Best Available Copy
ADST
Software Maintenance Manual
for the
BDS-D VIDS-equipped M1

Loral Western Development Labs
Electronic Defense Systems Software Department
Software Engineering Laboratory
3200 Zanker Road
P.O. Box 49041
San Jose, CA 95161-9041

July 11, 1993

Contract No. N61339-91-D0001
CDRL No. A002

Prepared for
Simulation Training and Instrumentation Command
Naval Training Systems Center
12350 Research Parkway
Orlando, FL 32826-3275
This document provides an overview of the hardware and software used to build and execute the Vehicle Integrated Defense System (VIDS) equipped M1.
TABLE of CONTENTS

1. Introduction ........................................................................................................ 1
  1.1. Scope ............................................................................................................... 1
  1.2. Purpose .......................................................................................................... 1
  1.3. Reference documents ..................................................................................... 1
    1.3.1. Government documents ....................................................................... 1
    1.3.2. Non-Government documents ............................................................... 1
  1.4. Overview ......................................................................................................... 1
  2.1. Architectural Overview .................................................................................. 1
  3.1. Hardware Configuration ............................................................................... 2
  3.1.2. Custom Hardware ................................................................................... 2
  3.2. Hardware to Software Interfaces .................................................................. 2
  4.1. VIDS Software Description ......................................................................... 3
  4.2. Development Environment Descriptions ..................................................... 3
    4.2.1. GT Development Environment Directory Structure .......................... 3
    4.2.2. PC Development Environment Directory Structure ............................. 6
  4.3. Runtime Environment Description ................................................................ 7
  4.4. Startup Procedure ......................................................................................... 7
  5. Utility Software .................................................................................................. 7
  6. Notes .................................................................................................................. 7

LIST of FIGURES

Figure 1. Directory Hierarchy for GT-resident common Subdirectory ..................... 4
Figure 2. Directory Hierarchy for GT-resident simnet Subdirectory ....................... 5
Figure 3. Directory Hierarchy for PC-resident Software ....................................... 6
Figure 4. Key Elements of VIDS.D ....................................................................... 8
1. Introduction

1.1. Scope

This document provides an overview of the hardware and software used to build and simulate the Vehicle Integrated Defense System (VIDS) equipped M1. The VIDS-equipped M1 provides a suite of sensors and countermeasures designed to increase the survivability of an M1 tank crew.

1.2. Purpose

This document provides information required to successfully build the VIDS-equipped M1 software. Diagrams and descriptions are provided to support coldstarts and software enhancements.

1.3. Reference documents

1.3.1. Government documents.

SPECIFICATIONS:

1.3.2. Non-Government documents.


2. Overview

The VIDS-equipped M1 provides sensors and countermeasures designed to increase the survivability of an M1 tank crew against smart enemy weapons. Reports from the sensors are used to alert the crew, prioritize threats and select appropriate countermeasures.

2.1. Architectural Overview
VIDS simulates a new capability for the M1 tank simulator. In general, VIDS executes as one of several major components of the M1 simulator. Consequently, other entities within the simulated battlefield cannot distinguish a VIDS-equipped tank from any other tank.

VIDS is composed of two independently executing applications: one application executes on a GT simulating sensors, the threat resolution module and countermeasures, while the other application executes on a PC simulating the user interface and visual display as well as activating audible alerts heard on the tank intercom. Like other entities within the simulated battlefield, the two VIDS applications communicate with one another using digital messages transmitted on an Ethernet® local area network. Messages conform to the format described in "The SIMNET Network and Protocols" and are referred to as Protocol Data Units (PDUs).

3. Hardware Configuration

3.1. Hardware Description

No hardware changes have been made to the GT. On the other hand, the PC is completely new. The PC is configured as follows:
   a. Everex Tempo 386/33
   b. 4MB of RAM
   c. 52 MB Quantum hard disk.
   d. 13" Sony Monitor.
   e. Elographics E274 Touch Screen
   f. Racal Interlan N15210-16 Ethernet card.
   g. Creative Labs Inc., Soundblaster card.

Finally, the PC runs under DOS 5.0.

3.1.2. Custom Hardware

None.

3.2. Hardware to Software Interfaces

During PC bootup, the AUTOEXEC.BAT executes \SYS\ETHERNET\NI5210, a terminate-and-stay-resident (TSR) assembly language program. It is this program from the Free Software Foundation which handles the low-level hardware interfaces to the NI5210 card.

During the VIDS-equipped M1 initialization, the VIDS PDU is added to the list of other multicast messages. The multicast message list defines which network messages are retrieved by the GT during the simulated battle. All other messages are discarded.
4. Software Description

4.1. VIDS Software Description

The detailed design of the VIDS software can be found in reference 1 of the Non-Government References documents in section 1.3.2.

4.2. Development Environment Descriptions

Since VIDS executes on two host computers, each development environment will be described separately.

4.2.1. GT Development Environment Directory Structure

The GT software is written in C. Standard UNIX® (SunOS release 4.0.3) utilities running on a SUN 3 workstation are used to build the application.

Major components of the GT software have been organized into a directory hierarchy of software libraries, refer to Figures 1 and 2. To support software reuse, the GT software is partitioned into two major subdirectories: common and simnet. Both common and simnet represent roots of other subdirectory hierarchies.

The majority of the VIDS software resides in simnet/vehicle/libsdr/libvids. This includes the software for the simulated sensors, countermeasures and threat resolution module. Software for reading VIDS PDUs is located in simnet/vehicle/libsdr/libRcvNet while software for writing VIDS PDUs is located in simnet/vehicle/libsdr/libSendNet
Figure 1. Directory Hierarchy for GT-resident common Subdirectory
Figure 2. Directory Hierarchy for GT-resident simnet Subdirectory
Makefiles for common and simnet exist to perform all operations necessary to perform partial or full software coldstarts. These Makefiles are found within respective tools directories. Note that the coldstart for common must precede the coldstart for simnet.

During a build, individual source files are compiled and copied into a local library file which is then copied into higher level library (lib) directory. Once all the libraries have been rebuilt or updated, the application is linked into an executable file as the last step within the simnet makefile.

To rebuild the software within the common subdirectory, establish common as the current working directory and type the following commands:

```
make clean
make headers
make install
```

The first command, "make clean", recursively deletes all object and library files within the directory tree. The second command, "make headers", recursively copies local header files to a centralized include directory. The third command, "make install", recursively compiles individual source files, builds local libraries of compiled objects and copies these libraries to a centralized lib directory.

To rebuild the software within the simnet subdirectory, establish simnet as the current working directory and type the same sequence of commands used to build the common subdirectory.

The resulting executable file (simnet/vehicle/vids/src/vids) must be copied to a tape cartridge. The tape cartridge is then used to copy the executable file to the target GT hard disk.

4.2.2. PC Development Environment Directory Structure

The majority of the PC software is written in C++, only two low-level functions are written in assembly. The Borland C++ software development environment (version 3.1) is used to edit/compile and link the application.

The directory hierarchy of software is significantly simpler than the GT software, refer to Figure 3.

```
vids
  vidscom
  sendpkt
sound
```

Figure 3. Directory Hierarchy for PC-resident Software
The Borland environment utilizes the concept of a project file to establish the same type of software dependencies used by the UNIX make utility. A menu option under Compile allows both partial and full software coldstarts.

4.3. Runtime Environment Description

The VIDS runtime environment is described in ADST Coldstart Procedures Manual for the BDS-D VIDS-equipped M1. A new file, VIDS.D, resides on the GT within the following subdirectory: /simnet/vehicle/vids/data. The contents of this file define the available sensors and countermeasures for a given simulated battle. Figure 4 lists a subset of its content. Omission of MWS or LWR parameters deactivates the corresponding sensor; omission of ROS or MCD parameters deactivates the corresponding countermeasures. However, when a countermeasure is deactivated, the corresponding button mapping must be deactivated (set to NULL_JAM_Switch or NULL_Salvo_Switch) so that the corresponding button on the PC display screen is appears as SPARE.

4.4. Startup Procedure

The VIDS startup procedure is described in ADST Coldstart Procedures Manual for the BDS-D VIDS-equipped M1.

5. Utility Software

None.

6. Notes

List of Acronyms:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADST</td>
<td>Advanced Distributed Simulation Technology</td>
</tr>
<tr>
<td>BDS-D</td>
<td>Battlefield Distributed Simulation - Developmental</td>
</tr>
<tr>
<td>GT</td>
<td>Graphics Technology</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>TSR</td>
<td>Terminate and Stay Resident</td>
</tr>
<tr>
<td>VIDS</td>
<td>Vehicle Integrated Defense System</td>
</tr>
</tbody>
</table>
Figure 4. Key Elements of VIDS.D