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Operations Planning Tools User's Guide

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**Fort Leavenworth Field Unit
Manpower and Personnel Research Division**

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

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EDGAR M. JOHNSON
Technical Director

MICHAEL D. SHALER
COL, AR
Commanding

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Technical review by

Major Charles D. Allen
Major Jim Edgar

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13. ABSTRACT (Maximum 200 words) Operations Planning Tools (OPT) was developed to assist planners in tactical course of action development, analysis, and selection. This document tells users how to operate OPT and how to integrate it in their planning process. OPT is capable of representing tactical engagements of multiple battalions, the routes of an attacker, combat power ratios, battle duration, and attrition of combat power. A timeline capability is provided to help synchronize attacks along multiple routes. Additional capabilities are available to fit many styles of planning, from the standard estimate-of-the-situation to plans made under extreme time constraints.			
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Operations Planning Tools User's Guide

**James P. Flanagan, Paul E. McKeown,
and Bonnie L. McDonald**

Science Applications International Corp.

Jon J. Fallesen

U.S. Army Research Institute

**Field Unit at Fort Leavenworth, Kansas
Stanley M. Halpin, Chief**

**Manpower and Personnel Research Division
Zita M. Simutis, Director**

U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

Office, Deputy Chief of Staff for Personnel
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FOREWORD

This document provides users of the Operations Planning Tools (OPT) with descriptions of the tools and instructions on how to use them for tactical planning. OPT was developed based on research on how planning is done by staff officers. The tools have been evaluated in laboratory settings and in division and corps staffs during command post training exercises. OPT has been received favorably by users. This version of OPT was developed from a corps-level effort, but is equally useful at division and brigade levels.

OPT was developed under the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) research task entitled "Enhancing Command Staff Performance in Combat Operations." The work was linked to efforts by the Future Battle Laboratory, Combined Arms Command, to demonstrate new command post technologies to the Commanders of U.S. Army, Europe and V Corps. Memoranda of agreement were in effect with the Combined Arms Combat Developments Activity, "Development and Implementation of the Future Battle Laboratory," dated 30 June 1989, and the Naval Oceans Systems Center, "Enhancements to Operations Planning Tools," dated 20 May 1991.



EDGAR M. JOHNSON
Technical Director

OPERATIONS PLANNING TOOLS USER'S GUIDE

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OPERATIONS PLANNING TOOLS

USER'S GUIDE

PURPOSE

The Fort Leavenworth Field Unit of the U.S. Army Research Institute (ARI) has developed operational prototypes of command and control (C2) workstations and decision aids. These prototypes are used to demonstrate and test capabilities for enhancing the performance of fielded tactical C2 systems and the staff officers who use them. The Tactical Planning Workstation is one of those prototypes containing tactical information display and management functions. The Tactical Planning Workstation served as a test bed to develop information control and display functions based on the typical soldier's limited computer abilities and knowledge. The Workstation also provided a platform for the development of a set of planning tools called Operations Planning Tools (OPT). OPT specifically aids the Course of Action (COA) development, analysis, and selection process. Initially developed on Sun Microsystems equipment, OPT now runs on Maneuver Control System hardware.

This User's Guide provides staff officers with an understanding of the capabilities and limitations of OPT. With the information in this guide, users will be able to operate the system and integrate OPT into the tactical planning process.

HOW TO USE THIS GUIDE

This guide begins with a simplified description of OPT features and capabilities in Section I. Section II defines OPT terms. A careful review of these terms will make understanding of the later sections much easier. An index is provided at the end of this guide to aid the reader in finding areas of the document that discuss key terms.

Section III is the main section of this guide. First, it goes through the basic operations that are used repeatedly in OPT. Then, it discusses how OPT supports the tactical decision making process as described in field manuals and Command and General Staff College student texts. It does this by progressing through typical activities from starting up the OPT system to ending a planning session.

Section IV suggests techniques for adjusting OPT to account for varied battlefield considerations that OPT does not include explicitly.

To support the planning activities of a specific unit, the OPT data base must be developed and installed to reflect the friendly and enemy force structure and other environmental considerations of the specific unit. Instructions to guide the development and installation of these data, referred herein as the Initial Scenario, are contained in Section 3 of the OPT Software Description document.

SECTION I - OPT Features

Tactical planning is a complex task that requires high proficiency in tactical operations. Performing tactical planning involves handling a large amount of information to make quick, informed decisions. The wargaming aspects of tactical planning require maintaining strength and location data on many units to calculate movement and attrition. The strength and location data have to be updated as the various phases of the battle evolve. Also, planners have to produce high quality plans quickly and with little advance notice. All of these requirements, and limited human ability to perform at consistently high levels of performance for extended periods, severely constrain the wargaming effort. The result is a degradation of the quality of the wargaming and of the resulting tactical plan.

OPT serves as a tool for the staff planner. It is a flexible tool that can support developing and analyzing alternative courses of action. OPT processes were designed to be simple to understand and use, and produce immediate results to staff planners. The concepts for OPT were based on careful examination of actual staff planning exercises.

OPT provides automated support to the operations planning element for developing, analyzing, selecting, and justifying a Course of Action (COA). When using OPT, the planner is in control of the planning process. The design of OPT allows the user to perform planning activities in the

OPT assists planning efforts. The user does the planning, OPT provides support.

sequence he wants to perform them. OPT does not impose either step-wise or rule-based procedures on the planning process. A rigid, computer-led approach to problem solving is not imposed on the planner. Also, OPT does not automatically generate COAs for the planner. Rather, OPT provides the support required by the planner when he wants to develop COAs and perform wargaming. The user determines how he wants to plan and how OPT will be used in the planning process.

OPT augments and supports the planning process by assisting the user in the following areas:

Graphic display to support battlefield visualization

OPT displays maps and tactical overlays. Unit information such as strengths, dispositions and locations are displayed together with battlefield control measures. Displays, supported by computer tools, help the planner

The planner can visualize the battlefield with maps, tactical overlays, and time synchronization displays.

visualize time and space relationships on the battlefield, to improve synchronization of battlefield resources.

Automated calculation of standard planning factors

OPT handles large quantities of data in a rapid and reliable fashion, reducing the need for planners to make "stubby pencil" calculations. OPT performs what could be cumbersome mathematical computations for planners if done manually. Instantaneous calculation of combat power ratios, time-distance estimates for combat movements, and unit attrition estimates are performed by OPT.

Calculation of combat powers, movement rates, and attrition estimates is automatic.

Assisting in Improved Information management

OPT data are easily created, displayed, modified, stored and recalled. The planning process using OPT is easy to learn and use, and familiar to planners. Planners can quickly access plans, make refinements, and test them interactively. When performed manually, this process is cumbersome and slow.

OPT allows quick creation of alternative COAs, and branches and sequels of plans.

SECTION II - OPT Terms

The following is a brief discussion of terms used in this user's guide.

Adj CP - OPT provides for input of "combat multipliers" that are not explicitly considered in the OPT movement and attrition calculations. Combat multipliers are input using the CP Factor field in the Segment Report (see Figure 20). Initially, the CP Factor field contains a value of 1.0, indicating that the calculated combat powers of the opposing units will be used directly to compute the combat power ratio for that segment. Changing the CP Factor from 1.0 to any other amount results in an adjusted combat power being calculated and displayed in the Adj CP (Adjusted Combat Power) field of the segment report. The adjusted combat powers for each of the opposing sides is used to calculate the combat power ratio for the battle, which in turn influences movement rate and attrition rate calculations.

Attack - An offensive action characterized by movement supported by fire.

Base Combat Power - The combat power value assigned to a specific type of unit based on its primary weapon systems. For example, a BTR battalion has a base combat power of 1.0. The Base Combat Power values for all unit types are viewed by selecting the "See Planning Factor" button at the top of the OPT window (see Figure 13). The values are modified by selecting the "Edit Planning Factor" button, available in the COA Selection Window (see Figure 10).

BLUEFOR - This term refers to friendly forces.

BMNT - Beginning Morning Nautical Twilight. Begins when the sun is 12 degrees below the horizon. It is the start of that period when, in good conditions and in the absence of other illumination, enough light is available to identify the general outlines of ground objects, conduct limited military operations, and engage in most types of ground movement without difficulty. This value is input, with EENT, as part of the Initial Scenario, as described in Section 3 of the OPT Software Description Document.

CCM - This term refers to the cross country mobility of a specified piece of terrain. CCM terrain labels are GO, SLOW GO, and NO GO.

Close Combat - Refers to a role assigned to a unit during a segment. In a close combat role, firepower assets are fully engaged with the opposing forces. Since a close combat unit is heavily engaged in the battle, attrition of the unit will be relatively higher than units with other roles.

COA Comparison Report - After development of several COAs, the user may select the COA Comparison Report (see Figure 26) to view direct comparison of the results of each COA. Comparisons are made of movement times and the attrition of BLUEFOR and OPFOR units.

COA Description Report - The COA Description report is optionally displayed with the COA Comparison Report. The COA Description displays the text given to describe what is unique for each COA. The text is entered using the COA Summary window. This text is useful for providing an explicit reference to COAs being compared.

COA Selection Window - When the first OPT window is opened on the display screen, the COA Selection Window is shown. The display consists of a "planning tree" presented in the form of an organization chart. The planning tree always has the Initial Scenario box at the top. Subordinate Scenarios and COAs are in lower boxes with connecting lines showing linkages between the entities. Holding down the right button on these boxes brings up a menu that allows the user to create, display (and optionally edit), and delete the entity selected. Also, wargaming results from several COAs can be compared. See Section III.1.D pages 17-18, Figure 10, and Section III.2.G page 37 for further information.

COA Summary Report - Located at the top left of the COA window is a button called COA Summary. Clicking on this button with the left mouse button will display the COA Summary Report (see Figure 23). This report provides wargaming results for all routes in the COA and summarizes the data for the COA. These data include COA start and end times, distance and duration of movement, and aggregated combat power losses.

Combat Power Ratio (CPR) - The Combat Power Ratio is the ratio of combat power (CP) of opposing forces, expressed as BLUEFOR:OPFOR. For example, a CPR of 3.0 (3:1) would indicate Blue forces having three times the power of the Opposing forces; a ratio of .5 (1:2) would indicate Blue forces having half the power of Opposing forces. In the Segment Report (see Figure 20), both the basic CPR and the adjusted CPR (using the Adj CP values) are displayed. Planners may use the CPR value to determine the feasibility of performing specified missions.

Course of Action (COA) - A COA is a plan open to the commander that will accomplish the desired objective. The COA is initially stated in broad terms with the details determined during wargaming. In OPT, a COA consists of a tactical overlay on a map, with movement routes, durations, and battle segments with attrition results.

CP Factor - A factor shown in the Segment Report (see Figure 20) that is used to adjust the total combat power of BLUEFOR or OPFOR forces (or both) for that segment. The CP Factor accounts for battlefield conditions not included in basic combat power calculations. These battlefield conditions are called combat multipliers. Examples are smoke, deception, close air support, fatigue, and surprise. By default, the CP Factor is 1.0, resulting in no modification to the basic combat power calculations. Clicking with the left button on the BLUEFOR or OPFOR CP Factor allows the user to input and apply the appropriate combat multipliers.

Create OPT Route - A menu selection from within the Map Option Menu that starts interactive creation of a route on the battlefield. Each route reflects the force movements associated with that COA.

Delay - An operation usually conducted when the commander needs time to concentrate or withdraw forces, to establish defenses in greater depth, to economize in an area, or to complete offensive actions elsewhere. In the delay, the destruction of the enemy force is secondary to slowing his advance to gain time.

Delay Time - In the Segment Report (see Figure 20), the user may specify a time duration to account for performance of special activities during the segment. An example is additional time for a river crossing.

Edit Planning Factors - The user may elect to edit the planning factors used to calculate combat powers, attrition, and movement time values for all COAs. The Edit Planning Factors window (see Figure 27) is displayed by clicking with the left button on the Edit Planning Factors button at the top of the COA Selection window (see Figure 10).

EENT - End Evening Nautical Twilight. This occurs when the sun has dropped 12 degrees beneath the horizon, and is the instant of last available daylight for the visual control of limited ground operations. At the EENT, there is no further sunlight available. This value, with BMNT, is input as part of the Initial Scenario, as described in Section 3 of the OPT Software Description Document.

Force Array - The Force Array Report (see Figure 21) displays the names of units participating in the battle in a segment. For each unit in the segment, the role, combat power, and beginning and ending strengths are displayed. The Force Array Report must be displayed to select or de-select units for that segment. There are two ways to request display of the Force Array Report. It is an option on the Route Option Menu (see Figure 19), obtained by holding down the right button on the desired route segment. If the Segment Report (see Figure 20) is already displayed, clicking with the left button on the "Force Array" field at the top right corner of the Segment Report will toggle display of the Force Array Report window.

Hasty Defense - A defense normally organized while in contact with the enemy or when contact is imminent and time to organize is limited.

Initial Scenario - The "Initial Scenario" is the starting point for creating Scenarios and COAs. The box at the top of the planning tree that appears in the COA Selection window is the Initial Scenario (see Figure 10). When displayed, the Initial Scenario shows the starting tactical overlay of unit locations and battlefield control measures. A new scenario or COA can be created from this Initial Scenario, and will appear in the planning tree underneath the Initial Scenario. The Initial Scenario is created from text files using a "build data base" function that runs off-line from the operational OPT system. The OPT Software Description, published separately, describes the data base and the process used to build or modify the data base.

Map Option Menu - The user may display this menu by moving the pointer to any spot on the map (not covered by a unit, route, or battlefield control measure) and holding down the right mouse button. He may then exercise one of many options that controls the display of map background and scale, and the tactical overlay.

Mission - The user selects the proper mission for the opposing forces when initially creating a route. The mission can be changed at any time for specific route segments using the Segment Report window.

OPFOR - Term used in OPT tables to label information about the force opposing the BLUEFOR.

Planning Factors - These are factors used to calculate combat powers, time-distance estimations, and attrition estimations. These factors are Base Combat Powers, Movement Rates, and Attrition Rates.

Prepared Defense - A defense normally organized when out of contact with the enemy or when contact with the enemy is not imminent and time for organization is available.

Print - An OPT capability to output on the printer a hard copy report of wargaming data within certain report windows. The windows able to be printed are:

- COA Comparison Report with COA Description (Figure 26)
- COA Summary Report (Figure 23)
- Route Summary Report (Figure 22)
- Segment and Force Array Reports (Figure 20 and Figure 21)
- Strength Adjustment Worksheet (TOAST) (Figure 32)

Role - All units identified with a segment are assigned a role of either Close Combat, Support, or Uncommitted. The role assignment influences combat power, movement, and attrition calculations in that segment of a route.

Route - A route is a series of one or more segments, interactively input by the user, that together depict an axis of advance or an avenue of approach.

Route Name - The user names each route that he creates. For example, a main attack on a selected course of action could be named "Main".

Route Start Time - When prompted during creation of a route, the user enters the time he believes forces will start moving on a route. This start time may be changed by calling up the Route Option Menu on the route and selecting the "Route Start Time" option.

Scenario - A starting point for the development of COAs. Instead of using Initial Scenario data as a starting point, the user may specify proposed unit locations and strengths for both friendly and opposing forces. This feature helps wargaming by supporting the development of different sets of assumptions for planning.

Segment - Segments are parts of a route for which separate battle events along the route can be defined. The planner, in visualizing the battlefield, creates segments that reflect areas where forces will be committed with specific missions. An example of a segment is a penetration of the first defensive belt of units in prepared defense. All movement and attrition calculations are performed on a segment basis. Segment characteristics may be altered at any time.

Segment Report - A Segment Report (see Figure 20) provides the user with a summary of battle parameters and results. These include time estimates, distance, CCM data for the segment, combat power ratios, and CP losses. Display of the Segment Report can be obtained by selecting either the Segment Report or the Force Array options from the Route Option Menu (see Figure 19).

Support - A role assignment of a unit selected for a segment. When in a support role, the combat power and attrition rate of the unit is reduced relative to a close combat role. For example, a GS (general support) artillery unit is normally assigned a support role because its total firepower would not be available for the close combat taking place with maneuver forces.

Timeline - The timeline is a display at the bottom of the OPT window (see Figure 24). The display is toggled on and off by a button (labeled "Timeline") located in the top black band of the COA window. The timeline shows start and stop times for all segments of each route in the COA. Colors on the timeline indicate daytime and nighttime, as determined by the current values of BMNT and EENT (the BMNT and EENT values are input as part of the Initial Scenario, as described in Section 3 of the OPT Software Description Document⁴). Interaction with the timeline is done by "clicking" either on the timeline or on a route. When clicking on the timeline, markers appear on the routes showing the approximate location of forces on the route at that indicated time. Alternatively, clicking anywhere along the route will cause display of the time the units will be at that location.

Uncommitted - A role assignment of a unit selected for a segment. In this assignment the unit may be graphically displayed but its combat power is not included in force combat power, movement, or attrition calculations. Additionally, the unit does not experience attrition when assigned an uncommitted role.

Unopposed Movement - A status of forces when moving and not in contact with the enemy. Specific uses are for forces moving from assembly areas into initial battle positions or movement until contact with the enemy occurs.

Wargame Animation Tool - This tool aids in battlefield visualization over time. Those units involved in a selected battle segment are moved specific to positioning for that segment. Selecting different segments along a route will visually provide the relative unit relationships over time.

Window - A bounded portion of the display screen that contains a cohesive set of data being displayed or edited by the user. Several windows may be present on the display screen at the same time.

SECTION III - OPT in Support of Tactical Decision Making

1. Basic Operations in OPT

The basic user actions needed to operate OPT are described in this section. To provide clarity in the guide, these actions are described using a typical set of planning and wargaming techniques. The user should be aware that the system is extremely flexible and will support various styles of planning and wargaming, as well as different sequencing of planning tasks.

A. **Mouse Operation** OPT uses a three button mouse (a three button trackball can also be used) to control the location of a pointer on the screen. Figure 1 describes the normal actions when using the mouse. The user moves the pointer to an item of interest on the monitor and then clicks or holds down a mouse button.

Technique	Action
Point	Move the mouse pointer to a specific area on-screen.
Click	Quickly press and release the left button.
Hold Down	Hold down the button while moving the pointer. Usually done with the right button while working with menus.
Drag	Press the button and hold it down while you move the pointer.
Release	Let up on the button after dragging, or after positioning the pointer on the desired menu item.

Figure 1. Standard Mouse Operations

The functions of the three mouse buttons are:

Left Button - Select Objects

Middle Button - Establish new windows and center maps (clicking the middle button re-centers the map at the position of the pointer).

Right Button - Menu Request.

The mouse pointer is used for most actions in OPT. Move the pointer to an object and click to select the object (e.g. add a unit to the force array of a battle), or hold down to request a menu (e.g. display a different map scale).

Occasionally, two or more objects are grouped too closely for the system to determine which object the user intended to be selected. The system will present a list of all objects in the immediate area, and ask which object is desired. This process is done with on-screen prompts that ask questions and give directions. Follow the screen prompts.

B. **Windows** There are two types of windows used in OPT; windows without frames, and windows with frames (four dark corners). Manipulation of windows without the narrow frames and dark corners is limited to movement, termination, and, in some cases, printing (see

Operations with windows are consistent with other PC and workstation systems.

Figure 2 and the Print definition on page 9). To access these functions, point at the top portion of the window and hold down the right mouse button. A menu will appear listing the available options. Point the mouse to the desired option and release the mouse button to activate the function.

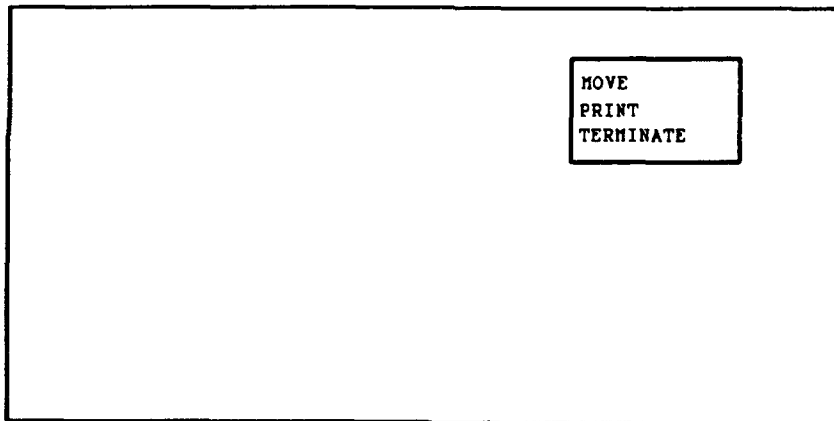


Figure 2. Windows without Frames

Windows with frames can be manipulated in many ways. The two following procedures are quick and useful tools to arrange the display of windows on the screen (see Figure 3).

Movement - A window may be dragged to a new location. Point to the narrow white frame of the window and, using the left mouse button, drag the window to the desired location.

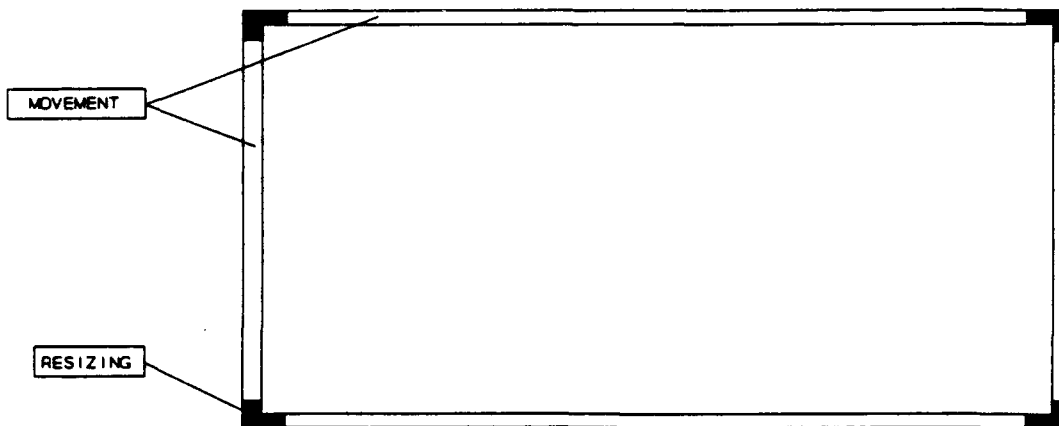


Figure 3. Window with Frame

Resizing - A window may be resized (made smaller or larger). Point to one of the four dark corners of the window and, using the left button, drag the selected corner to the desired location.

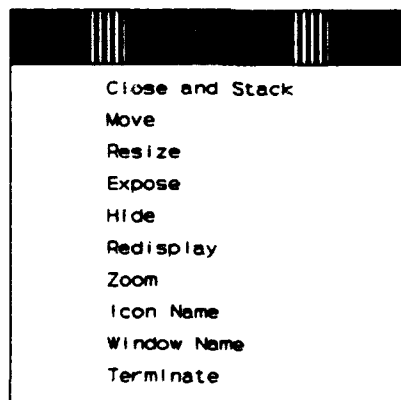


Figure 4. Window Options Menu

Additional tools are available in windows with frames, through the selection and use of a Window Options menu. To obtain the Window Options menu, move the pointer to the white frame of the window and hold down the right mouse button (see Figure 4). While the button is depressed the Window Options menu

will appear. Move the pointer to a desired option. Releasing the button will activate the option. Following is a discussion of the Window Option menu selections.

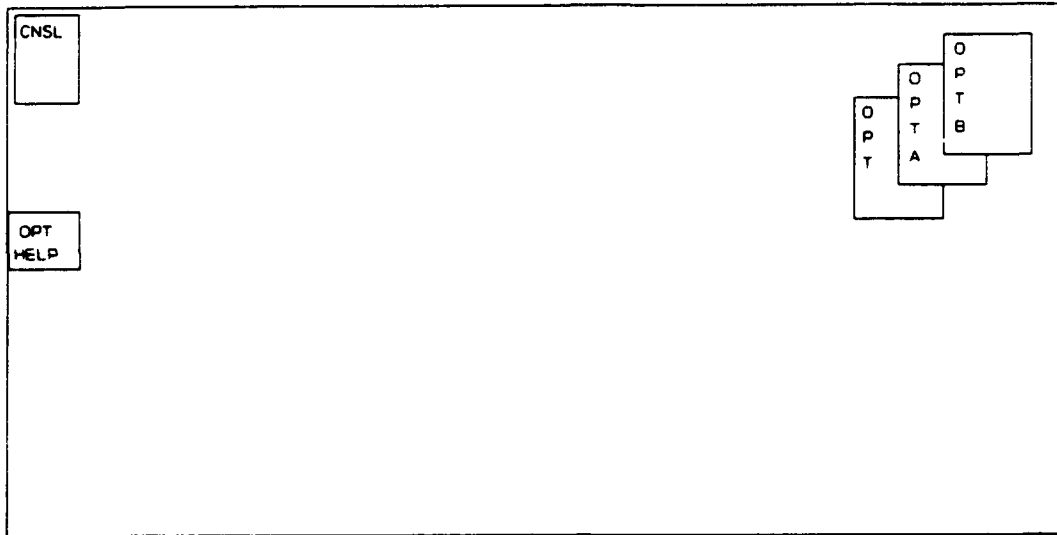


Figure 5. Close and Stack Icon Display

Close and Stack - This option allows a displayed window to be temporarily closed and stored as a small icon in the upper right hand corner of the screen, on top of the OPT button (see Figure 5). To redisplay that window, move the pointer to the icon and click the left mouse button. The recalled window will reappear on the monitor. Up to seven icons may be stacked on top of the OPT button.

Move - Move a window with the aid of on-screen prompts.

Resize - Resize a window with the aid of on-screen prompts.

Expose - Position a selected window in front of all windows currently displayed.

Hide - Position a selected window behind all currently displayed windows.

Redisplay - This option redraws all graphics in the window. This is useful when the presented graphics have white spaces or missing characters.

Zoom - Redraws the on-screen graphic to full vertical display. When selected a second time, the graphic is redrawn in its original size and location.

Icon Name - Allows for naming an icon when the window is "closed and stacked" on the OPT button (see Figure 6). The names aid in easy reference.

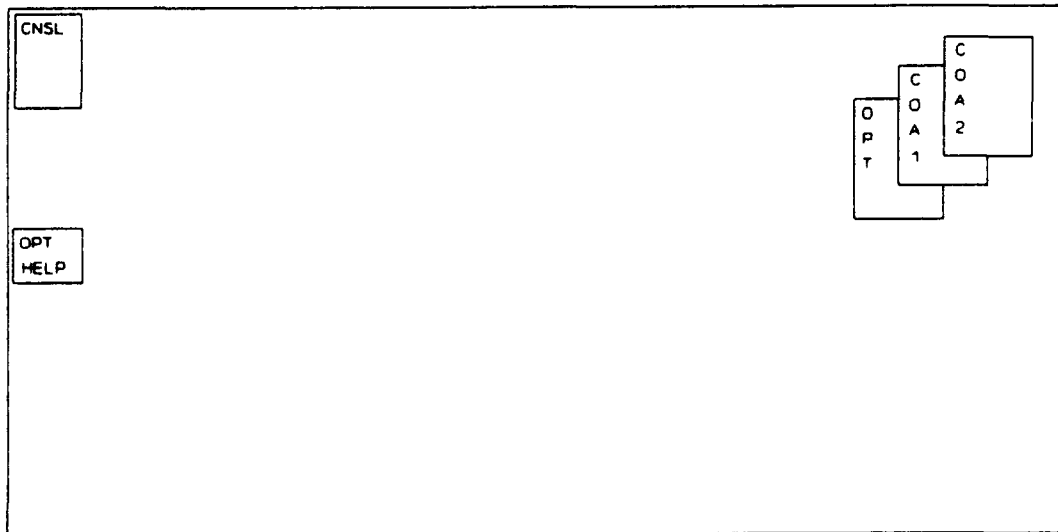


Figure 6. Close and Stack with Icon Name

Window Name - Allows for naming a window.

Terminate - This option allows the user to delete any window no longer required.

C. **System Startup and Shutdown** A system level menu is used to facilitate starting and terminating OPT operation, and performing certain OPT maintenance functions. This menu appears when first logging onto the computer system, and when terminating OPT operation normally. The details of these procedures are described in the following paragraphs.

System Startup. When the system is initially turned on and the system login prompt appears, enter the appropriate login and password combination as established by the system manager. The OPT System Menu will appear (see Figure 7). Select the first option, Start OPT.

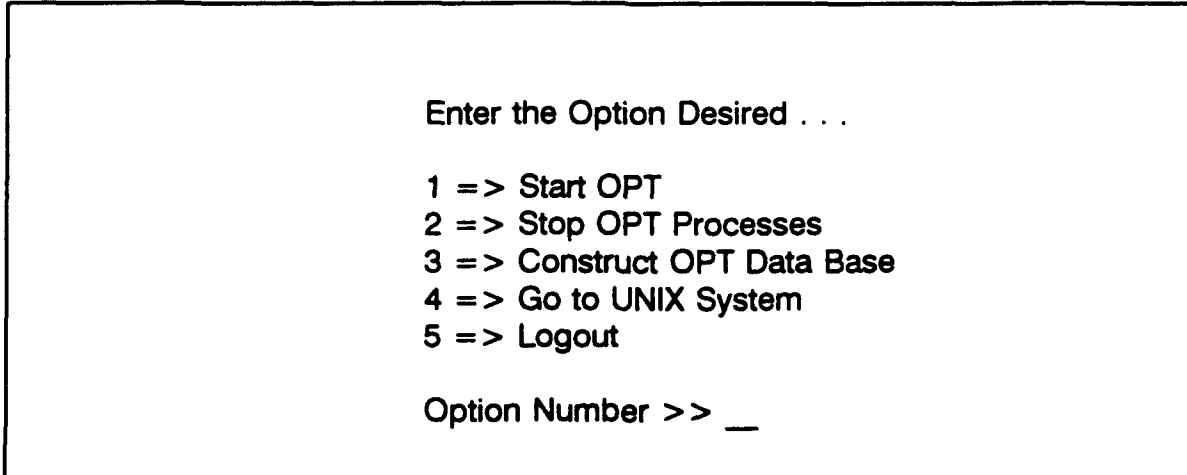


Figure 7. OPT System Menu

An option to restore the scenario data base files will be presented. If the most recent use of OPT was terminated abnormally, any data changes made during that session will be lost if the scenario files are not restored. If the previous session was terminated normally, then the scenario files will be correct and do not need to be restored. If you are unsure about the status of the previous session, it doesn't hurt to restore the scenario files anyway (but it does take about one minute to accomplish).

Next, the screen will display an OPT Logo Banner, two small boxes in the upper left corner, and one small box in the upper right corner. The OPT system is now ready to use. The OPT Logo Banner may be terminated using the Window Options menu as described on page 12 for windows without frames.

System Shutdown. When finished using OPT, the following shutdown procedure should be followed. Point to the grey area of the screen (not on any window). Request a menu by holding down the right mouse button and select "Terminate" from the menu. This clears the screen of all OPT windows. Point to the console icon in the upper left corner of the screen and click the left mouse button to open the console window. With the pointer in the console window, simultaneously press the Control and C keys on the keyboard. The OPT System Menu will appear (see Figure 7). Selecting option 5, Logout, will put the system back at the system login prompt. The computer system may then be powered down using the established procedures for that system.

In addition to the startup and shutdown procedures, other functions are available to the user in the OPT System Menu (Figure 7).

Stop OPT Processes. Occasionally, error messages or other difficulties may occur when attempting to start the OPT system. This is usually caused by starting OPT too soon after a previous shutdown of OPT. The OPT processes take one to two minutes to gracefully terminate after initiation of the shutdown procedure. If this condition occurs, obtain the OPT System Menu by executing the shutdown procedure described above. Select option 2, Stop OPT Processes, and wait two minutes. Then select the Start OPT option to restart OPT. If the problem persists, repeat this procedure, but wait an additional minute before restarting OPT again.

Construct OPT Data Base. This option causes the destruction of all Scenarios and COAs that are currently in OPT, and the construction of the Initial Scenario as described in the OPT Software Description. Using this option, planners can "wipe the slate clean" to start a new series of plan analyses. This option must also be used when changes are made to the basic BLUEFOR or OPFOR force structure contained in the Initial Scenario.

Go To UNIX System This function should not be used by the OPT user. It is available to allow programmers or other qualified people access to the OPT files for trouble-shooting or emergency modifications.

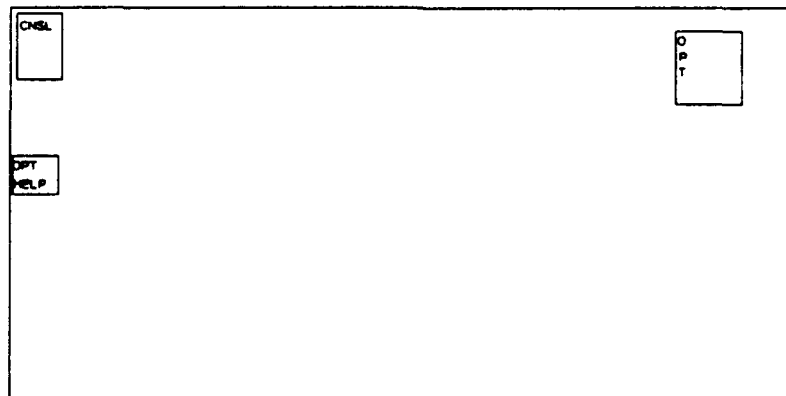


Figure 8. System Startup

D. **Getting Started** When the system is started and the OPT Logo Banner is terminated (described on page 16, the initial screen display is blank with two small white boxes in the upper left corner, and

a small box in the upper right corner (see Figure 8). The box in the upper right corner, referred to as a "button", has the word OPT inside it. The box located in the upper left hand corner is referred to as the "console icon". The console icon is used for system shutdown, as described on page 16. The box below the console icon, labeled OPT HELP, contains information about the operation of OPT as a reference for the user.

Click on the OPT button with the left mouse button. In a few seconds a blinking window frame will appear on the monitor. Move the window anywhere on the monitor, then click the left mouse button. The window will appear in the selected position in the standard default size (see Figure 9).

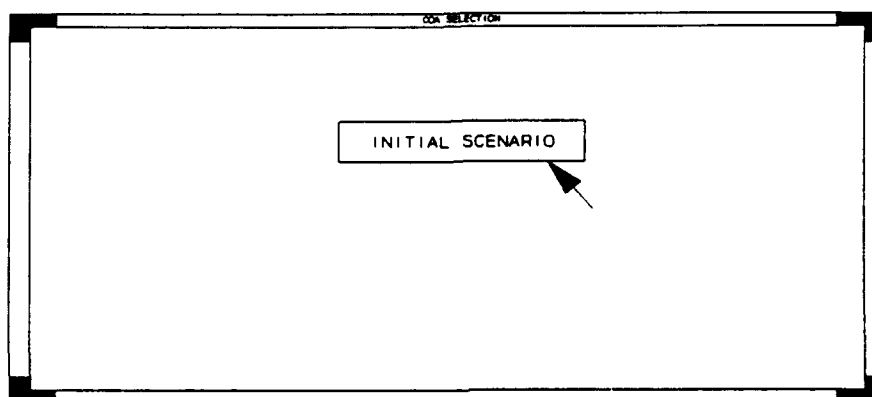


Figure 9. Initial COA Selection Window

As an alternative to the standard default window size, move the blinking window frame to the desired position and then hold down the middle mouse button. This fixes the upper left corner of the window. While still depressing the middle mouse button, move the pointer to the desired location of the lower right corner of the window and then release the button. Using this technique, a full screen display of any window can be created. However, windows should not be placed to cover the computer "busy" indicator located at the top center of the monitor. Covering the busy indicator will cause the window to flash off and on.

The COA Selection window contains a "planning tree", constructed like an organization chart. Each box in the planning tree represents a scenario (unit locations, battlefield control measures) or COAs (routes, force arrays, movement and attrition estimates).

The location of a box in the planning tree reflects its role in the planning process; e.g., a COA under another COA is a branch or sequel (contingency plan).

Selecting Planning Actions In the center of the COA Selection window is a rectangular box labeled "Initial Scenario" (see Figure 9). If any subordinate Scenarios or COAs were previously defined, their names will also appear in boxes below the Initial Scenario box (see Figure 10). Point to the desired box and hold down the right mouse button. A Planning Action menu will appear. Select from the following options:

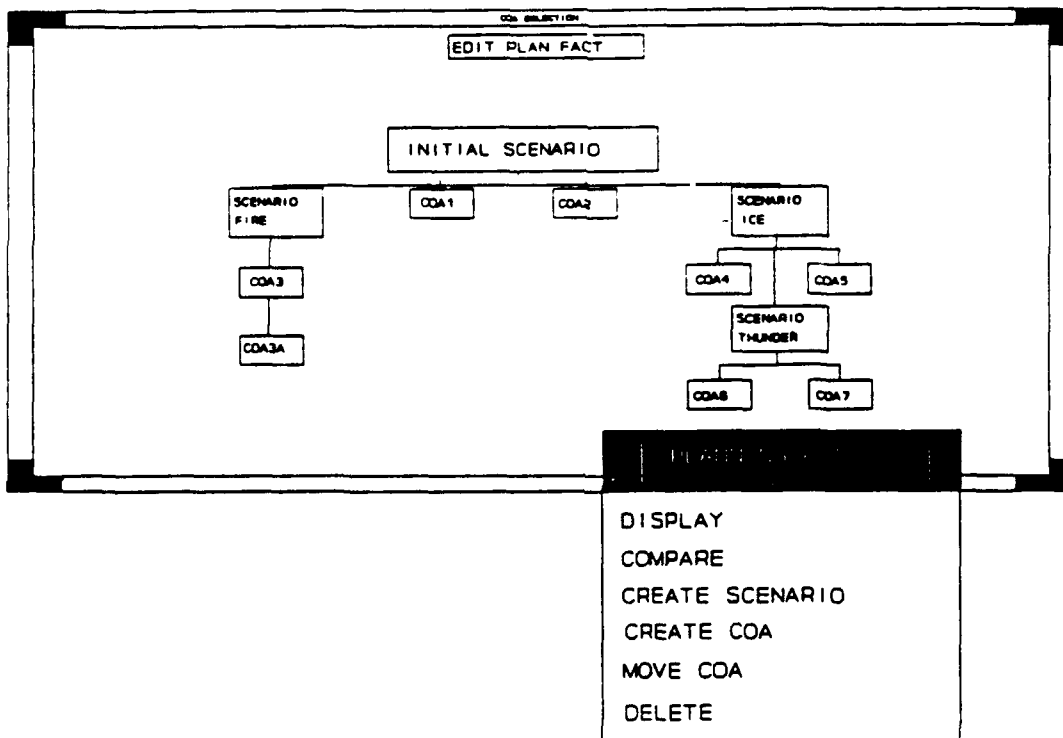


Figure 10. COA Selection Window with Planning Action Menu

Display - Presents an overlay of the selected COA, Scenario, or Initial Scenario. The latest tactical information on battlefield control measures, unit locations and unit status are shown. In a COA display, all routes will also be displayed.

Compare - After completion of wargaming and analysis of two or more courses of action, this option may be selected. The system will display a summary of each specified COA along with a relative comparison between the COAs.

Create COA - Creates a COA based on the Initial Scenario, a Scenario or another COA. This new COA can be a sequel, or a branch of the planning based on the data present in the 'parent' or higher scenario or COA.

Create Scenario - Creates a scenario (unit locations, strengths, control measures, etc.) as a basis for planning. The scenario may be based on the Initial Scenario or another Scenario.

Move COA - A COA is a scheme of maneuver with force allocations and assigned missions. The strengths and initial locations of units are derived from the Scenario from which the COA was created. The Move COA option allows a COA, and all of its subordinate branch and sequel COAs, to be moved from one scenario to another. This provides quick wargaming of an integrated set of COAs using different starting strengths and locations of the forces.

Delete - Allows deletion of the selected scenario or COA. The Initial Scenario cannot be deleted.

The planning tree in Figure 10 shows the hierarchical relationship between the various elements that exist within a sample planning session. There are important rules for governing changes to a scenario or a COA. When a scenario or COA is created, it "inherits" all of the data that is in the higher scenario or COA. To preserve the viability and traceability of this "inheritance", no changes can be made to a scenario that has at least one subordinate scenario, or any COA that has subordinate COAs. Thus, in Figure 10, COA3 will not accept any changes to unit locations, unit strengths, or control measures. Nor can any changes be made to the wargaming in COA3, such as routes, segments, and force arrays. All other COAs in Figure 10 can be modified. Similarly, scenario ICE cannot be modified, but the other scenarios (except the Initial Scenario) will accept changes. The Initial Scenario can only be modified using the procedures described in Section 3 of the OPT Software Description.

The prohibition on making changes to "higher" scenarios or COAs does not prevent exploring other planning alternatives. For example, if it were desired to explore another approach to the plan in COA3 (in Figure 10), create a second subordinate COA (possibly named COA3B) and make the desired changes in the new COA. Similarly, changes to scenario ICE can be reflected in a new scenario (possibly named SLEET) created from ICE. The effect of the changed scenario on subordinate COAs can be easily determined by moving the COAs to scenario SLEET, using the Planning Action menu as described above in "Move COA". Figure 11 summarizes the rules for taking actions within scenarios and COAs.

	Initial Scenario	Scenario <u>without</u> subordinate scenarios	Scenario <u>with</u> subordinate scenarios	COA <u>without</u> subordinate COAs	COA <u>with</u> subordinate COAs
Modify starting unit locations, strengths, and task organization	No	Yes	No	No	No
Modify control measures	No	Yes	No	Yes	No
Modify wargame	No	No	No	Yes	No
Move COA to another scenario	No	No	No	Yes	Yes

Figure 11. Possible Actions in OPT Windows

To start COA planning, move the pointer to the Initial Scenario box, obtain the Planning Action menu and select either "Create COA" or "Create Scenario". A rectangular box and blank entry field will appear on the monitor to enter the name of the new COA or Scenario (see Figure 12). The pointer must be located in the window to enter the name. When the name is entered, press the "Return" key. The original OPT screen display will reappear with the newly created COA or Scenario appearing in the diagram. Move the pointer to the new COA box and hold down the right button for the Planning Action Menu, then select the "Display" option, to bring up the COA window.

A scenario serves as a starting point for planning. It incorporates assumptions of unit dispositions and strengths at some future time.

For example, assumptions could be made regarding unit dispositions and strengths at both 24 and 48 hours in the future. Those assumptions would be entered into two separate scenarios. COAs are then developed from each scenario. In the planning tree, boxes representing these COAs would be positioned underneath the corresponding scenario box.

NAME	
------	--




Figure 12. Naming a COA

Whenever the "Display" action is taken on a planning tree box in the COA Selection window, the resulting window will have the attributes shown in Figure 13. The upper frame of the window will show, on the left side, the name of the COA or scenario being displayed. At the upper center will be the name of the COA or scenario from which the displayed COA or scenario was created (the immediately higher box in the planning tree). At the right of the upper frame is the current map scale. Directly below the upper frame is a series of four buttons that activate special OPT functions, which are discussed later in this guide. The buttons and where they are described are:

- COA Summary Page 33
- Timeline Page 35
- See Plan Fact Page 39
- TOAST Page 42

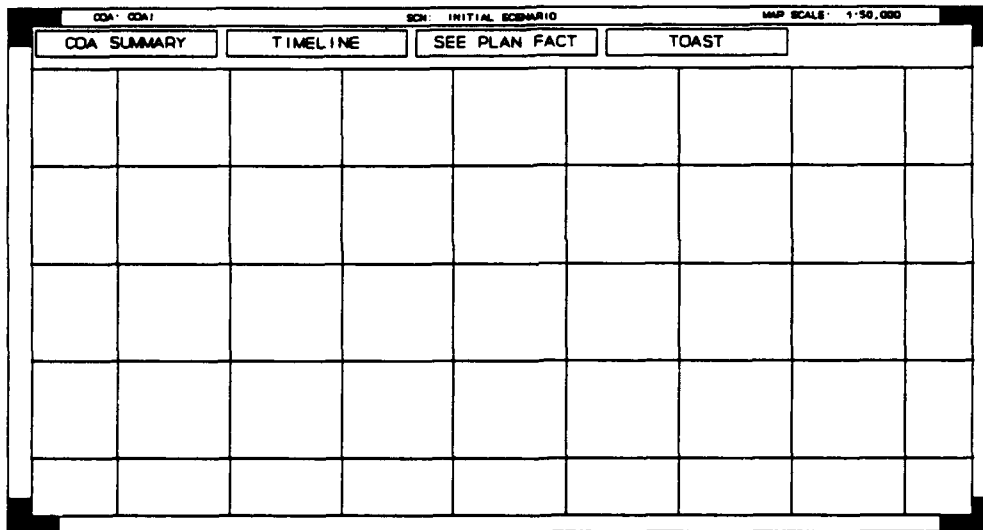


Figure 13. Window Containing Scenario or COA

F. **Display Options** After the map and overlay are displayed for a COA or Scenario, several display options are available. These options may be used at any time.

Grids - Point to any spot on the map (not on a unit, route, or control measure) and hold down the right mouse button to display the Map Options menu. Select "Map Features" and release the mouse button. Then select "Grids" using the left mouse button. Selecting the "Done" button will cause UTM Grids to be displayed. Repeating this process will turn off the display of UTM grids.

Map Scales - Point to any spot on the map (not on a unit, route, or control measure) and hold down the right mouse button. On the Map Options menu, select "Map Scales". Moving the pointer to the right, select any of the available scales. The scale of the current map is shown in the top right corner of the window.

Control Measure Information and Manipulation - Point to the desired control measure and hold down the right mouse button. A Control Measure Option menu will appear (see Figure 14) that allows display of the status of the control measure (see Figure 15). Additionally, the existing control measure may be moved, modified or deleted.

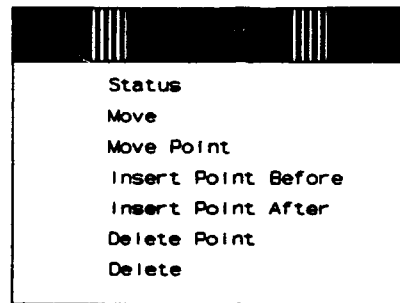


Figure 14. Control Measure Option Menu

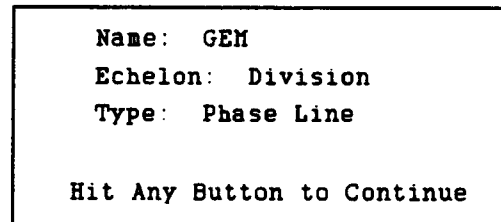


Figure 15. Control Measure Status Window

Tactical Overlay Information - Point to any spot on the map (not on a unit, route, or control measure) and hold down the right mouse button. A Map Options menu will appear. Select "Tactical Overlay". Move the pointer to the small arrow in the right side of the box to activate a secondary menu. Specify the units and control measures desired to be viewed. Menu instructions assist in displaying the overlay information. Any actions taken to control the display of unit symbology in the Tactical Overlay menu, overrides previous actions taken in the TOAST menu (see the discussion on page 45). Likewise, any later actions taken in TOAST to control display of unit symbology will override actions taken with the Tactical Overlay menu.

Creating Control Measures - Move the pointer to any spot on the map (not on a unit, route, or control measure) and hold down the right mouse button to obtain a Map Options menu. From the menu, select "Create BLUEFOR CM" or "Create OPFOR CM". Move the pointer to the arrow revealing a secondary menu. Select from a variety of control measure types that may be added to the overlay. On-screen prompts guide in creating the control measure graphic. Once a control measure is created, it may be moved, modified or deleted by pointing at the desired control measure and holding down the right mouse button.

Scrolling - OPT uses several techniques for scrolling text and graphic displays. While displaying a COA graphic in a window, notice narrow dark bands on the left and bottom of the window. By moving the pointer to one of these dark bands and holding down the left mouse button, the bands can be dragged either up and down, or left and right. This has the effect of moving the display within the window.

Another technique is to move the pointer to the gray shaded area of the scroll bars and then clicking the left mouse button. The scroll bar will immediately move to the newly selected area and the display will be re-centered accordingly.

Finally, there are small boxes with directional arrows in three corners of the window. Move the pointer to any of these boxes and click the left mouse button. The display will move one line at a time. This last application is most useful in reading text displays.

2. OPT as a Decision Aid

A. **Building a Route** A route can be built at any time while working on a COA. A route indicates the direction a force is moving, beginning with a starting point moving towards an end point. The route consists of segments which are areas where tactical actions will take place and forces will be employed. In most cases a route will correspond to a main attack, supporting attack, counterattack, or exploitation.

For example, consider a main attack route that starts with a penetration of enemy forces who are in prepared defensive positions. Then, the enemy reverts to hasty defense as the battle moves back to an objective. The user would construct his route with at least three segments. The first segment would specify an area of the battlefield, the BLUEFOR and OPFOR units, and a BLUEFOR mission of "attack" and OPFOR in "prepared defense". The second segment would start at the end of the first segment and would specify the succeeding piece of terrain, the units involved and BLUEFOR units in "attack" and the new mission for OPFOR units in "hasty defense". The final segment would be similar to segment two, but because of attrition and other factors, different units would be selected for the final battle.

B. **Initializing an OPT Route** To define a route required for OPT operation, position the pointer anywhere on the map (not on a control measure, existing route, or unit) and hold down the right mouse button. A Map Options menu will appear. Select "Create OPT Route". A window will appear prompting for information required to initialize the route (see Figure 16). With the pointer positioned in the window, enter the name of the route. For example, if the route is reflecting an axis of advance for a main attack, the name could be "MAIN". Once the name is entered, press the "Return" key. The pointer will move to the next field, which is Route Start Time.

To define the Route Start Time, enter the six-digit date-time-group that movement is anticipated to begin on this designated route. When the entry is completed, press the "Return" key.

Segments of a route are used to divide the battlefield for analysis, similar to the box, belt, and avenue-in-depth techniques described in CGSC ST 100-9.

A segment consists of a set of opposing forces (the force array), with constant missions, on specified terrain.

A change of force array, mission, or movement direction is cause to create a new segment.

After the time is entered, select an appropriate mission for the opposing forces. To do this move the pointer into the dark band with the words "Select Missions" and hold down the right mouse button. A menu with mission options will be displayed (see Figure 17). Select from this list of options. Then, the selected BLUEFOR and OPFOR missions will be displayed in the window.

OPT Movement Route Definition

Route Name

Route Start Time

BLUEFOR
OPFOR

Figure 16. Create OPT Route Window

MOVEMENT	---
---	MOVEMENT
ATTACK	PREPARED
ATTACK	HASTY
ATTACK	DELAY
PREPARED	ATTACK
HASTY	ATTACK
DELAY	ATTACK

Figure 17. Mission Option Menu

To change the route name, the start time, or the missions of the opposing forces, move the pointer to the appropriate box and click the left mouse button. The pointer will appear in the selected box; make any change desired. When all information in the window is correct, should click on the "DONE" button. This starts the actual placing of the route on the battlefield. (All of this information, except the route

name, can also be changed after the route has been defined, so the absolute accuracy of this initializing information is not a concern.)

Next, define the battles or tactical actions that are envisioned to take place along the route, using the on-screen prompt and menu now appearing on the monitor. Each of these battles are defined in OPT as a segment. The segments are specified as straight lines between end points defined by clicking with the left mouse button at the appropriate locations. When all segments of a route have been defined, click on the "DONE" button using the left mouse button (see Figure 18). The segments will be displayed with a number for each segment. Review the display and confirm that the segments and their locations are consistent with the visualization of the course of action.

A route can be created quickly. All of the data describing the route can easily be changed later.

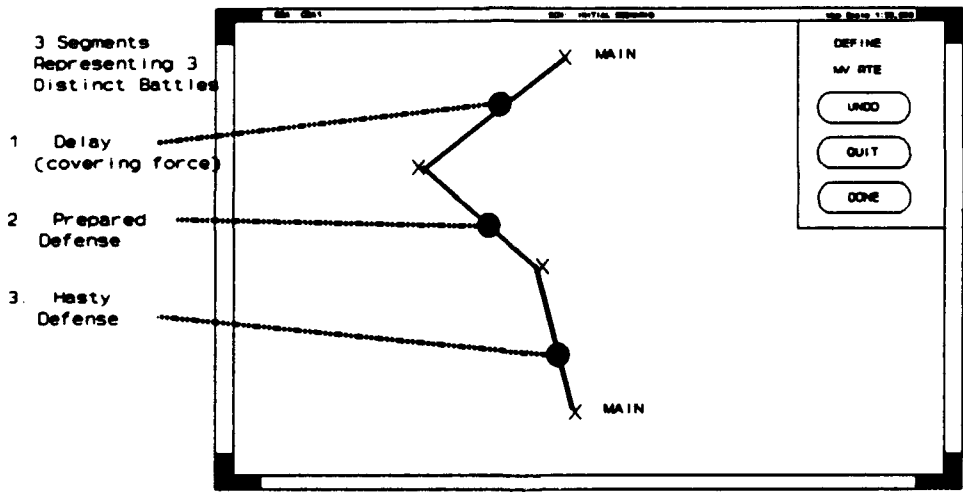


Figure 18. Creation of an OPT Route

To modify any of the segments, or add or delete segments, move the pointer to the segment point on the route nearest to the desired modification. Holding down the right mouse button causes a Route Option menu to appear with the name of the route in the title line (see Figure 19). Move, delete, insert or delete any point for any segment. On-screen prompts are provided. A "Change Start Time" option is also available with this menu. Selecting this option will also result in on-screen prompts that guide the changing of the start time of movement on the route.

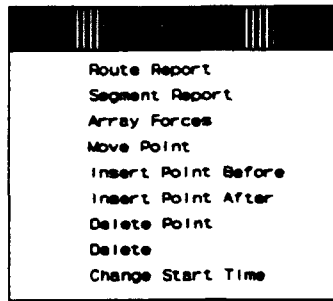


Figure 19. Route Option Menu

After designation of segments for a given route, additional routes may be created, or the wargaming process for segments in the already defined route may be started. At any time, new routes can be created, existing routes modified, or old routes deleted.

C. **Beginning Wargaming** After defining at least one route, or at least one segment of a planned route, the process of arraying forces in support of COA development can be started. OPT will support this process by providing tools for correlating forces, estimating time-distance relationships, and providing rapid and simple attrition estimations for each segment. Additionally, OPT provides tools to assist in visualizing the battles and synchronizing forces. OPT does not require that a rigid process be followed, but rather serves as a calculator, bookkeeper and thought organizer. Recognizing that individuals may differ in their analysis, OPT provides a flexible approach to tactical planning.

Time		BLUEFOR	OPFOR	Ratio	Terrain
Start	010500	Mission			GO <input type="checkbox"/> 40
End	011406	Cmbt Pwr	55.3	21.1	SLOW GO <input type="checkbox"/> 60
Movement	9:06	CP Factor	<input type="text" value="1.3"/>	<input type="text" value="1.0"/>	NO GO <input type="checkbox"/> 0
Delay	<input type="text"/>	Adj CP	71.8	3.2	<input type="button" value="Apply COM"/>
Duration	6.21	Loss(CP)	7.6	4.2	Dist(km) 2.6

Figure 20. Segment Report

To begin wargaming, move the pointer to the first segment in the route to be wargamed. Next, hold down the right mouse button to obtain the route options menu, and select "Array Forces". Two blinking window frames will appear. They should be positioned using the left mouse button. A Segment Report

Default Unit Role <input type="checkbox"/> CLOSE COMBAT <input checked="" type="checkbox"/> SUPPORT <input type="checkbox"/> UNCOMMITTED									
BLUEFOR Unit	Role	CP	Strt%	End%	OPFOR Unit	Role	CP	Strt%	End%
1 BDE 310	Close	20 2	85	63	21 GMRR	Close	14 7	95	53
2 BDE 310	Close	16 8	85	63	22 GMRR	Close	6 4	95	74
41 FA BDE	Suprt	8 2	95	82					
269 AR BDE	Close	10 2	100	4					
Total Combat Power		55 3			Total Combat Power		21 1		

Figure 21. Force Array Report

window (see Figure 20) and Force Array window (see Figure 21) will be displayed. The Segment Report window has a "Force Array" button that is used to display the force array window. Additionally, these windows may be moved or terminated, and the contents printed, by moving the pointer to the top of the window and holding down the right mouse button and obtaining a Window Options menu. The segment line selected will be displayed in a heavy white line and the segment number will be displayed at the top of the Segment Report.

OPT instantaneously wargames as each change is made to a route. Attrition and battle duration results are produced and displayed in the Segment Report. Unit starting and ending strengths are calculated and shown in the Force Array Report.

The Segment Report will display a start time for the segment, terrain data reflecting cross country mobility, a distance in kilometers, the missions of the opposing forces and a text area where notes or pertinent information can be recorded. To use the text area, move the pointer into the blank white area in the top of the segment report and depress the left mouse button. A cursor will appear, and text may be entered. There is a scrolling bar and arrows in this area to scroll textual data.

The Segment Report window contains the wargaming results of the battle in the segment, and areas where the user can input terrain type, any delay time, mission, and combat power multiplier data for the segment.

Other data will be added to the Segment Report as the segment is wargamed, as shown in Figure 20. Thus, instantaneous results are presented as each modification is made to the wargame.

The percentage values allocating the terrain into GO, SLOW-GO, and NO-GO categories are modifiable. Initially, the display will indicate 100% is GO. If cross country mobility is not 100% GO, enter the appropriate values for each category, ensuring that the three values add up to 100%. To do this, point at the value to be changed, click the left mouse button, enter the desired value, and press the "Return" key. When all values have been entered, click with the left mouse button on "Apply CCM". If the values do not add up to 100%, the system will not accept the entries.

Forces may be arrayed by moving the pointer to a unit and depressing the left mouse button. The unit selected will turn white on the overlay and the name will appear in the Force Array window. The unit, along with its role, combat power, and starting and ending strengths for the

The Force Array window summarizes the force structure for the segment in terms of the units and their roles, and their beginning and ending strengths.

selected segment will be displayed. Notice that as opposing forces are selected, an end time and duration for the segment will be computed and displayed. The combat power of the forces and the respective ratio will also be displayed along with an estimate of combat power losses. Use the "Unadjusted CPs" button on the force array window to view the pure, or base, combat power of units.

Select as many units as appropriate for the segment. Remember, the segment reflects a specific battle with each side having specified missions, and involving selected units in specified roles. At any time, the units, roles, and mission may be changed.

Units may be added or deleted from the force array, their role changed, the missions of the opposing forces changed, and the terrain movement capability altered.

To add forces to the segment array, move the pointer to a unit and click the left mouse button.

With each change, the resulting movement times, combat powers and ratios, and estimated losses are instantaneously presented. This provides a quick way to perform "what if" analysis as an integral part of the planning process.

To remove a previously selected unit, move the pointer to a unit's symbol displayed in white and click the left mouse button.

To change the mission of one or both forces, move the pointer to the mission button in the Segment Report and hold down the right mouse button for the Mission Options menu.

At the top of the Force Array Window are three boxes labeled "Close Combat," "Support" and "Uncommitted". These choices allow more accurate reflection of the actual status of the units involved in the battle

within a segment. For example, if two tank battalions of a brigade are leading a main attack against an OPFOR tank battalion, those units would be in close combat and should be assigned that role. A follow-on battalion providing overwatch or limited firepower would have the role of support. If another battalion is selected for this segment but not involved directly in the battle (will pass through at a later point), it should be assigned a role of uncommitted. Direct support artillery which is fully involved in the battle should be considered in close combat, while artillery that is in general support should be considered in the support role.

Units in the support role have reduced combat power and suffer less attrition, reflecting their less than full commitment to the battle in the segment. Units in an uncommitted role are displayed but not included in either combat power or attrition calculations. The combat power of Close combat units which are attacking are doubled to account for maneuver and surprise. Defending units in prepared positions are likewise rewarded by doubling of their combat powers. The role of any selected unit may be modified by moving the pointer to the name of the unit in the Force Array window, holding down the right mouse button, and selecting the correct role.

The time required for a segment and the combat power of a force can be easily modified, to account for unique battle conditions. To increase the time for a segment (because of a delay required for reorganization, refueling or rearming, for example), move the pointer into the delay box and click the left mouse button. Then enter the amount of delay required, using the keyboard, and press the "Return" key. To adjust the Combat Power of one or both forces, move the pointer into the CP Factor box of the Segment Report and click the left mouse button. Then enter the new CP Factor from the keyboard, and press the "Return" key.

Use Delay Time to account for time spent performing functions other than movement.

When satisfied with the results of the wargaming for that segment, work can begin on the next segment. The ending strengths of the current segment will be the starting strengths for the next segment. All the units in a segment and their present roles will be put in the next segment, by default. Make selected changes as desired to properly visualize and wargame the next segment.

Unit Roles - The degree of commitment or involvement of a unit in a specific battle.

OPT provides a tool to assist in displaying units selected within a segment. Units may be moved and displayed consistent with a scheme of maneuver. To move a unit, point at a unit, hold down the right mouse button, and select the "Move" option. Then move the pointer to the desired new location and click the left mouse button. The unit will be displayed at the new location.

When wargaming the next segment, the units from the previous segment are included, their locations are adjusted by the length and direction of the previous segment, and their strengths reflect any previous attrition.

To wargame later segments, move the pointer to the desired segment and hold down the right mouse button to select "Array Forces". OPT will immediately display the wargaming results of this new segment. Review and modify the mission, forces, unit strengths and roles to insure their accuracy and compliance to the scheme of maneuver. Review the new location of the units and modify them as necessary. This process is repeated until the entire route is wargamed.

Route Summary MAIN								
Seg Num	CP Ratio	Combat Power		Start (DTG)	Distance (km)	Duration (hr mn)	CP Losses	
		BLUFOR	OPFOR				BLUFOR	OPFOR
1	2.0	71.8	35.8	010500	2.6	5.21	7.6	4.2
2	3.1	52.2	16.9	011021	10.4	1.41	1.3	1.0
3	2.2	34.7	15.9	011203	3.7	2.18	2.6	1.8
4	2.0	28.5	14.1	011421	4.5	1.01	0.5	0.4
5	2.5	27.6	11.2	011522	3.0	0.35	0.3	0.2
TOTAL					24.6	10.57	12.3	7.6
Start DTG 010500 SEP					GO SLOW GO NO GO			
End DTG 011557 SEP					TERRAIN	90%	10%	0%

Figure 22. Route Summary Report

A Route Summary report may be requested by pointing to any spot on the route, holding down the right mouse button, and selecting "Route Summary" (see Figure 22).

Route Summary - contains the wargaming results of a single route.

A summary of the wargaming results of all segments in the route will be displayed. As with the individual segment reports, text may be entered at the top of the

Route Summary window. While the Route Summary report is displayed, further modifications and 'fine tuning' of the segments may be done, with the results immediately displayed in the Route Summary report. When satisfied with the results of the route, repeat the process for other routes within the COA. As with the Segment and Force Array Reports, the Route Summary Report can be moved, terminated, or the contents printed through use of the Window Options menu.

COA Summary COA1						
MAIN ATTACK IN NORTH. SPRT ATTACK ON CENTER AND SOUTH						
Route Name	Start DTG	End DTG	Distance (km)	Duration (hr:mn)	CP Losses	
					BLUFOR	OPFOR
MAIN	010500	011614	24.6	11:14	12.2	7.5
SECONDARY	010430	011609	22.9	11:39	8.3	5.1
Summary	010430	011614	24.6	11:44	20.5	12.7

Figure 23. Course of Action Summary Report

When two or more routes are created, a COA Summary report may be requested which includes wargaming results of all routes (see Figure 23). This is done by clicking with the left mouse button on the "COA Summary"

COA Summary - contains the wargaming results of all routes in a COA.

button at the top of the COA window. A flashing window will appear at the bottom of the monitor. Move the window to a desired location and click the left mouse button. As with the other wargaming reports, modifications to the wargaming of any segment result in the immediate display of wargaming results in the COA Summary report. Also, a text area is provided for notes and important data to be entered. The notes area and unique COA and route names should be used to help distinguish among the many COAs and branches which can be developed and wargamed. The COA Summary window may be moved, terminated, or the contents printed by using the Window Options menu, as described for the Segment and Force Array Reports.

The process described above is repeated for all courses of action to be developed and wargamed, starting with defining a new COA in the COA Selection window.

OPT provides easy "what if" case development, and instantaneous results.

A valuable feature of OPT is the ability to do "what if" planning during the actual development of a COA. Force arrays, mission assignments, and unit roles may be changed with the click of a button. Each aspect of the COA can be modified and the results reviewed. By the time the process is completed, the final product has been subjected to numerous "in process" reviews.

D. Wargame Visualization Techniques The G-3 Plans Officer must analyze the entire battlefield in his COA development and analysis. Follow-on battles, commitment of reserves, and changes in missions are examples of factors the planner must consider in analyzing a COA. Also, individual units are added or removed from battles to best accomplish the mission. Currently, planners use "butcher paper" sketches or yellow stick-on notes on an overlay to track units as they move in a course of action. These manual processes help the planner to visualize a sequence of battlefield events. Obvious disadvantages to these manual processes are the time and effort required to calculate movement rates based on terrain, battle conditions, and forces committed.

OPT includes a tool that aids in battlefield visualization over time. The Wargame Animation Tool highlights those units involved in a battle segment to provide automated visual tracking of these units. The highlighted units are automatically moved and displayed in later battle segments. With the units highlighted and moved automatically, the battlefield can be quickly viewed over time, and the force array modified to make efficient use of resources to accomplish mission objectives.

The Wargame Animation Tool is automatically enabled when the planner begins selecting units in the "Force Array" window in the initial segment. Both BLUEFOR and OPFOR unit symbology, when selected, are turned white on the overlay. The unit names remain either blue or red.

Movement of units from segment to segment along a route is displayed using the Wargame Animation Tool.

Units may be moved to represent their approximate location at the beginning of the battle segment. This movement process is accomplished by moving the pointer to the selected unit and holding down the right mouse button. From the pop-up menu, select "Move". Point to the desired new location and click the left mouse button. The unit symbology will immediately move to the new location. On-screen prompts aid in performing this task.

The Wargame Animation Tool is handy for visualizing force deployments. For example, consider an attack to be led by two mechanized infantry battalions, followed by an armored battalion with several artillery battalions. The planner may display the units to represent this deployment on the overlay using the Wargame Animation Tool. Opposing forces may also be arrayed as the planner believes they will be

deployed along the battlefield. When the planner wants to wargame the next segment, all units displayed in the previous segment are automatically moved and displayed at the start of the next segment. This updated graphic display of unit symbology presents a visual starting point for wargaming the next battle segment. Units may then be moved to represent the commitment of reserves, more effective use of terrain, or changes in mission.

E. **Use of the Timeline** The Timeline tool (see Figure 24) provides a capability to determine the time that forces are predicted to be at any spot on a route. Also, it displays the locations of forces on multiple routes simultaneously, thereby assisting in synchronizing forces.

Synchronization of forces and battlefield events is facilitated using Timeline.

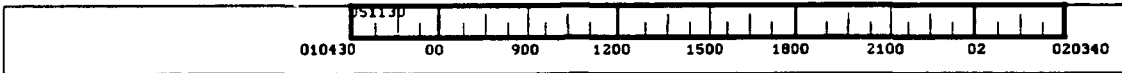


Figure 24. Timeline

The timeline may be obtained in either of two methods. First, on the COA map display, point at the timeline button and click the left mouse button. After selection, a timeline will appear at the bottom of the window. The start time for the COA will be displayed on the left end of the timeline and the end time will be on the right end. Hours and days (if required) will be displayed along the timeline band. The band itself will have light and dark colored areas to denote daylight and nighttime. Each of the routes will have a white marker denoting the front edge of the advancing forces. Move the pointer into the timeline band and click the left mouse button at any point. The time for that point will be displayed in the timeline band and the markers on the routes will display the forward edge of the units' movement at that time. This process may be repeated as needed along the entire timeline band. Alternatively, move the pointer to any spot on the route and click the left mouse button. The unit marker will move to this point and the time will be displayed in the timeline band.

A second method of turning on the timeline is the Unit Role Status display. This display is requested by pointing to one of the units involved in a COA and holding down the right mouse button to select the "Role Status" option. The timeline appears at the bottom of the display, together with a series of boxes representing each of the routes in the COA and the segments within each route. The segments for each route will be colored to indicate the role (close combat, support, or uncommitted) of the selected unit in

each segment. A legend of the colors is shown in the lower left corner of the display. This method is further described in the next paragraph.

F. **Unit Role Status** OPT provides a tool to check the utilization of forces within a COA. This aid provides a capability to analyze the missions and roles of individual units to insure they have not been over- or under-utilized.

Move the pointer to a specific unit, hold down the right mouse button, and select "Role Status". The Timeline appears at the bottom of the display (if not already displayed). Immediately above the Timeline will be a series of boxes representing each of the routes in the COA and the segments within each route (see Figure 25). The selected unit name will be displayed in the lower left corner along with a color code for the display. The color code indicates whether the unit is assigned to the route and its role. If the segment is not colored, the unit is not involved in that segment. If colored blocks for different routes overlap, the unit has been assigned missions on different routes simultaneously. If no block is color coded, this unit has not been assigned any mission for the COA. The length of the blocks (representing segments) corresponds to the Timeline displayed below. A small block with a thin line indicates a delay time within the segment. Times may be obtained by clicking the left mouse button at any desired place on the Timeline or on the segment blocks.

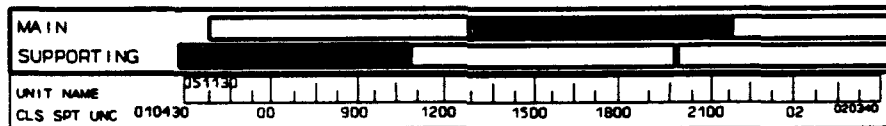


Figure 25. Role Status

G. **Comparing COAs** After multiple COAs have been developed and analyzed, a summary and comparison of any or all COAs may be displayed. To begin, click on the OPT button to obtain the COA Selection window. Then select one of the COAs (a base COA) to compare by pointing to the appropriate COA box in the planning tree and holding down the right mouse button. When the Planning Action menu appears, select "Compare". A prompt will ask for identification of other COAs to be compared against the already selected COA. This task is performed by clicking the left mouse button on each COA.

When the selection of COAs is complete, click the left mouse button on "Done". A COA Comparison report will appear (see Figure 26). The top half of the window will present "Wargaming Actual Outcomes",

including Start Time, End Time, Distance (km), Duration (hrs), and Combat Power Losses (BLUEFOR and OPFOR) for each selected COA. The bottom half of the window displays "Wargaming Relative Outcomes". Here, the same

The wargaming results of alternative COAs can be easily compared.

factors are shown with values relative to the base COA factors, which are set to values of one (1.0). A yellow band indicates the base COA. This base COA may be changed by clicking on a different COA with the left mouse button. The newly selected COA will be colored yellow and all of its values will be displayed as one, and the factors for the other COAs will be recalculated. One final feature of this display is a button named "COA Description". When selected, the text display that was entered previously in the COA Summary Report for each COA will be displayed. The COA Comparison Report, together with the COA Description, can be printed using the Window Options menu.

Wargaming Actual Outcomes						
COA	Start DTG	End DTG	Distance (km)	Duration (hh:mm)	CP Losses	
					Bluefor	Opfor
COA1	010430	011614	24.6	11:44	20.5	12.7
COA2	010500	020730	27.2	26:30	23.6	20.3
Wargaming Relative Outcomes						
COA	Start DTG	End DTG	Distance	Duration	CP Losses	
					Bluefor	Opfor
COA1	010430	011614	1.00	1.00	1.00	1.00
COA2	010500	020730	1.14	1.39	.95	1.07

Figure 26. COA Comparison Report

H. **Making Quick Estimates** OPT can be used to make quick estimates on questions outside of the formal planning process. Because of its straightforward, modular design, OPT can be used in a reduced mode to make single estimates of distance and combat power ratios. A planner may wish to know the distance between two points (such as two rivers) or along a road. Distance can be calculated by creating a route along a feature of interest or between points. Forces do not need to be arrayed in the segment for distance and time to be calculated. The segment report (see Figure 20) will display the distance

OPT PLANNING FACTORS							EDIT Disabled			
ATTACKERS MOVEMENT RATE (km per hour)							ATTRITION RATES			
<input type="checkbox"/> Unopposed <input type="checkbox"/> Prepared Defense <input checked="" type="checkbox"/> Hasty Defense <input type="checkbox"/> Delay							Delay = 1/2 Rates			
							<input checked="" type="checkbox"/> Attacker <input type="checkbox"/> Defender			
CPR	FAV		MARGINAL		UNFAV		CPR	Std	Curr	
	Std	Curr	Std	Curr	Std	Curr				
0.25	0.63	0.63	0.49	0.49	0.25	0.25	0.25	0.3856	0.3856	
0.50	0.75	0.75	0.58	0.58	0.29	0.29	0.50	0.2991	0.2991	
0.75	0.88	0.88	0.66	0.66	0.34	0.34	0.75	0.2356	0.2356	
1.00	1.00	1.00	0.75	0.75	0.38	0.38	1.00	0.1878	0.1878	
2.00	1.50	1.50	1.10	1.10	0.56	0.56	2.00	0.0979	0.0979	
3.00	2.00	2.00	1.44	1.44	0.75	0.75	3.00	0.0619	0.0619	
4.00	2.40	2.40	1.80	1.80	0.83	0.83	4.00	0.0429	0.0429	
5.00	2.60	2.60	2.00	2.00	0.90	0.90	5.00	0.0326	0.0326	
Movement Rate Adjustment Factor							1.0	Adj. Factor		1.0
BASE COMBAT POWER										
BLUEFOR Units					OPFOR Units					
Unit Type		Std	Curr	Unit Type		Std	Curr			
M1A1 Bn		3.15	3.15	ANTI-Tank Bn		1.00	1.00			
FA Bn. 155		1.55	1.55	ANTI-Tank Rgt		3.00	3.00			
ATACMS		3.00	3.00	Arty Rgt. 2S1/2S3		4.90	4.90			
ACR Sqdn		2.75	2.75	Arty Rgt. 2S3		5.40	5.40			
Div Hel Bn		1.50	1.50	Arty Bde. 2S3		4.50	4.50			
Atk Hel Bn		4.00	4.00	Arty Bde. 2S3/2S5		6.20	6.20			
M2 Bn		2.00	2.00	Arty Rgt. 2S5. 24/BN		6.40	6.40			
Lance		2.00	2.00	Arty Rgt. 2S5. 18/BN		4.80	4.80			
MLRS Bn		3.30	3.30	Arty Bde. D20		3.00	3.00			
MLRS Btry		1.10	1.10	Arty Bde. HP		2.10	2.10			
M60A3 Bn		1.55	1.55	Arty Bde. M46/D20		3.90	3.90			
M113 Bn		1.00	1.00	Helo Det		1.00	1.00			
Recon Bn		1.60	1.60	Helo Rgt		6.00	6.00			
				MRL Bde		8.80	8.80			
				MRL Rgt		6.60	6.60			
				MRR. BMP/T72		6.85	6.85			
				MRR. BMP/T80		7.30	7.30			

Figure 27. OPT Planning Factors Report

Starting force ratios can be calculated quickly by arraying forces on a new, arbitrary route or segment (a route of any length and direction). Forces can be assigned to the route by graphically selecting units and designating close combat or support roles and missions. The planner does not need to relocate units to any given area nor template them into combat configurations. Combat power calculations will be made as long as the forces are arrayed to a segment. The planner needs to be cautious to not use the distance or duration results when arbitrary segments are used.

I. **Adjusting Planning Factor Values** OPT uses a set of planning factors and combat powers taken from CGSC ST 100-9. Attrition factors are based on the First Battle B-C training simulation. All factors are easily modified.

To modify a planning factor used in OPT, obtain the COA Selection window. An "Edit Plan Factor" button is displayed at the top edge of the window. Click on this button with the left mouse button to obtain the OPT Planning Factors Report (see Figure 27). Review and modify any of the displayed factors.

To make any changed value effective, the new planning factor values must be saved. To do this, point to the top of the OPT Planning Factors Window and hold down the right mouse button, then select the "Save PFs" option from the menu. Depending on the number of COAs present, this operation may take several minutes to perform, since all COAs must be wargamed again using the changed planning factors.

When working on a COA, the "Edit Planning Factors" function is no longer available. The button at the top of the COA display now says "See Plan Factors", allowing review of the planning factors. To make a change, click on the "OPT" button to obtain the COA Selection window, and proceed as described above.

Attackers Movement Rate Click the left mouse button on the mission of the defense facing the attacker. The movement rate values for an attacker against that defense mission will be displayed in the table. At the bottom of the table is a "Movement Rate Adjustment Factor" box that may be modified as necessary. To make the adjustment, move the pointer into the box and click the left mouse button. Enter the new value and press the "Return" key.

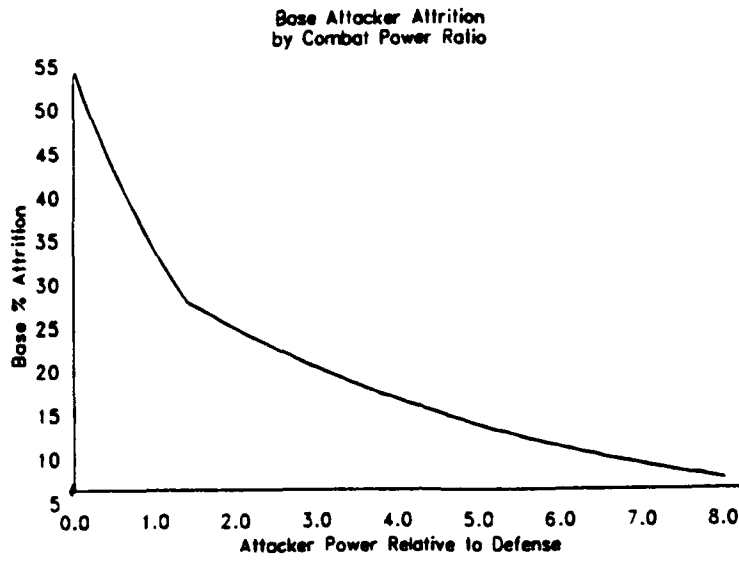


Figure 28. Attacker Attrition

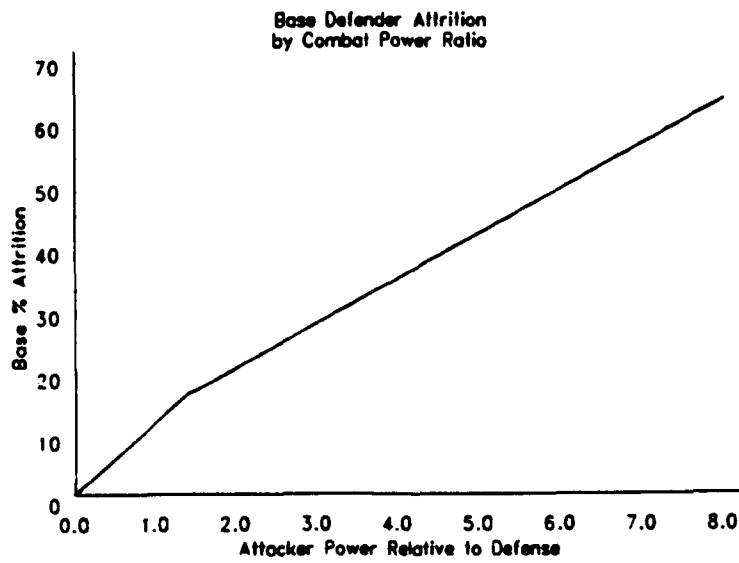


Figure 29. Defender Attrition

Attrition Rates Modify the attrition for the attacker or defender by changing the adjustment factor in the same method described above. Changes to the attrition rates will result in changes in the losses of combat power experienced by the opposing sides. Thus, combat power ratios and, indirectly, movement times will be altered. The values shown in Figure 27 are representative of the attrition algorithm used in OPT. This algorithm results in a curve as shown in Figure 28 for offensive forces, and in Figure 29 for forces in the defense. Modifications to the attrition factor has the effect of raising or lowering the curve for all values of combat power ratios. When reviewing the attrition results of wargaming, it should be noted that the duration of a segment also impacts the attrition, as shown in Figure 30. Segments shorter than about 4.5 hours will have less attrition than shown in Figure 28 and Figure 29, while longer segments will result in more attrition.

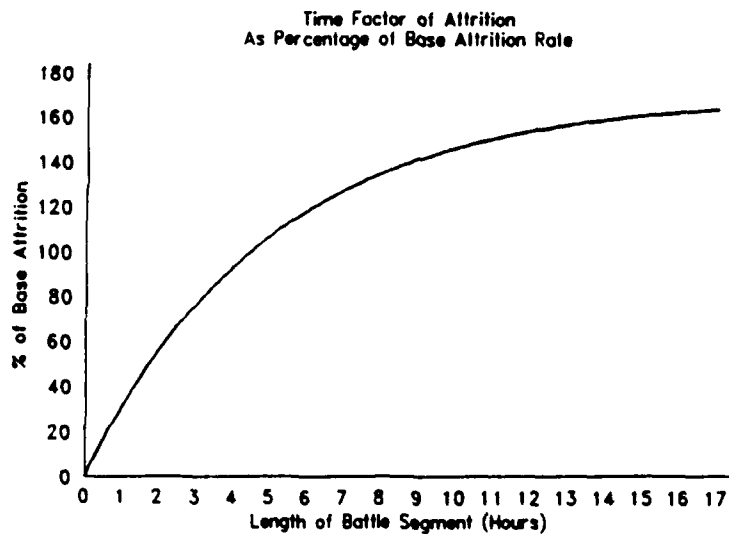


Figure 30. Time Factor of Attrition

Base Combat Power The combat power of various unit types may be modified. The display shows both the standard (STD) value for the unit and the current (CURR) value. Modify the current value by clicking in the appropriate CURR box, entering in the new value, and pressing the "Return" key.

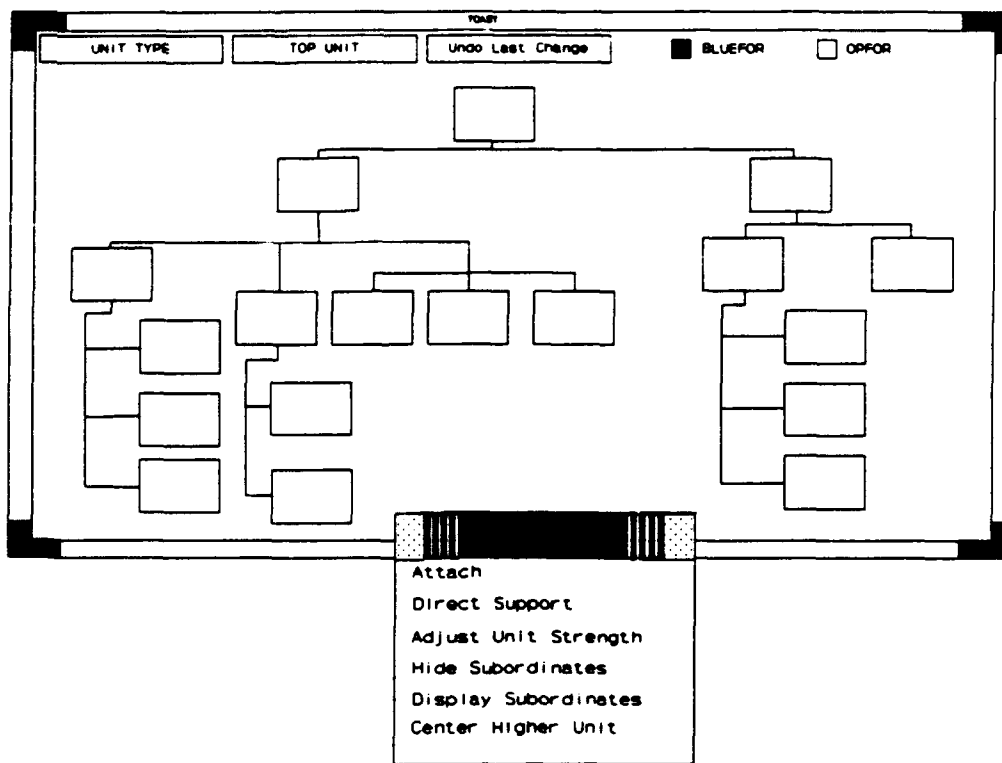


Figure 31. TOAST with Unit Menu

J. **TOAST** TOAST is an acronym for the Task Organization and Status Tool. This tool provides the capability to view the organizational structure of the units.

TOAST, the Task Organization and Status Tool

It also allows unit symbology to be displayed 'ON' or 'OFF' the map overlay, task organizational structure to be modified, and unit strengths and locations adjusted. Whenever the OPT window is present, TOAST is accessible by clicking on the TOAST button located at the top of the OPT window. After selection of this button, a rectangular frame will appear. The TOAST window is positioned on the screen by moving the pointer until the frame is in the desired location, and clicking the left mouse button. The task organization wiring diagram will then be presented (see Figure 31).

Options available by clicking on the buttons at the top of the TOAST window are:

Select the display of units by type Simplify the TOAST display by displaying selected types (combat, combat support, or combat service support). The 'UNIT TYPE' button provides this capability.

Identify the unit to be displayed at the top of the wiring diagram. To view specific portions of the organization chart, click the 'TOP UNIT' button. This option allows the user to identify which unit will be centered in the window display.

Identify which force (BLUEFOR or OPFOR) should be displayed by TOAST. Initially the diagram will display the BLUEFOR organization. By selecting the OPFOR button at the top of the screen, the OPFOR organization will be displayed. TOAST reflects the display status of each unit. BLUEFOR units being displayed are blue, OPFOR units being displayed are red. Units not being displayed are shown in brown. Units not having a known location are not displayable, and are colored green.

Ability to return to a previous structure. Whenever there has been a change to the organizational structure via the TOAST Unit menu (as described in beginning on page 45) an 'UNDO LAST CHANGE' button is available which will reset TOAST to the task organization structure prior to the last modification.

A feature that assists working with the organization chart is the split-screen option. Position the cursor at a point on the TOAST background desired to split the display. Call up a menu by holding down the right mouse button. The window may be split horizontally or vertically. The resulting split windows may themselves be further split, if desired. Each of the split windows has its own scrolling bars to facilitate access to the entire organization chart while performing task organization actions. When a split view is no longer desired, obtain a menu to remove the split screen by clicking on the background of the window involved with the right mouse button.

K. **Modification of the Task Organization** The task organization can be modified by pointing to a unit to be reassigned and holding down the right mouse button. Select the subordination type (attached or direct support) from the menu (see Figure 31) and then click on the new higher echelon unit using the left mouse button. The organization chart will be redrawn to reflect the new organization.

TOAST shows the current task organization. Within a scenario, the task organization can be modified, but not in a COA.

L. **Selective Control of Unit Symbology Display** Units can be selectively displayed on the tactical overlay by using the TOAST capability. TOAST reflects the current display status of each unit through the color of the unit symbology. Blue and red are the colors of currently displayed BLUEFOR and OPFOR units, respectively. Units symbols not currently displayed in the tactical overlay are shown in brown in TOAST. Units no currently displayed due to a lack of a UTM location, are shown in green in TOAST.

TOAST helps control display of unit symbology on the map.

To change the display status of a single unit, click on the unit in the TOAST organizational chart using the left mouse button. The color of the unit display on TOAST will change as will the state of the unit symbology on the map.

To change all subordinates of a unit, point at the unit and hold down the right mouse button. From the resulting menu identify either the 'Display Subordinates' or 'Hide Subordinates' selection. The display state of all the subordinate units as diagramed by TOAST will be either all display or all not-displayed as appropriate. The color of the TOAST unit symbology will reflect the state of display of the unit symbology on the map.

Any action taken in TOAST concerning the display of unit symbology, overrides any previous actions taken in the Tactical Overlay menu directly on the map (see the discussion of the Tactical Overlay information on page 23). Similarly, any later actions taken in the Tactical Overlay menu concerning display of unit symbology will override actions taken in TOAST.

M. **Displaying and Adjusting Unit Strengths and Locations** The planning of COAs includes assumptions involving BLUEFOR and OPFOR strengths and locations. OPT provides the user with tools to input these changes in a scenario, using the TOAST display. Within a COA, the initial strengths and locations can be viewed, but not changed, using the TOAST display.

The location and strength of any unit can be modified by pointing at the unit, holding down the right mouse button, and selecting the 'Adjust Strengths' menu option. A rectangular frame will appear. Use the mouse to move

Unit locations can be updated through the keyboard.

the frame as desired, and click the left mouse button to view the Unit Strength Worksheet. A table will appear that lists the selected unit and its subordinates (see Figure 32). Also listed will be the UTM location, full-up combat power, the current strength (%), and the current combat power. The location, the current strength, or the current combat power for each unit is changed by pointing at the field to be changed and clicking the left mouse button, or by traversing to the desired location by either the Tab, Return, or the Arrow keys. In order for the data entered into a field to be recognized, one of these keyboard actions must occur after changes have been made.

STRENGTH ADJUSTMENT WORKSHEET				
UNIT NAME	LOCATION	FULL CP	% STR	CURRENT CP
2 BDE 3ID	NC037634	9.85	75.0	7.39
1-15 IN	NC060060	2.00	75.0	1.50
4-89 AR	NC100070	3.15	75.0	2.36
1-89 AR	NC110050	3.15	75.0	2.36
4-70 AR	NC060080	3.15	75.0	2.36
5-41 FA	NC100000	1.55	75.0	1.16

DONE

CANCEL

RESET

Figure 32. TOAST - Strength Adjustment Worksheet

Changing the strength of a higher unit will affect all subordinates to be changed accordingly. Changes to the strengths of subordinate units will cause the strength of the higher unit to be recalculated. When all of the desired changes have been made, clicking on the 'DONE' button will install the changes and remove the window. If it is desired to start over with the original data, click on the 'RESET' button.

Clicking on the 'CANCEL' button will terminate the window without installing any changes which may have been made.

Use TOAST to specify the strengths of units for a scenario.

Multiple units can have their strengths updated with one action through use of the Task Organization structure.

A menu is available from the top of the Unit Strength Worksheet which provides the ability to MOVE, PRINT or TERMINATE the window. To access this menu, hold down the right mouse button when the pointer is located at the top of the Unit Strength Window. The PRINT option will provide a printout to the local printer of the data currently displayed in this window.

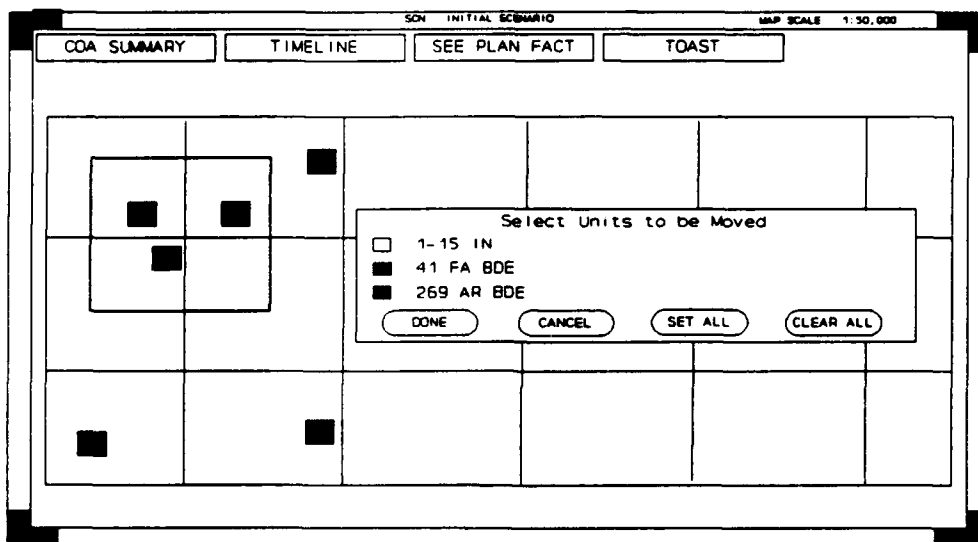


Figure 33. Multi-Unit Move

N. **Multi-Unit Moves** OPT provides a tool by which multiple units may be moved at one time. This is accomplished through the "Tactical Overlay" option on the map menu (requesting a menu from a spot on the map by holding down the right mouse button). Select either "BLUEFOR Move" or "OPFOR Move". Following on-screen prompts, define a rectangle on the map encompassing all the units desired to be moved, specifying any two opposite corners by clicking the left mouse button. A table will appear with the names of all units located in the rectangle (see Figure 33). With the left mouse button, select or de-select the specific units desired to be moved, and then click on the "Done" button. Using the mouse, slide the rectangle to a new position, and temporarily freeze the new unit locations by clicking the left

mouse button. Thus, several potential locations could be tried before clicking the right mouse button to finalize the multi-unit move.

SECTION IV - Adjusting for Other Battlefield Considerations

OPT performs a variety of calculations in a simple and straightforward manner that is easy to use and produces almost instantaneous results. While speed and simplicity are design goals for the system, these attributes result in one of the major limitations of the system. Many other factors are considered by planners in developing, analyzing, and recommending a course of action. These factors may range from minimal to large in their impact on a Course of Action. Many times, their impact will be directly related to the scenario being analyzed. In most cases, there will be special staff officers with expertise in these factors to assist the G-3 plans officer.

OPT algorithms are simple, quick, and straightforward.

OPT, while not addressing all combat multipliers explicitly, allows input of delay times. If a segment requires additional time for any reason, the delay time may be adjusted accordingly.

The combat power calculated by OPT may be adjusted, based on combat multipliers or other intangible factors. For example, use of deception, surprise, smoke, CAS, special combat support resources, morale, fatigue, etc., are combat multipliers that have direct impact on the effective combat power of a force. These combat multipliers can be applied by using the CP Factor button in the Segment Report. The rationale for use of the CP Factor can be recorded in the text area of the Segment Report, Route Summary, or COA Summary.

Provision is made to adjust OPT calculations in consideration of battlefield conditions not addressed by OPT.

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