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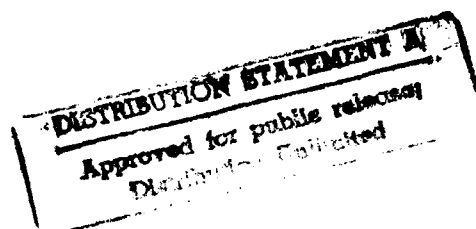
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13. ABSTRACT (Maximum 200 words)

This document provides detailed information describing the software design of the Vehicle
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TABLE of CONTENTS

LIST of FIGURES

1. Scope.

1.1. Identification.

This document defines the software design for the Vehicle Integrated Defense System (VIDS) simulation and its inclusion into the existing M1 Tank Simulator software. This software design satisfies requirements contained in the Requirements traceability tables (Section 7).

1.2. System overview.

The VIDS-equipped M1 Tank Simulator exists to support a series of survivability experiments. The nature of the experiments requires that the VIDS simulation be parameter driven. The VIDS parameters not only define available sensors and countermeasures, but also define their respective sensitivities and response times. For the present, two sensors and countermeasures are simulated:

Sensors
a. Laser Warning Receiver (LWR).
b. Missile Warning System (MWS).

Countermeasures
a. Multi-Salvo Smoke Grenade Launcher/Rapid Obscuration System (ROS).
b. Missile Countermeasure Device (MCD).

In general, the VIDS system responds to perceived threats in the following ways:
a. by displaying visual icons on the Commander's Controls Display Panel (CCDP).
b. by generating alert tones which can be heard on the tank crew intercom.
c. by examining user-selected countermeasure activation modes.
d. by seizing control of the turret.
e. by activating a selected countermeasure for each perceived threat.

Because VIDS can seize control of the turret, automatic turret rotation for counterfire is supported. Furthermore, VIDS supports automatic turret slewing for visual detection of threats.

1.3. Document overview.

This document identifies and describes new software CSCs and CSUs, as well as changes to and reuse of existing M1 Simulator CSCs and CSUs. Diagrams

and narratives are used to explain how the new VIDS simulation executes within the framework of the existing M1 Simulator.

2. Referenced documents.

2.1. Government documents.

SPECIFICATIONS:
1. PM-Survivability: VIDS Armored Vehicle Survivability Equipment (AVSE) BDS-D Functional Specifications, 29 May 1992.

2.2. Non-Government documents.

1. Loral: Battlefield Distributed Simulation-Development (BDS-D) Vehicle Integrated Defense System (VIDS) Feasibility Analysis Report, 14 October 1992.

2. BBN: The SIMNET Network and Protocols, Report 7627, June 1991.

3. Preliminary design.

3.1. CSCI overview.

The VIDS-equipped M1 Tank Simulator (hereafter referred to as the VIDS-equipped simulator) exists as one of many entities participating within a simulated battle. Each entity communicates with other entities by sending and receiving Protocol Data Units (PDUs). The external interfaces for the VIDS-equipped tank are illustrated in Figure 1.
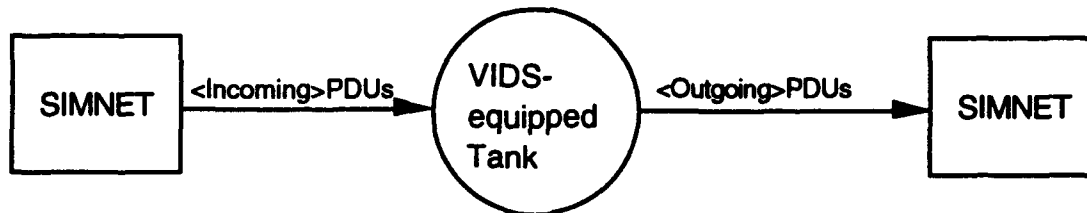
Incoming PDUs describe the activity in one or more simulated battlefields. Because the number of incoming PDUs can be quite large, a series of high-level filters are applied to retain only those PDUs which are applicable to a specific entity. Applicable PDUs are then filtered based upon entity-specific parameters such as distance and available sensors. Remaining PDUs are then classified and used to influence either the entity behavior or what the entity can detect.

Outgoing PDUs describe the visual appearance or behavior of the VIDS-equipped simulator. Typically, these define the current tank hull position and orientation, the turret orientation, the presence of smoke clouds or the existence of electro-optical jamming energy. For experimental purposes, a subset of the outgoing PDUs contain instrumentation information which can be used by analysts to better understand the use of the soldier-machine interface.

3.1.1. CSCI architecture.

The VIDS capability is partitioned between two host computers. One host is the current M1 tank GT hardware; the other host is a PC with an Elographics touchscreen mounted in front of a 13 inch color video monitor. The software executing on the PC supports the Soldier Machine Interface (SMI), hereafter referred to the as the CCDP. This includes all the VIDS buttons, setup windows and the display windows. The software executing on the GT simulates the behavior of the sensors, countermeasures and threat resolution module.

The VIDS-PC and VIDS-GT communicate with one another just like other entities participating within a simulated battle exercise. Because there may be multiple VIDS-equipped simulators within the same exercise, the VIDS-PC and VIDS-GT are paired so that only appropriate network messages are recognized and processed. In other words, the VIDS-PC knows the unique identifier (VehicleID) of its corresponding VIDS-GT, and the VIDS-GT knows the unique VehicleID of its corresponding VIDS-PC.

3.1.2. System states and modes.

The VIDS-GT as a functioning CSCI which operates in one of six predefined states. These states are:
   a. Startup.
   b. Idle.
   c. Initialize.
   d. Simulate.
   e. Stop.
   f. Exit.

Within the VIDS context, only the Startup, Initialize and Simulate states are significant.

During the Startup State, specific hardware devices are initialized and parameter files are read. It is during this state that the VIDS parameter file is read to establish the types and behaviors of available sensors and countermeasures. This file also defines a default set of countermeasures for each type of threat. After having read all the parameter files, a

communication link to the Simulation Network (SIMNET) is established. Having successfully completed these tasks, a transition is made to the Idle State.

During the Idle State, the M1 Tank Simulator waits to receive an activation request from SIMNET. When an Activation Request PDU is received, a transition is made to the Initialize State.

During the Initialize State, more extensive hardware and internal software initialization is performed. For VIDS, internal probability tables are built; and default alert, safety, countermeasure coverage and turret scanning sector settings are sent to the VIDS-PC. Having successfully completed this initialization, a transition is made to the Simulate State.

The Simulate State represents the main processing loop for the VIDS-GT. PDUs sent by the VIDS-PC are monitored and used to alter the behavior of VIDS. Electro-optical PDUs from other entities are read and used to determine if a threat is present. When a threat is detected, PDUs are sent to the VIDS-PC to provide visual and audible cues. Furthermore, detected threats are prioritized and countermeasures are activated. The Simulate State continues until:

a. An impact PDU is received which destroys the tank.
b. A deactivation PDU is received which forces a transition to the Stop State.
b. A reconstitute PDU is received which forces a transition to the Idle State.
c. An exit command is received from the M1 Console keyboard which forces a transition to the Exit State.

During the Stop State, a transition is made to the Idle State, followed by a transition to the Exit State.

For the VIDS-PC, there are only three states: Initialize, Simulate and Shutdown. During the Initialize State, data files are read which define button positions, content and behavior. Furthermore, the VIDS-PC waits to receive the default alert, safety, countermeasure coverage and turret scanning sector settings from the VIDS-GT. Once these settings have been received, a transition is made to the Simulate State.

As with the VIDS-GT, the Simulate State represents the main processing loop for the user interface. The touchscreen is continually monitored to determine if a button has been depressed or released. Specific button actions may generate brief user alert messages to appear on the display panel. Changed button values or sector widths are sent back to the VIDS-GT to influence the behavior of the sensors and countermeasures. The network

buffer is continually polled to determine if PDUs sent by the VIDS-GT require updates to the display or if audible alerts must be activated or terminated.

During the Shutdown State, dynamic memory is released, special interrupt handling is suspended and control is released to the normal operating system.

3.1.3. Memory and processing time allocation.

At the present time, there are no memory budgets more restrictive than those imposed by the respective host computers. However, the VIDS-GT functions which execute during the Simulate State must execute faster than $1/15^{th}$ of a second. This is due to the fundamental execution cycle on the GT. In fact, the VIDS software execution speed must take only a relatively small percentage (20% or less) of the 66.67 milliseconds since the sum total of all simulated M1 behavior must execute within this time frame.

3.2. CSCI Design Description.

Because the simulated VIDS system is partitioned between two host computers, the description of the VIDS CSC is divided into two parts: the VIDS-GT CSC and the VIDS-PC CSC. Note that the VIDS-PC CSC is also referred to as the Soldier Machine Interface (SMI) and the Commander's Controls Display Panel (CCDP).

3.2.1. VIDS-GT CSC

The VIDS-GT CSC handles the job of simulating the behaviors of available sensors and countermeasures. Parameters sent by the VIDS-PC CSC are used to constrain the behavior of the VIDS-GT CSC. Parameters sent by the VIDS-GT CSC to the VIDS-PC CSC are used to inform the tank commander what is known about any hostile threats. Specific design features include:

a.   The VIDS-GT CSC satisfies all requirements presently allocated to the GT. Refer to the table in Section 7 to locate which specific requirements are satisfied.

b.   TheVIDS-GT CSC is subdivided into three lower-level CSCs: VIDS_File_Read, VIDS_Init and VIDS_Simul.

c.   Each of the three lower-level CSCs are executed in sequential order. VIDS_File_Read and VIDS_Init are executed only once; VIDS_Simul is executed 15 times a second as part of the M1 code which executes in the Simulate State.

3.2.1.1.   VIDS_File_Read CSC

The VIDS_File_Read CSC handles the job of reading a specific text file defining the available sensors and countermeasures and the corresponding behaviors. Specific design features include:

a. This CSC satisfies the requirements for a parameter-driven set of sensor and countermeasure behaviors. Refer to the table in Section 7 to locate which specific requirements are satisfied.

b. This CSC sequentially reads a specific text file. Each line is either a comment or a keyword-value(s). Comment lines are skipped. Keywords are used to discriminate which values are being read, what format must be used, and where they must be stored.

c. The text file containing the sensor and countermeasure behaviors is read only once.

3.2.1.2.   VIDS_Init CSC

The VIDS_Init CSC handles the job of preallocating dynamic memory, initializing queues and sending default parameters to the VIDS-PC. Specific design features include:

a. This CSC does not satisfy any system-level requirements.

b. This CSC handles the job of preallocating and initializating the dynamic memory to be used during the simulation of the VIDS behavior. Furthermore, it performs a critical initialization step by sending the corresponding VIDS-PC a set of default alert, safety, countermeasure coverage and turret scanning sector settings.

c. This CSC satisfies the design requirements for preallocating and initializing dynamic memory and providing default parameters to the VIDS-PC.

3.2.1.3.   VIDS_Simul CSC

The VIDS_Simul CSC handles the job of managing the majority of other lower-level CSCs. It is these lower-level CSCs which model the behavior of the available sensors, countermeasures and threat resolution module. Specific design features include:

a. This CSC and its lower-level CSCs satisfy a majority of the system-level requirements allocated to the GT. Refer to the table in Section 7 to locate which specific requirements are satisfied.

b. This CSC handles the job of sequentially executing the lower-level CSCs. This includes getting updates from the VIDS-PC, monitoring the main and turret power states, determining if there are new threats, prioritizing the current threats, selecting countermeasures, activating countermeasures, sending updated threat status to the VIDS-PC and sending countermeasure activation information to other entities participating within the same simulated battle exercise.

c. This CSC satisfies the design requirement for monitoring the main tank and turret power states.

3.2.2. PC-Resident VIDS CSC

The VIDS-PC CSC handles the job of simulating the CCDP. This includes a set of multi-function buttons as well as the ability to activate audible alarms and display threat information. The display screen is used to portray the type and position of threats relative to the tank. Specific design features include:

a. The VIDS-PC CSC satisfies all requirements presently allocated to the SMI. Refer to the table in Section 7 to locate which specific requirements are satisfied.

b. The VIDS-PC CSC is subdivided into 3 lower-level CSCs: SMI_Init, SMI_Simul, SMI_Shutdown.

c. Each of the three lower-level CSCs are executed in sequential order. SMI_Init and SMI_Shutdown are executed only once; SMI_Simul is executed endlessly until a keyboard Control-C or right mouse button is received.

4. Detailed Design.

The detailed design is divided into two parts. The first part describes the VIDS-GT CSC and the second part describes the VIDS-PC CSC.

4.1 VIDS-GT CSC Detailed Design

4.1.1. VIDS_File_Read CSC

VIDS_File_Read reads a text file of parameters for available sensors and countermeasures. This CSC is executed only once during the Startup State of the existing M1 code. The text file contains parameters for the Laser Warning Receiver, Missile Warning System, Missile Countermeasure Device and the Rapid Obscuration System. Furthermore, the text file contains automatic turret rotation rates for countermeasure activation, counterfire and turret scanning. The text file also contains the unique identification (VehicleID) of the PC which simulates the behavior of the corresponding CCDP.

4.1.2. VIDS_Init CSC

VIDS_Init preallocates dynamic memory structures which are used frequently during the execution of the VIDS_Simul CSC. Preallocation is done here purely for efficiency because VIDS_Init is invoked during a non-critical processing state.

VIDS_Init also sends default settings and smoke grenade counts to the CCDP. Alert, safety, countermeasure coverage and turret scanning sector settings are graphically portrayed when the CCDP is powered on.

4.1.3. VIDS_Simul CSC

VIDS_Simul serves as the primary entry point for simulation of the sensors, threat resolution module and countermeasures. It represents the root of a functional hierarchy which is executed once during each execution cycle of the existing, M1 simulation software. During a single execution cycle, the following high-level functions are executed:

```
Get_CCDP_Updates();
React_to_Power_State_Changes();
Identify_Threats();
Manage_Countermeasures();
Send_Updates_to_CCDP();
Send_Updates_to_Network();
```

Each of these functions represent a functional sub-hierarchy which is described in the following sections.

4.1.3.1. Get_CCDP_Updates CSU

Get_CCDP_Updates retrieves the current CCDP settings. These settings are changed by user interaction with the touch screen. It is assumed that all error checking is performed by the VIDS-PC. Consequently, all individual values are assumed to be error-free and that combinations of settings are legal. For example, manual activation of the MCD or ROS is legal when Semi-Automatic or Automatic CM has not been selected.

4.1.3.2. React_to_Power_State_Changes CSU

React_to_Power_State_Changes determines if the VIDS-GT system should continue to receive sensor input and activate countermeasures. This is done by checking that both the tank Master_Power and Turret_Power are on. Only when they are both on is VIDS on.

When VIDS is off, internal data structures used to maintain knowledge of threats and active countermeasures is discarded. Later on in Send_Updates_to_CCDP, the VIDS_Power_State is sent to the CCDP so that a similar cleanup can occur on the VIDS-PC.

4.1.3.3. Identify_Threats CSC

Identify_Threats serves as the primary entry point of sensor simulation. A test is made to determine if there are any new threats which can be potentially detected by one of the active sensors. If one or more new threats exist, they are placed into a queue for later processing. Additional processing is performed by the following functions:

```
Filter_Threats();
Manual_Threat_Update();
Sensor_Simul();
```

Each of these functions are described in the following sections.

4.1.3.3.1. Filter_Threats CSU

Filter_Threats examines each new threat and determines if a corresponding sensor is active. Threats which do not have a corresponding active sensor are discarded. Note that an active sensor is defined in the text file read by VIDS_File_Read.

4.1.3.3.2. Manual_Threat_Update CSU

Manual_Threat_Update determines if an existing threat has been manually deleted by the VIDS-PC. If the CCDP settings indicate a deletion, the supplied threat identification is used to search and delete its record from the prioritized threat list.

4.1.3.3.3. Sensor_Simul CSC

Sensor_Simul invokes available sensors. This is done by looping through all possible sensors and testing if they were activated by parameters retrieved by VIDS_File_Read. The following sensors can be selected and simulated:

    LWR_Simul();
    MWS_Simul();

Each of these functions are described in the following sections.

4.1.3.3.3.1. LWR_Simul CSC

LWR_Simul serves as the primary entry point for simulation of the Laser Warning Receiver (LWR). This sensor is subdivided into two functional parts: one which simulates reaction delay and detection probability, and one which processes new threats as a function of sensor-specific coverage limits. The two functional parts are

    Process_New_Laser_Threats();
    Test_LWR_Coverage_Limits();

Each of these functions are described in the following sections.

4.1.3.3.3.1.1. Process_New_Laser_Threats CSU

Each new threat exists in a waiting queue. Each invocation of Process_New_Laser_Threats decrements a counter associated with each threat. The prescribed delay time for laser threats was retrieved by VIDS_File_Read. After the counter for a specific threat reaches zero, a detection probability is used to decide when a threat is detected. A detected threat is moved from the waiting queue to the new threats queue. A nondetected threat is deleted from the wait queue.

4.1.3.3.3.1.2. Test_LWR_Coverage_Limits CSU

Test_LWR_Coverage_Limits performs a series tests to determine if a threat falls within the currently defined alert sector, and LWR azimuth and coverage sectors. The alert sector is one of the current CCDP settings and can be changed at any time, whereas the LWR azimuth and coverage sectors were retrieved by VIDS_File_Read and remain constant during the simulation.

To simplify calculations, the threat position is mathematically transformed into the coordinate system of the tank hull. If the threat falls within the alert and coverage sectors, it is added to the wait queue. Otherwise, the threat is discarded.

4.1.3.3.3.2. MWS_Simul CSC

MWS_Simul serves as the primary entry point for simulation of the Missile Warning System (MWS). This sensor is subdivided into two functional parts: one which simulates reaction delay and detection probability, and one which processes new threats as a function of sensor-specific coverage limits. The two functional parts are

```
Process_New_Missile_Threats();
Test_MWS_Coverage_Limits();
```

Each of these functions are described in the following sections.

4.1.3.3.3.2.1. Process_New_Missile_Threats CSU

Each new threat exists in a waiting queue. Each invocation of Process_New_Missile_Threats decrements a counter associated with each threat. The prescribed delay time for missile threats was retrieved by VIDS_File_Read. After the counter for a specific threat reaches zero, a detection probability is used to decide when a threat is detected. A detected threat is moved from the wait queue to the new threats queue. A nondetected threat is deleted from the wait queue.

4.1.3.3.3.2.2. Test_MWS_Coverage_Limits CSU

Test_MWS_Coverage_Limits performs a series tests to determine if a threat is heading towards the tank, and if so, checks if the threat falls within the currently defined alert sector, and MWS azimuth and coverage sector angles. The alert sector is one of the current CCDP settings and can be changed at any time, whereas the MWS approach, azimuth and coverage sectors were retrieved by VIDS_File_Read and remain constant during the simulation.

To simplify calculations, the threat position is mathematically transformed into the coordinate system of the tank hull. If the threat is heading towards the tank and falls within the alert and coverage sectors, it is added to the wait queue. Otherwise, the threat is discarded.

4.1.3.4. Manage_Countermeasures CSC

Mange_Countermeasures serves as the primary entry point for countermeasure simulation. Countermeasure simulation satisfies the requirement to prioritize threats, select appropriate countermeasures and to

activate individual countermeasures for each threat. These activities are accomplished by invoking the following functions:

    Prioritize_Threats();
    Select_Countermeasures();
    Individual_CM_Simul();

Each of these functions are described in the following sections. Note that Prioritize_Threats and Select_Countermeasures are invoked only when the VIDS power is on.

4.1.3.4.1.   Prioritize_Threats CSC

Prioritize_Threats establishes which threats require the most immediate activation of countermeasures. Furthermore, to make sure that countermeasures are used efficiently, checks are made to determine if the available sensors are providing multiple reports for the same threat. If this is the case, only one countermeasure is activated. Finally, threats are automatically deleted if no new sensor reports are received within a predefined threat lifetime. These activities are accomplished by invoking the following functions:

    Fuse_Correlate_Threats();
    Sort_Prioritized_Threats();
    Update_All_Prioritized_Threats();

Each of these functions are described in the following sections. Note that Sort_Prioritized_Threats is invoked only when the queue of active threats has been changed through an addition, update or deletion.

4.1.3.4.1.1.   Fuse_Correlate_Threats CSU

Fuse_Correlate_Threats attempts to find a threat from the new threats queue in the prioritized threat queue. Recall that an new threat is one which has been recently detected by a sensor and may not yet be prioritized. If the new threat is found in the prioritized threat queue, the information describing the new threat is used to update the prioritized threat. Otherwise, the new threat is moved from the new threats queue to the prioritized threat queue. Note that new and updated threats are given a finite lifetime. The threat lifetime was retrieved by VIDS_File_Read.

4.1.3.4.1.2.   Sort_Prioritized_Threats CSU

Sort_Prioritized_Threats visits each threat in the prioritized threat queue to verify each threat is assigned the correct priority. Threats which have activated a countermeasure are lower in priority than threats which have not. A threat which is inside the safety sector is lower in priority than one

which is outside. Laser threats are higher in priority than missile threats. When two threats have equal priority, the one which is closest to the main gun has higher priority. When two threats are equal in angular proximity from the main gun, the one which will be reached with a clockwise turret rotation has higher priority.

4.1.3.4.1.3. Update_All_Prioritized_Threats CSU

Update_All_Prioritized_Threats visits each threat in the prioritized threat queue to decrement its lifetime. When the lifetime for a threat reaches zero, it is removed.

4.1.3.4.2. Select_Countermeasures CSU

Select_Countermeasures assigns countermeasures to new threats and reconfirms that the current countermeasure for an existing threat is correct. This is done by visiting each threat in the prioritized threat list and determining if it has been assigned a countermeasure. When a countermeasure has not been assigned, a table lookup is used to find the first available countermeasure. When a countermeasure has been assigned, a table lookup is still performed to confirm that the countermeasure is still recommended. This is done because the type of threat may have changed due to sensor fusion or because an expendable countermeasure is no longer available.

Once each threat has been assigned a countermeasure, a check is made to determine if there has been a manual change in the order of countermeasure activation. If the CCDP settings indicate a change, the corresponding countermeasure will be activated first in Individual_CM_Simul.

4.1.3.4.3. Individual_CM_Simul CSU

Individual_CM_Simul controls the activation and deactivation of countermeasures. In general, individual countermeasures are sequentially activated and deactivated until all threats have been handled. Only in special cases are concurrent activations supported. Futhermore, Individual_CM_Simul supports automatic modes for counterfire rotation and turret slewing if countermeasures cannot be activated.

Countermeasure activation, counterfire rotation and turret slewing can all be activated automatically or semi-automatically. (Semi-automatic activation is equivalent to automatic activation when the commanders palm switch is engaged.) Countermeasures can be activated manually using buttons on the CCDP, but manual counterfire rotation and turret slewing is still controlled by either the tank commander or gunner controls. Note, however, that all countermeasure activations require arming. A button on the CCDP arms countermeasure activations.

Manual countermeasure activation occurs when countermeasures are armed and the Jam or Salvo switch is depressed (backlighted) on the CCDP. Jamming continues endlessly until either the Jam switch is released or countermeasures are made safe (disarmed). The Salvo switch initiates a brief, timed-delay which results in smoke appearing in out-the-window displays and switch release (the CCDP SALVO button backlighting is extinguished). Furthermore, manual jamming or a salvo of smoke grenades can occur concurrently with any mode of turret slewing.

Automatic countermeasure activation occurs when all of the following conditions exist:
   a. the recommended countermeasure for a threat is available.
   b. countermeasures are armed.
   c. the commanders palm switch is engaged (necessary only for semi-automatic activation).
Furthermore, automatic modes for both counterfire rotation or turret slewing are ignored.

Automatic rotation for counterfire will occur if the following conditions exist:
   a. the conditions for automatic countermeasure activation do not exist.
   b. counterfire is in either the automatic or semi-automatic mode.
   c. the commanders palm switch is engaged (necessary only for semi-automatic activation).
Furthermore, automatic modes for turret slewing are ignored.

Automatic turret slewing will occur if the following conditions exist:
   a. the conditions for automatic countermeasure activation do not exist.
   b. counterfire is in the manual mode.
   c. the commanders palm switch is engaged (necessary only for semi-automatic activation).

The following countermeasures can be selected and simulated:

    ROS_Simul();
    MCD_Simul();

Each of these functions are described in the following sections.

4.1.3.4.3.1.   ROS_Simul CSU

ROS_Simul serves as the primary entry point for simulation of the Rapid Obscuration System (ROS). This system launches smoke grenades to temporarily hide the tank position from electro-optically guided or terminal homing missile threats.

For simulation, the turret is conceptually divided into 24 equal sectors each with 15 degrees of coverage. Each sector may contain zero or more grenades; and there may be more than one smoke grenade type.

For manual activation, the number and sectors are specified by the CCDP coverage sector. After a brief time delay, smoke grenades are launched a short distance from the tank hull. The delay time and launch distance were retrieved by VIDS_File_Read.

For automatic activation, launch sectors are selected dynamically. Launch sectors are selected which require the minimum turret rotations to get the recommended smoke grenades between the threat and the tank hull. After the predefined time delay and the turret has rotated a launch sector into position, one or more grenades are launched from adjacent sector positions. Note that if turret rotation is required, gunner and commander turret controls are disabled.

As grenades are launched, the inventory of available smoke grenades is decremented. Once all the recommended grenades have been launched, the prioritized threat record is updated so that additional smoke grenades will not be launched towards the same threat; gunner and commander turret controls are enabled.

4.1.3.4.3.2.   MCD_Simul CSU

MCD_Simul serves as the primary entry point for simulation of the Missile Countermeasure Device (MCD). This system directs infrared jamming energy towards a missile threat platform to disrupt the missile tracking system.

For simulation, the center of the jamming energy is coincident with the direction of the main gun. The azimuth and elevation coverage sectors were retrieved by VIDS_File_Read.

For manual activation, the jamming energy continues until it is manually deactivated. For automatic activation, the jamming begins when the turret is positioned towards the threat platform. Note that if turret rotation is required, gunner and commander turret controls are disabled. Jamming is activated for a brief time. The automatic activation time was retrieved by VIDS_File_Read. Once the jamming is deactivated, the prioritized threat record is updated so that that infrared jamming energy will not be directed against the same threat; gunner and commander turret controls are enabled.

4.1.3.5.   Send_Updates_to_CCDP CSC

Send_Updates_to_CCDP serves as the primary communication channel for sending information updates from the VIDS-GT to the VIDS-PC. The following types of information are sent:

    a. Changes to the top six threats.
    b. Changes to hull or turret orientations.
    c. Changes to master or turret power states.
    d. Audible alerts for new or changed threats.
    e. Changes in smoke grenade inventory.

Services provided by existing code are used to package and transmit the information to the corresponding VIDS-PC.

4.1.3.6.   Send_Updates_to_Network CSC

Send_Updates_to_Network serves as the primary communication channel for sending the state of the VIDS-equipped tank to other entities participating within the same simulated battle exercise. The following types of information are sent:

    a. The presence of smoke.
    b. The activation/deactivation of infrared jamming.
    c. Instrumentation (used only for data collection and analysis).

Services provided by existing code are used to package and transmit the information to other entities.

4.1.4. XField CSC

XField handles the low-level simulation of electo-optical energy. XField PDUs retrieved from the network are examined to determine the kind and spatial extent of electro-optical energy. If the VIDS-equipped tank falls within the energy field, the information describing the field is added to an internal list of other fields. Additionally, the presence of clouds (smoke) is used to determine if the field energy is absorbed. If a field absorbed, the field is not made available to the higher-level Identify_Threats CSC.

Fields are removed from the list when either an explicit XField PDU defines that the field no longer exists or the specified field lifetime expires.

An Xfield PDU sent by the VIDS-equipped tank (refer to the MCD_Simul CSU) is tagged appropriately to distinguish it from fields sent by other vehicles. Furthermore this type of field is periodically retransmitted to the network as long as the field is present.

4.1.5. Cloud CSC

Cloud handles the low-level simulation of smoke clouds. Smoke Cloud PDUs are initially transmitted to the network by the VIDS-equipped tank (refer to the ROS_Simul CSU) to inform other vehicles that new smoke clouds exist.

Each smoke grenade is simulated as a single cloud. Parameters are supplied which define the smoke type and corresponding spatial dynamics. This allows other vehicles to model the smoke growth, dissipation and interference with electro-optical energy.

Like XFields PDUs, Cloud PDUs are periodically retransmitted to the network as long as the smoke is potentially effective as an obscurant. When the smoke from a grenade is no longer effective, a Cloud PDU is transmitted to the network so that other vehicles can drop it from their internal lists.

4.1.6. Modifications to Existing Code

Modifications to existing code were made to support the VIDS-GT capability. The files and changes follow:

a. m1_main.c
Added invocation of VIDS_Init in veh_spec_init function.
Added invocation of VIDS_File_Read in veh_spec_startup.
Added invocation of VIDS_Simul in veh_spec_simulate.

b. m1_turret.c
Added the set_vids_az function to support automatic turret rotations to specific azimuth angles.
Added the set_vids_relative function to support final turret angles relative to the tank hull.
Added the set_vids_north function to support final turret angles relative to true north.
Added the set_vids_auto_on function to disable the gunner and commander turret rotation controls.
Added the set_vids_auto_off function to enable the gunner and commander turret rotation controls.
Added the set_vids_slew_rate function to support the specification of a rotation rate.
Added the get_vids_rate function to retrieve the current, VIDS-specific turret rotation parameters.

c. proc_a_pkt.c
Added code to recognize ROS resupply so that the initial supply and placement of smoke grenades could be instantly restored.

4.2. VIDS-PC Detailed Design

4.2.1. SMI_Init CSC

SMI_Init preallocates dynamic memory structures associated with drawing menus and displays which will be seen during the execution of the SMI_Simul CSC. Data files are read which define the placement and appearance of buttons and icons as well as the unique identifier (VehicleID) of its corresponding GT. Parameters are read which define active buttons and how long they must be pressed for a corresponding action to be activated. Finally, links are established between buttons and function invocations.

4.2.2. SMI_Simul CSC

SMI_Simul serves as the primary entry point for simulation of the real CCDP. It represents the root of a functional hierarchy which is executed endlessly until a keyboard Control-C or right mouse button event is received. During a single execution cycle, the following high-level functions are executed:

```
Get_Button();
Check_Alarms();
Process_Rcv_PDU();
```

Each of these functions represent a functional sub-hierarchy which is described in the following sections.

4.2.2.1.　　Get_Button CSU

Get_Button serves the need to monitor button, mouse, and keyboard activity. A right mouse button or keyboard Control-C signals a request to terminate the SMI_Simul CSC by transitioning to SMI_Shutdown. Otherwise, a test is made to determine if a displayed button has been held down. If a button has been held down long enough and it corresponds to a predefined action, the action is initiated through a corresponding function call. The corresponding function may change the current menu, the content of the display, the operating state or a combination of these changes. When a button changes one of the VIDS operating states, a network message is sent to the VIDS-GT to update its corresponding CCDP settings Additionally, when any button state is changed or when a user alert message is displayed, a network message is sent for data collection and analysis.

4.2.2.2.　　Check_Alarms CSU

Check_Alarms manages the VIDS alarm tones heard on the tank intercom. The status of each alarm type is checked to determine if it should be activated or terminated. When an alarm is activated, the alarm is heard for a predefined duration. An alarm is terminated when the duration has expired, a termination message was received from the GT or VIDS is powered off.

4.2.2.3.　　Process_Rcv_PDU CSC

Process_Rcv_PDU manages received network messages. Only messages sent by the corresponding VIDS-GT are processed. All other messages are discarded.

Depending upon the type of message, the display or alarm tones are changed. The message types which change the display include the following:
   a. Tank Power State updates.
   b. Tank Orientation updates.
   c. Prioritized Threat updates.
   d. Automatic CM Activation/Deactivation updates.
   e. Default Setups.
Only the Alarm Control message type affects what is heard on the tank intercom. Refer to the IDD in section 5 for the exact content of each message type.

4.2.3. SMI_Shutdown CSU

SMI_Shutdown releases memory allocated during SMI_Init and restores the mouse and display behaviors before terminating.

5.   CSCI data.

Within the VIDS-GT CSC, there is only one global data element: vids_debug. It it a boolean object which is toggled between two states to either activate or deactivate diagnostic messages.   Under normal conditions, vids_debug is false.

Within the VIDS-PC CSC, the following arrays represent global elements:
    a. Icon.
    b. Threat.
    c. Frame.
    d. Display.
    e. Vary.
    f. Buttons.
    g. fcnptrs.

These arrays used to support low-level drawing operations. Refer to the following header files for more details:

    global.h
    alarm.h
    buttons.h

The following table lists the type and content of the messages exchanged between the PC, GT and SAF.

Data Structure	Fields	Sub-fields	Range of Values	Descriptions
CCDP_Control_Settings (sent from CCDP to M1)				
	Alert_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the alert sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise. Threats which fall outside alert sector will be ignored.
		.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees. If Delta equals zero, threats will not be reported.
	Safety_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the safety sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise. Neither the turret nor any CM will be activated within the Safety Sector.
				Furthermore, the turret will not be automatically slewed into this sector for either Semi or Auto CFire.
		.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees.
				If Delta equals 0, then no safety region is defined. In other words, countermeasures can be activated/deployed in any direction.
	Turret_Scanning_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the turret scanning sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise.
		.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees.
				If Delta equals 0, then turret scanning is disabled.
	CM_Coverage_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the CM coverage sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise.
		.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees.

Data Structure	Fields	SubFields	Range of Values	Descriptions
				If Delta equals 0, then no smoke grenades will be fired by a Manual Salvo. A sector defined by Delta which is greater than 0 defines the coverage of smoke grenades when the Salvo button is depressed in Manual mode.
	.Manual_Grenade_Salvo			Defines an array which stores the number of smoke grenades to launch for each type of grenade. Smoke grenade type (LBA1, M76, XM81) is used to index into the array. Each array element contains the number of grenades to launch.
	.VIDS_Power_State		Off, On	Defines whether VIDS is on or off. When VIDS is off, only the Salvo and Arm_Safe Buttons operate.
	.Turret_Mode		Manual, Semi, Auto	Defines the turret scanning mode. The turret mode will return to Manual if manually deactivated, or if a threat is detected and CFire_Mode or CM_Mode is Semi or Auto.
	.CFire_Mode		Manual, Semi, Auto	Defines the counterfire mode. Semi or Auto provide for automatic turret slewing and positioning.
	.CM_Mode		Manual, Semi, Auto	Defines the countermeasure mode. Semi and Auto provide for automatic turret slewing and automatic CM activation.
	.Arm_Safe_State		Safe, Armed	Defines the Arm/Safe button state. The state must be Armed before any countermeasure is activated. This state is ignored for all CFire and Turret Scanning modes.
	.Delete_Threat		SIMNET Vehicle Id	Defines which target to be deleted. A value of 0 means that no manual deletions are required.
	.Selected_Top_Threat		SIMNET Vehicle Id	Defines which target is the top priority. A value of 0 means that no change is required.
	.ROS_Button_State		Deactivated, Activated	Defines the ROS countermeasure state. The ROS countermeasure may be activated manually or automatically. Manually deactivating the ROS countermeasure immediately terminates either type of countermeasure. Otherwise, deactivation occurs after the recommended number of smoke grenades have been launched.
	.MCD_Button_State		Deactivated, Activated	Defines the MCD countermeasure state. The MCD countermeasure may be activated manually or automatically. Manually deactivating the MCD countermeasure immediately terminates either type of

Data Structure	Fields	SubFields	Range of Values	Descriptions
				activation. Manual activation always requires manual deactivation; automatic deactivation follows automatic activation after a predefined delay.
	.Threat_Sensor_Filter		LBR, LDES, LRF, ATGM, HELO, TANK	Defines an array of bits which is indexed by LBR, LDES, LRM, ATGM, HELO, TANK. When a bit is set to 1, sensed threats of the specified type will be ignored.
	.Guise_Filter		UNKNOWN, FRIEND, FOE	Defines an array of bits which is indexed UNKNOWN, FRIEND, FOE. When a bit is set to 1, identified threats of the specified type will be ignored.
Tank_Power_State (sent from M1 to CCDP)				
	.Master_Power_State		Off, On	Defines the Master Power State. When this is Off, no CCDP button can be "depressed", all lights go out, the display is blanked, and any audible warning tone is terminated.
	.Turret_Power_State		Off, On	Defines the Turret Power State. When this is Off, no CCDP button can be "depressed", all lights go out, the display is blanked, and any audible warning tone is terminated.
Tank_Orientation (sent from M1 to CCDP)				
	.Hull_Orientation		0 to 360 degrees.	Defines the angle of the hull with respect to true North. Positive angles are counterclockwise.
	.Turret_Orientation		0 to 360 degrees	Defines the angle of the turret with respect to the hull. Positive angles are counterclockwise.
Smoke_Grenade_Inventory (sent from M1 to CCDP)				
	.Grenade_Type_Counts		0 - 64	Defines an array of smoke grenade totals. The array is indexed by L8A1, M76, XM81. Each array element contains the remaining grenades of the specified type.
	.Launch_Tube_Array		0 - 23	Defines the fixed number of simulated smoke grenade launch tubes. For simulation, each launch tube is positioned at 15 degree increments with an initial offset of 7.5 degrees from the main gun for a total 24 launch tubes.
				Furthermore, each tube can launch one of three types of grenades: L8A1, M76, XM81. Grenades can be launched in any order from a simulated tube.

Data Structure	Fields	SubFields	Range of Values	Descriptions
Alarm_Control (sent from M1 to CCDP)				
	.Alarm_Index		1-255	Defines the index into a prerecorded table of alarm tones.
	.Alarm_Activation		Off, On	Defines when the tone is played or terminated.
	.Alarm_Duration		0 - 60	Defines the number of seconds that a warning tone must be heard.
Prioritized_Threats (sent from M1 to CCDP)				
	.Total_Threat_Count		0-65535	Defines the number of recognized threats. Note that only the first 6 threats will be sent to the CCDP, and that the threats will be sent in priority order.
	.Threat_List	.Sensor_Detection	LRF, LBR, LDES, ATGM	Defines how the threat was detected.
		.Vehicle_Id	SIMNET Vehicle Id	Uniquely defines the threat.
		.Azimuth_Angle	0 to 360 degrees	Defines the angle of the threat with respect to true North. Positive angles are counterclockwise.
		.Elevation_Angle	0 to +-90 degrees	Defines the angle of the threat with respect to the horizon. Positive angles are above the horizon.
		. Range	0 - 10km	For future sensor simulations.
		.Guise	Friend, Foe, Unknown	Defines if the threat is friendly. For the present all, threats are foes.
		.Recommended_CM	NULL, MCD, ROS	Defines the recommended CM for automatic activation.
		.ROS (variant)	.Grenade_Type_Array	Defines an array of smoke grenade types. For ROS, the three types are L8A1, M76, XM81. Each array element defines the number of smoke grenades to launch for a given threat.
Auto_CM_State_Change (sent from M1 to CCDP)	.CM		ROS(Salvo), MCD(Jam)	Defines which button/display to light or extinguish when a countermeasure is automatically activated/deactivated.
	.State		Deactivated, Activated	
Default_CCDP_Setups (sent from M1 to CCDP)				
	.Jam_Switch_Mapping		NULL, MCD	Defines which CM is activated by depressing the Jam Switch. Null defines a nonfunctional Jam switch.
	.Salvo_Switch_Mapping		NULL, ROS	Defines which CM is activated by depressing the Salvo Switch. Null defines a nonfunctional Salvo switch.
	.Alert_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the alert sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise. Threats which fall outside alert sector will be ignored.

24

Data Structure	Fields	SubFields	Range of Values	Descriptions
	Safety_Sector	.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees.
		.Start_Angle	0 to 360 degrees.	Defines the start angle of the safety sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise. Neither the turret nor any CM will be activated within the Safety Sector.
		.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees. If Delta equals 0, then no safety region is defined. In other words, countermeasures can be activated/deployed in any direction.
	.Turret_Scanning_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the turret scanning sector. The start angle is defined to be relative to the front of the hull. Positive angles are counterclockwise.
	.	.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees. If Delta equals 0, then turret scanning is disabled.
	.CM_Coverage_Sector	.Start_Angle	0 to 360 degrees.	Defines the start angle of the CM coverage sector. The start angle is defined relative to the front of the hull. Positive angles are counterclockwise.
		.Delta	0 to 360 degrees.	Defines the angular offset from the start angle. The sector defined by the delta from the start angle is evenly divisible by 15 degrees. If Delta equals 0, then no smoke grenades will be fired by a Manual Salvo. A sector defined by Delta which is greater than 0 defines the coverage of smoke grenades
	.Manual_Grenade_Salvo			Defines an array which stores the number of smoke grenades to launch for each type of grenade. Smoke grenade type (L8A1, M76, XM81) is used to index into the array. Each array element contains the number of grenades to launch.
XField (exchanged between SAF and VIDS-equipped vehicles)				
	.type		Range_Finder_Laser, Beam_Rider_Laser, Designating_Laser, RF, Acoustic, IR, MF, ATGM.	Defines the type of field.
	.field_ID		0 to 65535	Uniquely identifies the field.
	.exp_duration		0 to the largest unsigned integer.	Expected duration (lifetime) of the field.

Data Structure	Fields	SubFields	Range of Values	Descriptions
	.theta_1		0 to 360 degrees.	One of two azimuthal angles which define the field
	.theta_2		0 to 360 degrees.	One of two azimuthal angles which define the field
	.phi_1		0 to 180 degrees.	One of two altitudinal angles which define the field
	.phi_2		0 to 180 degrees.	One of two altitudinal angles which define the field
	.power		0.0 to maximum floating point number.	Defines the total power emitted by the field.
	.frequency		0.0 to maximum floating point number.	Defines the base frequency of the field.
	.theta_sweep_frequency		0.0 to maximum floating point number.	Defines the frequency in Hertz for the theta dynamics to complete a cycle.
	.theta_sweep_amplitude		0.0 to maximum floating point number.	Defines the frequency in Hertz for the theta dynamics to complete a cycle.
	.phi_sweep_frequency		0.0 to maximum floating point number.	Defines the frequency in Hertz for the theta dynamics to complete a cycle.
	.phi_sweep_amplitude		0.0 to maximum floating point number.	Defines the frequency in Hertz for the theta dynamics to complete a cycle.
	.radius		0.0 to maximum floating point number.	Defines radius of the field at the source.
	.k			For future simulations.
Cloud (sent by VIDS-equipped vehicles)				
	age		0 to maximum floating point number.	Defines the age of the smoke cloud
	.location		SIMNET World Coordinates	Defines the location of the smoke cloud in the battlefield
	.lifetime		0.0 to maximum floating point number.	Defines the duration of the smoke cloud.
	.eta		0.0 to 1.0.	Defines the nominal attenuation per unit path length visibility in a band and is always a number less than one.
	.drift		An array of 3 floating point rates.	Defines the rate (meters/second) at which a cloud moves from its origin.
	.cloud_profile			Defines the cloud-unique dynamics: expansion and dissipation.
		.time	0 to maximum integer.	Defines the time after cloud starts in units of milliseconds.
		.radius	0.0 to maximum floating point number.	Defines the radius in metersof the cloud cylinder.
		.hheight	0.0 to maximum floating point number.	Defines the half height of the cloud cylinder.
	.nprof		1	For future simulations.

26

6.   **CSCI data files.**

Files are not shared between VIDS CSCs or CSUs.

7.   **Requirements traceability.**

The following table depicts the requirements traceability.

Req. No.	Description
1	**Provide a VIDS equipped combat vehicle.**
	The VIDS Step 2 activities will modify the BDS-D M1 Simulator to simulate a VIDS equipped combat vehicle providing:
1.1.	**A simulated VIDS Tactical Display panel.**
	The layout of the Tactical Display will be based on the examples shown in CBVIDS-004 and the VIDS Functional Specification. All operator actions taken shall be relayed to the Data Logger. The Tactical Display shall provide:
1.1.1.	A hardware implementation of a VIDS information display and control panel located in the M1 Simulator at the Tank Commander's position.
1.1.2.	An information display consisting of:
1.1.2.1.	The CM Data Field showing the countermeasures available (system and inventory status if applicable).
1.1.2.2.	The CM ARM/SAFE Field showing the current state.
1.1.2.3.	The Threat Position Data Field showing the azimuth, elevation, range, and type of threat data pertaining to highest priority or operator selected threat.
1.1.2.4.	The Mode Indicator showing CM selection and status.
1.1.2.5.	The User Alert Data Field showing applicable VIDS alerts.
1.1.2.6.	The Alert Sector delineating sector where threats can be initially detected.
1.1.2.7.	The Threat Icon Field showing relative azimuth position of the 6 highest priority threats.
1.1.2.8.	The CM Coverage Sector delineating sector in which CM may be directed.
1.1.2.9.	The Safety Coverage Sector delineating sector in which CM may not be dispensed or the turret positioned when in the Automatic or Semi-Automatic Mode. Manually positioning into this sector will result in a User Alert.

	4.4.1.1.3.3.3.1	4.4.1.1.3.3.3.2	4.4.1.1.3.3.3.1.2	4.4.1.1.3.3.4.1.2	4.4.1.1.4.4.2.3.1.2	4.4.1.1.4.4.1.2.3	4.4.1.1.4.4.5.d.	4.4.1.1.4.4.2.3.a.1.2	4.4.1.1.4.1.2.2	4.4.1.1.4.2.2.a.3.	4.4.1.1.4.a.1.2.2.3.

1.1.2.10.	The Turret Pointer indicating the direction in which the main gun is pointing. Top of display means same as front of hull.										
1.1.2.11.	The Hull Pointer indicating the top of the display.										
1.1.2.12.	The Programmable Turret Limits delineating the limits of turret SCAN.										
1.1.2.13.	The Menu Choice Field indicating the current function represented by each of the PFKs. When a PFK is selected the corresponding field shall be back lighted on the display.										
1.1.3.	The control panel shall contain fourteen Fixed Function Keys (FFKs) suitable for controlling the use of the VIDS. Sufficient functionality shall be provided to allow the following actions. Unused FFKs shall be labeled "SPARE". Activating a SPARE or any illegal action shall result in a User Alert.										
1.1.3.1.	POWER - Control whether VIDS is in the Off as opposed to the other Operational Modes. When power is Off none of the PFKs and only the ARM/SAFE and SMOKE GRENADE LAUNCH (SALVO) actions are functional. Transition out of Off Mode is to Manual, the top level menu is shown, and all setups are at default values.										
1.1.3.2.	ARM/SAFE - Allows/Disallows use of CM. If VIDS is Off Allows/Disallows use of smoke grenades. Activation of any CM is disallowed when it is in the SAFE condition and will result in a User Alert.										
1.1.3.3.	SMOKE GRENADE LAUNCH (SALVO) - When VIDS is Off this FFK dispenses 4 smoke grenades centered around the line of sight of the main gun. When VIDS is Manual this FFK dispenses Setup selected (or initial default) number and type of grenades. This capability is illegal if ROS is in the Semi-Automatic or Automatic Mode or if system is in SAFE condition (a User Alert results).										
1.1.3.4.	MAIN - Puts up the top level menu and sets VIDS to the Manual Mode. Any setup actions are preserved.										
1.1.3.5.	ENTER - Activates previous PFK selection. If no PFK is selected menu goes up one level. Attempts to go up from the top menu will result in a User Alert.										
1.1.3.6.	TARGET SELECT - Causes the currently selected target to be deleted and the next highest to be selected.										

ID	Description
1.1.3.7.	SCROLL UP - Selects the next highest priority target without deleting the current. Attempts to select UP from the highest will result in a User Alert.
1.1.3.8.	SCROLL DOWN - Selects the next lowest priority target without deleting the current. Attempts to select DOWN from the lowest will result in a User Alert.
1.1.3.9.	JAM - Used in the Manual Mode to activate the MCD system. If system is in Auto or Semi-Auto mode or in SAFE condition a User Alert results.
1.1.3.10.	CM OFF - Pressing SALVO or JAM while they are active manually deactivates the CM on going action.
1.1.4.	The control panel shall contain five Programmable Function Keys (PFKs) for use in changing VIDS states, menu selection and/or traversing, and performing Setup functions. PFK selections will not be activated until the ENTER function is activated. The top level menu shall offer a choice between NORM (light the year) and SETUP.
1.1.4.1.	NORM - Provide for placing SCAN, CM, and/or Counterfire into the Semi-Automatic or Automatic Mode as described in CBVIDS-004 (modified by follow-up data).
1.1.4.2.	SETUP - Provide Setup Menus and actions compatible to that described in CBVIDS-004 where possible.
1.2.	Sensor Simulations. VIDS Step 2 will simulate the Laser Warning Receiver (LWR) and the Missile Warning System (MWS). Each sensor simulation shall:
1.2.1.	Monitor the exercise to determine the occurrence of any activity which can be sensed.
1.2.2.	Apply processing and response times to simulate realistic sensor reaction.
1.2.3.	Apply probability of detection numbers to the sensed entity to simulate the sensor's effectiveness.
1.2.4.	For detected activities disclose the presence of the activity and what the sensor knows about it for further VIDS processing.
1.2.5.	Maintain sensor characteristics such as processing time and probability of detection as parameters so that they may be easily modified before an exercise.

1.3.	Countermeasure Simulations. The VIDS Step 2 will simulate the Multi-Salvo Smoke Grenade Launcher / Rapid Obscuration System (ROS) and the Missile Countermeasure Device (MCD).	
1.3.1.	The ROS simulation shall:	
1.3.1.1.	Be capable of deploying any of the three types of smoke as defined in the VIDS Functional Specification. When deployment requires turret motion deployment shall delay until the turret is positioned.	
1.3.1.2.	Initiate and maintain for each smoke deployment the location of the effective volume of the smoke screen created for the effective duration of the smoke screen. Communicate the presence and characteristics of this smoke screen to all participants in the exercise.	
1.3.1.3.	Initiate an appropriate visual effect for the smoke screen being generated and communicate to all participants in the exercise.	
1.3.2.	The MCD simulation shall be capable of deploying an IR jamming field as defined in the VIDS Functional Specification and communicating the presence and characteristics of this field to all participants in the exercise.	
1.3.3.	Characteristics of the ROS and MCD simulations such as processing and/or deployment times shall be implemented as parameters so that they may be easily modified before an exercise.	
1.4.	Countermeasures Management. VIDS Step 2 shall:	
1.4.1.	Monitor all disclosed data from activities as perceived by the sensors and:	
1.4.1.1.	Perform correlation of newly disclosed data with data from previous disclosures.	
1.4.1.2.	Perform fusion of data from different sensor's disclosures of the same or related activities.	
1.4.2.	Use the correlated and fused data to maintain knowledge of all sensed entities and known links between weapons and launching platforms.	
1.4.3.	Use knowledge of sensed entities to prioritize threats.	

	Description
1.4.4.	Indicate on the Tactical Display the highest priority or operator selected threat by blinking the associated icon.
1.4.5.	Determine if CM should be applied to selected threat and indicate recommendation on the display by backlighting in the CM Data Field.
1.4.6.	Determine if Counterfire should be directed against selected threat. If AUTOMATIC or if SEMI-AUTOMATIC and the palm switch is depressed initiate any needed turret movement.
1.4.7.	Determine if Scan is activated. If AUTOMATIC or if SEMI-AUTOMATIC and the palm switch is depressed initiate turret movement. Suspend scanning during Counterfire or CM activity.
1.4.8.	Provide a ROS initiation capability when grenades are available and CM is armed.
1.4.8.1.	When in the OFF Mode provide capability of manual firing of four grenades centered about line of sight of the main gun.
1.4.8.2.	When in the MANUAL Mode provide capability of manual firing of pre-programmed (or default) type number, and coverage of grenades.
1.4.8.3.	When in the SEMI-AUTOMATIC or AUTOMATIC Mode and ROS is the recommended CM select stores, salvos, and coverage based upon selected threat type and inventory. If AUTOMATIC or if palm switch depressed initiate any needed and initiate firing of grenades.
1.4.9.	Provide an MCD initiation capability when CM is armed.
1.4.9.1.	When in the OFF Mode MCD is not available.
1.4.9.2.	When in the MANUAL Mode provide capability of manual initiation of MCD using JAM action.
1.4.9.3.	When in the SEMI-AUTOMATIC or AUTOMATIC Mode and MCD is recommended CM, initiate use of MCD if AUTOMATIC or if palm switch depressed.
1.4.9.4.	Discontinue use of MCD when CM OFF action taken.
1.4.10.	An audible alarm shall be initiated upon determination of certain existing threats (as defined in the VIDS Functional Specification) or immediately proceeding an automatic turret movement for Counterfire or CM deployment.
1.5.	Selective Initialization. - VIDS Step 2 shall:

		Requirement
1.5.1.		Provide a capability to selectively load any combination of the implemented VIDS Sensor and Countermeasures at initialization.
1.5.2.		Allow modification of recommended threat to countermeasure pairing at initialization.
2		Provide VIDS threat platforms and Weapons Systems. The VIDS Step 2 activities will modify the BDS-D SAFOR so that it can be used to evaluate the effectiveness and suitability of the VIDS survivability suites by providing:
2.1.		New Simulated Threat Platforms. VIDS Step 2 shall modify the performance characteristics of existing BDS-D SAFOR platforms to simulate the T-90, the Mi-24/HIND/F, and the BRDM-2 to meet the specifications of the VIDS Functional Specification.
2.2.		New Simulated Weapons Systems. VIDS Step 2 shall:
2.2.1.		Modify the existing BDS-D HEAT and SABOT tank rounds to meet the specifications of the VIDS Functional Specification.
2.2.2.		Modify the existing BDS-D TOW missile to meet the specifications of the VIDS Functional Specification for simulation of the US. Hellfire and Soviet AT-2C, AT-4, AT-6, AT-9, and AT-11 ATGMs.
2.2.3.		Have weapons systems using laser designators, laser beam riding, laser range finders, laser jammers, or other laser uses communicate the presence and characteristics of this activity to all participants in the exercise.
2.2.4.		Have missiles using their booster/sustainer, large caliber gun firings or other systems producing intense optically sensible fields communicate the presence and characteristics of this activity to all participants in the exercise.
2.2.5.		Have weapons systems using RF uplink, track or search radar, or other RF uses communicate the presence and characteristics of this activity to all participants in the exercise.
2.2.6.		deleted.

Section	Requirement
2.2.7.	Have all weapon systems monitor the exercise to determine the occurrence of any non-tangible field produced by CM or other systems which could have an effect on its operation and use the data to modify their behavior accordingly.
2.2.8.	Maintain CM characteristics such as time needed to detect and probability of effectiveness as parameters so that they may be easily modified before an exercise.
2.3.	Selective Initialization. VIDS Step 2 shall:
2.3.1.	Provide a capability to selectively load any combination of the implemented VIDS SAFOR simulated threat platforms for an exercise.
2.3.2.	Provide a capability to selectively load the VIDS SAFOR simulated threat platforms with the implemented VIDS weapons systems for an exercise.
3	Provide VIDS Logistics. The VIDS Step2 activities will modify the existing BDS-D logistics to provide:
3.1.	M1 Simulator Expendables Re-Supply Logistic support shall be provided for the M1 at the Battlemaster position which shall have the capability to re-constitute the M1 in place.
3.2.	deleted.

8.   Notes.

Acronyms	Definitions
CCDP	Commander's Controls Display Panel
GT	Graphics Technologies
LWR	Laser Warning Receiver
MCD	Missile Countermeasure Device
MWS	Missile Warning System
PC	Personal Computer
ROS	Rapid Obscuration System
SAF	Semi-Automated Forces
SIMNET	Simulation Network
SMI	Soldier Machine Interface
VehicleID	An integer triplet consisting of site, host and vehicle numbers. Used to uniquely identify an entity within a battle exercise.
VIDS	Vehicle Integrated Defense System