. The SMEs suggested that certain overlays should be logically combined. The example given was the Obstacle overlay, which should be combined with the Drainage and Built Up Areas overlays since they all are tactically related in terms of restricting movement. Currently, this combining can be accomplished by requesting simultaneous display of the three overlays. The SMEs, however, felt that the tactical similarity of the three overlays warrants them being requested with a single request, as long as the capabilities for selectivity and the ability to distinguish different features discussed previously were available.

Use of Tactical Terminology. The SMEs generally felt that too much interpretation was necessary in using the applications. The terminology is oriented towards that data base, rather than the tactical use of the data. For example, the SMEs thought of Surface Configuration as slopes, and thought Dense/Old Forest must have something to do with tree diameter and spacing, but they weren't sure.

Suggestions for Specific Applications

Many suggestions were made that were specific to each application. These are noted below in the order of perceived usability shown in Figure 1. (Note that the general suggestions

described above are not repeated in the following paragraphs.) Also provided below is the rating scale given for each application and a breakdown of how it was rated by the six SMEs. Sample screen images of each application are given in Appendix B, and are referenced as a figure. For purposes of reference and orientation, the first figure in Appendix B, Figure B-1, shows the background EMAP without any of the LAAs being displayed.

Distance along a path.

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
3	3			

A screen image was not used to explain this application; rather, it was described verbally to the SMEs. The user requests the "Distance" function, clicks with the mouse to create a multi-segment line, and clicks with the right mouse button when complete. At that time, the total distance of all segments in the line is shown in kilometers at the top of the display window.

Two SMEs suggested that the user should have the ability to hold down a mouse button and "drag" the cursor along a curved path, similar to some PC paint programs. The distance would readout dynamically, like the current Lat-Long/UTM/Elevation readout. One of the SMEs also suggested that the distance be displayed in kilometers, miles, and nautical miles, for interoperability with other services and systems.

Elevation Bands (See Figure B-2).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
2	4			

This application was the one that elicited the most comments about use of translucent colors, rather than solid colors that totally cover the background EMAP. Adding contour lines would greatly improve the usability of the display. One SME also asked that the high points or hill tops be denoted graphically within each displayed elevation band.

Elevation at a Point (See Figure B-3).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
1	4	1		

One SME suggested that the unit of measurement (i.e., meters) be added to the elevation display. There were suggestions for two additional options (1) to shorten the display to just the grid square letters and either 6 or 8 digits (e.g. MC 942 200, versus 32U MC 94219 19953) and (2) to display a marker and the elevation value at the cursor position such that a series of elevation readouts could be simultaneously shown on the screen (e.g., o 312).

Cross Country Mobility (See Figure B-4).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	6			

Because the user would be highly unlikely to display both the wet and dry CCM overlays simultaneously, it was suggested that a separate legend be supplied for each separate CCM overlay. Also, since the wet CCM overlay contains so much SLOW-GO area, it was suggested that only the NO-GO be displayed, or that the feature selectivity discussed previously be available. Another comment dealt with the limited data base currently available. At other times of the year, weather conditions, such as snow and freezing temperatures, may result in different mobility results than is currently available.

Surface Configuration (i.e. Slopes; See Figure B-5).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	5	1		

The SMEs wanted the different categories of slopes to be tactically significant, and the legend to reflect that significance as well as the percentage of slope. For example, show slopes that are not passable by M1's, M113's, and 2½ ton trucks.

Line of Sight (See Figures B-6 and B-7).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
1	2	3		

The SMEs felt that, in many instances, a Line-Of-Sight (LOS) display with a limited arc (i.e., in a specified direction) would be adequate. It would reduce both processing time and display clutter. Options should be provided to consider vegetation (i.e., on a seasonal basis) in the algorithm, and to include electronic LOS. One SME felt the button that selected display of masked or unmasked areas was confusing. He suggested having two radio buttons labeled something like "visible" and "not visible."

Location Analysis (i.e., Tactical Assembly Area; See Figure B-8).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	3	3		

There were a variety of suggestions for this application. It was generally felt that too much data was presented at once, and that selectivity of features displayed was necessary as discussed previously. The legend should be oriented towards the graphic display, and the checklist of other considerations currently in the legend should be separated for clarity, possibly in the Operational Help display. It was also suggested that the application should scan the available data, and display recommended areas. Another suggestion was that the application should be restricted to a defined area similar to the query for terrain attributes in an area, rather than filling the entire window.

Obstacles (see Figure B-9).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	4	1	1	

The SMEs felt this application should be combined with built-up areas and drainage (i.e., hydrology), as well as including tactical obstacles. This would present a more complete picture of specific restrictions to movement, other than CCM. It was suggested that standard tactical symbols be used to

differentiate the types of obstacles, and that amplifying information on a specific obstacle be available as a query.

Vegetation (see Figure B-10).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	3	2	1	

It was suggested that there are too many categories presented, and the differentiation between the categories was vague. The SMEs also suggested that the categories be reduced and the display organized for tactically significance. For example, the presentation of sparse forest and dense forest should be in terms of relative vehicle mobility in those areas.

Drainage (see Figure B-11).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	2	4		

SMEs thought that the standard map color for water, "blue", should be used rather than red. They also wanted more hydrology information, particularly regarding the ability to ford streams. Areas that are unfordable should be highlighted or separately displayed. One SME felt the application was not usable without accounting for varying amounts of precipitation. The unfordable areas are restrictions to movement, and the SMEs felt it should be combined with the Obstacles display.

Cover (see Figure B-12).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	2	3	1	

The terminology for this display is not appropriate. The SMEs recommended calling this display "Concealment," rather than "Cover." The SMEs suggested that options be added to account for seasonal variations in canopy closure.

Transportation (see Figure B-13).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	1	4	1	

SMEs thought this display could be improved considerably by providing a better distinction of the various classes of roads. They also desired the addition of bridges with classification and rail nets.

Terrain Attributes in an Area (see Figure B-14).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	2	2	1	1

SMEs liked the general idea of this query, but wanted it implemented differently. Only data desired by the user should be displayed, rather than all data in the area. Also, it should be presented in tactical terms (e.g., fording sites, bridges and roads by classification, slopes by mobility class).

Mobility Arrows (see Figure B-15).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	2	1	3	

Generally, the SMEs thought this display was confusing and difficult to read. They suggested using different symbols (e.g., parallel lines with varying gaps between the lines to indicate the mobility by different force echelons). One SME thought the display was a good application for analyzing the validity of generated Avenues of Approach.

Built-up Areas (see Figure B-16).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	2	2	1	1

SMEs suggested that differentiation of density of built-up areas be provided, and the key for those densities be included in the legend.

Surface Materials (see Figure B-17).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
		3	3	

SMEs thought the definitions for this display were too vague to be usable (e.g., rough, very rough). The definitions should be expressed in terms of mobility capability.

Slopes > 10% (see Figure B-18).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	1	2	2	1

SMEs felt this query was redundant with Surface Configuration, particularly if display selectivity is provided. They suggested that the user be able to specify the slope threshold percentage.

Dense/Old Forest (see Figure B-19).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
	1	2	1	2

The definitions for this display were too vague for the SMEs. They also felt that the display was redundant with the EMAP and Vegetation overlay.

NO-GO Gaps (see Figure B-20).

SME Ratings

Highly Usable	Rather Usable	Borderline	Somewhat Unusable	Decidedly Unusable
		1	1	3

This display appeared to be identical with the Drainage overlay, and was redundant. The title of the display was

confusing, since the SMEs thought the title referred to areas between NO-GO areas.

Other General Comments

During the course of the assessment sessions, the SMEs sometimes made comments that provided additional insight into the potential usability of the LAAs in the field. They also provided information for considering possible improvements and enhancements of the LAAs. A summary of general comments follows.

Develop Modified Combined Obstacles Overlay (MCOO). In addition to the selective display of features discussed in the previous section, one SME suggested that a capability be provided to edit the displays, retain the results of queries, and add text and additional tactical symbols (i.e., through the Overlay Editor). Then the displayed terrain data could be combined with control measure graphics to produce an MCOO.

Make Available Relative Age of Maps and Terrain Data. Two SMEs suggested that the production date of the EMAP, DMA data, and ETL CCM data be available to the user. The SMEs felt there were some discrepancies between the EMAP and some of the DMA data that may have been explained by the passage of time.

Conclusions and Recommendations

As currently implemented, eight of the LAAs were rated usable by the SMEs, and eleven were rated not usable or of borderline usability (see Table 1).

Table 1

LAAs rated as usable and not usable.

Usable	Not Usable
Distance Along a Path Elevation Bands Cross-Country Mobility Surface Configuration Line-of-Sight Location Analysis Obstacles	Vegetation Drainage Cover Transportation Terrain Attributes - Area Mobility Arrows Built-up Areas Surface Materials Slopes > 10% Dense/Old Forest NO-GO Gaps

The SMEs made suggestions that apply generally to each of the LAAs. Implementation of these suggestions would make all of the applications usable. These suggestions are as follows:

- Legends should be supplied, when missing, and the descriptions made more precise.
- Cross-hatched areas should be outlined to provide clarified feature boundaries.
- Allow the user to be able to select which features to display.
- Provide easy discrimination between features in the displays.
- Some applications are partially redundant and should be combined.
- Terms in menus and legends should reflect tactical information, not data names.

Recommendations

It is recommended that the suggestions listed in the previous section be implemented. If the ability to selectively display features is implemented, it is recommended that four of the LAAs be removed from ALBM ATD, since their features are

contained in other applications. The LAAs recommended for deletion are Built-up Areas, Slopes > 10%, Dense/Old Forest, and NO-GO Gaps.

It is also recommended that a capability be provided to edit the various LAAs displays in such a way that feature types could be suppressed, displays in certain areas could be suppressed, and displays from various LAAs could be combined into one screen display. This capability would assist the user in developing Combined Obstacle Overlays (COOs).

Finally, it is recommended that the suggestions made by SMEs pertaining to specific applications be evaluated for possible implementation.

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APPENDIX A

BRIEFING MATERIALS

ALBM ATTD Knowledge Base Evaluation
Location Analysis Tools
Introduction

- Definitions
  - ALBM AirLand Battle Management
  - ATTD Advanced Technology Transition Demonstration
- ALBM ATTD Purpose
  - Define & refine operational requirements for automated decision aids for planning
  - Develop operational prototypes for Decision Aid Applications (DAAs)
  - Facilitate transition of DAAs to ATCCS
- Purpose of Operational Evaluation of ALBM ATTD
  - To ensure the needs of the user are considered in the development of the DAAs
- Types of Operational Evaluations of ALBM ATTD

Range of Applicability
Match of Requirements with DAA characteristics
Requirements Validation
Utility
    Performance
    Usability
Knowledge Base - Procedures, algorithms, parameters
    Completeness
    Accuracy
    Adequacy

ALBM ATTD Knowledge Base Evaluation
Terrain Analysis - ST 100-9, 1992

General Process

- Identify gaps (missing) in terrain data
- **Develop terrain factor overlays**
- Integrate weather
- Combine overlays
- **Identify Avenues of Approach**
- Analyze Avenues of Approach

ALBM ATTD Knowledge Base Evaluation
Terrain Analysis, continued

Identify gaps in terrain data
Fill gaps with data from other units, imagery, reconnaissance

Develop terrain factor overlays

- Tree spacing, stem diameter
- Stream width, banks, velocity, depth
- Canopy closure, vegetation density
- Soil types
- Height of vegetation and built-up areas
- Slopes

Integrate weather

Combine overlays into GO, SLOW-GO, and NO-GO areas

Terrain Factor	NO-GO	SLOW-GO	GO
Man-made obstacles	Yes	No	No
Built-up areas	Over 500 meters wide, or not easily bypassed	Easily bypassed, or under 500 meters wide	Easily bypassed, or under 500 meters wide
Slope uphill	Over 45%	30 - 45%	Under 30%
Hard surface roads/trails (only if terrain is not open) **See Note below**	No road, and no more than 1 trail per km	Per km, 1 road, or 2 trails, or one of each	2 or more roads per km
Tree diameter and spacing	6-8 inches thick, and less than 20 ft spacing	2-6 inches thick, and less than 20 ft spacing	Under 2 inches thick, or over 20 ft spacing
Stream bank height	Over 4 ft	Under 4 ft	Under 4 ft
Stream attributes	Depth over 4 ft, or velocity over 5 ft/sec	Depth 2-4 ft	Depth under 2 ft
Elevation variation in one km	Over 200 meters	100-200 meters	Under 100 meters

Note: Except for Hard Surface Roads/Trails, if the terrain meets any of the criteria in the NO-GO column, then the terrain is NO-GO even if all other attributes are in the GO category. If the terrain is not open (e.g. restrictive tree diameter and spacing), then the existence of roads/trails may have the effect of raising the mobility of the terrain. For example, if two roads exist in an area, then restrictive tree diameter and spacing would not reduce the mobility to SLOW-GO or NO-GO.

- Determine mobility corridors

Corridors use GO terrain, avoid NO-GO areas, and occasionally use SLOW-GO terrain if necessary.

Mobility corridors are determined two echelons down from the planner's echelon.

Mobility corridors are non-directional unless slope dictates a direction.

Unit	Mob. Corr. Width
Division	6 km
Bde/Rgt	3 km
Bn	1.5 km
Co	.5 km

- Determine Avenues of Approach (AAs)

AAs are determined for the echelon below the planner, using two mobility corridors for the next subordinate echelon.

Echelon	AOA	Mob. Corridor
Corps	Division	Bde/Rgt
Division	Bde/Rgt	Bn

The two mobility corridors should not be too widely separated.

AOA	Mobility Corridor	Max. Separation
Division	Bde/Rgt	10 km
Bde/Rgt	Bn	6 km
Bn	Co	2 km

Location Analysis Overview

Terrain Overlays	Elevation	Elevation Bands
	Terrain Attributes	Vegetation
		Drainage
		Obstacles (not tactical)
		Surface Configuration
		Surface Materials
		Transportation
	Terrain Analysis	Cross-Country Mobility - Dry (NO-GO, SLOW-GO)
		Cross-Country Mobility - Wet (NO-GO, SLOW-GO)
		Cover - 26-50%, 51-75%, 76-100%
	Cognitive Map	Mobility - Dry (NO-GO, Very SLOW-GO, SLOW-GO, GO). Includes Built Up Areas.
		Mobility - Wet (NO-GO, SLOW-GO). Includes Built Up Areas.
		Mobility Arrows - Bde, Bn, Co
		Mobility Corridors - Div, Bde, Bn, Co, Plt

Queries	Elevation at a point
	Distance along path
	Line-of-Sight
	Slopes > 10%
	Dense Forest
	NO-GO Gaps
	Built Up Areas
	Terrain Attributes at a Point
	Terrain Attributes in an Area

Specialized Queries	Tactical Assembly Area
	Logistics Area
	Command Post

APPENDIX B

SCREEN IMAGES OF LOCATION ANALYSIS TOOLS

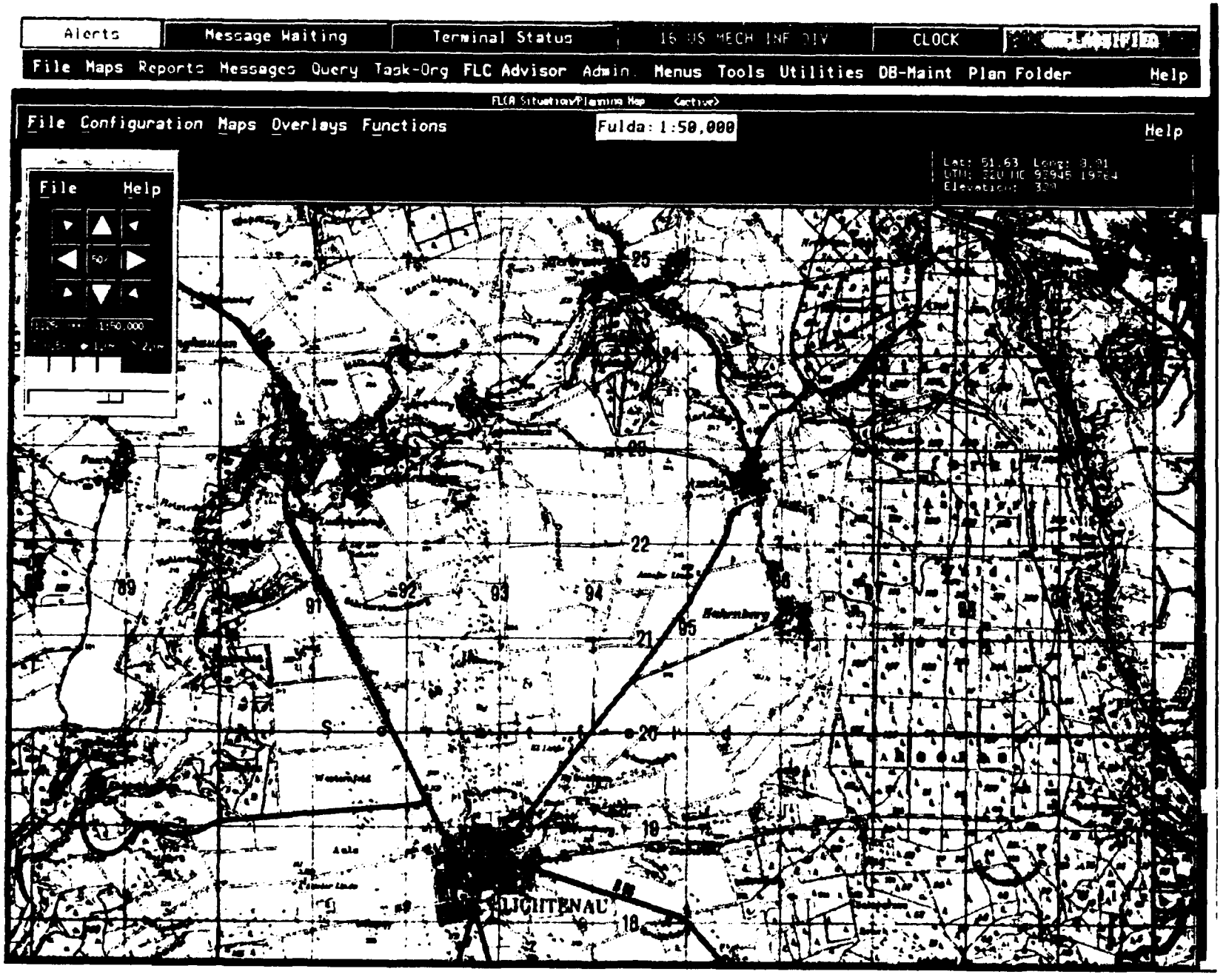

Figure B-1. Background Map.

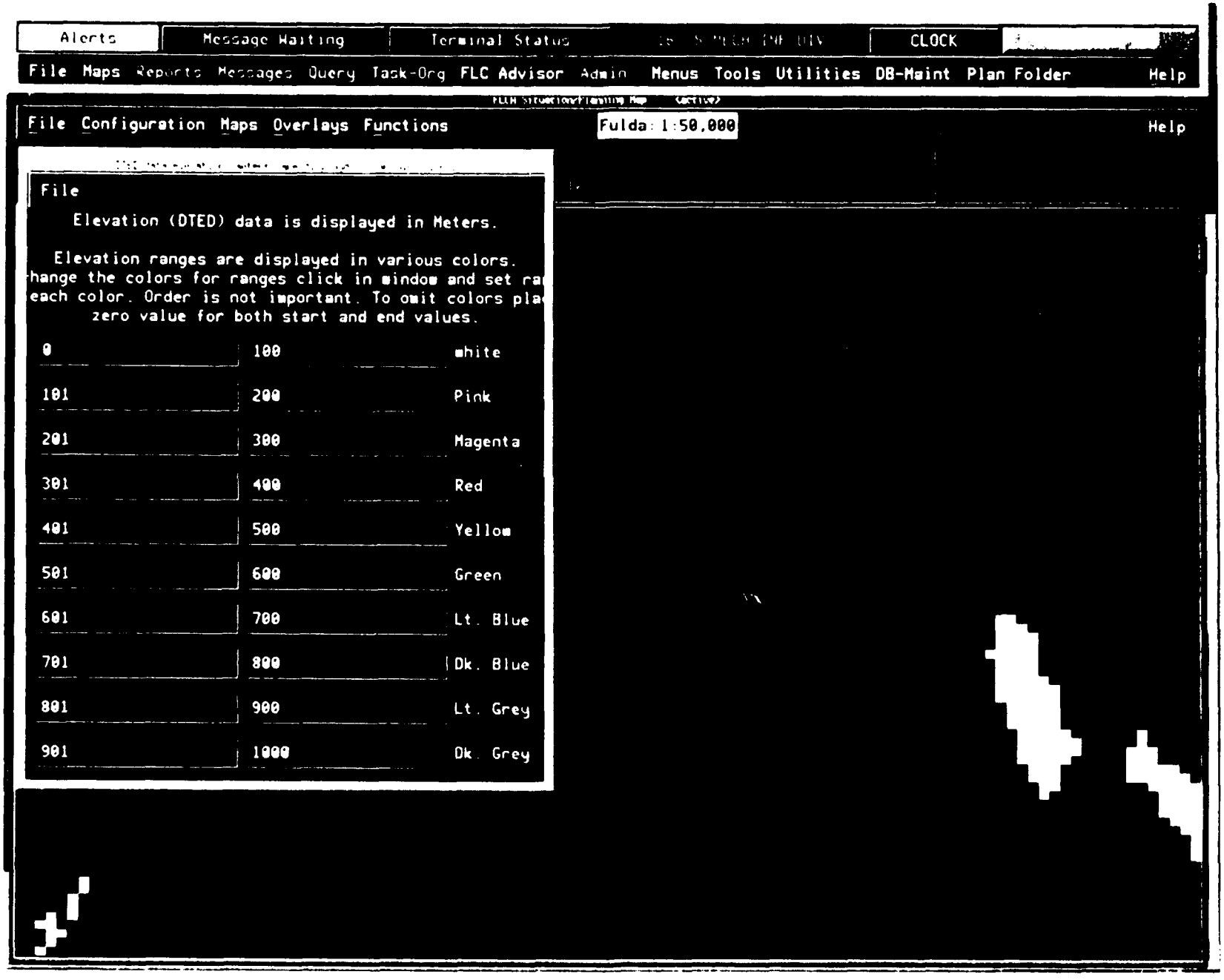

Figure B-2. Elevation Bands.

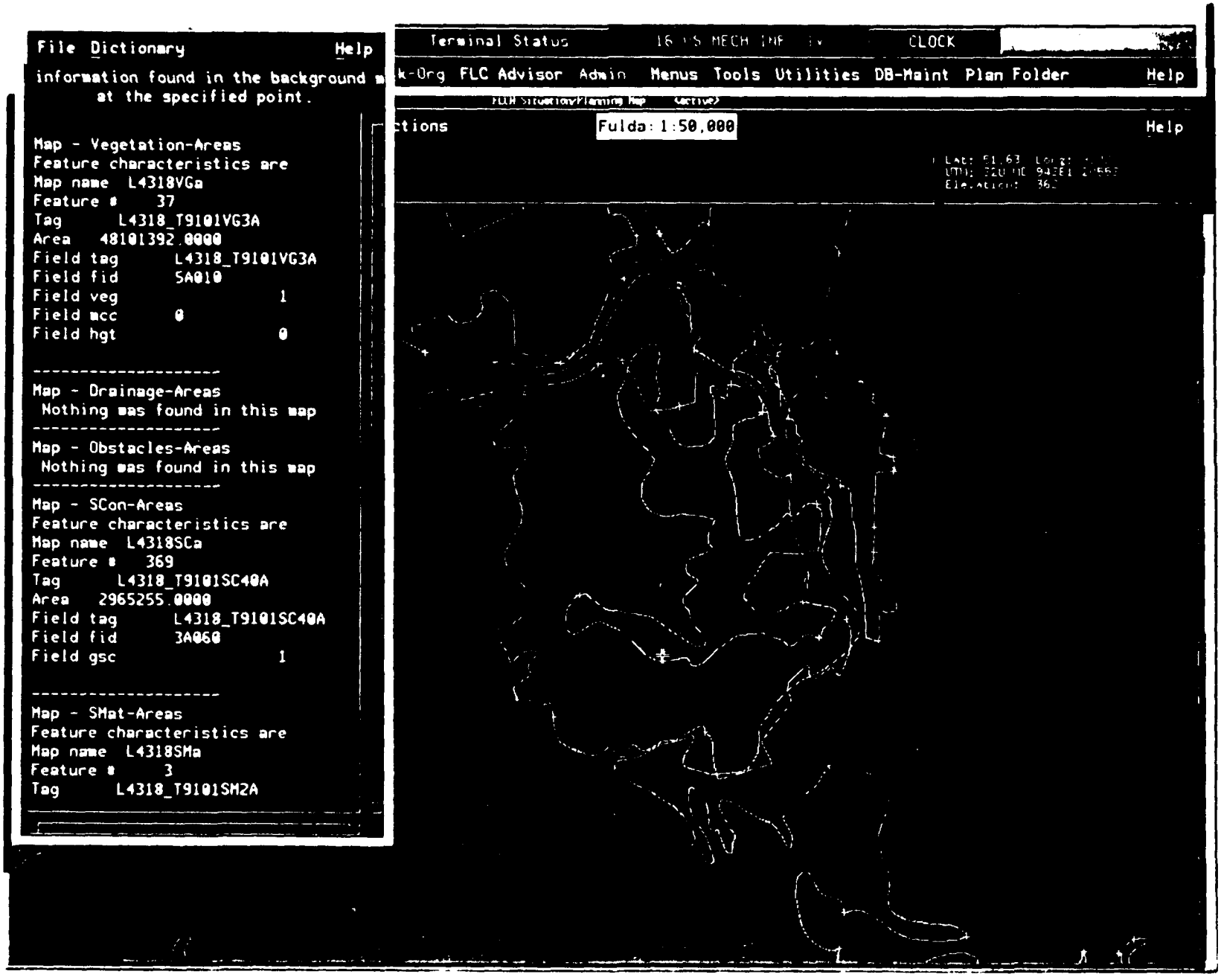

Figure B-3. Elevation at a Point.

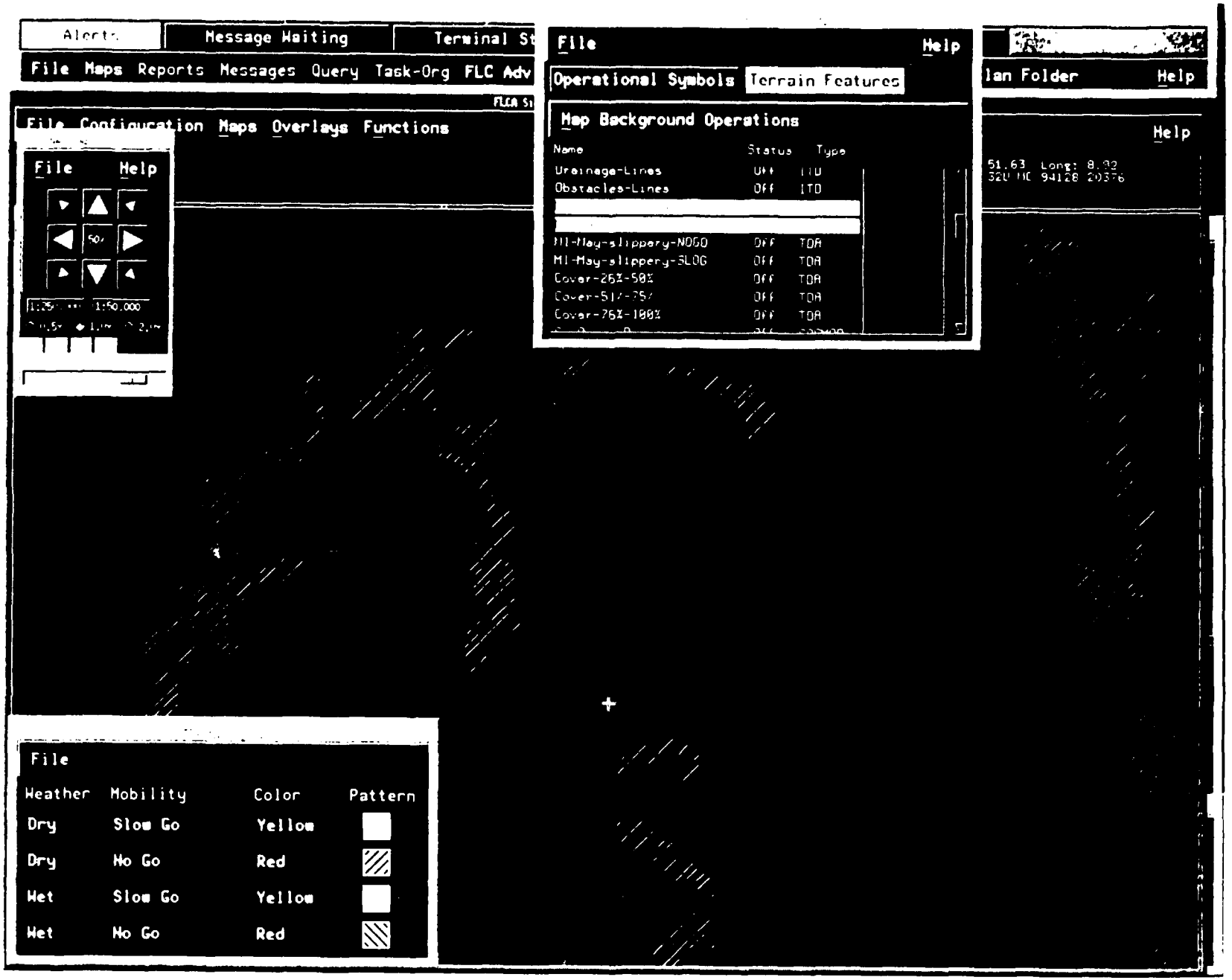

Figure B-4. Cross-Country Mobility.

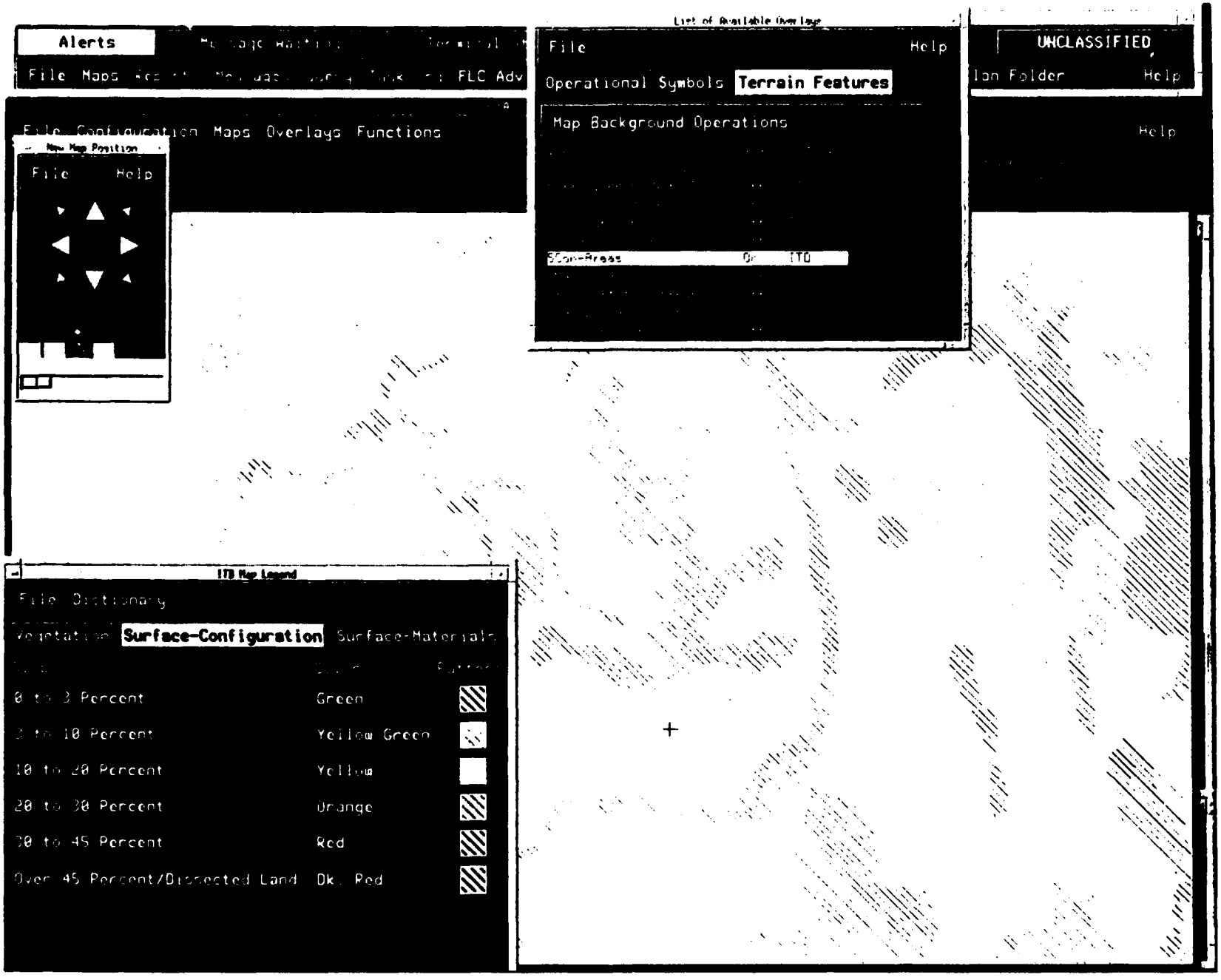

Figure B-5. Surface Configuration (Slopes).

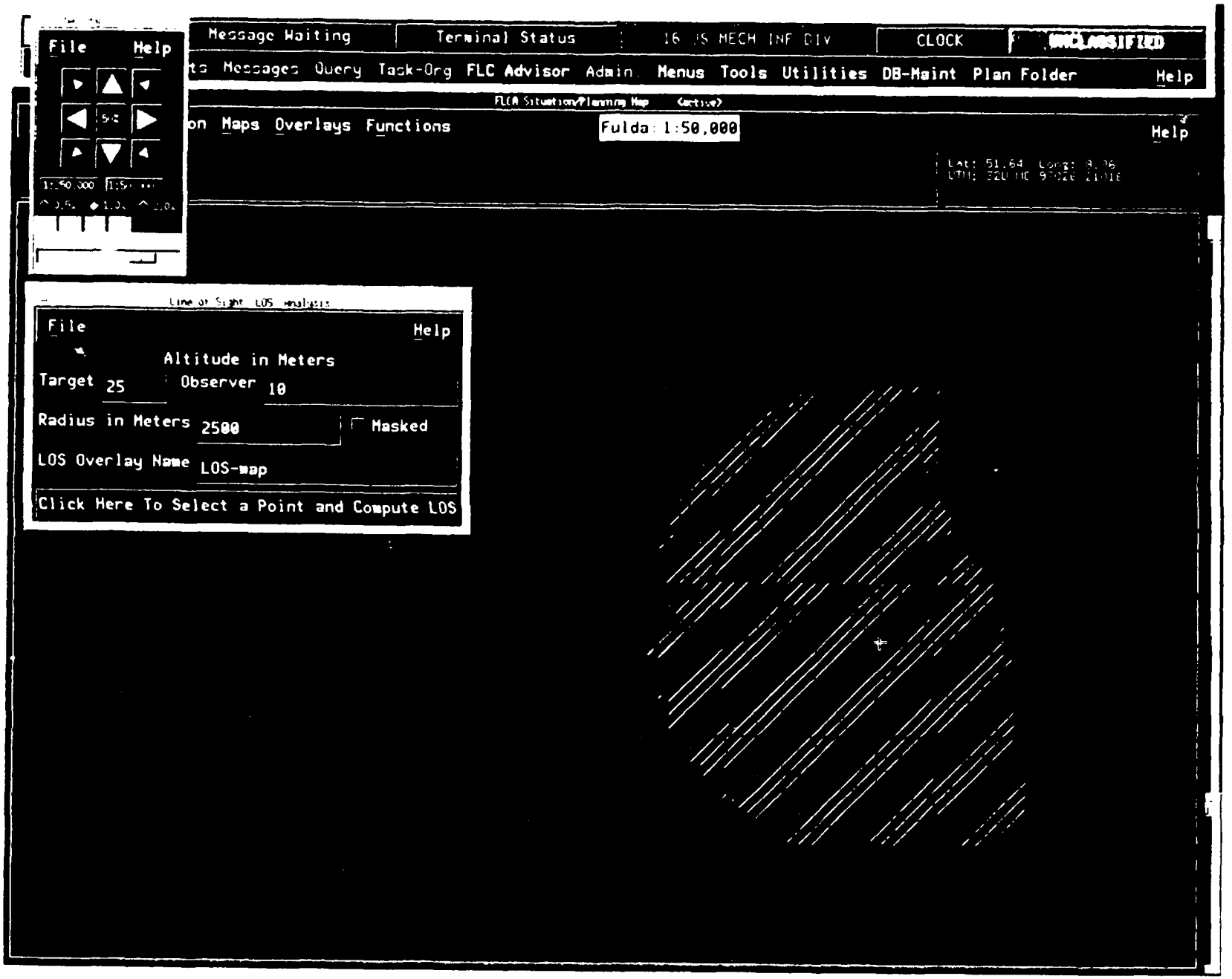

Figure B-6. Line-of-Sight, Not Masked.

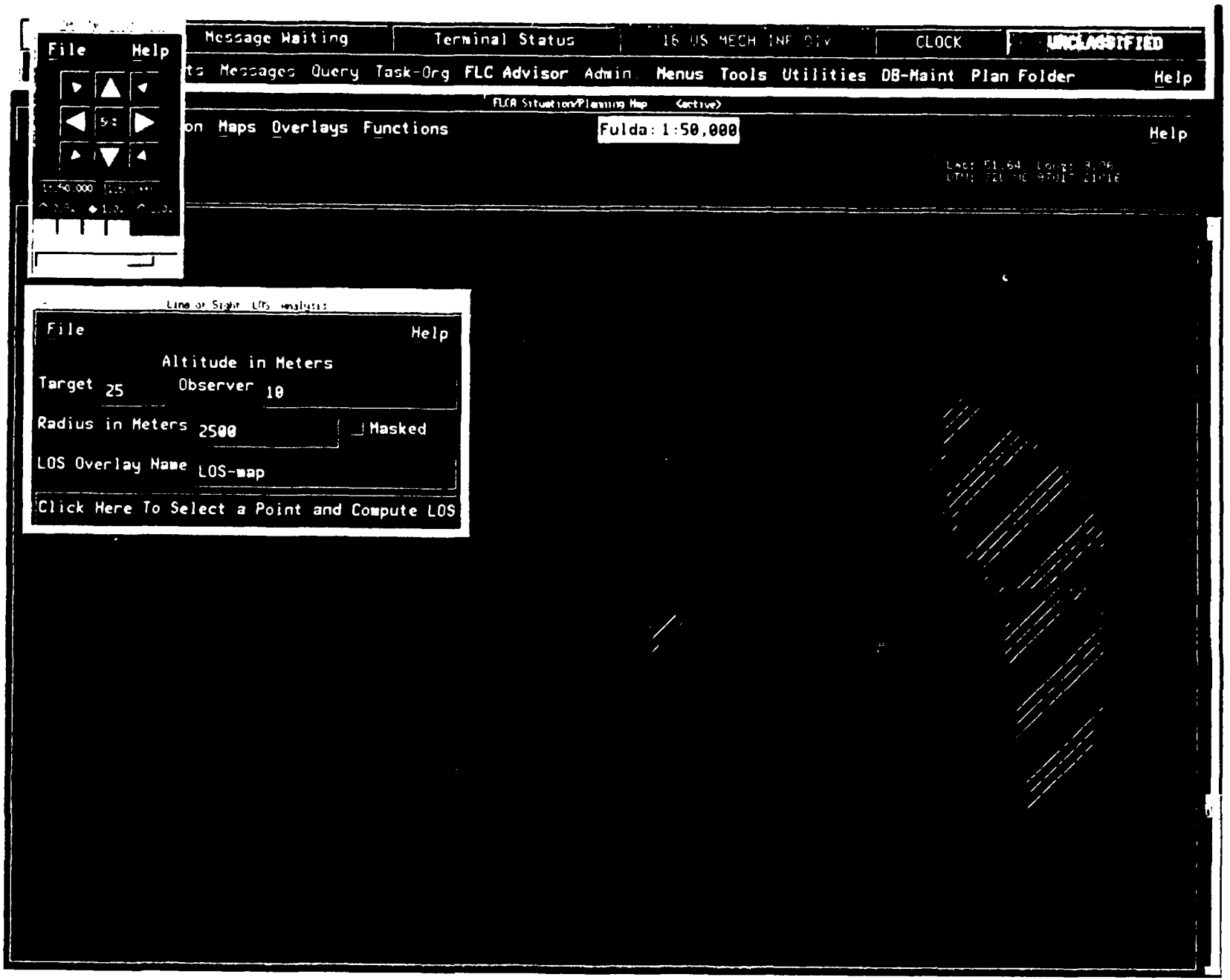

Figure B-7. Line-of-Sight, Masked.

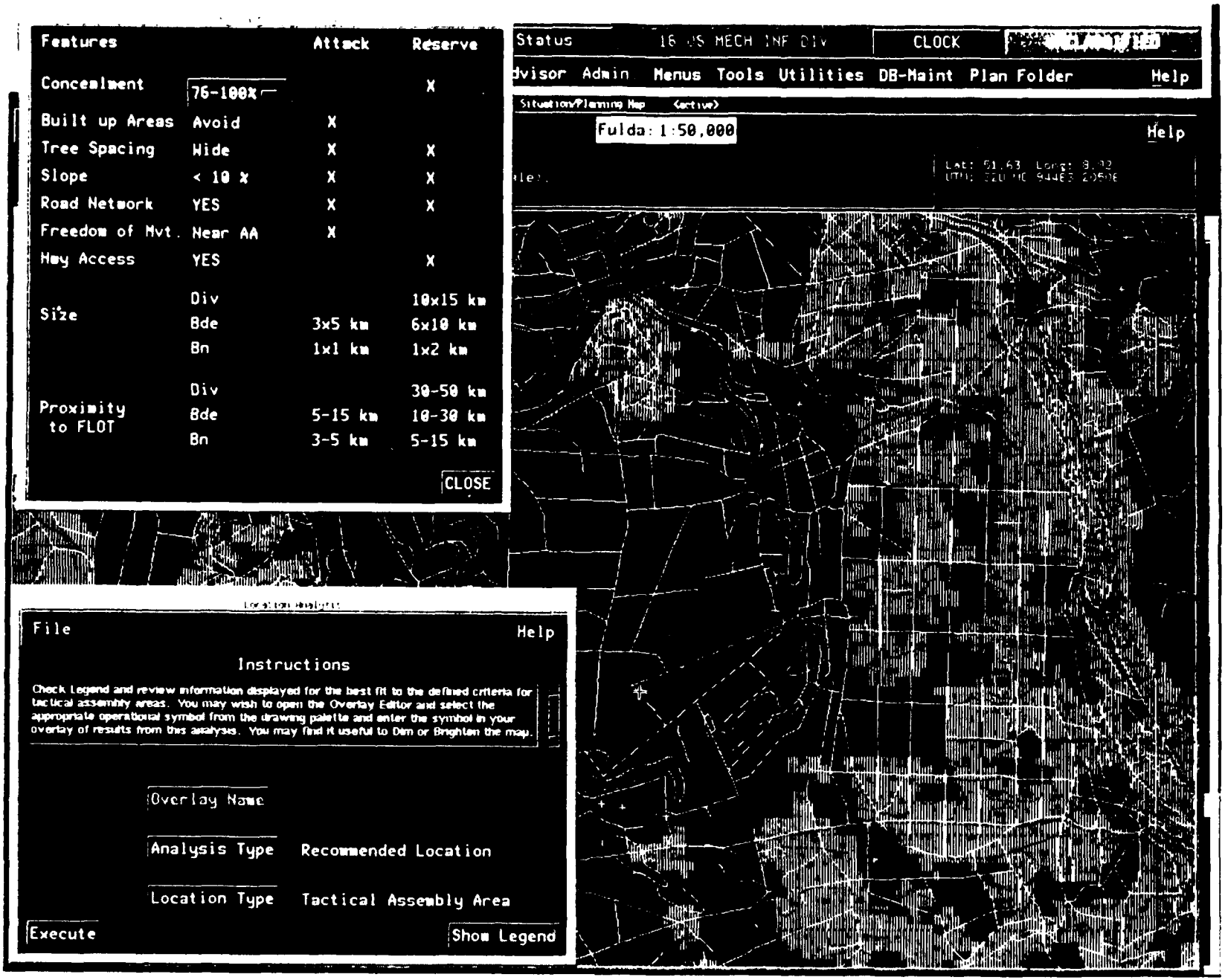

Figure B-8. Location Analysis (Tactical Assembly Area).

Figure B-9. Obstacles.

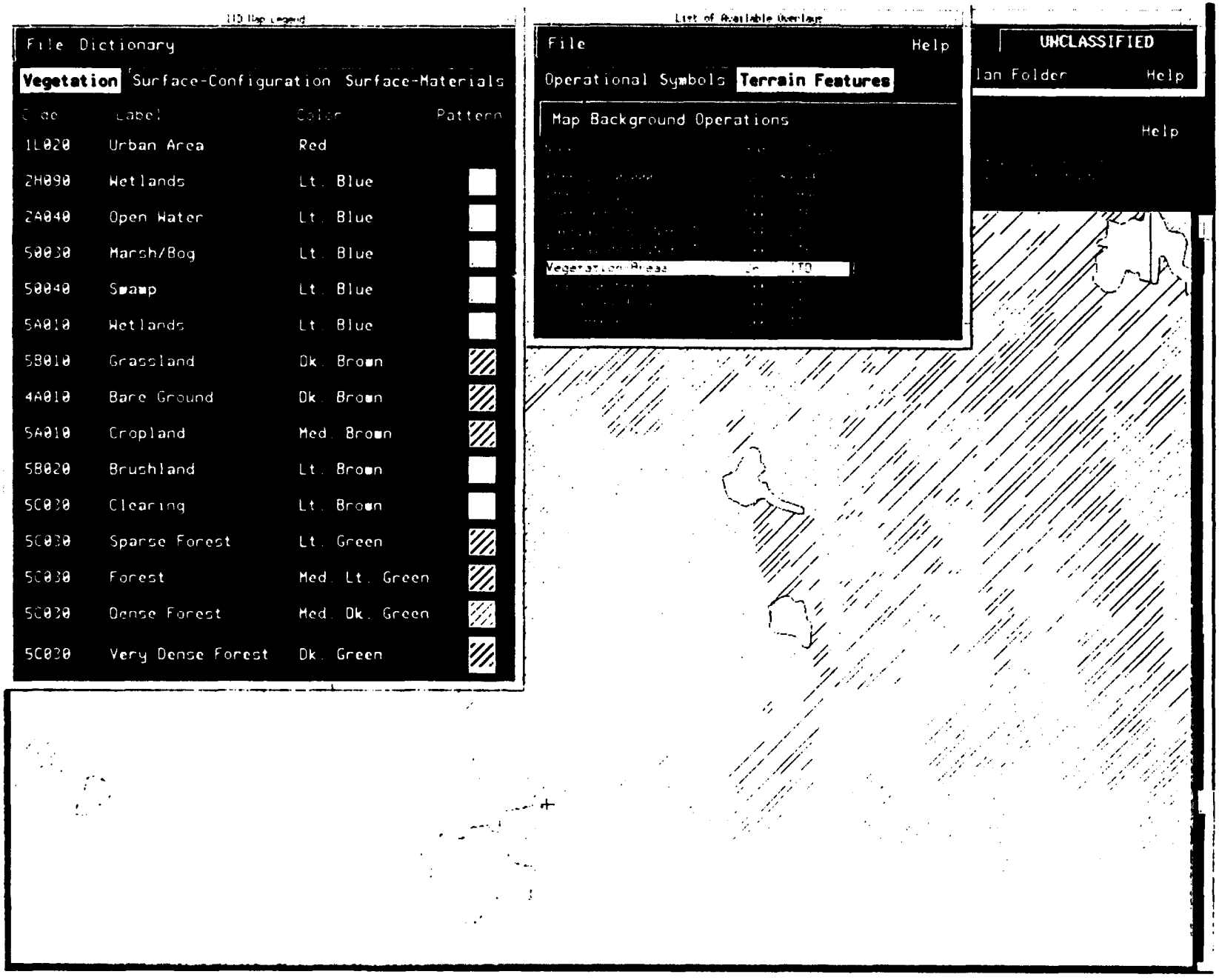

Figure B-10. Vegetation.

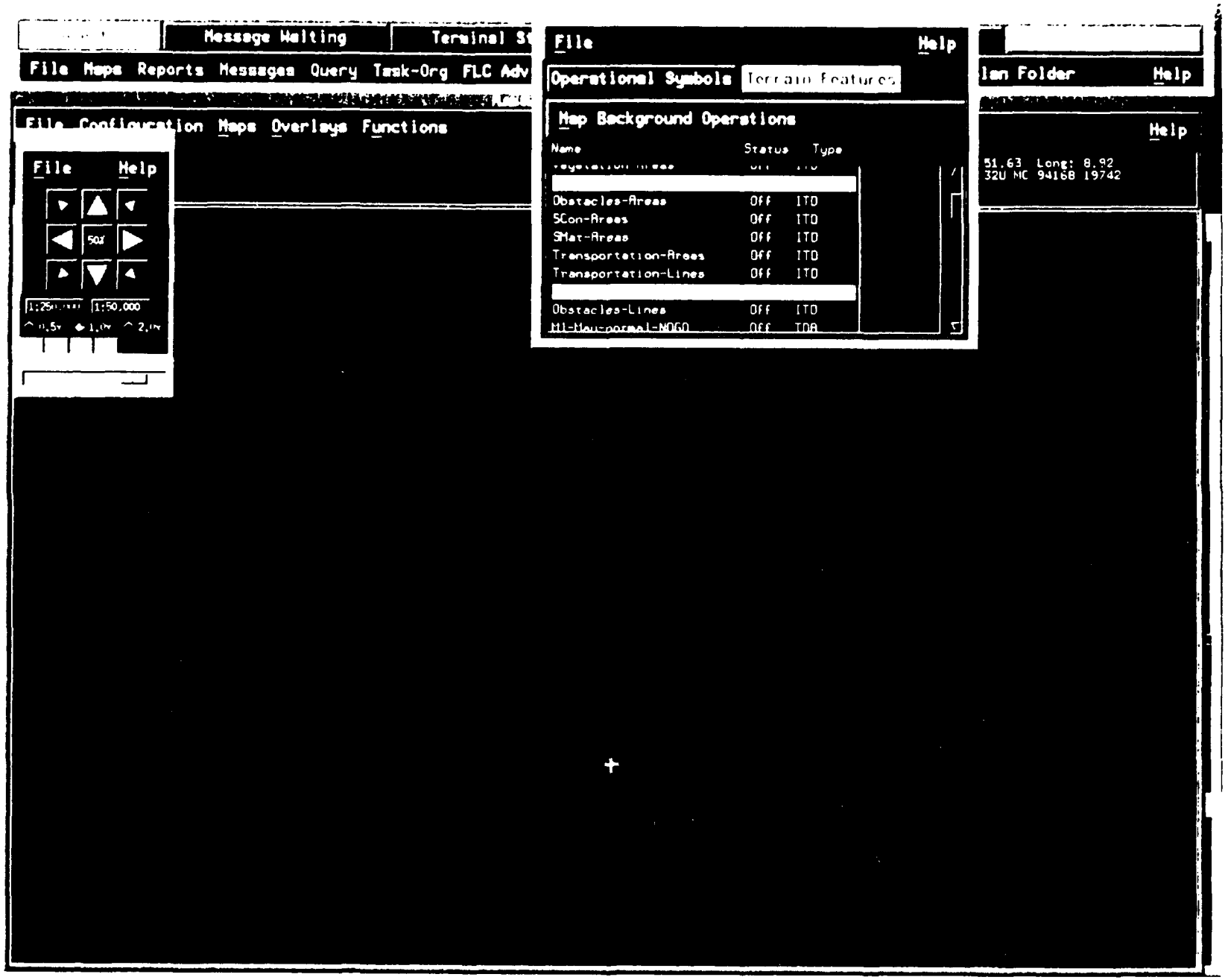

Figure B-11. Drainage.

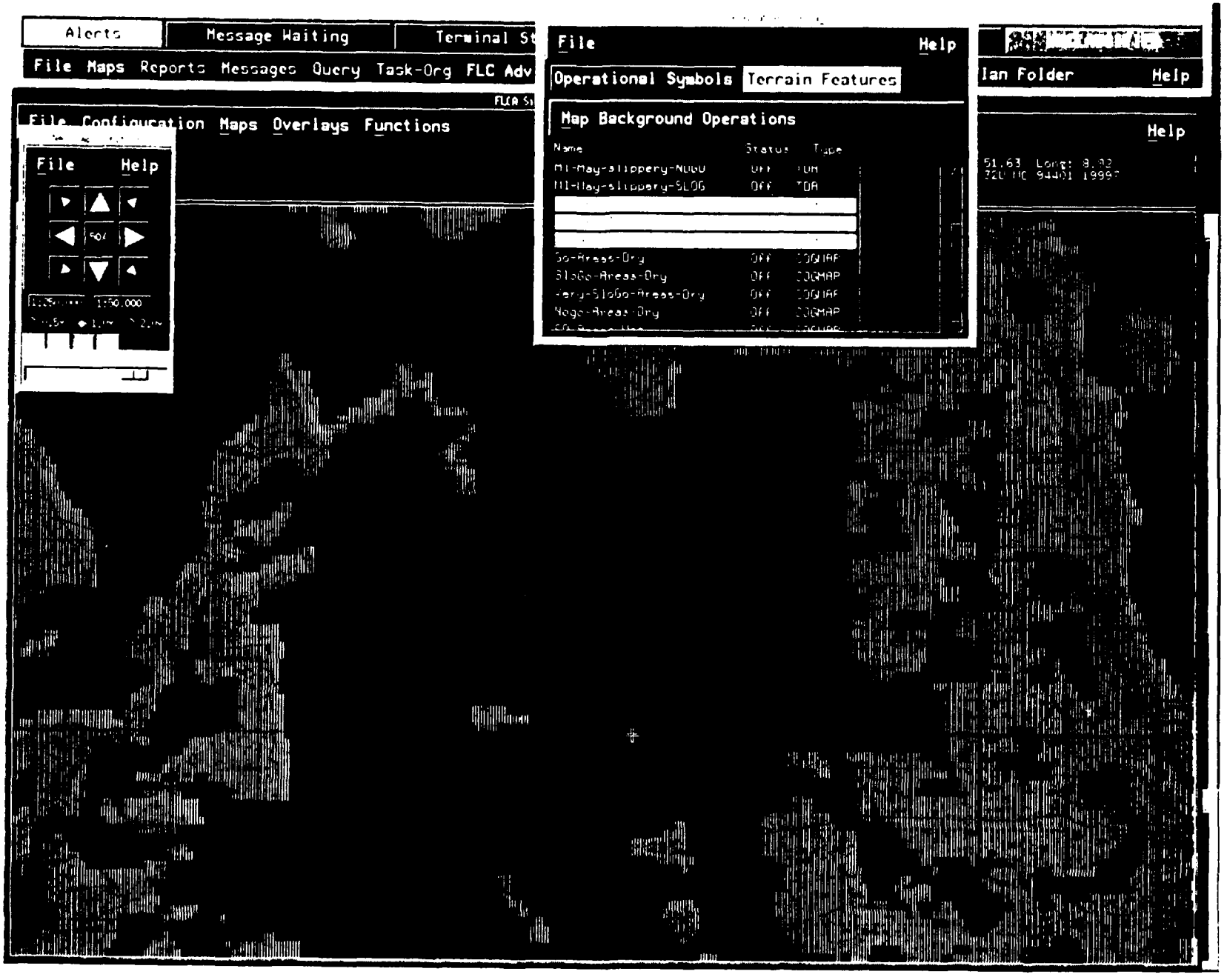

Figure B-12. Cover.

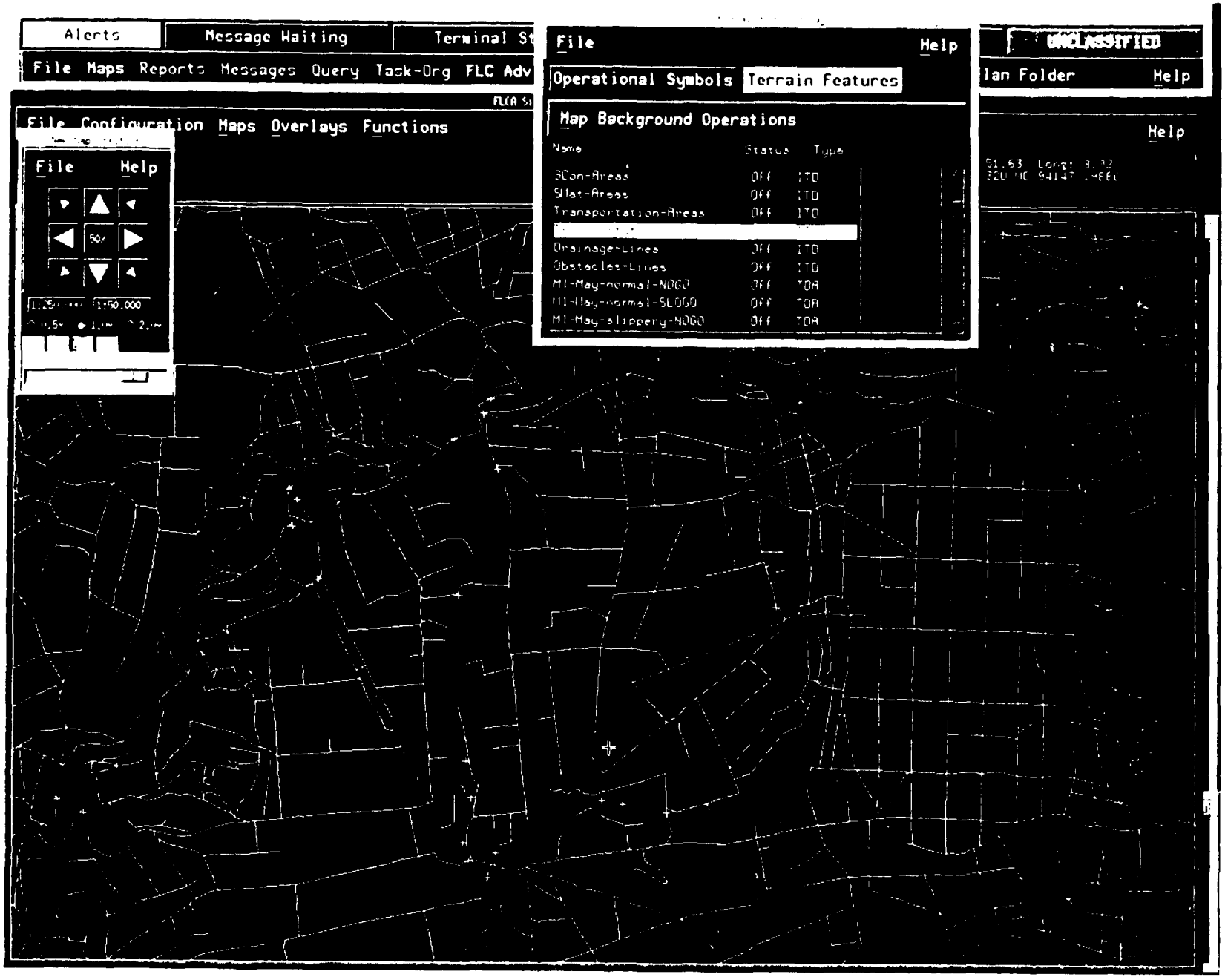

Figure B-13. Transportation.

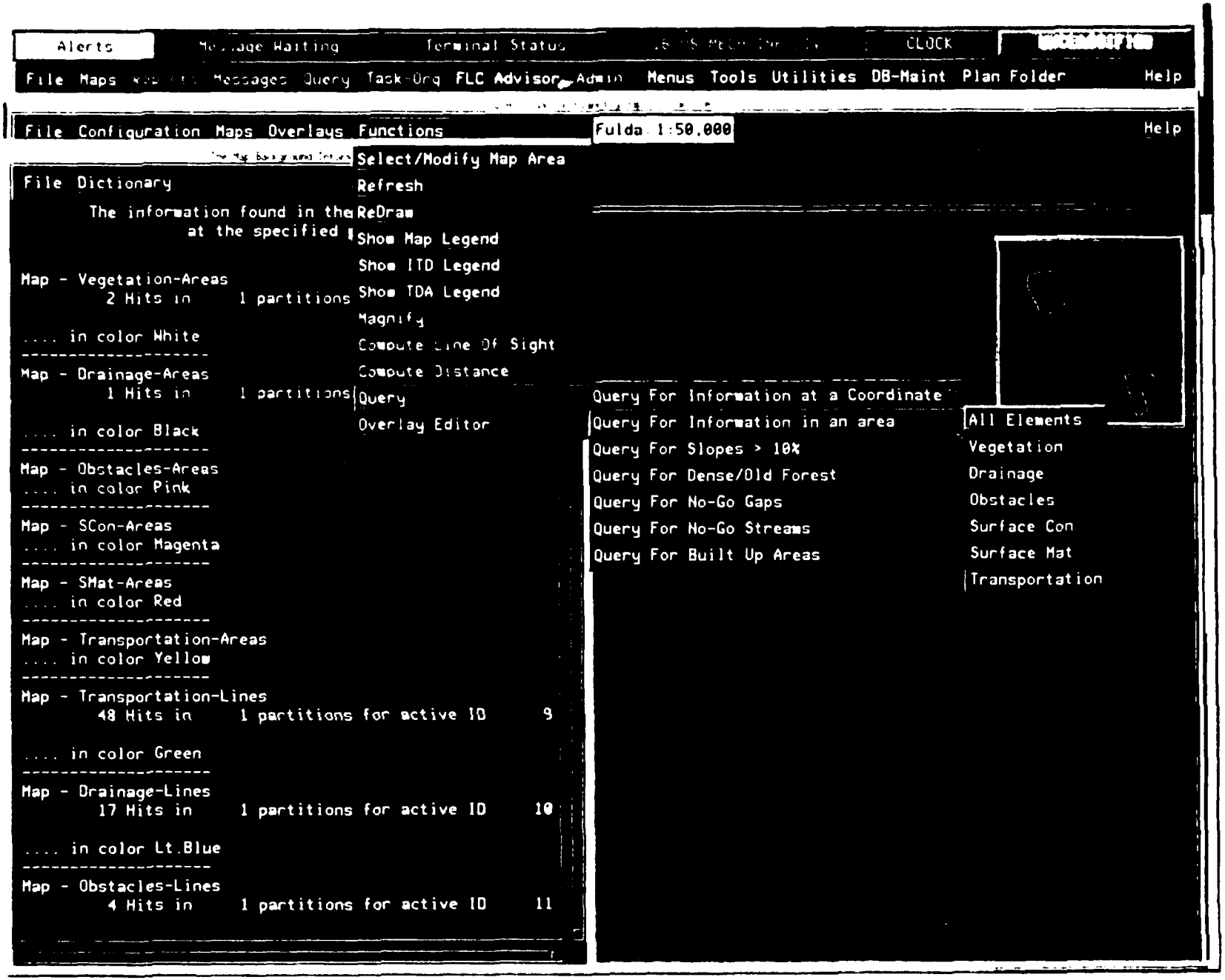

Figure B-14. Terrain Attributes (Area).

Figure B-15. Mobility Arrows.

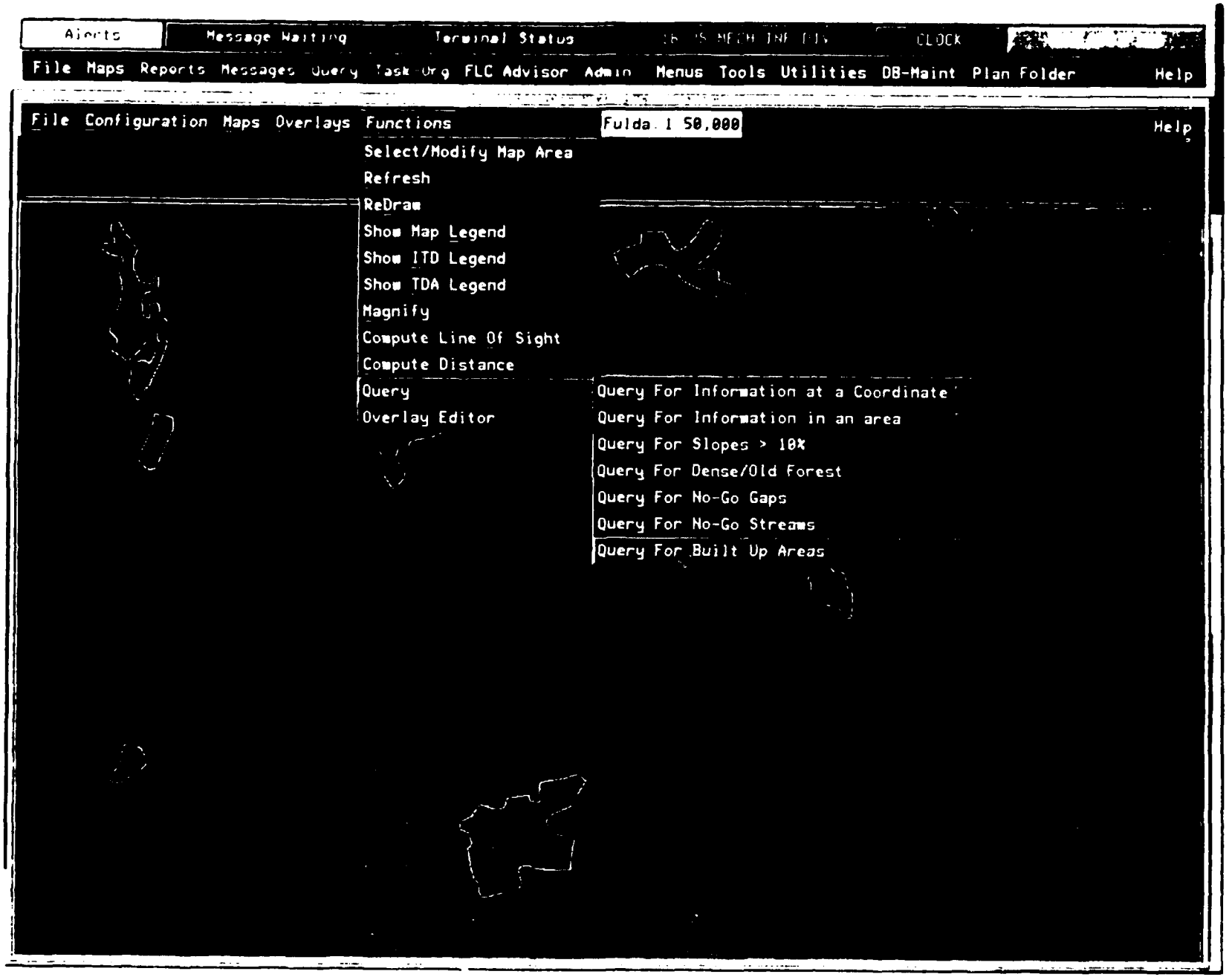

Figure B-16. Built-up Areas.

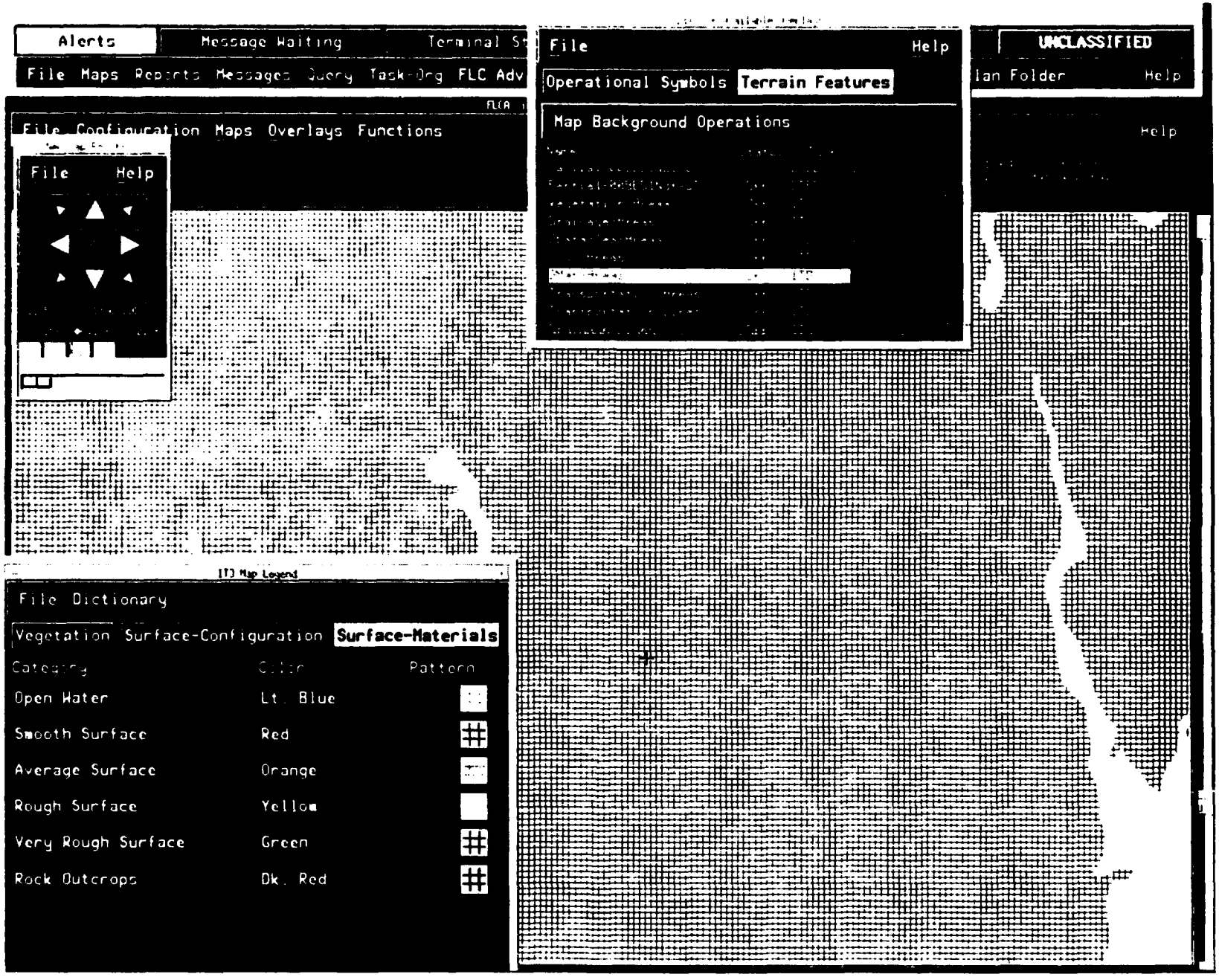

Figure B-17. Surface Materials.

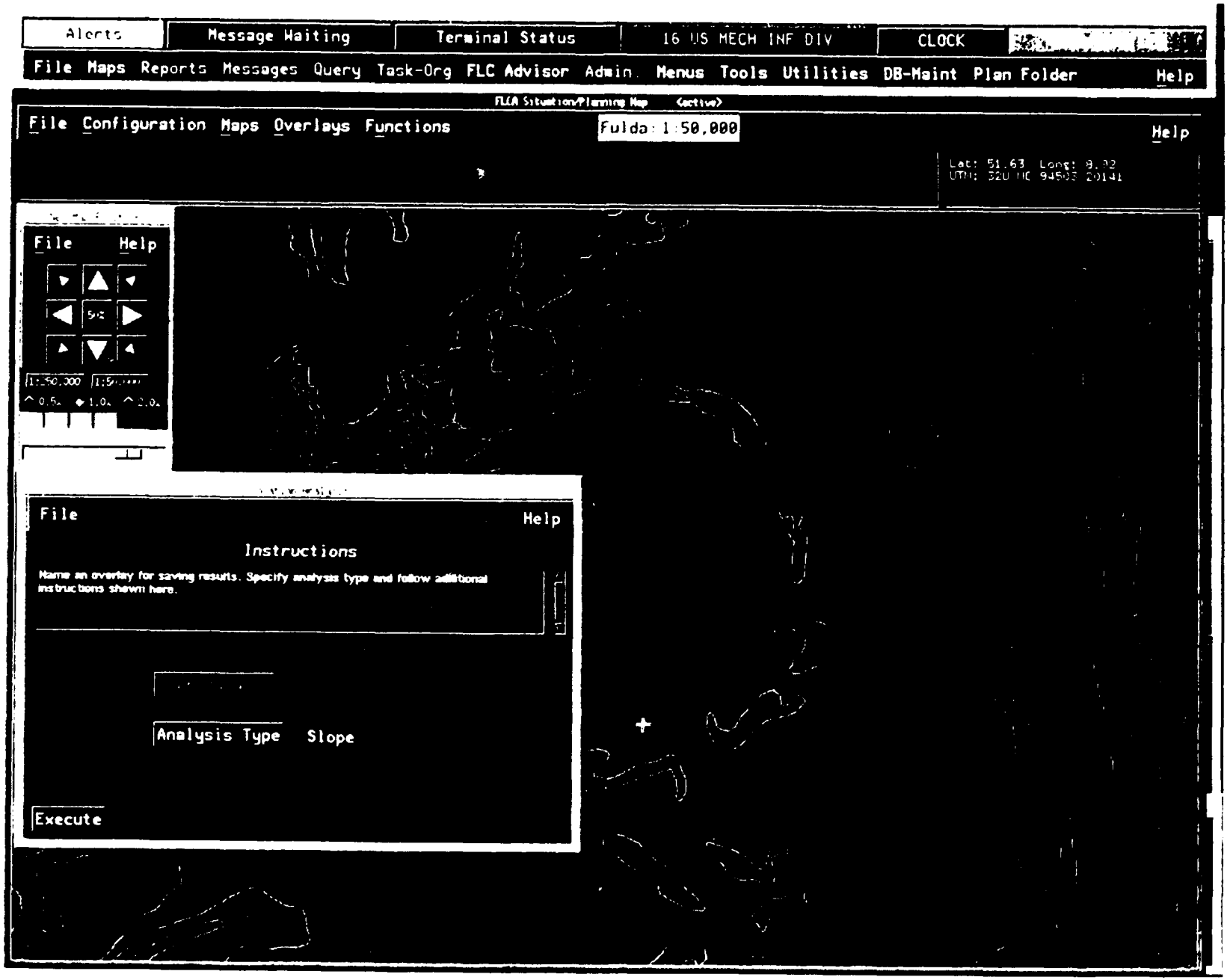

Figure B-18. Slopes Over 10°.

Figure B-19. Dense/Old Forest.

Figure B-20. NO-GO Gaps.

APPENDIX C

QUESTIONNAIRES AND RELEASE FORMS

Location Analysis Questionaire

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why?
	Highly Usable	Rather Usable	Border-line	Somewhat Unusable	Decidedly Unusable	
Elevation Bands						
Vegetation						
Drainage						
Obstacles						
Surface Configuration						
Surface Materials						
Transportation						
Cross-Country Mobility - Dry						

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why?
	Highly Usable	Rather Usable	Border-line	Somewhat Unusable	Decidedly Unusable	
Cross-Country Mobility - Wet						
Cover						
Mobility - Dry						
Mobility - Wet						
Mobility Arrows						
Elevation at a Point						
Distance Along Path						
Line-of-Sight						

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why?
	Highly Usable	Rather Usable	Border-line	Somewhat Unusable	Decidedly Unusable	
Slopes > 10%						
Dense Forest						
NO-GO Gaps						
Built-up Areas						
Terrain Attributes at a Point						
Terrain Attributes in an Area						
Tactical Assembly Area						

WALK THROUGH QUESTIONNAIRE

Your Background

Date: _____

Grade: _____

Branch: _____

Time in Grade: _____

Time in Service: _____

Current Position: _____

Duties of Current Position: _____

Highest level of civilian education: _____

Area of study: _____

Please indicate year(s) of attendance for military schools completed:

Officer Basic Course: _____

Officer Advanced Course: _____

Combined Arms & Service Staff School (CAS 3): _____

Command and General Staff Course (CGSOC or equivalent): _____

War College: _____

Other relevant military education: _____

Please indicate most significant tactical command or staff positions held:

Echelon	*Unit Type*	*Position*	*Months in Position*
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Which of the following best describes your experience and level of skill with computers?

Less than 1 year, relatively unfamiliar _____

1 - 3 years, somewhat familiar _____

More than 3 years, quite familiar _____

Which of the following best describes how you now do tactical planning?:

Manually _____

Use Maneuver Control System (MCS) _____

Use other aided systems (please list) _____

VOLUNTEER AGREEMENT

I, _____ (print name), hereby volunteer to participate in a study to evaluate the ALBM ATD prototype, FLCA 1.2, under the co-direction of Sharon Riedel from the Army Research Institute and MAJ M. C. Berwanger from the Battle Command Battle Laboratory, Ft. Leavenworth, KS.

The study has been explained to me and is described on the preceeding page, which I have signed. I have been given the opportunity to ask questions concerning this investigational study, and any such questions have been answered to my complete satisfaction.

I understand that I may at any time during the course of this study revoke my consent, and withdraw from the study without prejudice.

_____ _____

signature date

_____ _____

witness signature date

APPENDIX D

SUBJECT MATTER EXPERTS' BACKGROUNDS

Background Information

Information		SME A			SME B			SME C		
Service	Rank	MAJ			MAJ			MAJ		
	Time in Grade	2 months			1 year			2 years		
	Time in Service	11.5 years			12.5 years			17 years		
	Current Position	SAMS Student			SAMS Student			CAC - Threats		
	Current Duties	SAMS Student			SAMS Student			Ch, Theater Scenarios		
Education	Highest Military School	CGSOC			CGSOC			CGSOC		
Tactical Position	Echelon	Bde	Corps	Co	Bn	Trp		Corps	Div	Bn
	Unit Type	Inf	Hvy	MI	Cav	Cav		Abn	Inf	Inf
	Position	Asst S2	G2 Plans	Cmdr	S3	Cmdr		Plans Analyst	Dep G2	S2
	Months Service	24	18	15	12	19		18	12	12

Notes:

Abn	Airborne
Arm	Armor
Arty	Artillery
BCTP O/C	Battle Command Training Program Observor/Controller
Bde	Brigade
BICC	Battlefield Intelligence Coordination Center
Bn	Battalion
CAC	Combined Arms Center
Cav	Cavalry
CGSOC	Command and General Staff Officer Course
Co	Company
Div	Division
Hvy	Heavy
Inf	Infantry
MI	Military Intelligence
Plt	Platoon
SAMS	School of Advanced Military Studies

Background Information

Information		SME D			SME E			SME F		
Service	Rank	MAJ			MAJ			LTC		
	Time in Grade	2 months			4 years			2 years		
	Time in Service	12 years			16 years			19 years		
	Current Position	SAMS Student			BCTP O/C			BCTP O/C		
	Current Duties	SAMS Student			Observe Corps Intell Staffs			Observe G2 Activities		
Education	Highest Military School	CGSOC			CGSOC			CGSOC		
Tactical Position	Echelon	Bn	Bn	Co	Div	Bn	Corps	Bde	Bn	Plt
	Unit Type	Arm	Arm	MI	Inf	Inf	Hvy	MI	Arty	Inf
	Position	S2	BICC	Cmdr	G2	S2	Dp G5	S3	S2	Cmd
	Months Service	26	12	22	24	36	25	24	6	6

Notes:

Abn	Airborne
Arm	Armor
Arty	Artillery
BCTP O/C	Battle Command Training Program Observor/Controller
Bde	Brigade
BICC	Battlefield Intelligence Coordination Center
Bn	Battalion
CAC	Combined Arms Center
Cav	Cavalry
CGSOC	Command and General Staff Officer Course
Co	Company
Div	Division
Hvy	Heavy
Inf	Infantry
MI	Military Intelligence
Plt	Platoon
SAMS	School of Advanced Military Studies

APPENDIX E

LOCATION ANALYSIS APPLICATIONS RATINGS AND COMMENTS

Location Analysis Questionnaire Results

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Elevation Bands	B C	A D E F				A: Provide a legend. Show high elevation points (hill tops). B: Provide a legend. C: Could be extremely useful in terms of line-of-sight requirements. D: Legend would be helpful, especially with defined intervals. F: Add contour lines to assist in rapidly understanding elevation data.	B: A translucent overlay, or the ability to toggle between the overlay and the background map, would be useful. E: Has to be used with other overlays or the map. There is no feel for where you are or where towns are.
Vegetation		A D F	B C	E		A: Draw outlines around the vegetation areas. B: More useful if polygons with solid colors were used. D: Selectively edit the display, and create polygons of selected areas. E: Reduce the number of factors displayed. Provide better differentiation between factors, e.g., sparse vice dense forest. F: Need distinction between types of forests, tree spacing, trunk diameter. Need ability to update the data.	A: Too hard to distinguish one category from another. Too many categories to be useful. C: Low utility.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Drainage		A C	B D E F			B: Color should be blue, not red. C: If it can be modified for varying amount of precipitation. D: Hydrology information is needed to make this usable (fording, etc.) E: Differentiate based on impact on movement. Color should be blue. F: Need more hydrology data.	C: If it can't account for weather, its not really useful. F: Should be blue. A map is better because wider rivers are depicted with wider blue lines.
Obstacles		A C E F	D	B		A: Combine with Built Up areas. B: Insufficient information. Use standard symbols and allow user to select what he sees. C: It would be better if it used MCS symbology. D: Should be combined with hydrology. E: Provide more information on type of obstacle.	B: Shows me less, rather than more, info than I can get off the map. C: Need abilty to update the DMA data. How old is it? D: Use standard map symbology and incorporate with tactical obstacles on the display. E: Need ability to query individual obstacles.
Surface Configuration		A B C D F	E			A: Outline the areas. B: Give the user the choice to outline the polygons. C: Could be useful for NAI/TAI, artillery placements, etc. E: Too many slope classifications. No difference in military operations between 0-3% and 3-10%. F: The % slope should be keyed to mobility (vehicle) requirements.	A: Use different fills. Look at FM 34-130. D: Selectively edit to declutter and tailor the display. F: The slope classifications should indicate significant differences.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Surface Materials			A C D	B E F		A: Put definitions of factors in the legend; material is good but make legend usable to the planner. B: Not sure what this tells me. D: Utility doesn't jump out at me. Terminology is confusing. E: Not sure what the terms mean. Needed in only portions of the world. F: Poor definition of rough and very rough texture (furrows versus rocks?)	A: Not readily understandable. Not useful as designed. What do the terms mean? B: So generalized, it doesn't mean anything. C: Means very little to someone who is not an Engineer. F: Irrelevant. What is criteria for "rough".
Transport-ation		B	C D E F	A		A: Provide legend, and make differentiation of road differences for visual impact. B: Needs better representation of roads and a legend. C: Could be quite useful if it included bridges (with classification) and rail nets. D: Potential clutter when combined with other overlays. Needs selective edit and legend. E: Need better resolution of road categories (paved vs unpaved, width). Very important overlay to build. F: Data is already of the map. Need to show road capability.	A: Not useful as designed. B: Need a way to differentiate high speed roads, secondary roads, and dirt trails.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Cross-Country Mobility		A B C D E F				A: Outline the areas. C: Critical for the development of the Combined Obstacles Overlay. E: Legend is confusing. Provide separate legend for wet and dry. Just show NO-GO on wet, or allow selective display. F: How wet? Need to differentiate snow versus rain.	A: Useful. Colors need to stand out. B: Need to overlay this on a map to understand why terrain is SLOW-GO. Yellow (SLOW-GO) is a problem unless map is very dark. Outlining would help.
Cover		D E	A C F	B		A: Provide legend. Provide option for different seasons of the year. B: Provide legend. C: Should be called something else. Would be useful if tied to capabilities of overhead collection. D: This is not cover. E: Provide a legend. F: If this is only canopy closure, then it is "concealment", not "cover".	A: Would be useful with a legend and seasonal display. Display looks unrealistic because of jagged edges. C: This is really concealment. Seasonal aspects need consideration. D: Needs legend and editing capability. F: Must be seasonal.
Mobility Arrows		C F	D	A B E		A: Confusing; visually doesn't express what's intended. B: Confusing. C: Should use varying widths for different echelons, rather that different colored arrows. D: Doesn't capture mobility corridors for me. E: Not meaningful. F: Good assist to user in judging AAs generated by the computer.	A: Don't like the idea of this display. D: If I had to have it, use a different symbol.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Elevation at a Point	B	A C D E	F			A: Provide option to display the elevation value at the cursor position, and leave it there (like a query). B: Display unit of measurement (meters). C: Could be extremely useful in terms of line-of-sight requirements. D: Create menu options to shorten UTM readout. E: Good for planning, especially when used with line-of-sight. F: Little added value.	A: An example elevation would be "o 312".
Distance Along Path	B D F	A C E				A: Provide capability to do curved paths by holding down mouse button and dragging the mouse. Also, provide distance readout dynamically as the path is drawn. C: Handy gadget. D: Provide readout in km, miles, and nautical miles. E: Good use of automation.	D: Dragging a point with continuous readout is desirable.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Line-of-Sight	F	A B	C D E			A: Provide option to specify a partial circle to reduce processing time for large search radii. B: Option to evaluate less than 360 degrees is desirable. C: Could be very useful if it included vegetation and other things like radio line of sight. D: Incorporate electronic LOS, and vegetation. E: Expand to include radio LOS. Need ability to get LOS quickly, without setting parameters. F: Good display.	A: Need directional capability out to 50 km for IEW assets. B: Need directional capability out to 30 km for IEW assets. D: The display for masked and unmasked areas should be different. The selection button for masked/unmasked is difficult to use. Provide means to save the display. E: Need to consider seasonal vegetation.
Slopes > 10%		D	B C	A E	F	A: Not sure of the utility of this. B: Need option to specify what slope % is displayed. C: Very difficult to distinguish. It would be better if it could be manipulated by the operator (varying percentages of slope). D: Provide variable slope %. Provide edit and save capability. E: Not sure what 10% means. Allow user to set slope percentage. F: Redundant with Surface Configuration.	B: 10% slope has no utility. Percentage should be selectable.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Dense/Old Forest		A	C D	B	E F	A: Don't show lines dividing neighboring areas, unless they are meaningful. If abutting areas are different, provide different colors and a legend. What is "dense/old" forest? B: Not sure what this means, or what its utility is. A legend and description would help. C: Not sure what this does. D: Unsure of definition and applicability. F: Redundant with Vegetation.	D: Apparent anomalies between EMAP and the overlay may be due to different ages of the data.
NO-GO Gaps			D	A	B E F	B: No utility as presented. C: ? D: Would be useful if it contained NO-GO streams with hydrology data. E: Don't understand. F: Redundant with Drainage.	A: Appears to be the same as drainage lines. C: Looks like rivers (maybe NO-GO streams?).
Built-up Areas		A D	B C	E	F	A: Specify what the lower limit of a built up area is. C: Not much use as a stand-alone overlay. D: Provide definition of size/type of built up area, and selective display. E: Redundant with EMAP. F: Redundant with other products.	A: User should be able to specify the bottom threshold of what constitutes a built up area.

Terrain Overlay/ Query	Is the display usable, in terms of information content and format?					What should be done to improve the display, and why? (written answer)	Verbal Comments
	Highly Usable	Rather Usable	Border line	Somewhat Unusable	Decidedly Unusable		
Terrain Attributes in an Area		A F	B C	D	E	A: Usable if modified to allow the user to specify what attributes to display in the given area. B: Distracting. More information than I need, including extraneous info. C: Could be very useful with different, more tactically oriented, information. D: Information should be presented in tactical terms, not data base terms. E: Not sure what display tells me. F: It may be possible to provide a computer generated graphic from the data base.	C: Useful, if you could ask the right kind of questions, such as bridges, fording sites, etc. D: Need ability to save, zoom, transmit the box.
Tactical Assembly Area		A E F	B C D			A: Would like the capability to tailor which attributes the system looks at. B: Needs a legend, or better explanation. C: Good reminders. Would be real good with doctrinal template of TAA, AA, FAA, et al. D: I'm intrigued, but not enthralled. Good first step. Needs other specialized options, such as incorporation with "Terrain Attributes in an Area" query. E: Factors should be sufficiently precise for the entity being located. F: Needs to show several proposed TAAs.	B: The doctrinal checklist should be differentiated from the overlay/query display data. D: Checklist is not useful.

APPENDIX F

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

Appendix F

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AA	Avenue of Approach
AACT	Avenue of Approach Comparison Tool
CCM	Cross Country Mobility
ALBM	AirLand Battle Management
AMC	Army Materiel Command
ARI	Army Research Institute
ATCCS	Army Tactical Command and Control System
ATD	Advanced Technology Demonstration
BCBL	BAttle Command Battle Laboratory
C&C	Cover and Concealment
COA	Course of Action
CECOM	Communications and Electronics Command
DMA	Defense Mapping Agency
EM	Execution Monitor
ETL	Engineering Topographic Labortory
ESC	Enemy Situation Capabilities
FITE	Force Interactive Tactical Evaluator
FLC	Force Level Control
FM	Field Manual
FSC	Friendly Situation Capabilities
LAA	Location Analysis Applications
LOS	Line of Sight
MCOO	Modified Combined Obstacle Overlay
MCS	Maneuver Control System
MET4	Mission, Enemy, Terrain, Troops and Time Available Applications
OCOKA	Observation and Fire, Cover and Concealment, Obstacles, Key Terrain, Adequacy of Maneuver Space
OPORD	Operations Order
PEO-CCS	Program Executive Office for Command and Control Systems
SD	Standard Deviation
SME	Subject Matter Expert
TRADOC	Training and Doctrine Command

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