OSI

CYBERTANK ENGINEER'S HANDBOOK

CLASSIFIED

OMEGA

Neural Cybertank Design and Simulation

The Making of OMEGA...

By the time a computer game appears on retail shelves, it shares only a few of the characteristics originally visualized by the author. OMEGA is a case in point.

OMEGA has evolved from an idea that first came to Stuart Marks in 1984. It was an idea for a game that would allow players to engineer the mobile tactics of a piece of military robotic hardware - a boat, plane or ground vehicle - and compete in simulated battle against others. "I was so fascinated by the idea," Stuart said, "that I continued refining the design and by late 1986 was calling it "Tank Battle."

By early 1987, the initial design specs included many of the features which appear in OMEGA today. Stuart had expanded the scope of the project to include battlefield, chassis and artificial intelligence design modules. But it wasn't until the Summer of 1987, after ORIGIN had agreed to publish the game, that cybernetics entered the picture.

"I can't recall the specific incident," Stuart said, "but I remember bouncing ideas back and forth with Dallas Snell, ORIGIN's Executive Producer, when the term was mentioned. We both liked the futuristic feel of "cybernetics", and "cybertank" seemed a natural fit with the direction the game was taking."

The dramatic evolution continued. "The idea of making the player an employee of the Organization for Strategic Intelligence, grew from a conversation with friends during a round of beers at a local tavern," Stuart said. "Later, Richard Garriott, the author of the Ultima series, contributed a workable method of including manual control of the cybertanks, and Paul Neurath, the author of Space Rogue, came up with the idea for team play."

The most difficult corners to turn in the development of OMEGA focused on organizing the documentation, and implementing an easy-to-use design system for novices. The manuals and tutorials were the objects of intense quality testing at ORIGIN. An Artificial Intelligence Construction Panel and pre-defined Capsule Routines provided an effective way of allowing non-technical players to enjoy this simulation.

Stuart Marks and the team of graphic artists, programmers, sound engineers and producers at ORIGIN, have not only turned the corners - they've been able to straighten quite a few. The result is a truly unique gaming experience -

The OMEGA Experience!

Table of Contents

PART 1
TRAINING GUIDE

SECTION 1 - GENERAL INFORMATION

SECTION 2 - DESIGNING A CYBERTANK

SECTION 3 - BATTLE SIMULATION

SECTION 4 - BACK TO THE DRAWING BOARD

PART 2
MODULE REFERENCE

SECTION 1 - EXTERNAL CONTROL MODULE

SECTION 2 - DESIGNING A CYBERTANK

SECTION 9 - SYSTEM OPERATIONS

PART 3
CYBERTANK COMMAND LANGUAGE

SECTION 1 - CYBERTANK COMMAND LANGUAGE

SECTION 2 - MOVING THE CYBERTANK

SECTION 3 - USING THE SCANNER

PART 4
CAPSULE REFERENCE

PART 5
COMBAT OBJECTIVES AND TACTICS

PART 6
TROUBLESHOOTING

PART 1
TRAINING GUIDE

SYNOPSIS

This section is designed for the new employee. All new employees must read the Training Guide to develop an understanding of design and implementation. The Training Guide covers many important topics, including the Employee Identification Disc, designing a cybertank, testing a cybertank, and the Clearance Evaluation procedure.

SECTION 1
GENERAL INFORMATION

SECTION BRIEF

This section describes how to use the Training Guide, explains how to get started, and provides important background information.

1.1 EMPLOYEE IDENTIFICATION DISC

If you have not yet obtained an Employee Identification Disc (ID Disc), do so now. The procedure for creating an ID Disc is detailed in the Orientation Guide. *The remainder of this Training Guide assumes that you have read the Orientation Guide and followed its instructions.*

1.2 GETTING STARTED

The Training Guide is organized so that you can read it while operating your OSI/CACD terminal. For maximum training benefit, it is recommended that you work through this Training Guide while operating an OSI/CACD terminal. Follow the instructions in this guide carefully to ensure that your terminal session stays in sequence. To begin, make sure that the OSI Security Gate is showing. If not, select **CALL IT A DAY** from the EMPLOYEE menu, and restart OMEGA. Restarting OMEGA guarantees that your terminal is in sequence with this Training Guide.

After arriving at the OSI Security Gate, select the VERIFY button and follow the directions on the screen to gain access to OSI. After your password and retina pattern have been verified, you are transferred to the External Control Module (ECM).

1.3 SPECIAL KEYS

Throughout the Training Guide you will find these names used to identify special keys:

RETURN
DELETE
TAB
MARK
CURSOR-LEFT
CURSOR-RIGHT
CURSOR-UP
CURSOR-DOWN

These names are always typed in UPPER CASE, as they appear above. Some terminals do not have all of these keys. Consult the OSI/CACD System 2 Reference Card to determine which keys are available for your terminal type.

SECTION 2
DESIGNING A CYBERTANK

SECTION BRIEF

Designing a cybertank consists of two steps: designing the chassis and designing the Artificial Intelligence (AI). The term **chassis** refers to the cybertank's mechanical components. AI refers to commands which control the cybertank's actions via an on-board computer. This section details both aspects of cybertank design.

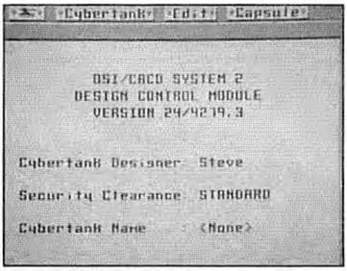
2.1 CHASSIS DESIGN AND AI DESIGN

Designing a cybertank chassis requires the selection of mechanical components from various equipment categories. These choices define the specifications for your cybertank.

Designing cybertank AI involves creating a sequence of commands for the cybertank's on-board computer. AI can be created rapidly using semicustom or full custom design techniques. Full custom design fully exploits the capabilities of the on-board computer.

2.2 BEGINNING THE CYBERTANK DESIGN PROCESS

To begin, select **DESIGN CYBERTANK** from the **DESIGN** menu. The OSI/CACD transfers you to the Design Control Module (DCM). Your name, your clearance level, and the name of your cybertank (currently <NONE>) are displayed on the screen (see Diagram 2.2).



OSI/CACD SYSTEM 2
DESIGN CONTROL MODULE
VERSION 24/4219.3

Cybertank Designer Steve

Security Clearance STANDARD

Cybertank Name   : <None>

Diagram 2.2 -- Design Control Module (DCM)

2.2.1 The Design Control Module

The DCM is the heart of OSI/CACD System 2. As a Cybertank Engineer, you must become very familiar with this module. The DCM includes the chassis and AI design facilities.

2.2.2 Creating a New Cybertank

To create a new cybertank, select **NEW** from the **CYBERTANK** menu. This allows you to name your new cybertank, and initiate its design. Every cybertank is given a code name of the designer's choosing. To maintain consistency with the Training Guide, name your initial cybertank design "ALPHA."

Your cybertank's name is entered using the File Storage Panel (FSP) now displayed on your screen (see Diagram 2.2.2). Type in "ALPHA", and click on the Save button (for keyboard control of the FSP, please refer to the OSI/CACD System 2 Reference Card). A place on your ID Disc is now reserved for a new cybertank design named "ALPHA."

Note: the FSP is described in detail in Part 2, Section 9.1

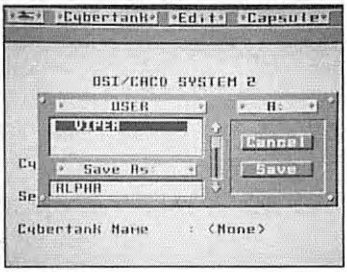


Diagram 2.2.2 -- File Storage Panel (FSP)

2.3 DESIGNING THE CYBERTANK'S CHASSIS

After reserving a place for ALPHA, the OSI/CACD transfers you to the Chassis Design Module (CDM). Here, you will design the chassis of your cybertank.

2.3.1 The Chassis Design Module Display Panel

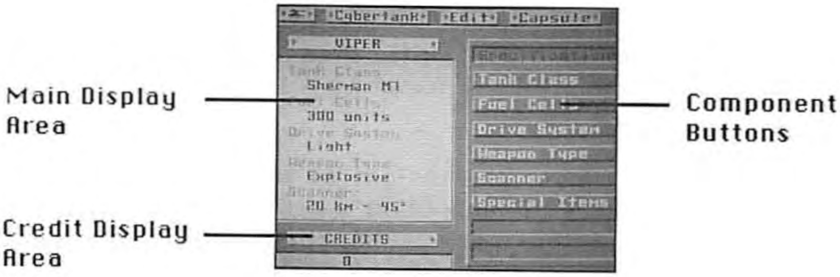
The CDM display panel is divided into three parts (see Diagram 2.3.1): the main display area, the component buttons, and the credits display area.

The main display area, located below the cybertank name plaque, displays information selected by using the component buttons at the right. Currently, ALPHA's **Specifications** are displayed.

To get a feel for using the CDM panel, try selecting each of the component buttons. Note each button's effect as it appears on the main display area.

The Specifications button shows a summary of equipment selected for the cybertank. The other component buttons display lists of equipment for each specific component.

Each piece of equipment has an associated cost. As an engineer with STANDARD Clearance, you are alloted an initial budget of 1,000 credits. The credits display area shows the remaining balance as you choose equipment.



Tank Class
Sherman M1
Fuel Cells
300 units
Drive System
Light
Weapon Type
Explosive
Scanner
20 Km - 45°

CREDITS
0

Diagram 2.3.1 -- Chassis Design Module (CDM)

2.3.2 Selecting Equipment

To see how equipment is chosen, select the Drive System button. The various drive systems appear in the main display area. Now, select Light as if it were a button. The small, circular button directly to the left of Light becomes highlighted and the credits area is updated accordingly.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> Instead of a small, circular indicator, a diamond appears indicating that Light has been selected. The credits display area is updated accordingly.

Now select Heavy. Notice that selecting Heavy "deselects" Light. This occurs because your cybertank can have only one drive system. Try choosing other drive systems.

The five primary equipment components are **Tank Class, Fuel Cells, Drive System, Weapon Type,** and **Scanner.** To authorize a cybertank, the cybertank must include one (and only one) choice for each component. In **Special Items,** you may include as many items as your budget allows (or none). Special items are optional.

2.3.3 Choosing ALPHA's Equipment

You are now ready to choose ALPHA's equipment. Display the various equipment by selecting the appropriate component (specified below in bold print). Then choose the item, specified in outline print, by selecting it in the main display area as if it were a button.

Tank Class determines the weight of the cybertank, the thickness of its armor, and other attributes (see Part 2, Section 2.3.3 for details). For ALPHA, choose the Sherman M7 Tank Class.

Fuel Cells provide energy for the drive system, weapon system, and scanner system. If a cybertank runs out of fuel, its mechanical functions cease operation. For ALPHA, choose 300 units of fuel.

The **Drive System** is the power plant of the cybertank. The cost (in credits) of a drive system indicates the amount of energy it can produce. For more information regarding drive systems, see Part 2, Section 2.3.5. For ALPHA, choose the Light Drive System.

Weapon Type determines the weapon type to be installed on the cybertank. For a discussion of Weapon Types, see Part 2, Section 2.3.6. For ALPHA, choose Explosive.

The **Scanner** is the eyes and ears of the cybertank. It detects enemy cybertanks and other objects in a wedgeshaped area emanating from the cybertank (see Diagram 2.3.3). The length of the wedge is called the *range* of the scanner and is measured in hectometers (**hm**). The width of the wedge is called the *sweep angle* and is measured in degrees (°). For ALPHA, choose the 20 hm - 45° scanner.

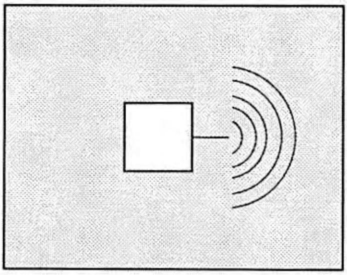
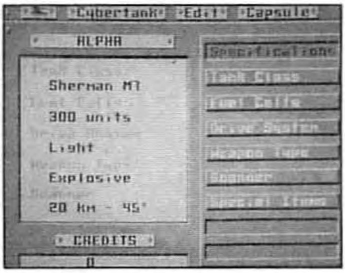


Diagram 2.3.3 -- Shape of the scanner

Special Items provide advanced battle capabilities. They will be discussed later when you have a large enough budget to use them.

2.3.4 Viewing ALPHA's Specifications

Select the Specifications button to view ALPHA's specifications. The main display area should look like Diagram 2.3.4. Notice that the items you have chosen exhaust your budget of 1,000 credits.



Tank Class
Sherman M7
Fuel Cells
300 units
Drive System
Light
Weapon Type
Explosive
Scanner
20 Km - 45°

CREDITS
0

Diagram 2.3.4 -- ALPHA specifications in the CDM

2.4 DESIGNING THE CYBERTANK'S AI

With the chassis complete , you can now design the cybertank's AI. Select **AI** from the **CYBERTANK** menu. The OSI/CACD transfers you to the **Artificial Intelligence Module (AI Module)**. Your screen should now look like Diagram 2.4.

*Note: The CDM and AI Module are both parts of the Design Control Module (DCM). You can transfer back and forth between the two by selecting **CHASSIS** or **AI** from the **CYBERTANK** menu.*

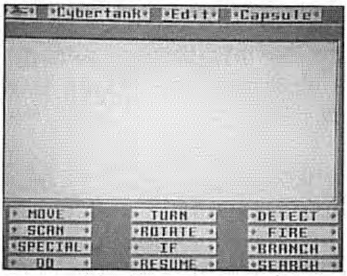


Diagram 2.4 – AI Module

The main viewing area of the screen is called the **edit window**. The Scroll-Bar directly to the right of the edit window is used to scroll through the lines of AI.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> Your terminal is equipped with **Multi-speed Scroll Arrows** located at the right edge of the edit window. These **Scroll Arrows** allow you to scroll through the lines of AI at varying rates of speed.

Below the edit window is the **CCL Construction Panel** (CP). The CP is comprised of various plaques.

2.4.1 Cybertank Command Language (CCL)

Cybertank AI is comprised of commands written in the Cybertank Command Language (CCL), a special language developed by OSI Engineers. CCL is easily understood because it resembles the English language.

2.4.2 Semicustom versus Full Custom Design

There are two basic methods available for designing AI, **Semicustom Design** and **Full Custom Design**.

When using **semicustom design**, the designer forms the AI by piecing together predefined sequences of commands, called AI Library Capsules. In **full custom design**, the designer enters each CCL command individually.

You will be using semicustom design for your first cybertank (ALPHA). Full custom design is discussed later in this Training Guide.

2.4.3 The AI Module

The AI Module is used to enter and change AI commands. Commands can be entered by typing, or by selecting the CCL Construction Panel (CP) plaques below the edit window.

Notice the thin vertical bar in the upper left-hand corner of the edit window. It is called the **Insertion Cursor (IC).** It indicates where text will be inserted when you start typing.

2.4.4 Entering ALPHA's AI

Type in the following lines, ending each with a RETURN:

```
Start
   Do Seek
   Do Destroy
   Branch to Start
```

Note: AI commands can be in UPPER CASE (CAPITAL) letters, lower case letters, or both.

Note: The AI Module has a built-in feature which automatically indents the next line when you press RETURN. DELETE returns the cursor to the left margin.

2.4.5 Examining ALPHA's AI

The four lines entered for ALPHA's AI embody the logic of a simple but effective AI. When ALPHA is battle activated, its on-board computer processes the AI, beginning with **Start.**

The first line, **Start**, is called a **Label.** A Label simply names a segment of AI. *Labels always appear on a line by* *themselves, and always begin in the leftmost column of the edit window.*

The second line, **Do Seek**, instructs the on-board computer to perform a routine called Seek.

Similarly, the third line, **Do Destroy,** instructs the on-board computer to perform a routine called Destroy.

The last line, **Branch to Start**, instructs the on-board computer to branch back to the label **Start** before processing additional commands.

These four lines make up a common structure called a "loop." The on-board computer will "loop back" to Start after it performs Destroy, such that the on-board computer alternately performs the Seek and Destroy routines .

2.4.6 Routines

A routine is a sequence of CCL commands which instruct the cybertank to perform a particular task.

ALPHA's AI incorporates two routines: Seek and Destroy. Seek causes the cybertank to seek out an enemy. Destroy causes the cybertank to fire at the enemy until it either runs away or is destroyed.

The routines Seek and Destroy are not yet defined in your AI. Fortunately, they are both available as Library Capsules. To use these Library Capsules, press RETURN and type the following two lines:

```
Include Seek
Include Destroy
```

Note: Press RETURN at the end of each line.

2.4.7 Library Capsules

Library Capsules are prewritten segments of AI. A Library Capsule can contain one or more routines composed of CCL commands and are often named after the first routine they contain. This is the case with both Seek and Destroy.

The line **Include Seek** represents the contents of the Library Capsule named Seek. You could replace **Include Seek** with the CCL commands from the Library Capsule "Seek" without changing the meaning of the AI.

Later in this Training Guide you are shown how to view, edit, and create Library Capsules. Part 4, "Capsule Reference," describes the Capsules available in the OSI Library.

2.4.8 Saving the Cybertank Design

Your cybertank design is now ready to be saved onto your ID Disc. Before proceeding, make sure that your AI is identical to the following (no distinction is made between upper and lower case letters):

```
Start
   Do Seek
   Do Destroy
   Branch to Start

   Include Seek
   Include Destroy
```

To save your cybertank design, select **SAVE** from the **CYBERTANK** menu. ALPHA's chassis and AI designs are now stored on your ID Disc.

2.5 AUTHORIZING A CYBERTANK

Your cybertank design must be **authorized** before it can be submitted to the Combat Simulation Module (CSM). Your design will be checked by the **Cybertank Authorization Module (CAM)** for any flaws; such as missing chassis components and incorrect CCL commands, as well as missing Library Capsules.

2.5.1 Activating the Cybertank Authorization Module

By selecting **AUTHORIZE** from the **CYBERTANK** menu, the OSI/CACD transfers you to the CAM and automatically begins the authorization process. If there are no problems with your design, the CAM will display the message "AUTHORIZATION COMPLETE."

At this point, select **AUTHORIZE** from the **CYBERTANK** menu to Authorize ALPHA.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> The Capsule Routines are found on the **RESOURCE** disc.

2.5.2 Successful Authorization

After the CAM has successfully authorized your cybertank, the ECM and Design buttons appear at the bottom of your screen. The ECM button transfers you to the External Command Module (ECM). The Design button transfers you to the Design Control Module (DCM). For now, select the ECM button. When the OSI/CACD System 2 asks if you want to save the changes made to ALPHA, select "YES".

2.5.3 Unsuccessful Authorization

If the CAM identifies a problem with your design, a message is displayed explaining the problem. If the problem is in your chassis design, press any key. You will be transferred to the Chassis Design Module (CDM) where you can fix the cybertank's chassis.

If the problem is in your AI design, the buttons Continue and Cancel appear at the bottom of the screen. Select the Cancel button to return to the AI Module, or select the Continue button to allow the CAM to continue searching for problems. When the CAM is finished, the OSI/CACD transfers you to the AI Module where you can fix your cybertank's AI.

Some problems with AI designs discontinue the authorization of your design. If this happens, press any key and you will be transferred back to the AI Module.

SECTION 3
BATTLE SIMULATION

SECTION BRIEF

The Combat Simulation Module (CSM) is a powerful and flexible tool used by engineers to observe cybertanks under a variety of battle conditions. This section describes how to design and conduct a battle simulation.

3.1 THE COMBAT SIMULATION MODULE

A maximum of 15 cybertanks can be included in a simulation. At least two cybertanks must be chosen for a simulation. One of these must be designated as the **Primary Cybertank.**

At the beginning of a simulation, the battle is viewed from the vantage point of the Primary Cybertank. During the simulation, the view can be changed to the vantage point of any of the other cybertanks.

The objective of every cybertank is to destroy its enemies. Its enemies usually include all of the other cybertanks in the simulation; however, the CSM has provisions for organizing cybertanks into teams. Cybertank teams are discussed in Part 2, Section 3.2.

Combat can be waged on a variety of battlefields. OSI includes three pre-designed battlefields and you can design your own (see Part 2, Section 7). The three OSI battlefields are copied onto every ID Disc.

3.2 DESIGNING A BATTLE SIMULATION

Battle Simulation Design consists of the following steps:

1. Selecting a **Primary Tank**
2. Selecting the **Other Tanks**
3. Selecting a **BattleField**
4. Choosing Teams (optional)
5. Placing Team Headquarters (optional)

To begin the design process, select **DESIGN A SIMULATION** from the **SIMULATE** menu. You will be transferred to the **Simulation Design Module (SDM).**

3.2.1 The Simulation Design Module Display Panel

Diagram 3.2.1 illustrates the SDM display panel. The left side of the panel is comprised of four display areas. The **EMPLOYEE** display area displays your name and clearance level. The **PRIMARY TANK, OTHER TANKS,** and **BATTLEFIELD** display areas show your simulation specifications.

The right side of the panel is used to make selections. It is composed of a three-part display area called the **File Selection Area**, and three buttons called Select, Category, and Drive.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

These terminal types are equipped with a Slot button instead of a Drive button. This button allows you to use other access slots.

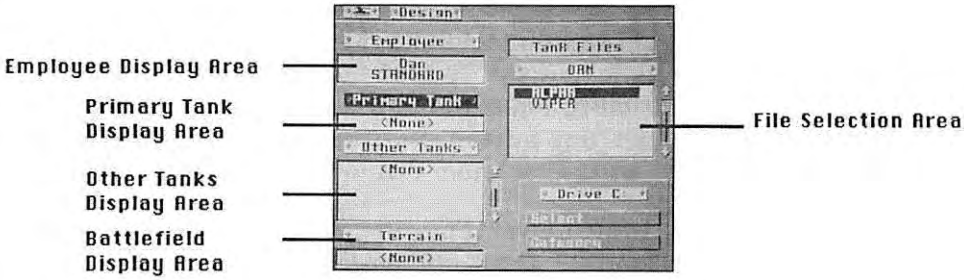


Diagram 3.2.1 -- Simulation Design Module (SDM)

3.2.2 Cybertank and Battlefield Files

The cybertanks and battlefield are selected from the current disc using the File Selection Area and the Select button as described below. You can change the current disc, which is usually your ID Disc, by inserting another disc into any access slot and selecting the Slot button until that disc is selected. The current disc's name is always displayed in the center part of the File Selection Area.

When selecting **Primary Tank** or **Other Tanks**, the lower part of the File Selection Area displays the names of the cybertanks on the current disc. When selecting the Battlefield, the names of the battlefields are displayed. The upper part of the File Selection Area displays the category: cybertanks or battlefields.

3.2.3 Selecting the Primary Cybertank

Examine the File Selection Area. Notice that the first cybertank is displayed in reverse type – it is *highlighted.*

There are two ways to change the highlighted file name. (1) If you are using a mouse or a joystick, you can select a file name by simply moving the pointer over it and pressing the button. (2) If you are using a keyboard, use the CURSOR-UP and CURSOR-DOWN keys on your terminal. *Note: For additional information on CURSOR keys, consult the OSI/CACD System 2 Reference Card under Simulation Design Module -- File Selection Keys.*

To make a selection, simply highlight the desired cybertank or battlefield and click on the Select button. Try this now. Make ALPHA the Primary Cybertank by highlighting "ALPHA" and selecting the Select button. Notice that the **PRIMARY TANK** display area on the left now displays **ALPHA.**

3.2.4 Selecting Other Cybertanks

Notice that the **PRIMARY TANK** plaque looks different than the other plaques. The color of the plaque is reversed indicating that the **PRIMARY TANK** category is active. Select the Category button. The **OTHER TANKS** plaque is now reversed indicating that **OTHER TANKS** is the active category. Other Cybertanks can now be selected.

Other Cybertanks are selected the same way as the Primary Cybertank. Select VIPER by highlighting "VIPER" and choosing the Select button. The **OTHER TANKS** display area now shows "VIPER." Select the Select button two more times. Notice that each time the button is selected, another VIPER is added to the **OTHER TANKS** display area. Now highlight "ALPHA" again and select the Select button.

As you can see, this simulation will include five cybertanks. The Primary Cybertank is ALPHA, and the Other Cybertanks consist of three VIPERS and one ALPHA.

Note: Duplicate cybertanks are allowed in simulations.

3.2.5 Selecting a Battlefield

Select the Category button to activate the **BATTLEFIELD** category. Notice that the File Selection Area now displays battlefields instead of cybertank files. Highlight HOUSTON and select the Select button. The **BATTLEFIELD** display area now displays HOUSTON.

3.2.6 Cybertank Teams

As previously mentioned, simulations can optionally involve teams of cybertanks. This is an advanced topic beyond the scope of this Training Guide. After you become familiar with standard combat, you may wish to pursue team scenarios. Cybertank Teams are discussed in Part 5, Section 2 of the Engineer's Handbook.

3.2.7 Saving the Simulation Design

Like cybertank designs, simulation designs have code names. For the purposes of this Training Guide, name the simulation ALPHASIM.

Select **SAVE SIMULATION DESIGN** from the **DESIGN** menu. The File Storage Panel (FSP) appears. Type ALPHASIM and select the Save button to save the simulation design onto your disc. You are then transferred to the ECM.

Note: In order for the CSM to execute the simulation, the Primary Cybertank, Other Cybertanks, and the Battlefield all must be located on the same disc as that of the simulation design.

3.3 CONDUCTING A SIMULATION

Select **START A SIMULATION** from the **SIMULATE** menu. The File Retrieval Panel (FRP) appears. Select the ALPHASIM simulation. The OSI/CACD loads the cybertanks (ALPHA and VIPER), the battlefield (HOUSTON), as specified by the simulation design, and transfers you to the CSM.

3.3.1 Starting a Simulation

Once transferred to the CSM, combat commences automatically. Press the **PAUSE** key to temporarily stop the simulation (refer to the OSI/CACD System 2 Reference Card to determine the appropriate key for your terminal type). Your screen should resemble Diagram 3.3.1.

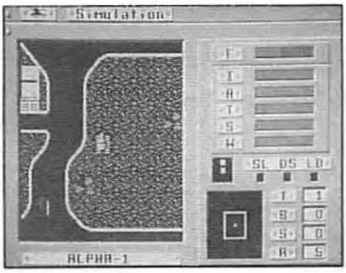


Diagram 3.3.1 -- Combat Simulation Module (CSM)

3.3.2 Status Bars

A great deal of information is displayed in the CSM. The large area to the left, called the Battlefield Display Area, shows a relatively small portion of the battlefield with the Primary Cybertank, ALPHA, in the center. The instrument panel on the right contains several status displays.

There are six status bars on top of the instrument panel (status bars are summarized in Table 3.3.2). The first is the fuel gauge. The shaded section represents the fuel remaining. As fuel is consumed, this area decreases in size. When out of fuel, the status bar is completely empty.

The other five status bars are damage indicators. Initially, each bar is empty, indicating no damage. As damage is incurred, the bar begins to fill, moving left to right. A solid bar indicates 100% damage.

Table 3.3.2

F - Fuel Remaining. Decreases as fuel is consumed. When the cybertank runs out of fuel, all mechanical functions cease.

I - Internal Damage. If internal damage reaches 100%, the cybertank is totally destroyed.

A - Armor Damage. If armor damage reaches 100%, the cybertank is totally destroyed.

T - Tread Damage. If tread damage reaches 100%, the cybertank is immobilized.

S - Scanner Damage. If scanner damage reaches 100%, the Cybertank Scanner System (CSS) fails and the cybertank is unable to detect cybertanks.

W - Weapon Damage. If weapon damage reaches 100%, the Cybertank Weapon System (CWS) fails, and the cybertank is unable to fire.

3.3.3 Other Status Indicators

Below the six status bars, are several other indicators. These will be discussed later.

3.3.4 Changing the Vantage Point

*Note: This subsection contains references to the **Cybertank Selection Keys**. To determine which keys should be used on your terminal, refer to the OSI/CACD System 2 Reference Card under Simulation Action Keys.*

Look again at the Battlefield Display Area. The Primary Cybertank, ALPHA, is displayed in the center. Press the **CYBERTANK SELECTION KEYS** to change the vantage point. The vantage point shifts to the cybertank number designated by the selection key.

Our simulation includes three VIPERs and two ALPHAs. Press the **CYBERTANK SELECTION KEYS** and observe the battlefield from the vantage point of each of the five cybertanks. The plaque below the Battlefield Display Area shows the name of the current cybertank.

3.3.5 The Satellite View

The CSM can simulate a view from the OSICOM I satellite. Select **SATELLITE VIEW** from the **SIMULATION** menu to see a satellite view of the entire battlefield. The flashing blips indicate active cybertanks in the simulation. When viewing the Satellite transmission, you can observe all the cybertanks' actions. To do so, press the **PAUSE** key to continue the action. After watching the simulation for a while, press the **PAUSE** key again to pause the simulation. To exit the satellite view, simply press any key or click the mouse or joystick button.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> The square box surrounding a small portion of the battlefield represents the region currently selected in the Battlefield Display Area. Note that the cybertanks are automatically paused during the Satellite viewing mode. Simulations cannot operate while viewing the satellite transmission. Press any key to return to the close-up view.

3.3.6 Pausing and Resuming the Simulation

The simulator should now be paused (idle). You can resume operation by pressing the **PAUSE** key. The **PAUSE** key toggles between idle and active. Press the **PAUSE** key now and watch the simulation.

Experiment with the controls as you watch the simulation. Change your vantage point with the cybertank selection keys. Examine the satellite view by selecting **SATELLITE VIEW** from the **SIMULATION** menu.

3.3.7 End of the Simulation

The battle simulation usually continues until only one cybertank remains alive with fuel; however, if none of the cybertanks move for an extended period of time, the simulator will abort the battle, and declare it a draw. This time-out feature prevents battles from continuing even though the cybertanks cannot find and destroy each other.

When the simulation ends, a panel appears in the center of the screen displaying the message, "SIMULATION COMPLETED -- PRESS ANY KEY TO CONTINUE." Press any key.

3.3.8 Restarting the Simulation

Select **RESTART THE SIMULATION** from the **SIMULATION** menu. The cybertanks are placed at new random locations on the battlefield and the simulation begins again. To illustrate the random placement of cybertanks, select **RESTART THE SIMULATION** again and notice that ALPHA is in a different place. As you can see, a simulation can be restarted before it has ended.

3.3.9 Coffee Break

Congratulations. You have successfully designed and authorized a cybertank (both chassis and AI), and designed and conducted a simulation. You have completed a great deal of training in a short time, and your accomplishments have been noted. Your Supervisor says you can take a fifteen minute coffee break. At this time, select **EXIT SIMULATION** from the **SIMULATION** menu to be transferred back to the ECM.

SECTION 4
BACK TO THE DRAWING BOARD

SECTION BRIEF

In this section you will return to the Design Control Module (DCM) to improve your cybertank's Artificial Intelligence (AI) through the use of the AI Module.

4.1 ENTERING THE AI MODULE

From the ECM, select **DESIGN CYBERTANK** from the **DESIGN** menu, as you did in Section 2.0, "DESIGNING A CYBERTANK." The OSI/CACD remembers the last cybertank design worked on in the DCM, ALPHA. ALPHA's AI is automatically loaded, and you are transferred to the AI Module.

*Note: There are several instances in which the OSI/CACD will not load the cybertank design you last worked on. This usually occurs when the OSI/CACD is not able to locate the cybertank design in any of the available access slots. If ALPHA does not load automatically, you must load it manually by selecting **LOAD** from the **CYBERTANK** menu.*

4.2 THE AI MODULE

The AI Module is used to enter and modify AI designs. You can add new instructions, remove old ones, change their order, etc. The AI Module provides great flexibility for the cybertank engineer.

4.2.1 AI Module Terminology

The material in this section uses terminology which may or may not be familiar to you. The following definitions will aid in your understanding.

The **edit window** is the large area that displays the AI. **Characters** are letters, digits, punctuation, or spaces. **Text** refers to the characters within the edit window. To **insert** is to add characters to the text; to **delete** is to remove characters from the text. **Editing** is the process of altering the text. The **Insertion Cursor (IC)** is the thin vertical bar in the edit window.

4.2.2 Moving the Insertion Cursor

You are currently in the AI Module, and ALPHA's AI is visible in the edit window. The IC is currently in the upper left-hand corner of the edit window, next to the word "Start." The IC can be moved using either a mouse/joystick or the keyboard as discussed below.

Using a Mouse/Joystick: Using a mouse/joystick, move the **pointer**, the small triangular arrow, to a position just *after* the word "Start," and click. Notice that the IC has moved to the pointer's position. Move the pointer and click to move the IC anywhere in the edit window.

Using the Keyboard: You can move the IC with the following CURSOR keys:

The CURSOR-LEFT key normally moves the IC one character to the left. If the IC is already at the beginning of a line, CURSOR-LEFT moves it to the end of the previous line.

The CURSOR-RIGHT key normally moves the IC one character to the right. If the IC is already at the end of a line, CURSOR-RIGHT moves it to the beginning of the next line.

The CURSOR-UP key normally moves the IC to the beginning of the current line. If the IC is already at the beginning of the line, CURSOR-UP moves it to the beginning of the previous line.

The CURSOR-DOWN key normally moves the IC to the end of the current line. If the IC is already at the end of the line, CURSOR-DOWN will move it to the end of the following line.

4.2.3 Inserting Text

The IC indicates the point in the text at which characters can be inserted or deleted.

Move the IC just to the right of the words "Do Seek." Now type the letters "i", "n" and "g". "Seek" becomes "Seeking." You have just inserted the three characters... i, n, and g. Type several spaces and notice how the IC moves.

Text can be inserted between any two characters. Move the IC between the letters "t" and "a" of the label "Start." Type "u" and "Start" becomes "Stuart."

4.2.4 Deleting Text

Text can be removed (deleted) one character at a time using the DELETE key. Move the IC between the letters "s" and "t" of the word "Destroy" in the line "Do Destroy". Press DELETE three times. "Destroy" becomes "troy." Notice that each time you press DELETE, the character to the left of the IC is removed. The IC, and each of the characters to right of it, move left to fill in the space.

4.2.5 Adding New Lines

Move the IC to the end of the text (just after the word "Destroy") and press RETURN. The IC moves to the next line. Type "New Line" and press RETURN. New lines can be added anywhere in the text.

Labels, such as "Start" (now "Stuart"), always begin in the far left column. Other lines, however, are indented. Since labels are less common than other lines, the AI Module automatically indents each new line for you when you press RETURN. Type "Other Line" and press RETURN.

To move the IC from the indentation column to the far left column (i.e., remove the indentation), press DELETE. To move the IC from the far left column to the indentation column (i.e., indent), press TAB.

Press RETURN to skip a line. Press DELETE to move the IC to the left column. Type "Label" and press RETURN. It is a good practice to add blank lines above labels – it makes the AI easier to read.

4.2.6 Double Lines

Some AI commands will not fit on a single line. *Without pressing RETURN,* type this sentence: "This is an example of a line which is too long." The AI Module automatically wraps your sentence to the next line. Notice that the continuation line is indented further than the original line. This feature also helps to make AI easier to read.

4.2.7 Outgrowing the Edit Window

At present, the text you are editing fits entirely within the edit window. As you add more commands, the text will eventually outgrow the size of the edit window.

Press RETURN. Notice that the label "Stuart" is no longer on the screen. Type three or four more lines, ending each one with a RETURN. One line disappears from the top of the edit window each time a new line is added at the bottom.

Although some of your lines of AI are no longer visible, the AI Module is still keeping track of them. You can see any part of the AI using **scrolling.**

4.2.8 Scrolling

Scrolling can be thought of as moving the edit window up and down to examine different parts of the text. You can scroll with either a mouse/joystick or the keyboard. The two methods are discussed below.

Using a Mouse/Joystick: You can scroll the text by clicking anywhere on the scroll-bar located directly to the right of the edit window. Clicking directly on the scroll-bar will scroll the text several lines. Clicking on the small arrows directly above and below the scroll-bar will scroll one line. By clicking on the small plaque (or "thumbprint" as it is often called), you can drag the plaque to any location in the scroll-bar. This thumbprint represents the location of the text currently visible in the edit window. For example, if the edit window is displaying the first few lines of text, then the thumbprint will be at the very top of the scroll-bar. On the other hand, if the edit window is currently displaying the last few lines of text, then the thumbprint will be at the very bottom of the scroll-bar.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

You can scroll the text by clicking on any of the six arrow buttons at the right side of the edit window. The upward-pointing arrows move the window toward the beginning of the text, and the downward-pointing arrows move the window toward the end. There are three sizes of arrows. The smallest arrows scroll one line. The medium arrows scroll several lines. The longest arrows scroll to the beginning (or end) of the text.

Using the Keyboard: You can always scroll text using the SCROLL keys. See the OSI/CACD System 2 Reference Card to determine which keys to use on your terminal.

4.3 WORKING WITH SECTIONS OF TEXT

The AI Module lets you modify sections of text, such as a words, lines, or paragraphs. You must first **select** the text. When selected, a section of text appears highlighted.

4.3.1 Selecting Text

Text can be selected using either a mouse/joystick or the keyboard. The two methods are discussed below.

Using a mouse/joystick: To select text, move the pointer to the beginning of the text you wish to select, press and hold the button down, and move the pointer to the end of the text section you wish to select. Once selected, release the button.

Using the keyboard: To select, move the IC to the beginning of the text you wish to select, press the MARK key, then move the IC to the end of the section of text (see the OSI/CACD System 2 Reference Card to determine the MARK key for your particular terminal type).

In either case, the text is highlighted as it is selected. Try selecting "Branch To" now.

Selected text is deselected when the IC is moved. If using the keyboard, the text is not deselected until the MARK key is pressed a second time.

Experiment with selecting and deselecting words, lines, and paragraphs. Notice that you can also select text "backwards." In other words, you can begin selecting from either end of the text section.

4.3.2 Deleting a Section of Text

When editing AI, you will occasionally want to delete a section of text. You could move the IC to the end of the section and press DELETE many times to remove the section, but there is an easier method.

To delete a section of text, simply select the text in the manner previously described, then press DELETE. To demonstrate, select "an example of" and press DELETE. The sentence *"This is an example of a line which is too long"* now reads *"This is a line which is too long."*

4.3.3 Replacing a Section of Text

It is often desirable to replace a section of text (typically a word) with something else. You could delete the old text and begin inserting new text, but, once again, there is a better method.

To replace a section of text, select it and type the replacement text. There is no need to press DELETE. For example, select "too long" and then type "short" to replace it. The sentence now reads: *"This is a line which is short."*

4.3.4 Cutting and Pasting Text

There will also be times when you need to rearrange text. The AI Module allows a section of text to be removed (Cut) from one location and placed (Pasted) in another.

To cut, select and highlight the text. Next, select **CUT** from the **EDIT** menu. The selected text is removed from the edit window and temporarily stored internally by the AI Module.

Note: Only the last cut or copied section of text is stored.

To paste, move the IC to the beginning of the new location for the stored text. Select **PASTE** from the **EDIT** menu. Paste inserts the stored text at the current location of the IC.

4.3.5 Copying and Pasting Text

Sometimes it is desirable to duplicate, or copy, a section of text. The AI Module allows a section of text to be Copied (without removing it) and Pasted to another place.

To Copy, select the text to be copied. Select **COPY** from the **EDIT** menu. The AI Module internally stores a copy of the selected text, *without removing the selected text from the edit window.*

To paste, move the IC to the beginning of the new location for the stored text. Select **PASTE** from the **EDIT** menu. A copy of the internally stored text is inserted at the current location of the IC. Each time you select **PASTE**, stored text is inserted. As you can see, it is easy to make multiple copies of a section of text.

4.3.5 Undo

*Special Note: The **UNDO** feature is not supported on Commodore 64 and Apple //+,c,e terminals.*

There will be times when you mistakenly delete portions of AI and your suddenly realize the error of doing so. If you immediately select the **UNDO** option from the **EDIT** menu, then your last action will be undone. Please note that this only works if you immediately select **UNDO**.

4.4 EDITING ALPHA

Congratulations! You now know almost everything there is to know about the AI Module and are probably curious about the plaques below the edit window. Relax. Those will be covered soon. For now, let's get on with editing ALPHA.

4.4.1 Reloading ALPHA

The editing exercises you completed in previous sections left ALPHA's AI in an unusable state. Reload ALPHA's AI by selecting **LOAD** from the **CYBERTANK** menu. The File Modification Panel (FMP) appears and tells you that unsaved changes have been made to the current cybertank design. It will ask if you want to "**SAVE CHANGES TO ALPHA?**"

Select the No button! If you select Yes, your good copy of ALPHA will be overwritten (replaced) by the edited one.

The OSI/CACD always informs you of current work that has not been saved to disc. When another cybertank is loaded, it will replace whatever is currently being edited. At present, this is desired since the current design is unusable.

After selecting the No button, the File Retrieval Panel (FRP) appears and you can reload ALPHA.

4.4.2 Replacing a Capsule

One of the advantages of semicustom design is that significant changes in the cybertank's behavior can be easily incorporated using different Library Capsules.

You may have noticed that one problem in ALPHA's behavior is that it spends so much time moving that it does not have much time to scan. The result is that ALPHA often misses "seeing" things.

The **Seek** routine currently used was designed to move a cybertank fairly quickly. **Search**, another routine available as a Library Capsule, puts more emphasis on scanning.

Modify ALPHA's AI by replacing **Do Seek** with **Do Search**. You can do this by replacing a section of text ("Seek") as discussed in Section 4.3.3.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

Capsule Routines are found on the **RESOURCE** disc.

4.4.3 Authorizing the new ALPHA

Each time a cybertank undergoes design modification, the changes must be authorized. Re-authorize ALPHA by selecting **AUTHORIZE** from the **CYBERTANK** menu. Oops, an error. The Cybertank Authorization Module (CAM) reports a problem: "The label SEARCH was not found in the following line: Do Search."

Select the Continue button to look for additional errors. After the CAM examines the rest of the AI, you are then transferred to the AI Module where you can make corrections to the problem.

What happened? There is nothing wrong with the command "Do Search", but the routine Search is nowhere to be found. It is only available in the Library Capsule named Search, and that has not been included in ALPHA's AI. To solve the problem, replace the line "Include Seek" with the line "Include Search".

4.4.4 Saving the Design As Beta

At this point, verify that ALPHA's AI is identical to the following. If necessary, edit the AI to make it match. It should be pointed out that the case of the letters does not matter (i.e., START is equivalent to Start).

```
Start
    Do Search
    Do Destroy
    Branch to Start

    Include Search
    Include Destroy
```

Before authorizing your cybertank, save it to disc. This time, select **SAVE AS** instead of **SAVE** from the **CYBERTANK** menu. By selecting **SAVE AS**, you are able to choose a new name for your cybertank design. Choose the name *BETA* by typing BETA and pressing RETURN. You have now created an entirely new cybertank design named BETA. Notice that the name plaque at the top of the edit window displays BETA. ALPHA has not been replaced; it is still on the disc and can be recalled at any time.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

Capsule Routines are found on the **RESOURCE** disc.

4.4.5 Authorizing BETA

Authorize your new cybertank, BETA, by selecting **AUTHORIZE** from the **CYBERTANK** menu. If the authorization is successful, as it should be, return to the External Control Module (ECM) by selecting the ECM button. If the authorization is unsuccessful, please refer back to Section 4.4.4 to verify your cybertank's AI.

You have now designed your first two cybertanks, ALPHA and BETA.

SECTION 5
REVISITING THE SIMULATION

SECTION BRIEF

This section revisits the Simulation Design Module (SDM) and discusses additional features of the Combat Simulation Module (CSM).

5.1 MORE ABOUT THE CYBERTANK COMBAT SIMULATOR

Now that you have a new cybertank, BETA, you need to design a new simulation that includes it.

5.1.1 Deleting the Old Simulation Design

Simulation designs which are no longer needed can be removed from a disc to conserve space. You will not be using ALPHASIM anymore, so remove it by selecting **DELETE A SIMULATION DESIGN** from the **SIMULATE** menu. The File Termination Panel (FTP) appears. It is very similar to the File Retrieval Panel. Select ALPHASIM in the usual way and select the Delete button.

5.1.2 Designing the New Simulation

To begin your new simulation design, select **DESIGN A SIMULATION** from the **SIMULATION** menu. Make the following selections. (If you need a review, refer back to Section 3.2).

PRIMARY TANK
BETA

OTHER TANKS
ALPHA
VIPER

BATTLEFIELD
HOUSTON

Select **SAVE SIMULATION DESIGN** from the **DESIGN** menu. Save the simulation under the name BETASIM. You are automatically transferred to the ECM.

5.2 RUNNING THE SIMULATOR

To begin the simulation, select **START A SIMULATION** from the **SIMULATE** menu. The File Retrieval Panel (FRP) appears. Select the BETASIM simulation to be processed. Once the cybertanks (BETA, ALPHA, and VIPER), and battlefield (HOUSTON) are loaded, you are transferred to the CSM and the simulation begins.

5.2.1 The Instrument Panel

The fuel and damage indicators have already been discussed. Several other instruments and lights also appear on the instrument panel.

SL - Scanner Lock. This LED turns on when the cybertank locks its scanner onto an object or enemy cybertank.

DS - Defense Shield. This LED turns on when the cybertank raises its shield. It is off when the cybertank has its shield lowered.

LD - Listener Device. This LED turns on when an enemy cybertank has locked its scanner onto the cybertank.

The three lights above are used only when the cybertank is equipped with specific special items. If the cybertank is not equipped with the items, the lights are inactive.

Also on the instrument panel is the Cybertank Directional Indicator (CDI). This indicator is directly left of the three lights. It indicates which direction the cybertank is currently facing, and in which direction the scanner is currently facing. (For specific details on the directional indicator, see the OSI/CACD System 2 Reference Card).

Directly below the directional indicator is the Cybertank Vision Indicator (CVI) which depicts what the scanner is "seeing." Objects and enemy cybertanks which are scanned by the cybertank show up as blips on this indicator. (For specific details on the Cybertank Vision Indicator, see the OSI/CACD System 2 Reference Card.)

Battle results are located at the lower right side of the instrument panel. The numbers displayed are as follows:

T - Total number of battles to be simulated
B - Number of battles previously fought
S - Number of successful battles
A - Number of active cybertanks remaining

5.2.2 Watching the Simulation

At this point, you can sit back, relax, and watch the simulation. When you are finished watching the simulation, select **EXIT SIMULATION** from the **SIMULATION** menu to return to the ECM.

5.3 TIME FOR SOME R & R

Congratulations. You are now fully qualified to design semicustom cybertanks and simulations and your accomplishments have been noted. You have completed this portion of your training ahead of schedule. The Departmental Manager has granted you a two day furlough. When you return, you will begin the final phase of your training.

SECTION 6
FULL CUSTOM DESIGN

SECTION BRIEF

This section describes the development of AI from the ground up. It provides information on how cybertanks operate, and are simulated. In addition, the Cybertank Command Language (CCL) is presented in more detail.

6.1 GENERAL INFORMATION

In the previous sections, cybertank AI was developed using semicustom design techniques. Predefined sequences of CCL commands, called Library Capsules, were used as building blocks in the AI construction. In this section, cybertank AI will be developed using Full Custom Design techniques. The AI is created entirely using individual CCL commands.

6.2 THE SIMULATED WORLD OF THE CSM

The CSM, like all simulators, attempts to approximate a real-world system by using an artificial model. As a cybertank engineer, it is important for you to understand the specific details of that model.

6.2.1 Battlefield Coordinate System

A battlefield is divided into a 64 x 64 grid of cells, each representing an area equal to one square hectometer (hm). Each cell contains one of several types of terrain, such as grass, water, trees, buildings, etc. The cells surrounding the battlefield form an impenetrable wall which mark the battlefield boundaries.

Each cell is identified by two numbers which are called its 'X' and 'Y' coordinates (see Diagram 6.2.1). The X-coordinate specifies the cell's east-west position and ranges in value from zero (west wall) to sixty-three (east wall). Similarly, the Y-coordinate specifies the cell's north-south position and ranges in value from zero (north wall) to sixty-three (south wall). Many CCL commands use these coordinates. It should be noted that since the battlefield wall occupies the outer edges of the battlefield, employees should only be concerned with coordinate values from 1-62.

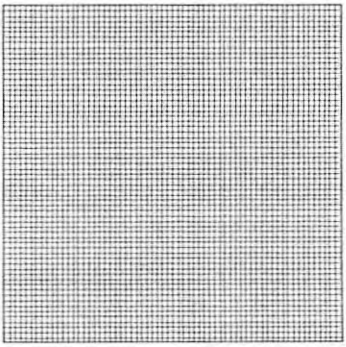


Diagram 6.2.1 -- 64 x 64 battlefield grid

6.2.2 The Eight Standard Directions

Diagram 6.2.2 illustrates the eight **standard directions.** A cybertank can move, detect obstacles, and scan in any of these eight directions. These eight directions represent the 45° angles of a circle.

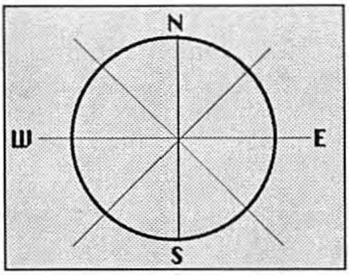


Diagram 6.2.2 – The eight possible facing directions

6.2.3 Distance

Each cell is adjacent to eight other cells, one in each of the standard directions. When calculating distance, any two adjacent cells are considered to be one hectometer apart.

6.3 THE SIMULATED CYBERTANK

As you have learned in your previous design experience, all cybertanks have standard equipment. The following provides insight into how these devices are simulated.

6.3.1 Movement

Movement is simulated by changing the X- and Y-coordinates of the cybertank. A cybertank's movement is limited to the eight standard directions. Each move of one hectometer consumes a certain amount of time, which is based on the weight of the cybertank and the speed of the drive system.

6.3.2 The Movement Sensor and the Scanner

The cybertank has a built-in movement sensor and scanner. Both devices constitute parts of the Cybertank Scanner System (CSS), but they are independent mechanisms and operate differently.

The movement sensor, referred to as the Movement Obstruction Sensor (MOS), which can be aimed in any of the eight standard directions, detects obstacles which can impede the cybertank's movement. It is limited to a range of three hectometers and covers a one degree area (a straight line) in the direction aimed. It covers a very small area. If more than one obstacle exists along the line, the MOS always detects the one nearest the cybertank.

The scanner can be instructed to find one of three things: 1) an enemy cybertank, 2) the enemy headquarters, or 3) the nearest object. Mounted on a rotating base, the scanner can face any of the eight standard directions. It continues to face that direction until it is instructed to rotate. Scanners are available in 20, 35, and 50 hectometer ranges, with sweep angles from 30 to 90 degrees. The scanner cannot "see through" all objects. Some objects block scanner signals.

6.3.3 The Weapon System

Cybertanks can be equipped with various weapons. Each weapon type has its own characteristics. All weapons have a maximum firing range of four (4) hectometers. They can be fired at enemy cybertanks, enemy headquarters, obstructions, at the closest object, or at any specific location within range. For ease of design, they can also be fired in the direction the scanner is facing, or the direction the cybertank is currently facing.

6.4 ELEMENTS OF THE CYBERTANK COMMAND LANGUAGE

As described previously, the Cybertank Command Language (CCL) is the language used to develop cybertank AI. Full Custom Design incorporates the various CCL commands individually to create the cybertank's AI. This subsection reviews and defines some basic elements of the CCL.

The following are brief descriptions of the basic elements. Do not be alarmed as they will be fully explained, with examples, later in this section.

6.4.1 Labels

Labels are used to designate the beginning of an AI segment (or routine) that can be executed using either the **Do** or **Branch** commands. The label provides a way to reference the segment of AI it names. In ALPHA and BETA, the label **Start** names the entire AI for the cybertank.

Some of the characteristics of Labels follow:

- A label always begins flush with the left margin of the edit window
- A label is always on a line by itself
- A label names the segment of AI that follows (up until the next Label)
- A label is usually referenced at least once by a **Branch** or **Do** command
- A label is a maximum of ten characters long
- A label is defined by the designer, and can be almost anything.

6.4.2 Reserved Words

The CCL commands, operators, and system variables are "reserved" for specific purposes and cannot be utilized as User Variables (see Section 6.4.4). See Appendix 1 for a list of Reserved Words.

6.4.3 System Variables

System Variables are used by the CCL for internal operations and represent the state of the cybertank. They may be used in computations, but cannot be altered. System variables are very useful, and often necessary, in designing cybertank AI. Examples include: TankX and TankY, which specify the cybertanks coordinates; FuelLevel, the amount of fuel remaining; and EnemyDist, the distance to the enemy. See Appendix 2 for a list of the System Variables.

6.4.4 User Variables

User Variables are defined by the AI designer. Unlike System Variables, User Variables can be altered. For example, you might make up a user variable called FuelStart. At the beginning of the AI you could store the value of FuelLevel in FuelStart. Later, you could subtract the current value of FuelLevel from FuelStart to calculate how much fuel your cybertank had consumed.

6.4.5 Action Commands

Action Commands cause the cybertank to perform a mechanical action, such as firing the weapon or rotating the scanner. These are, for the most part, self-explanatory.

6.4.6 Computation Commands

Computation commands, or logic commands, cause the on-board computer to perform computations such as arithmetic calculations. These commands are processed quickly since they do not involve mechanical activity.

6.4.7 Sequence Commands

Sequence Commands change the order in which commands are processed. When a simulation begins, the on-board computer begins processing commands starting with the first line in the cybertank's AI. Commands are normally processed in order, beginning to end.

Sequence Commands can be used to alter the order, usually to repeat a segment of AI. For example, the command **Branch to Start** in BETA forces the on-board computer to "loop back" to the beginning of the AI. As another example, **Do Search** causes the on-board computer to begin processing commands in the routine labeled *Search.* At the end of *Search,* another Sequence Command, **Resume,** causes the on-board computer to resume processing instructions from where it left off, the line immediately following the **Do Search** line.

6.4.8 Decision Commands

Decision Commands allow the cybertank's on-board computer to make decisions. These commands always begin with the word **If**. The last part of a Decision Command is actually a Sequence Command, only processed if a specified condition is met.

6.5 THE CCL CONSTRUCTION PANEL

The **CCL Construction Panel** (CP) is helpful in Full Custom Design. CCL commands can be constructed by simply selecting the plaques on the CP. To get to the AI Module and the CP, select **DESIGN A CYBERTANK** from the **DESIGN** selection menu. If the File Retrieval Panel (FRP) appears, select **ALPHA**. At this point, you should be transferred to the AI Module.

6.5.1 Experimenting with the CCL

If you are using a mouse or joystick, you can select the CP plaques in the usual way -- by clicking on them.

If you are using the keyboard, you can use the CP as follows: 1) Press the CONNECT key to connect to the CP. 2) Use the CURSOR keys to highlight the desired plaque. 3) Press RETURN. 4) When you are through using the CP, press the CONNECT key to disconnect from the CP. *Check the OSI/CACD System 2 Reference Card to determine the CONNECT key for your particular terminal type.*

Try the following example. Move the Insertion Cursor (IC) to the end of the text. Select the following plaques from the CP located at the bottom of the screen:

MOVE
FORWARD
3

Notice that the command **MOVE TANK FORWARD 3** has been entered into the text. Now select these plaques:

ROTATE
TO ENEMY TANK

Notice that the command **ROTATE SCANNER TO FACE ENEMY TANK** has been entered. Now try one more example:

IF
WEAPON
WEAPON RANGE
ENEMY WITHIN
DO

At this point, the CP is prompting you to enter a Label name. Type in BLASTEM and press RETURN. Notice that the command **IF ENEMY TANK IS WITHIN RANGE THEN DO BLASTEM** has been entered. The CP prompts you to enter label names, variable names, or X-Y coordinates when needed to complete a particular command.

***Note:** In all of the subsections below, User Variable names are being referenced in the commands. They are being used only as examples and have no material relevance in the CCL. System Variables can also be used in place of the User Variables in all of the below commands.*

All User Variables are printed in upper and lower case so they will stand out from the CCL commands.

6.5.2 MOVE Commands

Cybertank movement is accomplished by turning the cybertank to face one of the eight standard directions and then moving it forward or back. It is advisable to use the Movement Obstruction Sensor (MOS) before moving to avoid collision damage.

MOVE commands can specify either a **fixed** or **variable** distance for the cybertank to move. A fixed distance is indicated by a number in the 1 to 62 hectometer range. A variable distance is specified by using a variable name. When a variable is used, the value of the variable determines the distance the cybertank will move.

The CP can construct four different types of **MOVE** commands. Try building each of these:

```
MOVE TANK FORWARD 3
MOVE TANK FORWARD AdvanceAmount
MOVE TANK BACKWARD 2
MOVE TANK BACKWARD RetreatAmount
```

6.5.3 TURN Commands

TURN commands change the direction the cybertank is facing. There are several ways to turn the cybertank. Each is discussed below. Try to construct each of the commands with the CP.

The following two commands will face the cybertank in one of the eight standard directions. For example, TURN TANK TO 5 will turn the cybertank to face direction 5 (southwest). If a variable is used, the value of that variable determines the direction the tank will turn.

```
TURN TANK TO 7
TURN TANK TO  NewBearing
```

The following group of commands turn the cybertank a specified amount *relative to its current heading.* For example, suppose the cybertank is facing direction 6 (west).

If the command TURN TANK RIGHT 1 is processed, the cybertank will be turned to face direction 7 (northwest).

```
TURN TANK LEFT 1
TURN TANK LEFT ThisMuch
TURN TANK RIGHT 2
TURN TANK RIGHT ThatMuch
```

The following commands turn the cybertank to face a particular object or battlefield location. The on-board computer calculates the direction that best approximates the actual direction to the object or location.

```
TURN TANK TO FACE ENEMY TANK
TURN TANK TO FACE ENEMY HQ
TURN TANK TO Xcoordinate Ycoordinate
```

Finally, the cybertank can be turned to face the same direction as its scanner.

```
ALIGN TANK WITH SCANNER
```

6.5.4 DETECT OBSTRUCTION Commands

The **DETECT OBSTRUCTION** commands tell the MOS to probe in a specified direction the nearby cells on the battlefield. The effect is to set System Variables which can then be tested. The System Variables affected are ObstacleX, ObstacleY, ObstacleType, and ObstacleDist. These variables provide the obstacle's location, type, and distance from the cybertank. The cybertank can make decisions by testing these variables with If statements.

There are four types of **DETECT OBSTRUCTION** commands. Each is listed below. Try constructing each with the CP.

```
DETECT OBSTRUCTION AT 4
DETECT OBSTRUCTION AT ThataWay
DETECT OBSTRUCTION AT TANK DIRECTION
DETECT OBSTRUCTION AT SCANNER DIRECTION
```

6.5.5 SCAN Commands

The **SCAN** commands cause the scanner to scan an area around the cybertank for a specified type of object. The scanner can scan for enemy cybertanks, enemy headquarters, or the closest object to the cybertank. The area scanned is dependent upon the scanner's maximum range, sweep angle, and current direction.

The scanner cannot "see" through certain types of objects such as buildings, and it is possible for an enemy cybertank or headquarters to be hidden from view. The scanner's visibility may be improved by destroying intervening objects. For a complete list of objects and obstructions and their impact on the scanner, see Appendix 3.

The effect of scanning is to set System Variables which can then be tested. This process is similar to that of the movement sensor. The System Variables affected depend on the type of scan performed.

When scanning for enemy cybertanks, EnemyX, EnemyY, and EnemyDist are affected. These System Variables provide the enemy's location and its distance from the cybertank.

When scanning for enemy headquarters, EnemyHQX, EnemyHQY, and EnemyHQDist are affected. These System Variables provide the headquarter's location and its distance from the cybertank.

When scanning for the closest object to the cybertank, ObjX, ObjY, ObjType, and ObjDist are affected. These System Variables provide the object's location, type, and distance from the cybertank.

The three **SCAN** commands are listed below. Try constructing each with the CP.

```
SCAN FOR ENEMY TANK
SCAN FOR ENEMY HEADQUARTERS
SCAN FOR CLOSEST OBJECT
```

6.5.6 ROTATE Commands

ROTATE commands change the direction the scanner is facing. There are several ways to rotate the scanner. Each is discussed below. Try to construct each of the commands with the CP.

The following two commands face the scanner in one of the eight standard directions. For example, ROTATE SCANNER TO 3 will rotate the scanner to face direction 3 (southeast). If a variable is used, the value of the variable will determine the direction.

```
ROTATE SCANNER TO 7
ROTATE SCANNER TO OldBearing
```

The following commands rotate the scanner a specified amount *relative to its current heading.* For example, suppose the scanner is facing direction 4 (south). If the command ROTATE SCANNER LEFT 3 is processed, the cybertank will be turned to direction 1 (northeast).

```
ROTATE SCANNER LEFT 1
ROTATE SCANNER LEFT ThisMuch
ROTATE SCANNER RIGHT 2
ROTATE SCANNER RIGHT ThatMuch
```

The following commands rotate the scanner to face a particular object or battlefield location. The on-board computer calculates the standard direction which best approximates the actual direction to the object or location.

```
ROTATE SCANNER TO FACE ENEMY TANK
ROTATE SCANNER TO FACE ENEMY HQ
ROTATE SCANNER TO 52 13
ROTATE SCANNER TO Xcoordinate Ycoordinate
```

Finally, the scanner can be rotated to face in the same direction as the cybertank.

```
ALIGN SCANNER WITH TANK
```

6.5.7 FIRE Commands

Cybertanks can fire their weapon at specific objects, battlefield locations, or in a specified direction. When firing at either an object or a location, the direction of fire is *not* limited to the eight standard directions; however, the weapon has a maximum range of four hectometers. Although the cybertank has an unlimited supply of ammunition, the Cybertank Weapon System (CWS) must be operational to use it.

The various **FIRE** commands are listed below. Try to construct each with the CP.

This command instructs the cybertank to fire its weapon at an obstruction previously detected by the Movement Obstruction Sensor (MOS).

```
FIRE WEAPON AT OBSTRUCTION
```

These commands fire at specific targets previously scanned by the scanner. *Important: When firing at an enemy cybertank, it is possible to miss since it may move out of the way.*

```
FIRE WEAPON AT ENEMY TANK
FIRE WEAPON AT ENEMY HQ
FIRE WEAPON AT CLOSEST OBJECT
```

These following commands fire at a battlefield location specified by X- and Y-coordinates.

```
FIRE WEAPON AT 23 46
FIRE WEAPON AT Xcoordinate Ycoordinate
```

The last two commands cause the weapon to fire in a specified direction.

```
FIRE WEAPON AT TANK DIRECTION
FIRE WEAPON AT SCANNER DIRECTION
```

6.5.8 Special Commands

The majority of special commands involve special equipment which is not covered in this Training Guide. For detailed information about their function, refer to CCL Reference Guide in the Engineer's Handbook.

The special commands are listed below.

SELF DESTRUCT

LAUNCH REMOTE SCANNER
(requires the Remote Launcher)

RAISE SHIELD
LOWER SHIELD
(requires the Defense Shield)

JAM SCANNER SIGNAL
(requires the Jamming Device)

LOCK SCANNER
UNLOCK SCANNER
(requires the Scanner Lock)

REPAIR INTERNAL
REPAIR TREADS
REPAIR WEAPON
REPAIR ARMOR
REPAIR SCANNER
(requires the Repair Kit)

6.5.9 Decision Commands

Decision Commands, also known as IF commands, are too numerous to discuss individually. All IF commands have the following form:

```
IF <decision condition> THEN <sequence command>
```

When an IF command is processed, the decision condition is tested. If the decision condition is met, then the sequence command is processed.

A few of the decision conditions are listed below. The sequence command is either a BRANCH TO "Label" command or a DO "Label" command. Both are discussed in the following subsection.

```
TANK TREADS ARE NOT FUNCTIONAL
MOVEMENT IS OBSTRUCTED
TANK IS NOT FACING ENEMY TANK
TANK IS FACING ENEMY HQ
TANK IS ALIGNED WITH SCANNER
FUEL IS EMPTY
SCANNER IS NOT FUNCTIONAL
SCANNER IS LOCKED
ENEMY TANK WAS FOUND
ENEMY HQ WAS FOUND
CLOSEST OBJECT WAS NOT FOUND
TANK IS NOT ALIGNED WITH SCANNER
WEAPON IS NOT FUNCTIONAL
ENEMY TANK IS WITHIN RANGE
ENEMY HQ IS BEYOND RANGE
CLOSEST OBJECT IS WITHIN RANGE
REMOTE SCANNER IS AVAILABLE
SHIELD IS UP
REPAIR KIT IS UNAVAILABLE
```

Several examples of the above decision commands follow:

```
IF TANK TREADS ARE NOT FUNCTION THEN BRANCH TO CantMove
IF ENEMY TANK IS WITHIN RANGE THEN DO KillIt
```

In addition to the IF commands discussed above, there are three other forms:

```
IF <var> <op> <value> THEN <sequence command>
IF <var> <op> <var> + <value> THEN <sequence command>
IF <var> <op> <var> - <value> THEN <sequence command>
```

<var> represents a variable. It can either be a System or User Variable

<op> represents a relational operator. It can be any of the following:

< (less than)
> (greater than)
= (equal to)
<= (less than or equal to)
>= (greater than or equal to)
<> (not equal to)

<value> represents a value. It can be either a number, a System Variable, or a User Variable

<sequence command> can either be a **BRANCH TO** "Label" command or a **DO** "Label" command

Some examples of these types of IF commands follow:

```
IF TankY = 1 THEN BRANCH TO FoundTop
IF NewDamage > OldDamage THEN DO BeenHit
IF ScanDir = TankDir + 4 THEN BRANCH TO WatchRear
IF EnemyDist <= 4 THEN BRANCH TO FireAway
IF Delta <> NewVal - OldVal THEN BRANCH TO Error
```

6.5.10 Sequence Commands

Al Commands are normally processed in the order in which they appear; however, Sequence Commands can change the processing order. There are three Sequence Commands: BRANCH TO, DO, and RESUME.

The **BRANCH TO** command changes the processing order by redirecting the on-board computer to a specified Label. After encountering a **BRANCH TO** Label, the on-board computer processes the first command following the specified Label. It will continue to process commands in order from that point on. This can be used to form a loop, as in **BRANCH TO START**, or to skip past a segment of AI. BRANCH TO can also be written as **GOTO**.

The **DO** and **RESUME** commands work together. They are used primarily with **routines**. In Section 2, a routine was defined as "a sequence of CCL commands which causes the cybertank to perform a particular task." To be more precise, a routine is a sequence of CCL commands beginning with a Label and ending with a RESUME command.

When the on-board computer encounters a **DO** "Label" command, it remembers the command's location within the AI and then begins processing the commands following the specified Label.

When the on-board computer encounters a **RESUME** command, it recalls the location of the **DO** "Label" command which called the routine and branches back to the command immediately following the **Do** "Label".

In summary, the **DO** command causes a routine to be processed, and the **RESUME** command marks the end of the processed routine.

6.5.11 Assignment Commands

Assignment Commands alter the values of User Variables. These commands are used in the following three forms:

```
<user var> = <value>
<user var> = <var> + <value>
<user var> = <var> - <value>
```

<user var> represents any User Variable.

<var> represents a variable. It can either be a System or User Variable.

<value> represents a value. It can be either a number, a System Variable, or a User Variable.

When an Assignment Command is processed, the User Variable on the left side of the equals sign is assigned the value of the right side.

Some examples of Assignment Commands are as follows:

```
MyVariable = 100
NewCount = OldCount + 5
CountDown = CountDown - 1
DirTemp = TankDir
DeltaVal = NewVal - OldVal
```

All variables have values from 0 to 100. Any operation that results in a number greater than 100 is automatically assigned a value of 100. Any operation that results in a number less than 0 is automatically assigned a value of 0.

6.6 DESIGNING A CYBERTANK FROM THE GROUND UP

In previous sections, predefined sequences of CCL commands, called Library Capsules, were used as building blocks in AI construction. In this section, cybertank AI is developed entirely from individual CCL commands.

So far, you have designed two cybertanks. You have also designed and executed simulations. Hopefully, you are fairly comfortable with the operation of the AI Module, the Simulation Design Module (SDM), and the Combat Simulation Module (CSM). If you need further help with any of these review the appropriate section of this Training Guide.

6.6.1 Designing a Chassis

At this time, select NEW from the CYBERTANK selection menu. When the OSI/CACD System 2 asks if you want to save the changes to Alpha, select NO.

When the File Storage Panel (FSP) appears, name your new cybertank **GAMMA**. Once in the AI Module, select **CHASSIS** from the **CYBERTANK** selection menu to proceed to the Chassis Design Module (CDM).

While in the CDM, select whichever cybertank components you like. Keep an eye on the credits remaining. Try not to spend too much on any single item. Remember - you have a lot to choose.

After selecting **GAMMA**'s Tank Class, Fuel Cells, Drive System, Weapon Type, and Scanner, you should proceed to the AI Module.

6.6.2 A Cybertank's Perspective

To successfully design a cybertank's AI, you must begin thinking about all of the tasks a cybertank must perform. You must begin asking yourself, "If I were a cybertank, what would I do?" To answer this question, you should ascertain exactly what it is that makes a cybertank function and then decide how to implement that function. During most battle simulations, a cybertank must accomplish three basic tasks to be effective; moving around the battlefield, searching for an enemy, and eliminating the enemy. Each of these tasks is covered in detail in the following sections.

6.6.3 Moving Around the Battlefield

Like a baby, a cybertank must learn to walk before life becomes very interesting. Movement is THE most basic function used in cybertank operation.

Before tackling cybertank movement, try a simple experiment. Close your eyes and put your hands in your pockets. Now try to walk around the room. If you are like most people, you probably ran into a few walls, chairs, or other obstructions. What you just did is visually represented in Diagram 6.6.3.1.

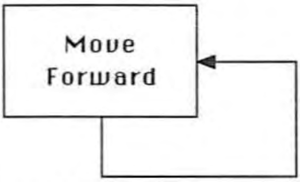


Diagram 6.6.3.1 -- Process flow of simple movement

As you can see, the above process does not require any thinking other than that used to move forward. From the experiment, you can also tell that the process is not very effective. To move more effectively, you should leave your eyes open and your hands out of your pockets. If that were the case, then the thought process could be depicted like that shown in Diagram 6.6.3.2.

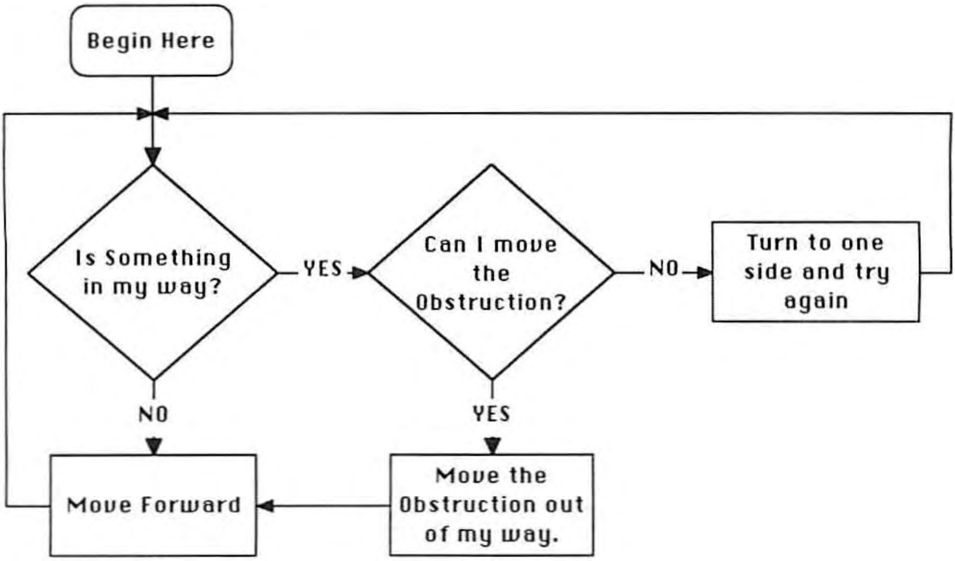

Begin Here
Is Something in my way?
YES
Can I move the Obstruction?
NO
Turn to one side and try again
NO
YES
Move Forward
Move the Obstruction out of my way.

Diagram 6.6.3.2 -- Process flow of complex movement

The above diagram shows the flow of your thinking while attempting to move around a room.

To see how this flow diagram works, try a specific situation. Suppose that you are in the corner of a room. To your left is a wall and straight ahead is a wall. So, starting at the top of the diagram and following the arrows, you ask yourself "Is something in my way?" The answer is "Yes, there is a wall in my way", therefore, you follow the arrow labeled "YES" and then ask yourself, "Can I move the obstruction?" Since the obstruction is a solid wall, the answer is "No." Since the wall cannot be moved, follow the arrow labelled "NO" and you turn either to the left or right and repeat the process.

Since a cybertank cannot physically pick up and move an object in its path, a commonly used technique is to attempt to destroy it. If after shooting an obstruction it is still intact, then it is known to be an indestructible object (like a wall, fortified building or water) and the cybertank must move around it.

The result of converting all the above ideas into cybertank terminology is shown below in Diagram 6.6.3.3.

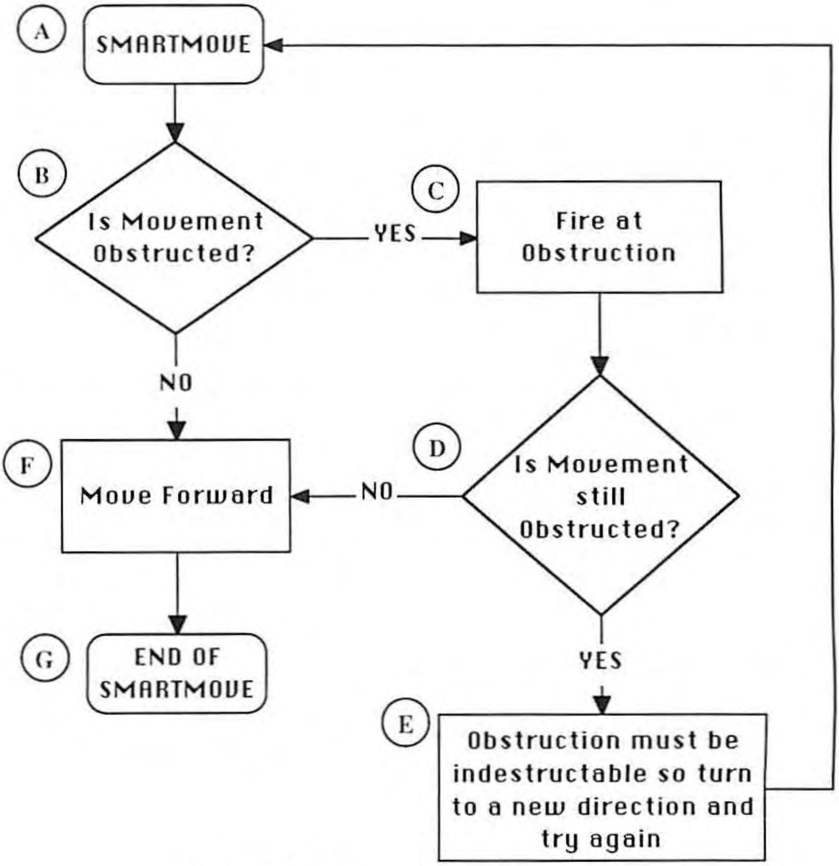

A
SMARTMOVE
B
Is Movement Obstructed?
YES
C
Fire at Obstruction
NO
F
Move Forward
NO
D
Is Movement still Obstructed?
G
END OF SMARTMOVE
YES
E
Obstruction must be indestructable so turn to a new direction and try again

Diagram 6.6.3.3 -- Process flow of cybertank movement

Once you have determined the thought process for some function, converting that process to CCL commands is a fairly simple process. For example, the above flow diagram can be written in CCL as follows:

```
A ==>      SMARTMOVE
B ==>          DETECT OBSTRUCTION AT TANK DIRECTION
               IF MOVEMENT IS NOT OBSTRUCTED THEN BRANCH
                  TO GO
C ==>          FIRE WEAPON AT OBSTRUCTION
```

```
D ==>           DETECT OBSTRUCTION AT TANK DIRECTION
                IF MOVEMENT IS NOT OBSTRUCTED THEN BRANCH
                   TO GO
E ==>           TURN TANK LEFT 1
                BRANCH TO SMARTMOVE
F ==>       GO
                MOVE TANK FORWARD 1
G ==>           RESUME
```

The letters along the left side correspond to the circled letters in the flow diagram. For example, the box labeled "B" represents the instructions "DETECT OBSTRUCTION AT TANK DIRECTION" and "IF MOVEMENT IS NOT OBSTRUCTED THEN BRANCH TO GO". You may have noticed that the label "GO" was included. This is because all boxes that have more than one arrow coming into them need to be preceded by a label. Since box "F" can be entered from boxes "B" and "D", it needs a label.

When developing an idea to use in a cybertank's AI, it is a good idea to use the following three step procedure:

1. Determine the thought process required for you as a human to accomplish the goal.
2. Convert your human thought process to that of a cybertank. Always keep in mind the limitations of a cybertank. In the above examples, a person could have picked up a chair and moved it out of his or her path. A cybertank does not have the luxury of arms with which to physically move objects; therefore, a cybertank must accomplish the needed action the best way it can. Since a cybertank cannot physically move the obstruction, it would attempt to shoot and destroy it.
3. The last step in developing an AI routine is converting the thought process to CCL instructions that the cybertank can understand. If you use the type of flow diagrams shown in the above examples, this conversion process should be painless.

To aid in your design training, this three step procedure will be used in the next two sections.

The above SMARTMOVE routine is going to be an integral part of your first cybertank created from scratch, so go ahead and enter it into the AI editor and **AUTHORIZE** it. When Authorization is complete, proceed to the ECM. When the File Modification Panel (FMP) asks if you want to save the changes you have made to **GAMMA**, select YES.

Once you are in the ECM, proceed to the Simulation Design Module (SDM) and design a battle simulation using your new cybertank, **GAMMA**. Include all of the other tanks you have worked on in previous sections of this Training Guide. Choose **Austin** as the battlefield. Austin has a lot of trees and buildings which **GAMMA** will have to maneuver around. Save the simulation design as **GAMMASIM**.

After designing the simulation, proceed to the Combat Simulation Module (CSM) and select the **GAMMASIM** simulation design. If you did everything correctly, you should see **GAMMA** moving around the battlefield. **GAMMA** should be shooting its way through trees and small buildings, but should be turning away from large buildings, brick walls, and water. If **GAMMA** does not seem to function correctly, go back to the AI Module and check the AI you entered.

After watching **GAMMA** for a while, you will notice that it does not search for enemy cybertanks and does not fight back when an enemy attacks it. That is because no AI has yet been designed to handle these situations. This is what will be covered in the next section.

At this time, proceed back to the AI Module.

6.6.4 Searching For an Enemy

Searching for an enemy cybertank is actually one of the easier tasks in designing AI. Think of a battle simulation as a game of "Hide and Seek." Your cybertank is "IT" and all the other cybertanks are somewhere out on the battlefield hiding. It is your job to find them.

If you were "IT" in a game of hide and seek, how would you go about finding the other players? If you are like most people, you would go from area to area, always looking around you for any sight of a head bobbing up from behind a table or a foot sticking out from under the curtains. This thought process is depicted in Diagram 6.6.4.1.

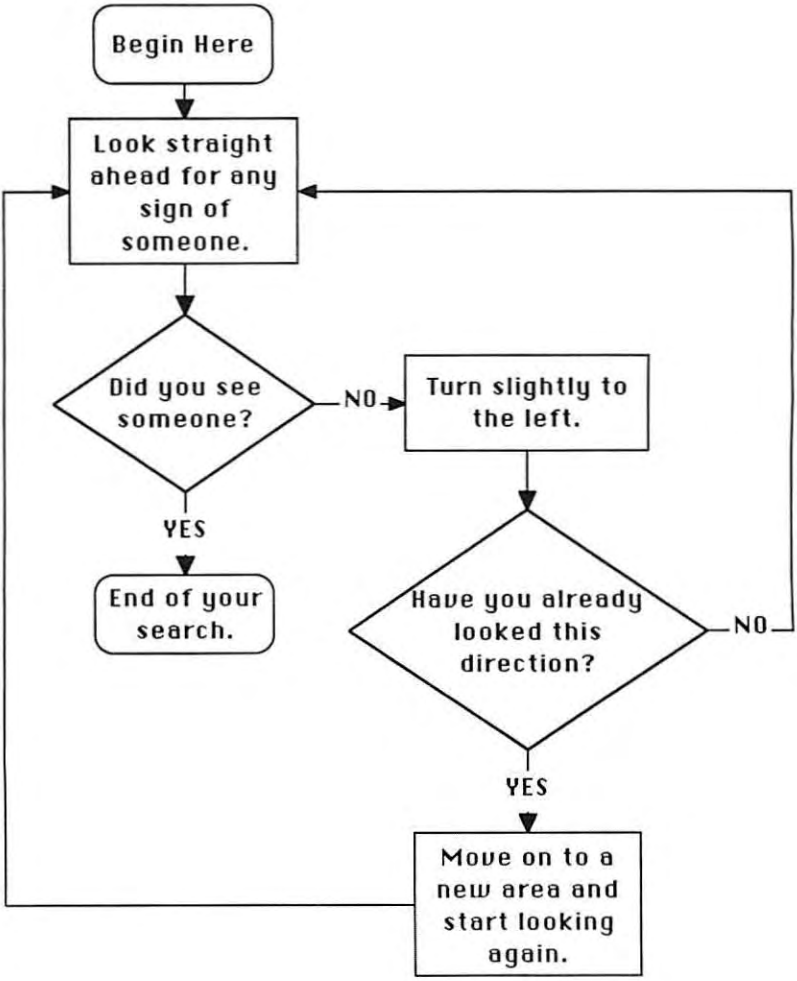

Begin Here
Look straight ahead for any sign of someone.
Did you see someone?
NO
Turn slightly to the left.
YES
End of your search.
Have you already looked this direction?
NO
YES
Move on to a new area and start looking again.

Diagram 6.6.4.1 -- Process flow of Hide and Seek

When converting the above process flow into cybertank terminology, you must take into account the differences between humans and cybertanks. Whereas a human has eyes, a cybertank has a scanner mechanism. It uses the scanner to "look" in a particular direction. If the scanner detects an enemy cybertank, it informs the on-board computer system just as the eyes would inform the brain that a person has been seen hiding under a table. With this in mind, the above human thought process can be converted to cybertank terminology as shown in Diagram 6.6.4.2.

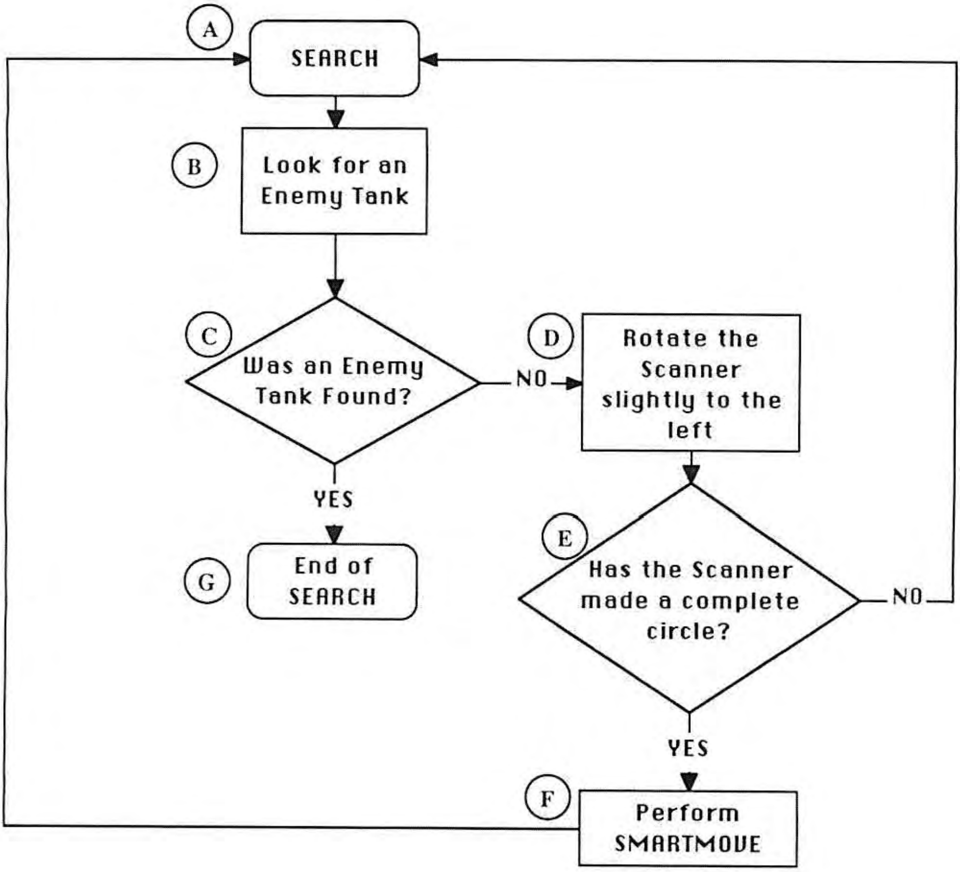


Diagram 6.6.4.2 -- Process flow of Cybertank Search

There are several points regarding the cybertank thought process that bear further discussion. The box labeled "F" uses the SMARTMOVE routine which was designed in the previous section. It is analogous to the "Move to a new area and start looking again" box in the Hide and Seek thought process. By moving the cybertank forward (or possibly off in a new direction due to obstacles), it is better able to cover a larger area of the battlefield in search of enemy cybertanks than it would if it just sat in one place. Going back to the Hide and Seek example, if a human stayed in one spot continually looking for people, the game would never end.

Another item that warrants further discussion is Box "E". Box "E" performs the same function as the "Have you already looked in this direction?" in the Hide and Seek thought process. Box "E" is only true (an answer of yes) when the scanner has made a complete 360° revolution. When this is true, Box "F" will be performed and the whole process will repeat.

Going back to the Hide and Seek example, assume that your head can rotate a complete 360° revolution. If you walked into a new area to search, you could continually scan the area for people as you slowly rotated your head. As soon as your head returned to its "normal" position (i.e., straight ahead), you would know that you had scanned the entire area and could therefore move on to another area. This same type of procedure can be used with cybertanks. By checking to see if the scanner is aligned with the chassis of the cybertank, it is possible to determine if the scanner has rotated 360^0.

With these facts in mind, the above cybertank search process can be converted to CCL instructions as follows:

```
A ==>       SEARCH
B ==>             SCAN FOR ENEMY TANK
C ==>             IF ENEMY TANK WAS FOUND THEN BRANCH TO
                       ENDSEARCH
D ==>             ROTATE SCANNER LEFT 1
```

```
E ==>          IF TANK IS NOT ALIGNED WITH SCANNER THEN
                  SEARCH
F ==>          DO SMARTMOVE
               BRANCH TO SEARCH
G ==>     ENDSEARCH
               RESUME
```

Go ahead and enter this SEARCH routine into **GAMMA**'s AI. Since this is a "routine", we need a few instructions which "use" or call it. You can accomplished this with the following lines:

```
          START
               DO SEARCH
               BRANCH TO START
```

These lines should be the first instructions in **GAMMA**'s AI. Since the routine SEARCH exits (or ends) when an enemy cybertank is found, the BRANCH TO START instruction is used to send the cybertank's on-board computer back to the beginning of the AI (the label START).

With these three lines, the SMARTMOVE routine, and the SEARCH routine entered into **GAMMA**'s AI, **GAMMA** should be able to move around the battlefield searching for an enemy. At this time, go ahead and AUTHORIZE **GAMMA**. If your version of **GAMMA** did not AUTHORIZE properly, check your AI commands to make sure you entered them correctly.

Once you have an AUTHORIZED version of **GAMMA**, proceed to the Combat Simulation Module (CSM). When the File Modification Panel (FMP) asks if you want to save the changes you have made to **GAMMA**, select YES.

When the CSM asks which simulation to use, you should select **GAMMASIM**.

Once the simulation begins, you will see **GAMMA** moving around the battlefield. Since your cybertank's turret always rotates with the scanner, when a new direction is specified, you should see **GAMMA**'s turret turning in a counter-clockwise direction. If **GAMMA** happens to detect an enemy cybertank, it will stop moving and continually scan in the direction of the detected enemy cybertank. This is because there is no AI in **GAMMA** that is designed to hunt or track down an enemy. As soon as the SEARCH routine detects an enemy cybertank, it exits and the on-board computer system returns to the line directly after the "DO SEARCH" instruction. Since the next instruction after the "DO SEARCH" is a "BRANCH TO START" instruction, the on-board computer system begins executing the instructions directly after the label "START". Since the instruction directly after the label "START" is "DO SEARCH", the computer system directs AI execution to the routine SEARCH. The first instruction in the SEARCH routine is "SCAN FOR ENEMY TANK". At this point, there is a very good chance that the enemy cybertank found earlier will be found again. If the enemy cybertank is found again, then the SEARCH routine exits, the computer system directs AI execution back to the "BRANCH TO START" instruction, and the process repeats. In this situation, **GAMMA**'s on-board computer system will continue this loop until the enemy cybertank moves out of **GAMMA**'s view. When (and if) the enemy cybertank moves out of **GAMMA**'s view, **GAMMA** will go back to its normal scanning pattern until it detects another enemy cybertank. To solve this problem, the next section describes the creation of a "HUNT" routine.

After watching **GAMMA** search for enemy cybertanks for a while, proceed to the AI Module to create the last basic function of a cybertank.

6.6.5 HUNTING THE ENEMY

Now that your cybertank is moving around the battlefield and searching for enemy cybertanks, it is time to tackle the last aspect of designing a cybertank from scratch -- hunting down and destroying the enemy.

Going back to the example game of "Hide and Seek," assume that you not only have to find the people hiding, but you must also "tag" them before they make it back to home base. Under this situation, you must ask yourself "Once I have found someone, how do I get close enough to tag him?" If you are like most people, you would move in the direction in which you last saw the person. For example, if you walk into a room and see someone in the back-right corner, you will begin moving towards the back-right corner. As long as the person stays in that corner, you will continue moving towards him. If, however, the person sees you coming and starts to run away, you would change your direction of pursuit to follow the person. Once you move to within arms-reach of the person, you would reach out and attempt to "tag" him.

The above human thought process could be represented like that shown in Diagram 6.6.5.1

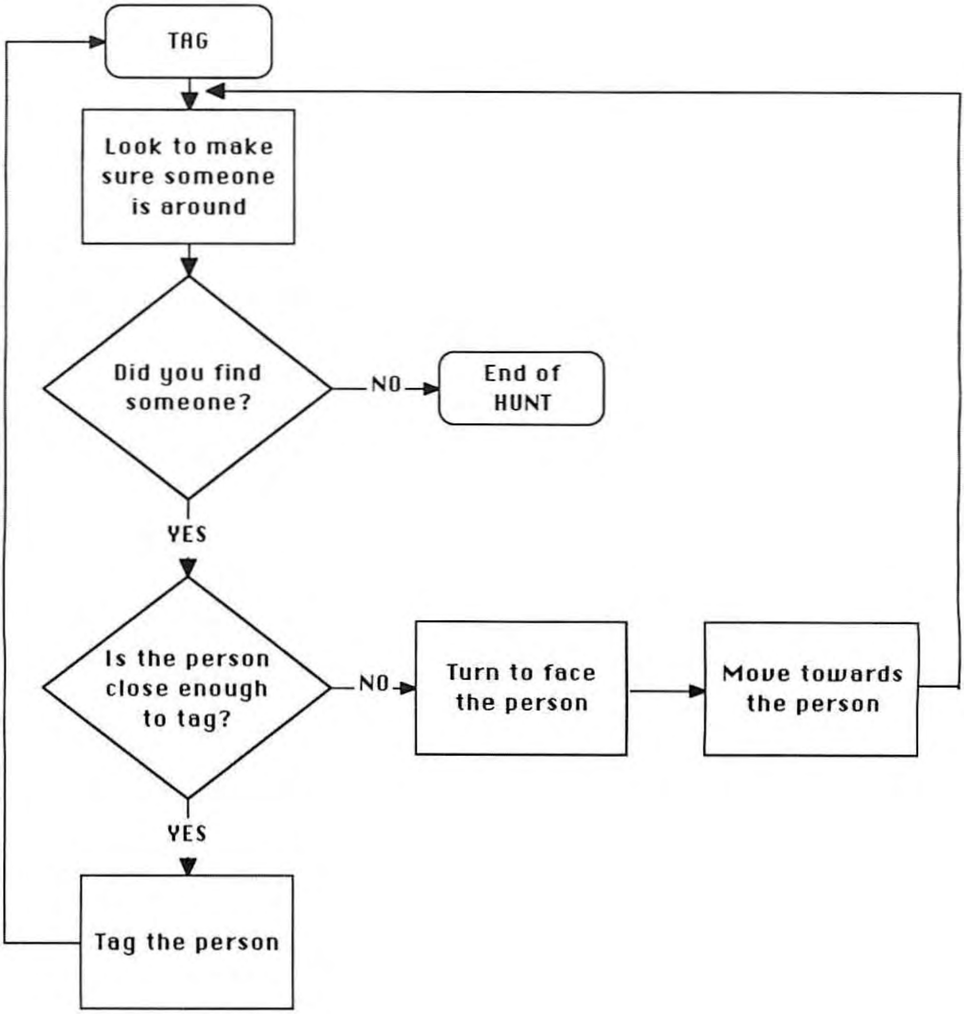


Diagram 6.6.5.1 -- Human thought process of tagging an opponent

When converting the above human thought process to that of a cybertank, you must remember that the purpose of the cybertank is to destroy the enemy, not simply "tag" it.

Converted to cybertank terminology, the above Diagram would look something like Diagram 6.6.5.2.

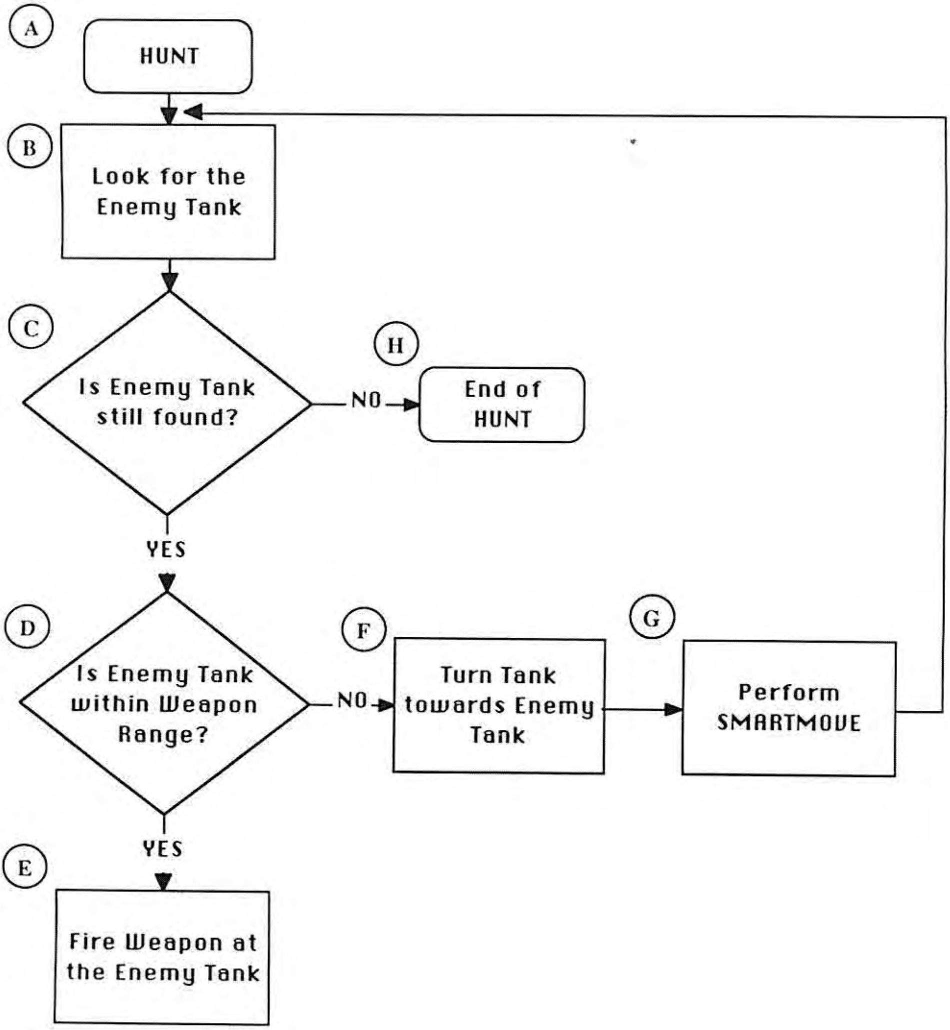

A
HUNT
B
Look for the Enemy Tank
C
Is Enemy Tank still found?
NO
H
End of HUNT
YES
D
Is Enemy Tank within Weapon Range?
NO
F
Turn Tank towards Enemy Tank
G
Perform SMARTMOVE
YES
E
Fire Weapon at the Enemy Tank

Diagram 6.6.5.2 -- Process flow of cybertank HUNT

Your cybertank's HUNT routine will only be called when the SEARCH routine (designed in Section 6.6.4) has succeeded in detecting a cybertank. It should be noted that the HUNT routine will abort if the enemy cybertank manages to elude it. In other words, if the HUNT routine loses sight of the enemy, it will abort and execution will go back to the SEARCH routine.

It should also be noted that a cybertank's weapon has a maximum range of four (4) hectometers, therefore a cybertank must move very close to the enemy before firing at it is practical.

Once the cybertank process flow is created, it can be converted to actual CCL commands as follows:

```
A ==>     HUNT
B ==>           SCAN FOR ENEMY TANK
C ==>           IF ENEMY TANK WAS NOT FOUND THEN BRANCH
                   TO HUNTDONE
D ==>           IF ENEMY TANK IS BEYOND WEAPON RANGE THEN
                   BRANCH TO CLOSEIN
E ==>           FIRE WEAPON AT ENEMY TANK
                BRANCH TO HUNT
F ==>     CLOSEIN
                TURN TANK TO FACE ENEMY TANK
G ==>           DO SMARTMOVE
                BRANCH TO HUNT
H ==>     HUNTDONE
                RESUME
```

Go ahead and enter this HUNT routine into **GAMMA**'s AI. Since this is another routine, you need another instruction to "use" or call it when necessary. This is accomplished by inserting the line "DO HUNT" before the "BRANCH TO START" instruction at the beginning of **GAMMA**'s AI. The beginning of **GAMMA**'s AI should look like the following:

```
    START
          DO SEARCH
          DO HUNT
          BRANCH TO START
```

With these instructions, the SMARTMOVE routine, the SEARCH routine, and the newly created HUNT routine entered into **GAMMA**'s AI, **GAMMA** will now be able to move around the battlefield, search for enemy cybertanks, move towards any enemy cybertanks found, and attempt to destroy them. At this time, go ahead and AUTHORIZE **GAMMA**. If your version of **GAMMA** does not AUTHORIZE properly, check all of your AI commands to make sure you have entered them correctly.

Once you have an AUTHORIZED version of **GAMMA**, proceed to the Combat Simulation Module (CSM). When the OSI/CACD System 2 asks if you want to save the changes you have made to **GAMMA**, select YES.

When the CSM asks which simulation is to be used, you should select **GAMMASIM**.

Once the simulation begins, you should see **GAMMA** moving around the battlefield searching for enemy cybertanks. When **GAMMA** detects an enemy cybertank, it should turn to face it and begin moving towards it. Remember, if an obstruction blocks **GAMMA**'s scanner the HUNT routine will "give up" and quit hunting. At that point, **GAMMA** will resume searching for other enemy cybertanks. Once **GAMMA** finds a clear path to an enemy cybertank, it should move to within weapon range (4 hectometers) and then begin firing. **GAMMA** will continue to fire at the enemy cybertank until one of three conditions is met: 1) **GAMMA** is destroyed, 2) the enemy cybertank is destroyed, or 3) the enemy cybertank moves in such a way that it is no longer detected by **GAMMA**. Of course, the condition we are most interested in is the destruction of the enemy cybertank.

After watching **GAMMA** search for enemy cybertanks and (hopefully) destroy a few, pat yourself on the back for a job well done. You have successfully designed and implemented a cybertank from scratch. You have seen what it takes to create a cybertank without the use of Library Capsules and you have done well. If you keep in mind the three steps outlined in the previous sections in regards to creating a cybertank's AI, you will do very well when creating future cybertank designs. Remember to always ask yourself the basic question "If I were a cybertank, what would I do?"

6.7 GOING AT IT ALONE

Now you are ready to design your own cybertanks using the Full Custom Design techniques discussed in the previous three sections. Use what you have learned to design the best AI you can. Borrow ideas from other designs and add your own. Remember to use the three step procedure outlined in the above sections.

1> Determine the thought process necessary for a human to accomplish the task.

2> Convert the human thought process to that of a cybertank.

3> Convert the cybertank thought process to actual CCL commands.

You will probably have problems getting your first few designs authorized. If this happens, do not panic. Check your commands carefully and try again.

Once your cybertank design has been successfully authorized, save it. Next, you should create a new simulation design using your new cybertank as the primary cybertank, and with GAMMA, ALPHA, BETA, and VIPER as the other cybertanks. Choose a battlefield and save the simulation design.

Run the simulation and see how your new cybertank fares.

If you do not like it, transfer back to the Design Control Module (DCM) and improve it. Testing your cybertank design is the topic of the next section.

SECTION 7
TESTING A CYBERTANK

SECTION BRIEF

This section describes the Cybertank Test Module (CTM), the primary diagnostic tool for design problems.

7.1 THE CYBERTANK TEST MODULE

OSI/CACD System 2 includes a facility used for testing cybertanks known as the **Cybertank Test Module** (CTM). The CTM is particularly helpful when a cybertank is not behaving as the designer intended. Such discrepancies are usually due to incorrectly formulated AI, and are known as "bugs". The CTM is commonly referred to as the "debugger."

7.1.1 Loading the Simulation Design

In order to test a cybertank, you must first have a simulation design in which the cybertank to be tested is the Primary Cybertank. In this section, GAMMA will be tested using the simulation design GAMMASIM.

To begin testing your cybertank, select **TEST CYBERTANK** from the **DESIGN** menu. When the File Retrieval Panel (FRP) appears, select GAMMASIM.

7.1.2 The CTM Control Panel

After you select the simulation design to be used for testing, the OSI/CACD loads the related cybertanks and battlefield, then transfers you to the CTM. The CTM automatically starts the simulation. The CTM is actually an extensively modified version of the Combat Simulation Module (CSM).

The CTM differs from the CSM in several ways. The instrument panel has been replaced by a display area, and the **SIMULATE** menu has been replaced by the **DEBUGGER** menu. The CTM operates in one of two modes -- **Trace Mode** and **Status Mode**. The mode can be toggled by selecting and deselecting **TRACE MODE ON** from the **DEBUGGER** menu.

NOTE: If during the following sections of the Training Guide, **GAMMA** gets destroyed, select **RESTART** from the **DEBUGGER** menu.

7.2 TRACE MODE

When the CTM is in **Trace Mode**, as it is now, the display area on the right side of the screen shows the cybertank's AI. The upper part of this display area shows the cybertank number and name (currently #01: GAMMA), and the Label of the section of AI currently being executed. The lower part of this display area shows the cybertank's "thoughts".

A great deal can be learned by watching the cybertank's behavior on the battlefield while examining its AI being processed. Trace Mode allows you to see the cybertank's commands as they are being processed.

7.2.1 Pausing the Test

Press the **PAUSE** key to pause the test. The **PAUSE** key works the same way in the CTM as it does in the CSM. That is, pressing it toggles the pause mode on and off. See the OSI/CACD System 2 Reference Card to determine the **PAUSE** key for your particular terminal type.

7.2.2 Single Stepping

When the test is paused, pressing the **STEP** key causes the test to run just long enough to process one CCL command, after which the test remains paused. This allows you to examine the AI and its effects one command at a time. This feature is known as **single stepping**. See the OSI/CACD System 2 Reference Card to determine the **STEP** key for your particular terminal type.

Experiment with pausing and single stepping now.

7.3 STATUS MODE

Status Mode lets you examine the cybertank's current **status registers**. These status registers are comprised of various System and User Variables used by the cybertank. User variables and certain System Variables can be altered for testing under specific conditions.

7.3.1 Selecting Status Mode

Change from Trace Mode to Status Mode by deselecting **TRACE MODE ON** from the **DEBUGGER** menu. The display area on the right side of the screen shows one of several different **pages** of status registers.

Note: When Trace Mode is on, you will notice a check mark in the Debugger menu. When Trace Mode is off, the check mark is removed.

Three groups of System Variables are displayed on the current page. Use the **PAGE SELECT** keys to view other pages. Consult the OSI/CACD System 2 Reference Card to determine which keys to use on your terminal.

7.3.2 Changing Status Registers

It is sometimes useful to change the value of a specific status register while testing a cybertank. This can help you check the cybertank's response to a particular situation. Status registers can only be altered when you have paused the test.

Note: Not all of the status registers can be altered. Consult Part 2, Section 5.5 of the Engineer's Handbook to determine which registers can be altered.

To alter a status register, first use the **PAGE SELECT** keys until the appropriate register is displayed. Next, select the register by using either a mouse/joystick or the **REGISTER SELECT** keys (consult the OSI/CACD System 2 Reference Card to determine which keys to use on your terminal). The current value of the status register is highlighted. Finally, enter the new value using the keyboard and press RETURN.

Note: Most status registers have restrictions on what value can be entered. For example, the X-Location of the cybertank ranges from 1-62. Entering a value larger than 62 is invalid.

Experiment with changing status registers. Changing the **X Location** and **Y Location** under **TANK** relocates the cybertank to the new location entered.

When you are finished testing your cybertank, select **EXIT** from the **DEBUGGER** menu. The OSI/CACD transfers you to the ECM.

SECTION 8
CLEARANCE EVALUATION

SECTION BRIEF

This section describes procedures used in obtaining a Clearance Evaluation.

8.1 PROMOTION CRITERIA

As an OSI employee, you may request an evaluation at any time. The Cybernetic Engineering Division of OSI uses employee performance as the sole criterion for advancement. Promotions are accompanied by an automatic Clearance Level upgrade and an increased budget.

To aid OSI management in making objective performance assessments, an automated system for evaluating cybertanks has been installed in the OSI/CACD System 2. When you request a Clearance Evaluation, you are required to submit a cybertank design as an example of your work.

Your cybertank will be subjected to ten (10) simulated battles – against a cybertank created by OSI, and on a battlefield created by OSI. If your cybertank design is adequate (wins at least 7 out of the 10 battles), as demonstrated by its success in combat, the Director will approve your promotion.

8.2 REQUESTING A CLEARANCE EVALUATION

You may request a Clearance Evaluation electronically through your terminal. Select **CLEARANCE EVALUATION** from the EMPLOYEE menu. The File Retrieval Panel (FRP) appears. You should then select your best *authorized* cybertank for evaluation.

8.3 THE EVALUATION PROCESS

After you have selected your cybertank, the OSI/CACD loads your cybertank, an OSI cybertank, and an OSI battlefield. The OSI cybertank is your cybertank's enemy during the evaluation. A modified version of the Combat Simulation Module (CSM) is used to perform the evaluation. Most of the functions of the standard CSM, such as the satellite view, are available under the **EVALUATION** menu.

To complete the evaluation process as quickly as possible, you can turn off the sound and graphics. It is advisable, however, to examine the battles closely to identify the enemy's weaknesses.

8.4 PROMOTION APPROVAL

When your evaluation is complete, an official OSI Employee Evaluation Report is filed. The Printer Setup Panel (PSP) appears and you can display the report on your terminal screen or send it to your printer (if one is connected). For more information regarding the PSP, please refer to the OSI/CACD System 2 Reference Card.

NOTE: For users of Commodore 64 terminals only:

The OSI Employee Evaluation Report cannot be directed to a printer.

If your cybertank fared well (wins at least 7 of the 10 battles), the report is stamped "Promotion Approved," and your Clearance Level is raised accordingly. If not, do not be discouraged. Your skills will improve with experience.

8.5 TIME FOR A VACATION

Congratulations. You are now conversant in the basics of cybernetics. You have completed the OSI training program in record time, and your accomplishments have been noted. The Director has granted you a two-week vacation. Enjoy it if you can!

PART 2
MODULE REFERENCE

SYNOPSIS

This section is designed for new and experienced employees. The Module Reference provides quick access to all functions of the OSI/CACD System 2 operating environment. All sections of the OSI/CACD System 2 are covered in detail.

SECTION 1

EXTERNAL CONTROL MODULE

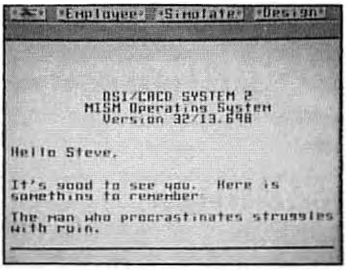
SECTION BRIEF

This section describes the menu commands and functions of the External Control Module (ECM).

1.1 ECM FUNCTION AND LAYOUT

The **External Control Module** (ECM) is the launching point for all modules in the **OSI/CACD System 2.**

On the menu bar at the top of your terminal you will see four selection menus. These are:

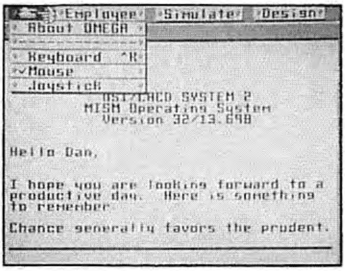


```
          OSI/CACD SYSTEM 2
        MISM Operating System
          Version 32/13.698

Hello Steve,

It's good to see you.  Here is
something to remember:

The man who procrastinates struggles
with ruin.
```

Diagram 1.1.0 -- OSI/CACD System 2 ECM menu bar

These selection menus represent gateways into other areas of the **OSI/CACD System 2.**

1.1.1 The SYSTEM Menu



OSI/CACD SYSTEM 2
MISM Operating System
Version 32/13.698

Hello Dan,

I hope you are looking forward to a productive day. Here is something to remember

Chance generally favors the prudent.

Diagram 1.1.1 --SYSTEM Menu

This menu, represented by the cybertank icon, is referred to as the **SYSTEM Menu**. The following functions are available within it:

ABOUT OMEGA
Displays the copyright notice and the name of the principal system designer.

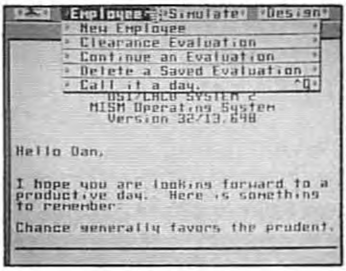
KEYBOARD
Selects the keyboard as your primary input device.

MOUSE
Selects the mouse as your primary input device.

JOYSTICK
Selects the joystick as your primary input device.

Special Note: Not all input devices are supported on all terminal types.

1.1.2 The EMPLOYEE Menu



```
            OSI/CACO SYSTEM 2
        MISM Operating System
          Version 32/13.698

Hello Dan,

I hope you are looking forward to a
productive day.  Here is something
to remember:

Chance generally favors the prudent.
```

Diagram 1.1.2 --EMPLOYEE Menu

NEW EMPLOYEE
Returns you to the Security Entrance Procedure at OSI's main complex entrance.

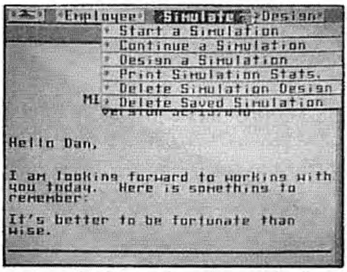
CLEARANCE EVALUATION
Initiates an Employee·Evaluation request for possible promotion to a higher clearance level.

CONTINUE AN EVALUATION
Continues a previously saved Clearance Evaluation.

DELETE SAVED EVALUATION
Deletes a previously saved Clearance Evaluation. See Section 9.3 for more information on using the File Termination Panel (FTP).

CALL IT A DAY
Performs a security shutdown of your computer terminal and unlocks your office door so you can leave. Excessive early departures will be duly noted.

1.1.3 The SIMULATE Menu



Hello Dan,

I am looking forward to working with you today. Here is something to remember:

It's better to be fortunate than wise.

Diagram 1.1.3 –SIMULATE Menu

START A SIMULATION
Invokes the Combat Simulation Module.

CONTINUE A SIMULATION
Invokes the Combat Simulation Module and continues a previously saved simulation.

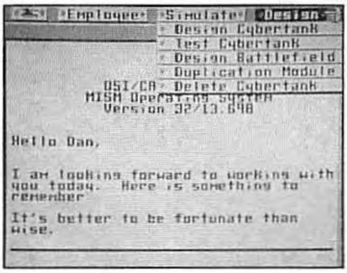
DESIGN A SIMULATION
Invokes the Simulation Design Module.

PRINT SIMULATION STATS
Prints the various statistics of a simulation to your printer. See Section 1.2 for detailed information.

DELETE A SIMULATION DESIGN
Deletes a simulation design that was created with the Simulation Design Module.

DELETE SAVED SIMULATION
Deletes a simulation that was saved from the Combat Simulation Module.

1.1.4 The DESIGN Menu



```
OSI/CA
MISM Operating System
Version 32/13.648

Hello Dan,

I am looking forward to working with
you today.  Here is something to
remember

It's better to be fortunate than
wise.
```

Diagram 1.1.4 --DESIGN Menu

DESIGN CYBERTANKS
Invokes the modules used to create and modify cybertanks.

TEST CYBERTANK
Invokes the Cybertank Test Module used to test cybertanks in a simulation.

DESIGN BATTLEFIELD
Invokes the Battlefield Design Module.

DUPLICATION MODULE
Invokes the Data Duplication Module.

DELETE CYBERTANK
Deletes a cybertank from a your ID Disc.

1.2 SIMULATION STATISTICS

A very useful feature of the ECM is the ability to print simulation statistics. At any time, you can choose this option to view the various statistics for a simulation design. Below is a sample printout of simulation statistics:

```
                 NUMBER OF TANKS:     4

                 NUMBER OF BATTLES:   12


                 [ CUMULATIVE RANKINGS ]

TANK NAME        1    2    3    4    5    6    7

ALPHA            6    3    2    1
BETA             4    4    3    1
GAMMA            1    4    5    2
DINKY            1    1    2    8
```

Diagram 1.2 -- Simulation Statistics

The above example of Simulation Statistics tells us a number of things. This example tells us that the cybertank ALPHA was the most successful. ALPHA won 6 out of the 12 simulations. Next was BETA which won 4 our of the 12 simulations. These numbers are discovered by examining the numbers along the column labeled "1 ". This column tells us how many times each cybertank came in "first place." The other columns tell us how many times each cybertank came in all of the other places (second thru seventh place). By examining the Simulation Statistics for a given set of battles, it is rather easy to determine each cybertank's relative strength and effectiveness.

1.3 ELECTRONIC MAIL SYSTEM

An important feature of the ECM is its electronic mail system (EMAIL). All OSI memorandums are posted through the EMAIL system. Additionally, it is important that key personnel be kept abreast of world events. The ECM will brief you on current national and world events, as well as internal news bulletins. These news briefings, along with OSI memorandums, are mandatory reading for all personnel.

SECTION 2

DESIGNING A CYBERTANK

SECTION BRIEF

This section describes the OSI/CACD System 2 modules used to create and modify cybertank designs.

2.1 GENERAL INFORMATION

The two main areas of cybertank design are: 1) the chassis, and 2) artificial intelligence (AI).

The chassis includes the hardware and mechanical components of a cybertank. Chassis design is limited only by your budget. The chassis is created and modified using the **Chassis Design Module (CDM).**

Once a chassis is designed, the cybertank must be given the intelligence to function. A cybertank's intelligence is limited only by your skill as a cybernetics engineer. A cybertank's AI is created and modified using the **Artificial Intelligence Module (AI Module).**

OSI authorization is mandatory for all cybertank designs. Only those cybertanks that conform to OSI design specifications are cleared for combat simulations. Cybertank designs are authorized using the **Cybertank Authorization Module (CAM).**

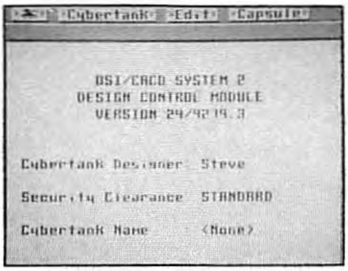
2.2 DESIGN CONTROL MODULE

The **Design Control Module (DCM)** is the initial launching point for the Chassis Design Module (CDM), Artificial

Intelligence Module (AI Module), and Cybertank Authorization Module (CAM).

The DCM is entered by selecting **DESIGN A CYBERTANK** from the DESIGN menu in the External Control Module (ECM).

The DCM screen displays the designer's name, clearance, and the current cybertank design, if one has previously been loaded (see Diagram 2.2.0).



OSI/CACD SYSTEM 2
DESIGN CONTROL MODULE
VERSION 24/9219.3

Cybertank Designer: Steve

Security Clearance: STANDARD

Cybertank Name : <None>

Diagram 2.2.0 -- DCM

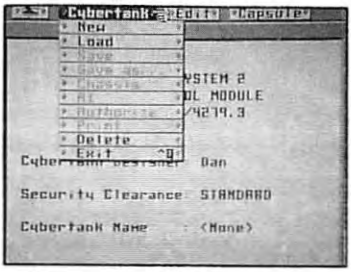
To design a new cybertank or edit an existing one, select either **NEW** or **LOAD**, both located within the **CYBERTANK** menu. For a new cybertank, enter the name of the cybertank to be created and press **SAVE**. You will be transferred to the Chassis Design Module (see Section 2.3) to create your cybertank's chassis. If you wish to edit an existing cybertank, select the **LOAD** option in the **CYBERTANK** menu. The selected cybertank is loaded and you are transferred to the AI Module (see Section 2.4).

The next time you enter the DCM, you are immediately transferred to the AI module, with the last modified cybertank design loaded. This default option is provided for your convenience, since you will probably edit your cybertank's AI instead of its chassis. If you wish to edit the chassis, simply select the **CHASSIS** option in the **CYBERTANK** menu.

NOTE: There are several instances in which the last cybertank design will not be loaded. It usually occurs when the design was not located in any of the available access slots. If this happens, the design must be loaded manually.

The DCM, CDM, and AI Module all share the same menus. Different menu items are enabled or disabled depending upon the module you are using. The menus are described in this section. Features unique to each module are discussed in the following sections.

2.2.1 The CYBERTANK Menu



Cybertank Designer Dan

Security Clearance STANDARD

Cybertank Name : <None>

Diagram 2.2.1 --CYBERTANK Menu

NEW

Allows you to create a new cybertank design. If selected, the File Storage Panel (FSP - see Section 9.1) appears. Enter the name of your new cybertank design and select the **SAVE** button. You will be transferred to the CDM to design the new cybertank's chassis (see Section 2.3).

LOAD

Lets you retrieve a previously saved cybertank design. If selected, the File Retrieval Panel (FRP - see Section 9.2) appears. Select the cybertank design you wish to load and you are transferred to the AI Module (see Section 2.4).

SAVE

Stores the current cybertank design to your ID Disc.

SAVE AS

Allows you to save the current cybertank design using a new name. If selected, the FSP apppears. Enter a new name for your cybertank design. It should be noted that the new version of the design is totally separate from the original. The original remains unchanged. After saving, the new cybertank design file becomes the working design.

CHASSIS

Transfers you to the Chassis Design Module (CDM) (see Section 2.3).

AI

Transfers you to the AI Module (see Section 2.4).

AUTHORIZE

Transfers you to the Cybertank Authorization Module (CAM) for approval of your cybertank design in conforming to OSI's specifications (see Section 2.6).

PRINT

Prints the current cybertank design. The printout contains the cybertank's chassis components and a complete listing of its artificial intelligence. Refer to the OSI/CACD System 2

Reference Card for more specific printing instructions.

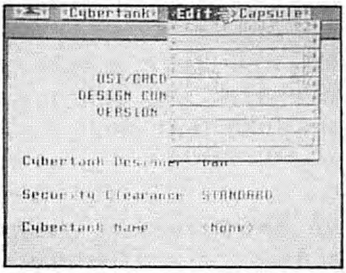
DELETE
Used for deleting cybertank designs from your ID Disc. If selected, the File Termination Panel (FTP - see Section 9.3) appears with the names of all the cybertank designs on your ID Disc displayed. Highlight the name of the cybertank design you wish to remove and select the **DELETE** button.

WARNING:

Once a cybertank design is terminated, it cannot be recovered!

QUIT
Exits the DCM and returns you to the External Control Module (ECM).

2.2.2 The EDIT Menu



OSI/CRCD
DESIGN CON
VERSION

Cybertank Designer Dan

Security Clearance STANDARD

Cybertank Name <None>

Diagram 2.2.2 –EDIT Menu

CUT
Removes selected text from the AI and places it in temporary storage.

COPY

Places selected text into temporary storage without removing it from the AI.

NOTE: Only the last saved text is kept in temporary storage. When you cut or copy new text, previously stored text is lost.

PASTE

Inserts all text in temporary storage at the current cursor position. If text has been highlighted/selected, it is replaced by the pasted text.

CLEAR

Removes selected text from the AI without disturbing the contents of the temporary storage buffer.

SELECT All

Selects all of the text in the AI.

EXPANDED TEXT

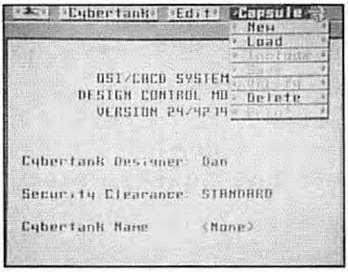
Toggles between the short command structure and the long, verbose structure when using the CCL Construction Panel (CP - see Section 2.5). For example, the command "If Tank Found Then Shoot" becomes "If Enemy Tank Was Found Then Shoot" when **EXPANDED TEXT** is turned on. The default setting is **EXPANDED TEXT** on, denoted by a checkmark preceeding the **EXPANDED TEXT** menu item.

UNDO

*Special Note: The **UNDO** feature is not supported on Commodore 64 and Apple //+,c,e terminals.*

There will be times when you mistakenly delete portions of AI and your suddenly realize the error of doing so. If you immediately select the **UNDO** option from the **EDIT** menu, then your last action will be undone. Please note that this only works if you *immediately* select **UNDO**.

2.2.3 The CAPSULE Menu



OSI/CACD SYSTEM
DESIGN CONTROL MO
VERSION 24/42.14

Cybertank Designer: Dan

Security Clearance: STANDARD

Cybertank Name <None>

Diagram 2.2.3 --CAPSULE Menu

Special Note: See Part 4 for a complete description of the creation and use of AI Capsules.

NEW
Used to initiate the design of a new AI Capsule. When selected, you are transferred directly to the AI Module (see Section 2.4).

LOAD
Used to retrieve a previously saved AI Capsule. If selected, the FRP appears. Highlight the desired capsule and select the **LOAD** button. You are transferred to the AI Module (see Section 2.4), with the selected capsule loaded.

INCLUDE
Used to place an AI Capsule into your cybertank's AI. When selected, the FRP is displayed. Select the desired AI Capsule and it will be inserted at the current cursor position.

SAVE
Used to save the current AI Capsule.

VERIFY

Used to check an AI Capsule for syntax errors. This process is analagous to the Authorization procedure used when designing cybertanks, but no chassis design is required.

DELETE

Used to remove AI Capsules from your ID Disc. When selected, the FTP displays the names of all AI Capsules on your ID Disc. Highlight the AI Capsule you want to delete and select the **DELETE** button.

WARNING

Once an AI Capsule has been deleted, it cannot be recovered!

PRINT

Prints a complete listing of the current AI Capsule to your printer. Refer to the OSI/CACD System 2 Reference Card for more specific instructions for printing.

2.3 CHASSIS DESIGN MODULE

2.3.1 GENERAL

The Chassis Design Module (CDM) is used to create and modify a cybertank's chassis, including its tank class, fuel cells, drive system, weapon type, scanner, and assorted special items.

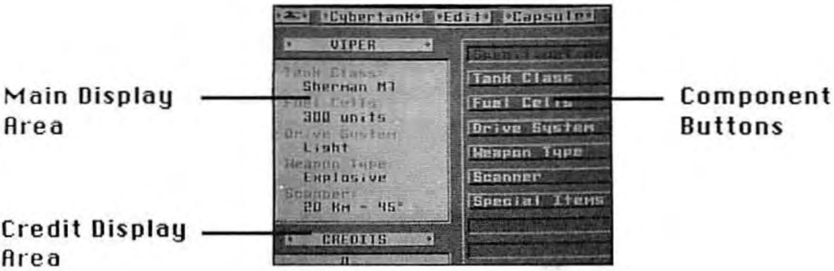
A varied selection of components provides endless possibilites for chassis design - limited only by budget restrictions. Due to variations in price and attributes, it is important to be selective with the components used in your design. Some tank classes weigh more than others, some weapons fire faster than others, etc. To assist in the design phase, the attributes of each component are included in tables in this section.

You must choose at least one of each component, with the exception of **Special Items**. If you fail to equip your cybertank with one of each component, your cybertank will be useless and thus not authorized for combat simulations.

Chassis design is limited by your budget. Your budget is limited by your security clearance. Entry-level security clearance is designated **STANDARD**. There are ten clearance levels available to cybernetic engineers. Promotions to higher clearance levels are based upon the efficiency and effectiveness of your cybertanks (see Section 6, CLEARANCE EVALUATION). A budget of 1000 credits accompanies a STANDARD Clearance. Each successive clearance level increases your budget by 1000 credits.

2.3.2 CDM CONTROLS

Upon entering the CDM, the cybertank's general specifications are displayed in the the **Main Display Area** (see Diagram 2.3.2). These specifications can be displayed at any time by selecting the **Specifications** button.



Tank Class:
Sherman M7
Fuel Cells:
300 units
Drive System:
Light
Weapon Type:
Explosive
Scanner:
20 Km - 45°

0

Diagram 2.3.2 -- Chassis Design Module (CDM)

Select any of the other component buttons (**Tank Class, Fuel Cells, Drive System, Weapon Type, Scanner**, or **Special Items**) to display a list of specific options for that component. Choose the desired component and the small, circular button directly to the left of the item becomes highlighted. With the exception of **Special Items**, you can select only one option per component. You can select all of the options in **Special Items** (if you have enough credits).

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

Selected items are designated by a small diamond to the left of item, not a small, circular button.

2.3.3 TANK CLASSES

Tank classes have the following attributes: weight, armor, and water resistance. Weight affects movement, and light cybertanks move faster than heavy cybertanks. Strong armor offers better damage protection than light armor. Only amphibious cybertanks can traverse water without damage. The following table itemizes the attributes of each tank class:

TANK CLASS	WEIGHT	ARMOR	AMPHIBIOUS	COST
Cougar X	Medium	Weak	No	200
Sherman M7	Heavy	Weak	Yes	350
Olympia	Light	Weak	No	500
Bradley M4	Medium	Average	No	650
Mercury	Medium	Weak	Yes	750
Centaur	Light	Average	No	825
Challenger	Heavy	Strong	No	975
M5 Turtle	Medium	Average	Yes	1100
Britannia	Medium	Strong	Yes	1500
Bentley	Light	Strong	Yes	2000

2.3.4 FUEL CELLS

Fuel is required for all cybertank functions. The more fuel cells a cybertank carries, the longer it will run. When a cybertank's fuel supply is exhausted, no mechanical functions will operate.

2.3.5 DRIVE SYSTEMS

The drive system controls all mechanical functions. Its weight affects movement and fuel consumption. The heavier the drive, the slower the cybertank and the more fuel it consumes. Drive system speed is rated from one to five, one being slowest, five being fastest.

Drive System	Weight	Speed	Cost
Light	Light	1	150
Standard	Medium	2	275
Heavy	Heavy	3	400
Turbo	Medium	3	525
Dual-Turbo	Light	3	700
Gyro	Heavy	4	900
Flux	Medium	4	1200
Fission	Light	4	1500
Fusion	Medium	5	2000
Ion	Light	5	2500

2.3.6 WEAPON TYPES

Cybertanks can be equipped with only one weapon. Weapons vary in their firing speed, damage capabilities, and areas of damage.

Weapons that use shells are slower than others, since they must reload after every shot. Lasers do not require any reloading time and are the fastest weapons.

Projectile weapons (**Piercing**, **Explosive**, and **High Explosive**) inflict medium damage on external instrumention. armor and

Lasers create havoc internally, but have little effect on external components.

Gauss guns are electrical weapons that inflict heavy damage on external mechanisms (scanner, weapon, etc.), but have little effect on internal systems.

Plasma guns are extremely effective against armor, but do little damage internally.

Nuclear weapons cause very heavy damage to all cybertank systems.

Weapon	Speed	Damage Amount	Damage Area	Cost
Piercing	Slow	Light	Ext. Armor/Instruments	175
Explosive	Slow	Lt-Med	Ext. Armor/Instruments	250
High Explosive Anti-Tank	Slow	Medium	Ext. Armor/Instruments	475
Laser	Fast	Medium	Internal	675
Turbo Laser	Fast	Med-Heavy	Internal	750
Gauss Gun	Average	Heavy	Ext. Instruments/Weapon	900
Plasma Gun	Average	Heavy	Ext. Armor	1300
Nuke	Slow	Heavy	Ext./Int.	1800

2.3.7 SPECIAL ITEMS

Special items are optional and not required for authorization. You can equip your cybertank with as many special items as your budget allows. Some special items require accompanying logic in your cybertank's artificial intelligence. Others are automatically activated when placed in your cybertank's chassis. The following provides detailed information on each special item:

Energy Miser

Reduces the fuel consumption rate by approximately 50%.

This device can be activated without special AI instructions.

Comm-Link

Used to communicate with other cybertanks on your team. In team combat, a cybertank without a Comm-Link is unable to communicate with team members.

This device requires special AI instructions. See Part 3, Section 6 for more information.

Repair Kit

Multi-purpose repair kits can repair any damage to a cybertank. There are only four repairs allowed per kit, so use them wisely.

This device requires special AI instructions. See Part 3, Section 5.1 for more information.

Scanner Lock

A normal scanner only identifies the current location of an enemy cybertank and movement cannot be detected unless you perform multiple scans. You can lock onto an enemy cybertank and track its movement by using the Scanner Lock. By using this item, your scanner will rotate automatically to face the enemy and is unaffected by your cybertank's movement.

You can unlock your scanner at any time. It unlocks automatically if the target cybertank is destroyed or the scanner's view is obstructed. In addition, an enemy cybertank can unlock your scanner by disrupting your signal with a Jammer (described below).

This device requires special AI instructions. See Part 3, Section 3.6 for more information.

Listener

Determines whether or not an enemy cybertank has locked onto you with its scanner. Identifies the need to jam an enemy signal.

This device requires special AI instructions. See Part 3, Section 3.7 for more information.

Jammer

Used to jam an opponent's scanner signal once lock-on has been discovered. The Jammer disrupts an enemy's scanner signal and forces it to unlock. A Listner device need not be installed for the Jammer to function.

This device requires special AI instructions. See Part 3, Section 3.8 for more information.

Launcher

This device launches a remote scanner into the air. A remote scanner links your Cybertank Scanner System (CSS) with the **OSICOM I** satellite. Once linked, you are relayed the location of the enemy cybertank nearest you.

Remote scanners remain airborne only briefly and are destroyed upon impact with the ground. Each Launcher is equipped with only four remote scanners and should be used wisely.

This device requires special AI instructions. See Part 3, Section 3.9 for more information.

Defense Shield

This offers additional protection against enemy cybertanks. Although damage is greatly reduced with the shield up, it is not eliminated.

You can raise and lower the shield at any time, but a raised shield restricts the use of other systems – the scanner range is cut in half, fuel consumption increases, and most importantly, the cybertank is unable to fire its weapon. All systems function normally when the shield is lowered.

This device requires special AI instructions. See Part 3, Section 5.2 for more information.

Accelerator

Increases the processing speed of a cybertank's on-board computer. Logic operations are twice as fast. An Accelerator does not speed up mechanical cybertank operations, such as movement or scanner rotation.

No AI instructions are required for this device.

2.4 ARTIFICIAL INTELLIGENCE MODULE

2.4.1 GENERAL

A special Cybertank Command Language (CCL) was developed to aid in the design of a cybertank's artificial intelligence. The creation of a cybertank's AI is performed using the Artificial Intelligence Module (AI Module).

The AI Module contains a full-featured text editor. CCL commands can be entered from the keyboard or with the CCL Construction Panel (CP) (see Section 2.5). Once entered, commands can be edited using cut, copy, paste, insert and delete functions.

AI design can be facilitated using predesigned AI Library Capsules. Library Capsules are self-contained segments of artificial intelligence that perform isolated functions. You can modify existing Library Capsules or create new Capsules using the AI Module. See Part 4 for more information on Library Capsules.

2.4.2 THE INSERTION CURSOR

All text, whether entered by keyboard or with the CP, is inserted at the thin vertical bar referred to as the **Insertion Cursor (IC)**. You can move the IC anywhere in the edit window by moving the mouse/joystick pointer and clicking the button. In addition, you can move the IC with the following CURSOR keys (please refer to the OSI/CACD System 2 Reference Card to determine the appropriate keys for your terminal type):

The **CURSOR-LEFT** key moves the IC one character to the left. If the IC is at the beginning of a line, CURSOR-LEFT moves it to the end of the previous line.

The **CURSOR-RIGHT** key moves the IC one character to the right. If the IC is already at the end of a line, CURSOR-RIGHT moves it to the beginning of the following line.

The **CURSOR-UP** key moves the IC to the beginning of the current line. If the IC is already at the beginning of a line, CURSOR-UP moves it to the beginning of the previous line.

The **CURSOR-DOWN** key moves the IC to the end of the current line. If the IC is already at the end of the line, CURSOR-DOWN moves it to the end of the following line.

2.4.3 Inserting Text

The purpose of the IC is to indicate the point in the text at which characters can be inserted or deleted. Text can be inserted between any two characters. To insert text, simply move the IC to the position at which you want to start adding text and begin entering the text you want to insert.

2.4.4 Deleting Text

Text can be removed one character at a time using the DELETE key. Each time you press DELETE, the character to the left of the IC is removed. Characters to the right of the IC move left to fill in the gap.

2.4.5 Adding New Lines

New lines can be added anywhere in the text. Labels always begin in the far left column. Other lines are indented. Since labels are less common than other lines, the AI Module will automatically indent each new line when you press RETURN.

To move the IC from the indentation column to the far left column (ie., remove the indentation), press DELETE. To move the IC from the far left column to the indentation column (ie., indent), press TAB. Please refer to the OSI/CACD System 2 Reference Card to determine the TAB and DELETE keys for your particular terminal type.

2.4.6 Scrolling

You can scroll the text by clicking anywhere on the scroll-bar located directly to the right of the edit window. Clicking directly on the scroll-bar will scroll the text several lines. Clicking on the small arrows directly above and below the scroll-bar will scroll one line. By clicking on the small plaque (or "thumbprint" as it is often called), you can drag the plaque to any location in the scroll-bar. This thumbprint represents the location of the text currently visible in the edit window. For example, if the edit window is displaying the first few lines of text, then the thumbprint will be at the very top of the scroll-bar. On the other hand, if the edit window is currently displaying the last few lines of text, then the thumbprint will be at the very bottom of the scroll-bar.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

You can scroll the text in the edit window by clicking on any of the six scroll arrows at the right side of the edit window. The upward-pointing arrows move the window toward the beginning of the text, and the downward-pointing arrows move the window toward the end. There are three sizes of arrows. The smallest arrows scroll one line. The medium-sized arrows scroll several lines. The longest arrows scroll all the way to the beginning (or end) of the text.

You can also scroll the text using the SCROLL keys. There are six scroll keys, one for each of the scroll arrow buttons. See the OSI/CACD System 2 Reference Card to determine which keys to use on your terminal.

2.4.7 SELECTING TEXT

You can **select** and edit sections of text, such as words, lines, or paragraphs. Selected sections of text appear highlighted.

Text can be selected by dragging the mouse/joystick from a beginning selection point to an end point. Move the pointer to the beginning of the text you wish to select, press and hold the button down, and move the pointer to the end of the text section. Then release the button and the text will be highlighted.

To select text with the keyboard, move the IC to the beginning of the text you wish to select, press the MARK key (refer to the OSI/CACD System 2 Reference Card for keyboard control of the AI Module), then move the IC to the end of the text. Text is highlighted as it is selected.

When using a mouse or joystick, text is deselected by moving the IC. With the keyboard, text is deselected by pressing the MARK key a second time.

2.4.8 Deleting a Section of Text

To delete a section of text, select the text by using one of the methods discussed above (it will be highlighted) and press DELETE.

2.4.9 Replacing a Section of Text

To replace a section of text, simply select it and type the replacement text. There is no need to press DELETE.

2.4.10 Cutting and Pasting Text

You can easily rearrange sections of text using the **Cut** and **Paste** functions. You can remove (Cut) a selected section of text, like a sentence or paragraph, and move it to another location (Paste).

To Cut, select the desired text section and choose **CUT** from the EDIT menu. The selected text is removed from the edit window and stored internally by the AI Module.

To Paste that section into a new location, move the IC to a position that marks the beginning of the insertion. Select **PASTE** from the EDIT menu. The text you stored (Cut) is inserted at the IC.

2.4.11 Copying and Pasting Text

You can duplicate (copy) a section of text and place it in a new location. This function does not remove selected text from its current location in the edit window.

To Copy, select a section of text and choose **COPY** from the **EDIT** menu. A duplicate or copy of the selected text is stored internally by the AI Module.

To Paste, move the IC to a position that marks the beginning of the insertion. Select **PASTE** from the **EDIT** menu. A copy of the stored text is inserted at the current location of the IC. You can continue to paste that section into new locations by moving the IC and selecting **PASTE** from the **EDIT** menu.

WARNING: A cut or copied section of text is only stored temporarily. Each time you cut or copy a new section of text, any previously stored text is removed from internal storage.

2.4.12 UNDO

*Special Note: The **UNDO** feature is not supported on Commodore 64 and Apple //+,c,e terminals.*

There will be times when you mistakenly delete portions of AI and you suddenly realize the error of doing so. If you immediately select the **UNDO** option from the **EDIT** menu, then your last action will be undone. Please note that this only works if you <u>immediately</u> select **UNDO**.

2.5 USING THE CCL CONSTRUCTION PANEL (CP)

The CCL Construction Panel (CP) can assist in the design of a cybertank's AI. The panel, located at the bottom of the AI Module screen, provides access to OSI command language intructions. Using the CP, you can easily incorporate any of the instructions into your cybertank design.

If you are using a mouse or joystick, the CP is always enabled when using the text editor. If you are using the keyboard, you can use the CP as follows: (1) Press the CONNECT key, (2) Use the CURSOR keys to highlight the desired plaque, (3) Press RETURN. When you are done using the CP, press the CONNECT key to disconnect from the CP. Please see the OSI/CACD System 2 Reference Card to determine the CONNECT, CURSOR, and RETURN keys for your particular terminal type.

The CP is a series of plaques corresponding to specific cybertank functions (see Diagram 2.5.1 below). Move the pointer to the desired function and click on the plaque.

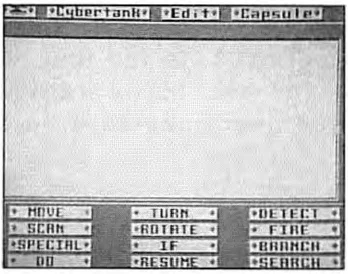


Diagram 2.5.1 – AI Module Construction Panel (CP)

The plaque marked **Special** is used to implement special items and instructions (ex: Self Destruct instruction). The **If** plaque provides all conditional instructions. The blank plaque skips a line in the AI text editor.

The CP guides you through all the combinations of instructions authorized by OSI for cybertank design. The CP is critically important if you are unsure of the instructions needed to implement a design element. The CP can simplify the design process.

For example, you want to make your cybertank move, but are unsure of the specific command language needed to implement movement.

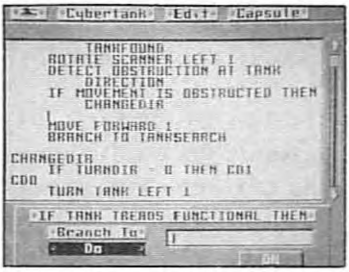
Select the **Move** plaque. The panel now displays **Forward** and **Backward** plaques, since a cybertank can only move in those directions. Select one of the plaques and you will be taken to the next step in the design phase for movement.

For example, click on the **Forward** plaque. The panel now displays a a series of number plaques. The number plaques are used to specify the amount of forward movement. The plaque marked '1' represents one hectometer, '2' equals two hectometers, and so forth. There is also a plaque marked **Var** that lets you specify a system or user variable as the number of hectometers. **[This should only be used by advanced users familiar with variables.]**

Select the plaque marked **1**. In the text editor, you will see the AI computer type out '**Move Tank Forward 1**'. You have just instructed your cybertank to move forward by one hectometer.

As you can see, selecting a series of plaques results in the appropriate instruction being included in your cybertank's AI. The AI computer automatically types the instruction into your text editor and resets the plaques on the CP.

Some commands require that you enter a label or variable, or decide between a "BRANCH TO" and a "DO" structure. For example, see Diagram 2.5.2



```
        TANKFOUND
    ROTATE SCANNER LEFT 1
    DETECT OBSTRUCTION AT TANK
        DIRECTION
    IF MOVEMENT IS OBSTRUCTED THEN
        CHANGEDIR
    |
    MOVE FORWARD 1
    BRANCH TO TANKSEARCH

CHANGEDIR
    IF TURNDIR = 0 THEN CD1
CD0
    TURN TANK LEFT 1
```

Diagram 2.5.2 -- Partially completed AI line using the CP

In the above diagram, the bottom left portion of the screen shows the two options: "BRANCH TO" and "DO". You can select either of these options before entering the label.

All "IF/THEN" commands need either a "BRANCH TO" or "DO" and the entry of a label. (For more information on using various commands, see Part 3 of this handbook.) Once you have chosen the appropriate instruction and selected "BRANCH TO" or "DO", you should enter a routine name (called a "Label").

The best way to become familiar with the CP is simply to play around with it. Most plaques are self-explanatory.

NOTE: You can always return to the previous series of plaques by clicking anywhere on the CP (except a plaque). This is extremely helpful if you have mistakenly selected an incorrect plaque.

You can return to the main series of plaques by clicking anywhere in the text editor.

2.6 THE AUTHORIZATION MODULE

Once you have selected your cybertank's chassis and designed its AI, you must **Authorize** it. This process checks the Chassis for design flaws, and compares *your* list of AI instructions against those approved by OSI.

During the authorization procedure, OSI notifies you of unacceptable instructions. Once notified of an unauthorized instruction you can resume the procedure (to receive notification of all other errors), or abort authorization altogether. When an error exists in instructions, you are automatically returned to the AI module for corrections. If a problem occurs in your chassis design, you are transferred to the Chassis Design Module (CDM).

Your cybertank design must be authorized by OSI before it is allowed on a battlefield. If your cybertank design does not pass Authorization, refer to Appendix 5 for a complete list of all Authorization errors and their possible remedies.

Once your design has been approved, OSI creates a cybertank ready for battle. Once the cybertank is created, you are given a choice of whether to exit to the ECM or return to the design module.

When you return to the design module, the design used to invoke the authorization process is displayed. You can then make additional modifications, save the cybertank design, or quit.

WARNING: Authorizing your cybertank's design does NOT save the design to your ID Disc. You must save the design yourself.

NOTE: Whenever you use the cybertank editor to modify a design, you must obtain authorization for the design changes. If you fail to re-authorize a design and enter a *battle, the cybertank will use its old chassis and AI and not the modified design.*

SECTION 3
SIMULATION DESIGN MODULE

SECTION BRIEF
This section describes all parts of battle simulation design.

3.1 SDM FUNCTION AND LAYOUT

The Simulation Design Module (SDM) is used to select the field of battle and designate authorized cybertanks for combat. Any authorized cybertanks can be selected for battle. You can also specify that duplicate cybertanks compete against one another. After simulation design, the battle begins.

To gain access to the SDM, select **DESIGN A SIMULATION** from the **SIMULATE** menu.

Diagram 3.1.1 illustrates the SDM display. The employee's name and clearance level is shown on the left side of the screen. Also on the left side of the screen are three areas labeled **PRIMARY TANK**, **OTHER TANKS**, and **BATTLEFIELD**. The selected cybertank and battlefield names are displayed in this area.

In the bottom right corner of the screen, are three buttons labeled **SELECT**, **CATEGORY**, and **DRIVE**. The **SELECT** button is used to designate cybertanks and/or a battlefield. You must select a **PRIMARY TANK** before selecting other cybertanks or a battlefield. The **CATEGORY** button is used to access the **PRIMARY TANK**, **OTHER TANKS**, and the **BATTLEFIELD** selections. The **DRIVE** button is used to change the active access slot (disc drive).

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

These terminals are equipped with a **SLOT** button rather than a **DRIVE** button. By pressing the **SLOT** button you are able to access additional access slots (or disc drives) that may be connected to your terminal.

The three areas in the upper right are unlabeled information areas. The upper area displays your current selection category – either **Tank Files** or **Battlefields**. The middle area identifies the disc in the active access slot. In most cases, your employee identification disc is identified. The information displayed in the third area is based on the current selection category. The **Tank Files** category shows all authorized cybertanks on the active DISC; the **Battlefields** category shows all battlefield maps found on the current disc.

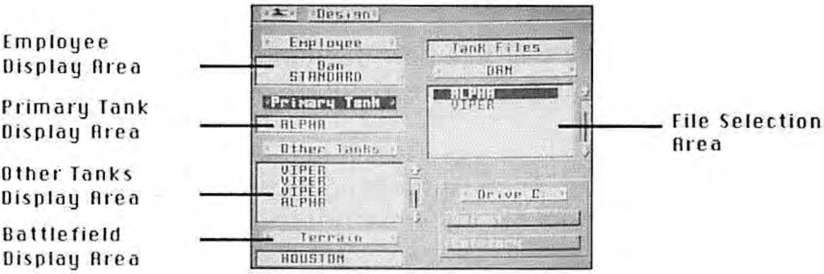


Diagram 3.1.1 – Simulation Design Module (SDM)

NOTE: When designing a simulation, the selected battlefield and cybertanks <u>must</u> reside on the same disc. If the necessary data files are on different discs, the Combat Simulation Module (CSM) displays an error message. For information on how to copy data files from disc to disc, see Section 8.

Additional options are available under the menu heading called **DESIGN:**

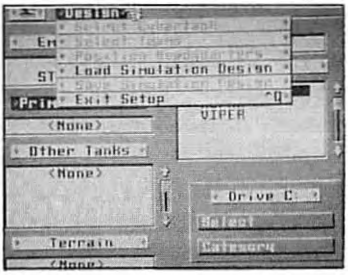


Diagram 3.1.2 -- DESIGN Menu

SELECT CYBERTANKS is used to designate the cybertanks you want included in the battle simulation.

SELECT TEAMS is used to specify cybertank teammates. You are allowed two teams with as many as seven cybertanks per team. See Section 3.2 for more information.

POSITION HEADQUARTERS is used to designate the position of the headquarters on the map. See Section 3.3 for more information.

LOAD SIMULATION DESIGN
Special Note: On Commodore 64 and Apple //+,c,e terminals the ***LOAD SIMULATION DESIGN*** *feature is not supported .*

This is used to retrieve a previously saved Simulation Design. If selected, the FRP appears. Highlight the desired Simulation Sesign and select the **LOAD** button. At this point, you can edit any part of the design.

SAVE SIMULATION DESIGN saves the current simulation setup to your ID DISC. You must select a primary tank, at least one other cybertank, and a battlefield before you can save a design. **SELECT TEAMS** and **POSITION HEADQUARTERS** are optional.

EXIT SETUP exits the SDM and returns you to the ECM.

When selecting cybertanks, note that the primary cybertank is the only one which.can be fully tested and analyzed in the Cybertank Test Module (CTM, see Section 5).

3.2 SELECTING TEAMS (OPTIONAL)

You are allowed two teams in a battle simulation with a maximum of seven cybertanks per team. If you select more cybertanks than you place on teams, the remaining cybertanks will compete individually. Available cybertanks that have not been placed on a team are listed on the right side of the screen.

The **SWITCH TEAM** button toggles between selecting cybertanks for **TEAM 1** and **TEAM 2**.

INIT TEAM removes all cybertanks from the currently selected team and places them on the available list.

The **SELECT TANK** button places the highlighted cybertank onto the currently selected team.

3.3 POSITIONING HEADQUARTERS (OPTIONAL)

When designing team simulations, you can position a headquarters for each team. This headquarters is an important target for enemy cybertanks. When competing in a simulation that includes a headquarters, there are two routes to victory: 1) terminate all opposing team-members, or 2) destroy the enemy team's headquarters. As you can easily see, protecting your team's headquarters *is of* paramount importance.

The positioning headquarters option is not available until you specify a battlefield and select team members.

NOTE: A headquarters is NOT necessary in order to compete with teams.

Diagram 3.3 shows the screen used to position a headquarters building (terrain features may vary depending upon the battlefield you select).

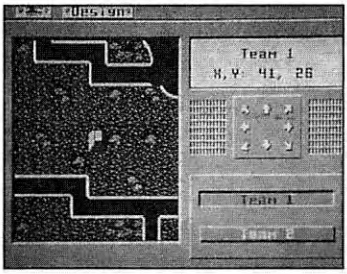


Diagram 3.3 -- Positioning a Headquarters Building

The left side of the screen shows a section of the battlefield with a headquarters building centered in the display. Use the scroll arrows on the right side of the screen to position the headquarters. The currently selected team number (1 or 2) is shown with the current coordinates of its headquarters in the area above the scroll arrows. The **TEAM 1** and **TEAM 2** buttons on the lower right are used to toggle between the two teams. (Please see the OSI/CACD System 2 Reference Card for information about using the keyboard.)

NOTE: A headquarters cannot be moved through indestructible objects.

SECTION 4
COMBAT SIMULATION MODULE

SECTION BRIEF
This section describes observing a simulation and analyzing the performance of your cybertank.

4.1 CSM FUNCTION AND LAYOUT

The first step in starting a simulation is to select the simulation design you want to use. **All selected cybertanks and the battlefield MUST reside on the SAME disc** (see Section 8 for information on how to copy data files from one disc to another).

Select **START A SIMULATION** from the **SIMULATE** menu. The File Retrieval Panel (FRP) is displayed with a list of simulation designs found on the current disc. Highlight the desired design and select the **LOAD** button. You are transferred then to the Combat Simulation Module (CSM). After the OSI/CACD loads the cybertanks and battlefield, the simulation will begin.

4.2 GENERAL COMMANDS

At the start of the simulation, the Battlefield Display Area displays the cybertank selected as the "**Primary Tank**" in the center of the display area. To view the other cybertanks, use the Cybertank Selection Keys. The next cybertank is centered in the display area with the name of the cybertank displayed directly below the display area. If a crater or destroyed tank is displayed in the center of the area, then that cybertank has been destroyed.

To pause the action, press the **PAUSE**. Press it again to resume the simulation.

The **SELECTION** and **PAUSE** keys can be found in your OSI/CACD System 2 Reference Card.

4.3 THE INSTRUMENT PANELS

The right side instrument panel displays the gauges for a selected cybertank. The gauges are defined as follows:

F	-	Fuel level
I	-	Internal damage (AI Computer, Engine)
A	-	Armor damage
T	-	Tread damage
S	-	Scanner damage
W	-	Weapon damage
SL	-	Scanner Lock (off = unlocked; on = locked)
DS	-	Defense Shield (off = down; on = up)
LD	-	Listener Device (on = being scanned)

Directly to the left of the scanner lock LED is an indicator, known as the Cybertank Directional Indicator, that shows the direction the cybertank is facing and the direction the scanner is pointing (for specific details on the Cybertank Directional Indicator, refer your OSI/CACD System 2 Reference Card).

The instrument below the Cybertank Directional Indicator depicts what the scanner is "seeing" (for a complete description of the Cybertank Vision Indicator, see your OSI/CACD System 2 Reference Card).

The lower right of screen provides four categories of battle information. The categories are:

- T - Total number of battles to be simulated
- B - Number of battles previously fought
- S - Number of successful battles
- A - Number of active cybertanks remaining

When a battle is over, the results are recorded to disc. This running tabulation is retained as long as the specific simulation design exists.

4.4 OTHER OPTIONS

The options below are available from the **Simulation** menu:

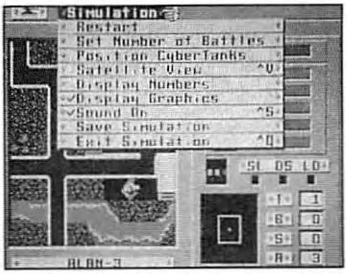


Diagram 4.4 -- SIMULATION Menu

RESTART SIMULATION is used to start the current simulation over again. All battles simulated and all cybertank victories are cleared.

SET NUMBER OF BATTLES is used to select the number of battles per simulation. If more than one battle is selected, the simulation automatically starts each successive battle. The simulation ends when all battles are completed.

POSITION CYBERTANKS is used to manually position the cybertanks in the simulation. You can move a cybertank to a new location or turn a cybertank to face a new direction. Select the large dot between the scroll arrows to toggle between POSITION and DIRECTION, then use the arrows for movement or rotation. Select **Restart** to begin the simulation using the new positions.

SATELLITE VIEW provides an overhead view of the battlefield as seen from the OSICOM I satellite. The entire battlefield is shown with the cybertanks appearing as flashing blips. When viewing the Satellite transmission, you can observe all the cybertanks' actions. To exit the satellite view, press any key or click the mouse or joystick button.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> The square box surrounding a small portion of the battlefield represents the region currently selected in the Battlefield Display Area. Note that the cybertanks are automatically paused during the Satellite viewing mode. Simulations cannot operate while viewing the satellite transmission. Press any key to return to the close-up view.

DISPLAY CYBERTANK NUMBERS displays the cybertanks as numbers. The numbers correspond to those shown when the CSM loaded the cybertanks from your ID Disc at the beginning of the simulation. Select this option again to return to the normal cybertank view.

DISPLAY GRAPHICS is used to toggle the Battlefield Display Area on and off. When the Battlefield Display Area is off, the speed of the simulation is increased and the battle time is decreased.

SOUND ON is used to toggle your terminal's speaker on and off. When the speaker is off, simulation speed increases.

SAVE SIMULATION is used to save a simulation in-progress. You can restart a saved simulation. Terminated cybertanks are not re-activated until the start of the next battle.

EXIT SIMULATION exits the CSM and transfers you back to the ECM.

SECTION 5
CYBERTANK TEST MODULE

SECTION BRIEF
This section details the operation of the Cybertank Test Module (CTM).

5.1 CTM FUNCTION AND LAYOUT

The Cybertank Test Module (CTM) displays AI instructions during a battle simulation instead of the instrument panel shown using the Combat Simulation Module (CSM). Instructions are viewed one at a time and you can observe the internal status of a cybertank to track its reaction to a specific command or situation. Instructions are viewed and tested in Trace Mode. Various cybertank status registers can be edited in Status Mode.

To use the CTM, select **TEST A CYBERTANK** from the **DESIGN** menu. The File Retieval Panel (FRP) will appear. Highlight the desired simulation design and select the **LOAD** button. You are transferred to the CTM. After the OSI/CACD loads the specified cybertanks and battlefield, the testing will begin.

5.2 GENERAL COMMANDS

At the start of the simulation, the Battlefield Display Area shows the cybertank selected as the "**Primary Tank**" in the center of the display area. To view the other cybertanks, use the Cybertank Selection Keys. The next cybertank is centered in the Battlefield Display Area with the name of the cybertank appearing directly below the display area. If a crater or destroyed cybertank is displayed in the center of the area, that cybertank has been destroyed.

To pause the action, press the **PAUSE** key. Press it again to resume the simulation.

The locations of the **SELECTION** and **PAUSE** keys can be found in the OSI/CACD System 2 Reference Card.

5.3 OTHER OPTIONS

The options below are accessed from the **Debugger** menu.

RESTART is used to start the current simulation over again.

SATELLITE VIEW provides an overhead view of the battlefield as seen from the OSICOM I satellite. The entire battlefield is shown with the cybertanks appearing as flashing blips. When viewing the Satellite transmission, you can observe all the cybertanks' actions. To exit the satellite view, press any key or click the mouse or joystick button.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

The square box surrounding a small portion of the battlefield represents the region currently selected in the Battlefield Display Area. Note that the cybertanks are automatically paused during the Satellite viewing mode. Simulations cannot operate while viewing the satellite transmission. Press any key to return to the close-up view.

SOUND ON toggles your terminal's speakers on and off. With the speaker off, the simulation speed is increased.

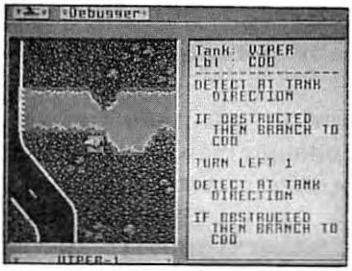
TRACE MODE ON toggles between Trace Mode and the AI

Status Mode (see Sections 5.4 and 5.5, respectively). The default setting is Trace Mode, which is represented by a check-mark preceeding the **TRACE MODE ON** option.

EXIT exits the CTM and transfers you back to the ECM.

5.4 TRACE MODE

Diagram 5.4 represents the screen displayed when AI Trace Mode is activated (details in AI and terrain may vary). Trace Mode is used to observe specific instructions during a simulation and their effect on the selected cybertank.



```
Tank: VIPER
Lbl : COD
-----------------------
DETECT AT TANK
  DIRECTION

IF OBSTRUCTED
  THEN BRANCH TO
  COD

TURN LEFT 1

DETECT AT TANK
  DIRECTION

IF OBSTRUCTED
  THEN BRANCH TO
  COD
```

Diagram 5.4 -- Cybertank Test Module (CTM)

When the CTM is in **Trace Mode**, the display area on the right side of the screen shows the cybertank's AI. The upper part of this display area shows the cybertank number and name, and the Label of the section of AI currently being executed. The lower part of this display area shows the cybertank's "thoughts." It should be pointed out that only the AI of the tank selected as the **Primary Tank** in the Simulation Design Module (SDM) can be shown. For security reasons, the AI of all other tanks in the simulation cannot be shown.

A great deal can be learned by watching a cybertank's behavior on the battlefield while examining its AI being processed. Trace Mode allows you to see the cybertank's commands as they are being processed.

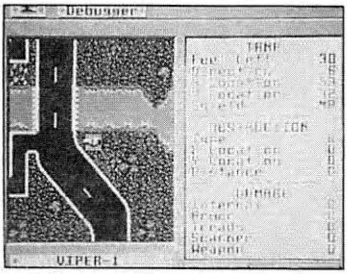
Press the **PAUSE** key to halt execution of the AI. The **PAUSE** key works the same way in the CTM as it does in the CSM. That is, pressing it toggles the pause mode on and off. See the OSI/CACD System 2 Reference Card to determine the **PAUSE** key for your particular terminal type. When the test is paused, pressing the **STEP** key causes the test to run just long enough to process one CCL command, after which the test remains paused. This allows you to examine the AI and its effects one command at a time. This feature is known as **single stepping**. To determine the **STEP** key for your particular terminal type, see the OSI/CACD System 2 Reference Card.

To return execution to full speed, press the **PAUSE** again.

By watching a cybertanks AI, you can gain a great deal of insight into logic and cybertank control. For example, if you are experiencing problems with a firing routine (ex. routine named "**SHOOTIT**"), then let the AI execute at full speed until you see the label "**SHOOTIT**" displayed. Press the **PAUSE** key to halt execution and then single-step through the firing routine to examine the execution of the AI instructions closely.

5.5 STATUS MODE

Diagram 5.5 represents the screen display for the Status Mode. Use this mode to change the various cybertank status registers.



```
Debugger

TANK
Fuel Left      30
Direction       6
X Location     53
Y Location     12
Speed          +0

DESTRUCTION
Type            0
X Location      0
Y Location      0
Distance        0

DAMAGE
Internal        0
Armor           0
Treads          0
Scanner         0
Weapon          0

VIPER-1
```

Diagram 5.5 -- AI Edit Mode

The entries on the right side of the screen represent the values of various System and User Variables. Several different screens (pages) are used to show the status of your cybertank, due to the many variables possible. Use the Cybertank Status Page Keys (see the OSI/CACD System 2 Reference Card) to scan the available pages.

The table below lists all of the entries which can be changed along with their respective System variable name:

	ENTRY NAME	SYSTEM VARIABLE
Page 1	Fuel Left	FuelLevel
	Direction	TankDir
	X Location	TankX
	Y Location	TanyY
	Type	ObstacleType
	X Location	ObstacleX
	Y Location	ObstacleY
	Distance	ObstacleDist
	Internal	IntDamage
	Armor	ArmorDamage
	Treads	TreadDamage
	Scanner	ScanDamage
	Weapon	WeapDamage
Page 2	Direction	ScanDir
	X Location	EnemyX
	Y Location	EnemyY
	Distance	EnemyDist
	Type	ObjType
	X Location	ObjX
	Y Location	ObjY
	Distance	ObjDist
	X Location	EnemyHQX
	Y Location	EnemyHQY
	Distance	EnemyHQDist
Page 3	Ally Number	AllyNum
	Code Received	AllyCode

	X Location	AllyX
	Y Location	AllyY
	Distance	AllyDist
	X Location	AllyEnemyX
	Y Location	AllyEnemyY
	Distance	AllyEnemyDist
	Direction	AllyEnemyDir
Page 4	Ally Number	CopyNum
	Code Received	CopyCode
	X Location	CopyX
	Y Location	CopyY
	Distance	CopyDist
	X Location	CopyEnemyX
	Y Location	CopyEnemyY
	Distance	CopyEnemyDist
	Direction	CopyEnemyDir
Page 5	Repair Kits	KitsLeft
	Launchers	RemotesLeft
	XY Distance	XYDist
	Random #	RandomNum
	X Location	AllyHQX
	Y Location	AllyXQY

Pages six and higher list all the User Variables in the cybertank's AI. All User Variables can be edited.

To change the value of a System or User Variable, halt execution (see Section 5.2) using the **PAUSE** key. If you are using a mouse or joystick, simply click on the register you wish to change and it becomes highlighted. If you are using the keyboard, please refer to the OSI/CACD System 2 Reference Card to determine the appropriate keys to use to highlight the various status registers. Once you have highlighted the variable you want to edit, simply use the keyboard to enter the new value and press **RETURN**. Your cybertank then reflects the new status. If you enter an illegal value or attempt to select a variable which cannot be changed, a beep is generated and the highlight bar moves to the first entry on the page which can be edited.

SECTION 6

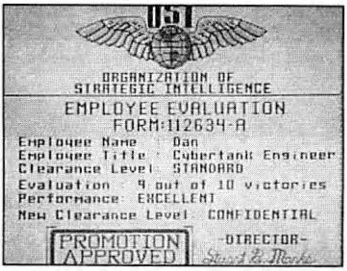
CLEARANCE EVALUATION

SECTION BRIEF

This section describes the importance of clearance evaluations and the method of accessing an evaluation.

6.1 CEM FUNCTION AND LAYOUT

The Clearance Evaluation Module (CEM) is used to evaluate the performance of your cybertank in a simulated battle against one of OSI's cybertanks. If your design is successful in the battle, you are promoted to the next clearance level (see Diagram 6.1). Promotions result in a larger budget which can be used to select better components for your next cybertank design. The CEM is very similar to the Combat Simulation Module (CSM) in layout and function.



OSI

ORGANIZATION OF
STRATEGIC INTELLIGENCE

EMPLOYEE EVALUATION
FORM:112634-A

Employee Name : Dan
Employee Title : Cybertank Engineer
Clearance Level: STANDARD
Evaluation : 9 out of 10 victories
Performance: EXCELLENT
New Clearance Level: CONFIDENTIAL

PROMOTION APPROVED

-DIRECTOR-
Stuart B. Marks

Diagram 6.1 -- Promotion Approved

To access the CEM, select **CLEARANCE EVALUATION** from the **EMPLOYEE** menu. The File Retrieval Panel (FRP) is displayed. Highlight the cybertank you wish to use in the evaluation and select the **LOAD** button. You are then transferred to the CEM. After the OSI/CACD loads your cybertank, OSI's cybertank, and the battlefield chosen by OSI, the evaluation will begin.

6.2 GENERAL COMMANDS

Your cybertank is automatically centered in the Battlefield Display Area. To view OSI's cybertank, use the Cybertank Selection Keys to center the OSI cybertank. The name of the currently displayed cybertank is shown below the display area. Action cannot be paused in the CEM.

6.3 THE INSTRUMENT PANELS

The instrument panel is exactly identical to that of the Combat Simulation Module (CSM), described in Section 4.3.

6.4 OTHER OPTIONS

The following options are available from the **Evaluation** menu in the CEM:

SATELLITE VIEW provides an overhead view of the battlefield as seen from the OSICOM I satellite. The entire battlefield is shown with the cybertanks appearing as flashing blips. When viewing the Satellite transmission, you can observe all the cybertanks' actions. To exit this view, press any key or click the mouse or joystick button.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

The square box surrounding a small portion of the battlefield represents the region currently selected in the Battlefield Display Area. Note that the cybertanks are automatically paused during the Satellite viewing mode. Simulations cannot operate while viewing the satellite transmission. Press any key to return to the close-up view.

DISPLAY GRAPHICS is used to toggle the Battlefield Display Area on and off. When the display area is off, the speed of the evaluation is increased and battle time is decreased.

SOUND ON toggles your terminal's speaker on and off. When the speaker is off, the speed of the evaluation is increased.

SAVE EVALUATION lets you save an evaluation in-progress. A saved evaluation can be continued at another time.

EXIT EVALUATION exits the CEM and then transfers you to the ECM.

SECTION 7
BATTLEFIELD DESIGN MODULE

SECTION BRIEF
This section describes the procedures used to create custom battlefields.

7.1 BDM FUNCTION AND LAYOUT

The Battlefield Design Module (BDM) is used to create custom battlefield designs for simulated cybertank battles. To access the BDM, select **DESIGN BATTLEFIELD** from the **SIMULATE** menu.

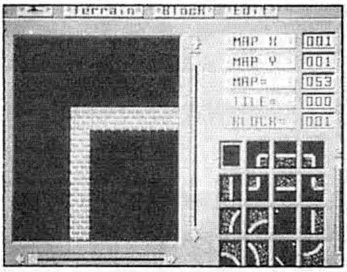
You must be familiar with the following terminology before designing a custom battlefield:

TILE -- A tile is a single terrain feature used to build more complicated features. Examples of tiles include: a tree, a section of grass, part of a building, or part of a coastline. Tiles form the foundation of all battlefield designs.

BLOCK -- A block is a group of tiles. Its maximum size is five tiles wide by five tiles tall. Using blocks, you can greatly simplify the construction of complex and/or repetitive terrain elements. For example, constructing a large highway is easier using blocks.

Blocks are like "large tiles", but unlike tiles, blocks can be edited, modified and deleted. You can design various block configurations and save them onto your ID Disc.

Diagram 7.1.0 represents the screen display of the BDM.



MAP X 001
MAP Y 001
MAP# 053
TILE# 000
BLOCK# 001

Diagram 7.1.0 -- Battlefield Design Module (BDM)

The left side of the screen shows a portion of the battlefield. This main display area can be scrolled to different areas of the battlefield using the four directional scroll arrows found to the right and below the display area.

The lower right section of the screen displays 16 tiles. The currently selected tile is enclosed by a small box. You can scroll through additional tile selections by using the up and down scroll arrows located directly above the tile area.

The following options are available from the **BATTLEFIELD** selection menu:

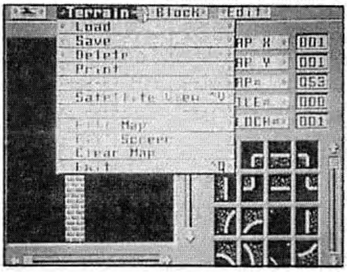


Diagram 7.1.1 -- BATTLEFIELD Menu

LOAD lets you retrieve a previously saved battlefield design. If selected, the File Retrieval Panel (FRP) will appear. Highlight the desired battlefield design and select the **LOAD** button.

SAVE lets you save the current battlefield design under a new name. If selected, the File Storage Panel (FSP) will be displayed. Enter the new name of your battlefield design. The new version of the design will be totally separate from the original. The original design will remain unchanged, unless you give it the same name as the original.

DELETE lets you remove battlefield designs from your ID Disc. If selected, the File Termination Panel (FTP) *will* be displayed with the names of all the battlefield designs on your ID Disc. Highlight the battlefield design you wish to remove and select the **DELETE** button. **Please be careful--once a battlefield design is terminated, it cannot be recovered!**

PRINT lets you print the current battlefield design to your printer. Refer to the OSI/CACD System 2 Reference Card for more information.

SATELLITE VIEW provides an overhead view of the battlefield as seen from the OSICOM I satellite. To exit the satellite view, simply press any key or click the mouse or joystick button.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> The square box surrounding a small portion of the battlefield represents the region that was displayed in the normal close-up view of the battlefield before choosing **Satellite View**. Pressing any key will return you to the close-up view.

FILL MAP fills the entire battlefield with the currently selected tile. Be extremely careful when using this option, as it affects the entire battlefield.

FILL SCREEN fills only the portion of the battlefield shown in the main display area with the currently selected tile.

EXIT will exit the BDM and return you to the ECM.

The following options are available from the **BLOCK** selection menu:

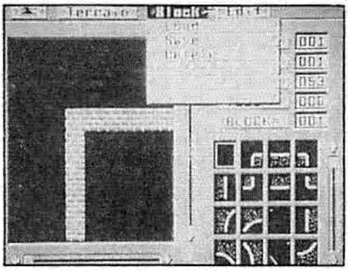


Diagram 7.1.2 -- BLOCK Menu

LOAD lets you retrieve a previously saved block configuration. When selected, the File Retrieval Panel (FRP) will appear. Select the desired block configuration and it will be loaded into the BDM. At this point, the blocks can be used or editted in any way.

SAVE lets you save the current block configuration under a new name. When selected, the File Storage Panel (FSP) will be displayed. Enter the new name of your block configuration. The new version of the block configuration will be totally separate from the original. The original will remain unchanged.

DELETE lets you remove block configurations from your ID Disc. When selected, the File Termination Panel (FTP) will be displayed with the names of all the block configurations on your ID Disc. Highlight the desired block configuration and select the DELETE button. **Be careful-- once a block configuration is terminated, it cannot be recovered!**

CLEAR BLOCK erases the currently selected block.

CLEAR COPY deactivates any block copy currently in progress. Section 7.2 offers more information on copying blocks.

The following options are available from the **EDIT** selection menu:

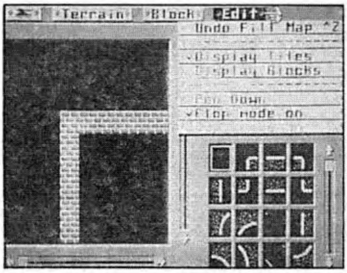


Diagram 7.1.3 -- EDIT Menu

DISPLAY TILES sets the lower right portion of the screen to display tiles. This setting allows you to use tiles in battlefield design. This option overrides the **DISPLAY BLOCKS** mode.

DISPLAY BLOCKS sets the lower right portion of the screen to display blocks. This setting allows you to use blocks in battlefield design This setting will override the **DISPLAY TILES** mode.

PEN DOWN is used to "draw" with the currently selected tile. When activated, the selected tile is drawn onto the battlefield at the center of the main display area. The tile is shown in inverse. Move the battlefield to draw multiple tiles. This mode is most useful to add large areas of the same terrain type. For example, **PEN DOWN** is very helpful in adding large forested areas to a battlefield design. **PEN DOWN** mode is only available when the **DISPLAY TILES** mode is active.

PLOP MODE ON is used to place individual tiles. Battlefield movement has no effect on a placed tile. If you are using a mouse or joystick, you can simply click anywhere in the main display area to place the current tile. If you are using the keyboard, please refer to the OSI/CACD System 2 Reference Card for more information.

COPY MODE ON lets you create a block by copying a section of your battlefield (See Section 7.2 for more information).

7.2 USING BLOCKS

To create a block, select the **DISPLAY BLOCKS** option from the **EDIT** menu. Next, select the **COPY MODE ON** option from the **EDIT** menu. Move the map to the area of the battlefield you wish to use in creating the block. If you are using a mouse or joystick, simply click on the tiles that you want to be part of the block. If you are using the keyboard, see the OSI/CACD System 2 Reference Card for more information.

You can select any tiles on the battlefield, but they must be a part of the same 5 x 5 tile area. After selecting the tiles you want, click anywhere in the Block Display Area (bottom right area of the screen) to create the new block (again, if you are using the keyboard, see the OSI/CACD System 2 Reference Card). You can use the up and down scroll arrows located above the block display area to scroll through the complete set of blocks.

Once you have the blocks, select **PLOP MODE ON** from the **EDIT** selection menu. You can move around on the battlefield and "plop" the currently selected block onto the battlefield by clicking anywhere in the main display area. If you are using the keyboard, please refer to the OSI/CACD System 2 Reference Card for more information.

To return to using tiles to create the battlefield, select the **DISPLAY TILES** option from within the **EDIT** selection menu.

SECTION 8

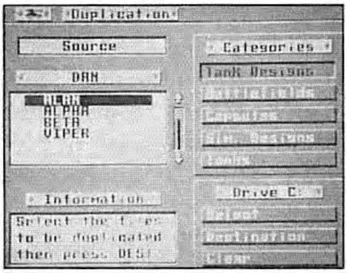
DATA DUPLICATION MODULE

SECTION BRIEF
This section describes how to copy various data files from one disc to another.

8.1 DDM FUNCTION AND LAYOUT

The Data Duplication Module (DDM) lets you copy cybertank data files from one disc to another. You can copy cybertank AI designs, battlefields designs, capsule designs, simulation designs, and authorized cybertanks.

Select the **DUPLICATION MODULE** option from the **DESIGN** menu. Diagram 8.1 below illustrates the Duplication Module screen display.



Select the files
to be duplicated
then press DEST

Diagram 8.1 -- Data Duplication Module (DDM)

The right side of the screen displays the categories of data files you can copy (TANK DESIGNS, BATTLEFIELDS, CAPSULES, SIMULATION DESIGNS, and TANKS).

Four selection buttons, **DRIVE**, **CATEGORY**, **SELECT**, and **DESTINATION**, are located on the lower right section of the display. The **DRIVE** button is used to select the active access slot (or disk drive). As the **DRIVE** button is selected, the name of the disc located in the active slot is displayed in the **SOURCE** field.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

These terminals are equipped with a **SLOT** button rather than a **DRIVE** button. By pressing the **SLOT** button you are able to access additional access slots (or disc drives) that may be connected to your terminal. You should remember this difference in terminal types while reading this manual.

The **CATEGORY** button is used to step through the four data file categories. Once a category is selected, data files within that category (if any) are displayed in the left-middle portion of the screen. You cannot copy files from different categories in a single procedure.

To select a data file to copy (source file), highlight it and choose the **SELECT** button. A "checkmark" is displayed to the left of a selected file. You can select multiple files within a category. To "deselect" a data file, highlight it, and the **SELECT** button will change to a **DE-SELECT** button. Simply select the **DE-SELECT** button to "deselect" the highlighted file.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> To select a data file to copy (source file), highlight it and choose the **SELECT** button. A "diamond" is displayed to the left of a selected file. You can select multiple files within a category. To "deselect" a data file, highlight it, and click the **SELECT** button again.

Once you have selected the data file(s) you want to copy, you must identify a destination for those files. Select the **DESTINATION** button. Three new buttons, **DRIVE, COPY** and **CANCEL,** are displayed.

The **DRIVE** button is used to select the destination or target access slot for the copy procedure. Select the **DRIVE** button until the desired disc name is displayed in the **DESTINATION** field at the upper left of the screen.

To begin the duplication procedure, select the **COPY** button. Various status messages will appear in the lower-left area of the screen labeled **INFORMATION.** These messages give you specific instructions (if needed) for completing the duplication process.

The **CANCEL** button is used to abort the duplication process and return to the data file selection process.

To exit the DDM and return to the ECM, select the **EXIT DUPLICATOR** option from the **DUPLICATION** menu.

SECTION 9
SYSTEM OPERATIONS

SECTION BRIEF
This section describes the operation of data file operation panels.

9.1 THE FILE STORAGE PANEL (FSP)

The FSP is used to store data files on your ID Disc. Diagram 9.1 illustrates the FSP panel. The name of the disc in the current access slot (or disk drive) is displayed on the upper left of the panel. Below the disc name is a list of all data files found on the current disc. Only files appropriate to the current module are displayed. For example, if you are in the Simulation Design Module (SDM), only previously saved simulation design data files are displayed. If there are more than three names, use the up and down scroll arrows to scroll through the list of names. Below the list of names is a small area labeled **SAVE AS:**. Enter the new file name.

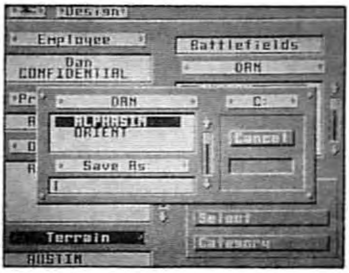


Diagram 9.1 -- File Storage Panel (FSP)

On the right side of the panel are three buttons labeled **DRIVE**, **SAVE**, and **CANCEL**. The **DRIVE** button is used to access other discs in other access slots. When the **DRIVE** button is selected, the name of the newly selected disc will be displayed.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> These terminals are equipped with a **SLOT** button rather than a **DRIVE** button. By pressing the **SLOT** button you are able to access additional access slots (or disc drives) that may be connected to your terminal. Keep this difference regarding terminal types in mind while reading this manual.

Select the **SAVE** button to save the data file to the current disc using the name you entered. You CANNOT save a file without first giving it a name.

The **CANCEL** button lets you abort the save process. You are returned to the current module.

9.2 THE FILE RETRIEVAL PANEL (FRP)

The FRP is used to retrieve data files from your ID Disc. Diagram 9.2 illustrates the FRP panel. The name of the disc in the current access slot (or disc drive) is displayed on the upper left of the panel. Below the disc name is a list of all data files found on the current disc. Only files appropriate to the current module are displayed. For example, if you are working in the Cybertank Design Module (CDM), only previously saved cybertank designs are displayed. If there are more than six names, use the up and down scroll arrows to scroll through the list.

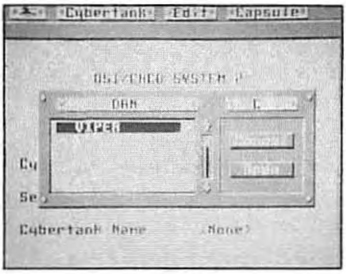


Diagram 9.2 --File Retrieval Panel (FRP)

On the right side of the panel are three buttons labeled **DRIVE**, **OPEN**, and **CANCEL**. The **DRIVE** button is used to access discs in other access slots (disc drives). When the **DRIVE** button is selected, the name of the newly selected disc is displayed.

Select the **OPEN** button to load the highlighted data file from the selected access slot.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> These terminals are equipped with a **SLOT** button rather than a **DRIVE** button. By pressing the **SLOT** button you are able to access additional access slots (or disc drives) that may be connected to your terminal.
>
> These terminals are also equipped with a **LOAD** button rather than a **OPEN** button. By pressing the **LOAD** button, you can load data files from the selected access slot.
>
> These differences in terminal types should be kept in mind while reading this manual.

The **CANCEL** button is used to abort the retrieval process. You are returned to the current module.

9.3 THE FILE TERMINATION PANEL (FTP)

The FTP is used to remove data files from your ID Disc. Diagram 9.3 illustrates the FTP panel. The name of the disc in the current access slot (or disc drive) is displayed on the upper left side of the panel. Below the disc name is a list of all data files found on the current disc. Only files appropriate to the current module are displayed. For example, if you are working in the Cybertank Design Module (CDM), only previously saved cybertank designs are displayed. If there are more than six names, use the up and down scroll arrows to scroll through the list.

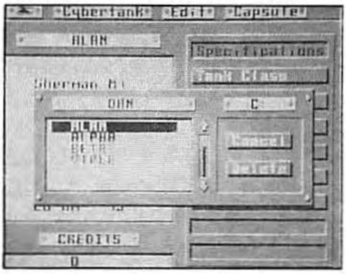


Diagram 9.3 -- File Termination Panel (FTP)

On the right side of the panel are three buttons labeled **DRIVE**, **DELETE**, and **CANCEL**. The **DRIVE** button is used to access other discs in other access slots. When the **DRIVE** button is selected, the name of the newly selected disc will be displayed.

NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:

These terminals are equipped with a **SLOT** button rather than a **DRIVE** button. By pressing the **SLOT** button you are able to access additional access slots (or disc drives) that may be connected to your terminal.

Select the **DELETE** button to delete the highlighted data file from the current access slot.

The **CANCEL** button is used to abort the termination process. The FTP is removed and you are returned to the current application.

Warning: Be very careful when using the FTP. Once a file is terminated, it can not be recovered.

PART 3
CYBERTANK COMMAND LANGUAGE

SYNOPSIS

This section presents the commands available for designing a cybertank's Artificial Intelligence (AI). The CCL Reference is a must for all inexperienced employees and contains a great deal of useful information for the experienced employee. Each section of the CCL Reference contains examples to clearly demonstrate the use and function of the commands.

SECTION 1
CYBERTANK COMMAND LANGUAGE

Before moving right into the CCL commands, several basic and fundamental concepts must be covered.

1.1 GENERAL DEFINITIONS

The Cybertank Command Language (CCL) was designed by OSI language engineers to facilitate the creation of cybertank artificial intelligence (AI). The Cybertank Command Language was modeled after the English language for maximum comprehension and utilization.

There is usually more than one command that can be used to perform a given function. The CCL designers created simple commands for common functions normally executed using traditional programming structure. Take, for example, the need to turn your cybertank to face in the direction of a scanned enemy. The traditional command structure requires the use of "System Variables" as follows:

```
Turn Tank To EnemyX EnemyY
```

Noting the frequency that cybertank engineers utilized the above command, OSI designers added the following command to the CCL to perform the same function:

```
Turn Tank To Face Enemy Tank
```

Obviously, this command is easier to understand.

1.2 CYCLE COUNT

All commands require a period of time to execute. Command execution time is measured in **cycles**. There are two fundamental types of commands in the CCL: 1) action commands that require physical or mechanical actions by the cybertank, such as turning to face a new direction, and 2) logic commands that do not have the cybertank perform physical or mechanical actions. Logic commands execute in 1 cycle, while action commands vary in execution time. Rotating the scanner, for example, requires less time than turning the entire cybertank.

Always keep cycle counts in mind when designing your cybertank's AI. For example, a cybertank using 10 cycles in its firing intelligence fires twice as fast as one with 20 cycles. Reducing cycle counts usually improves performance. It should also be noted that the cycle counts given in this handbook are base figures. For example, the command **ROTATE SCANNER LEFT 1** takes 10 cycles to execute, but the command **ROTATE SCANNER LEFT 4** takes 40 cycles to execute (10 cycles per angle of rotation times 4 angles.)

1.3 RESERVED WORDS

CCL commands, operators, and System Variables are "reserved" for specific purposes and cannot be incorporated in user-defined variables. See Appendix 1 for a list of Reserved Words.

1.4 STRUCTURE CONVENTIONS

The following conventions are used throughout this section for descriptive purposes:

"**Tank**" For the sake of brevity, all CCL commands refer to cybertanks as **tanks**.

[] Optional words in CCL commands are enclosed in square brackets. Commands will execute correctly with or without the bracketed words.

"**User Variable**" This designates where a User Variable name is to be used.

"**Any Variable**" This designates where either a User Variable name or a System Variable name is to be used.

"**#**" This designates where a User Variable name, a System Variable name, or a numeric digit is to be used.

"**Label**" This designates where a label name is to be used.

: (colon) This designates an alternative. For example, *[Branch To* : *Do]* indicates that either *Branch To* or *Do* can be used.

cyc This designates a command's cycle count. All initial command definitions include their cycle count.

"**X**" This designates that an X-coordinate on the map is to be used.

"**Y**" This designates that a Y-coordinate is to be used on the map.

1.5 LABELS

Labels used to designate the beginning of an AI segment can be executed with either the *Do* (*Gosub*) or *Branch To* (*Goto*) commands. A label may be composed of any alphanumeric character or symbol, with a 10 character maximum length. A label may contain a reserved word. If, during the Authorization process (discussed in Part 2, Section 2.6), you receive an "Out of label memory space" error message, try shortening the length of your labels. For a description of all possible Authorization errors, see Appendix 5.

1.6 SYSTEM VARIABLES

System Variables are used by the CCL for internal operations. They can be used in computations, but cannot be altered. System Variables are very useful, and often necessary, in designing cybertank AI. See Appendix 2 for a list of all of the System Variables.

1.7 USER VARIABLES

A User Variable is defined by the employee. Unlike System Variables, User Variables can be altered, can be composed of any alphanumeric character or symbol, and can be up to 15 characters in length. A User Variable name can contain a reserved word, but cannot consist of a reserved word alone. For example, "Turn" is a reserved word while "MyTurn" is a legal User Variable name.

1.8 OPERATORS

CCL supports the operators: "+" (addition), "-" (subtraction), "<" (less than), ">" (greater than), "=" (equals), "<=" (less than or equal), ">=" (greater than or equal), and "<>" (not equal). The operators are used as shown below.

```
1 cyc  "User Variable" = "#"
1 cyc  "User Variable" = "Any Variable" + "#"
1 cyc  "User Variable" = "Any Variable" - "#"
```

The above commands are called Assignment statements because the left side of the "=" is "assigned" the value of the right side.

```
1 cyc  If "Any Variable" = "#" Then [Branch To : Do] "Label"
1 cyc  If "Any Variable" = "Any Variable" + "#" Then [Branch To : Do]
       "Label"
1 cyc  If "Any Variable" = "Any Variable" - "#" Then [Branch To : Do]
       "Label"
```

The above commands are called Conditional statements (or IF/THEN statements.) These statements help control the flow of AI by checking various settings or conditions. Note that anywhere the "=" is used in the above Conditional examples, any of the operators ("<", ">", "<=", ">=", "<>") can be substituted.

Now for a few examples:

```
MyTurn = TankDir + 1
```

This sets the User Variable "MyTurn" to the System Variable "TankDir" plus one. So, if "TankDir" is currently equal to three, then "Myturn" would be assigned the value of four.

```
If Myturn >= 2 Then Branch to Done
```

This example causes the AI to branch to the label "Done" if and only if the User Variable "MyTurn" is greater than or equal to two. Based upon the first example, "Myturn" was set to four; therefore, the AI would indeed branch to the label "Done."

```
If Myturn = TankDir + 1 Then Branch to Done
```

This line causes the AI to branch to the label "Done" if and only if the User Variable "MyTurn" is equal to the System Variable "TankDir" plus one. So, the cybertank logic unit retrieves the value of "TankDir" and adds one to it. It then compares this value to "MyTurn." If they are equal, then the branch is taken.

Note: Adding one to "TankDir" is only for purposes of comparison. The value of "TankDir" does NOT change until an instruction is encountered which directs the cybertank to turn.

SECTION 2
MOVING THE CYBERTANK

Mobilizing your cybertank is a rather simple task, but one of extreme importance. With superb tactical maneuvering, your cybertank can sneak-up on the enemy without the enemy ever knowing what hit it. By the same token, bad judgement in movement can mean a quick termination of your cybertank. Many factors must be weighed when designing a path of movement: movement consumes fuel, a cybertank's treads must be functional, and obstacles must be avoided. With all this to consider, a cybertank must still be aware of its prime objective -- survival.

2.1 TREAD DAMAGE AND REPAIR

COMMAND STRUCTURE

1 cyc	If [Tank] Treads [are] Functional Then [Branch To : Do] "Label"
1 cyc	If [Tank] Treads [are] Not Functional Then [Branch To : Do] "Label"
60 cyc	Repair Treads

SYSTEM VARIABLES AFFECTED
TreadDamage

EXAMPLE USAGE

```
CheckTread
        If Tank Treads are Functional Then Branch To
                CT_Exit
        Repair Treads
CT_Exit
        Resume
```

Cybertanks use treads for moving and turning. When treads are destroyed, cybertanks cannot move. Repair kits, if purchased, can be used at any time to repair damaged treads. Refer to Section 5.1 for detailed information on cybertank repair.

2.2 MOVING

COMMAND STRUCTURE

```
40 cyc   Move [Tank] Forward "#"
40 cyc   Move [Tank] Backward "#"
```

SYSTEM VARIABLES AFFECTED

TankX
TankY

EXAMPLE USAGE

```
MoveClear
        Detect Obstruction at Tank Direction
        If Movement is Not Obstructed Then Branch To MC_Move
        Fire Weapon at Obstruction
        Branch To MoveClear
MC_Move
        Move Tank Forward 1
        Resume
```

Cybertanks can move forward (the direction they are facing) or backward (opposite the direction they are facing). You must specify the number of hectometers your cybertank is to move. Movement can range from 0 (useless) to 62 (dangerous).

Once instructed to move, your cybertank will not stop until it either reaches its destination or runs into an obstruction. If an obstruction is encountered, your cybertank incurs damage and stops. The amount of damage is determined by the object hit: buildings cause more damage than trees. Some objects (e.g. trees, bushes, houses, and headquarters) can eventually be destroyed if you continually ram them, while others, such as the battlefield barrier (resembling a brick wall) and reinforced buildings are indestructible. Your cybertank will eventually destroy itself if it continues to ram indestructible objects.

Moving a cybertank requires fuel. If your cybertank is instructed to move without fuel available, precious time is spent uselessly trying to start the engines.

Movement also requires functional treads. If a movement command is encountered and the treads are inoperable, the cybertank will waste time "spinning its wheels."

2.3 TURNING

COMMAND STRUCTURE

16 cyc	Turn [Tank] Left "#"
16 cyc	Turn [Tank] Right "#"
16 cyc	Turn [Tank] To "angle"
16 cyc	Turn [Tank] To "X" "Y"
16 cyc	Turn [Tank] To Face [Enemy] Tank
16 cyc	Turn [Tank] To Face Enemy HQ
16 cyc	Align Tank [with Scanner]

SYSTEM VARIABLES AFFECTED

TankDir

EXAMPLE USAGE

```
FindOpen
        Detect Obstruction at Tank Direction
        If Movement is Not Obstructed Then Branch To FO_Move
        Turn Tank Right 1
        Branch To FindOpen
FO_Move
        Move Tank Forward 1
        Resume
```

Cybertanks turn in eighths of a circle (45° increments).

When commanding a turn, the number of eighths to turn is specified. The following command will turn the cybertank one eighth (45°) to the right:

```
Turn Tank Right 1
```

The following command turns the cybertank three eighths (135 degrees) to the left:

```
Turn Tank Left 3
```

Cybertanks can also turn to specific angles. The angles are illustrated below in Diagram 2.3.

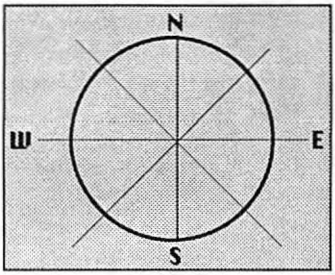


Diagram 2.3 -- The eight possible directions

The following command turns the cybertank to face northwest, regardless of the direction it is currently facing:

```
Turn Tank To 7
```

There are many instances where you need to have your cybertank move to a known location, but are not sure of the needed direction. Four different commands in the CCL will automatically turn your cybertank in the nearest direction to face a known location.

The following command will turn your cybertank in the nearest direction to face coordinates X=20 and Y=14:

```
Turn Tank To 20 14
```

Always list the X coordinate first, followed by a space and then the Y coordinate. **Do not use a comma to separate the coordinate pair.**

Use the following command to turn your cybertank to the closest direction to face an enemy cybertank **at its last scanned position**:

```
Turn Tank To Face Enemy Tank
```

Similarly, the following command will turn your cybertank toward the closest direction to face the enemy headquarters, if found:

```
Turn Tank to Face Enemy HQ
```

The following command will turn your cybertank to the direction its scanner is pointing:

```
Align Tank with Scanner
```

2.4 DETECTING MOVEMENT OBSTRUCTIONS

COMMAND STRUCTURE

4 cyc	Detect [Obstruction] at "#"
4 cyc	Detect [Obstruction] at Tank Direction
4 cyc	Detect [Obstruction] at Scanner Direction
1 cyc	If [Movement is] Obstructed Then [Branch To : Do] "Label"
1 cyc	If [Movement is] Not Obstructed Then [Branch To : Do] "Label"
1 cyc	If Obstruction [is] Enemy HQ Then [Branch To : Do] "Label"
1 cyc	If Obstruction [is] Ally HQ Then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

ObstacleX	ObstacleDist
ObstacleY	ObstacleType

EXAMPLE USAGE

```
MoveClear
        Detect Obstruction at Tank Direction
        If Movement is Not Obstructed Then Branch To
                MC_Move
        Fire Weapon at Obstruction
        Branch To MoveClear
MC_Move
        Move Tank Forward 1
        Resume
```

All cybertanks are equipped with a Movement Obstruction Sensor (MOS). This sensor determines whether an obstruction is in a specified direction. Any objects that can inflict damage to your cybertank in a collision are movement obstructions.

Using the MOS is different than using your scanner to find the closest object. Since scanners cover a large area, you would have to perform a series of complicated calculations to determine whether an object found in a scanner's area would impede movement. The MOS detects only obstacles between 1 and 3 hectometers from your cybertank's location in a specified direction.

The above example uses the "Detect Obstruction at Tank Direction" command. Once a "Detect . . ." command has been executed, you should use one of the "If . . ." commands to determine the results of the detection.

A common technique in the use of the sensor is to destroy an obstacle in your path. This is usually faster than trying to move around it. The above example illustrates this technique. An inherent problem in the example is that some obstacles cannot be destroyed. You could end up repeatedly trying to destroy an indestructible object.

This problem is overcome by checking the value of the System Variable **ObstacleType** to identify the obstacle. If it is indeed indestructible, you can design your AI to move around it. Refer to Appendix 3 for a complete description of object types. It is important to note that a cybertank's MOS is operational even when the Scanner is destroyed, but is not when your cybertank runs out of fuel.

2.5 DETERMINING CYBERTANK FACING

COMMAND STRUCTURE

1 cyc	If Tank [is] Facing [Enemy] Tank Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Not Facing [Enemy] Tank Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Aligned [with Scanner] Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Not Aligned [with Scanner] Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Facing Enemy HQ Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Not Facing Enemy HQ Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Facing "X" "Y" Then [Branch To : Do] "Label"
1 cyc	If Tank [is] Not Facing "X" "Y" Then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
MoveClear
        Detect Obstruction at Scanner Direction
        If Movement is Not Obstructed Then Branch To MC_ChkDir
        Fire Weapon at Obstruction
        Branch To MoveClear
MC_ChkDir
        If Tank is Aligned with Scanner Then Branch To
                MC_Move
        Align Tank with Scanner
MC_Move
        Move Tank Forward 1
        Resume
```

The relevance of these commands may not be readily apparent, but will become so when considering the impact of cycle counts.

The above example has the cybertank trying to move in the direction the scanner is facing. If you remove the command that checks alignment with its scanner, then the command "Align Tank with Scanner" is executed. This is extremely undesirable since turning a cybertank requires many cycles. It is more efficient to expend one cycle checking the cybertank's alignment than to waste numerous cycles turning the cybertank.

SECTION 3
USING THE SCANNER

All cybertanks are equipped with the Cybertank Scanner System (CSS), an essential piece of hardware. Various equipment can be built into the CSS, including a Scanner, a Remote Launcher, a Scanner Lock, a Listening Device, in addition to a Jammer.

Scanners vary in angle of effectiveness (or sweep angle) and range. The primary function of a Scanner is to quickly probe an area and return the results to the cybertank's main computer systems. Scanners are capable of detecting enemy cybertanks, headquarters, and various terrain features, and play an important role in cybertank design. Without a scanner, a cybertank is very limited in its range of sight (the MOS has a range of 3 hectometers with a one degree wide sweep angle -- see Section 2.4).

NOTE: The use of a defense shield halves the range of all scanners. (For more information on Defense Shields, see Section 5.2.)

3.1 SCANNER DAMAGE AND REPAIR

COMMAND STRUCTURE

1 cyc	If Scanner [is] Functional Then [Branch To : Do] "Label"
1 cyc	If Scanner [is] Not Functional Then [Branch To : Do] "Label"
60 cyc	Repair Scanner

SYSTEM VARIABLES AFFECTED
ScanDamage

EXAMPLE USAGE

```
CheckScan
        If Scanner is Functional Then Branch To CS_Exit
        Repair Scanner
CS_Exit
        Resume
```

The cybertank uses its scanner to find enemy cybertanks and locate objects. When its scanner is destroyed, a cybertank is essentially blind and normally doomed to fail. Repair kits, if purchased, can be used at any time to repair a damaged scanner. Scanners are reliable until they are completely destroyed.

3.2 SCANNING FOR ENEMY CYBERTANKS

COMMAND STRUCTURE

8 cyc	Scan for [Enemy] Tank
1 cyc	If [Enemy] Tank [was] Found Then [Branch To : Do] "Label"
1 cyc	If [Enemy] Tank [was] Not Found Then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

EnemyX
EnemyY
EnemyDist

EXAMPLE USAGE

```
FindTank
        Rotate Scanner Right 1
        Scan For Enemy Tank
        If Enemy Tank was Not Found Then Branch To
                FindTank
FT_FoundIt
        Resume
```

These commands are used to locate enemy cybertanks. It is necessary to execute the "Scan For Enemy Tank" command first, then use one of the "If. . ." commands to determine the results. The above example has the cybertank continuously scanning in all directions until an enemy cybertank is found.

3.3 SCANNING FOR OBJECTS

COMMAND STRUCTURE

```
8 cyc   Scan for [Closest] Object
1 cyc   If [Closest] Object [was] Found Then [Branch To : Do]
        "Label"
1 cyc   If [Closest] Object [was] Not Found Then [Branch To : Do]
        "Label"
```

SYSTEM VARIABLES AFFECTED

ObjX	ObjY
ObjType	ObjDist

EXAMPLE USAGE

```
ClearArea
        Tree = 4
        House = 5
        Align Tank with Scanner
CA_Loop
        Scan For Closest Object
        If Closest Object was Not Found Then Branch To
                CA_Rotate
        If ObjType = Tree then CA_Destroy
        If ObjType = House then CA_Destroy
CA_Rotate
        Rotate Scanner Right 1
        If Scanner Not Aligned with Tank Then Branch To CA_Loop
CA_Exit
        Resume
CA_Destroy
        If Closest Object is Beyond Weapon Range then Ca_Rotate
        Fire Weapon at Closest Object
        Branch To CA_Loop
```

These commands are used to locate the closest object to your cybertank. You must first execute the "Scan For Closest Object" command, then use one of the "If. . ." commands to determine the results.

One of the more common uses of these commands is to clear objects out of the way that might be interfering with your cybertank's ability to "see" an enemy tank. The above example illustrates this use. See Appendix 3 for a complete list of Object types.

3.4 FINDING THE HEADQUARTERS

COMMAND STRUCTURE

8 cyc	Scan for Enemy HQ
1 cyc	If Obstruction [is] Enemy HQ then [Branch To : Do] "Label"
1 cyc	If Obstruction [is] Ally HQ then [Branch To : Do] "Label"
1 cyc	If Enemy HQ [was] Found then [Branch To : Do] "Label"
1 cyc	If Enemy HQ [was] Not Found then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

EnemyHQX EnemyHQY
EnemyHQDist

EXAMPLE USAGE

```
CheckBase
        Scan for Enemy HQ
        If Enemy HQ was Found Then ShootIt
        Rotate Scanner 1
        Branch to CheckBase
ShootIt
        Fire Weapon at Enemy HQ
        Resume
```

All cybertanks are equipped with a special Headquarters Sensing Device (HSD) that allows the scanner to detect the presence of an enemy or allied base station. Once a base is detected and identified as friend or foe, a cybertank can decide whether to attack or defend it. The above commands are primarily used during team combat where the destruction of an enemy base station results in a victory.

3.5 ROTATING THE SCANNER

COMMAND STRUCTURE

16 cyc	Rotate [Scanner] Left "#"
16 cyc	Rotate [Scanner] Right "#"
16 cyc	Rotate [Scanner] To "angle"
16 cyc	Rotate [Scanner] To "X" "Y"
16 cyc	Rotate [Scanner] To Face [Enemy] Tank
16 cyc	Align Scanner [with Tank]
1 cyc	If Scanner [is] Aligned [with Tank] Then [Branch To : Do] "Label"
1 cyc	If Scanner [is] Not Aligned [with Tank] Then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

ScanDir

EXAMPLE USAGE

```
FindTank
        Rotate Scanner Right 1
        Scan For Enemy Tank
        If Enemy Tank was Found Then Branch To FT_FoundIt
        Branch To FindTank
FT_FoundIt
        Resume
```

Scanners rotate in eighths of a circle (45° increments). When commanding rotation, the number of eighths to turn is specified. The following command rotates the scanner one eighth (45 degrees) to the right:

```
Rotate Scanner Right 1
```

The following command will rotate the scanner three eighths (135 degrees) to the left:

```
Rotate Scanner Left 3
```

Scanners can also rotate to specific directions. The directions are illustrated in Diagram 3.5 below.

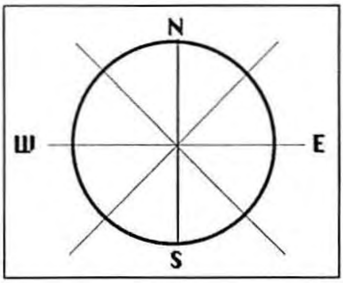


Diagram 3.5 -- The eight possible directions

The following command will rotate the scanner to face northwest, regardless of the direction it is currently pointing:

```
Rotate Scanner To 7
```

There are many instances where you need to point your scanner toward a known location, but are not aware of the proper direction. Many CCL comands automatically rotate your scanner in the nearest direction to face a known location.

The following command will rotate your scanner in the nearest direction to face the coordinates X=20 and Y=14:

```
Rotate Scanner To 20 14
```

Always list the X coordinate first, followed by a space and then the Y coordinate. **Do not use a comma to separate the coordinate pair.**

Use the following command to rotate your scanner to the nearest angle to face an enemy cybertank **at its last scanned position:**

Rotate Scanner To Face Enemy Tank

The following command rotates your scanner to the direction the cybertank is facing:

Align Scanner with Tank

3.6 LOCKING THE SCANNER ON A TARGET

COMMAND STRUCTURE

5 cyc	Lock [Scanner]
5 cyc	Unlock [Scanner]
1 cyc	If [Scanner is] Locked then [Branch To : Do] "Label"
1 cyc	If [Scanner is] Unlocked then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
FindTank
        Scan for Enemy Tank
        If Enemy Tank was Found then FT_Found
        Rotate Scanner Right 1
        Branch to FindTank
FT_Found
        Lock Scanner
        If Scanner is Unlocked then Branch To FindTank
        Resume
```

The Scanner Lock, a special item built into the CSS, can be purchased in the Chassis Design Module (CDM) if you have enough credits in your budget. Whenever a "Lock Scanner" instruction is executed, your cybertank's scanner locks onto the last scanned object, whether it is a tree, house, or another cybertank. Since trees and houses do not move, the most useful application for the scanner is to track the movement of enemy cybertanks.

NOTE: If an obstacle comes between your scanner and the scanned object, the scanner can no longer "see" the object and will automatically unlock. Also, enemy cybertanks may be equipped with Jammers that can "unlock" your scanner. Once your scanner is unlocked, you must continue scanning and try to detect the cybertank again.

3.7 DETECTING A SCANNER LOCKED ON YOU

COMMAND STRUCTURE

```
1 cyc   If [Tank is] Being Scanned Then [Branch To : Do] "Label"
1 cyc   If [Tank is] Not Being Scanned Then [Branch To : Do]
        "Label"
```

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
Detect
        If Tank is Not Being Scanned Then Branch To DT_No
        Jam Scanner Signal
DT_No
        Resume
```

Determining if another cybertank is locked onto your cybertank requires a special Listening Device available in the Chassis Design Module. When activated, the Listening Device checks whether or not your cybertank has been locked onto by another cybertank's scanner. The above example assumes the cybertank is equipped with a Listening Device and a Jammer (see Section 3.8), both of which are fairly expensive items.

3.8 JAMMING THE ENEMY'S SCANNER

COMMAND STRUCTURE

8 cyc	Jam [Scanner Signal]

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
Detect
        If Tank is Not Being Scanned Then Branch To DT_No
        Jam Scanner Signal
DT_No
        Resume
```

The Jam Scanner Signal command is useful only if your cybertank is equipped with a Jammer, a special device available in the Chassis Design Module (CDM). The Jammer will automatically unlock all enemy cybertank scanners which have locked onto your cybertank. This provides an opportunity for escape (hopefully) while enemy cybertanks try to re-scan and detect your new location.

3.9 LAUNCHING REMOTE SCANNERS

COMMAND STRUCTURE

15 cyc	Launch [Remote Scanner]
1 cyc	If Remote [Scanner is] Available Then [Branch To : Do] "Label"
1 cyc	If Remote [Scanner is] Unavailable Then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

EnemyX
EnemyDist
EnemyY
RemotesLeft

EXAMPLE USAGE

```
TryLaunch
        If Remote Scanner is Unavailable Then Branch To
                TL_No
        Launch Remote Scanner
TL_No
        Resume
```

A Remote Scanner is a special device available in the Chassis Design Module (CDM). When you purchase a Remote Scanner Launcher it is built into the CSS.

Remote Launchers hold four Remote Scanners. When the "Launch Remote Scanner" command is executed, the Remote Launcher hurls a Remote Scanner into the air. Remote Scanners are links between your cybertank and the **OSICOM I** satellite.

Once a Remote Scanner is airborne and linked to the satellite, it obtains the location of the enemy cybertank nearest your cybertank. Remote Scanners are single use items since they are destroyed upon impact with the ground. At the start of each battle, your cybertank is loaded with four Remote Scanners if it has been equipped with a Remote Launcher.

SECTION 4
USING THE WEAPON

Effective use of the Cybertank Weapon System (CWS) is crucial to the design of a potent fighting machine. Knowing when and where to fire is critical, and weapon maintenance plays an important role in your survival. Some weapons fire faster than others, and the amount and type of damage inflicted on the enemy depends on weapon type.

NOTE: NO cybertank weapon can fire through its own Defense Shield.

With all the variables that affect a weapon, it is important to be thorough and exercise caution before deciding to "pull the trigger."

4.1 WEAPON DAMAGE AND REPAIR

COMMAND STRUCTURE

1 cyc	If Weapon [is] Functional Then [Branch To : Do] "Label"
1 cyc	If Weapon [is] Not Functional Then [Branch To : Do] "Label"
60 cyc	Repair Weapon

SYSTEM VARIABLES AFFECTED

WeapDamage

EXAMPLE USAGE

```
CheckWeap
        If Weapon is Functional Then Branch To CW_Exit
        Repair Weapon
CW_Exit
        Resume
```

The CWS is used to damage and destroy the enemy as well as ravage the landscape. A well maintained weapon is one of the keys to survival. When the CWS is destroyed, your cybertank is defenseless and generally doomed to oblivion. Repair kits are available in the Chassis Design Module (CDM) and, if purchased, can be used at any time to reconstruct the CWS.

4.2 DETERMINING IF AN OBJECT IS WITHIN RANGE

COMMAND STRUCTURE

1 cyc	If [Enemy] Tank [is] Within [Weapon] Range then [Branch To : Do] "Label"
1 cyc	If [Enemy] Tank [is] Beyond [Weapon] Range then [Branch To : Do] "Label"
1 cyc	If [Closest] Object [is] Within [Weapon] Range then [Branch To : Do] "Label"
1 cyc	If [Closest] Object [is] Beyond [Weapon] Range then [Branch To : Do] "Label"
1 cyc	If Enemy HQ [is] Within [Weapon] Range then [Branch To : Do] "Label"
1 cyc	If Enemy HQ [is] Beyond [Weapon] Range then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
FindTank
        Scan for Enemy Tank
        If Enemy Tank Was Found Then Branch To CheckRange
        Rotate Scanner Right 1
        Branch to FindTank
CheckRange
        If Enemy Tank is Beyond Weapon Range Then TooFar
        Fire Weapon at Enemy Tank
        Branch to FindTank
TooFar
        Resume
```

Scanners range from 20 to 50 hectometers, while the weapons have only a four (4) hectometer maximum range. CCL designers developed the above commands to determine whether the last scanned object, enemy cybertank or enemy headquarters, is within (or beyond) your cybertank's weapon range. The above example first scans to find an enemy cybertank. Once found, it checks to see if the enemy is beyond its maximum weapon range. If the enemy is beyond range, the cybertank resumes normal operation. If an enemy is within range, the cybertank fires a shot and returns to scanning.

4.3 FIRING THE WEAPON

COMMAND STRUCTURE

```
40 cyc  Fire [Weapon] at [Enemy] Tank
40 cyc  Fire [Weapon] at [Closest] Object
40 cyc  Fire [Weapon] at Obstruction
40 cyc  Fire [Weapon] at "X" "Y"
40 cyc  Fire [Weapon] at Tank Direction
40 cyc  Fire [Weapon] at Scanner Direction
40 cyc  Fire [Weapon] at Enemy HQ
```

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
ClearPath
        Detect Obstruction at Tank Direction
        If Movement is Not Obstructed then LetsMove
        Fire Weapon at Obstruction
LetsMove
        Move Tank Forward 1
        Resume
```

The CWS is a very intelligent apparatus. Using the many possible variations of the above command, your cybertank can handle a wide variety of combat scenarios. For example, when the command "Fire Weapon at Enemy Tank" is executed, your CWS obtains the coordinates of the last scanned enemy cybertank from the Cybertank Scanner System (CSS). The weapon system turns the turret to the correct direction and fires the weapon. The same procedure is used to fire at specific locations. When firing at either the Tank Direction or Scanner Direction, the CWS first aligns the turret to the tank or the scanner direction.

After firing in a given direction, the projectile or laser hits the first object in its path. If no object is in the path, the projectile hits whatever is at the maximum weapon range (if anything). When a shot impacts an object, that object is damaged according to the type of weapon used. Most objects, like trees and houses, are easily demolished. Enemy cybertanks, on the other hand, are more difficult to destroy. Brick walls and large buildings are impervious to a cybertank's firepower due to their reinforced design and construction. Attempting to move through an indestructible object is futile, and very damaging to your cybertank.

Special Note: The CWS WILL NOT fire the weapon if your Defensive Shield is up (see Section 5.2 for more information on the Defense Shield).

SECTION 5
MISCELLANEOUS COMMANDS

SECTION BRIEF

This section presents a collection of diverse commands which are generally useful, but not commonly used.

5.1 REPAIRING DAMAGE

COMMAND STRUCTURE

60 cyc	Repair Internal
60 cyc	Repair Armor
60 cyc	Repair Treads
60 cyc	Repair Scanner
60 cyc	Repair Weapon
1 cyc	If [Repair] Kit [is] Available then [Branch To : Do] "Label"
1 cyc	If [Repair] Kit [is] Unavailable then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

IntDamage
ArmorDamage
ScanDamage
TreadDamage
WeapDamage
KitsLeft

EXAMPLE USAGE

```
TreadFixer
        If Tank Treads are Not Functional Then FixTreads
        Resume
FixTreads
        If Repair Kit is Available Then FixIt
        Resume
FixIt
        Repair Treads
        Resume
```

A Repair Kit is a special item available in the Chassis Design Module (CDM). It contains many contraptions, gizmos, and gadgets used to repair the various mechanisms and instruments on a cybertank. When a "Repair..." command is executed, assuming a Repair Kit is available, a percentage of the damaged equipment is repaired. Only a small amount of damage will be completely fixed. Four separate repair kits are included when this option is purchased.

5.2 DEFENSE SHIELD

COMMAND STRUCTURE

10 cyc	Raise [Shield]
5 cyc	Lower [Shield]
1 cyc	If Shield [is] Up Then [Branch To : Do] "Label"
1 cyc	If Shield [is] Down Then [Branch To : Do] "Label"

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
ChkShield
        If Shield is Down Then ShootIt
        Lower Shield
ShootIt
        Fire Weapon at Enemy Tank
        Resume
```

A Defense Shield is a special item available in the Chassis Design Module (CDM) which helps protect your cybertank from damage. When the Defense Shield is raised, an electro-magnetic field surrounds your cybertank reducing the amount of damage incurred by enemy cybertank fire.

There are three drawbacks to using a Defense Shield. The electro-magnetic field created by the shield reduces the maximum range of the cybertank's scanner; the CWS WILL NOT fire a weapon through the shield (in order to fire, your cybertank must first lower its Shield); the shield, when raised, consumes fuel. It is recommended that you raise the Defense Shield only when necessary and lower it as quickly as possible.

5.3 DETERMINING FUEL LEVEL

COMMAND STRUCTURE

```
1 cyc    If Fuel [is] Empty Then [Branch To : Do] "Label"
1 cyc    If Fuel [is] Remaining Then [Branch To : Do] "Label"
```

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
ChkFuel
        If Fuel is Empty Then Branch to NoMove
        Move Forward 1
NoMove
        Resume
```

All cybertanks require fuel to power onboard mechanical devices. Without fuel, a cybertank is a sitting duck. A lack of fuel affects the following:

1. The MOS, CSS, and CWS are inoperable.
2. All movement is terminated.
3. All CommLink communications are halted.
4. The Defense Shield cannot be raised.

As you can see, running out of fuel is no trivial matter. It is an important consideration in the design of your cybertank's AI. Always try to keep movement to a minimum, since it is a big fuel consumer. The Energy Miser, available in the Chassis Design Module (CDM), is an important option since it reduces fuel consumption by approximately 50%.

NOTE: Even though your cybertank may run out of fuel, its internal computer systems still continues processing logic functions. The AI still exerutes and TRYS to carry out all commands. If you design your cybertank to check its fuel level regularly, you can have it branch to a special routine (possibly self-destruct at that point) when it detects a lack of fuel .

5.4 WHEN ALL ELSE FAILS

COMMAND STRUCTURE

1 cyc Self Destruct

SYSTEM VARIABLES AFFECTED

All

EXAMPLE USAGE

```
CheckAll
        If Tank Treads are Functional Then Branch to OK
        If Scanner is Functional Then Branch to OK
        If Weapon is Functional Then Branch to OK
        If Fuel is Remaining Then Branch to OK
        If Repair Kit is Available Then Branch to OK
        Self Destruct
OK
        Resume
```

This command is pretty self-explanatory. When your cybertank is really down and out, the only noble thing to do is Self Destruct.

5.5 GENERALLY USEFUL COMMANDS

COMMAND STRUCTURE

1 cyc Get Distance [To] "X" "Y"
1 cyc Get Random [To #]
1 cyc Beep
0 cyc * (asterisk)

SYSTEM VARIABLES AFFECTED

XYDist	RandomNum

EXAMPLE USAGE

```
CheckDist
        Get Distance To 1 1
        If XYDist > 30 then MaybeGo
* This is a comment line
MoveIt
        Turn Tank to 1 1
        Move Tank Forward 1
        Beep
        Resume
* You can put anything you want here
MaybeGo
        Get Random to 100
        If RandomNum > 50 then NoGo
        Branch to MoveIt
* All of this is ignored by the computer systems
NoGo
        Resume
```

The above commands were developed after some of the staff at OSI fought long and hard for their development. The commands, while not necessary for the "everyday" use of a cybertank, prove useful in some instances.

The "Get Random" command was developed because some employees wanted their cybertanks to randomly move left or right when searching for any enemy.

Another employee wanted to know which corner of the map was nearest his cybertank so he could decide where to go when it was time to run and hide. The "Get Distance" command proved very useful in this case.

The "Beep" command produces a short beep sound useful in debugging certain routines in your AI.

The last statement cannot really be called a command. The "*" (asterisk) is used to comment your AI design. The cybertank's on-board computer system recognizes any line that starts with an asterisk as a comment line and does not attempt to execute it. It should be noted that the asterisk must be in the left-most column. Any text, comments, or explanations which follow an asterisk are ignored. It is suggested that all employees comment their AI. Commenting is extremely helpful when examining AI code months after it was originally written.

> **NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:**
>
> The asterisk character appears as a diamond shape on these terminal types.

5.6 SETTING A "BREAKPOINT"

COMMAND STRUCTURE

0 cyc Break

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
CheckEnemy
        Scan for Enemy Tank
        If Enemy Tank Was Not Found Then Branch To Done
        If Enemy Tank Is Not Within Weapon Range Then Branch To
                Done
        Break
Done
        Resume
```

The "Break" command is only important when testing a cybertank in the Cybertank Test Module (CTM) (see Part 2, Section 5). When executed, the "Break" command halts execution, **but only in the CTM.** While battling in the Combat Simulation Module (CSM) (see Part 2, Section 4), the "Break" command does absolutely nothing. The cybertank's on-board computer system ignores the command and continues execution with the next instruction.

5.7 ATTAINING MANUAL CONTROL

COMMAND STRUCTURE

```
1 cyc   If [Last] Key [Pressed] Then [Branch To : Do] "Label"
1 cyc   If [Last] Key [Pressed] = "1 character" Then [Branch To : Do]
        "Label"
```

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
ReadKey
        If Last Key Pressed = "I" then Branch to MoveForwd
        If Last Key Pressed = "F" then Branch to Fire
        Resume
MoveForwd
        Move Tank Forward 1
        Branch to Done
Fire
        Fire Weapon at Closest Object
Done
        Resume
```

The Cybertank Remote System (CRS) provides a great deal of control over your cybertank's actions. The CRS is basically a link between your terminal's keyboard and your cybertank. By issuing one letter commands [A-Z] from your terminal's keyboard during simulations, you can alter the behavior of your cybertank.

The above example checks to see if the "I" or "F" keys have been pressed. If either were pressed, the CRS passes the information to the cybertank's AI so it can respond accordingly by branching to the correct label. If neither the "I" nor "F" key were pressed, then the cybertank continues to function as usual.

Cybertanks that rely on the CRS to respond to keyboard control are often called Manual cybertanks. Manual cybertanks have a tremendous advantage over standard AI cybertanks because the cybertank benefits from the designer's logic and reasoning capabilities during a simulation. When designing Manual cybertanks, you do not have to worry about designing AI to move around indestructible buildings, avoid water, or retreat from the enemy. It is much easier to design a Manual cybertank.

5.8 SEQUENCE COMMANDS

COMMAND STRUCTURE

```
1 cyc  Branch To "Label"
1 cyc  Goto "Label"
1 cyc  Do "Label"
1 cyc  Gosub "Label"
1 cyc  Resume
```

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
TankProg
        Do ScanEnemy
        Do MoveFrwd
        Branch to TankProg
ScanEnemy
        Scan For Enemy Tank
        If Enemy Tank Found Then Do ShootIt
        Resume
MoveFrwd
        Move Tank Forward 1
        Resume
ShootIt
        If Enemy Tank is Within Range Then Do KillIt
        Resume
KillIt
        Fire at Enemy Tank
        Resume
```

The Sequence Commands listed above play an important role in the design of your cybertank's AI. The "Branch" and "Goto" commands direct the execution of your cybertank's AI to a specific "Label". When a "Branch" and "Goto" command is executed, your cybertank's on-board computer system searches the AI for the specified "Label." Once located, the computer system begins to execute the commands found directly after the "Label."

The "Do" and "Gosub" commands are similar to the "Goto" and "Branch" commands, except that the on-board computer system remembers which instruction the "Do" or "Gosub" is on. When a "Resume" command is encountered, execution is directed to the line directly after the line which contained the "Do" or "Gosub." This is useful if there is a routine in your cybertank's AI which is needed at several locations in your cybertank's AI program. Instead of typing the routine repeatedly, you can execute a "Do" or "Gosub" each time the routine is needed. Using the above example, the small routine named "KillIt" can be called from anywhere in a cybertank's AI. Since the routine ends with a "Resume" statement, execution will ALWAYS resume to the line directly after the "Do Killit" instruction.

Now to follow the procedure with another example:

```
Example
        Do MakePath
        Do MoveFwrd
        Do ScanEnemy
        Branch to Example
*********
MakePath
        Detect Obstruction at Tank Direction
        If Movement is Not Obstructed Then Branch To MakeOk
        Fire Weapon at Obstruction
MakeOk
        Resume
*********
MoveFwrd
        Move Tank Forward 1
        Resume
```

```
*********
ScanEnemy
        Scan for Enemy Tank
        If Enemy Tank Not Found Then Branch To NoEnemy
        If Enemy Tank is Beyond Weapon Range Then Branch To
            NoEnemy
        Fire Weapon at Enemy Tank
NoEnemy
        Resume
```

Ok, now to follow the logic in this AI section:

1. The routine "MakePath" is called with the "Do MakePath" command.

2. The routine "MakePath" checks to see if there is an obstruction. If there is no movement obstruction, then execution branches to "MakeOK". If there is an obstruction, then the cybertank fires at it (and hopefully destroys it).

3. Whether there was an obstruction or not, the AI winds up at "MakeOk". At "MakeOK" there is a "RESUME" command. This command returns the AI back to the command directly after the "Do MakePath". In other words, execution continues at the line "Do MoveFwrd".

4. The command "Do MoveFwrd" sends execution to the routine "MoveFwrd".

5. The "MoveFwrd" routine simply moves the cybertank forward 1 hectometer.

6. The "RESUME" command sends execution back to the line directly after the "Do MoveFwrd" command, which is the "Do ScanEnemy" command.

7. The "Do ScanEnemy" command sends the AI to the routine called "ScanEnemy".

8. The routine "ScanEnemy" checks to see if an enemy can be found and if so, is it within weapon range. If an enemy cybertank is not found, or one is found but is out of weapon range, then the AI will branch to the label

"NoEnemy". If an enemy is found AND it is within weapon range, then the cybertank will fire at it.

9. Whether a cybertank was fired at or not, execution winds up at the label "NoEnemy." At "NoEnemy" there is a "RESUME" command. This command returns the AI to the command directly after the "Do ScanEnemy." In other words, execution continues at the line "Branch to Example."

10. The command "Branch to Example" loops the AI back up to the label "Example" and the whole process is repeated over and over.

5.9 INCLUDING CAPSULE ROUTINES

COMMAND STRUCTURE
0 cyc Include "AI Capsule file name"

SYSTEM VARIABLES AFFECTED
None

EXAMPLE USAGE

```
TankProg
        Do ScanEnemy
        Do MoveFrwd
        Branch to TankProg

        Include ScanEnemy
        Include MoveFrwd
```

The "Include..." command simply makes it easier to create cybertanks. The directors and engineers at OSI have designed many useful and commonly used routines that can be included in your cybertank's AI. By using the "Include..." command, an OSI AI Capsule is incorporated into your cybertank's AI during the Authorization process. For more information on including Capsules in your AI, please see Part 4.

SECTION 6
USING THE COMMUNICATIONS LINK

The cybertank Communications Link (CommLink), a special device which can purchased in the Chassis Design Module (CDM), enables communication between cybertanks on the same team. When using cybertanks in the Team mode, it is often useful to transmit various data or instructions to other members of the team. Effective use of the Commlink aids in the performance of complicated tactical maneuvers by a team of cybertanks.

6.1 TURNING THE COMMLINK ON AND OFF

COMMAND STRUCTURE

1 cyc	Switch [CommLink] On
1 cyc	Switch [CommLink] Off

SYSTEM VARIABLES AFFECTED

None

EXAMPLE USAGE

```
CheckBase
        Scan for Enemy HQ
        If Enemy HQ was Found Then TellTeam
        Resume
TellTeam
        Switch CommLink On
        Transmit Code 1 To Team
        Switch CommLink Off
        Resume
```

The above commands switch your cybertank's CommLink on and off. When on, your cybertank can send and receive team member transmissions. When off, your cybertank's CommLink can neither send nor receive transmissions.

6.2 TRANSMITTING AND RECEIVING ON THE COMMLINK

COMMAND STRUCTURE

1 cyc	Transmit [Code] "#" [To Team]
1 cyc	Clear [CommLink] Data
1 cyc	Copy [CommLink] Data

SYSTEM VARIABLES AFFECTED

AllyNum
AllyCode
AllyX
AllyY
AllyDist
AllyDir
CopyEnemyDist

AllyEnemyX
AllyEnemyY
AllyEnemyDist
AllyEnemyDir
CopyNum
CopyCode
CopyEnemyDir

CopyX
CopyY
CopyDist
CopyDir
CopyEnemyX
CopyEnemyY

(For a complete description of these System Variables, see Appendix 2.)

EXAMPLE USAGE

```
CheckComm
        If AllyCode <> then CodeHere
        Clear CommLink
        Branch to CheckComm
CodeHere
        Switch CommLink Off
        Copy CommLink Data
        Switch CommLink On
        If CopyCode = 1 Then EnemyFound
        If CopyCode = 2 Then BaseFound
        Resume
```

The three commands listed above are essential in the operation of the CommLink. By transmitting various codes, a team of cybertanks can consolidate its forces and knowledge, forming a colɔssal army. The code actually transmitted via CommLink can range from 0 to 100. Cybertanks on a team have the option of ignoring any signal transmitted. For example, if the third cybertank on a team sends a code of 7, which all members of the team have designated as a distress call, any cybertank on the team can either ignore the distress call or speed to the rescue.

It is important to remember that all incoming transmissions update all of the System Variables in the CommLink (only if your cybertank's CommLink is switched on). To effectively use the CommLink as a receiver, a cybertank should:

1. After checking the "AllyCode", turn off the CommLink with the *Switch CommLink Off* command.

2. Use the *Copy CommLink Data* command to establish a copy of all transmitted variables

3. Use the *Switch CommLink On* command to re-establish communications.

When the *Copy CommLink* command is executed, all of the System Variables within the CommLink are copied over to the "Copy..." System Variables. All of the new copied System Variables begin with the word "Copy" and should be used in any subsequent AI commands. Based upon the above distress call, a cybertank which is instructed to attempt a rescue should do the following:

1. Check to see if the System Variable "AllyCode" equals 7.

2. If "AllyCode" is 7, then *Switch CommLink Off* to prevent any incoming transmissions which would overwrite the needed System Variables.

3. Use the *Copy CommLink Data* command to make a copy of the needed System Variables.

4. *Switch CommLink On* to allow the checking of new incoming transmissions. This allows the cybertank to change its duties based upon new information. For example, the discovery of enemy headquarter's by another team member may be more important than saving the team member in distress. Remember, as the AI designer, it is up to you to determine your cybertank's priorities.

5. Use the "Copy..." System Variables (CopyX, CopyY, etc...) to home in on the team member in distress.

The above, written in CCL, would resemble the following:

```
CheckComm
*  An AllyCode of 7 means team-member being attacked
*  An AllyCode of 1 means enemy HQ found

        If AllyCode = 7 then Branch To Rescue
        If AllyCode = 1 then Branch To FoundHQ
        Resume

Rescue
*   The cybertank now knows that a team-member is being
*   attacked.

        Switch CommLink Off
        Copy CommLink Data
        Switch CommLink On

*   The CommLink is turned off to ensure that new incoming
*   transmissions do not over-write the current values in the
*   CommLink. The CommLink data is copied into another set
*   of System Variables that are NOT over-written by incoming
*   CommLink transmissions. It is this second set of System
*   Variables that is used in subsequent AI commands. The
*   CommLink is turned back on so that the cybertank can
*   continue monitoring in case a more important transmission
*   is received (like the Enemy HQ being found).


GoToTank
*   This small routine moves the cybertank toward the team-
*   member that sent the distress signal. Since the Copy
*  CommLink Data command was issued, the System Variables
*  CopyX and CopyY are used as the cybertank's destination.
*   Along the way, the cybertank continues checking the
*  AllyCode System Variable in the CommLink to see if any
*  team-member has found the enemy HQ.

        Turn Tank to CopyX CopyY
        Detect Obstruction at TankDir
        If Movement Is Not Obstructed Then Branch To Move
        Fire Weapon at TankDir

Move

        Move Tank Forward 1

*  Now, check to see if anyone has found the enemy HQ

        If AllyCode = 1 then Branch To FoundHQ

*  Now, check to see if the cybertank is at its destination

        If TankX <> CopyX Then Branch To GoToTank
        If TankY <> CopyY Then Branch To GoToTank

*  If at destination, then return to the main AI

        Resume


FoundHQ
*  If the enemy HQ was found, the cybertank should perform the
*  same procedure as when moving to a team-member in
*  distress.

        Switch CommLink Off
        Copy CommLink Data
        Switch CommLink On
        Branch To GoToHQ

*  Now, the cybertank is free to use the "Copy..."  System
*  Variables to proceed to the team-member which found
*  the enemy HQ. Since this routine is a great deal like the
*  GoToTank routine used above, we will just assume the
*  routine is written and is called GoToHQ.
```

PART 4
CAPSULE REFERENCE

SYNOPSIS

This section is a must for new employees. The Capsule Routine Reference details the "hows" and "whys" of using pre-defined AI routines. Capsule routines can simplify the creation of a cybertank's AI. Employees can "plug-in" various routines to perform diverse operations.

SECTION 1
GENERAL INFORMATION

SECTION BRIEF
This section defines Capsules and how they are used.

1.1 WHAT IS A CAPSULE?

A Capsule is a pre-defined AI routine that can be incorporated into a cybertank's AI. Capsule routines can perform any cybertank function. For example, a Capsule routine can hunt for an enemy, move around an obstacle, retreat from a battle, and much more. Capsule routines range from the simple to the complex.

1.2 HOW TO USE A CAPSULE

OSI engineers and designers have created several Capsule routines to perform various tasks.

To examine an OSI Capsule routine, select **DESIGN CYBERTANK** from the DESIGN menu in the ECM. Next, select LOAD from the CAPSULE menu in the DCM. The File Retrieval Panel (FRP) appears.

Select the name of the desired Capsule and then select the OPEN button.

> NOTE: For users of Commodore 64 and Apple //+,c,e terminals only:
>
> The OSI Capsule routines are found on the RESOURCE disc.

At this point, you are transferred to the AI Module, but you are NOT working on a cybertank's AI -- you are working on a Capsule routine. You must INCLUDE (or incorporate) a Capsule in a cybertank's AI.

1.3 OSI CAPSULE STANDARDS

Except for three Capsules written exclusively for the OSI Training Guide, all Capsules designed by OSI observe the standard conventions listed below. Capsule routines created by new employees do NOT need to follow these capsule standards.

Capsule Variables

For all User Variables listed below, a value of zero implies "NOT SET", while a value of one implies "SET".

The following User Variables must be set or cleared BEFORE calling an OSI Capsule routine. If the variables are undefined they are assumed to have a value of zero (ie., not set).

L.ABORT - If set, all OSI Capsule routines abort if the cybertank incurs any damage during execution. If not set, any damage is ignored during execution of the routine.

L.WATER - If set, all OSI Capsule routines traverse through water when moving the cybertank. If this variable is not set, the cybertank always avoids water.

L.CLEAR - If set, all OSI Capsule routines move around any obstructions in the cybertank's path. If not set, all OSI Capsule routines fire the cybertank's weapon at the obstruction, allowing forward movement. If the obstruction cannot be destroyed (ie., a building), the cybertank will move around it.

The following User Variables will be set or cleared AFTER an OSI Capsule routine has executed. This allows you to determine why the Capsule routine has aborted or finished its execution.

L.DAMAGE? - Set if the cybertank incurred damage during execution of an OSI Capsule routine. All OSI Capsule routines set this variable if the cybertank is damaged. If you did not set L.ABORT, damage is not checked during execution and this variable will never be set.

L.ENEMYFOUND? - Set if an enemy cybertank is found during a search routine.

L.ENEMYLOST? - Set if an enemy tank being tracked is no longer found by the scanner. This occurs during a hunt, when an obstruction comes between the two cybertanks.

L.INRANGE? - Set if an enemy cybertank being hunted or scanned is within the cybertank's weapon range.

1.4 OSI CAPSULE ROUTINES

The following is a list of all OSI engineered Capsule routines available on the Resource disc. A brief explanation of each Capsule routine is included. Also included here is the label name that should be used when accessing the Capsule Routines. For example, if you included the routine **CenterSearch** in your AI, you could use the CCL instruction "**Do Center**" to perform the **CenterSearch** routine.

1.4.1 "SEARCH FOR ENEMY" CAPSULES

CenterSearch

> Label to use when calling: CENTER

This Capsule routine moves the cybertank to the center of the battlefield. While moving, it searches for enemy cybertanks. Once the cybertank is in the center of the battlefield, the Capsule routine continues a rapid but thorough search pattern. Any cybertank that uses this routine is looking for trouble.

Primary Usage: This Capsule is very offense-oriented. It is useful against enemy cybertanks that come straight at an enemy. The quick scanner search detects them long before they are within weapon range.

Weakness: This Capsule is impeded somewhat by certain battlefield designs. If, for example, a design hinders access to the very center of the battlefield, the cybertank is vulnerable to a sneak attack while searching for a route to the center.

CornerSearch

> Label to use when calling: CORNER

This Capsule routine finds the corner nearest the cybertank and moves toward it. During the move, it searches for enemy cybertanks. The theory behind moving to the corner for protection (which was devised by a clever young engineer at OSI) is that your cybertank's "back is covered" and enemy cybertanks can attack your cybertank from only three angles.

Primary Usage: This Capsule is a defense-oriented routine. Using the corners of the battlefield, a cybertank gains an advantage due to the protection of the walls. In addition, nestling up in a nice safe corner reduces the need for movement and conserves fuel.

Weakness: While this routine is defense oriented, a cybertank using it is usually discovered by enemy cybertanks. This is due, in part, to the nature of some lower-level cybertanks "hugging" the battlefield walls. Another drawback is that retreat or a "break and run" is restricted to a few directions.

EdgeSearch

> Label to use when calling: EDGE

This Capsule routine searches for enemy cybertanks by traversing the edges of the battlefield.

Primary Usage: This Capsule is effective in searching most of the battlefield. By following the battlefield walls, very little of the battlefield remains unscanned.

Weakness: Some battlefield designs are effective in countering this Capsule. Since the Capsule attempts to follow the battlefield walls, battlefield configurations with dead-ends make the cybertank spend a lot of time "getting its bearings." Cybertanks are vulnerable to attack during such periods.

RandomSearch

> Label to use when calling: RNDSEARCH

This Capsule routine randomly roams the battlefield searching for enemy cybertanks.

Primary Usage: Since this Capsule is random in design, it fosters various, unpredictable results. Random movement makes the cybertank difficult to track -- sometimes it moves left, sometimes it moves right.

Weakness: The primary downfall of this Capsule is its "randomness" or illogical actions. For example, a cybertank using this Capsule can be in very close proximity to an enemy cybertank and never detect it, while the enemy cybertank, by using a very systematic search pattern, is able to detect the "random" cybertank.

SitSearch

> Label to use when calling: SITSEARCH

This Capsule routine instructs the cybertank to sit in one spot and scan for an enemy cybertank. That's all it does -- very sweet, very simple.

Primary Usage: This Capsule routine is very effective in detecting any enemies in close proximity. It safeguards against accidently stumbling upon an enemy with defenses down, and is extremely fuel efficient.

Weakness: Because of the lack of movement, a cybertank using this routine is extremely limited in the amount of battlefield it can successfully scan. Also, the initial random placement of cybertanks by the Combat Simulation Module (CSM) may not be in a very advantageous position.

1.4.2 "TRACKING" CAPSULES

BeeLineHunt

> Label to use when calling: BEELINE

As the name implies, this Capsule routine makes a bee-line towards an enemy cybertank. The routine attempts to move towards the enemy cybertank until the enemy is within weapon range. This routine assumes that an enemy cybertank has already been detected.

Primary Usage: This Capsule routine is used to quickly approach an enemy cybertank. Slower tracking routines often lose the trail of very mobile enemy cybertanks. This routine was designed to provide maximum speed during "the hunt".

Weakness: Since this Capsule is preoccupied with getting to the enemy cybertank quickly, it often moves the cybertank into weapon range without being prepared to attack. A cybertank using this Capsule routine rarely gets off the first shots during a battle confrontation.

TrackEnemy

> Label to use when calling: TRACK

This Capsule routine tracks a located enemy cybertank. It does NOT actively seek out an enemy, since it assumes an enemy has already been found. As long as the enemy cybertank continues to move closer, this routine instructs the cybertank to remain stationary. If the wait is extended, your cybertank will move toward the enemy.

Primary Usage: This Capsule routine is most effective when speed is not of the essence. Since the enemy cybertank is usually moving toward you, your cybertank typically fires the first few shots.

Weakness: This routine slowly tracks an enemy cybertank and escape is a definite possibility.

WaitForEnemy

> Label to use when calling: WAIT

This Capsule routine instructs your cybertank to sit in one spot and wait for an enemy cybertank. This routine assumes that an enemy has already been found.

Primary Usage: This Capsule routine is most effective against slow, hulking, very powerful enemy cybertanks. Since a cybertank using this Capsule routine remains stationary while tracking an enemy, it is almost always assured the first shots. Against powerful enemies, the first few shots are extremely important.

Weakness: The primary weakness of this routine is that a cybertank is vulnerable to attack when stationary. While waiting for an identified enemy to approach, other cybertanks can approach without detection.

1.4.3 "ENEMY TERMINATION" CAPSULES

BerserkAttack

> Label to use when calling: **BERSERK**

As the name implies, this Capsule routine is a full-force attack on an opponent. This Capsule simply fires the cybertank's weapon ten times in a row -- no thinking, no wasted time, just plain old fashioned brute force.

Primary Usage: This Capsule is best suited for attacking slow, hulking cybertanks that come straight in for the kill. The combination of this Capsule with a very fast weapon (lasers) results in a very deadly cybertank.

Weakness: This method of attack is only effective as long as the enemy cybertank sits still long enough to receive all ten hits (if it takes that many). This routine is very ineffective against cybertanks that are known to be quick and very mobile.

KillTank

> Label to use when calling: **KILLTANK**

This Capsule routine fires the cybertank's weapon at an enemy cybertank until the enemy is destroyed or is no longer detected by the scanner. If the enemy cybertank moves out of weapon range, then this Capsule will move toward it until obstructed.

Primary Usage: This Capsule routine is primarily used against enemy cybertanks that are known to flee from combat. Your cybertank will chase a fleeing enemy.

Weakness: This Capsule routine is inefficient against cybertanks that employ a technique known as "back-up and wait". A cybertank which uses this technique will move backward one hectometer, wait for the opposing cybertank to move forward into range, then fire and move backward again. For a cybertank to successfully use this technique it must have a fast weapon and a light chassis for maximum firing and maneuvering speed.

NormalAttack

> Label to use when calling: **ATTACK**

This Capsule is a standard attack routine. Your cybertank fires at an enemy cybertank until it either moves beyond weapon range or is not detected by the scanner.

Primary Usage: This Capsule routine is, as the name implies, the normal attacking procedure. Since this Capsule routine does NOT attempt to follow an enemy cybertank, it is very effective against those cybertanks which use the "back-up and fire" technique (see **KillTank** above).

Weakness: This routine does not have any major weaknesses. It is a basic and predictable attack pattern.

1.4.4 "FLEE FROM ENEMY" CAPSULE

Panic

> Label to use when calling: **PANIC**

This Capsule routine instructs a cybertank to quickly move backwards ten hectometers. It does NOT check for obstacles while backing-up. If there is an indestructible obstacle behind the cybertank, damage will be incurred.

Primary Usage: This Capsule routine is typically used to quickly disengage from a combat situation. For example, if your cybertank becomes severely damaged during a battle, it can use this routine to get out of the immediate area for a quick breather (or to attempt repairs).

Weakness: Since it does not check for obstacles, the primary weakness of this Capsule is that the cybertank will probably incur damage while backing up.

PART 5
COMBAT OBJECTIVES AND TACTICS

SYNOPSIS

The OSI/CACD System 2 offers many different simulation possibilities. Each variation presents it own strategic options and subtleties.

SECTION 1
MELEE

SECTION BRIEF
The most common type of simulation is known as Melee. Melee is an all out free-for-all. Each cybertank in a melee simulation is an enemy of every other cybertank.

1.1 MELEE OBJECTIVE

The only objective during a melee simulation is to be the last active cybertank left on the battlefield. This objective can be attained through a number of strategic possibilities.

1.2 MELEE TACTICS

1.2.1 Destroying the Other Cybertanks

The most common method of being victorious in a melee simulation is to destroy all the other cybertanks in the simulation. If there are many other cybertanks in the melee, then a cybertank must be very powerful if it is to have a chance at being victorious. The chances of encountering two or more enemy cybertanks at the same time is relatively high; thus, a cybertank in a large melee must be able to sustain damage "from behind" while attacking another enemy.

During a small, or one-on-one melee, the victory does not necessarily go to the most powerful cybertank, but to the cybertank with the "cleverest" AI design. For example, a small, quick cybertank can move in on a larger, more powerful tank and get off a couple of shots before the larger tank is able to react. If this process is successfully repeated, then any cybertank can "wear down" a much larger, more powerful tank.

1.2.2 Hiding From the Other Cybertanks

The other commonly used tactic in winning a melee simulation is that of hiding from the other cybertanks. While this method is less exciting, it still produces a large number of victories. The cybertank that attempts to hide usually moves to the closest corner and sits there. By hiding in the corner, a cybertank is protected from assaults from behind by the battlefield wall. A cybertank hiding in the corner is less likely to be detected by other cybertanks, and while hiding, the other cybertanks are roaming around the battlefield, destroying each other. The other cybertanks are using a great deal of fuel moving around the battlefield, while the cybertank in the corner is stationary and conserves fuel.

SECTION 2
TEAM COMBAT

SECTION BRIEF

Cybertanks can also engage in team combat simulation. Team combat pits groups of cybertanks, composed of up to seven cybertanks, against one another. Team combat offers many strategic possibilities.

2.1 ABSOLUTE TERMINATION

As in a melee simulation, a team of cybertanks can be victorious by destroying all of the cybertanks on the opposing team [see Part 2, Section 3 for more information on the Simulation Design Module (SDM) and setting up cybertank teams]. With up to seven cybertanks per team, this can prove to be a very difficult task. To be effective, a team of cybertanks should employ the use of a CommLink (see Section 2.3 for more information regarding the CommLink). By using the CommLink effectively, a team of cybertanks can pool their resources and information. For example, cybertanks on the same team can come to the rescue of a team-member who is being attacked. It should be noted that any cybertanks in the simulation that have NOT been placed on a team are treated as if they were in a melee simulation (ie., all other cybertanks are the enemy).

2.2 HEADQUARTERS TERMINATION

The Simulation Design Module (SDM) allows a headquarters building to be placed on the battlefield for each of the two teams. A team that destroys an enemy's headquarters is the victor in team combat.

When a team combat simulation includes headquarter buildings, the strategic options increase. Since a headquarters is easy to destroy, it must be well protected. It is very effective to divide the offensive and defensive duties of the cybertanks on a team. The offensive tanks should be very good "search" tanks, possessing good scanners and able to cover a great deal of the battlefield as quickly as possible while searching for the enemy headquarters. The defensive tanks should be very powerful tanks. The defensive tanks will not have to move very much, and do not need to be fast or fuel efficient; however, they should be equipped with the best weapons and armor possible. Defensive tanks should also have good scanners so they can detect incoming enemy tanks as soon as possible.

The CommLink is an important part of the strategy in team combat that incorporates a design with a headquarters. Once the enemy headquarters is found by a cybertank, its position can be relayed to all members of the team. By doing so, all firepower can be concentrated in the area of the enemy headquarters.

2.3 TEAM COMMUNICATIONS

The cybertank Communications Link (CommLink), a special device which can be purchased in the Chassis Design Module (CDM), enables communication between cybertanks on the same team. When using cybertanks in the Team mode, it is often useful to transmit various data or instructions to other members of the team. Effective use of the Commlink aids in the performance of complicated tactical maneuvers by a team of cybertanks. By transmitting various codes, a team of cybertanks can consolidate its forces and knowledge, forming a colossal army. For complete information on the usage of the CommLink, please see Part 3, Section 6.

SECTION 3
MANUAL CONTROL

SECTION BRIEF

One of the most interesting simulation possibilities is that of manually controlled cybertanks. By pressing various keys on the computer terminal, a cybertank designer can exercise a great deal of control over the cybertank.

3.1 WHAT IS MANUAL CONTROL?

All cybertanks are equipped with what is known as a Cybertank Remote System (CRS). The CRS is basically a link between your terminal's keyboard and your cybertank. By issuing single letter commands [A-Z] from your terminal's keyboard during simulations, you can greatly alter the behavior of your cybertank.

Cybertanks that rely on the CRS to respond to keyboard control are often called Manual cybertanks. Manual cybertanks have a tremendous advantage over standard AI cybertanks because the cybertank benefits from the designer's logic and reasoning capabilities during a simulation. When designing Manual cybertanks, complex routines to move around indestructible buildings, avoid water, or retreat from the enemy are unnecessary. Such routines can be handled by the cybertank designer during the simulation.

3.2 HOW TO ACHIEVE MANUAL CONTROL

Attaining manual control is a rather simple process. In the following example, the CCL code continually checks to see if the last key pressed is an "I", "J", "K", "M", or " " (space). If the last key pressed is one of these keys, the on-board computer system will branch to the appropriate label. After the cybertank turns or moves forward, the on-board computer system branches back to the *ReadKey* label and the process is repeated.

```
ReadKey
        If Last Key Pressed = "I" then Branch to TurnNorth
        If Last Key Pressed = "J" then Branch to TurnWest
        If Last Key Pressed = "M" then Branch to TurnSouth
        If Last Key Pressed = "K" then Branch to TurnEast
        If Last Key Pressed = " " then Branch to MoveForward
        Branch to ReadKey
TurnNorth
        Turn Tank to 0
        Branch to ReadKey
TurnWest
        Turn Tank to 6
        Branch to ReadKey
TurnSouth
        Turn Tank to 4
        Branch to ReadKey
TurnEast
        Turn Tank to 2
        Branch to ReadKey
MoveForwd
        Move Tank Forward 1
        Branch to ReadKey
```

By using the above CCL, you can completely control the movement of your cybertank. If you want your cybertank to turn to the west, move forward one hectometer, and then turn to the south, you would press "J", " ", "M".

For a complete discussion of Manual cybertanks please see Part 3, Section 5.7).

PART 6
TROUBLESHOOTING

SYNOPSIS

This section discusses problems which may occur during operation of the OSI/CACD System 2. It also defines possible solutions to these problems.

SECTION 1
DISC PROBLEMS

SECTION BRIEF
During operation of the OSI/CACD System 2, problems can occur during disc access. Some of these are easily rectified.

1.1 FILE NOT FOUND

The File Retrival Panel (FRP) lets you select files to be loaded from a specified disc. The **File Not Found** error is often encountered when you are retrieving a data file from a disc and, for some reason, the disc was removed from the access slot.

To avoid this error, simply keep the disc containing the data file in the access slot. The disc may be removed after the OSI/CACD system has retrieved the specified data file.

The File Termination Panel (FTP) may produce this same error if, under the similiar circumstances, it is unable to delete a specified data file.

1.2 DISC WRITE PROTECTED

This error occurs when the OSI/CACD trys to save a data file to a write protected disc via the File Storage Panel (FSP). Most discs have write protect features to prevent information being written to them. If a disc is indeed write protected, the OSI/CACD is unable to save any data to the disc and this error message is displayed.

All 5 1/4 inch discs have a small notch in the right side. If the notch is covered, the disc is write protected. If the notch is uncovered, the disc is not write protected and information can be written to it. To avoid the **Disc Write Protected** error, simply remove the material that is covering the notch.

All 3 1/2 inch discs have a write protect tab built in the upper right-hand corner of the reverse side. If the tab is moved and unblocks the hole, the disc is write protected. If the tab is moved to block the hole, the disc is not write protected and information can be written to it. To avoid the **Disc Write Protected** error, simply move the tab so that it blocks the hole.

1.3 DISC FULL

All discs are limited in the amount of data they can store. If your disc is at its maximum capacity and you instruct the OSI/CACD to save another data file via the File Storage Panel (FSP), this error message will appear. Once your disc is full, you can delete some information to provide space. Use the File Termination Panel (FTP) to delete specific data files from the disc.

The **Disc Full** error can become a reccurring problem since most discs have a rather small capacity. The solution below may help.

The FSP can save a file to any disc (not only to your Employee ID Disc). Saving data files onto several discs can alleviate later problems. For instance, you may want to save cybertank designs on one disc, battlefield designs on another, etc. Remember, the Combat Simulation Module requires that the battlefield and all cybertanks in a simulation design reside on the same disc, resulting in the development of the the Data Duplication Module (DDM).

The DDM lets you copy data files from one disc to another. Using the DDM, you can copy those data files you are currently using onto your ID Disc, leaving unused data files on other discs, commonly referred to as backup discs.

1.4 DISC MALFUNCTION

The **Disc Malfunction** error message is displayed when an unknown problem prevents the OSI/CACD System 2 from accessing a disc. Due to the many circumstances that can create this error, only the most likely causes are listed.

If the disc is removed from the access slot during a load, save, or delete the OSI/CACD is unable to complete the procedure and only a portion of the data is processed. The OSI/CACD cannot perform correctly with a partially processed data file.

If this error message occurs when retrieving a data file, that data file is usually lost. This is the main reason that backup copies of data files are neccessary. Backing up data files is easy using the Data Duplication Module (DDM). While losing a data file in the above manner is unlikely, it happens on occasion.

SECTION 2
SECURITY ERRORS

SECTION BRIEF
OSI is a high-security complex. Procedures have been implemented to prevent unauthorized entrance into the OSI Complex and unauthorized access to cybertank designs.

2.1 ID DISC PASSWORD SECURITY

In order to verify employment, you must enter the correct password for the Employee ID Disc being used. Failure to enter the correct password prompts a Security Breach alarm and informs the guards at the OSI Security Gate. This prevents the use of stolen ID discs to gain entrance to the OSI complex. If you forget your password when using your own ID Disc, you will be denied entrance into the OSI Complex. The Orientation Guide details password security.

Being denied access to the OSI Complex is an unfortunate circumstance, but it cannot be corrected unless you identify the correct password. Although the information on your ID Disc can be copied onto another using the Data Duplication Module (DDM), your clearance level is lost.

2.2 CYBERTANK DESIGN PASSWORD SECURITY

Cybertank design protection is a high priority at OSI. Security leaks must be avoided. When an employee creates a new cybertank design, the password used for the Employee ID Disc is incorporated into the cybertank design. Only employees with knowledge of the correct password can access that design.

***NOTE:** If an employee does not identify a password for the ID Disc, then designs created by that employee are not password protected. Those designs are accessible without a password.*

In the Design Control Module (DCM), any cybertank design can be loaded from any disc. The design selected is inspected to ensure it has been properly authorized by OSI. If the passwords on the ID Disc and cybertank design do not match, the Security Breach alarm is then sounded.

Note that cybertanks created by other employees can also be used in simulations.

To obtain authorization when the passwords do not match, the designer can duplicate the design using the Data Duplication Module (DDM). The DDM removes the password from the cybertank design and it is now accessible by all employees. If an employee other than the designer trys to duplicate a protected design, the Security Breach alarm will sound. Only the designer can duplicate a protected cybertank design.

SECTION 3
SIMULATION ERRORS

SECTION BRIEF
The Combat Simulation Module (CSM) and the Cybertank Test Module (CTM) have a limited amount of memory available for processing simulations. Also, each cybertank in the simulation must be authorized for use.

3.1 SIMULATION OUT OF MEMORY

When loading a simulation, the CSM and CTM are limited by the amount of memory available. In rare cases, there is not enough memory available to load all of the cybertanks in the simulation design. You will be notified when these modules are unable to load all tanks in a design. The only recourse is to redesign the simulation using fewer tanks.

When a memory problem occurs, the active module will abort and you will be transferred to the External Control Module (ECM).

3.2 CYBERTANK/BATTLEFIELD NOT FOUND

The battlefield design and all cybertanks included in a simulation design must reside on the same disc when using the CSM or CTM. If either the battlefield, or any one of the cybertanks are not found on the disc, you will be notified via the terminal. In a situation such as this, the CSM and CTM will abort and transfer you to the External Control Module (ECM).

To rectify this problem, you can either redesign the simulation using the Simulation Design Module (SDM), or copy the cybertanks and battlefield onto the same disc with the Data Duplication Module (DDM).

3.3 CYBERTANK NOT AUTHORIZED

The CTM requires that the cybertank to be tested to have been authorized by the current employee. If you attempt to test a cybertank using an unauthorized cybertank design, the **Cybertank Not Authorized** message is displayed.

The **Cybertank Not Authorized** error message also appears during Clearance Evaluation if the cybertank selected is not authorized by the current employee.

To resolve this problem, authorize the cybertank using the Design Control Module (DCM).

SECTION 4
OTHER ERRORS

SECTION BRIEF
There are other system error messages which can appear at certain points.

4.1 AUTHORIZATION ERRORS

Many problems can and will occur while authorizing cybertanks. The various errors are discussed in detail in Appendix 5 of the Engineering Handbook.

4.2 ILLEGAL BATTLEFIELD

At the start of a simulation, the Combat Simulation Module (CSM) randomly picks the initial location of all cybertanks. Cybertanks can only be placed on grass, roads, dirt patches, etc. That is, they can only be placed in non-obstructed areas of the battlefield.

The Battlefield Design Module (BDM) lets employees create their own battlefields for combat simulations. There are few limitations in battlefield design, but there MUST be at least 30 non-obstructed areas (to allow placement of cybertanks) included in a design. If there are less than 30 the **Illegal Battlefield** error is displayed when you attempt to save the terrain.

Glossary

ACCESS SLOT: The mechanism used by the OSI/CACD System 2 to access discs. Also known as a disc drive.

AI: Artificial Intelligence. The underlying logic by which cybertanks function.

AUTHORIZE: The act of creating a cybertank from a cybertank design. All cybertank designs must be authorized by OSI before a cybertank can be created.

BDM: Battlefield Design Module. The component of the OSI/CACD System 2 used to create simulation battlefields.

CACD: Computer Aided Cybertank Design. The process of using powerful computers in the design and implementation of cybernetic machinery.

CAM: Cybertank Authorization Module. The component of the OSI/CACD System 2 used to identify cybertank design flaws. If any flaws are found, they are reported to the employee.

CAPSULE ROUTINE: Pre-written sections of Artificial Intelligence (AI) which perform specific functions. These routines can be incorporated into any employee's AI.

CCL: The Cybertank Command Language. The computer language used to construct cybertank AI.

CDI: Cybertank Directional Indicator. Shows the direction of the cybertank and scanner during a simulation.

CDM: Chassis Design Module. The component of the OSI/CACD System 2 used to build a cybertank's chassis/body.

CEM: Cybertank Evaluation Module. The component of the OSI/CACD System 2 which carries out an employee's request for a Clearance Evaluation.

CHASSIS: The body or frame of a cybertank including all electronic devices, weaponry, and armor.

CLEAR: The act of erasing text from the AI by first selecting it then selecting **Clear** from the **Edit** menu. The text removed is NOT retained in temporary storage.

CLEARANCE EVALUATION: A formal request for an employee evaluation. If passed, the employee achieves an increase in clearance level.

CLEARANCE LEVEL: Defines an employee's position/rank within the OSI high-security complex. As higher clearance levels are attained, the budget increases and additional information and equipment becomes available.

COMMLINK: A special item available in the Chassis Module which allows communications between cybertank team members. Only useful for team simulation designs.

COPY: The act of duplicating text in the AI by first selecting it then selecting **Copy** from the **Edit** menu. The text is retained in temporary storage until other text is copied or cut. Text in storage can be retrieved.

CP: Construction Panel. An automatic, easy-to-use tool used in the construction of a cybertank's AI.

CSM: Combat Simulation Module. The component of the OSI/CACD System 2 used to observe a cybertank battle.

CTM: Cybertank Test Module. The component of the OSI/CACD System 2 used to test a cybertank design. Includes many powerful diagnostic tools.

CUT: The act of removing text from the AI by first selecting it then selecting **Cut** from the **Edit** menu. The text removed is retained in temporary storage until other text is copied or cut. Text can be retrieved from temporary storage.

CVI: Cybertank Viewing Indicator. Shows the results of the last scanner usage.

DCM: Design Control Module. The gateway to all aspects of cybernetic design.

DDM: Data Duplication Module. The component of the OSI/CACD System 2 used to duplicate (or copy) data files to and from discs.

ECM: External Control Module. The main component of the OSI/CACD System 2 computer. It is from the ECM that the rest of the OSI/CACD is accessed.

EMAIL: Bulletin board system incorporated into the ECM which allows the posting of OSI memorandums and international news bulletins.

FRP: File Retrieval Panel. The control mechanism used to load data files from a disc.

FSP: File Storage Panel. The control mechanism used to record/save data files to a disc.

FTP: File Termination Panel. The control mechanism used to delete data files from a disc.

LABEL: A name consisting of ten characters or less that identifies a command routine in a cybertank's AI.

LIBRARY CAPSULE: A predefined set of CCL commands which execute a specific function.

OSI: The Organization of Strategic Intelligence. A pioneer company in the field of cybernetics.

OSICOM I: The OSI communications and surveillance satellite. It is from the OSICOM 1 that an aerial view of a battlefield can be accessed.

PASTE: The act of inserting temporarily stored text into the AI.

PSP: Printer Setup Panel. The control mechanism used to configure a printer for the OSI/CACD system.

SIMULATION: A closely approximated model of a cybernetic battle used for testing or experimentation.

VERIFY: Checks the cybertank AI for errors and notifies the employee of any problems. Although similar to authorize, verify will not create a cybertank.

APPENDIX 1
CCL RESERVED WORDS

The following list of words cannot be employed in User Defined Variables.

ACTIVE
ALIGN
ALIGNED
ALLY
ARE
ARMOR
AT
AVAILABLE
BACKWARD
BEEP
BEING
BEYOND
BRANCH
BREAK
CLEAR
CLOSEST
CODE
COMMLINK
COPY
DATA
DESTRUCT
DETECT
DIRECTION
DISTANCE
DO
DOWN
EMPTY
ENEMY
FACE
FACING
FIRE
FOR
FORWARD
FOUND
FROM
FUEL
FUNCTIONAL
GET
GOSUB
GOTO
HQ
IF
INACTIVE
INCLUDE
INTERNAL
IS
JAM
KEY
KIT
LAST
LAUNCH
LEFT
LOCK
LOCKED
LOWER
MOVE
MOVEMENT
NOT
OBJECT
OBSTRUCTED
OBSTRUCTION
OFF
ON
PRESSED
RAISE
RANDOM
RANGE
REMAINING
REMOTE
REPAIR
RESUME
RETURN
RIGHT
ROTATE
SCAN
SCANNED
SCANNER
SELF
SHIELD
SIGNAL
SWITCH
TANK
TEAM
THEN
TO
TRANSMIT
TREADS
TURN
UNAVAILABLE
UNLOCK
UNLOCKED
UP
WAS
WEAPON
WITH
WITHIN

APPENDIX 2
CCL SYSTEM VARIABLES

The following is a list of all CCL System Variables. Feel free to use them, but remember that they cannot be altered or used as labels.

AllyCode	AllyDir	AllyDist	AllyEnemyDir
AllyEnemyDist	AllyEnemyX	AllyEnemyY	AllyHQX
AllyHQY	AllyNum	AllyX	AllyY
ArmorDamage	CopyCode	CopyDir	CopyDist
CopyEnemyDir	CopyEnemyDist	CopyEnemyX	CopyEnemY
CopyNum	CopyX	CopyY	EnemyDist
EnemyHQDist	EnemyHQX	EnemyHQY	EnemyX
EnemyY	FuelLevel	IntDamage	KitsLeft
ObjDist	ObjType	ObjX	ObjY
ObstacleDist	ObstacleType	ObstacleX	ObstacleY
RandomNum	RemotesLeft	ScanDamage	ScanDir
TankDir	TankNum	TankX	TankY
TreadDamage	XYDist	WeapDamage	

The following are complete descriptions of the system variables.

AllyCode Code transmitted by team member. This value ranges from 0-100.

AllyDir The last direction heading of a transmitting team member.

AllyDist The distance between the transmitting and the receiving team members.

AllyEnemyDir The direction heading of an enemy cybertank last scanned by the transmitting team member.

AllyEnemyDist The distance to the enemy cybertank as it was last scanned by the transmitting team member.

AllyEnemyX The enemy cybertank's X coordinate as last scanned by transmitting team member. This value ranges from 1 to 62.

AllyEnemyY The enemy cybertank's Y coordinate as last scanned by transmitting team member. This value ranges from 1 to 62.

AllyHQX X coordinate of your cybertank's team headquarters.

AllyHQY Y coordinate of your cybertank's team headquarters.

AllyNum The identification number of the transmitting team member. Cybertank identification numbers are based on the order in which they were selected in the Simulation Design Module.

AllyX The X coordinate of the transmitting team member.

AllyY The Y coordinate of the transmitting team member.

ArmorDamage This is the current armor damage percentage. ArmorDamage value ranges from 0 (fully intact) to 100 (destroyed). When ArmorDamage reaches 100, the cybertank is destroyed.

CopyCode Holds a copy of AllyCode when *Copy CommLink Data* command is executed.

CopyDir Holds a copy of AllyDir when *Copy CommLink Data* command is executed.

CopyDist Holds a copy of AllyDist when *Copy CommLink Data* command is executed.

CopyEnemyDir Holds a copy of AllyEnemyDir when *Copy CommLink Data* command is executed.

CopyEnemyDist Holds a copy of AllyEnemyDist when *Copy CommLink Data* command is executed.

CopyEnemyX Holds a copy of AllyEnemyX when *Copy CommLink Data* command is executed.

CopyEnemyY Holds a copy of AllyEnemyY when *Copy CommLink Data* command is executed.

CopyNum Holds a copy of AllyNum when *Copy CommLink Data* command is executed.

CopyX Holds a copy of AllyX when *Copy CommLink Data* command is executed.

CopyY Holds a copy of AllyY when *Copy CommLink Data* command is executed.

EnemyDist The distance between your cybertank and the last scanned enemy cybertank.

EnemyHQDist This is the distance between your cybertank and the enemy headquarters -- unknown to your cybertank until either found by scanning or transmitted by a team member.

EnemyHQX The X coordinate of the enemy headquarters -- unknown to your cybertank until either found by scanning or transmitted by a team member .

EnemyHQY The Y coordinate of the enemy headquarters -- unknown to your cybertank until either found by scanning or transmitted by a team member.

EnemyX The enemy cybertank's X coordinate at last scanned position.

EnemyY The enemy cybertank's Y coordinate at last scanned position.

FuelLevel Amount of remaining fuel. This value ranges from 0 (empty) to 100 (full).

IntDamage Current damage percentage of your cybertank's internal mechanisms. Ranges from 0 (fully intact) to 100 (destroyed). When this value reaches 100, the cybertank is terminated.

KitsLeft The number of repair kits remaining.

ObjDist The distance between your cybertank and the last scanned object.

ObjType The type of object last scanned (see Appendix 3 for list of possible values).

ObjX X coordinate of the last scanned object. This value ranges from 1 to 62.

ObjY Y coordinate of the last scanned object. This value ranges from 1 to 62.

ObstacleDist The distance between your cybertank and the last movement obstacle detected. This value ranges from 0 to 3.

ObstacleType The type of movement obstacle last detected (see Appendix 3 for list of possible values).

ObstacleX X coordinate of the last detected movement obstacle. This value ranges from 1 to 62.

ObstacleY Y coordinate of the last detected movement obstacle. This value ranges from 1 to 62.

RandomNum Holds the random value generated by the *Get Random [to #]* command.

RemotesLeft The number of remaining remote scanners.

ScanDamage Current damage percentage of your cybertank's scanner. Ranges from 0 (fully intact) to 100 (destroyed). A cybertank is still operational with a destroyed scanner, but it cannot scan.

ScanDir The direction the scanner is currently facing. This value ranges from 0 to 7.

TankDir The direction your cybertank is currently facing. This value ranges from 0 to 7.

TankNum This is the number of your cybertank. Cybertank numbers are based on the order they were selected in the SDM.

TankX Your cybertank's current X coordinate.

TankY Your cybertank's current Y coordinate.

TreadDamage Current damage percentage of your cybertank's treads. This value ranges from 0 (fully intact) to 100 (destroyed). The cybertank still operates with destroyed treads, but it cannot move.

XYDist This holds the distance between your cybertank and the specified coordinate as calculated by the command*Get Distance to "X" "Y"*.

WeapDamage	Current damage percentage of your cybertank's weapon. This value ranges from 0 (fully intact) to 100 (destroyed). The cybertank is still operational with a destroyed weapon, but it cannot fire.

APPENDIX 3
OBJECT TYPES

The following list should be used as an aid in incorporating a System variable that reports an "object's type."

TYPE NUMBER	DESCRIPTION
00	No object
01	Roads, grass, etc...
02	Water
03	Damaged cybertanks, squashed trees
04	Trees
05	Houses, HQ
06	Buildings, barriers
Greater than 6	Cybertanks

Object types 3-5 are destructible while object type 6 (buildings, barriers) is indestructible.

Object types 2-6 are detectable by the MOS. Cybertanks are also detectable by the MOS as objects with types greater than 6.

Object types 3-6 can be detected with the CCS. Cybertanks are also detectable by the CCS as objects with types greater than 6.

Object types 4-6 block a scanner's line of sight when scanning for cybertanks and other objects.

APPENDIX 4
QUICK SYNTAX GUIDE

For complete information on the commands, please see Part 3 of this handbook.

Tank Movement

MOVE [TANK] FORWARD "#"
MOVE [TANK] BACKWARD "#"
TURN [TANK] LEFT "#"
TURN [TANK] RIGHT "#"
TURN [TANK] TO "ANGLE"
TURN [TANK] TO "X" "Y"
TURN [TANK] TO FACE [ENEMY] [TANK]
TURN [TANK] TO FACE ENEMY HQ
ALIGN TANK [WITH SCANNER]
IF TANK [IS] ALIGNED [WITH SCANNER] THEN [BRANCH TO : DO] "LABEL"
IF TANK [IS] NOT ALIGNED [WITH SCANNER] THEN [BRANCH TO : DO] "LABEL"
IF [MOVEMENT IS] OBSTRUCTED THEN [BRANCH TO : DO] "LABEL"
IF [MOVEMENT IS] NOT OBSTRUCTED THEN [BRANCH TO : DO] "LABEL"
IF OBSTRUCTION [IS] ENEMY HQ THEN [BRANCH TO : DO] "LABEL"
IF OBSTRUCTION [IS] ALLY HQ THEN [BRANCH TO : DO] "LABEL"
IF TANK [IS] FACING [ENEMY] TANK THEN [BRANCH TO : DO] "LABEL"
IF TANK [IS] NOT FACING [ENEMY] TANK THEN [BRANCH TO : DO] "LABEL"
IF TANK [IS] FACING ENEMY HQ THEN [BRANCH TO : DO] "LABEL"
IF TANK [IS] NOT FACING ENEMY HQ THEN [BRANCH TO : DO] "LABEL"
IF TANK [IS] FACING "X" "Y" THEN LABEL
IF TANK [IS] NOT FACING "X" "Y" THEN LABEL
DETECT [OBSTRUCTION] AT "#"
DETECT [OBSTRUCTION] AT TANK DIRECTION
DETECT [OBSTRUCTION] AT SCANNER DIRECTION
IF [TANK] TREADS [ARE] FUNCTIONAL THEN [BRANCH TO : DO] "LABEL"
IF [TANK] TREADS [ARE] NOT FUNCTIONAL THEN [BRANCH TO : DO] "LABEL"

USING THE SCANNER

```
ROTATE [SCANNER] LEFT "#"
ROTATE [SCANNER] RIGHT "#"
ROTATE [SCANNER] TO "ANGLE"
ROTATE [SCANNER] TO "X" "Y"
ROTATE [SCANNER] TO FACE [ENEMY] TANK
ALIGN SCANNER [WITH TANK]
SCAN FOR [ENEMY] TANK
SCAN FOR [CLOSEST] OBJECT
SCAN FOR ENEMY HQ
LOCK SCANNER
UNLOCK SCANNER
JAM [SCANNER SIGNAL]
LAUNCH [REMOTE SCANNER]
IF SCANNER [IS] FUNCTIONAL THEN [BRANCH TO : DO] "LABEL"
IF SCANNER [IS] NOT FUNCTIONAL THEN [BRANCH TO : DO] "LABEL"
IF SCANNER [IS] ALIGNED [WITH TANK] THEN [BRANCH TO : DO] "LABEL"
IF SCANNER [IS] NOT ALIGNED [WITH TANK] THEN [BRANCH TO : DO "LABEL"
IF [ENEMY] TANK [WAS] FOUND THEN LABEL
IF [ENEMY] TANK [WAS] NOT FOUND THEN LABEL
IF [CLOSEST] OBJECT [WAS] FOUND THEN [BRANCH TO : DO] "LABEL"
IF [CLOSEST] OBJECT [WAS] NOT FOUND THEN [BRANCH TO : DO] "LABEL"
IF ENEMY HQ [WAS] FOUND THEN [BRANCH TO : DO] "LABEL"
IF ENEMY HQ [WAS] NOT FOUND THEN [BRANCH TO : DO] "LABEL"
IF [CLOSEST] OBJECT [IS] ENEMY HQ THEN [BRANCH TO : DO] "LABEL"
IF [CLOSEST] OBJECT [IS] ALLY HQ THEN [BRANCH TO : DO] "LABEL"
IF [SCANNER IS] LOCKED THEN LABEL
IF [SCANNER IS] UNLOCKED THEN LABEL
IF [TANK IS] BEING SCANNED THEN [BRANCH TO : DO] "LABEL"
IF [TANK IS] NOT BEING SCANNED THEN [BRANCH TO : DO] "LABEL"
IF REMOTE [SCANNER IS] AVAILABLE THEN [BRANCH TO : DO] "LABEL"
IF REMOTE [SCANNER IS] UNAVAILABLE THEN [BRANCH TO : DO] "LABEL"
```

USING THE WEAPON

FIRE [WEAPON] AT [ENEMY] TANK
FIRE [WEAPON] AT [CLOSEST] OBJECT
FIRE [WEAPON] AT OBSTRUCTION
FIRE [WEAPON] AT "X" "Y"
FIRE [WEAPON] AT TANK DIRECTION
FIRE [WEAPON] AT SCANNER DIRECTION
FIRE [WEAPON] AT ENEMY HQ
IF WEAPON [IS] FUNCTIONAL THEN [BRANCH TO : DO] "LABEL"
IF WEAPON [IS] NOT FUNCTIONAL THEN [BRANCH TO : DO] "LABEL"
IF [ENEMY] TANK [IS] WITHIN [WEAPON] RANGE THEN [BRANCH TO : DO] "LABEL"
IF [ENEMY] TANK [IS] BEYOND [WEAPON] RANGE THEN [BRANCH TO : DO] "LABEL"
IF [CLOSEST] OBJECT [IS] WITHIN [WEAPON] RANGE THEN [BRANCH TO : DO] "LABEL"
IF [CLOSEST] OBJECT [IS] BEYOND [WEAPON] RANGE THEN [BRANCH TO : DO] "LABEL"
IF ENEMY HQ [IS] WITHIN [WEAPON] RANGE THEN [BRANCH TO : DO] "LABEL"
IF ENEMY HQ [IS] BEYOND [WEAPON] RANGE THEN [BRANCH TO : DO] "LABEL"

TANK STATUS

IF FUEL [IS] REMAINING THEN [BRANCH TO : DO] "LABEL"
IF FUEL [IS] EMPTY THEN [BRANCH TO : DO] "LABEL"
SELF DESTRUCT

DEFENSE SHIELD

RAISE [SHIELD]
LOWER [SHIELD]
IF SHIELD [IS] UP THEN [BRANCH TO : DO] "LABEL"
IF SHIELD [IS] DOWN THEN [BRANCH TO : DO] "LABEL"

TANK REPAIRS

REPAIR INTERNAL
REPAIR ARMOR
REPAIR TREADS
REPAIR SCANNER
REPAIR WEAPON
IF [REPAIR] KIT [IS] AVAILABLE THEN [BRANCH TO : DO] "LABEL"
IF [REPAIR] KIT [IS] UNAVAILABLE THEN [BRANCH TO : DO] "LABEL"

USING THE COMMLINK

TRANSMIT [CODE] "#" [TO TEAM]
CLEAR [COMMLINK] DATA
COPY [COMMLINK] DATA
SWITCH [COMMLINK] ON
SWITCH [COMMLINK] OFF
IF ALLY TANK "#" [IS] ACTIVE THEN [BRANCH TO : DO] "LABEL"
IF ALLY TANK "#" [IS] INACTIVE THEN [BRANCH TO : DO] "LABEL"

MISCELLANEOUS COMMANDS

GET DISTANCE [TO] "X" "Y"
GET RANDOM [TO "#"]
BEEP
BREAK

ATTAINING MANUAL CONTROL

IF [LAST] KEY [PRESSED] THEN [BRANCH TO : DO] "LABEL"
IF [LAST] KEY [PRESSED] = "1 CHARACTER" THEN [BRANCH TO : DO] "LABEL"

SYSTEM COMMANDS

BRANCH TO "LABEL"
GOTO "LABEL"
DO "LABEL"
GOSUB "LABEL"
RESUME

USING LIBRARY CAPSULES

INCLUDE "CAPSULE FILENAME"

APPENDIX 5
AUTHORIZATION ERRORS

The following lists all the possible errors that may occur during the Authorization process in the Cybertank Authorization Module (CAM).

DUPLICATE LABEL FOUND
This error occurs when the same label has been used twice in the AI. For a complete discussion of labels, see Part 1, Section 6.4 of this handbook.

FATAL ERROR: MAXIMUM NUMBER OF LABELS EXCEEDED
This error occurs when you exceed the memory allocated for label names. To remedy, try using fewer labels or shorter label names. For example, instead of using the label "SHOOTTANK", try using something like "SHOOT".

UNKNOWN COMMAND
This error occurs when an unrecognizable command is included in the AI. This normally occurs because of a misspelled or missing word.

USER VARIABLES EXCEEDED
This error occurs if you attempt to use more than 32 User Variables. The only way to correct this error is to cut down on the number of User Variables. For a complete discussion of User Variables, see Part 1, Section 6 of this manual.

DOES NOT COMPUTE IN THE LINE
This error occurs when an instruction in the AI is incomplete. For example, the instruction "**SCAN FOR FRIENDLY TANK**" is almost a valid instruction, but not quite since it is not complete.

VALUE USED IS OUT OF RANGE IN FOLLOWING LINE:
This error occurs when a value in an instruction is not within the allowable range. For example, in the instruction "**TURN TANK TO 9**", the 9 is an illegal value because you can only turn your tank to values 0-7.

THE LABEL ... WAS NOT FOUND IN THE FOLLOWING LINE:
This error occurs when an instruction attempts to reference a label which does not exist.

THE FOLLOWING LINE IS AN ILLEGAL LABEL:
When this error occurs, it signifies that a line in the AI, positioned in the left margin, is not a valid label. This is often caused by incorrect spacing or indentation.

THE FOLLOWING LABEL IS TOO LONG:
This error occurs when a label of more than 10 characters is encountered. Shorten the length of the label.

THE FOLLOWING CAPSULE WAS NOT FOUND:
This error occurs when attempting to **INCLUDE** a Capsule routine and the Capsule was not found. To remedy this error, simply insert the Disc which contains the Capsule routine into any access slot.

IF YOU INCLUDE A CAPSULE, THAT CAPSULE CANNOT INCLUDE ANOTHER
This error occurs when you **INCLUDE** a Capsule routine and that Capsule attempts to **INCLUDE** another. To remedy, you must remove all **INCLUDE** statements from any Capsules you wish to **INCLUDE**.

YOUR TANK MUST BE GIVEN INTELLIGENCE BEFORE IT CAN BE AUTHORIZED
This error occurs if your cybertank has no AI.

YOU ARE MISSING ONE OR MORE ITEMS FROM YOUR TANK'S CHASSIS
This error occurs if you have forgotten to install a needed component on your cybertank. For example, a cybertank cannot be Authorized if it has no scanner system. To solve, return to the Chassis Design Module (CDM) and obtain all necessary components.

THE COST OF YOUR TANK'S CHASSIS EXCEEDS YOUR AVAILABLE BUDGET
This error occurs when you attempt to Authorize a cybertank designed by someone with a higher clearance level, and the equipment on their cybertank exceeds the budget limitations of your clearance level.

ORGANIZATION OF STRATEGIC INTELLIGENCE

DIRECTOR
STUART B. MARKS

SUPERVISOR
DALLAS SNELL

ASSOCIATE SUPERVISORS
ALAN GARDNER
JEFF HILLHOUSE

OSI/CACD SYSTEM 2 ENGINEER
STUART B. MARKS

OSI/CACD SUPPORT
STEVE MEUSE
JOHN MILES
PAUL NEURATH
JAMES VAN ARTSDALEN

CYBERTANK COMMAND LANGUAGE ENGINEERS
ALAN GARDNER
RICHARD GARRIOTT
PAUL C. ISAAC
STUART B. MARKS
DALLAS SNELL

TERMINAL INTERFACES
CHUCK BUECHE
STUART B. MARKS
MICROMAGIC

TERMINAL SUPPORTS
JOHN MILES
DR. CAT

OSI/CACD GRAPHICS

DENIS LOUBET
STUART B. MARKS
JEFF DEE
GLEN JOHNSON

COVER ART

DENIS LOUBET

PACKAGE DESIGN AND PRODUCTION

LORI OGWULU
CHERYL NEELD
CAT PRAGOFF

ENGINEER'S HANDBOOK EDITORS

KEN ARNOLD
STEVE CANTRELL
ALAN GARDNER
MIKE HARRISON
STUART B. MARKS
DALLAS SNELL

QUALITY CONTROL

JOHN ASLIN
STEVE CANTRELL
KIRK HUTCHEON
PAUL MALONE
IAN MANCHESTER
JOEL MANNERS
DALE NICHOLS
JON NIALS
JEAN TAUCHER
JOHN WATSON

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

About the Author...

Stuart B. Marks

After spending some time with Stuart Marks, and learning of his intense interest and participation in sports, you're struck by the juxtaposition of his professional life and personal interests. His goal is "to enjoy life and avoid having to sit behind a computer terminal day after day." Yet, he is a talented programmer and game designer whose job requires that he scroll through screen after screen of program code on a daily basis. Luckily, he is able to stagger his hours and pursue the necessities of life — smashing forehands to the baseline and chipping delicate golf shots over greenside bunkers.

Born in Houston, Texas, Stuart spent most of his boyhood years in the outdoors, enjoying tennis, golf, water skiing, snow skiing, softball and volleyball. When he wasn't playing, he was watching, and he still follows the progress of the Houston Astros and Houston Oilers. He also plays championship caliber golf and tennis, competing in tournaments throughout the state.

Stuart attended the University of Texas, studying accounting to learn new methods of depreciating his Apple II computer. Ostensibly purchased to "help with homework", the computer soon became a tool for dealing with his lifelong fascination with games... and VisiCalc was replaced by Pong. Fortunately, there weren't many games that really captured Stuart's attention, and he began developing his own entertainment ideas.

Since 1981, Stuart has created eight different games for the personal computer. The first to be published is OMEGA. As long as Stuart has to take time away from sports to have his rackets restrung and his golf clubs regripped, you can bet he'll continue his pursuit of the software side of gaming.

Proof of
Purchase
OMEGA

ORIGIN T.M.

ORI 3101