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This document provides information regarding ModSAF configuration, user interface tools, and plan view display, graphics, unit, and mission operations. It discusses the set of tools available to the ModSAF user, miscellaneous commands to control the interface, and operation of the Logger.

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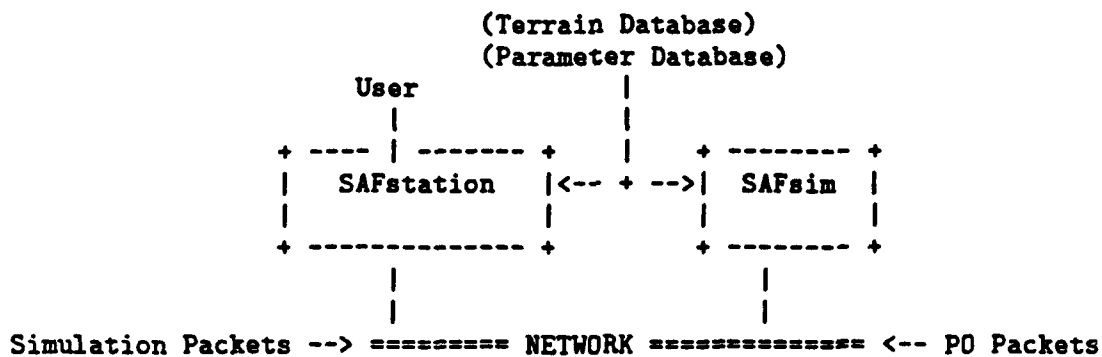
I n t r o d u c t i o n

The Modular Semi-Automated Forces (ModSAF) system can replicate the outward behavior of simulated units and their component vehicle and weapon systems to a level of realism sufficient for training and combat development. It permits large scale, combined arms, team training within a distributed interactive simulation (DIS) environment.

The ModSAF system lets the operator make the critical tactical decisions for the forces he controls. Since it can provide realistic representations of forces without requiring a large number of personnel, it can supplement a simulation exercise's capability to conduct force-on-force engagements during training exercises and tests.

The ModSAF architecture divides its functions into three components: the SAFstation, the SAFsim, and the Logger. These components are typically run on separate computers distributed over a network (although the SAFsim and SAFstation can run on the same computer). The components communicate physical battlefield state and events between themselves via the DIS protocol and command, control, and system information via the Persistent Object (PO) Protocol.

The figure below shows a SAFstation and a SAFsim communicating over a network via PO packets and DIS packets. These packets, containing data which is bundled up to send over a network, are marked with the same exercise ID. The SAFsim and the SAFstation communicate command, control, and system information via PO packets. There are PO packets for bundling graphic, unit, message, model parameter, task, task frame, and mission data. When a user creates objects on the SAFstation, PO packets whose data represents the state of each object are projected onto the network so that the objects they represent can be simulated by the SAFsim. The SAFsim and the SAFstation communicate physical battlefield state and events between themselves via simulation packets. There are simulation packets for bundling entity state, impact, collision, fire, initialization, radar, and weather data.



Modelling parameters used in the construction of the ModSAF system are contained in the Parameter Database (DB). Use of this set of parameter files allows modification of the ModSAF system without further computer programming. Both the SAFstation and the SAFsim have access to a Terrain DB.

The SAFstation allows users to create, load and run scenarios to simulate a battlefield situation. It lets a user interact with the ModSAF system by way of menus and mouse-sensitive graphics facilities. This interface provides an extensive list of actions and options. Its graphics facilities aid the user in many ways, such as adjusting map resolution and positioning objects such as control measures and units.

Objects are simulated by the SAFsim computer. The simulated objects, referred to as ModSAF entities, can behave autonomously. When a SAFsim simulates a unit, the SAFsim not only creates the SAF entities (such as a plane) in a unit but also builds a structure corresponding to the unit hierarchy. The user can then issue commands to the top-level units or drop down the chain of command to give orders to subordinate units or vehicles. The SAFsim interprets these orders and then generates the appropriate unit and vehicle behavior and tactics without further action from the user. However, the user can override or interrupt any automated behavior. When an object is simulated on the SAFsim it is given extensive capabilities; it can drive over the terrain avoiding obstacles, shoot at enemy objects, and be tasked to execute a mission.

At the vehicle/weapons system level, ModSAF vehicles are able to execute a realistic range of basic actions inherent to the type of the vehicle. For example, a tank can drive along a road and an airplane can orbit. ModSAF simulated entities can exhibit mobility and firepower combat damage according to type of weapon used, location of hit, angle of incidence of hit, and range of weapon. Similarly, weapons systems exhibit realistic rates of fire and realistic trajectories. Resource depletion is accurately simulated for both fuel and ammunition. Currently, ModSAF aircraft are resupplied when they land in response to a bingo fuel condition. Other simulated capabilities include intervisibility, target detection, target identification, target selection, fire planning, and collision detection. These capabilities are based on, but are not limited to, such appropriate factors as range, motion, activity, visibility, arc of attention, direction, orders, and evaluation of threat.

Automated behavior is governed by tasks and task frames. A task is a behavior performed by a ModSAF entity or unit on the battlefield. A set of representative tasks has been defined in terms of their characteristic parameters. Default values are provided by the ModSAF system for the task parameters, these values being drawn from standard military doctrine. These default values are open to modification by the user. Task frames group a collection of related tasks that run at the same time. Task frames are typically composed of move, shoot, and react tasks.

How to Use This Manual

This manual provides a comprehensive description of the features of the ModSAF and Logger user interfaces, as well as step-by-step user instructions. It can be used as a tutorial for beginning users or as a reference guide for more experienced users.

Used as a tutorial, it introduces the basic features first, and then moves gradually to the more complex ones. If you are unfamiliar with ModSAF, you should proceed sequentially through the manual, trying out procedures. In each procedure, numbered instructions tell you what steps to perform and what happens on the screen as you perform each step.

Used as a reference guide, this manual provides step-by-step instructions for tasks that can be performed at the ModSAF or Logger user interface. Experienced users who merely need to refresh their memory can refer to the numbered steps in the appropriate chapter or appendix.

The manual is divided into the following chapters:

- ModSAF Configuration - gives an explanation of the ways ModSAF can be set up.
- ModSAF Operation - gives instructions for starting and exiting the SAFstation and the SAFsim plus explains start up, and shut down procedures.
- Basic Tools of the ModSAF User Interface - shows the SAFstation screen layout and gives instructions for working with each screen section.
- The Tactical Map View - gives instructions for altering the map view.
- Graphic Operations - gives instructions for creating, deleting and editing graphics.
- Unit Operations - gives instructions for creating, deleting and editing units.
- Mission Operations - gives instructions for creating, assigning and editing missions.
- Miscellaneous Tools - gives instructions for using the intervisibility and artillery generation tools.
- Miscellaneous Commands - explains the choices offered by the File, Special, and Show As commands.
- Miscellaneous Editors - describes the User Preference, PVD Controls, Stealth Controls, and Overlay editors. The User Preference and PVD Controls editors are used for setting measurement and screen display defaults. The Stealth Controls editor is used to control the Flying Carpet (stealth/preview) view. The Overlay editor is used to create, edit, and delete overlays.
- The ModSAF Logger - gives operating instructions for the logger program.
- Release Notes - gives information about ModSAF distribution, building, operating, porting, documentation, and troubleshooting.

The manual contains the following appendices:

- **Menu Component Operations** - describes the data entry and editing procedures for the components appearing on pulldown menus, editor displays, and pop-up windows.
- **Task Frames** - describes the assignable task frames.
- **Editable Tasks** - describes the editable tasks.
- **Recovery Operations** - describes procedures for handling error messages and system crashes.

1 ModSAF Configuration

A ModSAF exercise can be configured in a variety of ways to make optimal use of hardware. The configuration of a ModSAF installation consists of two separate configuration procedures, computer configuration and network configuration. These two configuration steps are done together when starting up the ModSAF programs but they are logically independent.

1.1 Computer Configuration

ModSAF has three components:

- SAFstation - the graphical user interface (gui) and plan view display
- SAFsim - the SAF simulator
- Logger - the exercise recorder.

The ModSAF components can be configured in a variety of ways since the recommended ModSAF hardware is able to run any component. The components are currently organized into two computer programs: a modsaf program and a logger program. The modsaf program contains the SAFstation and the SAFsim linked together in one executable. A computer can run either the modsaf program or the logger program but not both at the same time. The logger program will run as a logger only. The modsaf program will run as either a SAFstation only, a SAFsim only, or a combined SAFstation/SAFsim.

To summarize, any ModSAF computer can be run as one of:

1. Logger
2. SAFstation only - used when you want to make heavy use of the user interface to monitor the battlefield, perform terrain analysis, or issue many orders.
3. SAFsim only - used when you want to get the maximum number of vehicles simulated.
4. Combined SAFstation/SAFsim - used when you want to simulate a small number of vehicles and do not intend to make heavy use of the graphical user interface. This is because the user interface takes computational resources away from the simulation. This option allows ModSAF to be used with a minimum of hardware resources.

To have a computer run as option 1, run the logger program. To have a computer run as option 2, the SAFstation only, run the modsaf program with the following flags: -gui -nosim. The flag, -gui.

enables the SAFstation operation and the flag, -nosim, disables the SAFsim operation. To have the computer run as option 3, the SAFsim only, run the modsaf program with the following flags: -nogui -simulate. The flag, -nogui, disables the SAFstation operation and the flag, -simulate, enables the SAFstation operation. To have the computer run as option 4, the combined SAFsim/SAFstation, run the modsaf program with the following flags: -gui -simulate.

1.2 Network Configuration

The network configuration determines how the different ModSAF computers interact with each other. Network configuration is accomplished by two flags: -exercise and -database. (There are many other issues and flags concerning network configuration, such as protocol type and network interface, but we will assume that they are all set up the same and ignore them.)

The -exercise flag takes as an argument a number (id) from 1 to 254. Only those computers set up to use the same exercise id can interact. If two computers are on different exercise ids then one cannot see or interact with the objects of the other. This is a standard DIS feature that allows for different training exercises to be held simultaneously on the same physical network. The exercise id partitions the exercise into logically distinct networks.

If two or more computers are on the same exercise id then they can interact because they will be able to see each other's DIS entities and interact with them via fire and detonation packets. The DIS packets are used by each computer on the simulation network to build a shared database that describes the state of the physical battlefield. Each exercise id defines a different battlefield.

ModSAF uses another set of packets called the Persistent Object Protocol to share command, control, and mission state between computers. These packets support the Persistent Object (PO) database that is used by ModSAF to request and control the simulation of ModSAF entities. PO database id's are used to create independent PO databases.

The -database flag takes as an argument a number (id) from 1 to 254. Only those computers set up to use the same exercise id and database id can share command and control information. Just having the same database id is not sufficient. This was done because having the same command and control information for two different battles would not make very much sense.

In order to implement the ModSAF equivalent of a traditional SIMNET SAF set up, start up one computer as a SAFsim and another computer as a SAFstation so that both computers are on the same exercise id and database id. No other computers will be on the same database id. Now when the SAFstation requests vehicles to be created, the SAFsim will respond by simulating

them. Then the SAFstation could issue orders to those vehicles and monitor both their physical and mission states. No other SAFstation would be able to do this because it would be using a different PO Database.

To increase the number of SAF vehicles that the SAFstation could control, just set up more SAFsim computers with the same exercise id and database id. Now when the SAFstation requests vehicles to be simulated, the SAFsims will arbitrate between themselves which SAFsim will do the simulation based on current loading. The simulation will create all vehicles in the same platoon on the same SAFsim however.

Putting multiple SAFstations on the same PO Database means that they can see each other's overlays and take control of each other's vehicles. Later versions of ModSAF will provide more control over these capabilities. This approach does allow two operators to work together to more flexibly control the SAF forces. Suppose the forces controlled by one operator are under attack while the other operator's forces are not. The free operator could more closely control some of the other operator's forces creating more realistic behavior.

To summarize, SAFsims can work together to provide a simulation server that responds to commands from users at SAFstations. For exercises requiring large numbers of entities you would allocate more computers to run as SAFsims increasing your simulation resources. One user at one SAFstation can control a hierarchy of SAFsims to simulate large units with many entities. For exercises that require low level human control of SAF entities or human operator interaction with manned simulators via radio, you can allocate more computers to be SAFstations. Multiple users at multiple SAFstations can control entities simulated on one or many SAFsims.

Putting a logger on the same PO Database means that it gets information about the unit hierarchies and the states of the missions of the vehicles and units on that PO Database. This allows the logger to create scenario files from a logger file. With those scenario files, ModSAF can restart the vehicles from SAFsims on that PO Database at any point on that tape. If you are only interested in the physical state of the battlefield, you can turn off PO packet logging and record only the DIS traffic for that exercise id.

2 ModSAF Operation

The usual ModSAF configuration requires the use of a SAFstation computer for the user interface processing plus a SAFsim computer for the simulation processing. It is possible, however, to configure ModSAF so that both the user interface and simulation functions are run on one computer. This is referred to as a "pocket" system and is only useful when running a very small exercise. Note that ModSAF can NOT be run in the background.

This chapter tells you how to bring up a SAFstation and a SAFsim. It also tells you how to run ModSAF on one computer, how to change the privilege level, how to start a system, and how to shut down a system.

To run ModSAF, you will first need to go to the directory that the ModSAF object code resides in. Typically, this could be named "usr/staff/<yourname>/modsaf/common/src/ModSAF". The ModSAF object code is named "modsaf_<platform>" (modsaf_sgi, modsaf_aix, modsaf_sun4, or modsaf_mips). The examples in the instructions that follow lead to both the SAFstation and the SAFsim computers running with simulation exercise identifier 2, PO database identifier 4, and default terrain.

The ModSAF user interface uses the X resource manager for selection of layout, sizing coloring, etc. The resources are found in the file 'common/src/ModSAF/ModSAF'. If you are running ModSAF after just logging in, issue the command `xrdb -merge ModSAF` from the ModSAF directory before running the program. If you forget to do this, the user interface will come up but it will not be completely or correctly drawn.

2.1 Using Command Line Options

1. Run ModSAF with the help option (`modsaf_<platform> -help`) to get online information about the command line arguments.
2. ModSAF has the following frequently used command line options (flags):
 - `-terrain <terrain database name>` to tell the program to read in a terrain database other than its default.
 - `-exercise <ID #>` to tell the program to read and write simulation packets with the named exercise id. If the `-exercise` option is not used to set an exercise ID, then by default, simulation packets are projected on exercise 1.
 - `-database <ID #>` to tell the program to read and write PO packets with the named database id. If the `-database` option is not used to set a PO database ID, then by default,

PO packets belong to PO database 1.

3. Several options are used for setting network arguments. If you are running at a site that uses the SIMNET protocol, you will use the following network command line arguments: `-assoc -noudp -simnet`. If you are running at a site that uses the DIS 2.0.3 protocol, you will use the following network command line arguments: `-udp -noassoc -dis -version 2.0.3`.

2.2 Entering/Exiting the SAFstation

1. Run the SAFstation program from the ModSAF directory by entering:
`modsaf_<platform> -gui -exercise <#> -database <#> -nosim`
The `-gui` option tells the program to bring up the user interface. The `-exercise <exercise #>` option tells the program the simulation exercise number. The `-database <PO database #>` option tells the program the PO database number. The `-nosim` option tells the program not to simulate objects. An example is the command, `modsaf_sgi -gui -exercise 2 -database 4 -nosim`. This command tells the program to bring up the graphical user interface, to make use of simulation packets whose exercise identifier is 2 and to read and write PO packets whose exercise identifier is 4. The program will not simulate objects but will communicate via PO database 4 with a SAFsim on the network. That SAFsim will simulate the objects placed on the SAFstation.
2. When the program is started, a minute or two may pass while the software learns the state of all the other machines on the network. The user interface will appear to signal that the program is ready to accept commands.
3. Click **Privilege** in the Menu Bar at the top of the screen. A pull-down menu appears with privilege level choices. Click `sysop` to enable all the system operations and to set the view mode to Omniscient View. (The default password is "foozball"). Under Omniscient View the Map displays all vehicles no matter what alignment they are and no matter where they are. See Section 4.8 [Set Viewing Mode], page 24, for an explanation of Commander's View.
4. To exit the SAFstation program, click on the **Quit** command in the File pull-down menu. Wait at least 45 seconds before restarting.

2.3 Entering/Exiting the SAFsim

1. Run the SAFsim program from the ModSAF directory by entering:
`modsaf_<platform> -nogui -exercise <#> -database <#> -simulate`
The option, `-nogui`, tells the program to run without a user interface. The `-simulate` option tells the program to simulate objects. The `-exercise`, and `-database` options set a PO database.

and simulation exercise id that matches those of the SAFstation. An example is the command, `modsaf_sgi -simulate -exercise 2 -database 4 -nogui`. This command tells the program to simulate objects on exercise 2. It also tells the program to read and write PO packets whose exercise identifier is 4 and to avoid running the user interface process.

2. When the program is started, a minute or two may pass while the software learns the state of all the other machines on the network. The user interface will appear to signal that the program is ready to The computer prompt will change to "modsaf@<machine name>", to signal that the program is ready to simulate objects.
3. To exit the SAFsim program: type `quit` in response to the "modsaf@<machine name>" prompt. Wait at least 45 seconds before restarting.

2.4 Running ModSAF on One Computer

1. Run the ModSAF program with both the `-gui` and the `-simulate` options.
2. To stop the running of the ModSAF pocket program, click `Quit` in the File subcommand menu. Wait at least 45 seconds before restarting.

2.5 Adjusting Privileges

Password protection applies to privilege changes. (The default password is "foozball".) To change your password to FOO, type `echo F00 > .password` in the `common/src/ModSAF` directory.

To disable password protection altogether, go to the `common/src/ModSAF` directory and type (without the quotes): `"rm -f .password ; touch .password"`.

All commands are enabled at the `sysop` privilege level. At the other privilege levels several commands are disabled. The `battlemaster` level disables the file deletion, new scenario, and quit commands. The `commander` and `operator` levels are the most restrictive. In addition to the `battlemaster` restrictions, these levels disable commands to create units, load scenario or overlay files. and set SAFstation alignment.

1. Click `Privilege` in the Menu Bar at the top of the screen.
2. A pulldown menu appears with privilege level choices: `sysop`, `operator`, `battlemaster`, and `commander`. A recessed box in front of the privilege level indicates the current setting. Click on a choice to change a setting. When the pop-up display appears to request a password, type the password applicable to your site.

2.6 Starting the Computer System

Start up directions are platform-specific and can be found in the user documentation that is supplied with the hardware. Typically, the system startup procedure would include the following steps.

1. Make sure all cables are properly connected.
2. Turn on power to the display monitor (or console terminal) and the computer.
3. In response to the monitor prompt (>>), enter auto to auto-boot the system. When the login prompt appears, the machine is ready for use.
4. Login with the name and password assigned at your site.

2.7 Shutting Down the Computer System

Shut down directions are platform-specific and can be found in the user documentation that is supplied with the hardware. Typically, the system shutdown procedure would include the following steps.

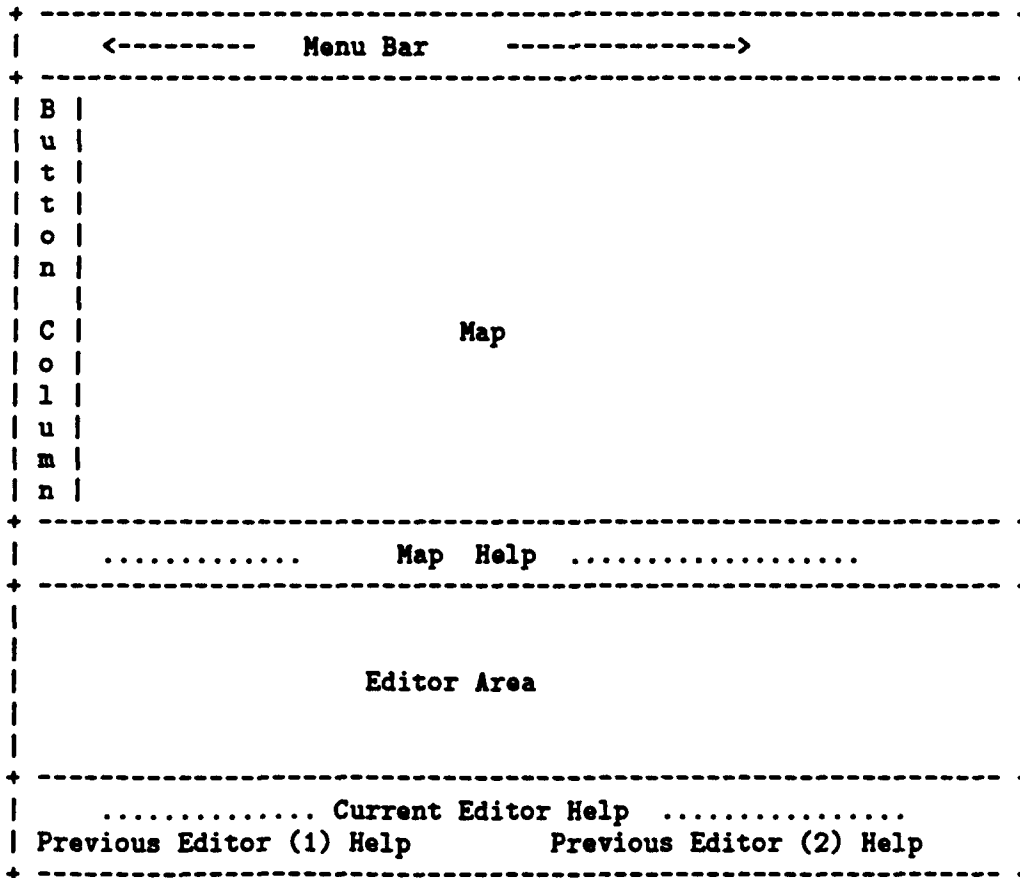
1. The operating system is shutdown via a sysadm (system administration) machine management powerdown command.
2. When prompted for whether you want to do an express powerdown, answer y for yes.
3. Wait for the monitor prompt to appear.
4. Turn off power to the display monitor (or console terminal) and the computer. In order to protect the disk, always do a software shutdown before doing a hardware shutdown.

3 Basic Tools of the ModSAF User Interface:

The ModSAF interface is built around hardware consisting of a color monitor, a keyboard, and a mouse. Object creation, menu-style input, message display, and execution of system functions take place on the color monitor. The color monitor displays terrain and the current state of the battlefield with friendly elements drawn in blue and enemy elements drawn in orange. The user can zoom and pan to any point on the color map and can display terrain features.

3.1 Using the Display

The SAFstation screen presents a view of the terrain and supports the wide range of operations needed for issuing SAFstation commands. The following figure shows the layout of the SAFstation screen. The Editor Area is not always displayed.



The screen is divided into the following rectangular areas, each with its own function:

- **Menu Bar** - This area, across the top of the screen, contains the pulldown menus: File, Map Scale, Map Features, Show As, Local Force, Special, Privilege, and On Order. When you select a pulldown menu, a menu appears offering more commands or options.
- **Button Column** - This area, down the left side of the screen, contains two sections: an object button section at the top of the column and a map button section at the bottom. For each section only one button is active or selected at a time.

The object buttons are: Select, Text, Line, Point, Unit, Delete, Artillery, and Terrain Tools. The Select button is used to select an existing object from the Map or to access editor buttons. The Point, Line, Text, and Unit buttons are used to create new objects of that kind. The Delete button is used to delete a graphic or unit from the Map and simulation. The Artillery button is used to generate an artillery mission. The Terrain Tools button is used to obtain intervisibility, measurement, and cross section data.

The map buttons are: Zoom, Pan, and Info. The Zoom button is used to zoom in, zoom out, and zoom in around an area. The Pan button is used to change the map center or change the viewing area. The Info button is used for getting data about a terrain location or a vehicle.

- **Map** - The Map takes up most of the color screen. It is a basic piece of the ModSAF system and allows the user to create scenarios and to monitor simulated battles. Its two-dimensional terrain view represents a piece of the terrain in the real world. It can show grids, roads, water, powerlines, pipelines, railroads, political boundaries, trees, contour lines, and buildings. If a message, "Redrawing Map. Please Wait.", appears in the Map, wait until the message disappears before issuing commands.
- **Map Help** - This line appears just below the Map. It identifies the currently selected map button and provides help for using the middle and right buttons of the mouse on the Map.
- **Editor Area** - This area is located beneath the Map Help. It is displayed when the user turns on the "Show Editor" feature or when an editor is brought up for an object. If no object editors are displayed, then the Editor Area will contain buttons for some miscellaneous editors for setting defaults, editing overlays, and controlling the Flying Carpet. The Editor Area can contain a display to let you enter data relevant to the currently selected object or miscellaneous editor. All editor displays, such as those for the point editor and the line editor, appear in the Editor Area. The Editor Area does obscure part of the Map, therefore its display is optional. The command, Show/Hide the Editor Area, accessed via the Special command in the Menu Bar lets you hide or display the Editor Area.
- **Current Editor Help** - This line appears just below the Editor Area. It supplies a help message to tell you what the current editor expects you to do now.
- **Previous Editor (1)** - This line appears below the Current Editor Help on the left side of the screen. It identifies the editor that will become active when the current editor is completed.
- **Previous Editor (2)** - This line appears below the Current Editor Help on the right side of the

screen. It identifies the editor that will be active when work in both the Current Editor and Previous Editor (1) is completed.

3.2 Using the Mouse

The mouse is the pointing device of the SAFstation. It is linked to an icon on the screen (an arrow, a cross, etc.) called the pointer. Moving the mouse with the hand results in a corresponding movement of the pointer on the screen. Commands to the SAFstation can be issued by moving the pointer to the desired position on the screen and then clicking one of the three mouse buttons.

In this document, "click/Middle" means click the middle mouse button; "click/Right" means click the right mouse button. Since the left button is used most often, click without a button choice means click the left mouse button.

In this document, "hold/Left" will be a shorthand way of saying "press and hold down the left mouse button". For example, "Hold/Left on an object in the Map" means to press and hold down the left mouse button while the mouse pointer is positioned on an object in the Map.

Sometimes it will be necessary to "drag" the mouse. This requires that a button remain depressed while the mouse is moved. This is done, for example, when an area of the map is outlined for the purpose of zooming in on that area. In this document, "Drag/Middle" will be a shorthand way of saying "move the mouse while the middle mouse button is held down."

When an editor is expecting you to select an item of a particular type, only those types of objects will be mouse sensitive. The mouse sensitive items will be indicated by a rectangle or circle around the object when the mouse passes over it. Objects in the Map are entirely sensitive objects; you can select a route by clicking any place on it, not just on its vertices.

3.3 Selecting Pulldown Menus

Pulldown menus appear when the mouse is clicked on a text string on the Menu Bar. The pulldown menu will show a number of alternative commands or options. Clicking the left mouse button on a command or option will execute or select it. To clear the screen of a menu without selecting one of its choices, click on terrain in the Map.

3.4 Using the Editor Displays

Editor displays offer a way to insert and alter parameter values. Clicking on a setting or entering data in an input box will tell the system to set a parameter. Clicking on a button will execute the action described by the button's label. A button, setting, or input box will be outlined in red to show that it has the "system focus " (i.e., it is the input that the system is currently expecting). To move the focus to a particular value, simply click on that value. To advance the focus to the next value, press the TAB key. Use Shift-TAB to move the focus in a backwards direction.

3.5 Using Pop-up Windows

Pop-up window displays are not confined to the Editor Area; they will appear at a pre-determined place. They can, however, be moved to another part of the screen. To move them, drag/Left on the label at the top of the display. The rectangular area that holds the pop-up display can be enlarged or shrunk. To change the size of a display, bring the mouse pointer to one of its corners. The mouse pointer will change from an arrow to a right angle symbol. When the right angle symbol is on the screen, drag/Left away from the display to enlarge or drag/Left toward the center of the display to shrink. A pop-up display will appear on the screen until it is deliberately dismissed by clicking on an appropriately labeled exit button such as OK, Cancel, or Done.

3.6 Working with Menu Components

Many commands and options that you request through the SAFstation are entered via the pull-down menus, editor displays, and pop-up windows. These items use components such as Text, Lists, Units (like speed, distance), Dials, Angles, Toggles, Meters, and Scroll Bars. See Appendix A[Menu Component Operations], page 95, for extensive directions for working with these menu components.

3.7 Using the Help

There are two help areas on the screen: the Map Help and the Current Editor Help.

Map Help appears just below the Map to identify the currently selected map button and to provide directions for using the mouse buttons.

Current Editor Help appears just below the Editor Area. It supplies a help message to tell you what the current editor expects you to do now. Previous Editor (1) Help appears below the Current Editor Help, on the left side of the screen, to identify the editor that will become active when the current editor is completed. Previous Editor (2) Help appears below the Current Editor Help, on the right side of the screen, to identify the editor that will be active when work in both the Current Editor and Previous Editor (1) is completed.

Usually you exit an editor by clicking on an exit button. However, the SAFstation can cause another editor to be displayed by selecting a different editor while using the current editor. An example is the specifying of a route while setting up a movement task. The SAFstation program knows that the task editor needs to be interrupted, rather than exited, so that a route can be supplied. A help message in the Current Editor Help line appears with the editor change so you can be aware of what the system wants you to do.

3.8 Using the Button Column

Two types of buttons are located in the Button Column on the left side of the screen. Object buttons, which appear at the top of the column, are used to select, create and delete an object. Map buttons, which appear at the bottom of the column, are used to manipulate the map.

When a button is selected, you stay in this mode until another button is selected. Object button operations use the mouse's left button and the map button operations use the middle and right mouse buttons. The figure below identifies the buttons that appear in the Button Column.

[Select]	(button shows an arrow icon)
[Text]	(button shows letters)
[Line]	(button shows military line symbol)
[Point]	(button shows military point symbol)
[Unit]	(button shows a tank)
[Delete]	(button shows a pair of scissors)
[Artillery Tool]	(button shows a detonation device)
[Terrain Tools]	(button shows a military map depot symbol)
[Zoom]	(button shows arrows pointing in to a point)
[Pan]	(button shows a viewport)
[Info]	(button shows a question mark)

Object buttons are used to do things to objects like: select an object for editing, select a

miscellaneous editor, delete an object, create a graphic object (a line, point, text label), and create a unit object. Moving from top to bottom, the object buttons are:

- Select button - black and labeled with an arrow icon. It lets you select an object from the Map.
- Text button - blue and labeled with the letters, "A" thru "F". It lets you put text on an overlay.
- Line button - blue and labeled with segments showing joined vertices. It lets you create a line (route) or area (circular route) control measure graphic.
- Point button - blue and labeled with military point symbols. It lets you create a point control measure graphic.
- Unit button - blue and labeled with a tank. It lets you create a unit.
- Delete button - red and labeled with scissors. It lets you delete objects.
- Artillery Tool button - red and labeled with a symbol which looks like an explosive. It lets you place indirect fire on the battlefield.
- Terrain Tools button - red and labeled with a military map depot symbol which looks like a compass. It lets you obtain intervisibility, measurement, and cross section information.

Object buttons place the SAFstation in a mode that can be interrupted; it can be superseded by another mode and then resumed when the interruptive mode is completed. Each time a new mode is selected, it is placed on top of the current mode (similar to stacking cards in a deck). When the current mode is done, the system will return back to the previous mode, the one that was active before the new one was selected.

Map buttons, which are useful at all times (such as zoom, data, and pan), are available on demand. The map buttons place the system in maps modes that can replace each other; they never interrupt and stack. The ModSAF Station will remain in one map mode until you select another map button. The map buttons are green and they appear on the bottom of the Button Column. The name of the current map mode, and the functions of the middle and right buttons are shown in a help window that appears beneath the map.

The map buttons include:

- Zoom:
 - Click/Middle zooms in, Click/Right zooms out.
 - Drag/Middle sets a screen area to zoom out to
- Pan
 - Click/Middle to recenter around selected terrain point.

Drag/Right to move viewport over another whole terrain grid.

- Info:

Hold/Middle on a vehicle in the Map for a description.
Hold/Middle on terrain in the Map for coordinates.

4 The Tactical Map View

The Map gives a two-dimensional view (plan view display) of the battlefield. In addition to terrain and units, it also displays the following battlefield events:

- An artillery round (indirect fire) detonating on the simulated battlefield is displayed with a large hollow purple star.
- A direct fire shot that hits is displayed with a gold line from the firer to the target. A solid circle on one endpoint indicates the target vehicle.
- A direct fire shot that misses is displayed with a grey line from the firer to the hit location. A hollow circle on one endpoint indicates where the shot lands.
- Two vehicles involved in a collision is displayed with a solid red star.
- A vehicle with a catastrophic failure is colored black.
- A vehicle with a known mobility failure is drawn with the hull bent.
- A vehicle with a known firepower failure is drawn with a bent gun tube.

Sometimes the portion of terrain that is displayed in the Map is not the area of interest. The scale, pan, zoom, scroll, and data operations described below let you change the map view and obtain data about a location or vehicle.

There are two SAFstation view modes: Omniscient View and Commander's View. Omniscient View displays all vehicles no matter what alignment they are and no matter where they are. Commander's View constrains the display to be consistent with the SAFstation alignment (Friendly, Enemy, or both) which the user sets via the Local Force command on the Menu Bar. View mode is tied to the current privilege selected from the Menu Bar. Commander's View will be used with the Operator or Commander privilege. Omniscient View will be used with Battlemaster or Sysop privilege.

4.1 Changing the Scale

When the scale is set to 1:100,000, 1cm on the screen represents 1km on the terrain. As you move to a scale of 1:5,000, less of the database appears, but what does appear is magnified. Higher magnifications can be obtained by repeated "zoom in" operations.

A current scale indicator is provided above the North-pointing arrow in the upper-right corner of the Map. The current scale can be a standard or a non-standard scale depending on the Standard Scale setting of the PVD controls.

1. Click **Map Scale** in the Menu Bar.
2. A pulldown menu appears listing possible scales (such as 1:1,500,000, 1:1,000,000, 1:500,000, 1:250,000, 1:100,000 1:50,000, 1:25,000, 1:10,000, 1:5,000 1:2,500 1:1,000, 1:500, 1:250) and the option of undoing the last zoom or pan operation.
3. To choose a scale, click on it. A recessed toggle box will appear with the selected scale and the map will be redrawn to the selected scale.
4. To revert to a map display consistent with that existing prior to the most recent zoom or pan operation, click **Undo last Zoom/Pan**. An alternate way to issue the command is via **ALT <Z>** (type the key labeled "ALT" and then type "Z").

4.2 Panning to a New Map Center

1. Click the green **Pan** button in the Button Column.
2. There are several ways to pan the map.
 - Click/Middle on a location you want as map center. The map will shift to position that location in the center of the Map.
 - Hold/Right to see a screen area box (a viewport). Drag/Right to move the viewport to a new location. Release the Right button when the viewport is on the area you want displayed.

4.3 Zooming In and Out

1. Click the green **Zoom** button in the Button Column. The Map Help message explains that when doing a zoom operation: Click/Middle zooms in, Click/Right zooms out, and Drag/Middle goes to a scale encompassing the dragged area.
2. The zoom operations use Click/Middle, Click/Right, and Drag/Middle as explained below.
 - Click/Middle when the pointer is on the location you want to become the center of the Map. The terrain in the Map will shift to place the selected location at the center and the map scale will be decreased one level to magnify the terrain.
 - Click/Right when the pointer is on the location you want to be at the center of the Map. The terrain in the Map will shift to place the selected location at the center and the map scale will be increased one level to display more terrain in the Map.
 - To mark a rectangular area of terrain for magnification, press and hold the mouse middle button when the pointer is placed at a location in the Map. **KEEP THE MIDDLE BUTTON PRESSED AND DRAG** the pointer to another position to specify the opposite

corner of the area. When you have dragged enough to set the corner, release the MIDDLE button. The terrain will shift to place the area center at the Map center and the map scale will be automatically adjusted to either a standard or non-standard scale that allows the selected area to appear on the screen. When the Zoom Any Scale default is set to ON, zooming in around an area displays the selected area without forcing the use of one of the standard map scales. See Section 10.1 [Set User Preferences], page 55.

4.4 Scrolling the Map

The Map can be scrolled by using horizontal and vertical scroll bars. These scroll bars are made available by setting the user preference options so that the Map Scroll Bars will display. See Section 10.1 [Set User Preferences], page 55.

1. Hold/Left on the scroll indicator inside the scroll bar. While holding, move the mouse. As the indicator moves, the map scrolls.
2. An arrow appears at each end of the vertical scroll bar. Click on the arrow as an alternate way to scroll.

4.5 Obtaining Terrain Information

1. Click the green Info button in the Button Column. The Map Help message explains that when doing a data operation: Hold/Middle on a vehicle for a description and Hold/Middle on terrain for coordinates.
2. Hold/Middle on either a vehicle or a terrain location. The vehicle or terrain data displays on the Map Help line. The terrain info gives the coordinates and altitude of the selected location. The vehicle info gives the vehicle id, marking, location and speed.
3. Release the pressed middle button to remove the displayed data.

4.6 Altering Terrain Feature Displays

UTM grid lines, water, roads, trees, buildings, powerlines, pipelines, towns, political boundaries, and contour lines (both major and minor) are terrain features that can be displayed in the Map. A toggle button that appears in front of each terrain feature sets its display status. When the button is pressed (recessed), the terrain feature is set for display. When the button is not pressed, the terrain feature is not displayed.

The color codes are: blue for water, red for roads, green for trees, blue-green for pipelines, mustard for political boundaries, brown for major contour lines, beige for minor contour lines, and black for gridlines, buildings, powerlines, and railroads.

The ModSAF system decides on the intervals for contour lines by reading data stored in a file. This file allows the system to set different intervals for each available terrain database or to use default levels. At any time the intervals can be adjusted by changing the data in the file.

1. Click **Map Features** in the Menu Bar. A menu similar to the one below appears.

```

+-----+
|  Trees and Canopies |
|  Contour Lines |
|  Grid Lines |
|  Hypsometric <Alt> H |
|  Water |
|  Roads |
|  Buildings |
|  Pipelines |
|  Political Boundaries |
|  Railroads |
|  Powerlines |
|  Towns |
+-----+

```

2. To change display status of a terrain feature, click on the terrain feature's toggle box.
3. If the setting was OFF, it will now be changed to ON and the toggle box and the terrain feature will be displayed. If the setting was ON, it will now be toggled to OFF and the toggle box and terrain feature will disappear.

4.7 Changing Hypsometric Display

1. Click **Map Features** in the Menu Bar.
2. Click on **Hypsometric** to change the display status of the hypsometric mapping.
3. An alternate way to change the display status of the hypsometric mapping is via ALT <H> (type the key labeled "ALT" and then type "H"). If the setting was OFF, it will now be changed to ON and the mapping (of pattern by altitude) will be displayed.

4.8 Set Viewing Mode

When the SAFstation privilege is set at Sysop or Battlemaster, the SAFstation viewing mode

is Omniscient View and all vehicles can be displayed.

When the SAFstation privilege is set at Commander or Operator, the SAFstation viewing mode is Commander's View and a vehicle is displayed ONLY if it meets at least one of the following conditions:

- It is a vehicle that this SAFstation is commanding;
- It is a vehicle whose alignment matches an alignment selected with the Local Force command (could be more than one alignment); OR
- It has been "detected" by one of the vehicles this SAFstation is commanding.

The SAFstation alignment (Friendly, Enemy, or both) is set via the Local Force command on the Menu Bar. However, it can only be set while the SAFstation is in Sysop or Battlemaster privilege.

1. To set the SAFstation to Omniscient View: click either Battlemaster or Sysop in the Privilege pulldown menu. When the SAFstation is in Sysop or Battlemaster privilege, the SAFstation alignment can be set via the Local Force command on the Menu Bar.
2. To set the SAFstation to Commander's View: click either Commander or Operator in the Privilege pulldown menu. Under Commander's View the Map display is constrained to be consistent with the SAFstation alignment set via the Local Force command.

5 Graphic Operations

Graphics can be placed in the Map to show a battle situation. These graphics are created by using the Point, Line and Text buttons. Graphics are deleted via the Delete button and edited via the Select button. See Section 3.8 [Using the Button Column], page 17.

When the Point, Line, or Text button is clicked, the editor for that object type will be shown in the Editor Area. The editor display has a "Done" button which starts out insensitive and then becomes sensitive when you specify an object location. Locations are set by clicking the left button in the Map. No graphic vertices are placed with the middle or right button. If you make a mistake placing a vertex location, you will be able to move it.

The ModSAF system insists that each graphic belong to an overlay. An overlay has a color parameter which becomes the default color for any graphics placed on the overlay. The value of the overlay color parameter can be changed by selecting another value from its list of values. The user can also supply a new overlay name. There are several ways to do this:

- Do nothing to accept the name that appears in the overlay name box.
- Hold/Left on the button labeled "Press for Other Overlays". Select another overlay from the displayed list.
- Click on the button labeled "Create New Overlay". Type a new name in the overlay name box.
- Click in the overlay name box. A blinking insert cursor (small black bar) appears. Use the keyboard to erase and type a new overlay name.

When the Select button is clicked and an object is picked from the Map, the editor for that object will be shown in the Editor Area. Menus of editable options (such as color, line style) will apply to the currently selected object. In the editor display, a parameter that is awaiting input will be outlined in red. To advance to the next parameter, press the TAB key or click in the parameter area of the display. You can return to the previously active parameter via Shift-TAB or by clicking in its area.

5.1 Creating a Point

1. Click the Point button (fourth button down in the Button Column) to bring up the point editor. A display similar to the example below will appear in the Editor Area. The Current Editor Help line will remind you to provide a location from the Map.

```

+-----+
| Point   Location   Style     Dashed  Direction  Color   |
| Editor                                     |
| [ Done ] Set-      Choose-one Toggle-  Set-an-  Choose-one |
| [Revert] coordinates from-a-list box   angle   from-a-list |
| [Abort ]                                     |
|
| Overlay                                     |
| +-----+                                     |
| | (overlay name) | | Name | | | | |
| +-----+                                     |
| Color: [<Black> = ] | | | | |
| [ Press for Other Overlays ] | | | | |
| [ Create New Overlay ] | | | | |
| [ Delete Overlay ] | | | | |
| +-----+                                     |
+-----+

```

2. To change the location unit type: click on one of the Location Unit toggles. To change the location value: click in a coordinate box and then click in the Map. If you make a mistake placing the point, just click on another position to move the point. You can also change the location of a point by entering a value in the Location box.
3. To change the style or color value: hold/Left on the current value and select a new value from the displayed list.
4. To change the setting of the Dashed toggle: click on its toggle box. A graphic whose Dashed setting is ON (recessed) will be drawn using a dashed rather than solid line to indicate (on the display only) that the information is uncertain.
5. To change the direction unit type: click on one of the Direction Unit toggles. To change the direction value: hold/Left on the angle arrow and drag/Left to move the arrow to a new setting. Another way to change the direction setting is to click on the text of the current value. press the SPACEBAR to erase, and then type in a new value.
6. Supply a point name by clicking in the Name box and typing text.
7. If necessary, supply an overlay name or overlay color.
8. To save the current settings: click Done.
9. Clicking on Revert removes any new settings but does not exit you from the editor. Clicking on Abort removes any inserted data and exits you from the editor.

5.2 Creating a Line or Area

A line graphic can be used to create routes, phase lines, and areas. A route is allowed to contain both road and cross country vertices.

1. Click the Line button (the third button down in the Button Column). A display similar to the example below will appear in the Editor Area.

```

+-----+
| Line/Area      Type                Points                Style                |
| Editor         X-Line  O-Area      Editing Modes      Choose-one         |
| [ Done ]      O-Dashed O-Dashed  X-Parts O-Whole O-Delete from-list      |
| [Revert]      Line      Area      Append Modes                          |
| [Abort ]                                           X-After  O-Before  Color                |
|                                           Route Modes  Choose-one         |
|                                           [ ] Use Roads  from-list         |
|
| +-----+
| | (overlay name) | | Minefield Width  Arrow                |
| |               | | Set-a-distance  X-None                |
| |               | | O-On End                |
| | Color: [<Black> = ] | | Label Location                |
| | [Press for Other Overlays] | | Choose-one  Label                |
| | [ Create New Overlay ] | | from-list  +-----+
| | [ Delete Overlay ] | | | |
| +-----+
| | Thickness  +-----+
| | Set-a-dial
+-----+

```

2. Click in the Map to position vertex points for the graphic. A graphic of the appropriate type will appear connecting the selected vertex locations in the Map. If you want to position a road point rather than a cross country point for a vertex, click ON the "Use Roads" toggle box. This will allow road segments to become "mouse sensitive". To position a road point, position the mouse pointer on the road. A segment of the road will be highlighted via a rectangular outline box. Clicking on that highlighted segment will position the road point at the location of the click. The route between two road points will stay on roads. You can select a cross country point even when the "Use Roads" toggle is ON since the toggle only controls whether road segments become "mouse sensitive".
3. To change the type: click on a new only-one-on toggle box.
4. To change the setting on the Editing Modes: click on one of the toggle boxes. There are three line editing modes: Parts, Whole, or Delete. When a mode is selected, directions for it appear in the Current Mode Help line. Further instructions for editing a line or area are presented in this manual. See Section 5.5 [Editing a Graphic], page 32.
5. To change the setting on the Append Modes: click on one of the toggle boxes. "After" lets you extend a line by suffixing and "Before" lets you extend a line by prefixing. When the "Use Roads" toggle is ON, the "Before" mode is inactive so that you can extend by suffixing only.

6. To change the setting on the Route Modes: click on its toggle box. "Use Roads" allows road segments to become "mouse sensitive" so that road points as well as cross country points can be part of the route.
7. To change the style or color: hold/Left on the current value and then select a new value from the displayed list. When a style is selected, the line is displayed so that its appearance corresponds to standard military graphics.
8. If you created a minefield line style, you can change its width by clicking in the Minefield Width input box and then doing a drag/Left in the Map to stretch a ruler value. Another way to alter the value is to hit the SPACEBAR to erase and then type in a value. Currently, minefields are only graphics; they are not simulated
9. To create a line with an arrow: click On End in the Arrow box. An arrow will appear at the end of the line.
10. To change the Thickness setting of the line, move the indicator (needle) inside the semi-circle dial.
11. If necessary, supply an overlay name or overlay color.
12. Enter a label by clicking in the label box and typing text.
13. To change the placement of the label: click on a new only-one-on Label Location toggle.
14. Click Done when you are finished.
15. Clicking on Revert removes any new settings but does not exit you from the editor. Clicking on Abort removes any inserted data and exits you from the editor.

5.4 Deleting a Graphic

1. Click the Delete button (labeled with scissors) in the Button Column. A display similar to the example below will appear in the Editor Area.

```

+-----+
| Delete      Object to Delete |
| Tool        [Click Here for Map Input] |
| [ Done ]    |
| [Abort ]    |
+-----+

```

2. To select an object from the Map: click on the button labeled **Click Here for Map Input** and then click in the Map to specify an object. Only objects that are valid deletion choices will be selectable. A large red "X" will appear on the object to mark it for deletion.
3. If you make a mistake, you can undo it by clicking the **Abort** button. You can also remove the large red "X" deletion mark, by relicking on an object.
4. Click **Done** to perform the deletion of any objects marked for deletion.

5.5 Editing a Graphic

Graphic objects displayed in the Map can be "mouse sensitive". When the pointer touches one of these mouse sensitive items it will acknowledge the touch by becoming enclosed in a rectangle or circle. This is referred to as being highlighted with an outline.

The several ways to edit a graphic via the Line/Area editor are presented below. To access this editor, put the SAFstation in Select mode via the first button (labeled with an arrow) in the Button Column. Then select the line or area graphic.

If you want to edit road segments and vertices, the "Use Roads" toggle needs to be set to ON so that road segments and vertices will be allowed to become "mouse sensitive". If you are only concerned with cross country segments and vertices, the "Use Roads" toggle can be set at OFF.

5.5.1 Adding a Vertex to a Line Segment

1. Set the Editing Mode to **Parts** on the display.
2. Click on a segment. A new vertex point will be inserted on the segment at the location of the click.
3. Repeat adding vertices or click **Done**.

5.5.2 Extending a Line

When the "Use Roads" toggle is ON, the "Before" mode is inactive so that you can extend a line only by suffixing.

1. Set the Editing Mode to **Whole** or **Parts** on the display. Set the Append Mode to **Before** to create a prefixed extension or to **After** to create a suffixed extension.
2. Click on the Map. Depending on the Append Mode, either the beginning or the end of the route will extend to the new point.
3. Perform another extension or click **Done** in the display.

5.5.3 Moving a Line or Area

Since road point vertices must remain on a road, they are not allowed to move the way cross country vertices can. Therefore moving a line or area should only be performed when the graphic contains no road points.

1. Set the Editing Mode to **Whole** on the display.
2. Hold/Left on a segment in the Map. An outline box will appear around the segment. Drag/Left to move the graphic to a new location.
3. Perform another move or click **Done** in the display.

5.5.4 Moving a Vertex

1. Set the Editing Mode to **Parts** on the display.
2. Hold/Left on a vertex in the Map. A circular outline box will appear around the vertex. Drag/Left to move the vertex to a new location.
3. Perform another move or click **Done** in the display.

5.5.5 Cutting a Vertex

When deleting a vertex in a line or area that contains road segment, begin the deletions at the last point.

1. Set the Editing Mode to **Delete** on the display.

2. Click on a vertex to delete it.
3. Perform another deletion or click **Done** in the display.

6 Unit Operations

When the Unit button is clicked, the unit editor will be shown in the Editor Area. The unit editor has a "Done" button which starts out insensitive and then becomes sensitive when you specify an object location by clicking in the Map.

To perform operations on a unit that was created, click the Select button and then select a vehicle/unit from the Map. The unit operations editor will appear in the Editor Area to let you assign operations to the selected unit. Directions for unit operations are provided below.

6.1 Creating a Unit

1. Click the Unit button (labeled with a tank) in the Button Column to bring up the unit editor. A display similar to the example below will appear in the Editor Area. The Current Editor Help line will remind you to provide a location from the Map.

```

+ -----+
| Unit      Vehicle  Formation  Methodology  Side      Location|
|Editor     Type                                           |
|[ Done ]   Choose-one Choose-one  Only-one-on  Only-one-on  Set-
|[Revert]  from-a-list from-a-list toggle      toggle      coords. |
|[Abort ]                                     |
| Direction      Competence  Call Sign    Fuel          Munitions |
| Set-an-angle   Set-a-dial   Set-text     Set-text     Set-text |
+ -----+

```

2. Set a location by clicking in the Map. If you want to change the location unit type: click on one of the Location Unit toggles. To change a location value: click in a coordinate box and then click in the Map. If you make a mistake, just click on another position to move the location. Another way to change the location is to type a new value in the Location box.
3. To change the vehicle type: hold/Left on the current value and select a new value from the displayed list.
4. To change the formation: hold/Left on the current value and select a new value from the displayed list.
5. To change the methodology or side setting: click on the appropriate toggle box.
6. To change the direction unit type: click on one of the Direction Unit toggles. To change the direction value: hold/Left while the mouse pointer is on the angle arrow and then drag/Left to move the arrow to a new setting. Another way to change the setting is to type a value in the Direction value box.

7. To change the competence parameter (used to influence the probability of hit): click inside the semi-circle to move the indicator. As the indicator is moved to the left end of the scale, the competence decreases and as the indicator is moved to the right it increases. The "-competence <floating point number>" option can be used when the program is run to set the default competence to the entered number (0.0 - 1.0).
8. To assign marking to the unit: click in the Call Sign box and type a label.
9. To change supply levels: click in the appropriate box, hit the SPACEBAR to erase, and then type the new amount.
10. Click Done when you are finished with the display.
11. Clicking on Revert removes any new settings but does not exit you from the unit editor. Clicking on Abort removes any inserted data and exits you from the unit editor.

6.2 Deleting a Unit

Use the Delete button (labeled with scissors) in the Button Column to delete a unit. When deleting a unit, first delete all of its subordinate vehicles. See Section 5.4 [Deleting a Graphic], page 32, for instructions.

6.3 Performing Operations on a Unit

1. Click on a unit in the Map to bring up the unit operations editor. A sample is shown below.

```

+ -----+
| Unit      + ----+  [Unit Tasking      ] + -----+
|Operations |      |  [Subordinate ...   ] | Other Tasks |
|[Done]     |Org.  |  ... Unit Tasking ] + -----+
|[Edit]     |      |  [Interrupt mission ] |             |
|[Configure]|Display|  [Override mission.. ] |  Spotter |
|           |      |  ... parameters ] |  Threats |
|           + ----+  [Resume suspended... ] |     etc.    |
|           |      |  ...mission      ] + -----+
|           |      |  [Cancel parameter.. ]
|           |      |  ...overrides   ]
|           |      |  [Change reaction  ]
+ -----+
|.....Mission Status Display.....|
|Status for unit ...              |
|**** Task Name **** : ** Task Status **
|           Spotter: No vehicles spotted
|           Threats: Looking for a target
+ -----+

```

2. The left side of the unit editor contains several buttons: Done, Edit and Configure. If the Configure button is active (written in black not grey), clicking on it will bring up the configuration editor. This editor consists of a collection of buttons, one for each of the unit subsystems. (In ModSAF, a unit is composed of many subsystems, i.e. dynamics, vehicle spotter, tasks, etc. We refer to these as the unit subsystems.) These unit subsystems can be viewed or modified (for ModSAF 1.0, only the vehicle spotter subsystem can be configured). To view or edit the parameters of a unit subsystem, click on its button. To make changes use the resulting subsystem editor. Click on the Edit button to bring up the unit editor which lets you make changes to vehicle parameters such as call sign, supplies etc. To make location and direction changes to a vehicle (to fine tune its position), edit its green orientation point since changing location via the Edit button will do a teleport which you usually want to avoid. Changing location via the vehicle's orientation point will make the vehicle drive to the new location. The orientation point appears as a circle with an arrow thru it. Moving a vehicle's orientation point when the arrow is solid (not dashed) tells the vehicle to drive and/or turn. The Done button exits the unit operations editor.
3. The unit editor contains a scrolled work area called an Organizational Display (Org. Display) to let you view the way the selected unit is task organized or to let you change the unit you wish to command. The symbols in the Org. Display are toggle buttons for each unit in the hierarchy displayed. Each button shows a military icon and is annotated with a call sign when it has been provided. The hierarchy is displayed from top to bottom, with superiors at the top, and subordinates at the bottom. A superior unit is displayed directly above its subordinates. The currently selected unit's button will appear recessed. Only one toggle button in a hierarchy can be selected at a time. The unit's direct superior, direct subordinates, and all its peers will be displayed by default. Controls appear beside the hierarchy to allow more or less of the graph to be displayed. To modify the graph appearing in the Org. Display, click one of the buttons (Show Superiors, Show Subordinates, Hide Superior, Hide Subordinates). To select a unit to command, click on its button in the Org. Display.
4. In the middle of the unit operations editor are buttons associated with mission commands. These commands will be explained in the next chapter.
5. On the right side of the editor display is the unit's set of current tasks. First there is the background frame (labeled "Other Tasks"), Next there are the frames that make up the unit's task frame ("to do") stack. Each task frame will be represented with the topmost frame on the left, and lower frames on the right. Each task has an associated toggle button. Those tasks whose toggles are ON (and that belong to active, not-suspended, frames) will have their status periodically updated in the Mission Status Display area. This allows several different task status messages to be displayed and also shows the user exactly what tasks the unit is executing.
6. When finished with the unit operations editor, click Done to exit. An alternate way to exit is to click on another unit in the Map. This alternate way means that you are not required to click Done when issuing operations to units.

7 Mission Operations

A ModSAF exercise contains simulated objects whose behavior is similar to that of manned simulators. A simulated object can exhibit extensive capabilities such as driving over the terrain and shooting at enemy objects. You command a simulated object by having it execute a mission consisting of one or more phases. Each mission phase contains a task frame which holds a collection of tasks that execute in parallel.

A mission has both a subject and action(s). The subject is the tasked unit and the actions are the tasks frames the unit is told to execute during each phase of the mission. The task frames and phases are created via the execution matrix editor which is accessed via the **Unit Tasking** or **Subordinate Unit Tasking** button on the unit operations editor. Unit tasking sets up a mission for a unit while subordinate tasking sets up a mission for a unit's subordinates. For example, if the currently selected unit is a platoon, then unit tasking would operate on the platoon, while subordinate unit tasking would operate on each of the vehicles in the platoon.

The execution matrix is a mission planning tool that lets you represent the phases of a mission and the actions that should be performed during each phase. The matrix has a column for each for each phase of the mission. For unit tasking, an execution matrix will have one row for the entire unit so you can give a mission to the unit as a whole. For subordinate unit tasking, an execution matrix will have a row for each of the unit's subordinates so you can give a mission to each subordinate.

The layout of the execution matrix is shown below.

```

+ -----+
| Execution
| [Assign]
| [Clear ]           <----- Phase Buttons ----->
| [Abort ]           [---] [---] [---] [---] [---]
+ -----+
|           [Unit 1] | <----- Frame Buttons ----->
|                   | [---] [---] [---] [---] [---] [---]
|                   +-----+
|           [Unit 2] | <----- Frame Buttons ----->
|                   | [ ] [ ] [ ] [ ] [ ] ...
|                   +-----+
|           [Unit 3] | <----- Frame Buttons ----->
|                   | [ ] [ ] [ ] [ ] [ ] ...
|                   +-----+
+ -----+

```

The execution matrix is divided into the following rectangular areas, each with its own function:

- **Phase Button Row** - This area, across the top of the matrix, contains buttons that become active when it is time to identify a phase transition. When a phase button is active, it is labeled "Create Phase". When you click an active phase button, the phase editor appears to let you select or modify a phase's transition type. After a transition type has been specified for the phase, the label will change to "Continue" to show an automatic transition or to the name of a graphic to show a control measure transition.
- **Unit Column** - This area, down the left side of the matrix, identifies the units you can task.
- **Frame Button Row** - This area, which is a unit's row across the matrix, contains buttons that become active when it is time to specify a frame for the units in a phase. When a frame button becomes active, it receives the label "Select Task Frame". After a frame has been specified, the label will change to show the frame name.

Enabling tasks, which allow switching between mission phases, are incorporated in the execution matrix of a multi-phase mission. A phase is categorized by transition type (the type of condition that allows units to transition between frames). There are currently two phase transition types:

1. **automatic** - To set up an automatic phase (which implies a sequential order of execution between frames) link the frames by selecting the **Continue** button from the phase editor. An automatic transition means that a new frame starts when a previous frame ends such as when vehicles reach their destination.
2. **control measure** - To set up a control measure phase (which implies conditional execution) link the frames by selecting the **Control Measure** button from the phase editor. A control measure transition means that a new frame starts when some control measure such as a phase line is reached.

Simulated units can alter their behavior from the strict parameters of a mission in response to battlefield conditions such as spotting an enemy. When that happens a reactive behavior, such as occupying a battle position, can take place. The SAFstation signals the user that a reaction is taking place by inserting a highlighted "Stop Reaction" button in place of the "Resume suspended mission" button on the unit operations editor. The way a user gives approval to the reaction is by not clicking the "Stop Reaction" button. If the user does click the "Stop Reaction" button, then the unit stops reacting to this particular situation. However, if the situation occurs again (for example, spotting a different enemy) then the unit would again execute the reaction. In other words, the unit will not keep reacting to the same enemy but will react to a new enemy.

A frame's reaction choices can be changed during a reaction. The user does this by clicking the "Change Reaction" button on the unit operations editor. This brings up the editor for the reaction

handling task. If you change the task parameters, then those changes will become the new reaction rules for the frame. See Section C.4 [Actions-on-Contact Task], page 111.

7.1 Setting Up a Task Frame

1. Click on the Task Frame button in the execution matrix editor to bring up the task frames editor which has buttons labeled with the available task frames. Frames that are valid for the selected unit are written in black and those that can't be assigned to the selected unit are written in grey. A sample is shown below.

```

+-----+
| Task Frames [Move ] [Road March] ... |
| [Abort ] |
+-----+

```

2. Select a task frame by clicking on its button. If the frame has a task that requires input, an editor for that task will come up and the Current Editor Help will prompt you (in red) for that input. For example, when a task requires that you choose a route you can use the line editor (accessed via the Line button) to create a new route. Another way to supply a route is to select one that is already created. Another example is a task that forces you to provide a target reference point. The system will instruct you to select an object on the map or create a point object.
3. After the required input(s) are entered, the frame editor for the selected frame appears. The Editor Area will show the frame name plus buttons labeled with the tasks that make up the selected frame. You can now edit the task frame by editing the parameters of its tasks.
4. To select a task to examine or edit, click on its button. An editor for the selected task comes up to let you view or change the task's parameters. A sample with a representative list of task parameters is shown below.

```

+-----+
| <Task Name>   Route           Speed  Formation |
| [Click Here for Map Input] 40    Wedge |
| [ Done ] |
| [Revert] |
| [Abort ] |
+-----+

```

5. You are permitted to change parameters in the task editors. Click **Revert** only to reset all the parameters to their default settings. Click **Done** when all the parameters have been set or click **Abort** to exit without keeping any edits.
6. Click **Done** in the frame editor to exit saving inputs. Click **Abort** only to exit the frame's editor without saving inputs. After a frame has been specified, its frame button label in the

execution matrix will show the frame name and a labeled graphic parameter input if there is one.

7. To require a frame to wait for user authorization before executing, set its **On Order** toggle to ON. This means that an authorization will be required from the user before the frame can execute. **On Order** appears in the Menu Bar at the top of the screen whenever on-order frame(s) are ready for this SAFstation to command. The **On Order** pulldown menu shows the pending items that are waiting for authorization. The user issues the corresponding on-order authorization by selecting the pending item from the pulldown menu. This will cause the on order task to start execution.

7.2 Setting Up a Single-Phase Mission

1. Click on the **Unit Tasking** or **Subordinate Unit Tasking** button in the unit operations editor to access the execution matrix editor.
2. To include a frame in a single-phase mission: click a unit's first frame button (it is labeled with "Select Task Frame"). When the task frame editor appears, click a frame button to select it as the assigned frame. Once the frame has been created, the frame name will replace the words "Select Task Frame" on the frame button. See Section 7.1 [Setting Up a Task Frame], page 41.
3. The phase button above the start frame column will also display the label, "Create Phase", once the frame has been created. If this was going to be a multi-phase mission, this button would be used to assign a transition type to the phase. Since this is a single-phase mission, this button can be ignored.
4. Click **Assign** when you have created the first phase frames for units you want to task. This implies a command to the simulated unit(s) to start performing the frame. Click **Clear** if you want to erase the frame input without exiting the execution matrix editor. Click **Abort** if you want to erase the frame input and exit the execution matrix editor.

7.3 Setting Up a Multi-Phase Mission

The execution matrix editor comes up when you click on the **Unit Tasking** or **Subordinate Unit Tasking** button in the unit operations editor. The execution matrix lets you specify the frames and the phase linkage in a mission. A sample matrix showing a multi-phase mission is shown below. The start frame for Unit 1 is a Road March frame on the graphic named "Route 1". The start frame for Unit 2 is a Road March frame on the graphic named "Route 2". When both units arrive at the control measure named "Point A", the next phase of the mission can begin.

Execution		[Phase Line A]	
[Unit 1]	[Road March]	[Assault]	
	[Route 1]	[Area 2]	
[Unit 2]	[Road March]	[Assault]	
	[Route 2]	[Area 3]	

1. To include a start frame in a multi-frame mission: click the first frame button that follows the unit label. When the task frame editor appears, click a frame button to select it as the assigned frame. Create the frame. Repeat the process to assign a start frame for each unit you want to task.
2. Once a start frame is created, the phase button bridging the gap to the next column of frames will display the label, "Create Phase". Click the **Create Phase** button. A phase editor will appear to let you set the type of transition (automatic or control measure) that will be required for the tasked units to stop executing the start frames and start executing the frames for the next phase. If a control measure transition is selected, you will need to select the control measure that needs to be monitored. A control measure can be either a line or point that the vehicle/unit must reach before transitioning to the next phase. Once the phase is specified, the next column of frame buttons is activated. If a continue transition is selected, the units will transition to the next phase as soon as the previous phase is finished.
3. To specify a frame for the next phase: click a frame button in the newly activated column and create a frame.
4. Continue creating phases and frames if you need to.
5. If you make a mistake in creating the execution matrix and would like to edit one of the task frames, select that task frame button. When the task frame editor for that frame comes up, click **Delete** to clear the frame. Note that the frame editing function is available when you are when creating an execution matrix and during mission execution.
6. Click **Assign** when you are satisfied with the way you have set up the execution matrix and want the tasked units to start executing their first frame. Click **Clear** if you want to ignore all frame and phase inputs without exiting. Click **Abort** if you want to exit without saving inputs.

7.4 Using On Order

A frame can have an "On Order" authorization required for its execution. To require a frame to wait for user authorization before executing, set its **On Order** toggle to **ON**. This means that an **On Order** authorization will be required from the user before the frame can execute. **On Order** appears

in the Menu Bar at the top of the screen when units are waiting for an authorization to execute a task frame. The On Order pulldown menu shows the task frames that are waiting for a pending on-order authorization. The user issues the corresponding on-order authorization by selecting the item from the pulldown menu.

7.5 Using the Status Monitor

On the right side of the unit operations editor display, is the unit's set of current tasks. First there is the background frame (labeled "Other Tasks"), Next there are the frames that make up the unit's task frame ("to do") stack. Each task frame will be represented with the topmost frame on the left, and lower frames on the right. Each task has an associated toggle button. Those tasks whose toggles are ON (and that belong to active, not-suspended, frames) will have their status periodically updated in the Mission Status Display area. This allows several different task status messages to be displayed and also shows the user exactly what tasks the unit is executing.

1. If necessary, click on a unit in the Map to bring up the unit operations editor. See Section 6.3 [Performing Operations on a Unit], page 36.
2. The editor has toggles associated with the mission tasks. Setting a task's toggle to ON tells the ModSAF software to display that task's status in the Mission Display Area at the bottom of the display. For example, the Enemy Detection task could show the vehicles that the unit detects. A sample is shown below.

```

+ -----+
| Unit      + --- + + ----- + + ----- + + -----+
| Operations |   | |Mission| | Other | |<frame name> |
| [Done]     |Org. | |Buttons| |Tasks | | [ ] Move  |
| [Edit]     |Dis- | |   |   | + ----- + | [ ] Actions on Contact|
| [Configure]|play | |   |   | |   |   |
|           |   | |   |   | |   |   |
|           + --- + + ----- + + -----+
+ -----+
|.....Mission Status Display.....|
|Status for Unit <unit label>: ...|
|**** Task Name ****: ** Task Status **|
|   Enemy Detection: Aware of these vehicles: a11, a12|
| Actions on Contact: Monitoring incoming rounds and enemy spotted|
|                   for Fire Threat Threshold <# of vehicles>|
|                   for Non-Fire Threat Threshold <# of vehicles>|
|           Move: Following route <route name> in <formation>|
|                   at <speed>|
|           etc. : etc.|
+ -----+

```

7.6 Interrupting a Mission

Usually a unit's task frame will end via phase termination and a new mission will be automatically assigned. In this case a new frame just takes the place of the old one. Sometimes, however, a unit's task frame needs to be interrupted. This interrupt can occur when a user clicks the **Interrupt Mission** button in the unit operations editor. For example, a platoon executing a **Move** can have its mission temporarily interrupted with an **Assault** frame. The original frame with its **Move** frame can be resumed after the **Assault**, since the frame was interrupted rather than terminated. Whenever the user wants to, he can select the unit and click the button labeled "Resume suspended mission" from the unit operations editor. At that time, the interrupting task frame will automatically be popped off the top of the unit's "to-do" list. This leaves the task frame that was previously performing at the top of the "to-do" list. That suspended frame is the one that the unit will resume performing.

1. If necessary, click on a unit in the Map to bring up the unit operations editor. See Section 6.3 [Performing Operations on a Unit], page 36.
2. Click on the **Interrupt mission** button in the unit operations editor to bring up the task frame editor.
3. Create a new interruptive frame. See Section 7.1 [Setting Up a Task Frame], page 41.

7.7 Resuming a Suspended Mission

The **Resume suspended mission** button in the unit operations editor is only sensitive when there is an interrupted frame available to return to.

1. If necessary, click on a unit in the Map to bring up the unit operations editor. See Section 6.3 [Performing Operations on a Unit], page 36.
2. Click the **Resume suspended mission** button to erase the unit's current (topmost) task frame.

7.8 Overriding Task Parameters

1. If necessary, click on a unit in the Map to bring up the unit operations editor. See Section 6.3 [Performing Operations on a Unit], page 36.
2. Click on the **Override mission parameters** button to bring up the override editor which lets you change task parameters. The override editor is a collection of buttons – one for each editable task in the unit's current frame. You can selectively override the parameters to any

task by clicking on its button and then making changes to its parameters. The buttons for editors with overrides in place will be a different color. Each task editor has a **Revert** button to revert the parameters back to their original values.

3. Click **Done** in the override editor. Notice that the **Cancel parameter overrides** button in the unit operations editor gets activated (turns from grey to black). This is because task parameter changes made via the **Change mission parameters** button are often meant to be temporary.
4. Click the **Cancel parameter overrides** button in the unit operations editor to cancel task parameter overrides.
5. Click **Done** in the Unit Operations Editor Display.

7.9 Changing Reactions

The **Change reaction** button in the unit operations editor is only sensitive during a reaction.

1. If necessary, click on a unit in the Map to bring up the unit operations editor. See Section 6.3 [Performing Operations on a Unit], page 36.
2. Click on the **Change Reaction** button to bring up the Actions-on-Contact task editor. This task is the one that handles reactions. You can selectively change any of the task parameters. See Section C.4 [Actions-on-Contact Task], page 111.
3. After making changes, click **Done** in the Actions-on-Contact task editor. Notice that the **Cancel parameter overrides** button in the unit operations editor does not get activated (turn from grey to black). This is because reaction changes made via the **Change Reaction** button are meant to endure the whole time the frame is executing. Reaction changes made via the **Override mission parameters** button are considered more temporary and can therefore be overridden.
4. Click **Done** in the Unit Operations Editor Display.

8 Miscellaneous Tools

The Terrain Tools button lets you obtain intervisibility, measurement and cross section data. The Artillery Tool button lets you generate an artillery mission. Instructions for using these buttons is provided in this chapter.

8.1 Terrain Tools

Terrain tools, accessed via the Terrain Tools button, are used to obtain intervisibility, measurement, and cross section data. When the Terrain Tools button is clicked, the Terrain Tools editor will appear in the Editor Area. Intervisibility between points, intervisibility in an area, intervisibility around a vehicle, or intervisibility between vehicles can then be calculated. By knowing the elevation, the system is able to determine the visibility at each point. In addition a cross section view of the terrain can be obtained.

1. Click the Terrain Tools button (labeled with a compass) located at the bottom of the object buttons. A display similar to the example below will appear in the Editor Area.

```

+-----+
| Terrain  Intervis  Terrain      Unit      Direction  Distance |
| Tools   Editor   X-Point  [Click Here ] [Click Here ] set-an-   (units) |
| [ Done ] to      for Map Input for Map Input angle   (length) |
| [Abort ] Point   [Cancel Choice] |
|         O-Area |
| |             |
|         Eye     Start   End |
| Cross   Height  Point   Point |
| Section (units) (type) (type) |
|         (height) (coord1) (coord1) |
|         (coord2) (coord2) |
| |             |
| Tree Blockage   Viewing Size |
|  " " " " " " |
| " * " " * " |
| Clear  Blocked  Infantry Airplane |
+-----+

```

2. To perform terrain point-to-point intervisibility: click Point to Point, click on the Terrain Click Here for Map Input button and then click and drag in the Map. A visibility line will be drawn on the Map showing green for fully visible, green-to-black dithered for partially visible, and black for blocked. The line also contains tick marks at the same interval as the

current grid on the screen. The cross section of that line is also calculated, as well as the distance between the starting and ending points, and the coordinates of the start and end points.

3. To perform terrain area intervisibility: click **Area**, click on the **Terrain Click Here for Map Input** button and then click and drag in the Map. A visibility circle from the selected point out to the dragged radius will be drawn. The visibility circle will be drawn on the Map showing clear for fully visible, clear-to-black dithered for partially visible, and black for blocked.
4. To perform vehicle point-to-point intervisibility: click **Point to Point**, click on the **Unit Click Here for Map Input** button and then click on a vehicle in the Map. Lines from the selected vehicle to other vehicles along with visibility percentages will be drawn.
5. To perform vehicle area intervisibility: click **Area**, click on the **Unit Click Here for Map Input** button and then click on a vehicle in the Map. A visibility circle from the selected vehicle out to a radius of 3500 meters will be drawn. The circle will be drawn on the Map showing clear for fully visible, clear-to-black dithered for partially visible, and black for blocked.
6. The ModSAF intervisibility model uses the height of the viewer for input. A default Eye Height is provided. If necessary, change the value by entering a new height.
7. Since the ModSAF intervisibility software contains a light transmittance model which can be used to model the cumulative effect of intervening trees, the editor does provide a Tree Blockage dial. A default is provided. If necessary, change the dial value by moving the needle in the dial.
8. Since the ModSAF intervisibility model uses both target width and height (relative to the viewer), the editor provides a Viewing Size dial. A median default is provided. If necessary, change the dial value by moving the needle in the dial.
9. When finished, click **Done**.

8.2 Artillery Tool

The Artillery tool, accessed via the Artillery button, is used to generate an artillery mission. When an artillery round (indirect fire) detonates on the simulated battlefield, the Map displays a large purple star.

1. Click the Artillery button located between the Delete (scissors) button and the Terrain Tools (compass) button. A display similar to the example below will appear in the Editor Area.


```

+-----+
| Artillery Mode          Location  Quantity  Rate  Dispersion|
| Tool                    [Coords]  " "      " "    [Distance]|
| [ Done ] X-Set Up Mission [Coords]  " "      " "    |
|[Abort ]  O-Fire Mission    " "      " "    |
|           O-Fire When Location  "__*__"  "__*__" |
|           is Set            Rounds Secs. per |
|                               Detonation      |
| Ammunition              Pattern          |
|X-500lb Bomb            X-Point           O-Square  |
|O-4.5in Proximity Mortar O-East-West Line O-North-South Line |
|O-4.5in Impact Mortar  |
|O-Proximity Howitzer   |
|O-Impact Howitzer      |
|O-MLRS                 |
+-----+

```

2. One way to generate an artillery mission is to choose **Set Up Mission** mode. Set the location, quantity, rate, dispersion, ammunition, and pattern parameters. Then choose **Fire Mission** mode. The artillery will fire and the mode will automatically reset to **Set Up Mission**. You can refire the same artillery mission by again choosing **Fire Mission** mode or you can fire a different mission by changing a parameter(s) before selecting **Fire Mission** mode.
3. Another way to generate a mission is to choose **Fire When Location Is Set** mode. Set the quantity, rate, dispersion, ammunition, and pattern parameters. Then when you set the location parameter, the artillery will fire. Remember that you have to click in a coordinate box before you can provide coordinates from the map. You can repeat the process of setting a new location to have the artillery fire again at another place.
4. When finished firing artillery, click **Done**.

9 Miscellaneous Commands

The Menu Bar at the top of the screen provides access to various ModSAF capabilities.

Clicking on a command in the Menu Bar gives access to a pulldown subcommand menu. An alternate way to access the subcommand menu is to hold/Left on a Menu Bar command. Drag/Left to the needed subcommand and then release the mouse button to select the subcommand. If you want to remove a subcommand menu from the screen without selecting one of the choices, click on terrain in the Map.

Some of the choices available in the subcommand menus were discussed in previous sections. The others are described below.

9.1 File Subcommands

The File menu lets you perform functions on scenarios, overlays, and user preferences. You can also exit ModSAF from this pulldown menu.

The pulldown File subcommand menu is shown below.

```

+-----+
| Save Scenario...  <ALT> S |
| Load Scenario... |
| New Scenario...  |
| Delete Scenarios... |
| Save Overlay to File... |
| Load Overlay File... |
| Delete Overlay File... |
| Load User Preferences... |
| Save User Preferences... |
| Delete User Preferences... |
| Quit             <ALT> Q |
+-----+

```

Note that any errors on file operations will be reported on a pop-up display. The SAFstation will beep you when reporting a file operation error.

The subcommands are as follows:

1. **Save Scenario** - A scenario of the overlays in memory can be saved in a disk file for the purpose of restarting an exercise. A pop-up display will request a name for the disk file. Click on a name from the list offered to create a newer version of an existing file or else type in a name of your own choice. A valid name is one alphanumeric word; don't use spaces or periods in the name. A separate scenarios directory (.././scenarios) is used to store the scenarios. The scenario directory can be overridden via the "-scenario" command line switch.
2. **Load Scenario** - A scenario disk file can be loaded to restart an exercise at the point that it was saved. An overlay retrieved from disk cannot have the same name as an overlay in memory. This prevents multiple objects from appearing at the same location. Placing scenario objects on a uniquely named overlay or changing the name of any overlay in memory whose name is the same as your disk file overlay (for example, the Unnamed overlay) are ways to get around this constraint.
3. **New Scenario** - This deletes all objects running on the same PO database, even those created on other SAFstations. This erases objects from both the Map and the simulation.
4. **Delete Scenarios** - A pop-up display shows you the names of the existing scenario files. To delete a file, click on its name in the list or type its name in the Selection box. If you want to exit without deleting, select Done without naming a file.
5. **Save Overlay to File** - An overlay in memory can be saved in a disk file for the purpose of reuse. A pop-up display will request a name for the overlay disk file. Click on a name from the list offered to create a newer version of an existing file or else type in a name of your own choice. A valid name is one alphanumeric word; don't use spaces or periods in the name. A separate overlays directory (.././overlays) is used to store the overlays. The overlay directory can be overridden via the "-overlay" command line switch.
6. **Load Overlay File** - An overlay disk file can be loaded for reuse. An overlay retrieved from disk cannot have the same name as an overlay in memory. This prevents multiple objects from appearing at the same location. Changing the name of any overlay in memory whose name is the same as your disk file overlay (for example, the Unnamed overlay) is a way to get around this constraint.
7. **Delete Overlay File** - A pop-up display shows you the names of the existing overlay files. To delete a file, click on its name in the list or type its name in the Selection box. If you want to exit without deleting, select Done without naming a file.
8. **Load User Preferences** - A disk file of the SAFstation user preference settings can be loaded into memory for the purpose of setting the SAFstation to those saved settings. A pop-up display will request a name for the disk file. Click on a name from the list offered or else type in a name.
9. **Save User Preferences** - A set of SAFstation user preferences can be saved in a disk file. A pop-up display will request a name for the disk file. Click on a name from the list offered to create a newer version of an existing file or else type in a name of your own choice. A valid name is one alphanumeric word; don't use spaces or periods in the name. A separate

directory (../profiles) is used to store the user preferences. The preferences directory can be overridden via the "-profile" command line switch.

10. **Delete User Preferences** - A pop-up display shows you the names of the existing user preference files. To delete a file, click on its name in the list or type its name in the Selection box. If you want to exit without deleting, select Done without naming a file.
11. **Quit** - This stops the SAFstation program. An alternate way is via <ALT> Q (hold down the key labeled "ALT" and then type "Q"). Wait at least 45 seconds before restarting.

9.2 Special Subcommands

The choices on the Special pulldown menu are described below.

1. **Show/Hide Messages** - The Message Log is set aside for simulated messages that replicate those that forces in the field send by radio to their command center. When the Message Log is displayed, it appears in a rectangular area at the right of the Map where it does obscure part of the map. Drag the mouse to **Show Messages**, a toggle that controls the showing and hiding of the Message Log. Release the mouse button to change the display setting.
2. **Show/Hide the Editor Area** - the SAFstation brings up various editors in the Editor Area. This area, when displayed, appears in a rectangle beneath the Map where it does obscure part of the map. **Show Editor** is a toggle in the Special pulldown menu. To toggle its setting, drag/Left to the **Show Editor** subcommand and then release the mouse button. When **Show Editor** is preceded by a recessed toggle button, the display setting is set to ON. An alternate way to change the display status is via ALT <E> (hold down the key labeled "ALT" and then type "E").
3. **Clear Messages** - When the Message Log has messages from the simulated objects, the **Clear Messages** command can be used to erase the Message Log.
4. **Freeze Display** - The Map is constantly being redrawn to reflect the current locations of battlefield entities. When the setting of the **Freeze Display** command is ON, the redraw of the Map is stopped. To restart the redraw process, toggle the command setting to OFF.

9.3 Show As Command

The **Show As** command on the Menu Bar changes the appearance of icons in the Map and changes the current level of command so that a unit can be shown (or commanded) at one of its corresponding hierarchical levels. For example, a platoon can be commanded as a platoon or as the several vehicles that make up the platoon.

The possible choices in the Show As menu are:

- Vehicle Pictures
- Vehicle Icons
- Platoon Icons
- Company Icons

9.4 Local Force Command

The SAFstation alignment (Friendly, Enemy, or both) is set via the Local Force command on the Menu Bar. However, it can only be set while the SAFstation is in Sysop or Battlemaster privilege.

See Chapter 4 [The Tactical Map View], page 21.

10 Miscellaneous Editors

If the **Show Editor** toggle is ON in the Special pulldown menu and no other editor is displayed, then some miscellaneous editors for setting defaults, editing overlays, and controlling the Flying Carpet can be displayed in the Editor Area. Every time one of these editors is started, the settings in the editor will reflect those made by the user in the previous interaction; they do not get reset to their original values.

10.1 Set User Preferences

User preferences can be saved to disk for reuse. See Section 9.2 [Special Subcommands], page 53, for instructions.

1. If the Editor Area does not appear on the ModSAF user interface, click **Show Editor** in the Special pulldown menu. Click the **Select** button, but do not select anything from the Map. Buttons will appear in the Editor Area.
2. Click the **User Preferences Editor** button in the Editor Area. A display similar to the one shown below will appear in the Editor Area to offer methods for setting defaults.

```

+-----+
|User Preferences  Coordinate System  Speeds          Angles          |
| Editor          X X/Y (TCC)         X Meter/Sec     X Degrees      |
|[ Done ]        0 Lat/Long           0 Km/Hour       0 Mils         |
|                0 UTM                0 Feet/Sec     0 Compass      |
|[Revert]        0 Mile/Hour          0 Knots         |
|[Abort ]        0 Mach                |
|
| Distances      Altitudes      Fuel Line Editing Mode  Zoom Scales    |
| X Meters       X Meters       X Liters   X Parts       X Any Scale    |
| 0 KM          0 KM           0 Gallons  0 Whole       0 Only Standard|
| 0 Feet        0 Feet         0 Pounds   |
| 0 Miles       0 Miles         |
| 0 NM          0 NM           |
|                               Map Scroll Bars
|                               X Top Left   0 Top Right
|                               0 Bottom Left 0 Bottom Right
|                               0 Do Not Display
+-----+

```

3. Click on an only-one-on toggle box to set a default choice.
4. When the Zoom Scales toggle is set to "Any Scale", zooming in around an area displays the selected area without forcing the use of one of the standard map scales.
5. At any time you can click **Revert** to undo any of your changes.

- Click Done when the display is set or click Abort to exit ignoring any changes.

10.2 Set Screen Display Options

- If the Editor Area does not appear on the ModSAF user interface, click Show Editor in the Special pulldown menu. Click the Select button, but do not select anything from the Map. Buttons will appear in the Editor Area.
- Click the PVD Controls button in the Editor Area.
- A PVD Controls Display similar to the one shown below appears to offer methods for setting the screen display options.

```

+-----+
| PVD Controls           Features                               |
| [ Done ]  Hypsometric  Water  Roads  Trees |
| [Apply ]  Buildings and  Pipelines  Political  Railroads |
| [Revert]  Powerlines  Contours  Towns  Grid Lines |
| [Abort]                                     Lines            |
|
|   Vehicle           Hypsometry           Map              Update |
| Picture Scale       Method                Notations         Rate   |
|   ".               X Color                 Call Sign   |
|   "  "             0 Dithered              Altitude   +-----+ |
|   " _ * _ "         Speed           | | + | + | + | | |
| Actual Magnified   | | 0:00:15 | |
| Size               | | - | - | - | | |
|                   +-----+ |
| FM 101-5-1        |
| Icon Size         |
|   ".               |
|   "  "             |
|   " _ * _ "        |
| Smaller Larger    |
| Size               |
+-----+

```

- The toggle box before a terrain feature is recessed when that feature is set to display. The terrain feature colors are: red for roads, green for trees, mustard for boundaries, blue-green for pipelines, blue for water, and black for buildings, gridlines, railroads, and powerlines. Major contour lines are drawn in brown and minor contour lines are drawn in beige. To change display status of a terrain feature, click on its toggle box.
- The vehicle picture scale used in the display of vehicle pictures is set by moving the indicator (needle) inside the semi-circle. As the indicator is moved to the left side of the semi-circle, the vehicle display shrinks to actual size relative to the map zoom scale. As the indicator is moved to the right side, the vehicle display enlarges.

6. The icon size scale used in the display of military icons is set by moving the indicator (needle) inside the semi-circle. As the indicator is moved to the left side of the semi-circle, the icon display shrinks. As the indicator is moved to the right side, the icon display enlarges.
7. The Hypsometry Method can be either "Color" or "Dithered". To select a method, click on its toggle box.
8. There are three Map Notation possibilities: Call Sign (label shown on the left), Altitude (shown on lower left), and Speed (shown on lower right). To select a choice, click its toggle box to ON.
9. The update rate can vary from 0 to 30 seconds between screen updates. The rate can be changed by clicking on the hour, minute, or second arrows. An alternate way to change the polling rate is by typing in a new rate. A rate of "0:00:00" means update as fast as possible. A change to a rate of 1 or 2 seconds can speed up zoom and pan operations.
10. At any time you can click **Revert** to return to original settings or **Apply** to see how the Map will appear with the new settings. When the display is set, click **Done** to exit making the changes. Click **Abort** only to exit the PVD Controls editor without making changes.

10.3 Control the Flying Carpet

The Flying Carpet (also referred to as the stealth/preview) presents a three-dimensional view of the simulated battlefield. A Stealth Control editor allows the ModSAF user to perform the Flying Carpet attach or teleport operation, and to change the attach mode.

The following attach modes are available:

tether attach

The Flying Carpet is attached to a vehicle at a certain distance and bearing. The Flying Carpet moves with the vehicle, changing its speed and direction automatically as the vehicle does. The spaceball movements allow the Flying Carpet to free fly relative to the vehicle, not the terrain.

compass attach

The Flying Carpet is attached to a vehicle at a certain distance and bearing. The Flying Carpet moves with the vehicle, changing its speed automatically as the vehicle does. However, the Flying Carpet will not change its direction. It remains facing the same direction even if the vehicle turns. The spaceball movements allow the Flying Carpet to free fly around the vehicle.

orbit attach

The Flying Carpet is attached to a vehicle at its center of mass. The Flying Carpet always moves with the vehicle. The spaceball movements allow the Flying Carpet to spherically travel around the vehicle which remains in the center.

mimic attach

The Flying Carpet becomes imbedded with the target vehicle, inheriting all components of velocity and orientation. The spaceball movements allow the Flying Carpet to slew its view up and down and to yaw around the Z axis of the target vehicle to facilitate viewing in all possible directions.

1. There are two ways to access the Stealth Control Editor Display:

- If the Editor Area does not appear on the ModSAF user interface, click **Show Editor** in the Special pulldown menu. Click the **Select** button (labeled with an arrow), but do not select anything from the Map. When buttons appear in the Editor Area, click the **Stealth Control** button to access the Stealth Control editor.
- Move the mouse pointer to a flying carpet symbol (a large arrow) on the Map. The symbol will highlight via an outline box to show its selection. Click to access the Stealth Control editor.

2. The figure below shows a sample Stealth Control Editor Display.

```

+-----+
| Stealth   Stealth/Preview           Attach To                               |
| Control [Click Here for Map Input] [Click Here for Map Input]             |
| [ Done ]  [Cancel Choice]           [Detach]                               |
| [Revert]                                     |                               |
| [Abort ]                                     |                               |
|                                     Attach Mode  Teleport Location  Teleport Azimuth |
|                                     Choose-one   Set coordinates   Set angle     |
|                                     from-a-list                                     |
+-----+

```

3. To select a stealth vehicle to control: click on the (Stealth/Preview) **Click Here for Map Input** button and then click on a stealth object in the Map.
4. To select a vehicle to attach to: click on the (Attach To) **Click Here for Map Input** button and then click on a vehicle in the Map. Attachment enables the Flying Carpet to become "latched onto" a vehicle. This allows the Flying Carpet to follow a vehicle without operator effort.
5. To change the Attach Mode: select a new value from the Attach Mode list. Attach the Flying Carpet to a target vehicle before assigning one of the attach modes. The Flying Carpet automatically exits an attach mode if its target vehicle no longer exists.
6. To teleport: click in a Teleport Coordinate box and then click in the Map to set a teleport location. To change the Teleport Azimuth: edit the angular value. When teleported, the Flying Carpet will be at the selected location and will be able to move with the dynamics of an airplane. The spaceball movements will allow the Flying Carpet to free fly around the terrain.
7. Click **Done** to remove the display, **Revert** to return to the original settings, or **Abort** to cancel

the display without making changes.

10.4 Edit an Overlay

The overlay editor lets you perform operations on overlays such as create, delete, rename, change color, set default overlay, and select which overlays to show or hide on the SAFstation.

The SAFstation automatically displays overlays that are created on it. It does not automatically display overlays that are created on other SAFstations running with the same PO database number. Their display status can be set to ON via the Overlay Display list.

1. If the Editor Area does not appear on the ModSAF user interface, click **Show Editor** in the Special pulldown menu. Click the **Select** button, but do not select anything from the Map. Buttons will appear in the Editor Area.
2. Click the **Overlay Editor** button in the Editor Area to bring up the overlay editor. A display similar to the example below will appear in the Editor Area. The **Current Editor Help** line will remind you of some of the overlay editing operations: such as changing the overlay name, selecting a different overlay as the current overlay, creating a new overlay or changing the display setting of an overlay.

```

+-----+
| Overlay Editor | Overlay | Overlay Display | | |
| [ Done ]      | +-----+ |  <overlay1> |
| [ Apply ]     | | (overlay name) | |  <overlay2> |
| [ Abort ]     | |               | |  <overlay3> |
|               | +-----+ | |
|               | Color: [<Black> = ] | |
| [ Press for Other Overlays ] | |
| [ Create New Overlay ] | |
| [ Delete Overlay ] | |
|               | +-----+ |
+-----+

```

3. To change the current overlay name: edit the text in the overlay name box.
4. To change the color of the current overlay: hold/Left on the current color value and select a new value from the displayed list.
5. To create a new overlay: click on the **Create New Overlay** button and then type a name in the overlay name box.
6. To delete an overlay: click on the **Delete Overlay** button. A pop-up confirmation display will appear asking whether you want to delete the current overlay. Click on the **Delete** button to confirm or on the **Don't Delete** button to avoid deletion.

7. To change the display setting of an overlay: click on its name in the Overlay Display list.

11 The ModSAF Logger

The logger program lets the ModSAF user record or play back a SIMNET or DIS exercise. It allows the user to specifically select which packet types (SIMNET Simulation, Data Collection, Persistent Object, DIS Simulation, Radio, and Radio Signal) to record or playback. Hence, the user can omit data during recording, which were part of the original packet stream. Similarly, he can select which protocols are played back (not everything in the file must be played).

The logger program has a graphical user interface. Operations like play, record, stop and pause are provided as graphic buttons, which the user can "push" using a mouse. The program can run on a workstation that has access to the network or it can run on any machine with an IP connection.

The logger program is capable of several "special effects" during playback. The program can play back a recorded exercise using any exercise ID. It can play both faster- and slower-than-real-time, altering velocities to eliminate hopping; freeze-frame and reverse playback are also provided.

To run the logger, you will first go to the directory that the logger object code resides in. Typically, this could be named "usr/common/src/logger". The logger object code is named "logger_<platform>" (logger_sgi, logger_aix, logger_sun4, or logger_mips).

The logger user interface needs the X resource data found in the file 'common/src/logger/Logger'. If you are want to run the logger program after just logging in, issue the command `xrdb -merge Logger` from the logger directory before running the program. If you forget to do this, the logger user interface will come up but it will not be completely or correctly drawn.

There are a few caveats for running the logger and the ModSAF SAFstation.

1. When playing back an exercise from the logger that includes PO packets. there must be NO ModSAF SAFsim's running anywhere on the network on that exercise.
2. When looking at a ModSAF SAFstation, any overlay received remotely from the network will default to NOT being shown. You must use the overlay editor to cause remote overlays to be displayed.
3. System error messages are generally printed to the console from which the logger program was started. Some errors also generate a pop-up window on the user interface display.
4. In the previous version of the ModSAF logger, when the logger quit or when the "Write Protect" was turned off after recording, all vehicles on all simulators using the same PO database as the logger disappeared. This no longer happens.

Directions for performing logger operations and for using features such as the auto shut off switch are provided in the sections that follow.

11.1 Playing a Logger File

1. Start the Program - Start the logger program by typing (without quotes) either
 - 'logger_<platform>' to display on the local display device, or
 - 'logger_<platform> -display workstation:0' to display on another workstation.
2. Display the User Interface - When the rectangular outline indicating the opening of a new window appears, click the mouse to display the logger's graphical user interface.
3. Enter the Filename - Click on the Open Log button at the bottom of the user interface. When the rectangular outline indicating the opening of a new window appears, click in it to view the Open Log selection display. Click on a filename in the displayed list to identify the file to be played back and then click the OK button. The Open Log display window will close and the selected name will appear in the File box of the user interface. The name of the file is expected to be a Unix pathname. Note: All the controls will be unresponsive until the file name is entered. If the entered file is found, many of the controls will become sensitive, including the Play buttons at the top of the screen. If the Play buttons do not become sensitive, it means the file was not found. You can edit the filename using the Backspace key, retyping, then hitting Return.
4. Set the Exercise - When the filename has been entered correctly, you must choose an exercise for playback. A default exercise is shown. If this default is not acceptable, click in the box marked Exercise, use the Backspace key to delete the default, type in a different exercise number, and hit Return. You can also change the exercise during playback using the same procedure.
5. Choose the Protocols - Chances are, the protocols stored in the file will be fine for playback. However, if you need to eliminate any protocol during playback, you can do so by clicking the box next to the protocol you wish to eliminate. A box which looks "green" indicates the protocol will be included in playback.
 - Simulation: The simulation protocol encompasses the bulk of the interactions which usually need to be logged for a SIMNET exercise.
 - Persistent Object: The PO protocol is needed for the capability of restarting an exercise from a logger file.
 - DIS: The DIS Simulation protocol encompasses the bulk of the interactions which usually need to be logged for a DIS exercise.
 - Data Collection: If a SIMNET exercise is going to be analyzed, then the Data Collection protocol should be recorded.

- Radio: Radio traffic packets.
 - Radio Signal: Radio signal packets.
6. Set the Playback Speed - The slider directly below the buttons at the top of the screen controls the speed of playback. The speed is displayed numerically to the left of the slider. Speeds greater than 1.0 result in faster than real time playback. Speeds less than 1.0 result in slower than real time playback.
 7. Press the Play Button - The fourth button from the left at the top of the screen is the Play button. Press this button to start playback. The elapsed time in seconds is displayed at the bottom of the screen. A number of other operations can be performed once playback has started:
 - Stop - To stop the playback, press the Stop button (second from the left at the top of the screen). All the vehicles will instantly disappear from the network. To start playing again after stopping, press the Play button.
 - Pause - To pause during playback, press the Pause button (leftmost button at the top of the screen). All the vehicles will stop where they are; even missiles will stop in flight. To continue, press the Pause button again.
 - Change Speed - To change the speed to be a fixed multiple faster or slower than real time, adjust the speed slider. The new speed takes effect when the mouse button is released.
 - Play Backwards - Press the Reverse Play (third button from the left at the top of the screen) to cause time to go backwards. Vehicles will back up along their tracks. Note that effects such as Weapons Fires are not shown during backward play. Backwards play can be started at any time during forward play, or after playback is stopped. To stop backward play, press one of Pause, Stop, Play, or Loop Play (discussed below).

11.2 Skipping to a Different Time

1. Stop Playback - Press the Stop button to ensure the logger is not playing. Seek operations cannot be performed unless the logger is stopped.
2. Adjust the Seek Slider - The seek slider is just below the speed slider. When the slider control is at its leftmost position, playback will start at the beginning of the file. When it is at its rightmost position the end of the file has been reached. The exact time remaining is displayed at the bottom of the screen.

11.3 Playing a Section Repeatedly (Loop Play)

1. Enter a Filename - If the Loop Play controls are not sensitive, you must enter a filename to be played. See Section 11.1 [Playing a Logger File], page 62.
2. Set the Beginning of the Loop - The first slider in the Loop Play section is used to set the start of the loop. Set this slider the same way you set the Seek slider. See Section 11.2 [Skipping to a Different Time], page 63). Note: you are not allowed to move the beginning of the loop past the end of the loop.
3. Set the End of the Loop - The next slider in the Loop Play is used to set the end of the loop. Set this slider the same way you set the Seek slider. Note: you are not allowed to move the end of the loop before the beginning of the loop.
4. Press Loop Play - The Fifth button from the left at the top of the screen is the Loop Play button. Press this button to start loop play. The elapsed time in seconds is displayed at the bottom of the screen. When the end of the loop is reached, the logger will automatically jump back to the beginning of the loop and start playing. All the operations available during normal play (Stop, Pause, Change Speed, etc.) can also be used during loop play.

11.4 Recording a Logger File

1. Start the Program - Start the logger program by typing (without quotes) either:
 - 'logger_<platform>' to display on the local display device, or
 - 'logger_<platform>-display <workstation>:0' to display on another workstation; with <workstation> being the name of the other workstation.
2. Display the User Interface - When the rectangular outline indicating the opening of a new window appears, click the mouse to display the logger's graphical user interface.
3. Enter the Filename - Click on the New Log button at the bottom of the user interface. When the rectangular outline indicating the opening of a new window appears, click the mouse left button to display the New Log display. Click in the Selection box and type the name of the file to be recorded. Then click the OK button. The New Log display window will close and the file name will appear in the File box of the user interface. The name of the file is expected to be a Unix pathname. Note: All the controls will be unresponsive until the file name is entered. If the entered file is found, many of the controls will become sensitive, including the Play buttons at the top of the screen. If the Play buttons do not become sensitive, it means the file was not found. You can edit the filename using the Backspace key, retyping, then hitting Return.
4. Set the Exercise - When the filename has been entered correctly, you should choose the exercise to be logged. If the default is not acceptable, click in the box marked Exercise, use the Backspace key to delete the default, type a different exercise number, and hit Return.
5. Choose the Protocols - Chances are, the default protocols will be fine for recording. However, if you need to select any extra protocols, or filter out protocols, you can do so by clicking the

box next to the protocol you wish to add or eliminate. A box which looks "green" indicates that the protocol will be included in recording.

6. Set the File Time - Below and to the right of the Filename entry are two boxes, File Start Date and File Start Time. This time is useful during playback for seek and loop play operations. To set the File Time, click in each box, type in the time (HHMM) or date (YYMMDD) of the exercise being simulated and hit Return.
7. Press the Record Button - The rightmost button at the top of the screen is the Record button. Press this button to start recording. The elapsed time in seconds is displayed at the bottom of the screen. Note that recording does not start until the first packet is received. Two other operations can be performed once recording has started:
 - Stop - To stop the recording, press the Stop button (second from the left at the top of the screen). The file will automatically be closed and write protected.
 - Pause - To pause during recording, press the Pause button (leftmost button at the top of the screen). Changes on the battlefield will stop being logged. To continue recording, press the Pause button again.

11.5 Reading Statistics

The logger program updates statistics regarding packet rate, vehicle count, file size, and elapsed time on the control screen so the user can monitor the logging.

1. Review the Statistics - The following statistics are available on the control screen:
 - Packet Rate (PPS) - The current packet rate in packets per second (PPS) is displayed in a graph near the bottom of the screen. During playback, this is the packet rate being generated by the player. During recording, this is the packet rate present on the network. Each line represents 100 PPS. Most simulators can handle packet rates of up to 1000 PPS.
 - Vehicles - The number of vehicles in the exercise is displayed in a graph near the bottom of the screen. During playback, this is the number of vehicles being generated by the player. During recording, this is the number of vehicles on the network. Each line represents 100 vehicles.
 - Tick Rate (Hz) - The current tick rate in Hertz (Hz) is displayed in a graph near the bottom of the screen. During playback, this is the mean tick rate over the previous second. During recording, a tick rate of zero is shown. Each line represents 1 Hz. A tick rate of 15 Hz is ideal, but a lower rate can occur occasionally.
 - Data Size (bytes) - The current size of the file is displayed in a box near the bottom of the screen. During playback, this does not change. However, during recording, the size of the file is updated each second. Because of the compression method used, up to a minute can pass without any file growth if nothing on the battlefield is moving.

- **Elapsed Time and Time Remaining (seconds)** - The Elapsed Time in seconds is displayed during recording and playback. The Time Remaining in seconds is displayed only during playback. Note that these measures may not be updated every second when the packet rate is very low, however they will show true time when they are updated (for example, 5 seconds may pass without any change, then the elapsed time will be incremented by 5). During reverse playback, the elapsed time will decrease, and the time remaining will increase.

11.6 Quitting Logger

1. **Stop Playback or Recording** - In order to guarantee no data is lost, the Quit button is not sensitive during playback and recording. Press Stop to make the Quit button sensitive.
2. **Press Quit** - The Quit button is at the lower left corner of the screen. Pressing Quit will destroy that control screen. If more than one control screen has been created (using the Studio button), each screen must be Quit before the logger program exits.
3. **View Ethernet Statistics** - After the logger program exits, the console from which it was started displays net statistics for the run including packets transmitted, packets received, and diagnostics. Also displayed are statistics indicating the minimum, average, and maximum number of packets which accumulated in the input ring (a measure of overall system performance).

11.7 Using Auto Shut Off

1. **Enable Auto Shut Off** - Auto Shut Off allows you to start recording or playback, and then have the logger automatically stop at some time in the future. Enable Auto Shut Off by clicking the box next to Auto Shut Off near the bottom of the screen. The Auto Shut Off date and time indicators will become sensitive.
2. **Set the Date and Time** - NOTE: The Auto Shut Off time is Wall Clock time. The default shut off time will be one hour in the future. To change the shut off time, click in the box marked "Time", use the backspace key to delete the default value, type in the time of shut off, and hit Return. If you need to, change the box marked "Date" the same way. The current time is displayed next to the Auto Shut Off controls for reference. When enabled, Auto Shut Off will automatically press the Stop button when the Auto Shut Off time is reached. A message will appear to let you know what happened, and Auto Shut Off will be disabled. Note that if a time earlier than the current time is entered while playback or recording is occurring, Auto Shut Off will happen as soon as you hit Return.
3. **If Necessary, Modify Auto Shut Off** - Auto shut off can be modified by

- **Disabling Auto Shut Off** - If after enabling Auto Shut Off you wish to disable it, just click in the box next to Auto Shut Off. When disabled, this box does not look pushed in, and the Date and Time entries are not sensitive.
- **Changing the Auto Shut Off Time and Date** - The Auto Shut Off time and date can be changed any time prior to shut off occurring. Edit each as described above.

12 Release Notes

The sections in this chapter provide information about ModSAF distribution and documentation. They also provide instructions for installing, building, operating, and porting the ModSAF application.

12.1 Distribution

There are two ModSAF 1.0 software distributions. The source code distribution contains all the source files needed to build the ModSAF program, and all the data file needed to run. Executables must be compiled after software installation. The executable distribution contains all of the executable and data files needed to run the ModSAF program.

The distribution includes 150 libraries and a source directory which break down as follows:

Total lines = 326335

 Whitespace = 43336

 Comments = 67393

 Inline = 5062

 C = 210544

 Source (C + Inline) = 215606

Percentage whitespace: 13.28 %

Percentage comments: 20.65 %

Percentage C: 66.07 %

Total lines in data files = 27808

Total lines of TeXinfo documentation = 103256

The root of the distribution directory structure is called 'common/'. This directory contains the subdirectories which are described in the following sections.

12.1.1 tools

Each **'Makefile'** in the ModSAF source tree references a common set of compiler configuration files. These files specify which compiler to use, what flags to specify, and the steps required to compile and install software archives, executables, documentation, and data files.

The **'tools'** directory contains the compiler configuration files. Included in the configuration files is the following:

- Configuration for Mips Magnum or M/2000 systems, using RISC/OS 4.50, 4.51, or 4.52. cc version 2.11 is required.
- Configuration for Silicon Graphics hardware and operating system.
- Configuration for Sun 4 systems, using the Gnu gcc compiler. The native Sun compiler can probably also be used, with some modification of the files in this directory (see Section 12.5 [Porting ModSAF 1.0], page 89).
- Prototype configuration for IBM AIX systems.

The Mips, SGI and SUN configurations are officially supported. Portions of the ModSAF software have been compiled and run on IBM, and HP systems, but the full system has not been built or tested. The tools directory is not included in the executable version of ModSAF 1.0.

12.1.2 libsrc

The directory **'common/libsrc'** contains the sources for all the software libraries which make up the ModSAF system. The ModSAF architecture is built up from many libraries (150 in the ModSAF 1.0 distribution). Most of these (142) are considered *ModSAF compliant*, which means they meet a set of coding standards which are spelled out in another document (see section 'Coding Standards' in Software Architecture Design and Overview Document). The remaining libraries (8) are legacy from the SIMNET project, and have been used without modification in ModSAF. During the initial build process, the file **'common/libsrc/modsaf.libs'** is created which contains a list of the ModSAF compliant libraries. None of the **'common/libsrc'** libraries are included in the executable version of ModSAF 1.0.

Overviews of the functionality of these libraries can be found in the topmost ModSAF info node, **modsafdir**.

12.1.3 include

The directory `'common/include'` contains two source subdirectories:

`'common/include/global'`

This directory contains globally referenced C header files, which contain definitions of physical constants, conversion factors, dynamic memory allocation conventions, and type definitions.

`'common/include/protocol'`

This directory contains the definition of the DIS, SIMNET, and PO protocols, as well as definitions of many experimental protocols which have been used in SIMNET.

In addition, there is the directory `'common/include/libinc'` where the C header files defined by the various libraries are deposited as part of the compilation process.

The directory `'common/include'` is not included in the executable version of ModSAF 1.0.

12.1.4 data

The directory `'common/data'` acts as a repository for data files defined in the ModSAF libraries. Data files are copied from library directories into this directory during the compilation process. The files in this directory can be identified by their extensions:

- `'rdr'` Data files formatted using the `'libreader'` format. These data files are used by the simulation and workstation applications at run time.
- `'xrdb'` X windows resource definition database files. These data files are incorporated into the X Server Resource Database at, or just prior to, run time.
- `'map'` A binary format used by `'libhm'`.

12.1.5 lib

The directory `'common/lib'` contains a subdirectory structure which acts as a repository for compiled software library archives (`ar(1)`). The directory structure is constructed automatically as part of the compilation process. First, there are subdirectories for each architecture which is built. The architecture is specified via the environment variable `BUILD_ARCH` and should have one

of the values: `sgi`, `mips`, `sun4`, or `aix`. If you use `csch` or `tcsh`, this can be set in the `.cshrc` file in your home directory using the command:

```
setenv BUILD_ARCH sgi
```

(Substitute your own architecture for `sgi`.) If you use `sh` or `ksh`, this can be set in the `.profile` file in your home directory using the command:

```
BUILD_ARCH=sgi  
export BUILD_ARCH
```

The `.cshrc` modifications are made automatically upon execution of the `'make-all'` script (see Section 12.3 [Building ModSAF 1.0], page 77).

Below the architecture directory, you will find a subdirectory which is specific to the application configuration which is built. For ModSAF, this will always be called `'modsaf'`. This name comes from a configuration file, which is also indicated by an environment variable. For `csch` or `tcsh` users, this should be set:

```
setenv BUILD_APP src/ModSAF/modsaf.config
```

For `sh` or `ksh`:

```
BUILD_APP=src/ModSAF/modsaf.config  
export BUILD_APP
```

As with the `BUILD_ARCH` variable, this is automatically placed in your `.cshrc` by `'make-all'`.

The files in the application subdirectories are merged into the ModSAF executable, by the linker (`ld(1)`). This directory is not included in the executable version of ModSAF 1.0.

12.1.6 info

The directory `'common/info'` contains the ModSAF documentation in Emacs-info format. The files in this directory are compiled from `'texinfo'` files in the library and source directories, and are installed during the compilation process.

12.1.7 src

The directory `'common/src'` contains sources for building executable programs and operating system related modules:

`'common/src/ModSAF'`

This directory contains the following:

- The ModSAF executable program and compilation script.
- The `'common/src/ModSAF/entities'` subdirectory which contains vehicle parameter files.
- The `'common/src/ModSAF/docs'` subdirectory which contains the top-level ModSAF 1.0 documentation.

`'common/src/interck'`

The source and executables for the interck bug finder program reside in this directory. This directory is not included in the executable version of ModSAF 1.0.

`'common/src/blaster'`

The source and executables for the network blaster program reside in this directory. This directory is not included in the executable version of ModSAF 1.0.

`'common/src/OSAtemplate'`

This directory contains the template files used by the `osatemplate` script found in the bin directory. This directory is not included in the executable version of ModSAF 1.0.

`'common/src/logger'`

The logger source files and executable program reside in this directory.

`'common/src/cmc'`

`'common/src/simle'`

These directories contain C header files and compiled operating system modules. These directories are not included in the executable version of ModSAF 1.0.

`'common/src/depends'`

`depends` is a program which examines ModSAF compliant software directories and identifies the dependencies between them. It is used to do ordered compilation, build Makefiles, and generate FIG format dependency graphs. This directory is not included in the executable version of ModSAF 1.0.

`'common/src/public'`

The `'common/src/public'` directory contains public domain source files for `xinfo`, `makeinfo`, and `make-3.68`.

- `xinfo` is a public domain X windows interface tool for reading Emacs-info format documentation without using emacs. It is included as a convenience for reading the ModSAF documentation.

- `makeinfo` is a public domain tool for creating Emacs-info format documentation from our texinfo documentation.
- `make-3.68`, also known as `gmake`, is a public domain make tool used in building the ModSAF application.

The compiled versions can be found in the 'common/bin' directories. These sources are provided as a convenience to the ModSAF customer and are not supported. This directory is not included in the executable version of ModSAF 1.0.

12.1.8 bin

The directory 'common/bin' contains subdirectories for each of the supported architectures: `sgi`, `mips`, `sun4`, `aix`. As explained earlier (see Section 12.1.5 [lib], page 71), this is specified by the environment variable `BUILD_ARCH`. Since this directory contains executable programs which are needed to compile ModSAF, it should be added to your program search `PATH`. For `csh` or `tcsh` users, this is done by adding it to the '.cshrc' file. For example:

```
set path = (/usr/staff/myname/common/bin/sgi . /bin /usr/bin /usr/bin/X11)
```

For `sh` or `ksh` users, the syntax is:

```
PATH=/usr/staff/myname/common/bin/sgi:~/bin:/usr/bin:/usr/bin/X11
export PATH
```

For `csh` or `tcsh` users, the 'make-all' script will place the correct directory in your path.

The 'common/bin/<BUILD_ARCH>' subdirectory contains an awk script 'fsm2ch.awk', which is used during the compilation of ModSAF task libraries. The 'fsm2ch.awk' file is originally located in 'common/libsrc/libtask' directory and is installed in the correct 'common/bin' subdirectory upon running the `make-all` script. The directories in 'common/bin' also act as a repository for compiled executables, such as the 'depends' program, 'makeinfo', 'gmake', and 'xinfo'. The executables for 'makeinfo', 'gmake', and 'xinfo' along with the 'osatemplate' script are distributed in the correct 'common/bin' subdirectory.

12.1.9 terrain

The directory 'common/terrain' contains a subdirectory for each terrain database. The distribution includes the following databases:

'common/terrain/hunter-0110'

A version of the 50KM x 50KM Hunter-Liggett terrain database.

'common/terrain/itsec93-0101'

A 100KM x 100KM superset of the Hunter-Liggett terrain database for use at the I/ITSEC '93 show.

'common/terrain/ntc-0101'

A version of the 50KM X 50KM National Training Center terrain database.

'common/terrain/knox-0311'

A version of the 50KM x 75KM Ft. Knox, Kentucky terrain database.

12.1.10 profiles

The directory 'common/profiles' is created when the ModSAF program is first run, to hold user-customization profile files.

12.1.11 scenarios

The directory 'common/scenarios' is created when the ModSAF program is first run, to hold user-created scenario files.

12.2 Executable Version of ModSAF 1.0

The directories included in the executable version of ModSAF 1.0 are:

```
common/data
common/info
common/terrain
common/terrain/hunter-0110
common/terrain/ntc-0101
common/terrain/knox-0311
common/src
common/src/logger
common/src/ModSAF
common/scenarios
common/profiles
common/overlays
common/logs
```

The following steps should be followed to load the ModSAF 1.0 program from the distribution tape:

Getting Started

Choose a directory location on your machine for the executable code to reside in, such as `/usr/staff/myname/modsaf`. *Do not install the ModSAF 1.0 distribution "over" a previous ModSAF release.* Make sure you are in this directory before you begin the next step.

Unloading the tape requires approximately 50 Mbytes of disk storage for the executables and the terrain databases.

Load the software

Load ModSAF 1.0 Tape in tape drive. If you are on an SGI machine, unload the tape as follows:

for builtin drive:

```
tar xvf /dev/tapens
```

for external SCSI bus tape drive (replace # with SCSI device number)

```
tar xvf /dev/rmt/tps0d#ns
```

If you are on a Mips machine, unload the tape as follows:

```
tar xvf /dev/rmt/ctape0
```

The name of the tape device differs on other machines. Once the executables are installed skip ahead to the running instructions (see Section 12.4 [Running ModSAF 1.0], page 82).

12.3 Building ModSAF 1.0

The following steps should be followed to build the ModSAF 1.0 program:

Getting Started

Choose a directory location on your machine for the source code to reside in, such as `‘/usr/staff/myname/modsaf’`. Do not install the ModSAF 1.0 distribution "over" a previous ModSAF release. Make sure you are in this directory before you begin the next step.

Unloading the tape requires approximately 80 Mbytes of disk storage for source code, executables, documentation, and the terrain databases. Once fully compiled, approximately 170 Mbytes of disk storage is consumed by the source code, object code, terrain, and documentation.

All the executable programs (`‘xinfo’`, `‘gmake’`, `‘osatemplate’`, `‘makeinfo’`) which are needed to build ModSAF are on this tape.

The build process assumes the machine has a C compiler.

Load the software

Load ModSAF 1.0 Tape in tape drive. If you are on an SGI machine, unload the tape as follows:

for builtin drive:

```
tar xvf /dev/tapens
```

for external SCSI bus tape drive (replace # with SCSI device number)

```
tar xvf /dev/rmt/tps0d#ns
```

If you are on a Mips machine, unload the tape as follows:

```
tar xvf /dev/rmt/ctape0
```

The name of the tape device differs on other machines.

This will load all the ModSAF software, as described in the previous section. On an SGI machine, the system may ask you to supply a second tape. Ignore this request by hitting return.

Prepare your environment

The compilation of ModSAF requires that a few environment variables be set (see Section 12.1.5 [lib], page 71). The values you should use for these environment variables depends upon the architecture you will be running on and the way you will be using the ModSAF program. The ModSAF program can be built many different ways within the same source hierarchy. For example, executable versions of ModSAF for both a Sun 4 and an SGI can be built from the same set of sources.

The architecture is set via the environment variable `BUILD_ARCH`.

Most ModSAF 1.0 users should build the application using the standard application configuration, described by a file in the application source directory `'src/ModSAF/modsaf.config'`. This file specifies the set of compilation flags which select which features are enabled and which are not. There is another configuration, called `'src/ModSAF/safsim.config'` which builds the application without X windows. The application is set via the environment variable `BUILD_APP`.

Many programs used in the compilation of ModSAF are installed in the directory `'common/bin/<BUILD_ARCH>'`. This must be in your `PATH` for compilation to succeed (see Section 12.1.8 [bin], page 74).

The ModSAF program is very large, and many compilers will need extra disk space to build it. Most architectures support an environment variable called `TMPDIR` which specifies a directory in a large disk partition. You will probably need to specify such a directory. For example:

```
setenv TMPDIR /usr/tmp
```

Finally, you must select a set of `EXTRA_CFLAGS` to suit your needs. This environment variable specifies extra flags which are passed to the C compiler when the program is built:

- '-g' This specifies that a symbol table should be included, so that the program can be debugged using 'dbx'.
- '-O' This specifies that the program should be optimized to improve execution speed. The exact version of this flag differs between machines, and some machines do not allow this flag together with -g. On an SGI or a Mips, the flags '-g3 -O2' will yield the maximum optimization which current compiler versions can perform on ModSAF. *WARNING: Optimized code generally cannot be debugged reliably using dbx.*
- '-mips2' Newer versions of SGI hardware and compilers support the MIPS II instruction set. If you have such a machine, the '-mips2' option will yield up to a 2x performance boost, with no negative effects. This argument *does not* interfere with debugging.

See the Unix manual page on 'cc' for more information. If multiple arguments are used, they must be combined with quotations. For example:

```
setenv EXTRA_CFLAGS '-g3 -O2'
```

If you do not set these environment variables yourself, the `'make-all'` script will set up a standard configuration in the `'.cshrc'` file in your home directory.

Compile the ModSAF software

To compile the ModSAF software:

```
cd src/ModSAF
```

make-all

If necessary, the **'make-all'** script will set a few necessary environment variables and put the correct **'common/bin'** subdirectory in your path before building anything (see Section 12.1.5 [lib], page 71).

'make-all' makes the **'depends'** program, many software libraries, and the ModSAF application, which is called **'modsaf_arch'**. Where **arch** is replaced with the architecture you are building on. For example, the executable would be called **'modsaf_sgi'** for the Silicon Graphics architecture.

You will get an error message in certain libraries which do not have TeXinfo documentation, as the build process attempts to generate Info documentation in every library. These error messages can be safely ignored.

When the build is complete, the **modsaf** application will be test run to have it display its arguments and verify that the executable does run.

Install the simle driver (Sun only)

If you are running ModSAF on a SPARC based SunOS 4.1.1 (or higher), you can use the installable **simle** driver to send and receive SIMNET libassoc packets. There are several files used to load the **simle** driver, all of which are in the directory **common/src/simle/dvr**:

'simle_rc'

Contains the lines that should be put into the file **/etc/rc.local** to load the driver at boot time.

'simle_load'

A script to do the loading, which should live in **/etc**.

'simle_mknod'

A script to make the necessary **"/dev/simle*"** file, which should live in **/etc**.

'simle.o' The driver object, which should live in **/etc**.

'simle_install'

A script to put the above 3 files in **/etc**, add the contents of **simle_rc** to **/etc/rc.local** (if not already there), execute **/etc/simle_load**, and configure up to 2 ethernet cards that may be present. This change to **rc.local** is permanent and means the **simle** driver will be loaded into the kernel each time the machine is rebooted. You must be root to run this script.

To install this driver, run the **simle_install** script as root.

Use the xinfo documentation tool

Determine the absolute info path where the info sources have been installed. If you installed the software in `‘/usr/staff/myname/modsaf’`, the `<absolute-info-path>` will be `‘/usr/staff/myname/modsaf/common/info’`.

```
cd /usr/staff/myname/modsaf
common/bin/xinfo -file modsafdir -path <absolute-info-path>
```

You may click on various text nodes to follow the ModSAF documentation tree. When finished, click "quit" to exit.

Customize emacs to use info documentation:

If you are unfamiliar with the use of Info in emacs, you can enter emacs and type `~h i`. Read the instructions and type `h` to get a tutorial on the use of Info.

To access modsaf info documentation from emacs, you will have to edit the `dir info` node to access the `modsafdir info` node:

1. Enter emacs. To find the filesystem location of the `dir` node,
2. Type `~h i` This will bring you into the info system at the `dir` node.
3. Type `~x~b` to get a buffer list. The absolute pathname of the `dir` node will be listed.
4. Exit emacs. As root, you can edit the `‘dir’` file in the directory identified in the previous step to add the following line to the end of the file:

```
* ModSAF: (<absolute-info-path>/modsafdir).
    Documentation about ModSAF.
```

Once the `dir` node is modified, emacs will be able to access the modsaf info sources directly:

1. Enter emacs
2. Type `~h i`
3. Type `m`, followed by `modsaf` to enter the `modsaf` node.

Create /etc/assoc.def

Create the file `‘/etc/assoc.def’` file which will describe the simulation site and host of the machine which will run the ModSAF application. Site numbers are typically assigned to a site by Loral. Host numbers are assigned by the site manager at a given site. As an example, if you are site 1 and the machine you are on is host 5, you can create the `‘assoc.def’` file as follows (as root):

```
cat > /etc/assoc.def
site 1
host 5
^D
```

Configure the real time clock (SGI only)

The SGI operating system defaults to an extremely low clock resolution of 10 ms. This can be fixed using the command `‘/etc/ftimer -f on’`. This command requires `root`

privileges. You can set up the machine to automatically fix the real time clock by creating a boot-up initialization script:

```
cat > /etc/rc2.d/S99ftimer
/etc/ftimer -f on
/etc/ftimer
^D
chmod +x /etc/rc2.d/S99ftimer
```

12.4 Running ModSAF 1.0

If you are running on an SGI system, and you want to use the network, you must login as root. Remember that as root, any command you issue from the current directory must begin `./<command>`. Once the ModSAF program has been successfully compiled, it can be run from the directory `'common/src/ModSAF'`. There are actually two ModSAF programs, which are combined into a single executable. For the Mips architecture, the executable file is called `'modsaf_mips'`; for the SGI, `'modsaf_sgi'`, and so on. The two ModSAF programs are:

SAFStation

This is the ModSAF user interface. This program provides a map display, and allows a user to create units, missions, and make assignments to ModSAF vehicles.

SAFSim This is the ModSAF vehicle simulation program. This program creates SAF vehicles in response to requests from the SAFStation program (or other programs running on the network), and controls the behavior of those units.

For testing, these two programs can be run together on a single computer. However, such a configuration may not be able to meet real-time simulation requirements because of the burden of user interface processing.

The ModSAF user interface uses the X resource manager for selection of layout, sizing, coloring, etc. The resources used by ModSAF can be found in the file `'common/src/ModSAF/ModSAF'`. If you are using a machine with X windows version X11R5, you can set up the system to automatically load this file when the program starts by adding the following to your `'.cshrc'`:

```
setenv XAPPLRESDIR .
```

or if you use a variant of sh, add this to your `'.profile'`:

```
XAPPLRESDIR=.
export XAPPLRESDIR
```

If, however, you are using X windows version X11R4, a bug in the X resource manager prevents this from working. On such machines, you must use the `xrdb` command every time you login. The executable for `xrdb` will be found in your X11 bin directory, either `/usr/X11/bin`, or `/usr/local/X11/bin`. This directory should replace `<Xbindir>` in the command below:

```
cd /usr/staff/myname/modsaf/common/src/ModSAF
/<Xbindir>/xrdb -merge ModSAF
```

The above two commands need to be done anytime you login, after logging in, to configure the X server to use the default resources.

12.4.1 Command Line Arguments

The ModSAF program takes many command-line arguments, most of which are described in the following sections. The default values for these arguments are compiled into the ModSAF program, but can be overridden with an environment variable. The name of the environment variable depends on your architecture. The Silicon Graphics Architecture uses MODSAFSGIARGS, the Mips uses MODSAFMIPSARGS, and the SUN architecture uses MODSAFSUN4ARGS. For example, to change the default terrain database to `knox-0311` on an SGI, add the following to your `.cshrc`:

```
setenv MODSAFSGIARGS '-terrain knox-0311'
```

or if you use a variant of `'sh'`, add this to your `.profile`:

```
MODSAFSGIARGS='-terrain knox-0311'  
export MODSAFSGIARGS
```

For an overview of the command line arguments and to see their default values, use (the program name varies):

```
cd common/src/ModSAF  
modsaf_sgi -help
```

12.4.1.1 SAFStation

The command line argument `-gui` selects the SAFStation functionality. To disable the SAFStation, instead use `-nogui`.

In addition, all standard X windows command line options are supported. For example, to set the display device, use `-display machine:0`.

12.4.1.2 SAFSim

The command line argument `-simulate` selects the SAFSim functionality. To disable the SAF-

Sim, instead use `-nosim`.

Another command line argument which impact the simulation is the simulation loading factor `-load floating point number`. This option specifies the portion of maximum simulation load imposed by one simulated vehicle, and is used in the inter-machine load balancing algorithm. Since a typical workstation can support about 60 local vehicles, the value $1/60$ (0.167) is used.

12.4.1.3 Networking

The ModSAF program can be configured to support many different networking schemes. To select a networked ModSAF, use the option `-network`. To disable networking use `-nonet`.

The network device can be selected with the argument `-netdev device`. The appropriate network device varies on different machines.

The DIS and SIMNET protocols support multiple simultaneous *exercises* running on a single network. To specify the exercise in which a ModSAF should participate, use the command line option `-exercise 1-254`.

The ModSAF system uses the Persistent Object protocol for communications between SAFSims and SAFStations. The protocol allows multiple simultaneous persistent object databases within a single exercise. All ModSAF computers which are using the same database will work together to do SAF simulations. To specify the database being used by a set of ModSAF simulators, use the command line option `-database 1-254`.

Simulation protocols must use an application layer protocol to move packets between computers. In SIMNET this function was performed by the *Association Layer Protocol* (libassoc). In DIS, for the time being, this function is being performed with the *Internet User Datagram Protocol* (UDP/IP). The ModSAF software allows either protocol to be used, regardless of whether SIMNET or DIS simulation protocols are being used. To use the Association Layer Protocol, use `-assoc -noudp`. To use the User Datagram Protocol, use `-udp -noassoc`.

Note that the Association Layer Protocol requires a modified operating system kernel on the Mips Magnum, and extra hardware and a modified kernel on the Mips M/2000.

Using the Association Layer Protocol on a Sun requires some extra configuration (see Section 12.3 [Building ModSAF 1.0], page 77).

The UDP networking software can run either asynchronously (driven by software signals generated by the operating system), or via polling. The performance characteristics of each method will differ between different operating systems. To select asynchronous operation use `-asynch`; for polling, use `-synch`.

No standard exists for which UDP port should be used for transmitting different protocols (although 3000 is most common for DIS). To select the port for DIS protocol, use `-disport port`. To select the port for PO protocol, use `-poport port -noexperimental`. To select the port for Stealth protocol, use `-stealthport port`.

Another option for transmitting the PO protocol under UDP/IP is to package all PO packets into a single experimental DIS PDU kind. To do this, use `-experimental kind (134-255)`.

The ModSAF program supports both SIMNET 6.6.1 and DIS protocols. To use DIS, use `-dis`. For SIMNET, use `-simnet`.

The current defacto standard DIS version is that used at the I/ITSEC '93 interoperability demonstration (DIS 2.0.3). Although this version is the default, it can be selected by using the `-version 3` option. To select the ITSEC '92 version (DIS 1.0), use `-version 1`. Note that these two versions are not compatible. Every computer on the network must be using the same version of the DIS protocol for interoperation. DIS version 2.0.2 (`-version 2`) is no longer supported.

12.4.1.4 Terrain

The terrain database can be selected with the command line option `-terrain name`. The name can be the name of a terrain database in the directory 'common/terrain', or it can be the absolute pathname of a terrain database directory (starting with '/').

12.4.1.5 Site Customization

The simulation address for a machine should be set in the file '`/etc/assoc.def`'. This address can be overridden with the command line option `-simaddr site (1-65535) host (1-65535)`.

The ModSAF user can create user interface profiles (for example, the default coordinate system, metric vs English, etc.), and save them to disk. The default directory for these files is 'common/profiles', however this can be overridden with `-profile directory`.

The ModSAF user can save scenarios (created units and command graphics) to disk. The default directory for these files is 'common/scenarios', however this can be overridden with `-scenario directory`.

Some features of the ModSAF user interface require *privileges* to access. These privileges, are password protected, by default. The default password, for historical reasons, is 'foozball'. This password can be modified by creating a file in the 'common/src/ModSAF' directory called '.password'. For example, to change the password to 'frabnitz', type:

```
cd common/src/ModSAF
cat > .password
frabnitz
^D
```

To disable password protection, create an empty '.password' file:

```
cd common/src/ModSAF
rm -f .password
touch .password
```

12.4.2 Configuring ModSAF

By default, when the ModSAF program is run from the directory 'common/src/ModSAF', data files ending in '.rdr' are loaded from the directory './../data', which translates to 'common/data'. However, these data files can be overridden by placing modified versions in the directory from which the program is run. Instead of loading the default files, the modified versions will be loaded.

The default X resources used by ModSAF can be overridden using the X resource manager. Typically, this is done by placing resource modifications in a user's '.xresources' file. The exact name of a widget resource can be found by looking in the '.xrdb' file which configures the widget by default. Also, some possible X resource customizations are described in the ModSAF library TeXinfo documentation.

12.4.3 Known Problems

The following is a list of known problems with the ModSAF 1.0 release.

- The execution matrix is an experimental piece of software which has several known problems:

- A mission for a unit cannot be saved until after it is assigned.
- The ability to edit an execution matrix after it has been assigned is extremely limited. Many editing operations will have undesired effects.
- There is no ability to specify global mission parameters such as fire permissions, or enemy situation. These parameters must be specified for every frame.
- The logger has the following list of problems
 - The logger does not yet support The DIS 2.0.3 protocol. It only supports Simnet and DIS 1.0.
 - Recording over part of an existing file does not work.
 - The Internal button doesn't work unless the Network button is also activated
- In some circumstances, M2, BMP1, and BMP2 will attempt and fail to engage targets with missiles when the target is not in the same plane/orientation as the attacker.
- Due to the use of absolute elapsed time instead of relative time, the task state for VEnemy changes more frequently than necessary.
- Turret scan sectors are often incorrect during road marches.
- Parameter changes made to a platoon or company after creation are not propagated down to the individual vehicles. For example, you cannot teleport a platoon to a new location by editing the platoon.
- When a vehicle is shooting at an enemy and runs out of that type of munition it will not shoot even if it is assigned more ammunition.
- There are a few munitions that are currently not defined in the vehicle's vassess parameter file. This means the vehicle can not shoot that munition.
- Many soviet formations are not correct. One effect of this is that vehicles will cross paths when occupying a position.
- The "Conform to Terrain" option in the Move task frames is an experimental piece of software. which often leads to incorrect movement.
- Occasionally an M2 will not start moving again after its stops to fire its TOW missile.
- Some mixed platoons don't have the right force id (friendly/enemy).
- You can't stop a air to air intercept with the STOP REACTION button.
- Tanks cannot shoot DI yet. (US M59, USSR D) They have a weapon for it, but it is not listed in the vehicle's VAssess section of the rdr file.
- Selecting a stealth from the map display when the Unit Operations menu is present will lead to overlapping control menus. Exit the Unit Operations menu before choosing a stealth.
- After executing several hard turns, the fixed wing aircrafts may lose altitude and may not be able to recover.
- Fixed wing aircraft can not perform the task "Fly Route". If assigned this task, they will just sit there. FWA should only be assigned "Sweep", "Cap", and "Return to Base".

- Rotary wing do not currently have a landing task. They can only be told to return to base.
- Rotary wing aircraft performing takeoff right now will either spin a bit, or bump the ground. They will then perform normally.
- Rotary wing aircraft performing a fly route will occasionally in passing a route point turn around and go back to it, then continue on their route.

12.5 Porting ModSAF 1.0

The ModSAF software is quite portable. It uses K&R C, with modest extensions (such as unique identifiers which exceed 8 characters).

X windows is used exclusively for windowing (SGI GL is not used). X versions 4 and 5 both work well with ModSAF (R5 seems to have improved performance on the Mips platform). The OSF/Motif 1.1 widget set is used.

The first step in porting ModSAF to a new platform is to edit the configuration in the 'common/tools' directory. Most of the configuration parameters are in the file 'make.config'. This file include specification of the C compiler and options.

You must give a name to the new architecture, for example, if you are porting to a Hewlett Packard operating system, you could call the architecture 'hp'.

The application description file (such as 'common/src/ModSAF/modsaf.config') must include this new architecture name in the list of supported architectures (ARCHLIST).

Edit the file 'common/tools/make.config' to include any special compiler, linker, archiver, etc. directives. In the middle of this file you will find a set of flag settings for each architecture. Copy an existing architecture and modify it as needed. This may include some of the following:

One common change is for machines which do not have the single-precision square root function, `fsqrt`. On such machines add the definition `-Dfsqrt=sqrt` to the `<arch>_CFLAGS`.

Another difference between machines is whether they have or need the command 'ranlib' executed on library archives. This is selected by the `<arch>_RL` and `<arch>_RLFLAGS`.

It is unlikely that a new machine will be able to easily support the SIMNET Association Layer Protocol, because it requires access to raw 802.3 Ethernet packets. On such machines, skip the compilation of 'libnetif', 'libassoc', and 'libp2p' and add `-DNO_ASSOC` to the `<arch>_CFLAGS`.

Another common difference between unix systems is whether the string operation header file is called 'string.h' or 'strings.h'. If it is the former, then add the definition `-DUSESTRINGDOTH` to the `<arch>_CFLAGS`.

Once the tools directory is set up for a machine, most directories should compile without mod-

ification.

12.6 Printing ModSAF Documentation

The complete ModSAF documentation set is roughly 1000 pages, so it makes sense to only print documents selectively. The documents are written using the TeXinfo documentation system. Printing the documents requires access to the T_EX software package. T_EX is available from the University of Washington, for a small fee.

You will need the T_EX input file 'texinfo.tex'. If you do not have this file, one has been provided in 'common/bin'. Copy this to the directory where T_EX looks for input files (often in a directory called 'inputs/', or 'macros/').

There are rules in each 'Makefile' which can translate the '.texinfo' documents into '.dvi' documents, the output of T_EX. For example, to generate the documentation for 'libctdb', use:

```
cd common/libsrc/libctdb
make libctdb.dvi
```

'dvi' files must be translated to a printer's native language before they can be printed. One tool commonly used for this translation is 'dvi2ps'. Several conversion tools are included in the T_EX distribution.

12.7 Troubleshooting

When I compile an individual library, I get lots of error messages

The ModSAF Makefiles now expect to use the GNU make program, gmake. Did you compile with 'gmake'?

Are the BUILD_ARCH and BUILD_APP environment variables set correctly?

Is the correct 'bin' subdirectory in your path?

See Section 12.3 [Building ModSAF 1.0], page 77.

See Section 12.1.5 [lib], page 71.

See Section 12.1.8 [bin], page 74.

When I start the program with -gui I get an X error.

The user interface is all mashed up into the upper left screen corner.

If you are using X11 R4, did you run 'xrdb -merge ModSAF'?

If you are using X11 R5, did you 'setenv XAPPLRESDIR .'?

See Section 12.4 [Running ModSAF 1.0], page 82.

When I start the program under 'dbx' I get an I/O error.

The asynchronous UDP implementation uses the SIGIO signal to receive incoming packets. 'dbx' can be told to ignore this signal by adding the command:

```
ignore 23
```

to the file '.dbxinit' in your home directory.

I get a warning from 'cpp' about redefinition of M_PI.

I get a warning from 'cpp' about redefinition of NULL.

These warnings have been seen on the SGI, and we have not yet identified where the redefinition is occurring. They can be safely ignored.

My C compiler dies with a "symbol table full" error.

The ModSAF program is very large, and has been known to choke compilers. Check your operating system reference manuals to see if the compilers limits can be increased.

My C compiler dies with an internal error while linking.

Some C compilers use the directory '/tmp' for storing internal files during compilation. There may not be enough space in the root partition to hold some of these files. If this is the case, the compiler can often be told to redirect temporary files to a different directory (the Mips uses the environment variable TMPDIR).

I can't lint the ModSAF program.

Although there is a lint target in each library, many of the libraries include many X and Motif header files, which can overwhelm lint. The interck program finds many of the same errors lint can find, and many more.

'dbx' shows incredible values for local variables.

'dbx' complains that the program has no symbol table.

By default, the ModSAF program is set up to compile with optimization. This makes

use within a debugger difficult or impossible. Change the definition of your environment variable `EXTRA_CFLAGS` to include a symbol table (usually `-g`) and omit optimization. See Section 12.3 [Building ModSAF 1.0], page 77.

Network performance at my site degrades badly when I run ModSAF.

The DIS protocols currently use *broadcast* UDP/IP for packet transmission. These packets will be received by every computer on the network, and some may respond with "I hear you but I don't know why you are telling me" packets (Mips RISC/OS does this). The SIMNET Association Layer Protocol, in contrast, is *multicast* so that only those computers which explicitly ask for the packets will hear them. The ModSAF program allows the DIS protocol to be sent using the SIMNET Association Layer Protocol (as protocol family 3) with the command line arguments `-assoc -noudp -dis`.

See Section 12.4.1.3 [Networking], page 84.

I need to run in an area for which no terrain database is available.

The library `'common/libsrc/libctdb'` contains a program called `'ocean'`, which can be used to create nominal (flat) databases anywhere in the world. Go to that directory, `'make ocean'`, and run `'ocean -help'` for details.

How can individuals use different compiler configurations?

The environment variables `EXTRA_CFLAGS` and `EXTRA_LDFLAGS` can be set by different users to augment the compilation process. These flags are used *in addition* to those specified in `'common/tools/make.config'`.

ModSAF says it is out of cycles.

This is a normal error which indicates that the simulation capabilities of the ModSAF program have been exceeded. Performance can be improved on some architectures by using optimization and special compiler directives (such as `-mips2` on the SGI). Also, SGI users may encounter this error if the fast timer is not turned on (See Section 12.3 [Building ModSAF 1.0], page 77).

Appendix A Menu Component Operations

The pull-down menus, editor displays, and pop-up windows that appear on the screen will contain various menu components for data entry and parameter editing. Directions for working with these menu components are provided below.

A.1 Insert a Value

1. Click inside the outline box at the place on the display that needs a value. A blinking insert cursor (small black bar) appears.
2. Type a value.

A.2 Alter Text

1. Click after the character to change in the text. A blinking insert cursor (small black bar) will appear. Press BACKSPACE repeatedly to erase character-by-character in a right-to-left direction. Type the new text. Text appearing in inverse video requires a carriage return.
2. Sometimes the Current Editor Help line will instruct you that hitting the SPACEBAR will erase the text. Often erasing and entering new text is easier than editing the existing text.

A.3 Select a Value from a List

1. To select a different value for a parameter whose expected value is an element of a list, move the mouse pointer onto the current value.
2. Press the left button while the mouse pointer is on the value.
3. A display of all elements in the list appears. Click on a different value in the list to select it.

A.4 Select a Value from the Map

There are several ways to supply data from the Map.

- Click in a coordinate box to let the editor know that you want to change a coordinate. The coordinate box will be outlined in red to show its selection. Click on a position in the Map. The coordinates will automatically be supplied to the display. These coordinates can also be changed by the keyboard.
- Click on a display's map input button. This button will be marked with a label such as **Click Here for Map Input** to indicate its function. Click on an object or location in the Map.
- To change a "distance" value, type in a new value or click in the map and drag to stretch a ruler value.

A.5 Set a Dial

Some parameters, such as the vehicle scale or competence parameters, are set by setting an indicator (a needle) inside a semi-circle dial. One side of the semi-circle is marked with the low range value and the other side is marked with the high range value.

1. There are two ways to adjust the dial setting:
 - Click inside the dial to have the indicator move there.
 - Hold/Left on the indicator inside the dial. While holding, move the mouse to move the indicator. Release the left button when the indicator is at the correct setting.

A.6 Change an Angle Setting

Some parameters, such as the direction parameter, are set by adjusting an angular value. These parameters are associated with a display that shows a circle with an arrow inside it.

1. If you need to, adjust the type of measurement unit (such as degrees or mils) by clicking a new only-one-on unit toggle.
2. There are several ways to adjust the angular value that appears to the right of the circle:
 - Replace the text. Hit the SPACEBAR to erase the current text and then type a new value.
 - Hold/Left on the indicator (arrow) inside the circle. While holding, move the mouse to move the indicator. As the indicator moves, the angular value changes to reflect the current setting. Release the left button when the indicator is at the correct setting.
 - Click inside the circle to have the arrow indicator move there, thereby indicating a new angle value.

A.7 Change a Toggle Setting

1. There are two types of toggle settings:

- Off-on parameter toggles can be preceded by a toggle box (for example, the dashed setting for control measures or the display setting for a terrain feature). Whenever you click on the parameter, you change the setting. If the setting was OFF, it will now be changed to ON and the box will appear pushed in. If the setting was ON, it will now be toggled to OFF and the recessed toggle box will be removed from the display or else it will appear not pushed in.
- Only-one-on toggles are diamond-shaped. They are used when a user needs to pick one value from a group. Click on one diamond-shaped toggle to select it. If the setting was OFF, it will now be changed to ON and the setting of any other diamond-shaped toggles in the group will be set to OFF.

A.8 Adjust a Meter

1. The figure below shows a sample meter.

```

+ ----- +
|  +|+|+|+|  |
|  0:03:00  |
|  -|-|-|-|  |
+ ----- +
(Hr:Min:Sec)

```

2. There are two ways to adjust the time shown in a meter:

- Replace the time text. See Section A.2 [Alter Text], page 95.
- Use the up-arrows or down-arrows above the time (hh:mm:ss) to advance or decrease a value in the meter. To increase the hour value, click on the up-arrow above the hours value. Decrease the hour value in the meter by clicking on the down-arrow below the hours value. Likewise to adjust the minutes or seconds value, use their arrows.

A.9 Scroll Vertically

If the amount of data is too long to fit entirely in its display area, a vertical scroll bar will appear to the right of the display area. Inside the scroll bar is a scroll indicator (a grey box).

1. Hold/Left on the scroll indicator inside the scroll bar.

2. While holding, move the mouse up or down to move the scroll indicator. As the indicator moves, the data scrolls vertically.
3. An arrow appears at each end of the vertical scroll bar. Click on the arrow as an alternate way to scroll.

A.10 Scroll Horizontally

If the amount of data is too wide to fit entirely in its display area, a horizontal scroll bar will appear underneath the display. Inside the scroll bar is a scroll indicator (a grey box).

1. Hold/Left on the scroll indicator inside the scroll bar.
2. While holding, move the mouse left or right to move the scroll indicator. As the indicator moves, the data scrolls horizontally.
3. An arrow appears at each end of the horizontal scroll bar. Click on the arrow as an alternate way to scroll.

Appendix B Task Frames

A user can assign task frame(s) to a unit. A task frame holds a collection of tasks that execute in parallel. The Move, Road March, Follow a Vehicle, Halt, Occupy Position, and the Assault task frame are designed for ground units. The Return to Base, the Sweep, and the CAP task frames are designed for air units. The Mount and Dismount frames are designed for IFV units that are accompanied with DI (those units have "/DI" in their name, for example: M2/DI Platoon, MARDER/DI Platoon, BMP1/DI Platoon, BMP2/DI Platoon, or BTR80/DI Platoon).

The parameters for some of the tasks of these frames can be edited by the user. See Appendix C[Tasks], page 109 for a description of editable tasks.

B.1 Move Frame

The Move frame instructs a ground unit to drive cross country (unit stays in formation even when on a road) to a specified location. If an enemy is encountered, the unit will perform the reactions specified in the Actions-on-Contact task. The default reactions are set at "Contact Drill" which means continue on the route with fire permission ON.

The Move task frame has two editable tasks: the Move task and the Actions-on-Contact task. The following procedure creates a Move task frame.

1. Click **Move** in the frame editor.
2. The Move task needs a destination point or route so the Move task editor will appear in the Editor Area. To create a destination point, just click in the Map to create it. To supply a point or a route that has already been created, just select it from the Map. To create a route: click the **Line** button in the Button Column, place the line, and click **Done** in the line editor. Edit the other task parameters (such as rate-of-march, formation, and catch-up speed) if you want to. Rate-of-march is the desired speed and catch-up speed is the speed limit for a vehicle that has fallen behind and needs to catch up to its unit. A catch-up speed set at zero means that there is no speed limit (except, of course, the vehicle's maximum speed). Click **Done** in the Move task editor.
3. The Move frame editor comes up to let you access the editable Move tasks. Editing is not required since the default settings of the parameters are often adequate.
4. Click **Done** in the Move frame editor.

B.2 Road March Frame

The Road March frame instructs a ground unit to perform a roadmarch move (stay on the road when a road route is assigned) to a specified location. If an enemy is encountered, the unit will perform the reactions specified in the Actions-on-Contact task. The default reactions are set at "Contact Drill" which means continue on the route with fire permission ON.

The Road March task frame has two editable tasks: the Move task and the Actions-on-Contact task. The following procedure creates a Road March task frame.

1. Click **Road March** in the frame editor.
2. The Move task needs a destination point or route so the Move task editor will appear in the Editor Area. To create a destination point, just click in the Map to create it. To supply a point or a route that has already been created, just select it from the Map. To create a route: click the **Line** button in the Button Column, set the "Use Roads" toggle to ON, place the line, and click **Done** in the line editor. Edit the other task parameters (such as speed, formation, and catch-up speed) if you want to. A catch-up speed set at zero means that there is no catch-up speed limit. Click **Done** in the Move task editor.
3. The Road March frame editor comes up to let you view or edit the other Road March tasks. Editing is not required since the default settings of the parameters are often adequate.
4. Click **Done** in the Road March frame editor.

B.3 Follow a Vehicle Frame

The Follow a Vehicle frame instructs a ground unit to follow a specified ground vehicle. Its Move task can be given a vehicle to follow (and offsets), and optionally, a route. If a route is given, the platoon follows that route, but tries to keep station on the vehicle (the followers adjust their speed). If no route is given, then every 10 seconds the unit guesses where the leader will be in 60 seconds and generates a route internally based upon that information.

If the leader doesn't move more than 5 meters between two 10-second samples, the internal route is not changed. That way if the leader turns in place or fidgets a little, the following vehicles can ignore that movement. If the leader does moves more than the threshold 5 meters, new locations are selected.

If an enemy is encountered, the unit will perform the reactions specified in the Actions-on-Contact task. The default reactions are set at "Contact Drill" which means continue on the route with fire permission ON.

The following are some suggestions to keep in mind when using the Follow a Vehicle frame.

- When following a vehicle, if the leader vehicle stops and you want to adjust the subordinates' positions, assign an Occupy Position.
- If the leading vehicle suddenly turns sharply, the followers will all trade places to more quickly get back in formation.
- The routes generated by the vehicles make a guess where the leader will be in the future. If that guess is across a river, the followers can get confused. Getting a platoon to follow a vehicle across a bridge, can require stopping the leader vehicle on the other side of the bridge to wait for the followers. Once the leader stops, the followers should know exactly where to go.
- The following platoon will not understand that they should use the road that their leader is using unless you tell them what the road route is.

The Follow a Vehicle task frame has two editable tasks: the Move task and the Actions-on-Contact task. The following procedure creates a Follow a Vehicle task frame.

1. Click **Follow a Vehicle** in the frame editor.
2. The Move task needs a vehicle to follow so the Move task editor will appear in the Editor Area. To set a leader vehicle, just click on it in the Map. To set the following offsets, set the Follow Angle and Follow Distance parameters. Supplying a route is optional. Edit the other task parameters if you want to. Click Done in the Move task editor.
3. The Follow a Vehicle frame editor comes up to let you access the editable tasks of the frame. Editing is not required since the default settings of the parameters are often adequate.
4. Click Done in the Follow a Vehicle frame editor.

B.4 Halt Frame

The Halt frame, which is used to tell ground vehicles to stop moving, instructs vehicles on a road to drive to alternating sides (herringbone formation) and instructs vehicles that are off a road to stop in formation. If an enemy is encountered, the unit will perform the reactions specified in the Actions-on-Contact task. The default Actions-on-Contact reactions are set at "Contact Drill" which means set fire permission ON.

To execute a herringbone formation, a unit re-orders its subordinates based on their position on the road. This ordering is accomplished by finding the number of peers behind each subordinate. The subordinate with the most number of peers behind it is the leader and the one with the least is the last one. Once this order is determined, the herringbone is done by sending the even numbered

subordinates off the left side of the road and the odd numbered subordinates off the right side. The distance off the road and the stopping look ahead time are parameters in the configuration files.

The Halt task frame has one editable task: the Actions-on-Contact task. The following procedure creates a Halt task frame.

1. Click **Halt** in the frame editor.
2. Currently there are no required inputs for the Halt frame.
3. The Halt frame editor comes up to let you access the Halt editable tasks. Editing is not required since the default settings are usually adequate.
4. Click **Done** in the Halt frame editor.

B.5 Occupy Position Frame

The Occupy Position task frame instructs a ground unit to occupy a named battle position line, to set its sectors of fire between two named target reference points, and to attempt to find a cover position that offers visibility to the named engagement area point. When the unit arrives at the battle position, it will position its vehicles in covered positions along the battle position line. A vehicle's limits for angles of elevation and depression are taken into consideration when selecting a good cover position. A vehicle will not be placed at a location whose underlying terrain prevents the gun from being physically pointed at the enemy. If that location is behind a tree line or building and no cover has been found, the vehicle will position itself in a concealed location behind the tree line or building. The vehicles will also position themselves to maintain visibility to the engagement area TRP. If an enemy is encountered, the unit will perform the reactions specified in the Actions-on-Contact task. The default reactions are set at "Contact Drill" which means set fire permission ON.

The Occupy Position task frame has two editable tasks: the Actions-on-Contact task and the Occupy-Position task. that the Occupy-Position task can be either assigned by the user or can result from a reaction set by the Actions-on-Contact task. The following procedure creates an Occupy Position task frame.

1. Click **Occupy Position** in the frame editor.
2. Since the Occupy-Position task needs user input (a Battle Position line, two TRPs to delineate target sector, and an Engagement Area TRP), the Occupy-Position task editor will appear in the Editor Area. To create the Battle Position line, click on the Line button in the Button Column. Click in the Map to position the Battle Position vertices and then click **Done** in

the line editor. To create the Right TRP, click on the **Right TRP Click Here for Map Input** button and click in the Map. To create the Left TRP, click on the **Left TRP Click Here for Map Input** button and click in the Map. Then click on the **Engagement Area TRP Click Here for Map Input** button and click in the Map. (Note that previously created graphics can be used as well as newly created ones.) Click **Done** in the **Occupy-Position** task editor.

3. The **Occupy Position** frame editor comes up to let you access the editable tasks of the **Occupy Position** frame. Editing is not required since the default settings of the parameters are often adequate.
4. Click **Done** in the **Occupy Position** frame editor.

B.6 Assault Frame

The **Assault** task frame instructs a ground unit to get into line formation and drive in a direction towards the enemy with fire permission **ON**.

The **Assault** task frame has one editable task: the **Assault** task. Note that the **Assault** task can be either assigned by the user or can result from a reaction set by the **Actions-on-Contact** task. The following procedure creates an **Assault** task frame.

1. Click **Assault** in the frame editor.
2. An assault objective is required, so the **Assault** task editor will appear in the **Editor Area**. If the objective is already created, just click on it. Otherwise you need to create it by placing a line, area, point, or text graphic on the map. Edit the other assault task parameters if you want to. Click **Done** on the **Assault** task editor.
3. The **Assault** frame editor comes up to let you access editable tasks. Editing is not required since the default settings are often adequate.
4. Click **Done** in the **Assault** frame editor.

B.7 Return to Base Frame

The **Return to Base** task frame instructs an aircraft to land and resupply at the base location.

The **Return to Base** task frame is made up of one editable task: **Return-to-Base**. The following procedure creates a **Return to Base** task frame.

1. Click **Return to Base** in the frame editor.

2. The Return-to-Base task needs a base location or a route to the base, so the Return-to-Base task editor will appear in the Editor Area. If the base point or the route is already created, just click on it. Otherwise you need to create a base point or route. To create a base point, click in the Map. To create a route: click the Line button in the Button Column, place the route, and click Done on the line editor. Edit the other task parameters if you want to. Click Done on the Return-to-Base task editor.
3. Click Done on the Return to Base frame editor.

B.8 Sweep Frame

The Sweep task frame, which is similar to a scouting mission, instructs an aircraft to fly along a pre-planned route and then orbit at the end of the route. It is capable of following the waypoints of a line, or of going directly to a point or text. While performing the Sweep task frame, a vehicle will automatically perform an air-to-air intercept if a target is found that satisfies the requirements of the Commit-Criteria task.

The Sweep task frame is made up of three editable tasks: Follow-Route, Bingo-Fuel, and Commit-Criteria. The following procedure creates a Sweep task frame.

1. Click Sweep in the frame editor.
2. The Follow-Route task needs an air route so the Follow-Route task editor will appear in the Editor Area. If you have already created the route, just click on it. Otherwise you need to create one. To do so, click the Line button in the Button Column, place the route, and click Done on the line editor. Edit the other task parameters if you want to. Click Done on the Follow-Route task editor.
3. The Bingo-Fuel task needs a refuel location. If the point has already been created, just click on it to supply the task frame with its location. Otherwise you need to create one. To do so, click the Point button in the Button Column, place the refuel point, and click Done on the point editor. Edit the other task parameters if you want to. Click Done on the Bingo-Fuel task editor.
4. The Commit-Criteria task is set with defaults. To access them: click Commit-Criteria, edit defaults if you wish, and then click Done on the Commit-Criteria task editor.
5. Click Done on the Sweep frame editor.

B.9 CAP Frame

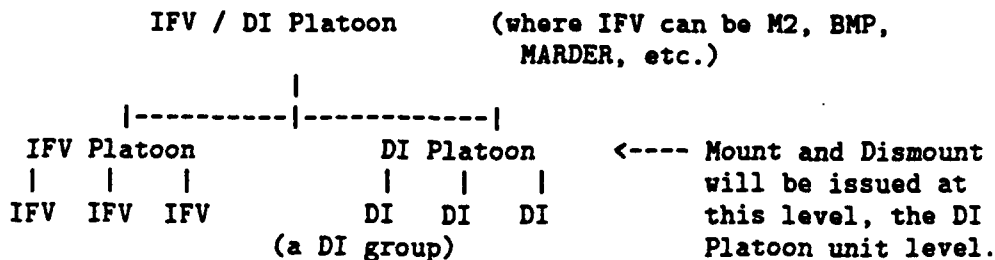
The Combat Air Patrol (CAP) task frame, which is used when an aircraft needs to monitor an area, instructs an aircraft to fly in a racetrack pattern around a CAP point. While performing the combat air patrol (CAP) task frame, a vehicle will automatically perform an air-to-air intercept if a target is found that satisfies the requirements of the Commit-Criteria task.

The Combat Air Patrol (CAP) task frame is made up of three editable tasks: CAP, Fuel, and Commit-Criteria. The following procedure creates a CAP task frame.

1. Click CAP in the frame editor.
2. The CAP task needs a patrol location, so the CAP task editor will appear in the Editor Area. If the patrol point is already created (a point or text control measure is acceptable), just click on it. Otherwise you need to create it. To create a CAP point, click in the Map. Edit the other task parameters if you want to. Click Done on the CAP task editor.
3. The Bingo-Fuel task needs a refuel location, so the Bingo-Fuel task editor will appear in the Editor Area. If the refuel point is one already created (a point or text control measure is acceptable), just click on it. Otherwise you need to create it. To do so, click the Point button in the Button Column, place the refuel point, and click Done on the point editor. Edit the other task parameters if you want to. Click Done on the Bingo-Fuel task editor.
4. The Commit-Criteria task is set with defaults. To access them: click Commit-Criteria, edit defaults if you wish, and then click Done on the Commit-Criteria task editor.
5. Click Done on the CAP frame editor.

B.10 Mount Frame

A unit has associated Dimounted Infantry (DI) when its name includes "/DI". When such a unit is created, its associated DI appear in the dismounted state. The DI/IFV hierarchy which appears in the Organizational Display of the unit's Operations Editor looks like this:



The DI maintain a 1-1 association with an Infantry Fighting Vehicle (IFV) in its unit. This allows the DI to be "smart", in a sense that they will know whether or not they are mounted, and to what vehicle, if so.

The Mount task frame should be assigned at the DI superior unit level as shown in the figure above. When the DI Platoon unit is assigned a Mount frame, the following behavior will occur:

1. A Move task frame is generated so that the IFV that is associated with each DI group drives to the position of those DI. If the vehicle is doing something else at the time, that frame will be suspended until the vehicle gets where he is going.
2. When all the IFV arrive, each DI group mounts its vehicle and disappears from the Map.
3. If the DI cannot mount (due to an IFV being killed or having a mobility failure), a radio message appears from that DI group saying that he has no IFV to mount.

The Mount task frame is made up of one editable task: Actions-on-Contact. The default reactions are set at "Contact Drill" which means react by having fire permission ON.

The following procedure creates a Mount task frame.

1. Click Mount in the frame editor.
2. The Actions-on-Contact task is set with defaults. To access them: click Actions-on-Contact, edit defaults if you wish, and then click Done on the task editor.
3. Click Done on the Mount frame editor.

B.11 Dismount Frame

The Dismount task frame should be assigned at the DI superior unit level. This frame instructs an IFV unit to halt and then dismount a group of DI subordinates. If the unit is moving cross country, the vehicles will halt in formation. If this unit is on a road, the vehicles will halt off the road in a herringbone formation.

When the DI Platoon unit is assigned a Dismount frame, the following behavior will occur:

1. A Halt task frame is generated so that the IFV associated with the DI Platoon stop moving. If the vehicle is doing something else at the time, that frame will be suspended until the vehicle stops moving.

2. When the IFVs halt, the DI group associated with each IFV dismount and appear on the Map.

The Dismount task frame is made up of one editable task: Actions-on-Contact. The default reactions are set at "Contact Drill" which means react by having fire permission ON.

The following procedure creates a Dismount task frame.

1. Click Dismount in the frame editor.
2. The Actions-on-Contact task is set with defaults. To access them: click Actions-on-Contact, edit defaults if you wish, and then click Done on the task editor.
3. Click Done on the Dismount frame editor.

Appendix C Tasks

This chapter describes the editable tasks that are executed by a unit when the user assigns a task frame and when a reaction occurs as a result of a battlefield situation.

Tasks contain operating parameters used to control behavior. For example, movement behavior is dictated by the parameters of the Move task which holds values for such parameters as destination, speed, and formation. Shooting behavior is dictated by user editable parameters such as range and fire permission. Reactive behavior is dictated by the execution of a test of a battlefield condition. The Actions-on-Contact task tests for the observance of enemy vehicles. When they are detected, a reaction can execute to handle the situation. (for example, the unit can be given permission to fire).

C.1 Move Task

The user must supply either a route or a destination point to the Overwatch-Move task. The route is a line graphic and the destination point is either a point or text graphic. For a route, the unit will head for the closest segment of the route that they have not passed.

The unit's movements goals will be determined by the setting of the travel type parameter. The travel type can be either:

- Cross Country - The goal is generally to reach given waypoint(s) and stay in formation.
- Roadmarch - The goal can also be expressed as a desire to reach a series of waypoints. However, road following has the added constraint of remaining on the road in the correct order. The selection of a speed is a function of both the need to keep on the road at corners and the need to maintain separation.

The physical capabilities of a vehicle (maximum turn rates, maximum acceleration and deceleration rates, maximum speed, minimum turn radius) are considered for both travel types. To improve a unit's ability to stay in formation when traveling a cross country route, create the route so that its vertices are no further apart than 500-1000m and try to avoid having sharply acute angles (less than 30 degrees). Having a unit go to a point graphic that is too far away (for example 10km), will impair the unit's ability to stay in formation.

In addition to setting a destination and a travel type, the user can set the following Move task parameters:

- Conform to terrain - When this toggle is ON, the unit will attempt to use valleys as a tactical terrain feature.
- Formation - The user will be allowed to select a formation from an offered list.
- Spacing - The user can choose either Closed (50 meter) or Open (100 meter) spacing. This spacing refers to road following only.
- Following Angle - The user can set the angle that a following unit attempts to maintain relative to a leading vehicle during a Follow a Vehicle frame.
- Following Distance - The user can set the distance that a following unit attempts to maintain relative to a leading vehicle during a Follow a Vehicle frame.
- Rate of March - The user can set the desired speed.
- Catch-up Speed - The user is allowed to specify a catch-up speed limit. A value of zero means that there is no limit.

C.2 Occupy-Position Task

When this task results from assignment rather than reaction, the user must supply a Battle Position line, a Right TRP, a Left TRP, and an Engagement Area TRP to the Occupy-Position Task. If an invalid Battle Position (one without at least two distinct end points) is entered, a radio message will display to inform the user and Occupy Position will end.

C.3 Assault Task

The Assault task can be executed as a result of user assignment or as a result of an Actions-on-Contract reaction. When this task results from the user assignment of the Assault task frame, the user must supply an objective. This objective can be a line, area, point, or text. When the reaction selected via the Actions-on-Contact task is an Assault, then the vehicles will use the location of the enemy as the objective and will stop the assault and resume what they were previously doing if 50% or more of the unit is destroyed.

The user can set the following Assault task parameters:

- Route - The user can supply an optional route to the objective.
- Speed - The user can set the rate of movement to the objective.
- Stop Assault Percent - The user can set a percentage of unit strength below which the unit stops attacking. The number of vehicles representing 100 percent unit strength is the number in the unit when the attack starts.

- **Engagement Range** - The user is allowed to specify a distance to the enemy beyond which firing is not allowed.
- **Fire Type** - The user is allowed to specify "Distributed", to have the vehicles in the unit attempt to target an enemy vehicle that is not already targeted. Currently, the other options, "Volley Fire" and "None", are the same and they mean shooting without the need to distribute targets.

C.4 Actions-on-Contact Task

The Actions-on-Contact task monitors enemy activity by having each vehicle in the unit constantly check to see if the unit is under fire or if enemy vehicles are spotted. The task has reactions specified for four contact situations: Under Fire, Low Threat; Under Fire, High Threat; Not Under Fire, Low Threat; and Not Under Fire, High Threat. Currently both the Under Fire Threshold and the Not Under Fire Threshold have a default setting of three vehicles. This means that the unit executing the task will consider detection of or being under fire from three or more enemy vehicles as high threat. Less than three vehicles will be considered low threat. The user can alter these thresholds.

If any of the above situations are met, the unit reacts to the enemy contact by executing the specified reaction. The Actions-on-Contact reactions are named: Occupy Position, Assault, Contact Drill, and No Action. The Occupy Position reaction causes vehicles to execute the Occupy-Position task. The parameters (a Battle-Position line, two TRPS to delineate target sector, and an Engagement Area TRP) needed for the Occupy-Position task are generated automatically by using the enemy location as a reference point. The vehicles in the unit have their fire permission turned on and they position themselves in a defensive (covered, if possible) position along the generated Battle Position line. The Assault reaction causes vehicles to get into line formation and drive in a direction towards the enemy with fire permission on. The Contact Drill reaction instructs vehicles to continue following the current mission, but allows them to shoot at enemies while doing so. The No Action reaction instructs vehicles to continue following the current mission without allowing them to shoot at enemies.

The Actions-on-Contact task doesn't end until the task frame that it resides in is destroyed, but it does go back to the monitoring state when action is no longer required (meaning there are no more enemies in sight). The Actions-on-Contact task is considered the sponsor for the reactive task frame it generates. This means that this Actions-on-Contact task remains active even if the original frame it was a part of is suspended. This happens so that the reaction can be easily monitored and stopped when necessary. Also, if the situation has changed enough (such as more enemy appearing) to cause a different type of reaction, the Actions-on-Contact task will stop the current reaction and

start the appropriate reactive task frame.

The Actions-On-Contact task will stop the reactive task frame if the number of enemy vehicles has changed to be out of the range (one more than or two less than the threshold value) that caused that specific reactive taskframe to execute. As an example, consider an Actions-on-Contact task set with a threshold of three vehicles, low threat reactions set for Contact Drill, and high threat reactions set for Occupy Positions.

Suppose that when the enemy is first detected only two vehicles are seen. A Contact Drill reaction will be executed. The unit will continue to execute a Contact Drill until the number of enemy vehicles has reached 4 (3 threshold vehicles to start the reaction + 1). At that time, the Contact Drill will be stopped and the Actions-on-Contact task will go back to monitoring for enemy and will then immediately sponsor the execution of an Occupy Position reaction.

The unit will continue to execute the Occupy Position until the number of enemy vehicles is less than 2 vehicles (3 threshold vehicles - 2). It will then stop the Occupy Position reaction. When the Actions-on-Contact task goes back to monitoring for enemy it will immediately sponsor the execution of a Contact Drill.

As seen from the example above, hysteresis is built in to prevent the constant toggling between Occupy Position and Contact Drill when the number of enemy vehicles hovers around the threshold (3 vehicles). Also, if both reactive task frames were specified to be an Occupy Position, the Actions-on-Contact task would continue to sponsor the same reactive task frame when crossing the threshold. This is done to eliminate unnecessary starting and stopping of reactions.

The reactive task frame that gets executed from the Actions-on-Contact task can be overridden by selecting *STOP REACTION* during a reaction. This will stop the reaction and continue the mission. Also, the Actions-on-Contact task will not respond to enemy activity until a new situation (more or less vehicles causing a transition to a different range) occurs.

In addition to setting thresholds, reactions, and engagement range, the user can set the following Assault task parameters:

- Firing Technique - The user is allowed to specify "Alternating", to have the vehicles in the unit shoot with the constraint of waiting until after a coordinating partner shoots. The wait time is a configuration parameter. The user is allowed to specify "Simultaneous", to have the vehicles shoot without a coordinating partner.
- Fire Type - The user is allowed to specify "Distributed", to have the vehicles in the unit attempt to target an enemy vehicle that is not already targeted. Currently, the other options.

"Volley Fire" and "None", are the same and they mean shooting without the need to distribute targets.

C.5 Targeting Task

The Targeting task, set with fire permission ON (Fire at Will), is executed when a unit is assigned an Assault task frame and when an Actions-on-Contact task generates an Assault or Contact Drill reaction.

In addition to setting engagement range and an optional position to fire at, the user can set the following task parameters:

- Fire Permission - The user can specify one of these values: "Fire at Will" to turn permission ON, "Hold Fire" to turn fire permission OFF, or "Weapons Tight" to turn fire permission ON once the unit has been fired upon.
- Assessment Mode - The user can choose either "Closest To Self" to shoot at the closest target or "Closest To Location" to shoot at the target closest to the location specified by the coordinates in the Fire At Position selection area. To change those coordinates, click in a coordinate box to set the focus and then click in the Map to set new coordinates.
- Firing Technique - The user is allowed to specify "Alternating", to have the vehicles in the unit shoot with the constraint of waiting until after a coordinating partner shoots. The wait time is a configuration parameter. The user is allowed to specify "Simultaneous", to have the vehicles shoot without a coordinating partner.
- Fire Type - The user is allowed to specify "Distributed", to have the vehicles in the unit attempt to target an enemy vehicle that is not already targeted. Currently, the other options, "Volley Fire" and "None", are the same and they mean shooting without the need to distribute targets.

C.6 Return-to-Base Task

The user must supply a base location to the Return-to-Base task. The speed and altitude can be either the task's defaults or the values that are set by the user.

C.7 Follow-Route Task

The user must supply a route to the Follow-Route task. The aircraft heads for the closest segment of the route that they have not passed. The speed, altitude, movement type, and radar parameters can be either the task's defaults or the values that are set by the user.

The movement type values are:

- Low Level - follow at a constant altitude, only increasing altitude to go over an obstacle.
- Contour - follow the contour of the earth.
- Nap of Earth (NOE) - maintain constant altitude agl, veering around obstacles.

C.8 Commit-Criteria Task

While performing the CAP or Sweep task frame, a vehicle will automatically perform an air-to-air intercept if a target is found that satisfies the requirements of the Commit-Criteria task.

The vehicle-level air-to-air intercept task controls the movement of a vehicle during an air-to-air intercept. In its current implementation, it guides the aircraft on a pure-pursuit course of the enemy.

C.9 Bingo-Fuel Task

The Bingo-Fuel task holds parameters that identify a speed, altitude, and refuel point. When an aircraft satisfies the test for bingo fuel, it leaves its route and flies to its refuel point where it lands to get refueled and rearmed.

C.10 CAP Task

The user must supply a location for the CAP point. Default values for the other movement parameters (the racetrack distance, an inbound leg speed, an outbound leg speed, an altitude, and an orientation) can be used or else the user can supply values. The system automatically generates the four segments of the racetrack orbit: an inbound leg, an outbound turn, an outbound leg, and an inbound turn. The orientation parameter specifies the direction of the inbound leg. The

air vehicle will make a 180 degree counter-clockwise turn when transitioning between the inbound and outbound legs. The vector representing the outbound leg of the CAP will be in the opposite direction of the inbound leg.

Appendix D Recovery Operations

This chapter describes error messages and provides ways to recover from irregular situations. Error messages print on the console from which the program was started and generate a pop-up window on the user interface display. Some errors also display in the SAFstation Radio Log.

D.1 Error Messages

D.1.1 Invalid Filename

A file name is valid when it contains only alphanumeric characters, underscores or hyphens. If you attempt to save a file with an invalid name, a Save File pop-up display with an OK button and the following message will appear:

```
File name contains illegal characters.  
Please use alphanumeric characters only.
```

To correct the situation, click the OK button. The pop-up display that requests a name for the disk file will reappear. Click on a name from the list offered to create a newer version of an existing file or else erase the invalid name and type in a valid one.

D.1.2 File Not Found

If you attempt to load a file that has not been saved, a File Manager pop-up display with an OK button and the following message will appear:

```
Please select/enter a valid file name.  
Please use alphanumeric characters only.
```

To correct the situation, click the OK button. The pop-up display that requests a name for the disk file will reappear. Click on a name from the list offered to load an existing file or else erase the invalid name and type in a valid one.

D.1.3 Duplicate Overlay

If you attempt to load a scenario file that contains an overlay whose name is the same as an overlay that is currently in memory, a System Error pop-up display with an OK button and the following message will appear:

```
Error loading scenario <scenario pathname>:  
Overlay in file conflicts with existing overlay
```

To correct the situation, click the OK button. Use the overlay editor to change the name of the existing overlay. See Section 10.4 [Edit an Overlay], page 59. Another way to correct the situation is to click **New Scenario** to delete all objects (including overlays) running on the same PO database number as this SAFstation.

D.1.4 Illegal Password

If you enter a password that the system does not recognize, a System Error pop-up display with the following message will appear:

```
Password not matched
```

To correct the situation, retype the password and click the OK button. Use the Cancel button to avoid entering a password.

D.1.5 Stealth Not Found

If you bring up the Stealth Control Editor and ModSAF doesn't have the information it needs to access a stealth, a System Error pop-up display with the following message will appear:

```
Unable to find preferred stealth
```

If you don't need to use a stealth, use the Cancel button. Otherwise, there are several ways to correct the situation:

1. Bring up a stealth on the network if necessary.
2. Click on the stealth's large arrow icon on the Map.

3. If there are several stealth's on the network, there can be several stealth arrows on the Map. Each one will be a different color. Use the Info button to obtain a stealth's site/host ID and determine which arrow you should click on.

D.1.6 Situation Change

If a unit changes what it is doing (such as when a reaction occurs), while you are in the process of making changes to the unit's parameters (via the Override mission parameters button) a pop-up display and radio message with the following message will appear:

Unit changed what it was doing, overrides might not apply
To make the change, exit the override editor and start over

This message informs you that the change might not currently apply since the situation change has actuated a new set of tasks. To guarantee the change, redo it. otherwise, if the change was insignificant just ignore the message.

D.2 Recovering from a SAFstation Crash

A cue that the SAFstation has crashed is that the normal SAFstation screen disappears or that buttons or map objects are no longer mouse sensitive. If necessary, have a technician close the SAFstation window and then restart the SAFstation. Simulated vehicles will reappear on the SAFstation screen.

D.3 Recovering from a SAFsim Crash

A cue that the SAFsim has crashed is that simulated objects disappear from the SAFstation screen.

If a SAFstation is working with more than one SAFsim (they all use the same PO database), then entities simulated on the crashed SAFsim will be automatically simulated on the other SAFsim. It will take at least thirty seconds for vehicles simulated on the crashed SAFsim to be taken over by the working SAFsim.

If a SAFstation is working with only one SAFsim then it is a good idea to save the scenario on the SAFstation so that the exercise could be restarted.

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