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SYSTEM REQUIREMENTS DOCUMENT (SRD) FOR THE U.S. ARMY COMMON DRIVER TRAINER (CDT) SYSTEM

27 January 2016

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TABLE OF CONTENTS

1.	**TRAINING SYSTEM DESCRIPTION**	1
1.1	**Scope.**	1
1.2	**Background.**	1
2.	**APPLICABLE DOCUMENTS.**	2
2.1	**Government Documents.**	2
2.2	**Non- Government Documents.**	3
2.3	**Order Of Precedence.**	5
3.	**REQUIREMENTS.**	5
3.1	**Training System Description.**	5
3.2	**Mission.**	5
3.2.1	**CDT Systems Requirement Diagram.**	6
3.2.2	**Definitions of Major Systems.**	6
3.3	**Top Level Requirements.**	7
3.3.1	**Top Level Operational Requirements.**	7
3.3.1.1	**Technical Data and Computer Software Rights.**	8
3.3.1.2	**Configurations.**	8
3.3.1.3	**Stand Alone Driver Training.**	8
3.3.1.4	**Crew Training.**	8
3.3.2	**Operational Modes.**	8
3.3.3	**Interoperability.**	12
3.3.3.1	**Interoperability with Internal Components.**	12
3.3.3.2	**Interoperability with External Systems.**	13
3.3.4	**Compatibility.**	13
3.4	**Major Systems.**	13
3.4.1	**Instructor/Operator Station (IOS).**	13
3.4.1.1	**IOS.**	14
3.4.1.1.1	**IOS Safety Systems.**	16
3.4.1.1.2	**IOS Monitors.**	16
3.4.1.1.2.1	**Computer Generator Imagery (CGI) Display Monitors.**	16
3.4.1.1.2.2	**Topographical Map Display Monitor.**	16
3.4.1.1.2.3	**Master Display Monitor.**	17
3.4.1.1.2.4	**Instructor's Stealth View Monitor.**	18
3.4.1.1.2.5	**Closed Circuit Television (CCTV) Monitor.**	18
3.4.1.1.2.6	**JCR Log Monitor.**	18
3.4.1.1.3	**Joystick.**	18
3.4.1.1.3.1	**Stealth View Eye Point Control.**	18
3.4.1.1.3.2	**IOS Driving Control - Normal.**	19
3.4.1.1.3.3	**IOS Driving Control - Vehicle Limitations Override (VLO).**	19

3.4.1.1.4 **IOS Communications.** 19
3.4.1.2 **IOS Rack.** 20
3.4.1.2.1 **Cabinet Door Locks.** 20
3.4.1.2.2 **Power Control and Initialization.** 20
3.4.1.2.3 **IOS Printer.** 21
3.4.1.2.4 **IOS Computer.** 21
3.4.1.3 **IOS Setup Window.** 21
3.4.1.3.1 **Progression.** 21
3.4.1.3.2 **Common Scoring.** 21
3.4.1.3.3 **Vehicle Dynamics.** 22
3.4.1.4 **IOS Software.** 22
3.4.1.4.1 **Class Manager (CM) Application.** 22
3.4.1.4.1.1 **Administrator Capabilities.** 22
3.4.1.4.1.2 **Instructor Capabilities.** 25
3.4.1.4.1.3 **Administrator/Instructor Reports and Forms.** 25
3.4.1.4.2 **IOS Application.** 26
3.4.1.4.2.1 **Simulation Control and Information Window.** 26
3.4.1.4.2.2 **Vehicle Instrument And Control Window.** 28
3.4.1.4.2.3 **Scenario Selection Window.** 28
3.4.1.4.2.4 **Vehicle Malfunction Window.** 29
3.4.1.4.2.5 **Own Vehicle Weapons Firing Window.** 29
3.4.1.4.2.6 **Incoming Fire Window.** 30
3.4.1.4.3 **Shutdown Application.** 30
3.4.1.4.4 **Scenario Generation System (SGS) Application.** 31
3.4.1.4.5 **IOS Statistics Application.** 31
3.4.1.4.6 **Maintenance and Utilization Logs Applications.** 32
3.4.1.4.6.1 **Electronic Maintenance Log (EML).** 33
3.4.1.4.6.1.1 **Records For Each STS Session.** 34
3.4.1.4.6.1.2 **Records For Each AS Session.** 34
3.4.1.4.6.1.3 **Records For Each IOS Session.** 35
3.4.1.4.6.2 **Master Electronic Maintenance Log (M-EML).** 35
3.4.1.4.7 **Password Change Application.** 35
3.4.1.4.8 **STS Visual Display Control Application.** 36
3.4.2 **STS.** 36
3.4.2.1 **STS Rack.** 36
3.4.2.1.1 **Cabinet Door Locks.** 36
3.4.2.1.2 **STS Computers.** 37
3.4.2.1.2.1 **Simulation Host Computational System.** 37
3.4.2.1.2.2 **IG Computers.** 37
3.4.2.2 **Motion Platform.** 37
3.4.2.3 **Visual Display System.** 37

3.4.2.3.1 Luminance. 38
3.4.2.3.2 Contrast Ratio. 38
3.4.2.3.3 Total Geometric Accuracy. 38
3.4.2.3.4 Adjacent Channel Matching. 38
3.4.2.3.5 Image Stability. 38
3.4.2.3.6 Field-Of-View (FOV). 38
3.4.3 Generic Vehicle Cab Requirements. 38
3.4.3.1 Cab. 39
3.4.3.1.1 Cab Input/Output (I/O) Subsystem. 39
3.4.3.1.2 Cab Safety Interlocks. 39
3.4.3.1.3 In-cab Camera(s). 39
3.4.3.1.4 In-cab Audio Subsystem. 39
3.4.3.1.4.1 In-cab Communication Subsystem. 39
3.4.3.1.4.2 In-cab Sound Subsystem. 40
3.4.3.1.5 Vehicle Specific Kit(s). 40
3.4.3.1.5.1 Alternate Dashboard(s). 40
3.4.3.1.5.2 Accessory Panels. 41
3.4.3.1.5.3 Switchboxes. 41
3.4.3.1.5.4 Vision Restriction Plates. 41
3.4.3.1.5.5 Space Restrictor(s). 42
3.4.3.1.5.6 Storage Container(s). 42
3.4.3.2 Vehicle Specific Software. 42
3.4.3.2.1 Terrain Traction 42
3.4.3.2.2 Terrain Roughness 42
3.4.3.2.3 Vehicle Specific Scoring. 42
3.4.3.2.3.1 Malfunction Scoring. 42
3.4.3.2.4 IOS Gauges Window. 43
3.4.3.2.5 Vehicle Dynamics Model. 43
3.4.3.2.6 Cab Calibration Software. 43
3.4.3.2.7 Cab Diagnostic Software. 43
3.4.3.3 Vehicle Specific Ancillary Components. 44
3.4.3.3.1 Driver Vision Enhancer (DVE). 44
3.4.3.3.2 Ancillary Station(s). 44
3.4.3.3.2.1 Ancillary Station Communications. 44
3.4.4 CDT Ancillary Components. 44
3.4.4.1 Common Data Server (CDS). 45
3.4.4.2 After Action Review (AAR). 45
3.4.4.3 Master IOS. 45
3.4.4.4 Maintenance Laptop. 46
3.4.4.5 Calibration Tool. 47
3.4.4.6 Diagnostic Tool. 47

3.4.4.7 **Mobile Training Facility (MTF).** 48
3.4.4.8 **Auxiliary Mounting Fixture.** 48
3.4.4.9 **Development Software Support Environment.** 48
3.4.4.10 **Disk Duplicators.** 48
3.4.4.11 **Forklift.** 48
3.5 **Major Subsystems.** 49
3.5.1 **Computational Subsystem.** 49
3.5.1.1 **Trainer Computer Systems.** 49
3.5.1.2 **Computer architecture requirements.** 49
3.5.1.2.1 **Open System Architecture.** 49
3.5.1.2.2 **Scalable Architecture.** 49
3.5.1.3 **Computer Hardware Requirements.** 49
3.5.1.3.1 **Computational Hardware.** 49
3.5.1.3.2 **Peripherals.** 50
3.5.1.3.3 **Hardware Failure.** 50
3.5.1.4 **Computer Processing Requirements.** 50
3.5.1.5 **Computer Operations Control Function.** 51
3.5.1.6 **Computer Software Requirements.** 51
3.5.1.6.1 **Programming Language.** 51
3.5.1.6.2 **Integrity in Handling Calendar Dates.** 51
3.5.1.6.3 **Application Software.** 51
3.5.1.6.4 **Diagnostic Software.** 52
3.5.1.6.4.1 **Computer and Peripheral Diagnostic Programs.** 52
3.5.1.6.4.2 **System Daily Readiness Check Program.** 52
3.5.1.7 **Computational System Network.** 52
3.5.1.7.1 **Distributed Interactive Simulation/High Level Architecture (DIS/HLA).** 53
3.5.1.7.2 **Virtual - Distributed Interactive Simulation (V-DIS).** 53
3.5.1.8 **Transport Delay.** 53
3.5.1.9 **Information Assurance (IA).** 53
3.5.1.9.1 **Acquisition of IA Products.** 53
3.5.1.9.2 **Secure Configuration.** 53
3.5.1.9.3 **Security and Privacy.** 54
3.5.2 **STS / Host Software.** 54
3.5.2.1 **Host IO.** 54
3.5.2.2 **CDT System Mode Manager.** 54
3.5.2.3 **Scenario Runtime.** 54
3.5.2.4 **Common Scoring.** 54
3.5.3 **Visual System.** 55
3.5.3.1 **Performance Characteristics.** 55
3.5.3.2 **Functional Training Capabilities.** 56

3.5.3.3 **General Training Scene Requirements.** 56
3.5.3.4 **Image Generator (IG).** 56
3.5.3.4.1 **Polygon Capacity.** 56
3.5.3.4.2 **Range of Vision.** 56
3.5.3.4.3 **Update Rates & Channel Synchronization.** 57
3.5.3.4.4 **Pixel Fill Rate.** 57
3.5.3.4.5 **Occulting.** 57
3.5.3.4.6 **Color.** 57
3.5.3.4.7 **Color Processing.** 57
3.5.3.4.8 **Image Quality.** 58
3.5.3.4.9 **Load Management.** 59
3.5.3.4.10 **Texture.** 59
3.5.3.4.10.1 **Static Texture Mapping.** 59
3.5.3.4.10.2 **Dynamic Texture.** 59
3.5.3.4.11 **Shading.** 59
3.5.3.4.12 **Atmospheric and Meteorological Effects.** 59
3.5.3.4.13 **Illumination.** 60
3.5.3.4.13.1 **Natural Illumination.** 60
3.5.3.4.13.2 **Light Points.** 60
3.5.3.4.13.3 **Artificial Light Sources.** 60
3.5.3.4.14 **Transport Delay.** 60
3.5.3.4.15 **Database Storage Capacity.** 61
3.5.3.4.16 **Scene Content Management.** 61
3.5.3.4.17 **Overload Prevention.** 61
3.5.3.4.18 **Sensor Simulation.** 61
3.5.3.4.19 **Image Generator Interface.** 61
3.5.4 **Audio System.** 61
3.5.4.1 **Communication Subsystem.** 61
3.5.4.1.1 **IOS Communications.** 62
3.5.4.2 **Automated Cueing Subsystem (ACS).** 62
3.5.4.3 **Scoring Assistant Subsystem (SAS).** 63
3.5.4.4 **Sound Subsystem.** 63
3.5.5 **Motion System.** 64
3.5.5.1 **Motion System Safety.** 64
3.5.5.1.1 **Interlocks.** 64
3.5.5.1.2 **Warning Visuals.** 65
3.5.5.2 **Vehicle Simulation.** 65
3.5.5.3 **Vehicle Dynamics.** 65
3.5.5.4 **Motion Simulation.** 66
3.5.6 **Steering Force Feedback Subsystem.** 67
3.5.7 **Training Environment.** 67

3.5.7.1 **Terrain Databases.** 67
3.5.7.1.1 **CDT Terrain Attributes (Legacy and New databases).** 68
3.5.7.1.2 **Existing CDT Terrain Databases.** 68
3.5.7.1.3 **New CDT Terrain Databases.** 69
3.5.7.1.3.1 **Location and Extent.** 69
3.5.7.1.3.2 **Source Data.** 69
3.5.7.1.3.3 **Geo-specific 3D Features.** 70
3.5.7.1.3.4 **Performance Characteristics.** 70
3.5.7.1.3.5 **Terrain Attributes.** 70
3.5.7.1.3.6 **Testing.** 73
3.5.7.1.3.7 **Deliverables.** 74
3.5.7.2 **Environmental Control System.** 74
3.5.7.3 **Terrain Services.** 74
3.5.7.3.1 **Dynamic Terrain.** 74
3.5.7.3.2 **Environmental Effects.** 75
3.5.7.3.3 **Environmental Runtime Component (ERC).** 75
3.5.7.4 **Models.** 77
3.5.7.4.1 **Interactive Human Models.** 77
3.5.7.4.1.1 **Ground Guide.** 77
3.5.7.4.2 **Moveable Objects.** 78
3.5.7.4.3 **Relocatable Objects.** 78
3.5.7.4.4 **Other Entities.** 78
3.5.7.4.4.1 **Common Moving Models (CM2).** 78
3.5.7.4.4.2 **Semi-Automated Forces (SAF).** 79
3.5.7.4.5 **Moving/Repositionable/Switchable Models, Animations & Special Effects.** 79
3.5.7.4.5.1 **Traffic Models.** 80
3.5.7.4.6 **Terrain Following.** 80
3.5.7.4.7 **Weapon Impact Detection.** 80
3.5.7.4.8 **Training Environment Data Communications.** 80
3.6 **General Hardware and System Requirements.** 80
3.6.1 **Safety.** 80
3.6.1.1 **Emergency Buttons.** 80
3.6.1.2 **Temperature Sensing Alarms.** 81
3.6.1.3 **Smoke Detectors.** 81
3.6.1.4 **Nonskid Surfaces.** 81
3.6.1.5 **Safety Markings.** 81
3.6.2 **Human Engineering.** 82
3.6.3 **Construction.** 82
3.6.3.1 **Workmanship.** 82
3.6.3.1.1 **Wiring.** 82

3.6.3.1.2 **Shielding**....83
3.6.3.1.3 **Cable and Wire Markings.**....83
3.6.3.1.3.1 **Cable Marking Method.**....83
3.6.3.1.3.2 **Cable Marking Information**....83
3.6.3.1.3.2.1 **"W" and "P" Cable Designations**....83
3.6.3.1.3.2.2 **To-and From Designators.**....84
3.6.3.1.3.2.3 **Assembly/Part Number.**....84
3.6.3.2 **Materials and Processes.**....86
3.6.3.2.1 **Materials.**....86
3.6.3.2.2 **Hazardous Materials.**....86
3.6.3.2.3 **Metals.**....86
3.6.3.3 **Parts.**....87
3.6.3.3.1 **Power Supplies.**....87
3.6.4 **Reliability, Availability and Maintainability (RAM) Requirements**....87
3.6.5 **Shock and Vibration.**....87
3.6.6 **Environmental Conditions.**....87
3.6.6.1 **Operational Climatic Environment.**....87
3.6.6.2 **Non-operational Climatic Environment.**....88
3.6.7 **Transportability.**....88
3.6.8 **Facilities and Facility Equipment.**....88
3.6.8.1 **Trainer power requirements.**....88
3.6.8.2 **Grounding System.**....88
3.6.8.3 **CDT System Footprint.**....89
3.6.8.3.1 **CDT System Height Clearances.**....89
3.6.8.3.2 **CDT System Area Clearances.**....89
3.7 **Logistics.**....89
3.7.1 **Nameplates or Product Markings.**....90
3.7.1.1 **Unique Identification.**....90
3.7.1.2 **Trainer Nameplate.**....90
3.7.1.3 **Warning Marking for Simulated and Modified Equipment.**....90
3.7.1.3.1 **Trainer-use-only Identification.**....90
3.7.2 **Maintenance.**....91
3.7.2.1 **Maintenance Concept.**....91
3.7.2.1.1 **Qualitative Maintainability Requirements.**....91
3.7.2.1.1.1 **Special Tools.**....92
3.7.2.1.1.2 **Built-In Test (BIT).**....92
3.7.2.1.1.3 **Accessibility.**....92
4. **NOTES.**....92
4.1 **Definitions.**....92
4.2 **Acronyms List.**....95
4.3 **Vehicle Dynamic Data Input Template**....99

4.4 **RITM Report Example**.....102
4.5 **Common SRD Annexes and Appendices**.....103

LIST of FIGURES

Figure 1. CDT Systems Requirement Diagram 6
Figure 2. CDT Independent Mode 9
Figure 3. CDT Integrated Mode 10
Figure 4. CDT Network Mode 11
Figure 5. CDT Hybrid Mode 12
Figure 6. Notional IOS Monitor Layout 15
Figure 7. Examples of Cable Markings 85
Figure 8. Trainer-Use-Only Identification Sticker 91

LIST of TABLES

Table 1. IOS Monitor Layout - MTF 15
Table 2. CDT Terrain Types 70

1. TRAINING SYSTEM DESCRIPTION

1.1 Scope.

This System Requirements Document (SRD) describes the requirements for the Common Driver Trainer (CDT). The CDT will assist in the training of tactical vehicle drivers during Initial Entry Training (IET) and sustainment as described in this document's Annexes. The simulator(s) will enable training in the critical driver tasks that can be repetitively trained in a simulator and are dangerous and/or infrequently trained in the "real world" (i.e. driving on ice, fording streams, driving under blackout conditions, driving down steep embankments when coming off an improved road, etc.). The CDT shall be reconfigurable to accommodate the different vehicle variants as defined in the individual SRDs included as annexes to this document. The CDT vehicle platform shall be composed of common modules along with a specific module for the different vehicle variants. The components of the specific module shall be the driver's compartment, instruments, controls for the driver, and the software required to operate the driver compartment and interact with the common modules. The driver training scenarios can be "scripted" to enable practice encountering the same tactical, terrain and traffic conditions repetitively, or programmed for random variations in traffic along the same route. The training scenarios can also be executed "unscripted" allowing maximum variability of route and environmental conditions. Scoring of the driver trainer scenarios are accomplished by the system so that training evaluation is consistent among all the students.

1.2 Background.

The U.S. Army Program Executive Office for Simulation, Training and Instrumentation (USA PEO STRI), Product Manager for Ground Combat Tactical Trainers (PM GCTT) has a requirement for driver training simulators to support the Training and Doctrine Command (TRADOC) schools with institutional drivers training and to support operational units with sustainment drivers training. The CDT product line is the Army's preferred solution for initial and sustainment driver trainer needs. This product line encompasses driver training simulators for military wheeled, tracked and specialty vehicles, to include both tactical and non-tactical vehicles, utilizing a common platform. Each CDT system will be reconfigurable to accommodate the different vehicle variants as defined in the product system specifications.

New products delivered under the CDT product line will be extensions to the existing CDT product line. Currently, the Army has procured and fielded 53 base stations and 58 specific variant cabs. This includes a Stryker Variant (SV) cab, Mine Resistance Ambush Protection Variant (MV) cab and Tank Variant (TV) cab. The Government's intent is to reuse the existing architecture (to include software and hardware design and implementation) and update this base architecture and product line with user interoperability requirements, technical refreshes due to obsolescence and/or supportability requirements.

2. APPLICABLE DOCUMENTS.

The following documents of the exact issue listed form a part of this specification to the extent specified herein. This specification is designated as a first tier document. The documents referenced directly in this specification are designated as second tier documents and are considered part of this specification to the extent specified herein. Documents referenced in successive tiers are not part of this specification and are to be used for guidance only.

2.1 Government Documents.

DoDD 8500.01	Information Assurance, 23 April 2007
AR 25-2	Information Management, 23 March 2009
MIL-STD-130N DA Form 348	Identification Marking of U.S. Military Property Management / Records, Equipment Operator's Qualification Record, 22 June 2004
AR 600-55	The Army Driver and Operator Standardization Program, 18 June 2007
MIL-STD-1472G	Department of Defense Design Criteria Standard, Human Engineering, 13 December 2010
DoD Joint Technical Architecture (JTA)	Human-Computer Interface Standards Version 6.0, 03 October 2003

MIL-PRF-89020B	Performance Specification Digital Terrain Elevation Data (DTED)
PRF-PT-00430 Appendix B	CDT Common SRD, Scenario Generation System, Version 2.3 22 January 2013
PRF-PT-00430 Appendix A	CDT Common SRD, Mobile Training Facility, Version 2.4 22 January 2013
TSRD(Training System Requirement Document):	CDT TWV TSRD v2.4 27 March 2012
TDPs(Technical Data Packages):	Common Driver Trainer (CDT) Software Technical Data Package (TDP) Software Delivery v7.1.19 Patch 2, 6 June 2012 (12 Disc Set)
Common Driver Trainer (CDT) Hardware Technical Data Package (TDP)	CDT Common Bases (LOT I, II, CES, TV, TEV and MTF) with CDT Cabs (Stryker, MRAP, Tank, and Tank Engineering Variants), 1 Aug 2012 (1 Disc)

2.2 <u>Non- Government Documents</u>.

American National Standards Institute (ANSI)

ANSI GEIA–STD–0007-A		Logistics Product Data
ANSI Z35.1-72	-	Accident Prevention Signs, Specification for
ANSI Z35.4-73	-	Informational Signs Complementary to ANSI Z35.1, Accident Prevention Signs, Specification for

ANSI Z53.1-79	-	Safety Color Code for Marking Physical Hazards
21 CFR 1040		Performance Standards for Light-Emitting Products, April 1, 2011

Institute of Electrical and Electronics Engineers (IEEE):

IEEE 200-1975 Revision 1988	-	Standard Reference Designations for Electrical and Electronics Parts and Equipment (ANSI/IEEE Y32.16)
IEEE Standard 1278.1a-1998		Standard for Distributed Interactive Simulation (DIS)
IEEE Standard 1516		High Level Architecture
NFPA 70		National Electric Code, 2008 edition
CIGI 3.3		Common Image Generator Interface (CIGI) Open Source Standard 2008 http://cigi.sourceforge.net/specification.phg
BG0001-CMMOS-001 Rev D		SE Core Common Moving Model OpenFlight Specification
SE Core AI-0600233		Virtual Simulation Architecture Distributed Interactive Simulation (V-DIS) specification
SECORE-2009-CM2-MEL v6.2 27 Feb12		SE Core Common Moving Models List
SECORE-2009-CM2-0003_CM2 Process		SE Core Common Moving Models Process
SGI RGB Format		Silicon Graphics Image (SGI) Red, Green, and Blue (RGB) File Format http://paulbourke.net/dataformats/sgirgb/

2.3 Order Of Precedence.

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS.

3.1 Training System Description.

The CDT product line shall encompass driver training simulators for all military wheeled, tracked and specialty vehicles, to include both tactical and non-tactical vehicles, utilizing a common hardware and software platform. Each CDT system shall be reconfigurable to accommodate the different vehicle variants as defined in the product system specifications annexes. The CDT product line shall reuse the existing architecture (to include software and hardware design and implementation) and evolve this base architecture and product line for new user requirements, interoperability and/or technical refresh due to obsolescence and supportability requirements.

3.2 Mission.

The primary mission for products developed under the CDT product line will be to train all identified driving tasks as defined in this SRD and associated Annexes and Appendices for each vehicle from the wheeled, tracked or specialty vehicle communities included in the CDT product line. Products developed under the CDT product line will also be used to assist in the training of individual and/or collective tasks up to the platoon level. Products developed under the CDT product line will enable training in critical driver operator or crew tasks that can be repetitively trained in a simulator environment and tasks which are dangerous and/or infrequently trained in the "real world" (i.e. driving on ice, fording streams, driving under blackout conditions, driving down steep embankments when coming off an improved road, etc.). This training will also include the capabilities of any vehicle appended subsystem(s) associated. Appended subsystems would include any approved vehicle add-ons (e.g. plows, trailers, commander’s station, and gunner’s station) based on the vehicle’s critical training requirements. Figure 1 shows the CDT Systems requirements elements.

3.2.1 CDT Systems Requirement Diagram.

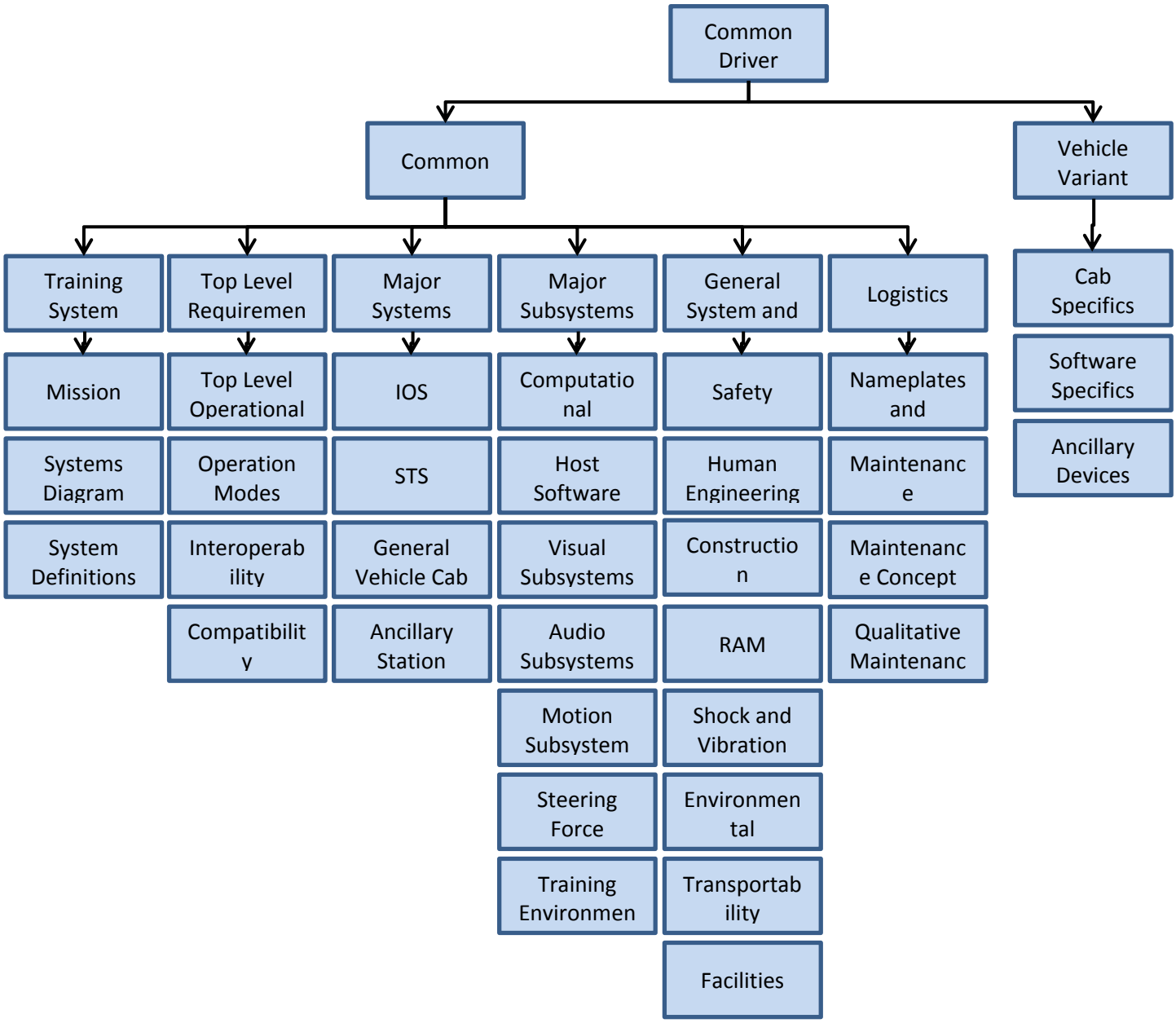


Figure 1. CDT Systems Requirement Diagram

3.2.2 Definitions of Major Systems.

Each of the major components existing with the current CDT product line are summarized below, functions allocated to each of the components are defined in other sections throughout this SRD or annexes to this document.

a) Base IOS/STS Configuration – The delivered configuration (fielding) of STSs controlled by a single IOS.
   Base Configuration Examples:
   i. 1:1 Configuration : one IOS controlling one (1) STS or one (1) STS/AS combination
   ii. 1: N Configuration (Pod): one Master IOS controlling any number up to six (6) STSs or six (6) STS/AS combinations.

b) IOS - The Instructor/Operator Station (IOS) – The IOS is the instructor's primary workstation. Although the IOS does not contain the simulation executive software, it allows the instructor to select a scenario, set initial conditions, initiate the scenario and monitor a student's progress through the scenario.

c) STS - Each Student Training Station (STS) - The STS contains the components and equipment necessary to replicate a single vehicle and is the student's primary workstation. At a minimum, each STS will have a cab mounted on a motion platform with a visual display unit. Each STS will also include the computational and image generation components necessary to simulate the vehicle and its environment. Each STS could include one or more Ancillary Stations (AS) to support After Action Reviews (AAR) or crew training.

d) General Vehicle Cab - The cab is a large boxlike structure which houses the replication of a vehicle's driver's station. The cab can be dedicated to a single vehicle or can be designed to be reconfigurable to support training of multiple vehicle types using a single cab. The cab will contain all of the controls, switches, lamps, indicators and other equipment or components necessary to train the student in the driver's training tasks defined in each CDT Variant's appendices.

e) AS - Ancillary Station (AS) - The AS is a floor-mounted workstation. One or more AS's can be appended to each STS. Typically, the primary use for an AS is as an AAR station used by both instructors and students to review a student's performance, but an AS could also have a dual function as a Commander's Station, Gunner's Station, Equipment Operator's Station, or an Assistant Driver. A single AS can be dedicated solely to one function or can be used for multiple functions, i.e., a single AS can be used as both an AAR and a Commander's Station.

3.3 <u>Top Level Requirements</u>.

3.3.1 <u>Top Level Operational Requirements</u>.

Each CDT system, regardless of configuration, shall be capable of simulating, stimulating and emulating all operations necessary to train students to perform the training tasks defined by the requirements listed in the Annexes for each of the vehicle variants.

The contractor shall begin development with the most recent CDT design and product baseline that was developed and fielded for the CDT TV-TEV ECP II and SV2 and the tech refresh programs for CDT SV Tech Refresh 7.2.0

3.3.1.1 Technical Data and Computer Software Rights.

The Government requires the rights in technical data and computer software, per FAR 252.227-7015, that permits the Government to fully support, maintain and modify the CDT system software and technical data throughout the program life cycle. Specifically, the Government intends to have training programs and devices operated, maintained and supported throughout its life cycle by competitively-awarded contracts, at least in part.

3.3.1.2 Configurations.

The configuration for each CDT system shall be defined based on the user training requirements in their Training System Requirements Document (TSRD). The configuration for each CDT system shall be defined in the applicable CDT Variant Annex.

3.3.1.3 Stand Alone Driver Training.

The CDT shall provide initial and sustainment training of an individual's driver training requirements detailed in the variant's annexes.

3.3.1.4 Crew Training.

The CDT shall provide initial and sustainment training the driver's tasks and also include other crew members for that variant vehicle (Commander's Station, Gunner's Station, etc.). The set of training stations shall interoperate together as an integrated CDT training system representing a single variant vehicle type.

3.3.2 Operational Modes.

The CDT training system shall have the following modes of operation:

a) Independent Mode (Single-Vehicle – Driver Only training) Figure 2.
   i. The Driver Station shall operate in an independent mode to provide individual training.
   ii. Driver Station operating in a single scenario controlled by an IOS.

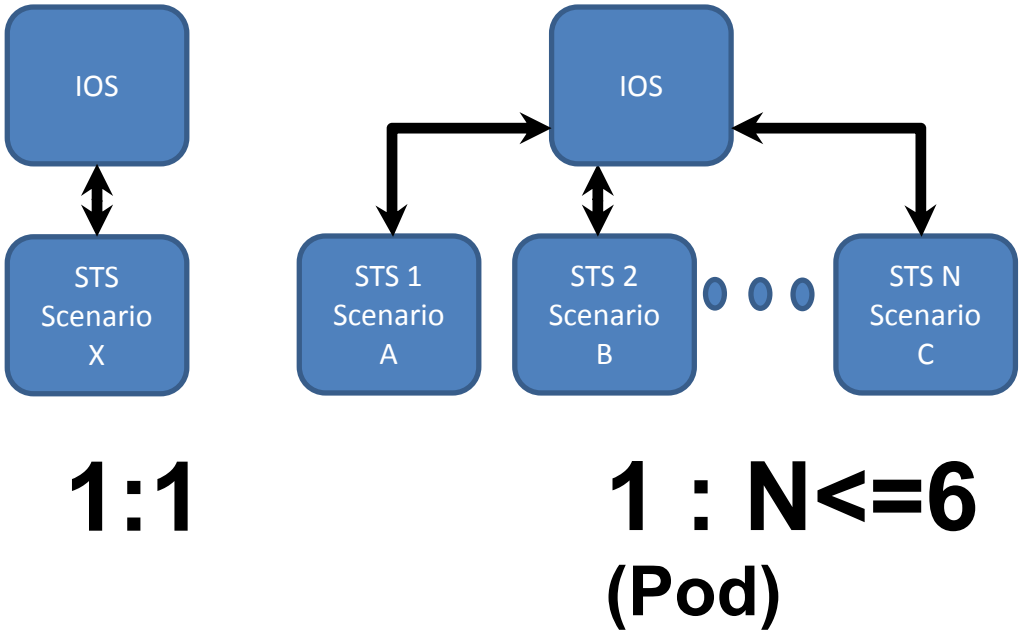


Figure 2. CDT Independent Mode

b) Integrated Mode (Single-Vehicle – Driver and Crew training) Figure 3.
   i. The Driver Station shall interoperate with the Ancillary Station in an integrated mode acting as one vehicle to provide crew driver training.
   ii. AS and Driver Station in a single scenario controlled by an IOS.

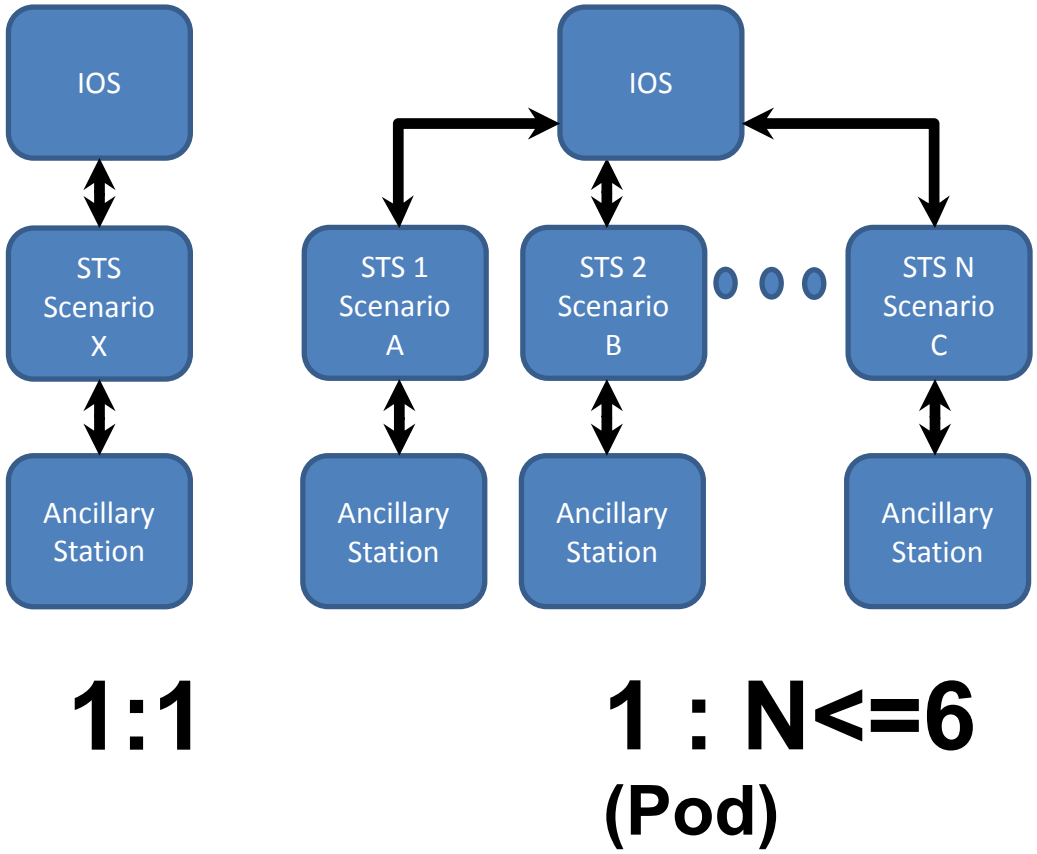


Figure 3. CDT Integrated Mode

c) Network Mode (Multiple Vehicles – Driver Only and/or Driver and Crew training) Figure 4.
   i. Multiple STSs (up to 8) operating in the same scenario, up to the limitations of the computational systems.
   ii. A Master IOS shall control the overall simulation including control of all STSs.

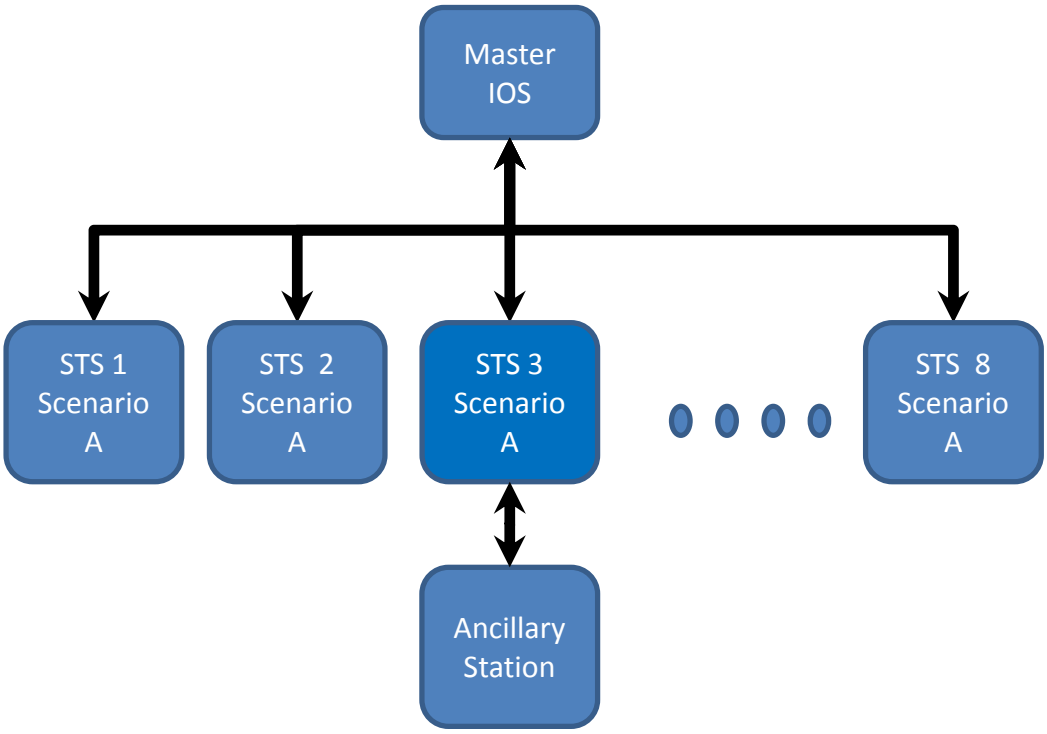


Figure 4. CDT Network Mode

d) Hybrid Mode (Multiple Vehicles – Driver Only and/or Driver and Crew training) Figure 5.
   i. For a CDT base 1: N (pod – N<=8) configuration, the IOS shall allow a combination of individual and integrated modes of training
   ii. Multiple STSs operating in the same scenario and other remaing STS pod operating independently, up to the limitations of the computational systems.
   iii. A Master IOS shall control the overall simulation including control of all STSs in a pod (networked and individual training).

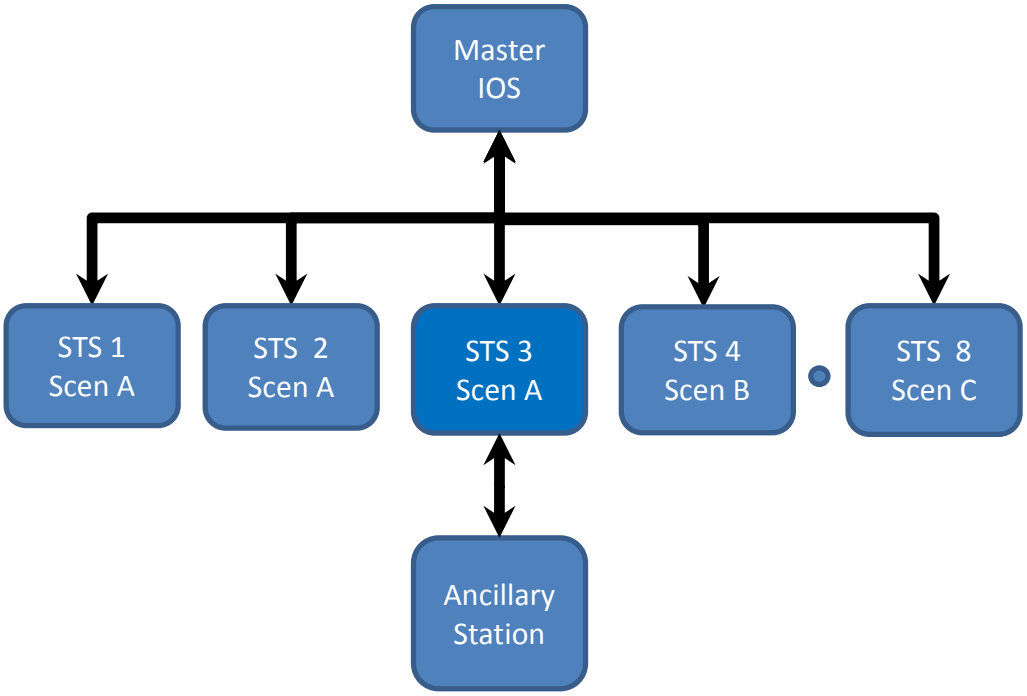


Figure 5. CDT Hybrid Mode

3.3.3 Interoperability.

The CDT architecture shall be based on Government and industry standards which promote the interoperability of components and systems. Open system standards shall be used to the maximum extent to define interfaces between components and between systems.

3.3.3.1 Interoperability with Internal Components.

Internal components are those components which are integral to the operation of the CDT training system and include actual or simulated components used in actual vehicles that are the basis for CDT variants. Components include, but are not limited to:

a) Dashboard gauges, indicators and data bus systems

b) GPS and other position tracking systems (Joint Capabilities Release (JCR)-Log, MTS, etc.)

c) Command and Control (C2) systems, i.e. Force XXI Battle Command Brigade and Below (FBCB2)

d) Radios and other communication systems

3.3.3.2 Interoperability with External Systems.

External systems are those systems which are not part of normal CDT operations, but which CDT may be required to interoperate with to achieve a specific training objective. External systems include, but are not limited to:

a) Actual tactical systems,

b) Live training systems,

c) Constructive training systems and simulations,

d) Other Virtual training systems,

e) Military gaming systems, i.e. Virtual Battlespace 2 (VBS2)

Interoperation with external systems shall require a re-evaluation and re-accreditation of the Information Assurance posture of either the CDT system, the other external system or both.

3.3.4 Compatibility.

The CDT common system shall employ a common mechanical, electrical and data interface for the cabs. The CDT simulation software and variant vehicle simulation software architecture and data requirements shall be maintained. Physically, any cab shall be able to interface with any CDT common platform. In order to ensure proper vehicle variant operation, a system shall require the addition of specific vehicle dynamics, vehicle operating simulation software and variant scoring software.

All current CDT product line functionality and performance shall be maintained unless an engineering change proposal has been submitted and approved by the Government.

3.4 Major Systems.

3.4.1 Instructor/Operator Station (IOS).

The IOS shall provide access to all the control and monitoring functions of the CDT. The CDT IOS shall allow system start up and initialization; allow the system administrators to create, maintain and access student and class records; allow the Instructors to control training scenarios and monitor the student's performance in real time; allow communications with students and

allow maintenance personnel to access diagnostic and maintenance software. The CDT IOS shall have the capability to control and monitor the base configuration in an independent mode or integrated mode. Maximum base configuration (pod) shall be six (6) STSs or six (6) STS/AS combinations. Each STS or STS/AS combination can simulate a different vehicle configuration (Variant), operate in a different environmental database, and execute different training scenarios.

In a network mode, a CDT IOS shall be able to connect and control two or more co-located STS/AS combinations making it a Master IOS controlling the networked STS/AS. The networked systems shall be able to interact on a common environmental database executing a single scenario. In the network mode, the requirement is to allow a minimum of 8 (eight) vehicles to interact and allow man-in-the-loop convoy and collective training exercises.

3.4.1.1 IOS.

The CDT IOS shall contain hardware and software for system start-up, initialization and runtime which allows the system operators (Administrators, Instructors and Maintainers) to perform their respective functions on the CDT. The IOS shall include:

a) A large flat work surface,
b) Safety (emergency) buttons,
c) Communications controls,
d) A joystick,
e) A mouse,
f) A keyboard with Common Access Card (CAC) smartcard reader, and
g) An array of color flat screen monitors to control and monitor CDT operation.
h) Chairs (Instructor and Observer)

A typical monitor arrangement is shown below in Figure 6.

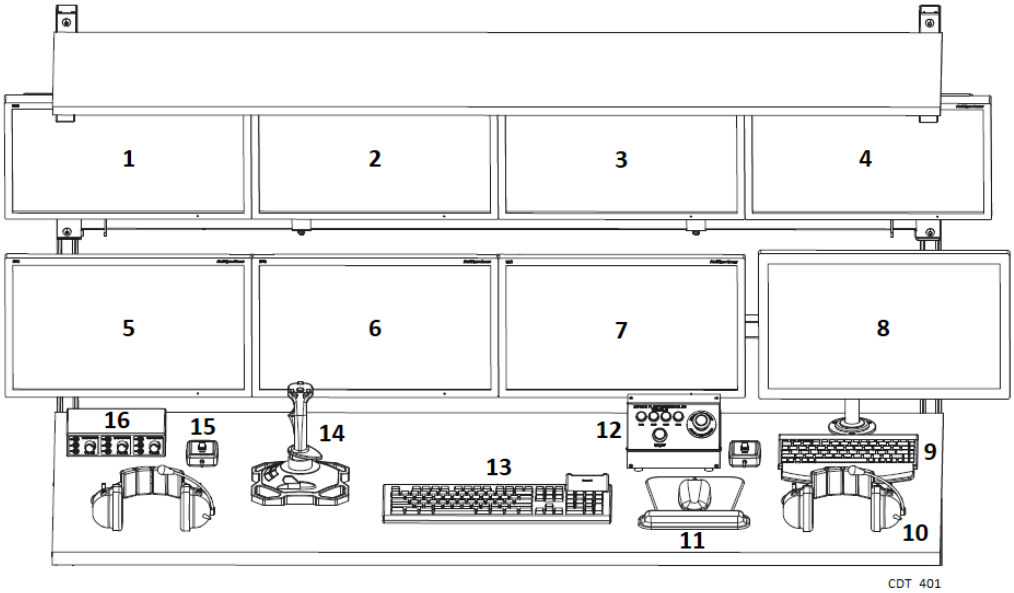


Figure 6. Notional IOS Monitor Layout

Table 1. IOS Monitor Layout - MTF

Item	Control or Indicator	Description
1	Left view	Repeater monitor from drivers left view(s)
2	Center view	Repeater monitor from drivers center view(s)
3	Right view	Repeater monitor from drivers right view(s)
4	CCTV	Closed Circuit Television view(s)
5	Topographical map	Display scenario driver route
6	IOS Main	Primary control monitor
7	Stealth view	Bird's eye view of vehicle
8	JCR Log	Display monitor for the Instructor JCR Log (TWV Only)
9	Mini Keyboard	JCR Log mini keyboard with touch pad (TWV Only)
10	Headset	Instructor headset (2)
11	Mouse	IOS control
12	E-STOP	Motion only stop
13	Keyboard	Keyboard combined with CAC reader
14	Joy stick	IOS override control
15	Push to Talk (PTT) Switch	Push to talk (PTT) switch box
16	Communication Amplifiers	Up to 4 Communication hookups
	EPO (Not Shown)	Emergency Power Off (MTF only)

3.4.1.1.1 IOS Safety Systems.

The IOS shall include an Emergency Power Off (EPO) button. The IOS shall include an Emergency Stop (E-STOP) button. The section labeled 'Emergency Buttons' will detail each button in more detail.

3.4.1.1.2 IOS Monitors.

The IOS shall have an array of monitors that allows the CDT operators to accomplish the various tasks for the Administrator, Instructor and Maintainer. All IOS monitors shall be color, flat screen monitors. The monitors shall have a minimum diagonal measurement of 19 inches for a 4:3 format display or 20 inches for a 16:9 format (wide screen) display. The minimum native resolution shall be 1280 x 1024. The array of monitors shall include the following:

a) CDT Monitors (One monitor per CGI channel)

b) Topographical Map Monitor

c) Master Display Monitor

d) Instructor's Stealth View Monitor

e) Closed Circuit Television (CCTV) Camera Monitor

f) Display Monitor for the Instructor JCR Log (TWV Only)

3.4.1.1.2.1 Computer Generator Imagery (CGI) Display Monitors.

The IOS shall have color, flat screen monitors to simultaneously view the total CGI Field Of View (FOV) presented to the student in the driver's compartment. The monitors shall be arranged to provide the FOV listed in paragraph 3.4.2.3.6. When an auxiliary viewing device (e.g., Drivers Vision Enhancer) is in use by the driver in the driver's compartment, the center CGI monitor shall display the imagery for that auxiliary device.

3.4.1.1.2.2 Topographical Map Display Monitor.

The IOS shall have a dedicated topographical map display monitor. The topographical map display shall show the simulation from a point directly above the database (perpendicular to the ground plane) at an altitude that depends on the magnification selected. The topographical map display shall have the following characteristics:

a) Shows all database detail (i.e., roads, structures, rivers, obstacles, foliage, etc.) no matter what magnification is selected. The highest magnification shall display the database detail with a resolution consistent with the native resolution of the topographical map display monitor. The topographical map display shall be displayed without any display scintillation, flashing or low resolution blockiness.

b) The topographical map display shall provide a minimum of the following magnification selections.

   i. Zoom capability that can display any area from the entire database down to a 50 meter or closer radius areound a selected map location while maintaining full resolution.

   ii. Highest magnification shall show a radius of 50 m around the selected map center.

   iii. Terrain features and scenario model objects shall change detail levels automatically based on the zoom level.

c) The topographical map display shall show own vehicle position and orientation in the database by a distinctive, own vehicle icon.

d) Each icon shall be distinguished by a unique color and associated code/number to distinguish each vehicle (driver/crew) in a scenario.

e) The topographical map display shall distinctively show the actual path of own vehicle progression during the scenario.

f) The topographical map display shall show all moving entity positions and orientations in the database. Each category of moving entities shall have a distinctive icon to differentiate from other moving entity categories and own vehicle.

g) The topographical map display shall show the prescribed vehicle path in scripted scenarios.

h) The topographical map display shall show the cue trigger points in scripted scenarios.

i) The topographical map display shall have the capability to selectively center the map on own vehicle or manually position the map center.

j) Each STS shall have its own dedicated topographical map view that is rendered.

k) The Instructor shall be able to dynamically allocate ansy STS's topographic map to any IOS display using its segemented and/or single view.

3.4.1.1.2.3 <u>Master Display Monitor.</u>

The IOS shall have a master display monitor which displays all IOS function, control and monitoring Graphical User Interface (GUI) windows and all maintenance application windows. There shall be a mouse and keyboard with the master display monitor which shall be the input/output interface for all Administrator, Instructor and Maintainer functions.

All CDT control and monitor windows shall be presented on the master display monitor. All control and monitor GUI windows shall be continuously updated in real time during scenario execution. Multiple, resizable windows shall be able to be displayed simultaneously (the number of windows and the clarity of information shall be dependent on the number and size of windows

selected) on the master display monitor. The control and monitor windows shall also be able to be minimized (reduced to a single icon) or maximized (expanded to full screen).

3.4.1.1.2.4 Instructor's Stealth View Monitor.

The IOS shall have a color, flat screen monitor to display the joystick controlled Instructor's eye point view. The Instructor's eye point view shall be either tethered to the simulated training vehicle or a stealth view with free unrestricted movement throughout the training database for each simulated training vehicle. The tethered view shall present the CGI imagery of the training environment as seen from a fixed point relative to the own vehicle. The joystick shall control the azimuth position relative to own vehicle, distance from the vehicle, elevation above own vehicle and the viewing angle of the eye point. When not being positioned by the joystick, the attached view shall remain in a constant position and look angle relative to own vehicle throughout the training session. The stealth view shall allow unrestricted movement of the Instructor's eye point view throughout the training database. The default position for the stealth view shall be tethered directly above the vehicle looking forward. The CDT system shall generate an independent stealth view for each STS. A 2D on-screen text shall overlay a unique identification number next to each ownship in the exercise.

3.4.1.1.2.5 Closed Circuit Television (CCTV) Monitor.

The IOS shall have a CCTV monitor that shall display a view of the inside of the driver's compartment and trainee.

3.4.1.1.2.6 JCR Log Monitor.

The JCR Log monitor/keyboard is used to communicate to each AAR JCR Log station (TWV only).

3.4.1.1.3 Joystick.

The IOS shall have a joystick. The joystick shall be used to control the eye point positioning and movement in the stealth display or to control own vehicle movement when the Instructor takes control of vehicle operation. The joystick shall have full 360 degree axis movement (fore, aft, left, right and intermediate axis in between) with the joystick. Joystick buttons and operation shall be the same for all vehicles.

3.4.1.1.3.1 Stealth View Eye Point Control.

When the tethered eye point mode is selected for the stealth view monitor, the joystick shall control the azimuth position relative to each own vehicle, distance from each vehicle, elevation above each own vehicle and the viewing angle of the eye point. When unrestricted eye point movement is selected for the stealth view monitor, the joystick shall allow the Instructor to move

the eye point forward and reverse, turn left and right, adjust viewpoint elevation and the viewpoint look angle. Stealth view eye point control shall be active any time a scenario is active whether running or paused. The joystick shall have a control that provides the ability to adjust the speed of the eyepoint movement when in Stealth Mode.

3.4.1.1.3.2 IOS Driving Control - Normal.

When own vehicle control is selected by the Instructor, the joystick shall provide control for both the normal Instructor control and control with vehicle limitations override in effect. While the normal Instructor control has been selected, the joystick shall have a button that will allow the user to set/release the parking brake. The joystick shall have a button that will allow the user to change transmission gear selection. The joystick shall have a button that will allow the user to start/shutdown the engine.

Forward deflection of the joystick shall result in inputs to the vehicle dynamics model simulating the application of throttle to the ownship. Rearward deflection shall result in inputs to the vehicle dynamics model simulating the application of the ownship brakes. Deflection of the joystick to the right shall provide input to the vehicle dynamics model simulating deflection of the steering mechanism that results in a right turn. Deflection of the joystick to the left shall provide input to the vehicle dynamics model simulating deflection of the steering mechanism that results in a left turn. The simulated steering deflection shall increase as the joystick left/right deflection angle increases.

3.4.1.1.3.3 IOS Driving Control - Vehicle Limitations Override (VLO).

The Instructor shall also be able to select whether the driver's compartment or the IOS has driving control over the vehicle simulation by way of the IOS joystick. If IOS driving control is selected, the Instructor shall be able to select normal vehicle dynamics mode or vehicle limitations override vehicle dynamics mode. When vehicle limitations override mode is selected, the vehicle equations of motion shall be suspended so that the own vehicle can traverse any terrain that the simulated vehicle could not normally negotiate. While in vehicle limitations override mode, the own vehicle shall be capable of maneuvering on slopes too steep for normal operation and on surfaces that normally provide insufficient traction.

3.4.1.1.4 IOS Communications.

Each CDT IOS shall include a headphone/microphone set for both the instructor/operator (I/O) and an observer in order to communicate with the STS and ancillary stations. The IOS station shall be equipped with a mixer, amplifier and a voice communications control software using built-in sound device in the IOS computer. The IOS computer shall support up to four (4) attached headsets. Each headphone set (I/O & observer) shall have an independent jack and volume control. The headphone sets provided for use at the IOS shall be closed –ear headset/boom noise-cancelling mic/computer compatible David Clark headsets P/N 40642G-01 or equivalent.

3.4.1.2 IOS Rack.

The CDT IOS shall include a Commercial Off The Shelf (COTS) standard 19 inch roll around electronics rack for housing components necessary to support the functionality of the IOS. The IOS rack shall include:

a) Door latches with locks

b) CDT power controls,

c) a printer and

d) Computer and networking resources.

e) Cable harness space

3.4.1.2.1 Cabinet Door Locks.

All equipment cabinet doors shall be equipped with key operated locks. All cabinet locks shall be keyed alike.

3.4.1.2.2 Power Control and Initialization.

The IOS shall have a simplified procedure and capability to power-on the CDT system(s) and initialize the system(s) to a state where all systems and subsystems (i.e. STSs and Ancillary Stations) are powered up and ready to operate. The CDT system shall be initialized and ready to operate within 10 minutes of initial power-on. From the initialized, ready to operate state, operators shall be able to initiate Administrator, Instructor or Maintenance functions

The software shall automatically configure the system based on hardware installed for that variant, to include any appended systems, upon power on. The software shall load the dynamics and visual models for the selected variant upon initialization of the system or from the selection of the variant at the IOS if multiple dynamics models exist for the variant hardware configured. The software shall send a message to the IOS to display within the IOS GUI the simulation being configured. The software shall send a message to the IOS to be displayed on the IOS GUI when the hardware configuration does not match.

The IOS shall also have the capability to power-down the CDT in a controlled, safe manner consistent with the CDT hardware and software (both application and operating system) requirements.

3.4.1.2.3 IOS Printer.

The IOS Rack shall have a black and white printer to print hard copies of student reports, class reports and student performance analysis. The IOS printer shall be able to print information from the master display monitor windows at the operator's request. The IOS printer shall also be able to print out diagnostic data from diagnostic and maintenance applications.

3.4.1.2.4 IOS Computer.

The IOS Rack shall contain computer(s) which meets the technical specifications defined in paragraph 3.5.1.3.1 titled 'Computational Hardware'. The IOS Computer shall be capable of running all of the IOS Software defined in paragraph 3.5.1.6 ' Computer Software Requirements' without noticeable lags, lockups or system crashes.

3.4.1.3 IOS Setup Window.

The IOS Setup Window shall normally appear on the master display monitor.

3.4.1.3.1 Progression.

Progression shall be determined based on the scores obtained by the student in previous scenarios. At the completion of a scenario, if the student passes, the CDT shall provide the next recommended scenario based on the Program of Instruction (POI) for the student. The Instructor shall be able to;

a) Select the next recommended scenario,

b) Run the previous scenario by selecting the scenario by number.

c) Select a different scenario by selecting the scenario by number.

d) Run same scenario by selecting re-run.

Selection of a scenario other than the CDT recommended scenario will not affect the normal progression of the student. At the completion of a scenario selected by instructor, the student must go back to the next scenario in the POI to continue the normal progression.

3.4.1.3.2 Common Scoring.

The CDT IOS shall provide automatic performance grading for pre-programmed scenarios. The student's performance shall be compared and graded against predetermined criteria for student actions. The general areas of scoring shall as a minimum include management of switches and controls, physical control of the vehicle, response to malfunctions, and actions required by the tasks identified for the different vehicle platforms as described in the Annexes. The full performance/proficiency analysis shall be available to the Instructor for electronic display and

printout in hard copy form. At the end of a scenario and through an optional manual scoring GUI, the Instructor shall have the capability to amend or override the automatic scoring and provide a free text written explanations for the changes. The Instructor shall also be provided the option to store the student performance/ proficiency analysis or discard it.

3.4.1.3.3 Vehicle Dynamics.

The CDT software architecture shall include a standardized interface to facilitate data exchanges with vehicle dynamic model software. Each vehicle variant cab shall include vehicle dynamic model software. The CDT system shall load the appropriate vehicle dynamic model software during the system power up and initialization process.

3.4.1.4 IOS Software.

3.4.1.4.1 Class Manager (CM) Application.

The CDT IOS shall include Class Manager software which allows users with appropriate privileges (Administrators and Instructors) to perform the following functions as a minimum:

a) Group one or more scenarios into custom POIs.

b) Create student records for each student.

c) Create a database of instructors.

d) Group one or more students into a Class.

e) Assign one or more instructors to a Class.

f) Assign a POI to a Class.

g) Print student reports.

h) Print Class reports.

i) Create archives of records.

j) Export records to external media.

k) Restore CDT records from external media.

l) Import Resident Individual Training Management (RITM) system data from external media.

m) Retrieve all relevant personal information from a inserted CAC card automatically.

3.4.1.4.1.1 Administrator Capabilities.

The Administrator shall be able to accomplish the Class Manager functions listed herein from a single GUI Administrator window. The Administrator GUI window shall have radio button

selections to Manage POI, Manage Scenarios, Manage Student Records, Manage Instructor Records and Manage Class Records. The selection of the specific Administrator function shall present a GUI window with data entry fields, pull down menus and radio buttons appropriate to the type of CDT training data being managed.

a) Manage POI – When selecting the Manage POI function, the Administrator shall have the capability to create POIs by adding available scenarios in a specific sequence. The Administrator shall also have the capability to edit POIs by changing the sequence of scenarios and deleting scenarios. The Administrator shall also have the capability to delete a POI. The Manage POI function shall be accomplished from a single, user friendly GUI window. Exiting the Manage POI GUI function without saving the data shall prompt an option to save the data, exit the function without saving or cancel the operation.

b) Manage Scenarios – When selecting the Manage Scenarios function, the Administrator shall have the capability to configure scenarios from the library of training scenarios available in the training database. The Administrator shall be able to configure scenarios by editing the scoring limits, edit the scoring modifiers, edit the scenario configuration data and select available configuration options. The manage scenarios function shall be accomplished from a set of selectable user friendly GUI window.

c) Manage Student Records – When selecting the Manage Student Records function, the Administrator shall have the capability to manage student data in the training records database. The Administrator shall be able to accomplish the following functions from the Manage Student Records GUI window:

    i. Create a student record in the training records database. Student identification shall be loaded manually by the instructor or by scanning the student's CAC. Scanning a student's CAC card shall copy the Student's personal information into the CDT database. The student's personal information shall include at a minimum: email, rank, first and last name.

    ii. Permanently delete students and their personal information from the training records database. An appropriate warning shall be presented to the Administrator advising of the action being taken and an option to cancel the action before actual deletion.

    iii. Archive a student's record to an external storage media, removing the student record from the training records database.

    iv. Retrieve a student's record from an external storage media, adding the student record into the training records database.

    v. Create student reports for viewing and printing.

d) Manage Instructor Records – When selecting the manage instructor records function, the Administrator shall have the capability to manage Instructor data in the training records

database. The administrator shall have the capability to perform the following functions from the manage instructor records GUI:

i. Add Instructor's personal information to the training records database.

ii. Permanently delete Instructors and their personal information from the training records database. An appropriate warning shall be presented to the Administrator advising of the action being taken with an option to cancel the action before actual deletion.

e) Manage Class Records – When selecting the Manage Class Records function, the Administrator shall have the capability to manage training class data in the training records database. The Administrator shall have the capability to perform the following functions from the Manage Class Records GUI window:

i. The Administrator shall be able to create a training class by establishing the class ID, class name, class location and the class start and end dates. The Administrator shall also be able to assign an Instructor or Instructors to the class from a selection of Instructors in the training database.

ii. The Administrator shall be able to populate a training class by either manually entering student data via the keyboard or by importing student data from RITM (see section 4.4 RITM for a example) via a comma delimited data file on external media, i.e. Digital Video Disk (DVD) or Compact Disk (CD) Read Only Memory (ROM).

iii. The Administrator shall be able to modify a training class by removing either an Instructor or a student from the class and adding additional Instructors or students. When deleting an Instructor or student from a training class, the Instructor or student data remains in the training records data base.

iv. The Administrator shall be able to permanently delete a class and its associated data from the training records data base. An appropriate warning shall be presented to the Administrator advising of the action being taken and an option to cancel the action before actual deletion.

v. The Administrator shall be able to archive a class record to an external storage media, removing the class record from the training records database.

vi. The Administrator shall be able to retrieve a class record from an external storage media, adding the class record into the training records database.

vii. The Administrator shall be able to generate class reports for viewing or printing

f) Access Archived Operation Data – The Administrator shall be able to access any cumulative archived data stored in the Class Manager, the Common Data server or on external media.

3.4.1.4.1.2 <u>Instructor Capabilities.</u>

The Instructor shall be able to accomplish the Class Manager functions listed herein from a single GUI Instructor window. The Instructor GUI window shall have radio button selections for each function. The selection of the specific Instructor function shall present a GUI window with data entry fields, pull down menus and radio buttons appropriate to function being accomplished.

a) Training Initialization – The Instructor shall be able to login a student by either scanning the student's CAC or manually entering the student's ID information in the appropriate GUI field(s). If the student is not in the training records database, a warning shall be generated stating a student record must be established in the training records database before training can proceed. The Instructor shall also be able to retrieve student scoring history from the student data in the training records database.

Create/Delete Student Record – The instructor shall be able to create or delete a student record in the training records database. Student information shall be loaded manually by the instructor or by scanning the student's CAC. The student record shall contain all information necessary to create and print the reports and forms specified in paragraph 3.4.1.4.1.3 'Administrator/Instructor Reports and Forms' (below).

3.4.1.4.1.3 <u>Administrator/Instructor Reports and Forms.</u>

The Administrator and Instructor shall have the capability to print student and class reports and forms.

a) Student Performance Report. – The student performance report shall document the analysis of the student's performance on a scenario. The Student Performance Report shall include student name, date, scenario identifier, class identifier, Instructor name, miles driven in scenario, time to execute scenario, simulated fuel used in scenario, final student score for scenario, final rating and any Instructor comments.

b) Student Transcript Report. – The student transcript report shall document the student's training on the CDT. The Student Transcript Report shall include facility name, student name, current date, dates that the report covers, class identifier in the report header. The body of the report shall include an itemized list, sorted by date of the following information for each training session: CDT identifier; date of training, Instructor's name, non-scripted scenario identifier (if applicable), scripted scenario identifier (if applicable) miles driven in scenario, time to execute scenario, simulated fuel used in the scenario, final score for scenario and the final rating for the scenario. The report shall also include a total of the quantitative data (number of scenarios run, miles, time, fuel, etc.) in the report.

c) Enrolled Student Class Report. – The student class report shall document the data for the students in a class. The Student Class Report shall include facility name, current date, class identifier and dates that the report covers in the report header. The body of the report shall include a list of students, sorted by name with the following information for

each student: soldier's name, number of non-scripted scenarios completed, number of scripted scenarios completed, number of scenario miles driven, amount of scenario time driven, amount of simulated scenario fuel consumed, number of student training sessions and the average score of the completed scenarios. The report shall also include a total of the quantitative data (number of scenarios run, miles, time, fuel, etc.) in the report.

d) Class Status Report. – The class status report shall document data for the classes at a facility. The Class Status Report shall include the facility name, current date, and the dates covered by the report in the report header. The body of the report shall include a list of classes, sorted by name with the following information for each class: number of students in the class, the number of non-scripted scenarios completed by the class, the number of scripted scenarios completed by the class, the total number of scenario miles run by the class, the total scenario time for the class, number of student training sessions and the total simulated fuel consumed by the class. The report shall also include a total of the quantitative data (number of students, number of scenarios run, miles, time, fuel, etc.) in the report.

3.4.1.4.2 IOS Application.

3.4.1.4.2.1 Simulation Control and Information Window.

There shall be a simulation control and information window that provides real time information about scenario execution. The simulation control and information window shall allow the Instructor to control scenario execution. The simulation control and information window shall allow the Instructor to control the display mode of the Instructor stealth view monitor.

a) Simulation Information. -The simulation information portion of the window shall provide to the instructor the scenario (scripted and unscripted) run time/scenario elapsed time, scenario miles driven/scenario odometer, scenario fuel consumed for the scenario being executed. The simulation portion of the window shall also present malfunction alerts and automated scenario scoring for the scenario being executed. During scripted scenario execution, the Instructor shall be alerted to programmed vehicle malfunctions when they are activated no matter which of the possible scenario control and monitoring windows are being viewed. The malfunction alert shall have visual display characteristics (e.g., color, flashing, font size, separate window, etc.) for timely recognition. The vehicle malfunction alert window shall provide the Instructor the capability to deactivate the malfunction and continue the scenario execution without the malfunction. During either scripted or non-scripted scenario execution, the Instructor shall be alerted to any driver action that generates a scoring deduction. The scoring deduction alert shall have visual display characteristics (e.g., color, flashing, font size, separate window, etc.) for timely recognition but different than the malfunction alert. Each scoring deduction alert shall also include a time tag listing the time of occurrence from the start of the scenario. The scoring deduction alert shall accumulate from the

beginning to the end of the scenario with only the latest five scoring deductions shown instantaneously. There shall be the capability for the Instructor to select the scoring deduction alerts with the cursor and show all scoring deduction alerts along with their time tag that have accumulated to that time. There shall also be continuous display of the current cumulative score for the scenario that is updated each time a scoring deduction event is registered.

b) Simulation Control. -The Instructor shall be able to control the execution of the selected training scenario after the scenario begins. The Instructor shall be able to start, stop, jump the scenario to the next section (instructor placed flag(s) or beginning) forwards and/or backwards, pause and resume the selected training scenario from a scenario control GUI window. The Instructor shall be able to set flags during the execution of the scenario that identifies points of interest in the scenario. The Instructor shall then be able to position the scenario at the flagged locations and either replay the scenario from that point or have the student re-drive the scenario from that point. The Instructor shall also have the capability to jump back 30 seconds in the scenario and either replay the last 30 seconds over, or to allow the student to execute that section of the scenario over. A separate control shall be provided that clears a hard collision (i.e. resets all visuals, states and controls) and jumps back to either the last flagged point in the scenario or a point 30 seconds before the collision (whichever is closer to the collision point) in the scenario to allow the student to continue execution of the scenario prior to the collision. The Instructor shall also be able to select whether the driver's compartment or the IOS has driving control over the vehicle simulation by way of the IOS joystick. If IOS driving control is selected, the Instructor shall be able to select normal vehicle dynamics mode or vehicle limitations override mode. When the Instructor is controlling the own vehicle, steering, throttle, service brake, and transmission control inputs from the driver compartment shall be ignored by the simulation. If normal vehicle dynamics mode is selected, all movement of the own vehicle shall be subject to the limitations of the vehicle equations of motion and terrain traversability. In normal vehicle dynamics mode, the own vehicle shall not move in a manner that would not be possible if control was exercised from the driver compartment controls. When vehicle limitations override mode is selected, the vehicle equations of motion shall be suspended so that the own vehicle can traverse terrain that the simulated vehicle could not normally negotiate. When vehicle limitations override mode is selected, the own vehicle shall be capable of maneuvering on slopes too steep for normal operation and on surfaces that normally provide insufficient traction.

c) Stealth Capability Control. -The Instructor shall be able to select the function and view of the IOS Stealth capability for each STS. The Stealth capability shall allow either the vehicle tethered view capability or the Stealth view capability with free unrestricted movement throughout the training database. The tethered view capability shall present the CGI of the training environment as seen from a fixed point relative to the own vehicle. The joystick shall control the IOS Stealth view eye point as described in azimuth position relative to own vehicle, distance from the vehicle, elevation above own vehicle and the viewing angle of the eye point. When not being positioned by the joystick, the

attached view shall remain in a constant position and look angle relative to own vehicle throughout the training session. The stealth view capability shall allow unrestricted movement of the Instructor's eye point view throughout the training database. The joystick shall allow the Instructor to move forward and reverse; turn left and right; adjusts viewpoint elevation and the viewpoint look angle.

3.4.1.4.2.2 Vehicle Instrument And Control Window.

The vehicle instrument and control window shall graphically represent all monitored driver's compartment controls, indicators, switches, instruments and displays of the vehicle being simulated. The graphical representations of the vehicle controls, indicators, switches, instruments and displays shall either represent the status due to student actions (e.g., flip a switch, turn a knob, brake pedal position, etc.) or the status or value resulting from the vehicle simulation (e.g., speedometer readings, fuel level, etc.). The graphical representation of the monitored driver's compartment controls, indicators, switches, instruments and displays shall be updated in real time during scenario execution.

3.4.1.4.2.3 Scenario Selection Window.

The IOS shall have a scenario selection window. The scenario selection window shall allow an Instructor to search for a scenario, select a scenario, adjust selected scenarios parameters and initialize execution of the scenario. A scenario shall be selectable from a training scenario library. The IOS shall have a method for initializing scenarios using on-screen menus. The IOS shall provide an option for the Instructor to place a student anywhere with the scenario progression matrix by selecting a particular scenario. The GUI interface shall provide a selection of training scenarios to the Instructor. The GUI interface shall provide a high level overview of the training scenario description to include if appended systems are necessary and whether the scenario can be utilized as a network scenario. The IOS shall allow the Instructor to assign ownship positions based on the systems available when a network mode training scenario has been selected. The IOS shall allow the Instructor to assign appended systems based on the systems available when an integrated mode scenario is selected by the Instructor. See paragraph on 3.5.2.2 'Mode Manager' for system initialization. The IOS shall also allow the Instructor to configure the scenarios as an unscripted scenario selection. When this is selected by the Instructor, a scenario setup window shall be displayed to the Instructor on the master display monitor. The scenario setup window shall present vehicle and scenario setup options that are specific to the vehicle being simulated and the training category selected by the Instructor. The IOS shall have a method to select and change, at a minimum, the following scenario parameters:

a) Relocatable objects

b) Visibility

c) Meteorological effects: haze, fog, rain, snow, wind all with variable density

d) Time of day (morning, afternoon, dusk, night)

e) Vehicle Malfunctions

f) Automated Cues On/off (see Automated Cueing Subsystem)

g) Scripted scoring communication On/Off

h) Vehicle variants

i) Loads

j) Trailer Options

k) Other vehicle variables required to meet training requirements for that vehicle

l) Traffic

m) Motion active (setting shall enable or disable movement of the motion platform during a scenario.

The scenario setup window shall not be available to the Instructor when scripted scenarios are selected. The IOS shall display the scenario configuration selections to the Instructor for approval prior to beginning execution of the training scenario. The IOS shall provide the capability to unselect any previously selected options before execution of the training scenario.

3.4.1.4.2.4 Vehicle Malfunction Window.

The vehicle malfunction window shall display all the possible malfunctions and vehicle failures simulated for the selected vehicle. During unscripted scenarios, the vehicle malfunction window shall allow the Instructor to select any of the available malfunctions for that vehicle by a radio button associated with that malfunction. The vehicle malfunction window shall indicate that the malfunction is activated. Upon activation, the vehicle simulation then provides the proper operating characteristics for the selected malfunction. The vehicle malfunction window shall allow any active malfunction to be cleared by selecting the associated radio button changing the malfunction to a deactivated state. Upon deactivation, the simulation shall return to normal vehicle operating characteristics. During scripted scenario execution, the vehicle malfunction window shall not allow Instructor activation of a vehicle malfunction or failure. When a vehicle malfunction or failure is activated by the scripted scenario, the vehicle malfunction window shall automatically display the malfunction as activated. The vehicle malfunction window shall allow the automatically activated malfunction to be cleared by selecting the associated radio button changing the malfunction to a deactivated state or by the predetermined vehicle malfunction course of action programmed into the host system. Upon deactivation, the simulation shall return to normal vehicle operating characteristics. If the Instructor deactivates the malfunction from an alert on the simulation control and information window, the malfunction shall have a deactivated indication on the vehicle malfunction window.

3.4.1.4.2.5 Own Vehicle Weapons Firing Window.

The Own Vehicle Weapons Firing Window shall display the own vehicle weapons controls for the vehicle being simulated. During scripted and unscripted scenarios, the instructor shall have

the capability to control own vehicle weapons. The instructor shall have the capability to select the weapon for firing and to direct the pointing of the selected weapon in azimuth and elevation relative to the own vehicle main body if the weapon has that capability. The instructor shall have the capability to fire the selected weapon as if someone else in the vehicle (other than the driver) was firing the weapon. The activation of selected weapon firing by the instructor shall initiate an aural cue and visual cue that represents the weapon being fired. The aural cue shall be a single shot or a burst of shots when activated depending on the weapon being simulated. The visual cue shall be presented in the driver's field of view when activated depending on the weapon's position relative to the driver's compartment. The vehicle dynamics shall react appropriately to the type of weapon being fired and the direction of fire.

3.4.1.4.2.6 Incoming Fire Window.

The Incoming Fire Window shall display possible weapon attacks on the ownship. During scripted and unscripted scenarios, the instructor shall have the capability to trigger selected incoming weapon attacks. The effect shall be random within a +/- 70 degrees from the ownship's front center and within 100 meters of the vehicle ownship. The activation of the selected weapon by the instructor shall initiate an aural, motion and visual cues representing the particular weapon selected. The aural cue shall be a single shot or a burst of shots when activated depending on the weapon being simulated. The motion cue shall represent a shockwave the variant cab would experience where the random weapon is detonated. The visual cue shall be presented in the driver's field of view when activated depending on the weapon's position relative to the driver's compartment. The weapon selected shall be able to modify the terrain database (dynamic terrain) after detonation. The vehicle dynamics shall react appropriately to the type of incoming direction of fire and dynamic terrain changes. The following operating or environmental conditions listed in priority order shall produce appropriate aural, motion, dynamic terrain and visual effects to the driver trainee:

a. Own vehicle hit by Rocket Propelled Grenade (RPG).
b. Own vehicle hit by an Improvised Explosive Device (IED) buried, exposed, etc.
c. Own vehicle triggering a mine.
d. Own vehicle taking on small arms fire.

3.4.1.4.3 Shutdown Application.

The IOS shall provide a Shutdown Application, accessible via an icon on the IOS Desktop, for the Instructor to power down the CDT training system and all associated CDT subsystems. The Shutdown Application shall be a one step selection to execute by the Instructor. The Shutdown Application shall halt and/or stop the simulation application and COTS applications that are executing on the CDT training systems. The Shutdown Application shall power down each CDT system to its operating system power off mode.

3.4.1.4.4 Scenario Generation System (SGS) Application.

The CDT architecture shall support a Scenario Generation capability and include a SGS Application. The SGS software shall be capable of being installed on either the CDS (when a CDS workstation is available) or one of the IOS. The CDT SGS shall have the capability to generate scripted and unscripted scenarios utilizing any training environment (visual data base and ancillary data) installed on the CDT. The SGS shall have the capability to:

a) Set the scenario initial conditions parameters (e.g., start location, environmental settings, etc.)

b) Set the preferred vehicle driving path for scenario.

c) Set locations and trigger radius for aural cues, driving instructions, scenario trigger points, exploding ordinance, malfunction activation, etc.

d) Set the environmental traffic paths and configuration.

e) Create scenario description document in the proper format

f) Create aural cues (vocal and sound) for use in the scenarios

g) Set scenario scoring criteria.

h) Save scenario data in the proper format and location for instructor access and training scenario execution.

i) Modify existing training scenarios and either replace the original scenario or save as a new scenario configuration.

The CDT shall have the capacity to store scripted training scenarios as stated for each specific variant. The minimum capacity of the mass storage device used to store the training scenarios shall be no less than 300GB.

The requirements for the SGS are contained in PRF-PT-00430, Appendix B Version 2.3 dated 22 Jan 2013.

3.4.1.4.5 IOS Statistics Application.

There shall be a separate information application entitled CDT Statistics that provides both real time information and cumulative statistics for the CDT system. The Statistics page shall display the following information:

a) Time Statistics
    i. Time Current Scenario – The elapsed time since the start of the current scenario.
    ii. Total Simulated Time – The total time the system has been actively running scenarios since the last system statistics reset, usually monthly. Idle time is not counted in Total Simulated Time.

iii. Total Networked Time – The total time the system has been actively running scenarios in Network Mode since the last system statistics reset, usually monthly. Idle time is not counted in Total Networked Time.

b) Distance Statistics
   i. Miles Driven Current Scenario – The total distance the student has driven since the start of the current scenario.
   ii. Total Simulated Miles – The total simulated miles the system has been driven since the last system statistics reset, usually monthly. The Total Simulated Miles shall include miles driven in both scripted and unscripted modes of operation including free play. In other words, if it moves, it counts.

c) Fuel Statistics
   i. Fuel Consumed Current Scenario – An estimate of the fuel consumed (based on an vehicle specific average miles per gallon estimate) since the start of the current scenario.
   ii. Total Fuel Consumed – The total estimated fuel consumption for the system since the last system statistics reset, usually monthly.

d) Metrics window
   i. Previous 7 Days – This line within the Metrics window shall display the Total Simulated Time, Total Networked Time, Total Miles Driven and Total Fuel Consumed for the last 7 calendar days. This metric may span more than a single week or month.
   ii. Previous 30 Days – This line within the Metrics window shall display the Total Simulated Time, Total Networked Time, Total Miles Driven and Total Fuel Consumed for the last 30 calendar days. This metric may span more than a single month.

e) Monthly Statistics window
   i. This window shall be a scrollable window with a single line of data for each month of system operation. Each line shall display the Year, the Month, the Total Simulated Time, Total Networked Time, Total Miles Driven and Total Fuel Consumed for that month.

f) Last Reset – This metric shall display the date of the last reset.

The Statistics page shall also contain a button labeled “Reset Monthly Stats” with a warning message to ensure reset. Activating the “Reset Monthly Stats” shall: cause the Total Simulated Time, Total Networked Time, Total Simulated Miles, and Total Fuel Consumed statistics to be reset to zero; update the Last Reset metric to the current date; close the current line in the Monthly Statistic window; and initialize a new line in the Monthly Statistics window.

3.4.1.4.6 <u>Maintenance and Utilization Logs Applications.</u>

3.4.1.4.6.1 <u>Electronic Maintenance Log (EML).</u>

Each CDT system shall include an Electronic Maintenance Log (EML) software application. The EML shall be capable of being configured to match the system configuration as fielded, i.e. a system can consist of 1 IOS, 1 to n STS and 0 to n Ancillary Stations (i.e. Commander's Stations, Gunner's Stations, etc.). The EML shall be hosted on the IOS with a desktop icon. The EML shall be capable of accepting entries for each IOS, STS and Ancillary Station separately and for each CDT system as a whole. The EML shall automatically record the date, time and log-in data of the user making each entry into the EML as part of each entry.

The EML shall allow a user with Maintainer privileges to make entries consisting of the date and type of all Preventive Maintenance Check & Services performed. The following types of PMCS services shall be allowed: Daily Readiness Checks (DRC), Weekly (W), Bi-weekly (BW), Monthly (M), Bi-monthly (BM), Quarterly (Q), Semi-annual (S) and Annual (A).

The EML shall allow a user with Maintainer privileges to make entries for any hardware replacement activities performed. The entry shall include the manufacturer, model number, part number and serial number for both the original item and the replacement item.

The EML shall allow a user with Maintainer privileges to schedule and make entries for any perishable item replacement activities performed. Perishable items shall include but not be limited to such items as: Complementary Metal-Oxide-Semiconductor (CMOS) batteries, projector bulbs, printer cartridges and other items which are consumed during the normal course of operations. The entry shall include the manufacturer, model number, and part number for each perishable item. The scheduling function shall allow a Maintainer to enter a frequency or scheduled date for replacement of each perishable item. The scheduling function shall allow the Maintainer to set up to two reminders for each scheduled replacement activity.

The EML shall allow a user with Maintainer privileges to make entries for any hardware update activities performed. The entry shall include a text field for entering a brief description of any hardware added to or removed from the system.

The EML shall allow a user with Maintainer privileges to make entries for any software update activities performed. The entry shall include the software version number and patch number, if applicable. The entry shall include a text field for entering a brief description of the software installed.

The EML shall automatically record an entry in the EML each time the system password is changed. The entry shall indicate if the automated password change procedure or the manual method was used. The entry shall include a masked entry for the new password which will only

be unmasked by a user with Administrator privileges. The entry shall automatically record the date, time and log-in data of the user changing or attempting to change the password as soon as the attempt begins.

The EML shall include a System Usage Monitor (SUM) function. The SUM shall be capable of interfacing with the IOS statistics software. For purposes of this section, a session shall be defined as the time between when the subsystem (IOS, STS, or Ancillary Station) is powered on until the time when the subsystem is powered down.

3.4.1.4.6.1.1 Records For Each STS Session.

The SUM shall be capable of recording the following data for each STS session:

a) STS number
b) Cab type mounted on the STS
c) Power On time
d) System Mode, i.e. the system mode shall be Training (T), Maintenance (M) or Demo (D)
e) Session elapsed time, i.e. the running total of time from STS power up to STS power down
f) Session driving time, i.e. the running total of time spent in actual scenarios
g) Session miles, i.e. the running total of miles driven in scenarios
h) Shall not be resettable, even on software updates

3.4.1.4.6.1.2 Records For Each AS Session.

The SUM shall be capable of recording the following data for each Ancillary Station session:

a) STS number
b) Cab type mounted on the STS
c) System Mode, i.e. the system mode shall be Training (T), Maintenance (M) or Demo (D)
d) Ancillary Station number
e) Session elapsed time, i.e. the running total of time from Ancillary Station power up to Ancillary Station power down
f) Session training time, i.e. the running total of time spent in actual scenarios
g) Session miles, i.e. the running total of miles driven in scenarios
h) Shall not be resettable, even on software updates

3.4.1.4.6.1.3 Records For Each IOS Session.

The SUM shall be capable of recording the following data for each IOS session:

a) IOS number, if more than 1 IOS is located at a facility

b) System Mode, i.e. the system mode shall be Training (T), Maintenance (M) or Demo (D)

c) Session elapsed time, i.e. the running total of time from IOS power up to IOS power down

d) Session effective training time, i.e. the summed total of time spent in actual scenarios by all STS and Ancillary Stations connected to the IOS during the session

e) Session effective miles, i.e. the summed total of miles driven in scenarios by all STS and Ancillary Stations connected to the IOS during the session

f) Cab type mounted on each STS during the session

g) Ancillary Station type for each Ancillary Station used during the session

h) Shall not be resettable, even on software updates

3.4.1.4.6.2 Master Electronic Maintenance Log (M-EML).

Each CDT Common Data Server (CDS) shall include a Master Electronic Maintenance Log (M-EML) software application. The M-EML shall be capable of being configured to match the overall site configuration as fielded including all IOS, STS and Ancillary Stations. The M-EML shall be hosted on the CDS. The M-EML shall be accessed via a separate desktop icon. The M-EML shall be capable of accepting entries for each IOS, STS and Ancillary Station separately and for each CDT system as a whole. The M-EML shall periodically and automatically poll each IOS and update the M-EML records based on the data received.

The M-EML shall include a Master System Usage Monitor (M-SUM) function. The M-SUM shall be capable of interfacing with each IOS SUM. The M-SUM shall be capable of collecting and storing the SUM data for each IOS separately. The M-SUM shall also be capable of consolidating the individual SUM data into overall facility usage reports. The facility usage reports shall include, but not be limited to, weekly, monthly, quarterly, semi-annual and annual effective training time and effective mileage reports.

3.4.1.4.7 Password Change Application.

The CDT host software shall include a Government Furnished Information (GFI) Password Change Application. The Password Change Application shall allow an authorized Maintainer to individually or collectively change the system password on the IOS computer, the AAR computer, the Audio computer, the STS computer and the Repeater computer. The Password

Change Application shall allow an authorized Maintainer to individually or collectively change the Internet Protocol (IP) Address on the AAR computer, the Audio computer, the STS computer and the Repeater computer. The Password Change Application shall also allow an authorized Maintainer to individually or collectively change the system password and IP Address on the CDS computer if connected to the system. The Password Change Application shall also allow an authorized Maintainer to individually or collectively change the system password and IP Addresses on any computers connected to the system.

3.4.1.4.8 STS Visual Display Control Application.

The CDT host software shall include a STS Visual Display Application. The application shall allow a user seated at the IOS to control the visual display(s) on the STS. The application shall have an icon available on the IOS Desktop.

3.4.2 STS.

The STS shall consist of a motion platform with interfaces for mounting CDT compatible cabs, one or more standard 19 inch roll around 42U electronics rack(s), a Visual Display Unit and ancillary stations, if required. The maximum height of a computer rack shall be 42U. Computers, circuit cards and electronic components which will be subjected to displacement or loosening of connections during normal motion platform operation shall not be placed within the cabs, dashboards or other components normally placed on the motion platform during operation. Each STS shall include one or more CAC readers capable of reading the smart chip data on the card. Each driver station, assistant driver station, vehicle commander station or other ancillary station in an STS shall require a student to be logged in by via IOS manually, IOS CAC reader or the AAR CAC reader..

3.4.2.1 STS Rack.

The CDT STS shall include a COTS equipment rack for housing components necessary to support the functionality of the STS. The STS rack shall include:

a) Power controls,

b) Computers, and

c) Networking resources, i.e. switches, routers.

d) Equipment cable areas

3.4.2.1.1 Cabinet Door Locks.

All equipment cabinet doors shall be equipped with key operated locks. All cabinet locks shall be keyed alike.

3.4.2.1.2 STS Computers.

3.4.2.1.2.1 Simulation Host Computational System.

The STS Computational System shall contain computer(s) which meets the technical specifications defined in paragraph 3.5.1.1 labeled 'Trainer Computer Systems'. The Simulation Host Computer(s) shall be capable of running all of the CDT simulation control software without noticeable lags, lockups or system crashes. The current CDT architecture utilizes separate computers for computational system processes, but multi-core processors and multi-thread systems may be considered provided the functional modularity of the CDT software architecture is maintained.

3.4.2.1.2.2 IG Computers.

The CDT Image Generation (IG) system provides simulated imagery for out the window and sensor displays. The CDT IG system shall be PC based with commercially available hardware that can be separately procured. The IG shall be able to use modern PC and video card hardware as replacements, when original hardware becomes unavailable. The replacements shall be backwards compatible with the original hardware delivered with the system.

3.4.2.2 Motion Platform.

The CDT motion platform shall be installed on the motion system of paragraph 3.5.5 'Motion System'. The motion platform shall provide the support structure for the visual display system and the common physical/mechanical interface for the installation of the vehicle variant driver's cab. The motion platform shall have an interlock system that prevents motion activation unless the vehicle variant cab is securely installed.

3.4.2.3 Visual Display System.

The visual display system shall portray the simulated training environment to the trainee utilizing the visual interface (e.g., windshield/windows, vision blocks, periscopes, direct view through open hatch, sensors, etc.) with applicable obscurations/restrictions of the specific operational vehicle being simulated. The visual display system configuration shall be scalable in terms of dimension and number of channels to optimize the displays for the specific driver's compartment configuration and the training requirements.

The Visual Display Unit (VDU) shall use a Commercial Off-the-Shelf (COTS) high definition Ultra Short Throw (UST) projector in a rear projection configuration. The display resolution of each VDU projector shall be a minimum of 1440h x 1080v.

3.4.2.3.1 Luminance.

Luminance shall provide no less than 250 lumens of light output onto a VDU projection screen of 21 square feet and deliver 14.4 foot-Lambert (ft-L) at the center of each display channel.

3.4.2.3.2 Contrast Ratio.

The minimum contrast ratio for all displayed images shall be 150:1 for each display channel.

3.4.2.3.3 Total Geometric Accuracy.

The total geometric distortion for each display shall minimize the error in apparent location for any point in the scene relative to the true projected position.

3.4.2.3.4 Adjacent Channel Matching.

Variations in color, brightness, contrast, and resolution between adjacent channels shall be minimized for the full range of simulated conditions. Gaps between displays shall be minimized and shall not impact training effectiveness.

3.4.2.3.5 Image Stability.

The displayed image shall not drift more than two pixels per four hours of continuous operation. The displayed image shall not have any perceptible movement relative to the CDT display structure (i.e., jitter in response to system motion) during scenario execution. Normal operation of the CDT system shall not adversely affect the alignment, focus or stability of the visual display system or the displayed images.

3.4.2.3.6 Field-Of-View (FOV).

The CDT shall have a total FOV of 180 degrees horizontal by 45 degrees vertical when measured from the center point of the CDT three channel display configuration. The center point of the display configuration is the common point where the nominal FOV for each of the three display screens is +/- 30 degrees horizontal FOV and +/- 22.5 degrees vertical. The design eye point of the driver's compartment shall be located as close to the center point of the display configuration as the driver's compartment design, size and weight allows.

3.4.3 Generic Vehicle Cab Requirements.

3.4.3.1 Cab.

Each CDT current and new cab shall be capable of mating with the existing CDT common component interfaces (detailed in provided CDT Technical Data Package). Each CDT cab shall provide an Ethernet interface to allow connection of the Maintenance Laptop for calibration and diagnostic purposes. Reconfiguration from one CDT variant cab to another shall be achievable in less than 1.0 hour by a two person crew.

3.4.3.1.1 Cab Input/Output (I/O) Subsystem.

Each CDT cab shall include an electrical/electronic Input/Output subsystem. The CDT architecture currently supports the following COTS items: WAGO and United Electronics Industries (UEI) I/O systems.

All future CDT cab variants shall use the WAGO-I/O-SYSTEM as used previously in the CDT TV and CDT TEV cabs.

3.4.3.1.2 Cab Safety Interlocks.

Each CDT cab shall include safety interlocks on all doors, seat belts and crewmember's safety harnesses. Whenever an interlock is opened (i.e. door opened, seat belt or harness unbuckled), the CDT system shall display a warning message at the IOS and the motion platform shall settle to the fully lowered position know as the 'Parked' position.

3.4.3.1.3 In-cab Camera(s).

Each CDT cab shall include one or more CCTV cameras. The placement of the primary CCTV camera shall be optimized to capture the student's interaction with the controls of the simulated vehicle. The placement of an additional CCTV camera shall be optimized to capture the student's facial expressions and reactions to allow the Instructor to monitor the student for the onset of motion sickness. Each vehicle variant shall have the camera locations determined during driver's compartment design.

3.4.3.1.4 In-cab Audio Subsystem.

Each CDT cab shall include an in-cab Audio Subsystem. The in-cab Audio Subsystem shall allow verbal communications between the student and the Instructor, The in-cab Audio Subsystem shall also be capable of providing automated verbal cues, corrective instructions, environmental sounds and aural cues to the student.

3.4.3.1.4.1 In-cab Communication Subsystem.

Two-way communication between the instructor and student shall be provided at all times when the system is initialized. Communication shall be accomplished through either headsets, the

student's appropriate helmet, or a speaker and microphone located in the driver compartment. The instructor shall be able to select the headset/helmet, in-cab speaker/microphone subsystem or both for student communication audio in the driver's compartment. The instructor shall be able to control overall voice communications volumes for the entire system.

Each CDT cab shall allow students to utilize the Combat Vehicle Crew (CVC) helmet that is utilized in the actual vehicle or the appropriate gear used for communications in the actual vehicle. If headsets are used, each headset shall have an independent jack and volume control. The headsets provided for use in the cab shall be David Clark computer compatible headsets part number 40642G-01 or equivalent.

Any speakers and microphones utilized for the in-cab communication subsystem shall be separate and distinct from the speakers utilized in the in-cab sound subsystem described below.

3.4.3.1.4.2 In-cab Sound Subsystem.

Each CDT cab shall include a in-cab Sound Subsystem. The in-cab sound subsystem shall be capable of providing realistic sounds typically experienced by a driver operating a military vehicle singly and in convoy with other military vehicles in urban, rural, wooded, desert, seaport, airport, and motor pool areas in all types of weather conditions and in both combat and non-combat operations. The in-cab sound subsystem shall represent vehicle weapon firing and incoming weapon sounds the driver would experience.

Each CDT cab shall contain at least four full range speakers and a larger woofer. The in-cab sound subsystem shall be capable of providing sounds to all speakers in the cab.

All nonverbal sounds and aural cues shall be played through the in-cab sound subsystem. This includes all vehicle caution, warning, alert and malfunction alarms except when the sound is generated by and played from a speaker within a COTS dashboard or Government Furnished Equipment (GFE) vehicle panel as specified in the cab requirements document (annexes).

3.4.3.1.5 Vehicle Specific Kit(s).

Each CDT cab shall include one or more vehicle specific kits. When provided with a cab, each vehicle specific kit shall contain the components and accessories necessary to transform the generic cab into a cab which replicates the form, fit and function of the driver's station inside the cab of a specific vehicle or family of vehicles. Installation of a vehicle specific kit shall not require removal of the cab from the motion platform. Reconfiguration from one vehicle specific kit to another shall be achievable in less than 30 minutes by a two person crew, with a desired objective time of 15 minutes.

3.4.3.1.5.1 Alternate Dashboard(s).

Each vehicle specific kit shall include one or more alternate dashboards. When provided as part of a vehicle specific kit, each alternate dashboard shall contain the components, gauges,

indicators, alarms, switches and other components necessary to replicate the form, fit and function of the driver's station inside the cab of a specific vehicle or family of vehicles. All dashboards provided with a cab shall mate to a single set of physical, electrical, electronic and data interfaces in the generic cab. All electrical, electronic and data connectors shall be uniquely sized and keyed to prevent accidental mismatches. Actual vehicle dashboards, or portions thereof, should be used whenever possible.

3.4.3.1.5.2 Accessory Panels.

Each vehicle specific kit shall include one or more static and/or dynamic accessory panels. A static accessory panel is any cover plate or panel which provides no dynamic interaction with the student. A dynamic accessory panel is any panel which contains any gauges, indicators, alarms, switches or other components that the student must interact with during operation of the simulator. When provided as part of a vehicle specific kit, each accessory panel shall contain the components, gauges, indicators, alarms, switches and other components necessary to replicate the form, fit and function of the driver's station inside the cab of a specific vehicle or family of vehicles. All accessory panels provided with a cab shall mate to the same physical, electrical, electronic and data interfaces in the generic cab. All electrical, electronic and data connectors shall be uniquely sized and keyed to prevent accidental mismatches. Actual vehicle panels, or portions thereof, should be used whenever possible.

3.4.3.1.5.3 Switchboxes.

Each vehicle specific kit shall include one or more switchboxes. When provided as part of a vehicle specific kit, each switchbox shall contain the components, gauges, indicators, alarms, switches and other components necessary to replicate the form, fit and function of the driver's station inside the cab of a specific vehicle or family of vehicles. All switchboxes provided with a cab shall mate to the same physical, electrical, electronic and data interfaces in the generic cab. All electrical, electronic and data connectors shall be uniquely sized and keyed to prevent accidental mismatches. Actual vehicle switchboxes, or portions thereof, should be used whenever possible.

3.4.3.1.5.4 Vision Restriction Plates.

Each vehicle specific kit shall include one or more vision restriction plates. Whenever a cab is intended to simulate more than one vehicle or family of vehicles, the cab shall be designed to match the largest field of view provided by any of the vehicles and vision restrictor plates shall be used to reduce the field of view to match other vehicles. All vision restriction plates provided with a cab shall mate to the same physical interfaces on the generic cab.

3.4.3.1.5.5 Space Restrictor(s).

Each vehicle specific kit shall include one or more space restrictors. Whenever a cab is intended to simulate more than one vehicle or family of vehicles, the cab shall be designed to match the largest interior space provided by any of the vehicles and space restrictors shall be used to reduce the interior space to match other vehicles.

3.4.3.1.5.6 Storage Container(s).

Each vehicle specific kit shall include one or more ruggedized storage containers for storing accessory panels, switchboxes, vision restriction plates and space restrictors. Whenever possible, all components required to simulate a particular vehicle or family of vehicles shall be stored within a single storage container. All storage containers shall meet the requirements for a two-man lift.

3.4.3.2 Vehicle Specific Software.

3.4.3.2.1 Terrain Traction .

The Coefficient of Traction for each terrain type and weather condition shall be input to the vehicle dynamics model software and affect the simulated vehicle performance during scenario runtime. See paragraph 3.5.7.1‘Terrain Database’ for Terrain Traction requirments.

3.4.3.2.2 Terrain Roughness .

The roughness factor for each terrain type and weather condition shall be input to the vehicle dynamics model software and Steering Force Feedback system and shall affect the simulated vehicle performance during scenario runtime.See paragraph 3.5.7.1 ‘Terrain Database’ for Terrain Roughness requirements.

3.4.3.2.3 Vehicle Specific Scoring.

The CDT Vehicle Specific Software shall include Vehicle Specific Scoring for each vehicle being simulated by the CDT. The specific scoring rules for each vehicle shall be defined in the Vehicle Specific Annexes.

3.4.3.2.3.1 Malfunction Scoring.

The CDT Vehicle specific software shall include vehicle specific scoring located in the vehicle annex for each vehicle malfunction being simulated in the CDT. For each vehicle malfunction the steps to clear the malfunction shall be displayed to the instructor with the implemented time

limits for each step to correctly clear the malfunction whether it is an Instructor Operator (IO) triggered malfunction or a scripted malfunction.

3.4.3.2.4 IOS Gauges Window.

The CDT Vehicle Specific Software shall include an IOS Gauges window for each vehicle being simulated by the CDT. The IOS Gauges Window for each vehicle assigned to the IOS or Master IOS shall be selectable and displayable on either the IOS or Master IOS during scenario runtime. The IOS Gauges Window shall display all gauges, lights, indicators and other controls availableon the cab dashboard. When the STS dashboard is compared to the corresponding IOS Window displays in real time, the following tolerances shall be meet:

a. Analog gauges/indicators within 10% difference,

b. Digital gauges/indicators to within 1% difference.

c. Boolean (on/off) indicators 100% accurate.

3.4.3.2.5 Vehicle Dynamics Model.

The CDT Vehicle specific software shall include Vehicle Dynamics Models for each vehicle being simulated by the CDT. The initial Vehicle Dynamics Model software shall simulate actual vehicle performance within 10% of the values of all vehicle tests performed during vehicle testing at accredited testing facilities. Section 4.3 'Vehicle Dynamic Data Input Template' contains a representative list of technical data used to create prior CDT simulated vehicles. Final vehicle dynamics model performance shall be tuned and verified by a Government sponsored vehicle expert and approved by Government Lead Engineer.

3.4.3.2.6 Cab Calibration Software.

Each CDT cab shall include firmware or software which interfaces with the CDT Calibration Tool to allow maintenance personnel to calibrate individual vehicle dashboard components and cab controls as needed.

3.4.3.2.7 Cab Diagnostic Software.

Each CDT cab shall include firmware or software which interfaces with the CDT Diagnostic Tool to allow maintenance personnel to diagnose and troubleshoot individual vehicle cab and dashboard components down to the Lowest Replaceable Unit (LRU) level.

3.4.3.3 Vehicle Specific Ancillary Components.

Ancillary components are optional components, equipment and software items. These items shall be included in a CDT system variant kit. The following subparagraphs contain the minimum requirements for each of the ancillary components.

3.4.3.3.1 Driver Vision Enhancer (DVE).

Whenever an actual vehicle being simulated by the CDT allows a driver to use a DVE, then the CDT cab shall contain all of the mounting hardware and simulation software to allow the student driver to use a DVE within CDT scenarios. The DVE mounting hardware in the CDT cab shall replicate the form, fit and function of the DVE mounting hardware found in the actual vehicle.

3.4.3.3.2 Ancillary Station(s).

Unless otherwise specified in a Variant Annex, vehicle ancillary stations shall consist of floor-mounted sets of optional workstations, components, and equipment and software items. The purpose of a vehicle ancillary station is to facilitate training additional crewmembers whenever training of crew coordination tasks is required. A Commander's Station or Gunner's Station are examples of vehicle ancillary stations. The following subparagraphs contain the minimum requirements for a vehicle ancillary station.

3.4.3.3.2.1 Ancillary Station Communications.

The CDT shall have audio communications between the IOS (Instructor & observer) and the student at any ancillary station. The CDT shall have audio communications between the driver at the STS and the student at any ancillary station. Communications shall be accomplished via headsets with boom microphones for the student at the ancillary station. The ancillary station headset shall be adjustable for head size with cushioned, closed ear (completely surrounds the ear) headset speaker enclosures with noise canceling speakers and adjustable, noise canceling microphones. The ancillary station shall have controls to adjust the volume levels of the headset audio individually. IOS communications to the student at the ancillary station shall be active anytime the ancillary station and IOS are both powered-up.

3.4.4 CDT Ancillary Components

A work surface shall be provide with sturdy construction and shall be finished with high pressure laminate and a chair. The following subparagraphs contain the additional minimum requirements for each of the ancillary components.

3.4.4.1 Common Data Server (CDS).

The CDT architecture shall support a CDS capability. The CDS shall serve as a centralized data repository at locations where more than one CDT system is deployed. The CDS shall use a client-server architecture with an object-relational DataBase Management System (DBMS) to allow data to be stored and retrieved from a central location with multiple IOSs. The CDS shall store student records, class records, scenarios, terrain databases and instructor data. When connected to a CDS, each IOS shall use the CDS as the default source for all data available on the CDS. The CDS shall include a separate COTS PC workstation (multi-core CPU) with a single monitor, keyboard and mouse. The CDS shall include a mass storage device with a minimum capacity of 1 Terabyte (TB). The CDS shall include a separate workstation and loaded with the CDT SGS software.

3.4.4.2 After Action Review (AAR).

The CDT architecture shall support an AAR capability per STS. When specified as part of a CDT system, there shall be one AAR system per Driver's Station. The AAR subsystem shall allow off-line review of training results. The AAR system shall record and playback all of the scenario as a single file and include the capability to pause, rewind, and fast forward (2x, 4x and 8x) the playback scenario. The AAR shall be functionally available at any time after the completion of a scenario and shall not preclude the concurrent use of any other CDT system modules (i.e., IOS and STS) for training purposes. The AAR user shall be able to browse and select scenarios for playback by student name and scenario ID. The AAR shall offer vehicle ownship center, right, left and DVE computer generated imagery and the CCTV camera video feeds. The playback of a training scenario, shall recreate the visual image selected (vehicle ownship CGI or CCTV view) and have all of the aural communications and instrumentation cues of the original scenario execution. The AAR shall be designed to allow the recorded imagery to be archived on Compact Disk- Read only (CD-R) disks that can be played on standard PC workstations.

3.4.4.3 Master IOS.

The CDT System shall have a Master IOS capability when multiple STS are utilized in network mode. The Master IOS capability shall be available to the instructor after networking mode has been selected by the instructor.

The Master IOS shall have the same requirements as the CDT IOS defined in section 3.4.1 'Instructor/Operator Station' with the following added capabilities.

The Master IOS shall display the Topographical Map and the Master Display on their respective monitors (refer to figure 6). The remaining monitors shall be capable of being dynamically allocated to user selectable channels during initialization and execution of scenario.

The Master IOS shall have the capability to select Vehicle component ownship positions when in networking mode. The ownship positions shall be displayed on the Two Dimensional (2D) map and Stealth viewer with a unique identification number.

The Master IOS shall have a scenario status graphical user interface to display the following information to the instructor:

a) Scenario Malfunctions Status
b) Scenario Scoring Status
    i. A GUI shall display necessary steps with go/no go indicator to the instructor.
    ii. A GUI shall also display the own vehicle unique identifier
c) Numerical Text Box to display at the minimum the following own vehicle information instead of the Driver's GUI Display:
    i. Speed
    ii. Transmission Gear Engaged
    iii. Active Indicators
    iv. Other Vehicle Specific data shall be defined in the Vehicle Variant Appendices.

d) Ownship positions

e) Scenario status

The Master IOS shall have a scenario control interface to allow the instructor to control the following functions:

a) Scoring
    i. On or Off
    ii. If On, then a waypoint will be triggered by the ownship before the scoring event to cue the instructor of the scoring event and the steps necessary to pass the scored event.
b) Automated Cueing and Scoring Assistant Subsystems - On or Off
c) At the end of the GUI selection screen a table of selected options are shown to the instructor based on their selections.

3.4.4.4 <u>Maintenance Laptop.</u>

A laptop computer shall be included at each CDT location to support diagnosis and calibration of CDT cabs. A CDT fielding with multiple CDTs in a common area shall receive one (1) maintenance laptop per twelve (12) to sixteen (16) STSs. All CDT Maintenance laptops shall meet the following minimum specifications:

a) 15-inch Display; 1024x768p Resolution
b) Intel Core 2 Duo 1.6 GHz Processor
c) 1024mb/1GB Memory
d) 60GB SATA Hard Drive
e) Optical drive: DVD-Rom
f) Intel Graphics Media Accelerator 950
g) Integrated video, S-Video output, VGA output
h) Integrated microphone and speakers, headphones jack, microphone jack
i) 10/100 Ethernet network device 56K v924 internal modem 802.11a/g Built-in wireless
j) 4 USB ports
k) Onboard keyboard and touchpad
l) Dimensions: 13.3″x 10.8″x1.4″
m) Weight: 5.2 pounds
n) Microsoft Windows Universal Gold Master - Army (UGM-A) Operating System (OS) pre-installed
o) Microsoft Office viewers (Word and Excel documents)
p) PDF Viewer
q) Capable to run all CDT Calibration and Diagnostic tools

3.4.4.5 Calibration Tool.

The CDT software shall include a Calibration Tool application. The Calibration Tool shall support the calibration of gauges and equipment within each CDT cab. The Calibration Tool application shall be installed on the Maintenance Laptop. Each CDT cab shall provide an Ethernet interface to allow connection of the Maintenance Laptop for calibration and diagnostic purposes.

3.4.4.6 Diagnostic Tool.

The CDT software shall include a Diagnostic Tool application. The Diagnostic Tool shall support the diagnosis and fault isolation of equipment within the CDT system. The Diagnostic Tool application shall be installed on the Maintenance Laptop. Each CDT system shall provide multiple Ethernet interfaces to allow connection of the Maintenance Laptop for diagnostic purposes.

3.4.4.7 Mobile Training Facility (MTF).

The requirements for the MTF are contained in PRF-PT-00430 Appendix A.

3.4.4.8 Auxiliary Mounting Fixture.

When installation is required in a facility where standard anchoring to the concrete floor is not possible, an auxiliary mounting fixture shall be provided. The auxiliary mounting fixture shall have provisions to provide a level mounting platform for the motion system with a minimum of two inches of height variation adjustment for the floor contacts. The auxiliary mounting fixture shall only make contact with the floor without drilling, anchoring or physical modification to the floor. The auxiliary mounting fixture shall increase the overall height to the standard CDT operational motion envelope no more than 12 inches. When mounted to the auxiliary mounting fixture there shall be no tipping or , rocking when operating the CDT in full motion mode. Lateral Movement shall not exceed 2 inches in any direction during 40 hours when operating the CDT in full motion.

3.4.4.9 Development Software Support Environment.

A Software Support Environment (SSE) computer shall be purchased, setup and delivered to the Government team. The SSE shall facilitate the changing and upgrading of the CDT software code and modules. Any compilers, editors and software tools necessary tools to produce executable CDT code and software shall be included on the SSE with their proper licenses and agreements. Additional software tools along with licenses and agreements shall be included on the SSE to view data bases, models, Virtual Local Area Network (VLAN) components and drawings for the CDT product line.

3.4.4.10 Disk Duplicators.

The contractor shall purchase and deliver a 1:1 disk duplicator per CDT system. If there are more than one CDT system co-located, the contractor shall purchase and deliver one (1) 1:1 disk duplicator per six (6) CDT systems. The disk duplicator shall allow the maintainers to make a hard drive backup of each hard drive used in the CDT system. The system shall be simple to use and operate.

3.4.4.11 Forklift.

The contractor shall purchase and deliver a Raymond Adjustable Baseleg Walkie Stacker Model RAS 25 with 60" extended forks when a facility has a CDT system with multiple CDT variant cabs. This shall allow the maintainers to easily and safely install and remove CDT variant cabs from the motion base.

3.5 Major Subsystems.

3.5.1 Computational Subsystem.

All computational system hardware and software shall be designed to satisfy the functional performance requirements specified in this document. The system shall be supportable and have a robust capability for future modification and expansion.

3.5.1.1 Trainer Computer Systems.

Each CDT's computer system, which consists of the computer hardware and software of the trainer, shall be programmed with algorithms and iteration rates that provide mathematically consistent and stable solutions. Iteration rates for time-critical aspects of real-time dynamics shall be no less than 60 Hertz. Instructor station and student station displays and indications shall be free of discernible stepping, oscillating, jittering, or other erratic behavior.

3.5.1.2 Computer architecture requirements.

3.5.1.2.1 Open System Architecture.

Hardware components shall conform to non-proprietary standards to allow the interfacing of components and systems manufactured by multiple vendors.

3.5.1.2.2 Scalable Architecture.

The trainer computer system architecture shall allow addition and replacement of modular hardware items, specifically mass storage devices, memory, processing units, I/O equipment, and network components, without requiring changes to trainer computer system software that is other than Commercial Item software.

3.5.1.3 Computer Hardware Requirements.

3.5.1.3.1 Computational Hardware.

Computer hardware, software, and network components shall be selected in a manner that minimizes the number of different types of spare parts, maximizes the commonality of software components and minimizes associated logistics support costs. Each computational hardware shall be delivered with a primary and backup hard drives. The backup hard drives per CDT system shall be enclosed in a marked, Electrostatic discharge (ESD) closable case.

Computer hardware and electronic parts designed to be placed on the motion platform shall be specifically rated and designed to tolerate the maximum motion and forces the motion device can produce. Placement of these parts on the motion platform shall be limited as much as possible to increase the use of common components between vehicle variants.

For all Engineering Change and/or Technical Refreshes to existing CDT systems, if either changes or additions to the existing computer system hardware, or both, are made, such equipment shall meet the requirements above. In addition, new hardware must be compatible with the remaining legacy hardware.

3.5.1.3.2 Peripherals.

Peripherals shall be provided to support the following functions:

a) Printing of hard copy output of information necessary to support the operation, maintenance and testing of the trainer in accordance with the requirements of this specification and the intended use of the trainer.

b) Storage of software and databases used for operation, maintenance and testing of the trainer.

c) Backup of all Class Manager databases up to a combined maximum of 4 gigabytes (GB) of information to electronic media shall be accomplished within 60 minutes. Recovery of all Class Manager databases up to a combined maximum of 4 GB of information from electronic media shall be accomplished within 60 minutes.

d) Reading to, and writing from, data storage and transmission media, including:

   i. CD ROM

   ii. DVD

3.5.1.3.3 Hardware Failure.

Adverse effects from failure of a hardware element shall be limited to the subsystem containing that hardware element. If the trainer computer system contains multiple processors, to the extent practicable, failure of a single processor shall not cause degradation of trainer operation in subsystems not controlled by the failed processor.

3.5.1.4 Computer Processing Requirements.

The Trainer Computer System shall have sufficient processing capacity to meet the performance requirements and the spare processing requirements described in this specification. Iteration rates, data structures, and algorithms shall provide mathematically consistent and stable simulations. The computational system shall provide adequate processor capacity, memory capacity, input/output device capacity, mass storage capacity, and communications/network equipment capacity to satisfy the performance requirements in this specification.

Each computer shall have a minimum of 10% spare processing capacity, with a total average across all computers of a minimum of 50% under worst case conditions. At least 50% of the total Random Access Memory (RAM) available in each computer shall be spare capacity. The total mass storage (i.e. hard disk) shall have a minimum of 70% spare capacity unless further detailed in this specification.

3.5.1.5 Computer Operations Control Function.

The computer control function shall provide control of the computational system, including start-up from a powered-down condition, loading the trainer operational programs, bringing the trainer system to operating status, shutdown, trapping unexpected system transient events, operation and management of network system components, and control of system diagnostics. The computer control function shall provide the means to enter commands interactively at the operating system level and observe and record responses to the entered commands. The use of the computer control function shall not require more than one operator.

3.5.1.6 Computer Software Requirements.

3.5.1.6.1 Programming Language.

All non-Commercial Item software shall be provided in American Standard Code for Information Interchange (ASCII) source form. All source code that is compiled and used in generating executable code shall be written in a high-level language, such as Ada or C++, chosen to provide the lowest life-cycle cost for the Army. All source code shall be in conformance with the applicable industry standard for the language used.

3.5.1.6.2 Integrity in Handling Calendar Dates.

The handling of calendar dates shall not cause erroneous results regardless of the date or dates being processed. All computational hardware and software subsystems shall be synched automatically in time and date for system readiness, operation and maintenance functions.

3.5.1.6.3 Application Software.

The application software shall include:

a) Software necessary to operate the trainer in accordance with the functional requirements of this specification.

b) Software used to perform testing, to monitor trainer operations, and to demonstrate compliance of the trainer with this specification.

3.5.1.6.4 Diagnostic Software.

Diagnostic software shall test the operation of the computers, peripheral equipment and other trainer hardware, and shall identify malfunctioning components to the lowest replaceable unit. The diagnostic software shall include, but is not limited to, the programs described in the following subordinate paragraphs.

3.5.1.6.4.1 Computer and Peripheral Diagnostic Programs.

Diagnostic programs for the computers, network, and peripherals shall be COTS software.

3.5.1.6.4.2 System Daily Readiness Check Program.

Daily readiness check programs shall enable operating personnel to determine that the trainer is ready for operation. Provisions shall be made for the automatic sequencing through the daily readiness check program, or portions thereof, to verify the desired output at each step. The operator shall have the option of either proceeding, after noting the discrepancies, or stopping the execution. Identification of errors shall be displayed. The system daily readiness check shall require less than 30 minutes to complete.

3.5.1.7 Computational System Network.

If a network is provided as part of the Computational System, it shall have the following performance characteristics:

a) Network protocols shall conform to recognized industry standards.

b) Analysis tools shall be provided for determination of:

   i. network faults

   ii. packet losses

   iii. bit error rate

   iv. peak and average network traffic loading rates sampled at periods less than or equal to one second.

   v. All packet and cell contents and all headers.

c) The network shall sustain the removal and addition of nodes without adversely affecting communications among the remaining nodes of the network. If a node incurs an error condition, the error condition shall not adversely affect the operation of the network.

d) Peak network traffic (when the sample period is less than or equal to one second) shall not exceed 50% of capacity.

e) The network shall be equipped with high level language support (for example, sockets).

f) The network shall support the bi-directional transfer of files and messages among nodes.

3.5.1.7.1 Distributed Interactive Simulation/High Level Architecture (DIS/HLA).

Each CDT system shall utilize DIS Protocol Data Units (PDUs) as defined in IEEE Standard 1278.1a-1998 to exchange simulation related data between components of a system (i.e. between the STS and an ancillary station) and with other systems when networked.

Each CDT system shall utilize High Level Architecture (HLA) as defined in IEEE Standard 1516 to exchange simulation data between other external systems when networked.

3.5.1.7.2 Virtual - Distributed Interactive Simulation (V-DIS).

CDT system shall utilize V-DIS PDUs as defined in the SE Core AI-0600233 'SE-CORE V-DIS' specification to exchange simulation related data between components of a system (i.e. between the STS and an ancillary station) and with other systems when networked.

3.5.1.8 Transport Delay.

The trainer transport delay shall not exceed 105 milliseconds for visual, motion, aural and/or instrument cues, nor shall exceed 35 milliseconds between any two cues. Transport delay (synchronization) shall be defined as the time from when an input is initiated at the vehicle controls, sampled, processed through the cueing systems, output to the visual display, motion actuators, and vehicle instruments, and these respective cueing systems provide a detectable output change in response to the input.

3.5.1.9 Information Assurance (IA).

The system design shall protect against unauthorized access to or modification of information, whether in storage, processing or transit, and against denial of service to authorized users or the provision of service to unauthorized users, including those measures necessary to detect, document and counter such threats. Countermeasures, procedures or other means shall be established to reduce the risks associated with security threats.

3.5.1.9.1 Acquisition of IA Products.

All IA and IA-enabled products shall be purchased through the US Army CHESS program or shall be Commercial Items which comply with the provisions of DODD 8500.01 and AR 25-2.

3.5.1.9.2 Secure Configuration.

Before software development, all IA and IA-enabled products shall be configured In Accordance With (IAW) DODD 8500.01E paragraph 2.3, and E2.1.16.4.

3.5.1.9.3 Security and Privacy.

The CDT system shall follow the IA requirements that provide for security and privacy. The system shall not display personal information unless proper access is given based on user identification and password log-in.

3.5.2 STS / Host Software.

3.5.2.1 Host IO.

The Host IO software used and extended to operate the driver's compartment shall interact and control the common and variant modules. The Host IO shall be capable of being installed in the common modules with no loss of functional capabilities per common or existing variant modules. The Host IO shall reuse the existing software interfaces to the extent possible and extend to meet the new variant requirement interfaces.

3.5.2.2 CDT System Mode Manager.

The CDT System shall initialize into individual training upon power up. The CDT System Mode Manager shall automatically display after initialization has completed. The CDT System Mode Manager shall identify and give the training status of its own CDT system and up to seven (7) other integrated CDT systems. The IOS shall have a CDT System Mode Manager window to configure the CDT System(s) into the other training modes (integrated or network).

3.5.2.3 Scenario Runtime.

The IOS shall have the capability to re-configure the stealth and Out The Window (OTW) displays while in integrated or network mode during scenario execution. This means, when a single IOS is connected to more than one STS in either integrated or networked mode, the Instructor shall have the ability to allocate any combination of OTW and stealth views to any monitors not dedicated to scenario control. For example, in the seven monitor configuration shown in Figure 6, if the IOS was controlling four STS in integrated mode, the Instructor could allocate displays 1, 2, 3 and 6 to stealth views at the start of a session. Whenever a student experiences difficulty, the IOS operator shall be able to select and switch the monitors to show that student's OTW views on monitors 1, 2 and 3 and a stealth view on monitor 6.

3.5.2.4 Common Scoring.

The CDT STS software shall provide automatic performance grading for pre-programmed scenarios. The student's performance shall be compared and graded against predetermined criteria for student actions. The predetermined criteria for scoring the student actions shall be displayed to the Instructor. Each criteria step shall display to the instructor and indicate if the criteria step passed or failed. The system shall display data to the instructor to indicate why a criteria step failed. The general areas of scoring shall as a minimum include management of

switches and controls, physical control of the vehicle, response to malfunctions, and actions required by the tasks identified for the different vehicle platforms as described in the Variant Annexes and Appendices. The full performance/proficiency analysis shall be available to the Instructor for electronic display and printout in hard copy form. The Instructor shall have the capability to amend or override the automatic scoring and provide a written explanation for the action. The Instructor shall also be provided the option to store the student performance/ proficiency analysis or discard it.

Since the automatic scoring is done within the Vehicle Specific Component (VSC), operation of the system in either integrated or networked mode should have no effect on the automatic scoring functionality. However, an instructor located at the IOS in integrated mode or at the Master IOS in networked mode shall be able to monitor and manage the scoring for all Vehicle Specific Components connected to the IOS or Master IOS as long as the VSC is connected to that IOS or Master IOS just as though the system was in independent mode.

3.5.3 Visual System.

The CDT shall provide real-time color computer generated visual images of sufficient detail to adequately train vehicle students. In addition, the visual simulation shall provide the essential cues required by the student to assess simulated vehicle position and velocity, characteristics of the terrain, and other information necessary to operate the simulated vehicle in training scenarios. The visual system shall consist of the image generation system, display system, terrain database(s), static and dynamic models, and any associated hardware and/or software required to simulate the vehicle visual/sensor scene environment. The terrain databases shall simulate an area of 20km x 20km to satisfy the requirements for the training tasks, procedures, postures, terrain features and conditions for the vehicle variant been trained. In addition, the terrain features shall be of sufficient detail, content, features, and variety to meet the requirements for the training tasks for each vehicle variant.

3.5.3.1 Performance Characteristics.

The image generation system and display system for each vehicle variant shall provide real-time visual and sensor displays of the synthetic environment for the simulated viewpoint positions and attitudes. The visual system imagery shall change with and be dictated by simulation events from the host. The system shall provide visual and sensor information concerning the environment, other units and events relevant to the scenario and vehicle system operation as would be available under the corresponding real world conditions. Sufficient detail shall be available to provide this information and to provide realistic depth perception over terrain surfaces. Unless otherwise specified, all of the specified performance and image generator capabilities shall be available simultaneously at any time during the training scenario(s).

3.5.3.2 Functional Training Capabilities.

A continuous visual scene shall be provided for seamless unrestricted movement throughout the entire synthetic environment.

3.5.3.3 General Training Scene Requirements.

Training visual imagery with the capabilities specified in this document shall be provided for all visual displays. Definitions of the specific environment databases, the geographic regions of coverage and supporting model databases are provided as a separate section in this document and in the Annexes. Training visual imagery shall be consistent with the real-world environment being depicted. The simulated features shall be similar to the real-world area in appearance, frequency of occurrence and other characteristics. Sufficient detail shall be available to provide this information and to provide realistic depth perception over terrain surfaces as it would be provided in the real world.

3.5.3.4 Image Generator (IG).

The IG shall consist of real-time computer image generation and image processing equipment. Computer image generation is considered to include that class of system that provides true perspective two-dimensional displays of stored three-dimensional databases. Image processing refers to operations performed on pixel image data. The requirements of this section are applicable to the visual scene as seen through the windshield, mirrors, vision blocks, and sensor utilized within the vehicles.

3.5.3.4.1 Polygon Capacity.

The image generator shall provide a minimum of 18,000 polygons per channel. The polygon capacity shall be met regardless of the displayed image geometrical orientation, distribution of polygons within the displayed image, number and distribution of moving models and the worst case combination of special processing and display features invoked.

The image generator shall provide the ability to have more than 100 active moving models and training conditions, active simultaneously, concurrently with providing Dynamic Terrain effects.

3.5.3.4.2 Range of Vision.

At full visibility, the image generation system shall display visibility not less than 5km for prominent terrain and any tactically significant cultural features that serve as navigation landmarks on the terrain. For the terrain surface, moving models, special effects, cultural objects and static objects, the image generator shall support object detection within a range of 2000 meters for unmagnified views. The transition in the detail portrayed from ‘close in’ to the ‘full 5km range’ shall be subtle and non-distracting to the trainee.

3.5.3.4.3 Update Rates & Channel Synchronization.

The displayed scene shall be generated from updated position and attitude data for the viewpoint and all moving entities at a rate not less than 60Hertz (Hz). All channels in the IG shall be updated and the updated image displayed synchronously.

3.5.3.4.4 Pixel Fill Rate.

Pixel fill shall be sufficient to satisfy the image update rate specification under all specified scene conditions in each view. This pixel capacity shall be satisfied regardless of the displayed image geometrical orientation, distribution of polygons within the displayed image, pixel overwrites, number and distribution of moving models and the worst case combination of special processing display features invoked, and/or polygon complexity attributes (i.e., texture, anti-aliasing and shading).

3.5.3.4.5 Occulting.

Each IG channel shall provide partial or total occulting, as appropriate, of surfaces and light points by surfaces nearer to the simulated viewpoint. Occulting surfaces shall be unrestricted in orientation with no restrictions in viewing angle. The IG shall properly occult all objects in the simulated environment with respect to the viewpoint (including sensors). Sufficient occulting levels shall be provided to properly occult all of the surfaces that can be drawn in a channel. There shall be no ghost images or shadows in the image (static or dynamic) from occulting errors. The system shall not show back plain occulting. Light points shall also be occulted properly at boundaries between polygons of a multiple polygon surface.

3.5.3.4.6 Color.

Each IG channel shall provide a minimum of 24 bits per color component (i.e., red, green, blue) allowing for 16.78 million unique colors to be represented.

3.5.3.4.7 Color Processing.

Luminance and chrominance information processing shall be accomplished with sufficient resolution and accuracy to ensure stable, continuous color at the display with minor discernible abrupt transitions and mach banding except as demanded by the phenomena being simulated. The visual system shall also preclude visible instantaneous changes in color and intensity due to changes in fading and shading as the eye point moves through the scene. The computed color and intensity shall be a function of reflectance, luminance, illumination magnitude and direction, range and atmospheric effects.

3.5.3.4.8 <u>Image Quality.</u>

The following artifacts shall be controlled to the extent specified below. Exceptions shall require explicit approval of the government. Any of the following shall not cause any degradation in training and/or shall not be the cause of any negative training.

a) Image ringing

b) Convergence errors

c) Mach banding

d) Moiré patterns

e) Scintillation of texture

f) Scintillation of small features

g) Flashing of polygons or texture or other anomalies such as that caused by depth buffer accuracy

h) Inter-raster edge flicker

i) Image swimming

j) Quantization of scene elements (stair-stepping and line crawling of edges and breakup of long narrow surfaces)

k) Multiple ghost images

l) Frame-rate reduction

m) Delay to visually represent temporal special effects

n) Dynamic resolution/sharpness degradation with image motion

o) Field tracking

p) Raster line pairing

q) Aliasing such as that caused by interactions of scene elements with the raster structure

r) Flashing and streaking of entire polygons and scan line segments

s) Abrupt transition of scene elements between adjacent pixels

t) Flashing and streaking by visual features due to logic errors and other causes

u) Abrupt changes in illumination, color, or intensity, e.g., flicker, and flashing

v) Level of detail transitions

w) Feature popping

x) Disappearing features

y) Occulting errors

z) Floating/buried features

aa) Terrain gaps

bb) Terrain spikes

3.5.3.4.9 Load Management.

The IG system shall control the scene content across all channels to accomplish the required image density and to manage the scene content around own vehicle and to prevent rapid changes in level of detail, color, and transparency for individual objects close to own eye point. Fade in of three-dimensional objects close to own eye point shall be accomplished smoothly in a manner that precludes the objects "popping" into the scene and prevents distraction. A high density of three-dimensional objects shall be maintained around own vehicle.

3.5.3.4.10 Texture.

The IG shall be capable of mapping image and pattern data onto all polygons in the environmental database. The effect of transparency, shading, illumination, and all other simulated characteristics specified for polygons shall be reflected in the texture-mapped polygons.

3.5.3.4.10.1 Static Texture Mapping.

The image data shall be spatially fixed on the surfaces and display correct perspective and orientation as the viewpoint and mapped surface move in the displayed image. The texture shall remain fixed relative to the underlying polygons and shall be valid for all orientations of objects and polygons in the environment

3.5.3.4.10.2 Dynamic Texture.

Dynamic texture patterns shall be provided which have the capability to move in any direction on the surface to which it is applied.

3.5.3.4.11 Shading.

The image generator shall support the smooth and curved surface polygon shading of terrain and cultural features and models. Shading shall not result in any Mach band or other color discontinuities in smooth surfaces.

3.5.3.4.12 Atmospheric and Meteorological Effects.

Simulation of atmospheric and meteorological effects shall be provided. Atmospheric and meteorological effects shall include clouds, overcast, fog, rain and snow. Atmospheric and meteorological effects shall be cognizant of the database area simulated, i.e. no rain inside of

tunnels or buildings. Precipitation effects shall be capable of accumulating on the ground over time to create rain puddles and snowdrifts. The color of the snow shall be white.

3.5.3.4.13 Illumination.

The IG shall be capable of illuminating the visual scene by both natural and unnatural sources.

3.5.3.4.13.1 Natural Illumination.

Natural illumination shall include day, dusk/dawn and night.

3.5.3.4.13.2 Light Points.

The IG shall be capable of producing light points for the visual enhancement of the database. The light point capacity shall be sufficient to meet the training requirements specified herein in concert with satisfying the image update rate specification under all specified scene load conditions in each channel.

3.5.3.4.13.3 Artificial Light Sources.

The IG shall be capable of illuminating data base surfaces and objects in a defined pattern and intensity fall-off from own vehicle head lights, driving lights and spotlights as applicable. The illumination pattern shall emanate from an appropriate position affixed to own vehicle and be steerable if applicable. Own vehicle illumination shall be controlled from the driver's compartment or ancillary station(s) as specified in the vehicle specific Appendices.

The IG shall be capable of generating simulated infra-red (IR) and night vision images for use by night vision equipment (including the DVE) and weapon sights as specified in the variant Annexes and vehicle specific Appendices.

The IG shall be capable of generating illumination patterns and intensities for other light sources including but not limited to, Semi-Automated Forces (SAF) and scripted vehicle headlights, stationary and vehicle-mounted spotlights, airport runway and taxiway lamps, billboard and marquee lights and lights within building windows. During night scenarios, SAF and scripted vehicle headlights shall not pop on or off as vehicles approach the ownship.

3.5.3.4.14 Transport Delay.

The visual system transport delay shall be minimized and must be sufficient to support the vehicle training tasks and satisfy the overall system transport delay.

3.5.3.4.15 Database Storage Capacity.

Although only one database shall be in use (selected) at any given time on any given visual system, each visual system shall have at minimum 2 GB storage capacity to simultaneously accommodate two complete databases. The system shall be capable of importing databases to support the training environment required by the user. The databases used in the system shall be Synthetic Environmental Data Representation and Interchange Specification (SEDRIS) compliant.

3.5.3.4.16 Scene Content Management.

Scene content management shall optimize the training value of the system by ensuring a maximum of needed visual cueing information for current operating conditions, and ensuring a minimum of scene discontinuities and other distracting image processing artifacts. The IG scene content management shall operate in a gradual, continuous manner to prevent rapid changes in level of detail, color and transparency for individual objects close enough to own eye point to cause distraction to the trainee.

3.5.3.4.17 Overload Prevention.

The system shall detect impending overload conditions prior to the occurrence of any scene discontinuity and shall adjust system parameters to maintain scene continuity. Both hardware and software scene content measures shall be used. Reduction in frame rate update shall be used as a last resort only until load management is accomplished, as long as the minimum refresh rate of 60Hz is met.

3.5.3.4.18 Sensor Simulation.

The IG shall simulate the imagery and characteristics of any sensors or electronically generated/modified image sources that are contained in the specific operational vehicle.

3.5.3.4.19 Image Generator Interface.

The CDT to image generator interface shall utilize the Common Image Generator Interface (CIGI) version 3.3 or later.

3.5.4 Audio System.

3.5.4.1 Communication Subsystem.

The CDT Communication Subsystem shall use Voice Over Internet Protocol (VoIP) or other open system standard protocol to emulate inter-vehicle and intra-vehicle communication

systems. The CDT Communication Subsystem shall have a dedicated channel for each simulated radio connection. The CDT Communication Subsystem shall be configurable to match the performance requirements for each vehicle variant radio communication system defined in a variant appendix. The CDT Communication Subsystem shall emulate a dedicated internal radio connection (intercom) based on the vehicle configuration defined in the variant appendix. The intercom shall connect the driver, Instructor and any ancillary crewmembers operating a single vehicle simulator. The CDT Communication Subsystem shall have the capability to emulate Push to Talk (PTT) if a radio connection is selected other than the intercom. The CDT Communication Subsystem shall have an emergency radio connection that can override all existing radio connections to communicate an emergency situation from any training position in the CDT system regardless of configuration or mode. The CDT Communication Subsystem shall provide an indicator on the main IOS screen to notify the instructor of incoming VoIP data.

3.5.4.1.1 IOS Communications.

The CDT shall have audio communications between the IOS (Instructor & observer) and the student stations (STS and ancillary stations). Communications shall be accomplished via headsets with boom microphones for the Instructor and observer. The communications in the STS and included ancillary stations shall be via operational Combat Vehicle Crewman (CVC) helmets or headsets as defined in the particular variant annex. The IOS headset shall be adjustable for head size with cushioned, closed ear (completely surrounds the ear) headset speaker enclosures with noise canceling speakers and adjustable, noise canceling microphones. The IOS shall have controls to adjust the volume levels of the Instructor and observer headset audio individually. When the CDT configuration is multiple STSs controlled by one IOS, communications from the instructor to the student at any STS or ancillary station shall be individually selectable or to all students at once. Communications between the students and the instructor shall be available at all times when the student station (STS or ancillary station) and IOS are powered-up. IOS communications shall be available anytime the IOS is powered-up.

3.5.4.2 Automated Cueing Subsystem (ACS).

Each CDT system shall include an Automated Cueing Subsystem (ACS). The ACS shall be capable of providing verbal or nonverbal instructions and cues, or both, to the student driver. The instructor shall have the ability to select the ACS operating mode (verbal, nonverbal or both) at the IOS whenever the CDT is powered on. When in verbal mode, the ACS shall play pre-generated or pre-recorded sound files to provide the student driver with scenario instructions, route and driving directions, and other verbal messages via the Communications System. When in verbal mode the ACS shall also provide corrective input to the student driver (e.g., excessive speed warning, deviating from prescribed course, incorrect CTIS mode) by playing pre-generated or pre-recorded verbal messages through the Communications System. When in nonverbal mode, the ACS shall provide route and driving directions, corrective input and other messages to the student driver by displaying transparent messages on the center screen of the

Visual Display Unit (VDU). When in nonverbal mode, the ACS shall not be capable of delivering pre-generated or pre-recorded verbal scenario instructions to the student driver. When in both mode, the ACS shall provide both verbal and nonverbal cues, instructions and messages to the student driver as described above. The instructor shall have the ability enable/disable the entire ACS or just the corrective messages at any time from the IOS.

When in either verbal or both mode, the ACS shall not stack duplicative cues in any type of queue or list. If a scenario instruction, route cue, driving direction or other waypoint triggered cue is playing and a new cue is triggered, the current cue shall cease playing and the newly triggered cue shall begin playing immediately. If a corrective cue is playing when a new corrective cue for the same corrective action is triggered, the current cue shall continue playing and the new cue shall be ignored or dropped. If a corrective cue is playing when a new corrective cue for a different corrective action is triggered, the current cue shall continue playing to the end and then the new cue shall begin playing.

3.5.4.3 Scoring Assistant Subsystem (SAS).

Each CDT STS shall include a Scoring Assistant Subsystem. The SAS shall provide verbal cues to the driver whenever a scoring violation has occurred, i.e. speeding. The Instructor shall have the option to select which scoring violations SAS will provide verbal notification for during scenario setup at the IOS Setup Window and a option to mute the verbal cues.

3.5.4.4 Sound Subsystem.

Each CDT system shall include a Sound Subsystem. The Sound Subsystem shall be capable of providing realistic sounds typically experienced by a driver operating a military vehicle singly and in convoy with other military vehicles in urban, rural, wooded, desert, seaport, airport, and motor pool or staging areas in all types of weather conditions and in both combat and non-combat operations.

Each CDT cab shall contain at least four full range speakers and a larger woofer. The Sound Subsystem shall be capable of providing sounds to all speakers.

All nonverbal sounds and aural cues shall be played through the Sound Subsystem. This includes all vehicle caution, warning, alert and malfunction alarms except when the sound is generated by and played from a speaker within a COTS dashboard or GFE vehicle panel (i.e. iDID) as specified in the cab requirements document. The Sound Subsystem shall have the capability of playing at least one hundred twenty eight (128) aural cues simultaneously (or 64 simultaneous if all require stereo playback) when required by the training conditions. The Sound Subsystem shall support prioritization of cues according to the vehicle being simulated as specified in the cab requirements document. The Instructor shall be able to adjust a master

volume control for all aural cue volumes sound using the Sound Subsystem software interface at the IOS.

The Sound Subsystem shall be capable of generating and storing sound libraries for each CDT cab and vehicle variant. Each sound library shall contain the set of sounds listed in the specific requirements document. The priority for each sound contained in a sound library shall be determined by the specific requirements document. A volume level for each individual sound shall be stored in the sound library. The Sound Subsystem shall include a GUI based sound library editing application. The sound library editing application shall allow a user to create new sound libraries, edit and delete existing libraries, add new sound files to a library, delete sound files from the library, adjust volumes for each sound file in the library, set and change priority for each sound file within a library, and organize sound files within the library. Each sound library shall be capable of storing at least 128 sound files. The Sound Subsystem shall allow the user to use standard sound files, user-configurable one shot sound files, user-configurable looping sound files and user-configurable complex (start – loop – stop) sound files.

3.5.5 Motion System.

3.5.5.1 Motion System Safety.

The area under and around the CDT motion platform shall be marked as safety zone and confine this area. The motion platform shall include a visual indicator that is activated when the motion platform is in use. This visual indicator shall be visible from the IOS and safety zone area. The system shall provide an emergency exit for the student to exit the driver compartment in case the motion platform freezes in an elevated position. A constant electric (trickle charger) battery backup will be provided for the motion system hardware. If main power is lost, the backup motion system battery shall park the motion system to the rest position for student egress. If the E-STOP is activated, the motion system shall settle to the parked position.

3.5.5.1.1 Interlocks.

The CDT architecture and motion system shall support the use of interlocks to prevent motion under unsafe conditions. Recommended locations for safety interlocks shall include, but are not limited to, all doors, seat belts and crewmember's safety harnesses, and hardware fixtures for the cab. Whenever an interlock is opened (i.e. door opened, seat belt or harness unbuckled), the CDT system shall immediately display a warning message at the IOS and shall cause the associated STS to halt all motion, slowly lower the motion platform to its rest position and pause the simulation.

3.5.5.1.2 Warning Visuals.

The CDT motion platform shall include two hard panel drop-down visual warning flags which shall be clearly visible and interlocks shall trigger whenever the two rearmost cab mounting bolts are not properly installed and tightened.

3.5.5.2 Vehicle Simulation.

At a minimum, the CDT shall simulate the vehicle variant dynamically to the level of detail required to support the training tasks for the specific variant. The CDT shall replicate the performance and handling of the actual vehicle and shall include any differences in performance/handling of the vehicle variations. Vehicle simulation shall include at a minimum the following vehicle components:

a) Engine
b) Fuel system
c) Power Train/Transmission Gearbox
d) Electrical system
e) Brakes
f) Steering
g) Accelerator
h) Suspension System
i) Hull
j) Communication system
k) Driving optics and field of view restrictions
l) Fire suppression system (excluding CDT TWV variants)
m) Clutch/Transmission Selector
n) Tires/track systems

3.5.5.3 Vehicle Dynamics.

The CDT shall simulate the dynamics of the actual vehicle variant with sufficient fidelity to adequately train students for the training requirements contained in the specific vehicle variant annex. The vehicle dynamics shall be based on simulations of the physical characteristics of the above vehicle components, and the interaction with the terrain topography, terrain obstacles (all natural and man-made), surface, and soil characteristics surrounding the simulated vehicle variant. The effects of the terrain shall be combined with the forces due to the mass and momentum of the hull to determine the vehicle performance using multiple points per vehicle ownship (wheels, tracks, etc.) interaction with the terrain database.

Vehicle dynamics shall include steering feel, steering response, acceleration, deceleration, braking and suspension response. The vehicle dynamics simulation shall provide models of the power train (e.g., engine, transmission, etc.), suspension (e.g., springing, damping, range of travel, etc.), and moments of inertia of each vehicle. The parameters for these models shall be evaluated at 60 Hz to assure smooth and accurate simulation. The system shall provide the sensor information and feel to the student when operating a plow or any other earth moving device. The modes to be simulated shall include normal operation, malfunctions, emergency conditions, vehicle motion along and about all axis, rate of turn, acceleration, speed, angular velocity, transmission selection, and terrain surface/conditions.

The CDT shall simulate vehicle crashes and collisions. All collisions of own-vehicle with moving models, cultural features and other database features shall be detected at the point of collision. The collision object type, vehicle speed and direction shall be sensed and processed at a rate sufficient to meet the system transport delay/synchronization requirements. CDT system shall provide an appropriate aural, vehicle dynamic simulation, motion and visual response to all crashes and collisions depending on the object type and vehicle speed.

The vehicle dynamics model shall also respond to nearby explosions. The magnitude of the response shall be a function of explosion size and location (distance and azimuth). The vehicle dynamics simulation results shall drive the visual displays, motion cues, aural cues, and instrumentation in the driver compartment. The vehicle dynamic performance shall be modeled based on data provided by Government Subject Matter Experts.

3.5.5.4 <u>Motion Simulation.</u>

The motion capability provided shall simulate the motion (pitch, roll, yaw, heave, surge, and sway) associated with the operation of the actual vehicle variant with sufficient fidelity to adequately train vehicle students. In addition, at a minimum, the CDT shall also provide simulated motion associated with the following when applicable to a variant: acceleration; deceleration; braking; rates of turn; collisions; skids; banks; turns; sluggish steering; pivot steering; loose or thrown tracks; tire blowout; loss of steering; loss of brakes; brakes locked; transmission lock-up; engine overspeed; clogged filters (oil, air, fuel); terrain following; speed; traction; and suspension and motion resulting from terrain surface conditions (e.g., hard, gravel, mud, sand, ice, snow, and water). In addition, interactions with the environment and appended equipment (e.g., mud, snow, ice, rain, collisions, plows, rollers, etc.) shall be appropriately simulated.

The displayed visual image and the driver compartment/motion platform movement shall be synchronized to produce a realistic simulation of the vehicle in motion over roads or terrain. In addition, the driver compartment, its enclosure and the motion platform shall allow for the

reconfiguration/removal/replacement of the specific module for future updates/reuse. Performance of the aural cues and visual display scenes shall be coordinated with movement of the motion platform. The physical movement of the motion platform shall be determined by computations based upon the actual vehicle variant driver compartment motion (pitch, roll, yaw, heave, surge, and sway), and shall correspond in real-time to driver actions and terrain/environment/vehicle interaction.

The sensation of motion shall be representative of the sensations experienced in the actual vehicle. The acceleration of the CDT's driver compartment in any axis should correspond to the actual vehicle acceleration experienced under similar ride and configuration conditions. Representative vibrations should also be simulated by the CDTs. Vibration cues shall be generated at frequencies approximating those experienced in the vehicle variant. Such vibrations shall represent normal and abnormal vehicle vibration, control-induced changes of the vehicle, oscillations, rough/smooth terrain characteristics, vehicle impact, and brake application/release. The CDT motion simulation shall minimize the effect of the students to experience vertigo, motion sickness, or simulator sickness.

The motion platform shall be electrically actuated.

3.5.6 Steering Force Feedback Subsystem.

The CDT shall include a high-bandwidth torque loop steering force feedback subsystem. The model for the steering force feedback shall simulate the vehicle being simulated and the interaction of the terrain force feedback to be applied.

3.5.7 Training Environment.

CDT shall include an interactive training environment. The interactive training environment shall consist of terrain databases, models and environmental/special effects which provide a realistic virtual environment to the student driver.

3.5.7.1 Terrain Databases.

Each CDT shall contain all existing CDT terrain databases and any new CDT terrain databases required by the specific product requirements specification. Each CDT terrain database shall be a continuous representation of terrain elevation, terrain features (trees, rivers, soil type, etc.) and cultural data. Each CDT terrain database shall be required to smoothly blend the terrain and the features comprising the database (e.g., connect and/or continue rivers, roads, power lines and hilly areas) to avoid unrealistic discontinuities. Each CDT terrain database shall be modeled at a resolution that is consistent with the type of terrain being depicted and which provides the appropriate terrain/vehicle interaction for the type of terrain being traversed. In areas of some

regions, this will be equivalent to Digital Terrain Elevation Data (DTED) level 5 (1m), in other areas DTED level 2 (30m) or 1 (1km). Each CDT terrain database shall contain a database surround area of low resolution, generic terrain that will extend out to the visual range beyond the edge of the primary training environment. The database surround shall prevent seeing the edge of the database.

3.5.7.1.1 CDT Terrain Attributes (Legacy and New databases).

Each database shall have all terrain skin surface polygons properly flagged as terrain and attributed with CDT-compatible basic terrain types. A Traction Coefficient (TC) parameter defines the amount of traction between a normal rubber tire on an average mid-sized automobile and a particular type of terrain under the environmental conditions described. Perfect traction would be 1.0 and no traction is 0.0. The terrain TC shall be alterable during runtime via the Environmental Controls Window. A slider bar shall be available to raise or lower the TC (100% to 0%) of all terrain tiles. For example, when the TC slider is moved to the left, the TC factor of each terrain tile shall be lowered by the same percentage and when the slider is moved to the right, the roughness factor of each terrain tile shall be increased.

The Roughness Factor defines the probability of a driver receiving a noticeable jerk through the steering wheel force feedback system and vehicle dynamics due to irregularities in the terrain surface such as potholes, rocks, road seams, ruts and other similar irregularities. For the Roughness Factor, 0.0 indicates a very smooth, glasslike terrain with no irregularities and 1.0 represents an extremely rough, impassable terrain. The terrain roughness factor shall be alterable during runtime via the Environmental Controls Window. A slider bar shall be available to raise or lower the roughness factor of all terrain tiles equally. For example, when the roughness slider is moved to the left, the roughness factor of each terrain tile shall be lowered by the same percentage (i.e., less jerk in the steering wheel) and when the slider is moved to the right, the roughness factor of each terrain tile shall be increased.

3.5.7.1.2 Existing CDT Terrain Databases.

The CDT shall include the following existing CDT terrain databases:

a) CDT Common. The CDT Common database contains a mountain region, a rolling hills region, a steep hills region, a plains region, a village region, a desert region, an urban region, a motor poll and a highway.

b) Ft. Leonard Wood Test Area-244 (TA-244). The CDT TA-244 database contains areas of different terrain types (dirt, mud, cultivated field, sand, etc) and terrain features (trenches, bomb craters, minefields) needed to train drivers and commanders of the Assault Breacher Vehicle (ABV) and the Joint Assault Bridge (JAB) to properly employ their vehicle equipment using the CDT Tank Engineering Variant (TEV).

c) Afghanistan. The CDT Afghanistan database is a geospecific database containing an area of Afghanistan. It is used primarily to familiarize drivers of the Mine Resistant Ambush Protected (MRAP) All Terrain Vehicle (M-ATV) with the types of terrain they will encounter prior to deployment into the Afghanistan Theater.

d) Ft. Bragg Driver Training Course Databases. The CDT Ft. Bragg databases are geospecific databases containing an area of Ft. Bragg NC. Each database contains a separate Driver Training Course used primarily to familiarize drivers of the Mine Resistant Ambush Protected (MRAP) family of vehicles with the full extent of the vehicle's capabilities to traverse various terrain types and obstacles.

e) Ft Benning Drive Training Course: The CDT Ft. Benning database is a geospecific database containing an area of Ft. Benning GA. The database contains a beginning and advanced Driver Training Course used primarily to familiarize the full extent of the vehicle's capabilities to traverse various terrain types and obstacles.

3.5.7.1.3 New CDT Terrain Databases.

The CDT architecture shall allow the integration of additional SE Core compliant terrain databases into the CDT Scenario Generation System (SGS) and runtime software. Any new terrain databases developed for use on the CDT shall be submitted to SE Core for evaluation thirty (30) calendar days prior to CDT acceptance testing. Any new terrain databases developed for use on the CDT shall be integrated into the SGS. The CDT synthetic environment shall utilize the ERC software services from the SE Core Virtual OneSAF baseline. The Environmental Runtime Component (ERC) component shall replace all CDT legacy Height Above Terrain (HAT) and Collision capabilities. Unless superseded by a specific requirements document, all new CDT terrain databases shall meet the following requirements.

3.5.7.1.3.1 Location and Extent.

Each database shall have an extent and location as stated in the product requirements specification. Unless otherwise specified, the default size for all new CDT terrain databases shall be 20km x 20km.

3.5.7.1.3.2 Source Data.

Each database shall be built using geospecific source data. Digital elevation data, satellite and any other available imagery, and Geographical Information Systems (GIS) vector data for the Area Of Interest (AOI) shall be obtained from Government approved data sources with Government purpose rights. The digital elevation data shall have a resolution equal to or greater than DTED Level 2 (30 meter grid spacing). All imagery shall have a resolution of at least 1 meter per texel. Any discrepancies in the source data shall be corrected to ensure that vector data for lineal features such as roads are correlated with the imagery. All source data shall be

enhanced with SE Core compliant attributions. All corrected and finalized source data (original and SE Core enhanced) shall be delivered along with the final terrain database.

3.5.7.1.3.3 Geo-specific 3D Features.

Each database shall contain geo-specific 3D models (i.e. buildings and other structures) for which suitable photo texture imagery is available. All other 3D features in the AOI shall be populated in the terrain utilizing geo-typical library models. All 3D features in the database shall have bounding box collision volumes with CDT-compatible collision result codes assigned (e.g. soft vs. hard collision volumes). Unless otherwise specified, all bridges in new CDT terrain databases shall have a posted weight limitation sign and shall stress, sway and then collapse if a vehicle having a vehicle weight greater than the weight limitation attempts to cross the bridge.

3.5.7.1.3.4 Performance Characteristics.

Each database shall be built with a nominal visibility range of 5000 meters. Each database shall be optimized to run on all image generators used in the CDT product line at a frame rate of 60Hz with at least 30% spare rendering capacity using a per-channel field of view of 60 (H) x 45 (V) degrees and 5000 meter visibility range.

3.5.7.1.3.5 Terrain Attributes.

Each database shall have all terrain skin surface polygons properly flagged as terrain and attributed with CDT-compatible basic terrain types as defined in Table 2 'CDT Terrain Types'. The CDT Terrain Table shall be used to define the base values for each terrain tile.

Table 2. CDT Terrain Types

Terrain Type	Location/Type	Environmental Conditions **	Traction Coefficient	Roughness Factor *
Concrete (dry)	Primary Roads, Expressway, Urban Roads, 4 lane roads, sidewalk	Dry, 0% rain	0.7	0.05 - 0.45 0.10
Concrete (damp)	Primary Roads, Expressway, Urban Roads, 4 lane roads, sidewalk	Light rain, 1%-24%	0.65	0.05 - 0.45 0.10
Concrete (wet)	Primary Roads, Expressway, Urban Roads, 4 lane roads, sidewalk	Medium rain, 24%-74%	0.55	0.05 - 0.45 0.10
Concrete (very wet)	Primary Roads, Expressway, Urban Roads, 4 lane roads, sidewalk	Heavy rain, > 75%	0.5	0.05 - 0.45 0.10
Bridge (dry)	All bridges	Dry, 0% rain	0.7	0.05 - 0.45 0.10
Bridge (wet)	All bridges	Raining, 1-100% rain	0.35	0.05 - 0.45 0.10
Bridge (ice)	All bridges	Snowing, 1-100% snow, 33% chance of polygon being ice	0.07	0.05 - 0.45 0.10

Terrain Type	Location/Type	Environmental Conditions **	Traction Coefficient	Roughness Factor *
Asphalt (dry)	Secondary Roads, Motorpool, Docks, 2 lane roads	Dry, 0% rain	0.5	0.05 - 0.45 0.10
Asphalt (damp)	Secondary Roads, Motorpool, Docks, 2 lane roads	Light rain, 1%-24%	0.45	0.05 - 0.45 0.10
Asphalt (wet)	Secondary Roads, Motorpool, Docks, 2 lane roads	Medium rain, 24%-74%	0.4	0.05 - 0.45 0.10
Asphalt (very wet)	Secondary Roads, Motorpool, Docks, 2 lane roads	Heavy rain, > 75%	0.35	0.05 - 0.45 0.10
Cobblestone (dry)	European cobblestone roads, brick roads, closely packed stones	Dry, 0% rain	0.5	0.20 - 0.55 0.35
Cobblestone (damp)	European cobblestone roads, brick roads, closely packed stones	Light rain, 1%-24%	0.4	0.20 - 0.55 0.35
Cobblestone (wet)	European cobblestone roads, brick roads, closely packed stones	Medium rain, 24%-74%	0.3	0.20 - 0.55 0.35
Cobblestone (very wet)	European cobblestone roads, brick roads, closely packed stones	Heavy rain, > 75%	0.3	0.20 - 0.55 0.35
Rocky terrain (dry)	Off road rocky mountain	Dry, 0% rain	0.5	0.70 - 0.95 0.70
Rocky terrain (damp)	Off road rocky mountain	Light rain, 1%-24%	0.4	0.70 - 0.95 0.70
Rocky terrain (wet)	Off road rocky mountain	Medium rain, 24%-74%	0.3	0.70 - 0.95 0.70
Rocky terrain (very wet)	Off road rocky mountain	Heavy rain, > 75%	0.3	0.70 - 0.95 0.70
Trail (dry)	Off road trails in dirt or grass	Dry, 0% rain	0.5	0.25 - 0.45 0.30
Trail (damp)	Off road trails in dirt or grass	Light rain, 1%-24%	0.45	0.25 - 0.45 0.30
Trail (wet)	Off road trails in dirt or grass	Medium rain, 24%-74%	0.4	0.25 - 0.45 0.30
Trail (very wet)	Off road trails in dirt or grass	Heavy rain, > 75%	0.35	0.25 - 0.45 0.30
Grass (dry)	Off road without trails	Dry, 0% rain	0.45	0.20 - 0.40 0.30
Grass (damp)	Off road without trails	Light rain, 1%-24%	0.4	0.20 - 0.40 0.30
Grass (wet)	Off road without trails	Medium rain, 24%-74%	0.3	0.20 - 0.40 0.30
Grass (very wet)	Off road without trails	Heavy rain, > 75%	0.25	0.20 - 0.40 0.30
Gravel, loose rocks (dry)	Off road rocky areas with or without trails, rocky road	Dry, 0% rain	0.4	0.20 - 0.55 0.35
Gravel, loose rocks (damp)	Off road rocky areas with or without trails, rocky road	Light rain, 1%-24%	0.35	0.20 - 0.55 0.35
Gravel, loose rocks (wet)	Off road rocky areas with or without trails, rocky road	Medium rain, 24%-74%	0.25	0.20 - 0.55 0.35
Gravel, loose rocks (very wet)	Off road rocky areas with or without trails, rocky road	Heavy rain, > 75%	0.2	0.20 - 0.55 0.35

Terrain Type	Location/Type	Environmental Conditions **	Traction Coefficient	Roughness Factor *
Dirt (dry)	Off road solid packed dirt areas with or without trails, Afghan database dirt roads	Dry, 0% rain	0.5	0.25 - 0.45 0.30
Dirt (damp)	Off road solid packed dirt areas with or without trails, Afghan database dirt roads	Light rain, 1%-24%	0.45	0.25 - 0.45 0.30
Dirt (wet)	Off road solid packed dirt areas with or without trails, Afghan database dirt roads	Medium rain, 24%-74%	0.3	0.25 - 0.45 0.30
Dirt (very wet)	Off road solid packed dirt areas with or without trails, Afghan database dirt roads	Heavy rain, > 75%	0.15	0.25 - 0.45 0.40
Cultivated field (dry)	Off road plowed, loose dirt areas with or without trails, soft shoulder	Dry, 0% rain	0.4	0.35 - 0.55 0.45
Cultivated field (damp)	Off road plowed, loose dirt areas with or without trails, soft shoulder	Light rain, 1%-24%	0.35	0.25 - 0.45 0.45
Cultivated field (wet)	Off road plowed, loose dirt areas with or without trails, soft shoulder	Medium rain, 24%-74%	0.25	0.25 - 0.45 0.45
Cultivated field (very wet)	Off road plowed, loose dirt areas with or without trails, soft shoulder	Heavy rain, > 75%	0.15	0.25 - 0.45 0.45
Mud (base)	Basic muddy areas with or without trails	Dry, 0% rain	0.4	0.25 - 0.45 0.40
Mud (damp)	Muddy areas with or without trails	Light rain, 1%-24%	0.35	0.25 - 0.45 0.40
Mud (wet)	Muddy areas with or without trails	Medium rain, 24%-74%	0.25	0.25 - 0.45 0.40
Mud (very wet)	Muddy areas with or without trails	Heavy rain, > 75%	0.15	0.25 - 0.45 0.40
Hard Sand (dry)	Packed sand areas with or without trails	Dry, 0% rain	0.4	0.05 - 0.45 0.15 **
Hard Sand (damp)	Packed sand areas with or without trails	Light rain, 1%-24%	0.35	0.05 - 0.45 0.15
Hard Sand (wet)	Packed sand areas with or without trails	Medium rain, 24%-74%	0.4	0.05 - 0.45 0.20
Hard Sand (very wet)	Packed sand areas with or without trails	Heavy rain, > 75%	0.4	0.05 - 0.45 0.30
Loose Sand (dry)	Loose sand areas with or without trails, dune sand	Dry, 0% rain	0.15	0.20 - 0.45 0.30 **
Loose Sand (damp)	Loose sand areas with or without trails, dune sand	Light rain, 1%-24%	0.25	0.20 - 0.45 0.30
Loose Sand (wet)	Loose sand areas with or without trails, dune sand	Medium rain, 24%-74%	0.4	0.15 - 0.45 0.20
Loose Sand (very wet)	Loose sand areas with or without trails, dune sand	Heavy rain, > 75%	0.45	0.05 - 0.45 0.30
Swamp (All)	Swamp areas with or without trails	All weather conditions	0.15	0.05 – 0.15 0.05
Snow (dry)	Off road trails in snow areas	Dry, 0% snow	0.25	Same as underlying terrain roughness

Terrain Type	Location/Type	Environmental Conditions **	Traction Coefficient	Roughness Factor *
Snow (wet)	Off road trails in snow areas	All snowing conditions	0.2	Same as underlying terrain roughness
Ice (dry)	All roads in snow areas	Dry, 0% snow, 5% chance of polygon being ice	0.07	0.05 – 0.15 0.05
Ice (wet)	All roads in snow areas	Snowing, 1-100% snow, 12% chance of polygon being ice	0.07	0.05 – 0.15 0.05
River Ford	All water covered fording areas on trails	Equivalent to Trail (wet)	0.4	0.25 - 0.45 0.30
River Ford Shore	All shore areas leading into fords	Equivalent to Trail (damp)	0.45	0.25 - 0.45 0.30
River	All non-fordable areas on rivers	Equivalent to Water	0	0.00
Water (impassable)	All lakes and ocean areas	Impassable to wheeled and traced vehicles	0	0.00

NOTES:

1. The CDT Legacy basic terrain types are shown in a bold font
2. The Roughness Factor provides three values that represent the amount of vibration and jerk a driver would feel in the steering wheel and vehicle handling when travelling over that terrain type. The first two numbers represent a range for that terrain type with the lowest value representing the smoothest of that terrain type and the larger number representing the roughest. The third number represents the nominal or most expected value for that terrain type.
3. Since most roads in the United States are well-maintained, a nominal value of 0.10 might apply to all concrete and asphalt terrain tiles in a U.S. database but roads in foreign countries may be much rougher and require a nominal value throughout the database of 0.25 or higher.

3.5.7.1.3.6 <u>Testing.</u>

Each database shall be tested to assess the visual appearance, performance, and functionality of the terrain database. The test procedure shall include tests for:

a) Freedom from distracting visual artifacts (e.g. missing or flashing polygons, noticeable texture discontinuities)

b) Ownship and other entities conforming properly to the terrain surface

c) Ownship colliding properly with 3D objects in the terrain

d) Vehicle ownship model responding appropriately to varying terrain types in the terrain

e) Speed limit related warnings and scoring deductions generated as expected

f) IG render load within prescribed limits

3.5.7.1.3.7 Deliverables.

Each new terrain database and all associated Three Dimensional (3D) models shall be delivered in OpenFlight format, version 15.7. All texture files shall be delivered in Silicon Graphics Image (SGI) Red, Green, and Blue (RGB) format. In addition to OpenFlight, the following derivative terrain products shall be delivered:

a) Binaries (.epm) compatible with EP runtime v2.3.8

b) Correlated Objective Terrain Format (OTF) database with OneSAF extensions

c) CDT legacy Height Above Terrain (HAT) and collision databases or updates to the CDT ERC component module

d) CDT navigational database, which will contain, at a minimum, lane and speed limit data

e) Top-down 2D map image for use in the CDT IOS in .BMP format with a minimum resolution of 2048 x 2048 pixels (Plan View Display format)

f) OpenSceneGraph (.ive) database suitable for use in the CDT Scenario Generation System (SGS).

g) Corrected and finalized source data with SE Core compliant attributions

3.5.7.2 Environmental Control System.

CDT shall include an Environmental Control System (ECS). The ECS shall allow an instructor operator to alter the environmental conditions of a scenario during runtime via an interactive GUI window. When in network mode, only the Master IOS shall be able to alter the environmental conditions for the scenario.

3.5.7.3 Terrain Services.

The CDT architecture shall include a Terrain Services component.

3.5.7.3.1 Dynamic Terrain.

A Dynamic Terrain capability shall exist and be supported across all of the CDT system products including: scenario generation, terrain attribution, terrain services, IOS topographics, stealth displays and OneSAF. For example, all CDT entities (including automonus traffic) react to elevation changes, while IOS topographic map shall display a correlated visual representation of dynamic terrain modifications.

Each CDT terrain database shall include data parameters which define the physical makeup and properties of the underlying soil. The data parameters shall define the type of soil or terrain (i.e. dirt, grass, mud, sand, swamp, gravel, loose rocks, asphalt, and concrete) comprising the surface layer and underlying soil layers or horizons of each area. The data parameters shall define the

soil to a depth of at least 15 feet. The data parameters shall be sufficiently detailed to define a physics-based model of the terrain and soil types which will allow realistic interaction with construction and engineering equipment including, but not limited to explosive charges, mines, shovels, blades, plows, buckets, scoops and rollers. The data parameters shall be sufficiently detailed to allow the terrain to be realistically reconfigured and/or modified in real time during execution of a CDT scenario. The simulated terrain shall be capable of being placed (i.e. stockpiled), graded with spoilage to the side of a grader or dozer blade, rolled, moved, pushed, lifted, dropped, compacted, crushed, deformed, excavated/dug, trenched, collapsed, exploded and penetrated (i.e. as by a lane marking system lane marker) as appropriate. The data parameters shall be sufficiently detailed to allow any of the soil or terrain types to be stockpiled to a height of 15 feet. Visual portrayal of all terrain alterations and modifications shall occur in real time. Alterations and modifications to the simulated terrain shall yield a complete set of database definition data including but not limited to height above terrain, texture, and color. Modified terrain shall produce the correct dynamic response from scripted entities, SAF entities and ownships which encounter the altered terrain. The data parameters shall include parameters that allow the physical properties (i.e. density, fluidity, and traction) of the soil to be dynamically altered in real time by environmental conditions such as snow, rain, wind and the weight of equipment rolling over or being placed on the terrain.

3.5.7.3.2 Environmental Effects.

Environmental effects represent the physical changes which occur to the terrain properties due to changes in the environmental conditions, i.e. changes in traction due to rain. The Terrain Services component shall alter the visual appearance and physical properties of the terrain based on the environmental conditions as set by the ECS.

Examples of objective requirements for environmental effects which are not required at this time include:

a) Flooding – the ability to allow stagnant water to collect in a low-lying location over time ranging from small puddles up to intersections and underpasses filled with water several feet deep. Vehicle operations and movement in flooded areas should be treated as fording operations.

b) Flash flooding – the ability to simulate the effects of rapidly rushing water in narrow channels including, but not limited to, a wall of rushing water flowing with sufficient force to displace, overturn or carry a vehicle several yards downstream.

3.5.7.3.3 Environmental Runtime Component (ERC).

The CDT software shall include the SE Core Virtual OneSAF ERC.

The ERC Earth Skin State Application Programming Interface (API) shall be used to provide information about the terrain at a particular location including but not limited to the unit normal, trafficability code, and height of terrain.

The ERC Line of Sight API shall be used to determine whether or not a clear, unobstructed line of sight exists between a viewpoint and a target point. Data from the ERC Line of Sight API shall be used to provide input to SAF entities (including autonomous traffic and all human models) to determine if an entity can "see" other entities or terrain features and react appropriately to them.

The ERC Routing API shall be used to determine routes for SAF entities including autonomous traffic. Routes for SAF entities shall be recalculated using the Routing API whenever a dynamic change to the environment occurs including but not limited to explosions which create craters, setting roadblocks or barricades, digging or creation of fighting positions and building damage which results in creation of rubble piles.

The ERC Ultra High Resolution Building (UHRB) Building Route API shall be used to determine routes through UHRBs for autonomous human models, interactive human models and ground guides. For ground guides, the ERC UHRB Building Route API shall be used to determine the ground guide path when guiding a vehicle through a motor pool maintenance bay.

The ERC Features API shall be used to retrieve features in a particular area and also to create, commit, modify, or remove features during runtime. The Environment Data Model (EDM) shall be used to define all of the features and feature attributes the ERC supports. If additional features must be developed to meet CDT training objectives, the new features shall be integrated into the EDM and Features API. Then provided these features back to PM OneSAF with full Government rights. The Features API shall be used to support both static and dynamic features.

The ERC Air Ocean Space (AOS) API shall be used to provide weather, illumination, sun state and transmittance data to the image generation systems. The AOS API shall support both static and dynamic weather. For dynamic control of weather during runtime, the AOS API shall be integrated with the existing CDT weather, visibility and illumination controls.

The ERC Transmittance API, a subsystem of the AOS API, shall be used to determine the effects of weather and other obscurants on the capabilities of vehicle sensor systems including but not limited to the DVE and the Rear View Sensor System (RVSS).

3.5.7.4 Models.

3.5.7.4.1 Interactive Human Models.

The CDT shall use Interactive Human Models selected from the SECORE-2009-CM2-0001_CM2_Master_List_Status, the Common Moving Models (CM2) list. If a specific model is not available in the CM2 list, a new model shall be developed in accordance with SECORE-2009-CM2-0003_CM2 Process. At a minimum, a Vehicle Description Document (VDD) and an OpenFlight specification IAW BG0001-CMMOS-001 Rev. D shall be developed for any new models. Any new model shall be submitted back into CM2 for future use.

3.5.7.4.1.1 Ground Guide.

A host controlled, animated, interactive human model(s) shall be provided that gives visual hand and arm signals to direct vehicle movement or vehicle equipment configuration. The animated, interactive human model(s) shall have the capability of executing a minimum of 30 animated, smooth, human like, realistic hand and arm signals that correspond to real-world directions when performing vehicle maneuvering or configuration tasks. Interactive human model(s) positioning relative to the vehicle and signals being executed shall be associated with the vehicle being simulated. The signals shall include both day and night (military flashlight in hand) military hand and arm signals.

The interactive human model(s) signals shall be interactively controlled by evaluating the simulated vehicle's movement and position relative to a pre-defined desired path and the position relative to the interactive human model. The pre-defined path that the vehicle is supposed to follow shall have a tolerance depending on the location of the vehicle in the database. In areas that have other objects such as a motor pool stall openings, a row of vehicles, a tight passage between objects, etc., the actual vehicle location compared to the pre-defined path shall have a tolerance of +/- six (6) inches. In less dense, open areas, the deviation of the vehicle from the pre-defined path shall have a tolerance of +/- three (3) feet. The interactive human model(s) to vehicle positioning shall be evaluated for distance and offset (position in the field of view). Parameters for distance and offset shall be configurable for the vehicle being simulated. The frequency of interactive human model halts and repositions shall be minimized in order to maintain realistic progress for vehicle movements. When the simulated vehicle moves outside the acceptable tolerance or the interactive human model is outside the acceptable field of view, the interactive human model shall halt the movement and refer the student to the instructor. The interactive human model movement animations such as walking and turning shall be realistic. The interactive human model path shall not go through any database object. When directing a vehicle to back up, the front (visible) interactive human model shall act as if receiving signals from a second, rear ground guide. The simulated interactive human model(s) shall conduct safe, procedurally correct actions.

For vehicle configuration tasks, the interactive human model(s) shall be correctly positioned in front of the vehicle and shall provide hand and arm signal configuration commands consistent with the vehicle, vehicle equipment and equipment status. When multiple steps are required for equipment configuration, the interactive human model shall provide commands only when prerequisite actions have been accomplished.

For convoy commands, the animated human model(s) shall portray a lead vehicle commander, typically from the waist up in the lead vehicle hatch or waving out the passenger window . The lead vehicle commander shall be able to give hand signal to vehicles following the lead vehicle. The lead vehicle commander's hand signals or mounted signals shall be in response to scenario requirements and triggered at specific points on the lead vehicle path.

3.5.7.4.2 Moveable Objects.

The CDT architecture shall support the inclusion of moveable objects within CDT training scenarios. Moveable objects shall be defined as any object which can be moved, pushed, lifted, placed, or transported during runtime by another entity which has the capability to perform that action of that object. The CDT Scenario Generation System shall support the initial placement of moveable objects within a scenario during scenario development.

3.5.7.4.3 Relocatable Objects.

The CDT architecture shall support the insertion of relocatable objects within CDT training scenarios during scenario runtime. Relocatable objects shall be defined as any object or feature which can be created, placed, modified, or removed in a scenario during runtime. Examples of relocatable objects include but are not limited to jersey barriers, shipping containers, barricades, buildings, static vehicles, craters, fighting positions and debris piles. The CDT Scenario Generation System shall support the initial placement of relocatable objects within a scenario during scenario development. The CDT IOS software shall support the creation, placement, modification, or removal of relocatable objects during scenario runtime.

3.5.7.4.4 Other Entities.

The CDT shall achieve interoperability and fair fight with Current Force, Future Force, and future virtual simulators by providing a common synthetic environment, common virtual coordinate system, Common Moving Models (CM2), and common Semi-Automated Force (SAF)/Computer Generated Force (CGF) provided by SE Core.

3.5.7.4.4.1 Common Moving Models (CM2).

The CDT shall use visual models selected from the SECORE-2009-CM2-0001_CM2_Master_List_Status, the Common Moving Models (CM2) list. If a specific model is

not available in the CM2 list, a new model shall be developed in accordance with SECORE-2009-CM2-0003_CM2 Process. At a minimum, a Vehicle Description Document (VDD) and OpenFlight specification shall be developed for any new models. Any new model shall be submitted back into CM2 for future use.

3.5.7.4.4.2 Semi-Automated Forces (SAF).

The CDT shall use the SE Core Virtual OneSAF baseline to meet system requirements. The design shall support and be functional with the capabilities of OneSAF. For those requirements not met by OneSAF and to enhance the SAF capabilities of the simulator, the contractor can supplement with an alternate SAF system.

SAF entities shall follow the road network to include paved and unpaved roads with roads varying in size from simple trails to a four lane freeway/autobahn. SAF entities shall obey vehicle traffic regulations for the terrain specified. SAF entities shall include pedestrians (friendly, threat, and neutral forces). These entities shall support additional distractions for the crew, such as, weapons effects (including firing on the own vehicle to include hits and near misses or firing weapons into the air), pedestrians or children walking or running into the street, and aggressive driving (speeding, weaving in and out of traffic, cutting in front of the own vehicle).

The CDT shall provide real-time color computer generated visual images supported by OneSAF and SE Core of sufficient detail to adequately train vehicle crews. The visual simulation shall provide essential cues required by the crew member(s) to assess simulated vehicle position and velocity, characteristics of the terrain, and other information necessary to operate the module(s)/appended subsystem(s) in training scenarios.

SAF entities shall include static and dynamic models, and any associated software required to simulate the SAF entity appended subsystem(s) visual/sensor scene environment. Critical SAF entities include but are not limited to SE Core CM2 moving models, realistic high resolution animation, dismounted human models, particle based special effects, and animation shall be rendered in high level of detail to facilitate Warfighter's immersion in the synthetic environment and maximize training objectives.

3.5.7.4.5 Moving/Repositionable/Switchable Models, Animations & Special Effects.

The IG shall be capable of displaying a combination of dynamic and static models, as appropriate, to simulate the full complement of vehicles, trailers, buildings, bridges, and fixed and movable obstacles, realistically moving human models, animations and special effects with no performance degradation. A minimum of 100 dynamic (six degree of freedom) models, animations and special effects shall be provided. It shall be possible to reassign the moving coordinate systems to different displayed objects.

3.5.7.4.5.1 Traffic Models.

Urban traffic on highways and secondary roads shall be provided to aid in training convoy tasks and defensive driving tasks.

3.5.7.4.6 Terrain Following.

The attitude of all visible land vehicles shall reflect the terrain surface shape and orientation based on the elevation at a minimum of three support points. For own vehicle, contact point elevations and underlying soil types shall be at a sufficient rate to meet the vehicle dynamics requirements and the terrain and object interaction requirements for the type of vehicle. Own-vehicle attitude shall reflect the surface orientation.

3.5.7.4.7 Weapon Impact Detection.

All weapon impact points on the own vehicle shall be detected. Other incoming weapons effects scripted and/or IOS triggered such as artillery explosions, IED (buried, exposed, etc.), cannon fire, missiles, etc. shall be random in location, size, effect and number (i.e., single or multiple depending on weapon) and shall be designed as distractions to the student with visual, motion and aural cues.

3.5.7.4.8 Training Environment Data Communications.

When in stand-alone mode, the CDT system shall use a combination of Distributed Interactive Simulation (DIS), Virtual Distributed Interactive Simulation (V-DIS) and internal API function calls to communicate simulation and entity data between entities, objects and ownships.

When in network mode, each CDT system shall use a combination of Distributed Interactive Simulation (DIS) and Virtual Distributed Interactive Simulation (V-DIS) to communicate simulation and entity data between CDT systems.

3.6 General Hardware and System Requirements.

This section contains those hardware and systems requirements which are applicable to each CDT system as a whole regardless of its configuration.

3.6.1 Safety.

3.6.1.1 Emergency Buttons.

Emergency stop (E-STOP) and emergency power off (EPO) buttons shall be provided at the instructor station(s) and trainee station(s) as specified in the appropriate sections below. The E-

STOP and EPO buttons shall be located in their positions to minimize accidental and/or unwanted activations. Activation of an E-STOP button shall cause only the associated STS to halt all motion, slowly lower the motion platform to its rest position and pause the simulation. Activation of an EPO shall immediately remove all power from the CDT system (except the motion platform(s) which shall retain battery power) regardless of the system's configuration, halt all motion and slowly lower the motion platform(s) to the rest position. The EPO switch shall be capable of being connected to a facility power off shunt trip. Each of the emergency buttons shall be legibly and permanently marked to indicate its purpose.

3.6.1.2 Temperature Sensing Alarms.

All heat producing equipment cabinets shall be equipped with temperature sensing devices, which shall be integrated into an over-temperature alarm system. The IOS station shall be given a status when an over-temperature alarm has triggered.

3.6.1.3 Smoke Detectors.

All enclosed areas where personnel are working or training shall be equipped with smoke detectors, which shall be capable of being integrated into a fire alarm system. At a minimum, at least one smoke detector shall be located in each cab, STS area of an MTF and each IOS area of an MTF.

3.6.1.4 Nonskid Surfaces.

Surfaces where personnel normally step during trainer use and maintenance shall be inherently nonskid surfaces, or shall be covered with nonskid paint or material.

3.6.1.5 Safety Markings.

Danger, caution, and warning signs, labels, and markings shall be used to warn of specific hazards such as voltage, current, thermal, or physical hazards. Method, permanency, and legibility of equipment safety markings shall be as specified in applicable Government and industry standard safety documents. Guards, barriers, and access doors, covers, or plates shall be marked to indicate the hazard which shall be present upon removal of such devices. These markings shall be placed in a manner, so they are still visible when the barrier or access door is removed. Additionally, hazards internal to units shall be marked adjacent to hazards if they are significantly different from those surrounding items.

Physical hazards shall be marked in accordance with ANSI Z53.1-79.

Voltage hazards shall be marked in accordance with ANSI Z35.1-72, and ANSI Z35.4-73.

Laser labels shall be in accordance with 21 CFR 1040.

3.6.2 Human Engineering.

The CDT shall be designed to enhance operational efficiency, interaction, and realism; while meeting all applicable Human Factors Engineering (HFE) requirements for training devices. The CDT shall comprehensively integrate human characteristics into system definition, design, development and evaluation to optimize human performance in accordance with the HFE guidelines of MIL-STD-1472G. The detail design and functionality of the CDT system shall be in agreement with the following sections of MIL-STD-1472G:

5 Control;
5.1 Control/display integration;
5.2 Visual displays;
5.3 Speech &Audio;
5.4 Labeling;
5.7 Warnings, hazards & safety;
5.10 Workspace design;
5.11 Physical Environment;
5.12 Virtual Environment.

The User Computer Interface development effort shall be consistent with the DoD Joint Technical Architecture (JTA) Human-Computer Interface Standards (Version 6.0, 03 October 2003) to ensure user-oriented characteristics such as standardization, intuitive operation, and consistency with user expectations. The CDT design shall provide an interface that eases mental and physical tasks, as well as minimizes the chance of operator /maintainer error or accident.

The CDT shall ensure personnel safety of the instructor operator, trainee and maintainer by identifying and eliminating program risks associated with critical human factors that can have a significant impact on safety, performance, schedule, or operational readiness.

3.6.3 Construction.

3.6.3.1 Workmanship.

The following requirements shall apply.

3.6.3.1.1 Wiring.

Wires and cables shall be positioned or protected to avoid contact with rough surfaces, irregular surfaces and sharp edges, and to avoid damage to conductors and adjacent parts. Harnesses and cable form containment means shall be neat in appearance, uniformly applied, and positioned to retain critical form factors and breakout locations. The containment means (lacing, ties, tie down straps, etc.) shall not cause the insulation to deform to the point where performance is adversely

affected. There shall be no evidence of burns, of abrading, or of pinch marks in the insulation which could cause short circuits or leakage. Sufficient clearance shall be provided between wires or cables and heat generating parts to avoid deterioration of the wires and cables.

3.6.3.1.2 Shielding.

Shielding on wires and cables shall be secured in a manner that will prevent it from contacting or shorting exposed current-carrying parts. The ends of the shielding or braid shall be secured to prevent fraying.

3.6.3.1.3 Cable and Wire Markings.

Disconnectable cables and wires shall be permanently and legibly marked in accordance with the following requirements, which shall apply to all equipment categories. These types of disconnectables include plugs, jacks, lugged terminals, push-on captivated wires. Jumpers or links located on terminal boards, jacks or plugs are exempt from such marking. Soldered connections are also exempt from such marking. Markings shall not damage the wires or cables attached to and shall be located within approximately 8 cm from the connector, terminal or plug, oriented in such a manner as to be readable without removal of the wire or cable or support clamps.

3.6.3.1.3.1 Cable Marking Method.

The following methods shall be used to mark cables and wires:

a) Molded on the cable.

b) Stamped on the cable.

c) Securely attached, appropriately marked plastic bands. (no less than .25 mm thickness).

d) Bands of appropriately marked heat shrinkable tubing.

e) COTS items internally are not required to be marked.

f) COTS interface cable(s) with a CDT system shall be marked.

3.6.3.1.3.2 Cable Marking Information.

The following information shall be marked IAW Standard Reference Designations for Electrical and Electronics Parts and Equipment (ANSI/IEEE Y32.16) on all disconnectable cables.

3.6.3.1.3.2.1 "W" and "P" Cable Designations.

A "W" designation (W1, W2, etc.) shall be assigned to uniquely identify cables and wires. The numerical portion of the "W" designations shall be consecutive throughout the trainer. In

addition, each connector within the same cable shall be identified with a "P" designation (P1, P2, etc). The numerical portion of the "P" designations shall be consecutive for a given cable. The "W" and "P" designations shall be marked on cables in accordance with Figure 7 'Examples of Cable Markings'.

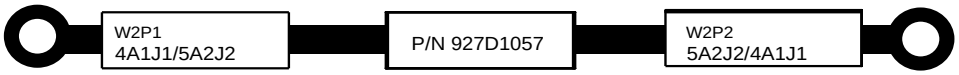
3.6.3.1.3.2.2 To-and From Designators.

In addition to the "W" and "P" designations, cable and wire markings shall also include "to-from" reference designators to identify the locations where they are connected. Cables and wires internal to subassemblies are not required to be marked with the "from" designator. The "to-from" designators shall be marked on cables in accordance with Figure 7 'Examples of Cable Markings'.

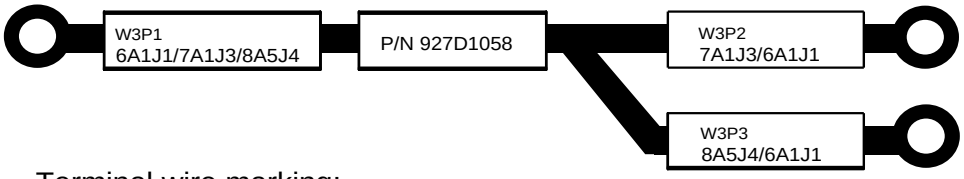
3.6.3.1.3.2.3 Assembly/Part Number.

Trainer-peculiar wires, cables, and harnesses shall also be identified and marked with the applicable assembly or part number. The number shall be included with other required cable markings where space permits. Otherwise, a separate marking shall be made adjacent to the "W", "P", and "to-from" designator markings.

Basic inter-cabinet cable:

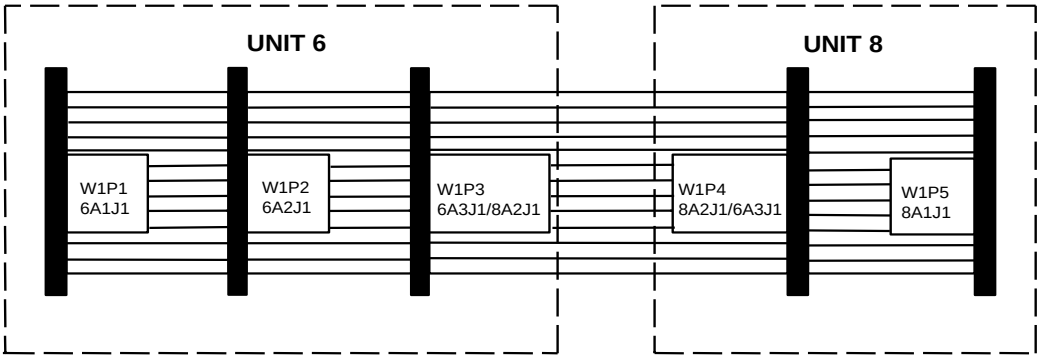


Multiple destination cable:



Terminal wire marking:

Daisy chain, continuous ribbon cable with clamp on connectors:



NOTE (1) PREFIX MAY BE OMITTED FOR WIRES OR CABLES LOCATED ENTIRELY WITHIN THE SAME CABINET.

NOTE (2) FOR PURPOSES OF THESE MARKING REQUIREMENTS, UNITS COMPRISED OF MULTIPLE CABINETS OR BAYS PERMANENTLY WELDED OR BOLTED TOGETHER SHALL BE CONSIDERED AS HAVING SEPARATE CABINETS.

NOTE (3) THE UNDERLYING CRITERIA FOR WIRE AND CABLE MARKING SHALL BE EASE OF MAINTENANCE AND REDUCTION OF CHANCES FOR MISCONNECTION.

Figure 7. Examples of Cable Markings

3.6.3.2 Materials and Processes.

Materials and processes shall be in accordance with the following requirements. Commercial and Non-Developmental Items (CaNDI) and GFE are exempt from these requirements, unless otherwise specified in this section. CaNDI must comply with the Government's definitions in order to be exempt.

3.6.3.2.1 Materials.

Materials selected for the trainer hardware shall meet the primary design requirements of their application and the following additional performance requirements:

a) Except in the case of consumable items, materials used in the construction of nonexempt equipment shall preclude deterioration in performance and appearance over the design service life of the equipment.

b) When it is commercially practicable, materials selected shall allow trainer-peculiar parts to be repairable by commonly applied commercial processes. Materials selected shall withstand, without deterioration, the effects of the environment in which the equipment will be operated, stored, and transported.

c) Materials selected shall preclude exposure of personnel, facilities, and the environment to toxic, explosive, electrical and fire hazards throughout the life cycle of the equipment.

3.6.3.2.2 Hazardous Materials.

The trainer shall not expose personnel or the environment to excessive levels of toxic, carcinogenic, teratogenic, and otherwise hazardous materials as defined by Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA). If hazardous materials must be used in order to meet the performance requirements of this specification, only Government-authorized materials shall be used, the hazardous items shall be suitably marked, and all due precautions shall be taken to prevent whatever harm the hazardous material could cause. Any batteries used in the COTS motion base, smoke detectors, or uninterruptable power supplies shall be appropriately marked and listed in the CDT System Maintenance Manual (SMM). The SMM shall provide the Material Safety Data Sheets (MSDS) and instructions for proper disposal for each hazardous material.

3.6.3.2.3 Metals.

Metals shall be corrosion-resistant, or shall be coated or metallurgically processed to resist corrosion. The environmental conditions to which the equipment will be exposed shall not cause corrosion and shall not cause deterioration of metal parts.

3.6.3.3 Parts.

The trainer hardware shall be comprised of CaNDI to the maximum extent practicable. Trainer Peculiar Equipment shall be kept to a minimum.

3.6.3.3.1 Power Supplies.

All power supplies to be used in the trainer shall be commercial items to the maximum extent practicable. The use of trainer-peculiar and Non Developmental Items (NDI) power supplies shall require specific written authorization by the Government.

3.6.4 Reliability, Availability and Maintainability (RAM) Requirements

The CDT shall be designed with a Mean Time to Repair (MTTR) of 1.0 hour.

The CDT shall be designed with a Mean Time Between Failure (MTBF) of 500 hours per trainer.

The CDT shall have an Operational Availability goal (Ao) of 95%. The trainers will be used 8 hours/day, 5 days/week, and 50 weeks/year equaling 2,000 hours per year. The availability rate of 95% translates that the trainers shall be available at least 1,900 of those hours.

3.6.5 Shock and Vibration.

All parts of the CDT shall be adequately designed to prevent performance degradation and damage (e.g., loosening of fasteners, disturbance of adjustable settings, etc.) during shock and vibration environments normally encountered during shipment/transportation (by ground or air) and for shock and vibration encountered during training operations. Displays and optics shall not suffer permanent damage due to excursions within the design limits of the motion system.

3.6.6 Environmental Conditions.

3.6.6.1 Operational Climatic Environment.

The CDT shall be designed for operation within a climatically controlled facility. The CDT shall operate without degraded performance within the following ambient environmental conditions:

a) Temperature: 15° to 29° C. (59° to 85° F).
b) Relative Humidity: 30 to 80 percent, non-condensing.

3.6.6.2 Non-operational Climatic Environment.

During transit and storage of the trainer and associated components, the systems shall accept ambient environmental conditions within the following extremes without degradation:

a) Temperature: -10° to 45° C. (14° to 113° F).

b) Relative Humidity: 10 percent to 95 percent, non-condensing.

3.6.7 Transportability.

The CDT shall be permanently installed in a fixed facility and shall be transportable (air, ground and sea) by standard commercial transportation. The CDT shall be of adequate strength to withstand, without damage, normal stresses incident to movement, handling in transit, hoisting, and tie-down aboard transporting vehicles. Major units (components, assemblies, subassemblies, etc.) shall be constructed such that installation, assembly, and disassembly can be accomplished with no special equipment or tools and without the necessity of soldering, cutting, welding or other destruction of material. All major units requiring more than a two-man lift shall have provision for movement by forklifts.

3.6.8 Facilities and Facility Equipment.

3.6.8.1 Trainer power requirements.

All components, except the motion platform, of each CDT system (regardless of configuration) shall be able to operate at, 120 Volts Alternating Current (VAC), 60 Hz, single phase power with a tolerance of ± 10 percent in voltage and ± 1 percent in frequency. The equipment shall be protected from power fluctuations, sags, surges, and transients. Each computer shall have a supplemental non-interruptible power supply to allow time to shut down the computers normally in case of a power failure. The electrical system design and installation shall be in accordance with ANSI NFPA 70.

The preferred power for the motion system shall be 208/240 VAC, 3 phase, 60Hz with a tolerance of ± 10 percent in voltage and ± 1 percent in frequency.

3.6.8.2 Grounding System.

The CDT system shall require a site approved grounding system sufficient to handle grounding of the system for:

a) Earth electrode ground

b) Signal reference ground

c) Fault protection

d) Lightning protection (MTF only)

Digital electronic simulation equipment shall require a low impedance earth electrode subsystem for acceptable performance. This equipment shall require a direct path to earth without the possibility of reflective noise generated voltage and current being picked up. The electrical bonding resistance at each tie point and from the central tie point to earth shall be 10 milliohms or less. Simulator equipment grounds shall be brought to a similar or central ground point tie point which is referenced to the earth electrode subsystem.

3.6.8.3 CDT System Footprint.

The operational footprint for any CDT base configuration shall be minimized. The CDT shall be able to fit and operate in a room with a 12 foot ceiling. When the motion platform is at maximum extent of motion with full mechanical actuator extension, the highest point of the STS motion envelope shall not extend beyond 11.5 feet from the floor.

3.6.8.3.1 CDT System Height Clearances.

The CDT shall be able to fit and operate in a room with a 12 foot ceiling. When the motion platform is at maximum extent of motion, the highest point of the STS shall not extend beyond 11 feet 6 inches (11’ – 6”) from the floor.

3.6.8.3.2 CDT System Area Clearances.

When floor-mounted in a facility, each CDT STS shall have a 2 foot safety clearance buffer from adjacent CDT STSs at their maximum motion envelope extents, adjacent walls or adjacent permanent building structures when it moves thru its full range of motion (maximum extent of motion).

3.7 Logistics.

Logistics for the CDT will be modified throughout the life cycle of the system and will utilize ANSI GEIA-STD-0007-A for Logistics Product Data. This standard defines logistics product data generated during the requirements definition and design of an industry or government system, end item or product. The standard is designed to provide users with a standard set of data tags for all or portions of logistics product data and customer defined sub-sets of logistics product data. The data tags shall be specific to;

a) Initial Spares/Repair Parts List

b) Common and Bulk List

c) Tools and Test Equipment List

d) Provisioning Parts List

e) Materiel Component List

3.7.1 Nameplates or Product Markings.

Trainer equipment and cables shall be identified and marked in accordance with the following requirements. Markings shall be permanent, securely fastened, and shall withstand the operational and storage environment of the trainer. Legibility shall be as required for ready readability. Markings shall be of a color which is in contrast to the color of the background surface. Markings of items shall not adversely affect the life and utility of the item. Letters shall be without serifs (sans-serifs) such as Gothic or Futura capitals, and the numerals shall be Arabic, except when Roman numerals are used for type designations.

3.7.1.1 Unique Identification.

Each upper level assembly shall have a Department of Defense human and machine readable unique identification (UID) with bar code label as defined in MIL-STD-130N.

3.7.1.2 Trainer Nameplate.

A nameplate shall be permanently affixed to the trainer in a prominent location designated by the contracting officer. The trainer nameplate shall include a 2-D Data Matrix bar code bar code that meets the IUID requirements of the contract. Methods of applying, type of lettering, permanency, and legibility of this nameplate shall be in accordance with MIL-STD-130N.

3.7.1.3 Warning Marking for Simulated and Modified Equipment.

The following types of trainer equipment shall be identified and marked IAW applicable Government and industry standards MIL-STD-130N:

a) Government-furnished or Contractor-acquired operational/tactical equipment which has been modified for use in the trainer.

b) Unmodified Contractor-acquired operational/tactical equipment that has not been fully tested and certified for military use.

c) Simulated equipment which has overall outward appearance which is substantially identical to the operational/tactical equipment for which it could be mistaken.

3.7.1.3.1 Trainer-use-only Identification.

The trainer-use-only identification shall consist of a sticker or nameplate with yellow background and the legend shown below in black. The sticker or nameplate shall not obscure

other identification or labeling. Method of applying, permanency, legibility, and lettering shall be as specified in applicable Government and industry standards. See Figure 8.

WARNING: FOR GROUND TRAINER USE ONLY

Figure 8. Trainer-Use-Only Identification Sticker

3.7.2 Maintenance.

The CDT Support Strategy utilizes Contractor Logistics Support (CLS) for its Total Life-Cycle. CLS will be provided by the WARFIGHTER FOCUS contract administered and managed by the PEO-STRI Field Operations Directorate, after an optional 12 months of Interim Contractor Support (ICS) after the first delivery from the development contractor.

3.7.2.1 Maintenance Concept.

The maintenance concept consists of two levels of maintenance: Field and Sustainment. Field maintenance, also known as on-system maintenance, repairs equipment on-site. Field maintenance shall include that maintenance considered to be operator level and direct support. Field maintenance consists of preventative maintenance daily readiness check and services, adjustments to controls and other maintenance that can be accomplished by the operator or trained technician with the aid of special tools, support equipment, additional training knowledge or skills, either on site or at a CLS/LCCS maintenance facility. It includes system activation, adjusting and aligning to specific parameters, troubleshooting, removal and replacement of failed components. Sustainment maintenance, also known as off-system maintenance, primarily repairs and returns equipment and components serviced. Sustainment maintenance consists of off-site maintenance capabilities conducted at the CLS/LCCS contractor or a designated contractor facility. It includes the use of designated repair points operated by the CLS/LCCS, original manufactures and vendors, in order to overhaul, rebuild, replace or calibrate failed equipment.

3.7.2.1.1 Qualitative Maintainability Requirements.

General maintainability characteristics of the trainer equipment shall be as specified in the following paragraphs.

3.7.2.1.1.1 Special Tools.

There shall be no need to use special tools for equipment maintenance unless common tools are inadequate.

3.7.2.1.1.2 Built-In Test (BIT).

Daily Operational Readiness Test (DORT). See paragraph 3.5.1.6.4.2 'System daily Readiness Check Program'.

3.7.2.1.1.3 Accessibility.

All CDT equipment racks, stairs, steps, handles and major assemblies shall be built in compliance with best commercial practices for accessibility to components to facilitate maintenance operations.

4. NOTES.

4.1 Definitions.

The following definitions are applicable to this specification.

AS - An Ancillary Station (AS) is a floor-mounted workstation. One or more AS's can be appended to each STS. Typically, the primary use for an AS is as an AAR station used by both instructors and students to review a student's performance but an AS could also be a Commander's Station, a Gunner's Station or an Equipment Operator's Station. A single AS can be dedicated solely to one function or can be used for multiple functions, i.e., a single AS used as both an AAR and a Commander's Station. Additional functions allocated to the AS are defined in other sections throughout this SRD.

Cab - The cab is a large boxlike structure which houses the replication of a vehicle's driver's station. The cab can be dedicated to a single vehicle or can be designed to be reconfigurable to support training of multiple vehicle types using a single cab. The cab will contain all of the controls, switches, lamps, indicators and other equipment or components necessary to train the student in the driver's training tasks defined in each CDT Variant's Appendices. Additional functions allocated to the cab are defined in other sections throughout this SRD and the Variant Annexes.

CDT Annexes - Annexes are used in the CDT Product Line to denote major variants of the CDT. Typically, a variant consists of a new baseline cab and multiple dashboards and panels to configure that cab into various sub-variant vehicles (e.g. SV, MV, TV and TEV).

CDT Appendices - This section is reserved for a list of all Appendices which apply to the Common Components of the CDT Product Line (e.g. MTF and SGS).

DS – A Driver's Station (DS) consists of that part of a cab which replicates a driver's position within a vehicle.

IA product - Product or technology whose primary purpose is to provide security services (for example, confidentiality, authentication, integrity, access control, or non-repudiation of data); correct known vulnerabilities; or provide layered defense against various categories of non-authorized or malicious penetrations of information systems or networks. Examples include such products as data/network encryption devices, firewalls and intrusion detection devices.

IA-enabled product - Product or technology whose primary role is not security, but which provides security services as an associated feature of its intended operating capabilities. Examples include such products as security-enabled web browsers, screening routers, trusted operating systems, and security-enabled messaging systems.

IOS - The Instructor/Operator Station (IOS) is the instructor's primary workstation. Although the IOS does not contain the simulation executive software, it allows the instructor to select a scenario, set initial conditions, initiate the scenario and monitor a student's progress through the scenario. Additional functions allocated to the IOS are defined in other sections throughout this SRD.

IOS Rack – The IOS Rack is a mid-sized tower containing the computers, network switches and cabling which allow the instructor to perform all instructor tasks. Additional requirements allocated to the IOS Rack and equipment therein are defined in other sections throughout this SRD.

MP - The Motion Platform (MP) is a Commercial Off The Shelf (COTS) system which sits beneath the cab and replicates the motions of an actual vehicle traversing the simulated training environment. Additional requirements allocated to the MP are defined in other sections throughout this SRD.

MTF - The Mobile Training Facility (MTF) is a semi-trailer with expandable sides designed to house a complete 1:1 CDT system. Additional requirements allocated to the MTF are defined in Appendix A to this SRD.

STS - Each Student Training Station (STS) contains the components and equipment necessary to replicate a single vehicle and is the student's primary workstation. At a minimum, each STS will have a cab mounted on a motion platform with a visual display unit. Each STS will also include the computational and image generation components necessary to simulate the vehicle and its' environment. Each STS may also include 1 or more ancillary stations to support AAR or crew training. Additional functions allocated to the STS are defined in other sections throughout this SRD.

STS Rack – The STS Rack is a large tower containing the image generators, computers, network switches and cabling which create the simulated training environment, controls the environment, monitors the environment and student's performance and reacts to student

actions. Additional requirements allocated to the STS Rack and equipment therein are defined in other sections throughout this SRD.

Variant – A CDT Variant is a product produced from the CDT product line. Typically, a Variant is dedicated to a particular family of vehicles or equipment. For example, the CDT Stryker Variant (CDT SV) is dedicated to training driver's of all models of the Stryker family of vehicles, the CDT Tank Variant (CDT TV) is dedicated to training driver's of various vehicles based on the M1A1 or M1A2 Abram's tank and the CDT MRAP Variant (CDT MV) is dedicated to training driver's of various models of MRAP vehicles. A Variant usually consists of a cab (either a single dedicated cab or a reconfigurable cab) and a set of software which replicates each vehicle's dynamics and supports the vehicle's training requirements. The functions and requirements for each Variant are defined in the Annexes to this SRD.

VDU - The current Visual Display Unit (VDU) consists of the large frame structure which supports the video projectors, mirrors, screens and/or displays which present the video images of the simulated training environment to the student in the cab. The VDU framework attaches to the cab and motion platform. Additional requirements allocated to the VDU are defined in other sections throughout this SRD.

VSK – A Vehicle Specific Kit (VSK) is another product produced from the CDT product line. Whereas, a Variant is dedicated to a particular family of vehicles or equipment, a VSK is dedicated to a single vehicle within the Variant family of vehicles. For example, the CDT M-ATV VSK is dedicated to training drivers of only the M-ATV vehicle which is part of the CDT MV family of generic vehicles. A VSK usually consists of dashboard modules and panels which are used in a reconfigurable cab, view restriction panels, space constraints and a set of software which replicates that vehicle's dynamics and supports that vehicle's training requirements. The functions and requirements for each VSK are defined in the Appendices to each Annex.

4.2 Acronyms List.

A	Annual
A_o	Operational Availability
AAR	After Action Review
ABV	Assault Breecher Vehicle
ACS	Automated Cueing Subsystem
UGM-A	Universal Gold Master - Army
ANSI	American National Standards Institute
AOI	Area of Interest
AOS	Air Ocean Space
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
AS	Ancillary Station
BIT	Built In Test
BW	Bi-Weekly
BM	Bi-Monthly
ºC	Degrees Celsius
CAC	Common Access Card
CaNDI	Commercial and Non-Developmental Items
CCTV	Closed Circuit Television
CD	Compact Disk
CD-R	Compact Disk Read Only
CDS	Common Data Server
CDT	Common Driver Trainer
CIGI	Common Image Generator Interface
CGF	Computer Generated Force
CGI	Computer Generated Imagery
CHESS	Computer Hardware, Enterprise Software and Solutions
CLS	Contractor Logistics Support
CM	Class Manager
CM2	Common Moving Models
CMOS	Complementary Metal-Oxide-Semiconductor
COTS	Commercial Off The Shelf
CTIS	Central Tire Inflation System
CVC	Combat Vehicle Crewman
C2	Command and Control
D	Demo
DBMS	DataBase Management System
DIS	Distributed Interactive Simulation
DORT	Daily Operational Readiness Test
DRC	Daily Readiness Checks
DS	Driver’s Station
DTED	Detail Training Environment Data

DVD	Digital Video Disk
DVE	Driver's Vision Enhancer
ECS	Environmental Control System
EDM	Environment Data Manager
EIA	Electronic Industries Alliance
EML	Electronic Maintenance Log
EPA	Environmental Protection Agency
EPO	Emergency Power Off
ERC	Environmental Runtime Component
ERC	ERC
ESD	Electrostatic discharge
E-STOP	Emergency Stop
ºF	Degrees Fahrenheit
FBCB2	Force XXI Battle Command Brigade and Below
FOV	Field Of View
ft L	foot-Lambert
GB	Giga Bytes
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GIS	Geographical Information Systems
GUI	Graphical User Interface
HAT	Height Above Terrain
HFE	Human Factors Engineering
HLA	High Level Architecture
Hz	Hertz
IAW	In Accordance With
IA	Information Assurance
ICS	Interim Contractor Support
ID	Identification
IED	Improvised Explosive Device
IET	Initial Entry Training
IG	Image Generator
I/O	Input/Output
IO	Instructor Operator
IOS	Instructor Operator Station
IP	Internet Protocol
IR	infra-red
JAB	Joint Assault Bridge
JCR	Joint Capabilities Release
JTA	Joint Technical Architecture
km	Kilometers
LAN	Local Area Network
LRU	Lowest Replaceable Unit
M	Monthly

m	Meters
MATV	MRAP All Terrain Vehicle
MP	Motion Platform
M-EML	Master Electronic Maintenance Log
MRAP	Mine Resistant Ambush Protected
M-SUM	Master System Usage Monitor
ms	Milliseconds
MSDS	Material Safety Data Sheets
MTBF	Mean Time Between Failures
MTF	Mobile Training Facility
MTTR	Mean Time To Repair
MV	Mine Resistance Ambush Protection Variant
NDI	Non Developmental Item
NSTISSP	National Security Telecommunications and Information System Security Policy
OneSAF	One Semi-Automated Forces
OS	Operating System
OSHA	Occupational Safety and Health Administration
OTF	Objective Terrain Format
OTW	Out The Window
PC	Personal Computer
PDUs	Protocol Data Units
PMCS	Preventive Maintenance Check System
POI	Program Of Instruction
PM	Program Manager
PM GCTT	Product Manager for Ground Combat Tactical Trainers
PTT	Push to Talk
PVD	Plan View Display
Q	Quarterly
RAM	Random Access Memory
RGB	Red, Green, and Blue
RITM	Resident Individual Training Management
ROM	Read Only Memory
RPG	Rocket Propelled Grenade
RTF	Ready To Train
RVSS	Rear View Sensor System
S	Semi-annual
SAF	Semi-Automated Forces
SAS	Scoring Assistant Subsystem
SE Core	Synthetic Environment Core
SEDRIS	Synthetic Environmental Digital Representation and Interchange
SGI	Silicon Graphics Image
SGS	Scenario Generation System

SMM	System Maintenance Manual
SRD	System Requirement Document
SSE	Software Support Environment
SSN	Social Security Number
STS	Student Training Station
SUM	System Usage Monitor
SV	Stryker Variant
T	Training
TA-244	Training Area 244
TB	Terabyte
TEV	Tank Engineering Variant
TRADOC	Training and Doctrine Command
TSRD	Training System Requirements Document
TV	Tank Variant
UEI	United Electronics Industries
USA PEO STRI	US Army Program Executive Office Simulation Training and Instrumentation
UST	Ultra Short Throw
UHRB	Ultra High Resolution Building
UID	unique identification
VAC	Volts Alternating Current
VBS2	Virtual Battlespace 2
VCR	Video Cassette Recorder
VDD	Vehicle Description Document
VDU	Vehicle Display Unit
V-DIS	Virtual Distributed Interactive Simulation
VLAN	Virtual Local Area Network
VLO	Vehicle Limitations Override
VOIP	Voice Over Internet Protocol
VSC	Vehicle Specific Component
VSK	Vehicle Specific Kit
W	Weekly
3D	Three Dimensional
2D	Two Dimensional

4.3 Vehicle Dynamic Data Input Template

Wheelbase 1		
Wheelbase 2 (and more, depending on axles count)		
Wheelbase 3 (and more, depending on axles count)		
Wheelbase 4 (and more, depending on axles count)		
Width		
Height		
Front overhang		
Rear overhang		
Rear hitch-axle distance		
Rear hitch heigth		
CG Location: vertical		
CG Location: longitudinal		
Eye Location: vertical		
Eye Location: longitudinal		
Axle track(s)		
Weights		
Curb weight		
Fully loaded weight (GVWR)		
GCWR		
Steering		
Lock to lock turns count		
Ackerman geometry (all steering axles)		
Chassis		
Suspension adjustment		
Suspension travel (dyn.)		
Springs data		
Shocks data		
Tires radius		

Table B: Components Inventory		
Model:	**Variant 1**	**Variant (i)**
Steering		
Sterring box ration		
Chassis		
Spring data		
Shocks data		
Tires type		
Notes on suspension type		
Notes on braking system		
Engine		
Model		
Power		
Torque		
Idle RPM		
Other items observed		
Transmission		
Model		
Torque converter model/ratio		
Transfer case		
Axle ratios		
Other items observed		
Features		
ABS (what axles?)		
Traction control (with details)		
Engine brake		

Table C: Performance measures		
Model:	**Variant 1**	**Variant (i)**
Speeds		
Max Road Speed		
RPM at 60 MPH		
RPM at 30 MPH		
Acceleration		
Acceleration to 50 MPH		
Acceleration to 20 MPH		
Acceleration to 40 MPH		
Acceleration to 60 MPH		
Gearshift (full throttle)		
RPM 1 to 2		
RPM 2 to 3		
RPM 3 to 4		
RPM 4 to 5		
RPM 5 to 6		
Mobility		
Forward Slope		
Side Slope		
Step Climbing		
Lateral acceleration/roll threshold		
Steering		
Turning circle (curbs)		
Braking / Deceleration		
From 20 MPH		
From 40 MPH		
From 60 MPH		
No-jake coast 60-40 MPH		
No-jake coast 40-10 MPH		
Jake coast 60-40 MPH		
Jake coast 40-10 MPH		

4.4 RITM Report Example

SS#	LAST 4	Last Name, First Name, MI	Gain UPC	Service Comp	Course Title	Course ID	FY	CLASS	PHASE	START DATE	END DATE
123456789	6789	Rucker, Alfonso, Q III	W32L8B	RA	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12
987654321	4321	Sparrow, Jack	W62R2D	NG	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12
564738902	8902	Solo, Han	W33X90	AR	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12
908872134	2134	Grant, Hihram S.	U88W4X	AR	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12
763555131	5131	Whirly, Clarence	W32L8B	RA	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12
612300812	0812	Showlaces, Tyrone U.	W33X90	AR	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12
833433190	3190	Upchuck, Ralph	W62R2D	NG	IN FLIGHT MISSLE MAINTENANCE / REPAIR	911-12D10	2012	001	0	25-Dec-11	10-Jan-12

4.5 Common SRD Annexes and Appendices

COMMON SRD ANNEXES

- Annex A
  - Stryker Variant — CDT SV SRD Annex A v 2.0 20050106 (PRF-PT-00430-1 Version 2.0 6 January 2005)
  - Appendix A — CDT SV SRD Annex A Appendix A v1.1 240812 (PRF-PT-00430-1 Appendix A Version 1.1 24 August 2012)
- Annex B
  - Tank Variant — CDT TV SRD Annex B v4.4 20120628 (PRF-PT-00486 Version 4.4 28 June, 2012)
  - Appendix A (TEV) — CDT TV Annex B Appendix A v1.0 20120628 (PRF-PT-00486 Appendix A Version 1.0 28 June 2012)
  - Appendix B (AV) — CDT TV Annex B Appendix B v1.0 20110915 (PRF-PT-00486 Appendix B Version 1.0 15 September 2011)
- Annex C
  - MRAP Variant — CDT MV SRD Annex C v3.1 210812 (PRF-PT-00510 Version 3.1 21 August 2012)
  - Appendix A (RG33) — CDT MV SRD Annex C Appendix A v1.0 20080905 (PRF-PT-00510 Appendix A Version 1.0 5 September 2008)
  - Appendix B (Caiman) — CDT MV SRD Annex C Appendix B v1.0 20080905 (PRF-PT-00510 Appendix B Version 1.0 5 September 2008)
  - Appendix C (Maxx Pro) — CDT MV SRD Annex C Appendix C v1.0 20080905 (PRF-PT-00510 Appendix C Version 1.0 5 September 2008)
  - Appendix D (RG31) — CDT MV SRD Annex C Appendix D v1.0 20080905 (PRF-PT-00510 Appendix D Version 1.0 5 September 2008)
  - Appendix E (M-ATV) — CDT MV SRD Annex C Appendix E v3.4 20110309 (PRF-PT-00510 Appendix E Version 3.4 9 March 2011)
  - Appendix F (ISS Caiman) — CDT MV SRD Annex C Appendix F v1.3 20130122 (PRF-PT-00510 Appendix F 1.3 22 January 2013)

- Appendix G (ISS MaxxPro) — CDT MV SRD Annex C Appendix G v1.3 20130122 (PRF-PT-00510 Appendix G 1.3 22 January 2013)

- Annex D
  - Tactical Wheeled Variant — CDT TWV SRD Annex D v2.0 20160127 (PRF-PT-00580 Version 2.0 27 January 2016)
  - Appendix A (FMTV) — CDT TWV SRD Annex D Appendix A v2.0 20160127 (PRF-PT-00580 Appendix A Version 2.0 27 January 2016)
  - Appendix B (PLS/LHS) — CDT TWV SRD Annex D Appendix B v2.0 20160127 (PRF-PT-00580 Appendix B Version 2.0 27 January 2016)
  - Appendix C (M915A3) — CDT TWV SRD Annex D Appendix C v2.0 20160127 (PRF-PT-0580 Appendix C Version 2.0 27 January 2016)
  - Appendix D (M915A5) — CDT TWV SRD Annex D Appendix D v2.0 20160127 (PRF-PT-0580 Appendix D Version 2.0 27 January 2017)

NOTES.

Annexes are used in the CDT Product Line to denote major variants of the CDT. Typically, a variant consists of a new baseline cab and multiple dashboards and panels to configure that cab into various sub-variant vehicles.

COMMON SRD APPENDICES

Appendix A
Mobile Training Facility (MTF) — CDT Common SRD Appendix A v2.4 20130122 (PRF-PT-00430 Appendix A Version 2.4 22 Jan 2013)

Appendix B
Scenario Generation System (SGS) — CDT Common SRD Appendix B v2.3 20130122 (PRF-PT-00430 Appendix B Version 2.3 22 Jan 2013)

NOTES

This section is reserved for a list of all Appendices which apply to the Common Components of the CDT Product Line.