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PERFORMANCE SPECIFICATION
FOR THE
INSTRUMENTABLE MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM
VEHICLE TACTICAL ENGAGEMENT SIMULATION SYSTEM
(I-MILES VTESS)

U.S. ARMY PROGRAM EXECUTIVE OFFICE FOR
SIMULATION, TRAINING, AND INSTRUMENTATION (PEO STRI)
12350 RESEARCH PARKWAY
ORLANDO, FL 32826-3276

Mario Rodriguez Jr
Systems Engineer, PM LTS

Glen Wynn
Logistician, PM LTS

Jesse Campos
Chief Engineer, PM LTS

Bob Capote
Associate Chief Acquisition
Logistics, PM TRADE

REVISION HISTORY

Revision Level	Date Of Change	Summary Of Change
1.0	9 Dec 2014	Initial
1.1	26 Jan 2015	Addressed comments from VTESS IPT, added fire control requirements into document

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1.0 Scope

This Performance Specification defines the efforts for the production of the Instrumentable Multiple Integrated Laser Engagement System (I-MILES) Vehicle Tactical Engagement Simulation System (VTESS). The requirements for this document are derived from MILES 2000 Operational Requirements Document (ORD) for Replacement of Ground Direct Fire Tactical Engagement Systems (TES) Devices, Cards Number 0291, and revised July 1996.

1.1 Background

The U.S. Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI), Project Manager Training Devices (PM TRADE), Product Manager Live Training Systems (PM LTS) has an immediate need to evolve and procure the I-MILES VTESS. I-MILES VTESS is a product within the I-MILES program of record and is also one system within in a larger Live Training System of Systems (SoS). The VTESS acquisition will complete the Basis of Issue (BOI) and potentially replace older legacy systems. The VTESS will provide a more realistic training capability, reduce life cycle costs, and integrate emerging commercial-off-the-shelf (COTS) or modified COTS technologies.

PM TRADE's TESS acquisition strategy is shifting from the acquisition of contractor specific system configurations to scalable, component based configurations that can be used across a variety of platforms, Soldiers and infrastructure. The basis for this strategy is the Component Architecture (CA) as defined in the Live Training Transformation (LT2) Tactical Engagement Simulation System (TESS) Component Architecture Foundation Overview, LT2 TESS CA-001. The CA segrates key functional devices used in the live training environment into major individual components and related software that communicate via non-proprietary wired and wireless network standards. The major components defined by the CA are the same types of components developed by industry over the past 20+ years and integrated for the delivery of live training systems. However, the CA replaces proprietary intra-component network communications with a common networking standard to enable components, independent of manufacturer, to interoperate with the TESS instrumentation network. The intra-component network specified in the CA adheres to the Live Player Area Network (LPAN) Interface Standard, PRF-PT-00549. LPAN utilizes commercially proven products to support TESS network and messaging. The standard defines the physical characteristics, protocols and messages communicated on the LPAN. It provides both wired (USB data) and wireless (ZigBee 802.15.4) interfaces and messaging structures to enable individual components to operate as a system.

Historically, TESS system software for managing and interfacing with components and performing Real Time Casualty Assessment (RTCA) has been developed by the Contractor for each TESS acquisition. Although interoperability is ensured by conforming to the Multiple Integrated Laser Engagement System (MILES) Communication Code (MCC) Standard, PMT90-S002 and the IS-TESS Interface Standard, PRF-PT-00552, the software delivered has been proprietary, inhibiting re-use and scalability without costly modifications. PM TRADE has developed an architectural framework based on open standards and Government owned software that will enable re-use across TESS hardware configurations and

acquisitions. Implementation of the Live Training Engagement Composition (LTEC) framework will result in reduced system development costs, enable scalability. and ensure a fair fight during exercises using systems from different vendors. LTEC is a Services Oriented Architecture (SOA) that consists of a collection of software services that either perform training simulation or communicate with TESS components. These services are supported by a framework that facilitates communication between services as specified in the Live Training Engagement Composition (LTEC) Interface Control Document (ICD), PRF-PT-00608. The current LTEC baseline is available for download from the LT2 Portal (www.lt2portal.org) by Government and Industry partners who sign Distribution Agreements with PM TRADE.

2.0 Applicable Documents

The following documents form a part of this Specification to the extent specified herein. The documents listed in this section are specified in Sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in Sections 3, 4, or 5 of this specification, whether or not they are listed. All references are the base documents and all change notices released to the base document apply.

2.1 Department of Defense Specifications

2.2 Availability of Department of Defense Specifications

Copies are available on the WWW at URL: http://www.assistdocs.com/search/

2.3 Department of Defense Standards

The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

MIL-STD-1275	Characteristics of 28 Volt DC Input Power to Utilization Equipment in Military Vehicles
MIL-STD-1472	Human Engineering
MILE-STD-1553B CN4	Digital Time Division Command/Respnse Multiplex Data Bus

2.4 Availability of Department of Defense Standards

Copies are available on the WWW at URL: http://www.assistdocs.com/search/

2.5 Department of Defense Directives

2.6 Availability of Department of Defense Directives

Copies are available on the WWW at URL: http://www.dtic.mil/whs/directives/

2.7 Department of Defense Instructions

2.8 Availability of Department of Instructions

Copies are available on the WWW at URL: http://www.dtic.mil/whs/directives/

2.9 Other Government Documents, Drawings, and Publications

LT2 TESS CA-001	Live Training Transformation (LT2) Tactical Engagement Simulation System (TESS) Component Architecture Foundation Overview, Version 0.1
LT2 TESS CPS-001	Live Training Transformation (LT2) Component Specification for the Common Power Supply (CPS), Version 0.1
PRF-PT-00608	Live Training Engagement Composition (LTEC) Interface Control Document (ICD), Version 1.1
706014G	ICD for the Data Communication Interface (DCI) to Detection Device (DD) Interface Design for the Combat Training Centers - Instrumentation System (CTC-IS).
FED-STD-595C	Colors Used in Government Procurement, Change Notice 1
PMT90-S002	Multiple Integrated Laser Engagement System (MILES) Communication Code (MCC) Standard, Revision M
PRF-PT-00549	Live Player Area Network (LPAN) Interface Standard, Revision C
PRF-PT-00552	IS-TESS Interface Standard, Revision D
PRF-PT-00647	Environmental, Construction, Safety, and E^3 Requirements Specification
19207-1246074K	M2A3/M3A3 ICD for External Training Devices
SAIB January 2006	Small Arms Integration Book (SAIB) dated January 2006

2.10 Availability of Other Government Documents and Publications

Copies of the above documents are available at PEO STRI, ATTN: SFAE-STRI-TRADE-LT, 12350 Research Parkway, Orlando, FL 32826-3276

2.11 Non-Government Standards and Other Publications

ATA SPEC 300	Packaging of Airline Supplies
SAE J578-1995	Color Specification for Electic Signal Lighting Devices

2.12 Availability of Non-Government Standards and Other Publications

Copies are available on the WWW at URL: http://www.nssn.org/search

3.0 Requirements

3.1 I-MILES VTESS Training System Definition

The I-MILES VTESS shall be a comprised of independent components as described in the Live Training Transformation (LT2) Tactical Engagement Simulation System (TESS) Component Architecture Foundation Overview, LT2 TESS CA-001 and as shown in Figure 1. The I-MILES VTESS components shall communicate via wired or wireless networks in accordance with the LT2 Live Player Area Network (PAN) Interface Standard PRF-PT-00549. The I-MILES VTESS shall implement the LTEC framework and software services to perform training simulation and provide communication between TESS components, in accordance with the Live Training Engagement Composition (LTEC) Interface Control Docuemnt (ICD), PRF-PT-00608. All I-MILES VTESS components, networks and core software elements shall be defined and controlled by individual LT2 TESS Hardware Component Agreements (HCA), Service Agreements, and System Composition Agreements (SCA).

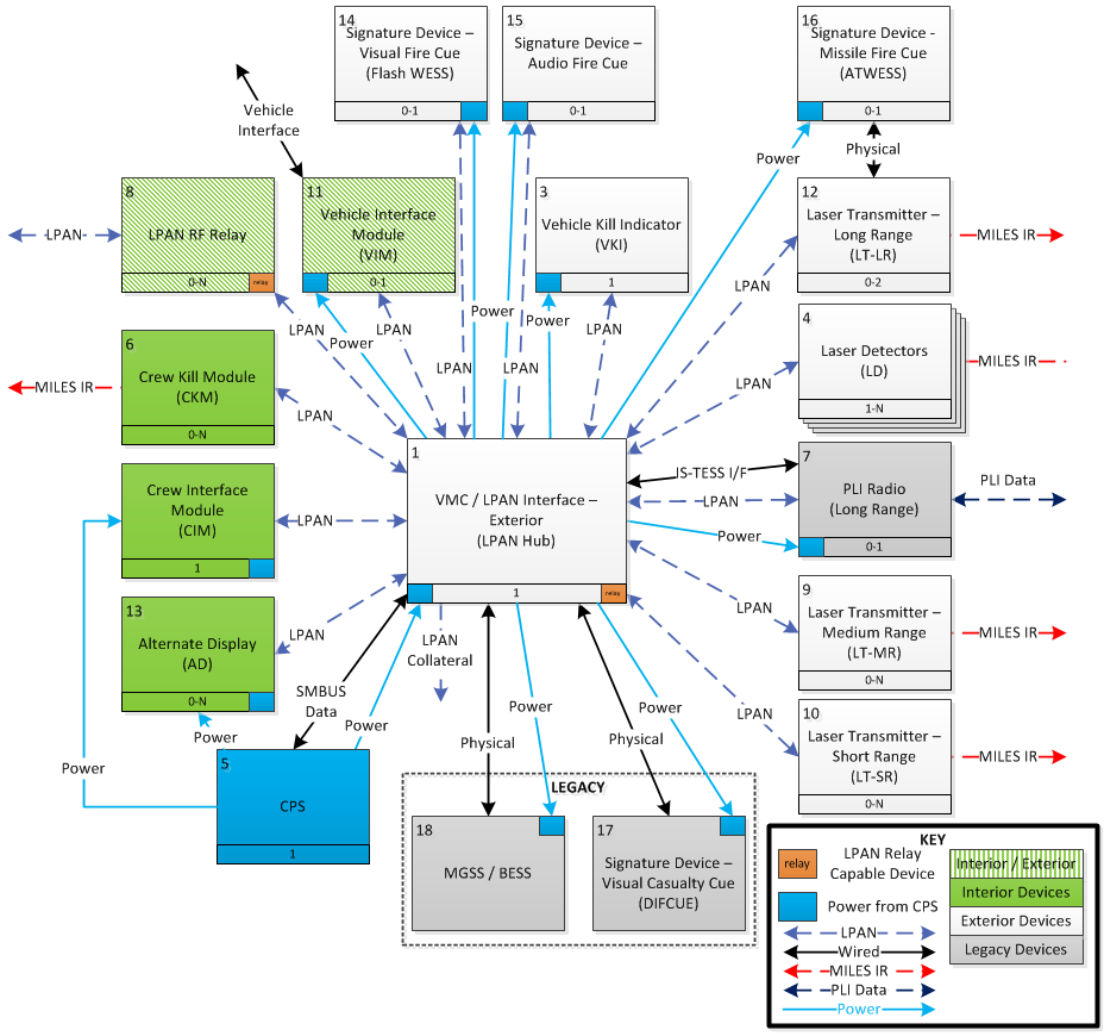


Figure 1 – LT2 TESS Component Architecture

I-MILES VTESS shall be fully programmable, including all component software and firmware residing on the system, using an external programming source that does not require opening system components. I-MILES VTESS shall provide target and shooter capabilities in support of live fire training exercises. I-MILES VTESS shall have commonality between all components used for all configurations. I-MILES VTESS shall support 128 unique configurations, including the predefined vehicle configurations listed in Table 1. The I-MILES VTESS shall have predefined configurations programmed into the system for the vehicles and structures listed in . I-MILES VTESS shall integrate with Government provided 'Gold Standard' Abrams, Bradley, Stryker Anti-Tank Guided Missile, and Stryker Main Gun System vehicles to support testing.

Vehicles and Structures
COB-V
COB-V-L - Car/Lt Truck/Van
COB-V-M - Medium Truck
COB-V-H - Heavy Truck
COB-V-T - Tractor Trailer
ENGINEERING VEHICLES
M-9 - Armored Combat Earthmover (ACE)
Dozer - D5/D7/D9
FLU419 - Tractor, Wheeled, Small Emplacement Excavator (SEE), FLU10344 - Tractor, Wheeled, High Mobility Material Handler (HMMH)
MW24C - Scoop Loader
M130G Grader
M728 - Combat Engineer Vehicle (CEV)
621G/613C-II - Wheeled Tractor Scraper / Airborne Scraper and Water Distributor System (ASWDS)
AVLB-M60A1 - Armored Vehicle Launched Bridge (AVLB) System
M200A1 - Mine Clearing Line Charge (MICLIC) Carrier Trailer
M104 - Wolverine Heavy Assault Bridge
MRAP
M-ATV - MRAP-All Terrain Vehcle (M-ATV) M1240
MRAP CAT I - MaxxPro (Maxxpro M1224, Maxxpro Plus M1234, Dash M1235, Ambulance M1234A1, MEAP M1224A1), BAE-TV 8 (M1230), FPI Cougar (A-1, A-2, ISS A1, ISS A2, HEV 4WD, HEV 6WD, JERRV 4WD, JERRV 6WD), BAE (RG-33) M1238, RG-33L Plus M1238A1, GDLS RG31A3 M1236
MRAP CAT II - M1232 BAE (RG-33L M1232, RG-33L Plus M1237, AUV M1239, HAGA M1233, HAGA Plus M1237A1), Cougar (A-1, A-2, ISS A1, ISS A2, MEAP), GDLS 8 (RG-31A2 M1221, RG31A2M1 M1221A2)
MRAP CAT III - Buffalo MK2, Buffalo MK3
ASV
M1117 - Armor Security Vehicle (ASV)
FOX
M93A1 - FOX Nuclear, Biological, and Chemical Reconnaissance System (NBCRS)
TRUCKS
M35 - 2½-ton cargo truck
MTVR (Medium Tactical Vehicle Replacement) or 7-Ton (Marine Corp). Includes: MK23, MK25, MK27, MK28, MK29, MK30, MK31, MK36, MK3
M939 - 5-ton, 6x6 Truck (includes M939A1 & A2, M923, M925, M927, M928, M929, M930, M931, M932, M934, M936)
Family of Medium Tactical Vehicles (FMTV), 5-ton Truck - M1078 Cargo Truck, M1079 Shop Van Truck, M1081 Standard Cargo/LVAD/Air-dropable, M1083 Payload Truck, M1084 Payload Truck with MHE, M1085

Vehicles and Structures
Long Wheel Base with Extended Cargo Bed, M1086 Long Wheel Base Truck with MHE, M1087 Expandable Van Truck, M1088 Tractor Truck, M1089 Wrecker Truck, M1090 Dump Truck, M1091 Fuel/Water Truck, M1093 Standard Cargo Truck/LVAD/Air-Droppable, M1094 Dump Truck/LVAD/Air-Droppable
TRACTOR TRAILER
M-915 Series - 14-20 Ton Trucks (M915 Line tractor, 916 LET, M917 Dump, M918 Distr, M919 Concrete mixer, M920 MET
HEMTT - M978 HEMTT Tanker, M983 HEMTT Tractor, M984 HEMTT Wrecker, M977 - Heavy Expanded Mobility Tactical Truck (HEMTT)
Palletized Load System (PLS) M1074/M1075
M911/M1070 - Heavy Equipment Transport System (HETS)
M870 MTVR Trailer
M172A1 Trailer
M1095 Cargo Trailer
M1076 Palletized Load System Trailer (PLST)
M1082 2.5 ton trailer
M747/M1000 Trailer
HMMWV
HMMWV - M56 Coyote Smoke Generator Carrier; M998/M1038 Truck Cargo/Troop Carrier; M1035 HMMWV Mini-Ambulance; M1037/M1042 S-250 Shelter Carrier; M1069 Tractor for M119 105m Gun; M1097 Heavy HMMWV; M1113 Expanded Capacity Truck Cargo/Troop Carrier; M1123 Heavy Truck Cargo/Troop Carrier; TUAS Shadow Ground Control Station/Launcher/Maintenance Vehicle
HMMWV Basic Armor - M966 TOW Carrier/Mini-Ambulance; M997 Maxi-Ambulance; M1025/M1026 Armanent Carrier; M1036 TOW Carrier; M1121 TOW Carrier
Armored HMMWV - M1043/M1044/M1114 Armament Carrier; M1045/M1046 TOW Carrier; M1116 Truck Cargo/Troop Carrier; M1145 FAC Carrier; M1151 Expanded Capacity Armament Carrier; M1152 Expanded Capacity Truck Cargo/Troop Carrier
M707 Knight
STRYKER
Stryker - M1126 - Infantry Carrier Vehicle (ICV)
Reconnaissance Vehicle (RV)
M1128 – Stryker Mobile Gun System (MGS)
M1129 - Stryker Mortar Carrier (MC)
M1130 - Stryker Commander's Vehicle (CV)
M1131 - Stryker Fire Support Vehicle (FSV)
M1132 - Stryker Engineer Support Vehicle (ESV)
M1133 - Stryker Medical Evacuation Vehicle (MEV)
M1134 - Stryker Anti-Tank Guided Missile (ATGM)
M1135 - Styrker NBC Reconnaissance Vehicle (NBC RV)
RECOVERY
M88A1/M88A2 - Heavy Recovery Vehicle
M113
M113 - Amored Personnel Carrier (APC), includes M113A1, A2 & A3
M548 - Cargo Carrier
M577 - Armored Personnel Carrier, command post, light, full-track, M1068 - Standard Integrated Command Post System (SICPS) Carrier
M901 - Improved TOW Vehicle (ITV)
M1064 - Heavy Mortar Carrier (120 mm Mortar)
M578 - Light Recovery Vehicle
FIELD ARTILLERY
M109 - Paladin (& Variants), Self-Propelled, 155mm Howitzer
M992A2 - Field Artillery Ammunition Support Vehicle (FAASV)
M777A2 - Ultra Lightweight Howitzer (UFH) 155 mm

Vehicles and Structures
M119A2 - Lightweight Howitzer 105 mm
M270A1 - Multiple Launch Rocket System (MLRS)
M142 - High Mobility Artillery Rocket System (HIMARS)
MIM-104 - Patriot Surface-to-Air Missile (SAM) System
OPFOR
BRDM - Amphibious Armored Vehcile (BRDM-1/BRDM-2/BDRM-3)
BMD - Airborne Amphibious IFC (BMD-1 & BMD-2)
BM21 - Multiple Rocket Launcher (MRL), 122mm
BTR - Wheeled APC (BTR-60/BTR-70/BTR-80)
MT-LB - Light, Armored, Multi-purpose APC
SA29/MT-12 - Anti-Tank Gun, 100mm
2S1 - Soviet 122-mm Self-Propelled Howitzer
2S6M - Tunguska Anti-Aircraft Artillery
2S23 - Nona-SVK Self Propelled Gun, 120mm
2S9 - Nona SPH/Mortar, 120mm
2A45M/2S25 - Sprut Anti-Tank Guns
ZSU-23/4 - Soviet Anti Aircraft Gun
SA-13 - Short-Range, Low Altitude Surface-to-Air (SAM) Transport System
SA-15 - Low-to-Medium Altitude Surface-to-Air (SAM) Transport System
STRUCTURE
Light - Adobe Building
Light - Clay Building
Light - Plywood Building
Medium - Brick Bunker/Building
Medium - Wood Bunker/Building
Fortified - 1m Thick Concrete
Heavy - Cement Bridge
Heavy - Cinder Block Bunker/Building
Heavy - Steel Bridge
ABRAMS ANALOG
M1A1
M1A1 AIM
M1A1 AIM SA
M1A1 FEP
T-55 (Analog)
T-62 (Analog)
T-72 (Analog)
T-80 (Analog)
T-90 (Analog)
Chieftain (Analog)
ABRAMS DIGITAL
M1A2 SEP v1
M1A2 SEP v2
T-55 (Digital)
T-62 (Digital)
T-72 (Digital)
T-80 (Digital)
T-90 (Digital)
Chieftain (Digital)
BRADLEY ANALOG
M2A2

Vehicles and Structures
M2A2 ODS
M2A2 ODS-E
M3A2
M3A2 ODS
M7 ODS
BMP-1 (Analog)
BMP-2 (Analog)
BMP-3 (Analog)
BRADLEY DIGITAL
M2A3
M3A3
M2A2 ODS SA
M7A3 B-FIST
BMP-1 (Digital)
BMP-2 (Digital)
BMP-3 (Digital)
OSV-T ANALOG
T-55 (OSV-T)
T-62 (OSV-T)
T-72 (OSV-T)
T-80 (OSV-T)
T-90 (OSV-T)
OSV
BMP-1 (OSV)
BMP-2 (OSV)
BMP-3 (OSV)

Table 1. I-MILES VTESS Configurations

3.2 I-MILES VTESS System Architecture

I-MILES VTESS shall have a common base kit configuration that supports all target requirements for all vehicles. I-MILES VTESS shall have a delta kit for each vehicle variant as required.

3.3 I-MILES VTESS Characteristics

I-MILES VTESS shall have the capability for use during periods of reduced visibility and darkness. I-MILES VTESS shall be able to simultaneously shoot and respond to direct fire events while maintaining the IS communication. I-MILES VTESS shall not inhibit use of tactical systems, switches, controls and displays. I-MILES VTESS:

1. Shall store on-board a PID, and a minimum capability of 128 vehicle configurations The PIDs and vehicle types shall be retained in memory such that they are available for selection by authorized personnel via the Control Mode.
2. Shall have externally programmable Probability of kill (P_K) for each Basic MILES code number. All P_K data values shall be externally programmable

independently of the re-loading of the system software. I-MILES VTESS shall have the capability to upload custom P_k tables via the LPAN and the IS-TESS.

3. Shall have the capability, via the Live Training Engagement Composition (LTEC), to prevent the host system from assessing a self kill from its own encoded laser transmission. The laser transmission is composed of the I-MILES code, Player ID, and Ammo Type. The self kill assessment shall be based on all three components of the laser transmission. If the I-MILES VTESS has no weapon, this requirement does not apply. I-MILES VTESS shall know it just fired a MILES engagement codes and will ignore these MILES codes with the same PID & Ammo Factor for the following 7.5 ±2.5 seconds after the firing event.
4. Shall set the state to catastrophic kill at system power up.
5. Shall provide all audio and visual indications of the lethality effects assessment routine (LEAR) on the Crew Interface Module (includes internal speaker) and all Signature Devices within 0.5 seconds of the MCC reception.
6. Shall provide an internal clock containing day, month, year, and time information to a 5 second accuracy in a 528 hour period.
7. When a casualty has been assessed, during both day and night conditions, shall display the weapon type causing casualty, the casualty assessment, 8 Hit Zones (Front, Right-Front, Right, Right-Rear, Rear, Left-Rear, Left, Left-Front), and Shooter PID. The message shall remain displayed for 7.5 ±2.5 seconds unless another event occurs.
8. Shall retain all system information in non-volatile memory.
9. Shall contain an event memory clear function via Controller Mode to clear the event memory.
10. Shall perform a BIT at power up.
11. Shall permit viewing of event data and BIT results (both day and night).
12. Shall return the I-MILES VTESS units to a full operational state without altering the count of remaining ammunition and stop any casualty assessment indication when the Target System detects and decodes the resurrection command from the instrumentation system or Universal Controller Device conforming to PMT90-S002.
13. Shall return the I-MILES VTESS units to a full operational state, stop any casualty assessment indication, and return ammunition loads to the basic load of the vehicle being simulated when the target system decodes the reset command from the instrumentation system or Universal Controller Device conforming to PMT90-S002.
14. Shall provide a low power indication (see 3.15.5) for any component with a battery.
15. Shall have the Crew Interface Module be located inside the vehicle's crew area.

16. Shall allow the system to associate and disassociate all components.
17. Shall keep track per component of the hours of operation and display it to the operator via the CIM per component.
18. Shall have a method to self test the battery power level of all batteries for immediate operation without the use of tools or modification. This test shall be performed automatically upon battery insertion and shall notify the operator of the battery power status. The battery power status percent shall be displayed to the user.
19. Shall provide an interface to the I-MILES VTESS Master Controller component for downloading data

3.3.1 Lethality Effects Assessment Routine (LEAR)

I-MILES VTESS shall perform a Lethality Effects Assessment Routine (LEAR) IAW the MILES Communication Code (MCC) Standard, PMT-90-S002 using LTEC IAW the Live Training Engagement Composition (LTEC) Interface Control Document (ICD), PRF-PT-00608. The VTESS detector components shall provide MILES hit-miss information to LTEC, which shall perform a Real Time Casualty Assessment (RTCA) and assess the appropriate catastrophic kill, mobility kill, fire power kill, communication kill, or hit. VTESS shall:

1. For a catastrophic kill, inhibit the firing of all Laser Transmitters, provide a visual/aural indication to the crew that a catastrophic kill has been assessed, and initiate a catastrophic kill target visual kill indication.
2. For a firepower kill, inhibit the firing of all Laser Transmitters, provide a visual/aural indication to the crew that a firepower kill has been assessed, and initiate a firepower kill target visual kill indication.
3. For a mobility kill, provide a visual/aural indication to the crew to stop vehicle motion and initiate a mobility kill target visual kill indication. Twenty seconds after the crew has received notification of a mobility kill, I-MILES VTESS shall initiate a cheat kill if it senses any vehicle movement greater than 15 meters.
4. For a communication kill, provide a visual and aural indication to the crew that a communication kill has been assessed and initiate a communication kill target visual kill indication. I-MILES VTESS shall not disable or interrupt the internal or external vehicle communication.

3.3.1.1 Audio and Visual Signals

I-MILES VTESS shall emit voice messages to indicate casualty assessments. The voice messages shall be emitted after the tone. The below casualty emitted tones shall be 74 +14/-6 dB when measured 0.60 meters from the signal source. For a non-catastrophic kill assessment, each tone shall be 0.5 second long. Upon completion of casualty assessment I-MILES VTESS.

1. Shall generate two flashes and two tones for I-MILES VTESS Target System's near miss indication.

2. Shall generate four flashes and four tones for I-MILES VTESS Target System's hit, firepower kill, mobility kill, or communication kill indication.
3. Shall generate for a catastrophic or cheat kill.
    a. When on vehicle power.
        i. Audio cue shall be a continuous tone of not less than thirty seconds or until the user has acknowledged the kill indication.
        ii. Visual cue shall be a continuous flash at a rate of 1.0±0.1 Hz.
    b. Battery power.
        i. Audio cue shall be a continuous tone of not less than thirty seconds for a maximum of ten minutes or until the user has acknowledged the Kill indication.
        ii. Visual cue shall be a continuous flash at a rate of 1.0±0.1 Hz lasting for only ten minutes.

3.3.1.1.1 Intercom Audio Signals

The I-MILES VTESS shall inject voice cues into the vehicle intercom system for the following actions.

1. Shall inject voice cues into the vehicle intercom system to communicate the casualty assessment to include zone of attack for:
    a. Near misses.
    b. Hit.
    c. Catastrophic kills.
    d. Firepower kills.
    e. Mobility kills.
    f. Communication kills.
    g. Cheat kills.
2. Shall inject voice cues into the vehicle intercom system for manual BIT results (Pass or Fail).
3. Shall inject voice cues into the vehicle intercom system for periodic failed BIT results.

3.3.1.2 Actions For Kill Conditions

I-MILES VTESS shall perform the following actions for each of the kill conditions.

1. For a **catastrophic kill**, inhibit the I-MILES VTESS laser transmitter from transmitting for all weapons, provide a visual/aural indication to the crew that a catastrophic kill has been assessed, and initiate a catastrophic kill target visual kill indication. Provide capability to cause casualties to the vehicle crewman

wearing legacy or current MILES vests and halos as a result of a catastrophic kill assessment of the I-MILES VTESS target vehicle. Casualties will be inflicted on crew, driver and troop compartment. (Crew Kill Module)

2. For a **firepower kill**, inhibit the I-MILES VTESS laser transmitter from transmitting for all weapons, provide a visual/aural indication to the crew that a firepower kill has been assessed, and initiate a firepower kill target visual kill indication.
3. For a **mobility kill**, provide a visual/aural indication to the crew to stop vehicle motion and initiate a mobility kill target visual kill indication. Twenty (20) seconds after the crew has received notification of a mobility kill, the I-MILES VTESS shall initiate a cheat kill if the vehicle the I-MILES VTESS is mounted on has any forward or backward movement. Any vehicle forward or backward movement is prohibited.
4. For a **communication kill**, provide a visual and aural indication to the crew that a communication kill has been assessed and initiate a communication kill target visual kill indication. I-MILES VTESS shall not disable or interrupt the internal or external vehicle communications.
5. For a **cheat kill**, inhibit the I-MILES VTESS laser transmitter from transmitting for all weapons, activate I-MILES VTESS Crew Kill Module (CKM) component, provide a visual/aural indication to the crew that a cheat kill has been assessed, and initiate a cheat kill target visual kill indication.
6. The I-MILES VTESS Target System shall assess a catastrophic kill if a mobility kill and a firepower kill have been assessed from two separate engagements.

3.3.2 Collateral Damage

When I-MILES VTESS assesses a catastrophic kill, I-MILES VTESS shall transmit 4 MILES words of a Code 27 code with the Shooter PID to any Soldiers located inside the vehicle or building.

3.3.3 Other Basic MILES Controls

I-MILES VTESS shall perform the following actions in response to a corresponding MILES Administrative Code received by the detection system IAW PMT-90-S002.

1. Perform an administrative kill (same effect as catastrophic kill).
2. Perform a Reset.
3. Perform a Resurrect.
4. Clear Event Data.
5. Synchronize the internal clock.
6. Controller Mode On.
7. Controller Mode Off.

8. Change even PID to odd by subtracting 1 from PID.
9. Change odd PID to even by adding 1 to PID.
10. Fire-Power Kill.
11. Mobility Kill.
12. Communications Kill.
13. Hit.

3.3.4 Cheat Events

Whenever the player tampers with normal power supply I-MILES VTESS shall detect a tamper attempt and perform a cheat kill on the I-MILES VTESS. Whenever the player tampers with internal/intersystem cable connections I-MILES VTESS shall detect a tamper attempt and perform a cheat kill on the I-MILES VTESS, Whenever the player tampers with detectors I-MILES VTESS shall detect a tamper attempt and perform a cheat kill on the I-MILES VTESS, Whenever the player tampers with semi-permanent memory data storage I-MILES VTESS shall detect a tamper attempt and perform a cheat kill on the I-MILES VTESS. The cheat event shall be stored in the event storage. The cheat kill will be presented to the crew via visual and audio cues. I-MILES external ancillary devices connection status shall not cause a Cheat Event/Kill (e.g. Instrumentation Radio, MGSS, and DIFCUE). I-MILES VTESS shall initiate a cheat kill if it doesn't have the required detectors installed and operational per vehicle/configuration type. The Cheat Kill shall have the same effect as a catastrophic kill on I-MILES VTESS.

3.3.5 Transferred Data

I-MILES VTESS shall allow, IAW the Live Player Area Network (LPAN) Interface Standard, PRF-PT-00549, and the Live Training Engagement Composition (LTEC) Interface Control Docuemnt (ICD), PRF-PT-00608, the uploading of vulnerability P_K data and data to program the I-MILES VTESS to assume the role and performance characteristics of the system on which it shall be installed.

The data to be transferred shall include the following:

1. PID.
2. Basic Ammunition Default Load (All primary weapons of the I-MILES VTESS vehicles).
3. Ammunition type (All primary weapons of the I-MILES VTESS vehicles).
4. Ammunition delay time (All primary weapons of the I-MILES VTESS vehicles).
5. P_K data.

3.3.6 Visual Indication

I-MILES VTESS shall initiate the Vehicle Kill Indicator to give the visual indications for each corresponding event. The visual indication shall perform as follows.

1. Be visible through 360 degrees in azimuth.
2. Provide a flash visible at a distance of not less than 1800 meters in full sunlight on a standard clear day with the unaided eye.
3. Flash at a rate of 1.0±0.1 Hz. Multiple visual indicators, if applicable, shall flash synchronously.
4. Be the color Yellow Amber, as defined in SAE J578-1995, paragraph 3.1.2.
5. Be placed not more than 12 inches above the highest point of the vehicle structure, excluding antennas.
6. Not to interfere with either the driver or vehicle commander.

3.3.7 Recorded Events

I-MILES VTESS shall record and store I-MILES events that occur during training exercises. The event recorder shall have sufficient storage capacity for storing, at a minimum, the data from the last 1000 events. Recorded data shall be retained under low power conditions and battery removal. Host PID shall be recorded with all events. The event data fields shall displayed on the Crew Interface Module. All events shall have an event number. The events shall be numbered with “1” always being the ‘first saved’/oldest event of the system. The date format shall be DDMMMYYYY, where DD represents day of the month (01-31), MMM represents the month (JAN-DEC), and YYYY represents the year. The time display format shall be XX:YY:ZZ, where XX represents hours (00-23), YY represents minutes (00-59), and ZZ represents seconds (00-59). For example, 02SEP2010 04:54:17. The event data fields shall include the following information described in the subsections below.

3.3.7.1 Initiation Events

Initiation events, which are power up, power down, and I-MILES VTESS component association/de-association, shall record the following:

1. Name of event (Power up, Power down, Association, Disassociation).
2. Synchronized time and date of event.
3. Host PID.
4. Component associated / disassociated, if applicable.
5. Built In Test (BIT) results (Power up and Association).
6. Host platform type.
7. Weapon associated.
8. Ammunition type
9. Ammunition load count

3.3.7.2 Firing Events

Firing events shall record the following.

1. Name of event (Firing).
2. Synchronized time and date of event.
3. Host PID.
4. Weapon type.
5. Ammunition type
6. Ammunition remaing (for the weapon type fired)

3.3.7.3 Lethality Assessment Events

Lethality assessment events shall record the following.

1. Name of event (hit, all kill types, and near miss).
2. Synchronized time and date of event.
3. Host PID.
4. PID of attacker.
5. Weapon and ammunition type.
6. Aspect angle of attack (8 hit zones).
7. Turret position (minimum of 8 hit zones).
8. Determination of fratricide by comparing shooter and target PID.

3.3.7.4 Cheat Events

Cheat Events shall record the following.

1. Name of event (tampering attempt description).
2. Synchronized time and date of event.
3. Host PID.

3.3.7.5 Administrative Events

Administrative events shall include the following.

1. Name of event (time synchronization, administrative kill, resurrect, reset, commanded BIT, or failed periodic BIT).
2. Synchronized time and date of event.
3. Host PID.
4. Controller (Shooter) PID or source of request (if applicable).
5. BIT results and battery status by component (if applicable).

3.3.8 Viewing Events

I-MILES VTESS shall visually display, upon request, all recorded events. The scrolled messages shall remain displayed for 7.5 ±2.5 seconds unless another event occurs. All event information shall be available for display to include event number and event name.

3.4 I-MILES VTESS Interfaces

3.4.1 MILES Interface

I-MILES VTESS shall interface and be compatible with MILES training devices using a laser light beam communication channel through the atmosphere IAW PMT 90-S002. The I-MILES VTESS laser transmitters and detectors shall be capable of compensating for the presence of scintillation with no degradation of system performance.

3.4.2 Instrumentation Interface

I-MILES VTESS shall provide a bi-directional data link (high speed serial interface) to communicate IAW the following ICDs:

1. PRF-PT-00552.
2. 706014 Rev F.

The instrumentation mode and ICD being used to communicate shall be selectable via Controller Mode.

3.4.3 Data Transfer Device Interface

I-MILES VTESS shall provide an external data output interface IAW with the PRF-PT-00549 to extract event data.

3.4.4 Vehicle Host Interface

I-MILES VTESS shall interface with host vehicle systems, and vehicle weapons systems. I-MILES VTESS installation shall not require any permanent modifications to the vehicles. I-MILES VTESS shall not degrade the performance of host platforms, and crew performance. I-MILES VTESS shall protect the vehicle and weapon circuitry from current sags, surges, and transients resulting from the interface with I-MILES VTESS components.

3.4.5 Vehicle Internal Communication Interface

I-MILES VTESS shall inject alert tones and aural messages into the vehicle's internal communications system. I-MILES VTESS shall be capable of operating with either the AN/VIC-3 or AN/VIC-5 Vehicle Intercommunication Systems.

3.4.6 Vehicle External Communication Interface

I-MILES VTESS shall not interrupt the external radio communication of the vehicle under any circumstances.

3.4.7 Weapon System Interface

All of the required weapon system interfaces shall provide electronic isolation with the primary weapon trigger circuitry of the vehicle. The interfaces shall protect the weapon trigger circuitry from voltage and current sags, surges and transients resulting from the interfaces. I-MILES VTESS shall provide normal gunnery procedures with no degradation of fire control functionality or crew operations. For Crew Served Weapons that utilize a Common Remotely Operated Weapon Station (CROWS) or Remote Weapon Station (RWS) I-MILES VTESS shall interface with the weapon trigger circuitry.

3.4.8 Direct/Indirect Fire Cue (DIFCUE) Interface

I-MILES VTESS shall interface with the DIFCUE, Device number 06-69 (Ref: 9721801C - Prime Item Function Specification for the Keyless Direct/Indirect Fire Cue). I-MILES VTESS shall provide the capability via Controller Mode to enable or disable the DIFCUE functionality. I-MILES VTESS operation, with the exception of the DIFCUE not firing, shall not be affected when the DIFCUE is not connected.

When the I-MILES VTESS DIFCUE functionality is disabled, I-MILES VTESS shall not generate a message to fire the DIFCUE under any circumstances.
When enabled, the DIFCUE interface shall:

1. Generate a firing command in response to a catastrophic kill assessment by the I-MILES VTESS.
2. Generate a firing command in response to the appropriate message from the instrumentation system.
3. Not generate a firing command in response to a MCC Universal Kill.
4. Notify the operator through the I-MILES VTESS BIT if the DIFCUE is not connected to the I-MILES VTESS.

3.4.9 I-MILES VTESS Combat Vehicle Interfaces

I-MILES VTESS shall interface with the Training Device Interface Port on Bradley ODS SA and A3 vehicles. The integration of the I-MILES VTESS to the M2A3/M3A3/M7A3 shall be IAW the M2A3/M3A3 ICD for External Training Devices 19207-1246074 REV K. I-MILES VTESS shall interface to digital Abrams vehicles via the 1553 bus IAW MIL-STD-1553B CN4, Digital Time Division Command/Response Multiplex Data Bus. I-MILES VTESS shall interface to the vehicle remote weapon station (RWS) and its weapon for the Stryker Series infantry carrier vehicle (ICV), mortar carrier (MC), commanders vehicle (CV) and engineer support vehicle (ESV). I-MILES VTESS shall interface with the ITAS Training System for the Stryker Series anti-tank guided missile (ATGM) carrier.

3.4.10 Main Gun Signature Simulator (MGSS) Interface

I-MILES VTESS shall interface with the MGSS, Device number 17-180 (Ref: 9721802D - Prime Item Function Specification for the Keyless Main Gun Signature Simulator). I-MILES VTESS shall provide the capability via Controller Mode to enable or disable the MGSS functionality. I-MILES VTESS operation, with the exception of the MGSS not firing, shall not be affected when the MGSS is not connected. When the I-MILES VTESS MGSS functionality is disabled, I-MILES VTESS shall not generate a message to fire the MGSS under any circumstances. When enabled, the I-MILES VTESS MGSS interface shall generate a firing command in response to the vehicle fire control system firing the main gun to the MGSS.

3.5 I-MILES VTESS Combat Vehicle Specific Requirements

3.5.1 Anti-Tank Weapons Effect Signature Simulator (ATWESS)

I-MILES VTESS shall include an ATWESS assembly that provides visual cues to simulate missile firings. The ATWESS assembly shall simulate two missiles before reloading. I-MILES VTESS shall provide the capability for authorized personnel to enable or disable the ATWESS functionality. When disabled, I-MILES VTESS shall not generate a message to fire the ATWESS under any circumstances. When enabled, the ATWESS assembly shall provide the following:

1. The firing event for the M22 cartridge to provide visual flash and smoke effects similar to that of a missile being fired.
2. A manual safety interlock/lever to eliminate accidental firing of the ATWESS. The safety interlock shall be pulled to ARM, and provide visual indication that the device is armed.
3. Use of the standard M22 cartridge (per missile simulated).
4. Generation of a firing command to the ATWESS in response to a simulated missile weapon firing initiated by the crew.
5. The laser transmitter shall transmit only when an unfired ATWESS is loaded and fired by the ATWESS firing device.
6. Inhibit the laser transmitter from transmitting and the ATWESS from firing if a weapon firing is initiated when the ammunition load has been expended.
7. The system shall notify the operator through BIT if the ATWESS firing system is not connected to the I-MILES VTESS.

Each I-MILES VTESS ATWESS assembly shall correlate with a specific missile on the simulated platform.

3.6 Shooting Systems

I-MILES VTESS Shooting System:

1. Shall automatic disable all laser transmitters within 500 msec when a catastrophic kill or firepower kill has been assessed by I-MILES VTESS.
2. Shall fire the appropriate laser transmitter in less than 500 msec from the actual trigger pull of the platform.
3. Laser transmitters shall be in compliance with Laser Class 1 (Objective) or Class 3R (Threshold) Eye-Safe regulations.
4. Shall fire one MILES round transmission as defined in PMT90-S002 for each blank round fired.
5. Shall have the rate of simulated fire be the same as the actual weapon.
6. Shall be triggered using normal weapon firing procedures.
7. Shall provide a means of mounting and aligning the MRLT to the vehicle or weapon system sights within 5 minutes or less. Alignment of weapons mounted on the vehicle shall not require the removal of the weapon from the vehicle mounting location. Laser alignment shall be accomplished by adjustments made to the LT and not the host weapon system sights. The alignment retention shall be at least 528 hours under training exercise conditions.
    a. The alignment device shall be stand-alone device(s). The alignment device shall be rugged enough and transportable to be carried on the vehicle during exercises.
8. The mounting of the MRLT shall not interfere with any tactical sighting device IAW Small Arms Integration Book (SAIB).
9. Shall provide a single shot dry-fire mode for all weapons. The dry-fire mode shall be selected via Controller Mode. The dry-fire device shall meet the environmental test requirements conditions described in section 3.15.10.
10. Shall provide the shooter with a visual indication that the laser transmitters are firing properly.
11. Shall not cause any artificial visual or electromagnetic signatures that provide a tactical advantage to players during training exercises.
12. Shall simulate constraints and provide reprogrammable delays for re-loading of weapons.
13. Shall be configurable to transmit all MILES Codes and all MILES Encoding Sequences.
14. Shall have no interconnecting cables with the other I-MILES VTESS components.
15. Shall operate with blanks as a normal operating condition when mounted on a weapon.
16. For the M2 MRLT shall transmit the M2 I-MILES weapon code parameters.
17. For the M240 and M249 MRTL shall transmit the M16 I-MILES weapon code parameters.

18. For M1platforms, shall provide the means for the selection of ammunition type on a round by round basis for the gunner and loader, track ammunition quantities, and compare gunner/loader ammunition selections for all primary weapons. If the selection of the gunner and loader does not match, only “near-miss” words shall be sent by the Shooter. Shall provide a loader's interface display when applicable.
19. Shall not require loader interaction or loader/gunner matching for any COAX weapon. Laser transmitter(s) shall generate, upon activation of the weapon system’s trigger of the 73mm, 100mm, 115mm, 120mm, 125mm, 25mm, 30mm, and missile and the firing of blanks by the COAX primary weapon laser transmitter (one blank round fired equals one MILES round transmission as defined in PMT90-S002). For the 120mm, 25mm, and the TOW weapons, actual weapon fire signal shall be used.
20. Shall for M2 and M3 Platforms, provide the means for the selection of ammunition type on a round by round basis for the gunner and track ammunition quantities for all primary weapons.
21. Shall display at each loader station (M1 platform) and at the Operator Module, upon command, ammunition selected, ammunition remaining, and reloading status.
22. Shall decrement the remaining ammunition count when the corresponding Laser Transmitter Unit is fired.
23. Shall inhibit the laser transmitter from transmitting the MILES code if a weapon firing is initiated when the vehicle’s ammunition load has been expended.
24. The munitions fly out time for the missile shall be range dependent when range is available from the vehicle. When range is not available the fly out time shall be selectable by the OC-T.
25. Shall for M2, M3, and M7 platforms, include a Flash WESS assembly that provides visual cues to simulate the firing of the 25 mm or 30mm weapon. The Flash WESS assembly shall:
    a. Provide a lamp flash that operates at a rate of fire of the weapon being simulated up to a maximum of 200 flashes per minute.
    b. Provide a flash that is visible from the front center 12 o’clock position ± 90 degrees at a distance of 1000 meters in a full sun lit standard clear day with the unaided eye.
    c. Not use a pyrotechnic.
26. Shall for M2, M3, and M7 platforms, include an Audio WESS assembly that provides aural cues to simulate the firing of the 25 mm or 30mm weapon. The Audio WESS assembly shall
    a. Provide an audio signature (replicating the sound of the 25mm or 30mm weapon firing) for the firing of each individual 25mm

ammunition with a sound pressure level of 135 +/- 3 dB when measured 2 meters from the signal source.

b. Not use a pyrotechnic.

27. Shall for M2, M3, and M7 platforms, generate a firing command to the Flash WESS and Audio WESS in response to a simulated firing of their respective 25 mm or 30mm weapon.

28. Shall transmit only upon activation of the corresponding WESS such as MGSS, ATWESS, Flash or Audio WESS (when the WESS is enabled).

29. Shall include firing system delays for trigger pull time and actual firing time. I-MILES VTESS shall inhibit the firing of successive rounds until time has expired between rounds to simulate reloading the weapon and simulate the limitations imposed by the weapon's rate of fire as listed in Table 2 and Table 3.

Primary Weapons	**Basic Load**	**Firing Rate**	**Effective Range**
120 mm			
APFSDS round	12 (14 for M1A2 configurations)	12 RPM	3000 m
HEAT round	12	12 RPM	3000 m
MPAT round (M830 A1)	12	12 RPM	3000 m
Canister round (M1028)*	4	12 RPM	500 m
M240 (7.62 mm COAX)	9900 (SIMULATED DRY FIRE QUANTITY)	100 RPM	1100 m
Secondary Weapons			
M240 (7.62mm)	N/A	100 RPM	1100 m
M2 (12.7mm; turret type for the M1A1)	N/A	70 RPM	1830 m

* See **Error! Reference source not found.** for round parameters.

NOTE: custom configurations shall allow any combination of 120mm rounds up to a maximum of 40 rounds.

Table 2. M1 Abrams Series Configurations (M1A1 AIM SA and M1A2 SEP V2)

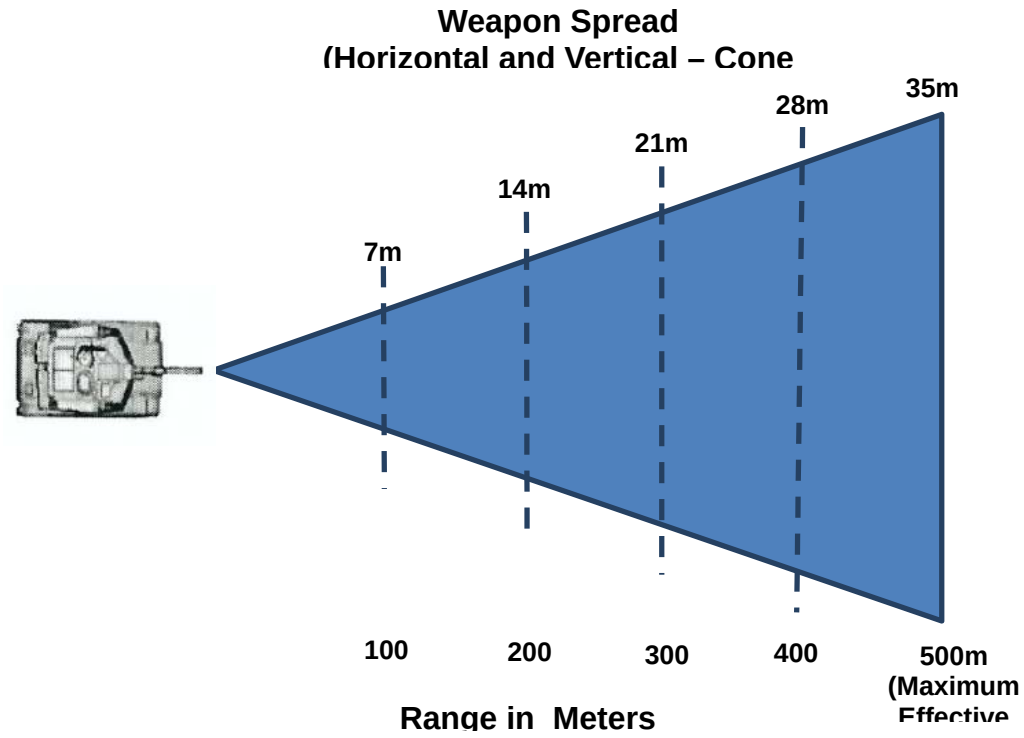


Figure 2. M1028 Canister Spread

The I-MILES VTESS shall simulate the M1028 munitions spread (cone) as shown in **Error! Reference source not found.**. The I-MILES VTESS shall transmit Code 16 (Canister Round) Ammunition Factor parameters as specified in PMT90-S002 (Table E1) to simulate the M1028 round. One MILES round of Code 16 shall simulate one MILES round of M1028.

Bradley Fighting Vehicle Systems Ammunition Capabilities and Stowage							
Ammunition Capabilities				Stowage Capability by Variant			
Ammunition Type	**Tracer Burn-Out Range (Meters)**	**Maximum Effective Range (Meters)**	**Weapon System Firing Rate**	**M2A2 ODS SA, M2A3**	**M3A3**	**M7A3 B-FIST**	**M2A2 ODS-SA BFIST**
25mm APDS-T (M791)	2000	2000	Single Shot (not greater than high rate) Low= 100 ± 25 rds/min High= 200 ± 25 rds/min				
25mm APFSDS-T (M919)	2500	2500	Single Shot (not greater than high rate) Low= 100 ± 25 rds/min High= 200 ± 25 rds/min				

25mm HEI-T (M792)	2000	3000	Single Shot (not greater than high rate) Low= 100 ± 25 rds/min High= 200 ± 25 rds/min				
*** Ready (Combination of only one or two types of 25 mm Ammunition at a time can be in the ready)**				70/230*	70/230*	70/230*	70/230*
*** Stowed (Any combination up to maximum stowed capability)**				600	1200	600	600
TOW Missile	N/A	3750	N/A				
Ready				2	2	N/A	N/A
Stowed				5	10	N/A	N/A
7.62mm Coax Machine Gun	900	1100	100 rds/min				
Ready				800	800	800	800
Stowed				1400	3400	3600	3600
Custom configurations shall have the capability to modify the basic load up to the maximum allowable capacity per variant. However, Only one type of AP round (either M791 or M919) can be loaded at one time.							

Table 3. Bradley Fighting Vehicles Ammunition Capabilities and Stowage

3.6.1 Pairing Probabilities

The aim point shall be the center of the target profile during tests. For weapons that use blank ammunition for training purposes the MILES pairing probability shall be tested using blank ammunition, an independent certified government shooter shall be used for all pairing tests performed. Pairing probability shall be tested in its intended operational mode. A valid pairing shall include the correct decoding of the MILES Code, PID, and Ammo Type. The atmospheric conditions for a standard clear day for the I-MILES training system are defined in Figure as a visibility of 23.5 Km. Adjustments for ranges due to visibility shall be calculated from data shown in Figure . Results from these calculations that shall be used are shown in section 8.0. The only adjustments made to shooting range shall be due to visibility, if required. The only adjustments made to pairing percentages shall be due to temperature, if required. The pairing requirements are shown in Tables 4, 5, and 6. Tables 7 and 8 have the effective and suppression ranges for the machine guns.

15%, 50%, 90% OF WEAPON EFFECTIVE RANGE						
Weapon	**Target System**	**Firing Mode**	**Assessment Required**	**-18 - <20 °C**	**20-30 °C**	**>30 – 49 °C**
All MRLT (Machine Gun Operation)	Three manworn MILES IWS side by side, with 1±0.1 meter between the center of each target	Burst mode consisting of six to nine shots	Hit or Kill (on one or more targets)	>=80%	>=85%	>=80%
All MRLT (Single Shot Operation)	One manworn MILES IWS	Single Shot	Hit or Kill	>=90%	>=95%	>=90%
I-MILES CVTESS 120 mm	VTESS	Single Shot	Hit or Kill	>=90%	>=95%	>=90%
I-MILES CVTESS 25 mm	VTESS	Single Shot	Hit or Kill	>=90%	>=95%	>=90%
SLM (RPG)	VTESS	Single Shot	Hit or Kill	>=90%	>=95%	>=90%
SLM (AT-4)	VTESS	Single Shot	Hit or Kill	>=90%	>=95%	>=90%
M2 MRLT	VTESS	Burst mode consisting of six to nine shots	Hit or Kill	>=80%	>=85%	>=80%
M240	VTESS	Burst mode consisting of six to nine shots	Hit or Kill	>=80%	>=85%	>=80%
Canister	Twenty manworn MILES IWS distributed within and outside the spread of the weapon.	Single Shot	Hit or Kill(on all targets within the spread of the weapon) AND near miss or no assessment on targets outside the spread of the weapon.	>=90%	>=95%	>=90%
All other weapons listed in Section 3 of this performance specification	VTESS	Single Shot	Hit or Kill	<15%	<20%	<15%

Table 4. Effective Range Pairing Requirements

170% OF WEAPON EFFECTIVE RANGE						
Weapon	**Target System**	**Firing Mode**	**Assessment Required**	**-18 - <20 °C**	**20-30 °C**	**>30 - 49 °C**
All MRLT (Single Shot Operation)	One manworn MILES IWS	Single Shot	Hit or Kill	<15%	<20%	<15%
I-MILES CVTESS 120 mm	VTESS	Single Shot	Hit or Kill	<15%	<20%	<15%
I-MILES CVTESS 25 mm	VTESS	Single Shot	Hit or Kill	<15%	<20%	<15%
SLM (RPG)	VTESS	Single Shot	Hit or Kill	<15%	<20%	<15%
SLM (AT-4)	VTESS	Single Shot	Hit or Kill	<15%	<20%	<15%

Table 5. Roll Off Pairing Requirements – 170% Effective Range

170% OF WEAPON EFFECTIVE RANGE						
Weapon	**Target System**	**Firing Mode**	**Assessment Required**	**-18 - <20 °C**	**20-30 °C**	**>30 - 49 °C**
All MRLT (Machine Gun Operation)	Three manworn MILES IWS side by side, with 1±0.1m between the center of each target	Burst mode consisting of six to nine shots	Hit, Kill or Near Miss	<15%	<20%	<15%

Table 6. Roll Off Pairing Requirements – 170% Effective Range

15%, 50%, 90% of Weapon Suppression Range						
Weapon	**Target System**	**Firing Mode**	**Assessment Required**	**-18 to 20 degrees C**	**25 +/- 5 degrees C**	**30 to 49 degrees C**
All MRLT (Machine Gun Operation)	Three manworn MILES IWS side by side, with 1±0.1m between the center of each target	Burst mode consisting of six to nine shots	Hit, Kill or Near Miss	>=80%	>=85%	>=80%

Table 7. Suppression Pairing Requirements

Weapon	Effective Range	Suppression Range
M240 or M249	800 m	1,100 m
M2/M2A1	1,829 m	1,800 m
M1 Abrams 120 mm	3000 m	N/A
M2/M3/M7 Bradley 25 mm	3000 m	N/A
SLM (AT-4)	300 m	N/A
SLM (RPG)	200 m	N/A

Table 8. Weapon Effective Range

3.6.1.1 Shooter Hit Profile

The statistical hit profile for the I-MILES VTESS MRLT shall consist of a collection of aim points that pair the MILES light weapon hit words and PID from the MRLT with a MILES IWS manworn target system. This profile, when measured in the dry-fire mode at the midpoint of the weapon's effective range, shall be larger than a circle with a diameter of 0.2 meters and shall fit inside a rectangle measuring 1.5 meters in the horizontal plane and 2.5 meters in the vertical plane.

3.6.1.1.1 I-MILES VTESS M1 120mm (except canister) Weapons, M2/M3/M7 25mm Weapons, and M2/M3 TOW Hit Profile

The statistical hit profile for the front, back, and sides of the MILES shooter systems listed in **Error! Reference source not found.** shall consist of a collection of aim points that pair the MILES heavy weapon hit words and PID from the I-MILES VTESS Laser Transmitters (LT) with the MILES target systems listed in **Error! Reference source not found.**. The profile dimensions when measured in the dry-fire mode at the midpoint of the Weapon's effective range shall attempt to replicate the actual shape of the vehicle. The shooter hit profile shall be larger than a 2.0 meter (length) x 1.0 meter (height) rectangle and shall fit inside an 8.5 meter (length) x 5.0 meter (height) rectangle.

3.6.1.1.2 I-MILES VTESS M1 120mm Canister Hit Profile

The statistical hit profile for the I-MILES VTESS canister round shall consist of a consistant aim point that pairs the MILES hit words and PID from the Laser Transmitter with a MILES IWS manworn target system. The shooter hit profile dimensions when measured in the dry-fire mode at ranges of 100M, 200M, 300M, 400M, and 500M shall be in compliance with the values in **Error! Reference source not found.** both vertically and horizontally (the spread is cone shaped).

I-MILES VTESS LASER Transmitters		Target System
I-MILES VTESS 120mm	vs.	MILES XXI M1 system
I-MILES VTESS 25mm	vs.	MILES XXI M1 system
I-MILES VTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	MILES XXI M1 system
I-MILES VTESS STRYKER Main Gun	vs.	MILES XXI M1 system
I-MILES VTESS 120mm	vs.	MILES XXI M2/M3 system
I-MILES VTESS 25mm	vs.	MILES XXI M2/M3 system
I-MILES VTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	MILES XXI M2/M3 system
I-MILES VTESS STRYKER Main Gun	vs.	MILES XXI M2/M3 system
I-MILES VTESS 120mm	vs.	I-MILES TVS
I-MILES VTESS 25mm	vs.	I-MILES TVS
I-MILES VTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	I-MILES TVS
I-MILES VTESS STRYKER Main Gun	vs.	I-MILES TVS
I-MILES VTESS 120mm	vs.	I-MILES CVTESS
I-MILES VTESS 25mm	vs.	I-MILES CVTESS
I-MILES VTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	I-MILES CVTESS
I-MILES VTESS STRYKER Main Gun	vs.	I-MILES CVTESS

Table 9. I-MILES VTESS Laser Transmitters vs. Target Systems

3.6.1.2 Near Miss Profile

I-MILES VTESS shall project a laser beam(s) to produce out to the effective range the near miss profile onto a target for each weapon and its ammunition being simulated. The laser beam near miss profile shall convey ammunition type, PID, and the number of near miss words as specified in PMT-90-S002. The profile dimensions when measured in the dry-fire mode at the midpoint of the Weapon's effective range shall be a minimum of 10% and a maximum of 25% larger in all directions than HIT profile measured from the same weapon on the same target. The near miss mode shall not apply to missile weapons.

3.7 Target System

I-MILES VTESS Target System.

1. Shall process the electronic signals to decode the MILES code messages IAW PMT-90-S002.
2. Shall detect the encoded laser beam transmitted by I-MILES devices in ambient illumination ranging from full darkness to full sunlight.
3. Shall pair (via a Hit, Mobility Kill, Communications Kill, Firepower Kill, or Catastrophic Kill assessment) throughout 360 degrees of detection coverage in azimuth and ±45 degrees of detection coverage in elevation off the centerline of the entire target vehicle.
4. For missile engagements, the initiation of the casualty determination shall not be dependent on the closing of the decoder's tracking interval window. In the event that the number of messages for a casualty evaluation is received before the tracking interval (decoding window) ends, the casualty assessment shall be made at that point.
5. In the event that only the Basic MILES code portion of the message is decoded (no valid PID is decoded) the I-MILES VTESS shall still perform the casualty assessment.

3.7.1 Target Hit Profile

The statistical hit profile for the front, back, and sides of the I-MILES VTESS target system shall consist of a collection of aim points that pair the MILES vehicle heavy weapon hit words and PID from the following Laser Transmitters (LT) in **Error! Reference source not found.** with I-MILES VTESS. The profile dimensions when measured in the dry-fire mode (if applicable) at the midpoint of the Weapon's effective range shall attempt to replicate the actual shape of the vehicle. The profile shall be larger than a 2.0 meter (length) x 1.0 meter (height) rectangle and shall fit inside an 8.5 meter (length) x 5.0 meter (height) rectangle. I-MILES VTESS Hit Profile shall have the collective laser detector Hit Zones be configurable to represent the Hit Zone of the simulated vehicle. The Hit Zone shall have uniform coverage with no detection gaps between detectors.

LASER TRANSMITTERS		I-MILES VTESS TARGET SYSTEM
SLM (AT-4)	vs.	I-MILES VTESS
SLM (RPG)	vs.	I-MILES VTESS
I-MILES VTESS 120mm	vs.	I-MILES VTESS
I-MILES VTESS 25mm	vs.	I-MILES VTESS
I-MILES VTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	I-MILES VTESS
MILES XXI 120mm	vs.	I-MILES VTESS
MILES XXI 25mm	vs.	I-MILES VTESS
MILES XXI vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	I-MILES VTESS
MILES CVTESS 120mm	vs.	I-MILES VTESS
MILES CVTESS 25mm	vs.	I-MILES VTESS
MILES CVTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	vs.	I-MILES VTESS

Table 10. Laser Transmitters vs. I-MILES VTESS Target System

3.8 Force-on-Target (FOT)

I-MILES VTESS shall support a Force-on-Target operational mode. I-MILES VTESS shall retain all performance requirements in FOT mode. All components needed for the I-MILES Target System shall be able to withstand the actual firing of live ammunition from a M1 Abrams main gun and a M2 Bradley main gun. Selection of the FOT mode shall require Controller Mode On. The I-MILES VTESS FOT mode shall allow for the option of firing the simulation of the missile to include the use of the ATWESS.

3.9 Built-In Test (BIT) Characteristics

A built-in fault detection and locating system shall be provided to detect performance degradation and failures and provide Go/No Go status for the I-MILES VTESS. BIT features shall include the following.

1. Provide an assessment of overall system integrity in less than 30 seconds upon command. Reported system status shall be real time status of the assessment just performed.
2. Diagnose problems and faults to the component level and provide a Go/No Go status.
3. Shall be entirely self-contained, and shall require no external measurement equipment.
4. Display and store the results of manual and power-up BIT to the operator when the system has completed an integrity checkout. Display and store the results of Periodic Bit if a failure occurs.
5. Power On BIT - Shall automatically initiate a complete BIT sequence in response to powering up the system with results indicated and stored.
6. Manual BIT - Shall initiate a complete BIT sequence in response to a request from the operator and/or from the instrumentation system.
7. Periodic BIT – I-MILES VTESS shall automatically initiate a complete BIT sequence once every 7 +/- 1 minute during its operation. If BIT passes no event shall be saved.
8. Execution of manual BIT and periodic BIT shall not affect the operation of the I-MILES VTESS during a training exercise.
9. Each I-MILES VTESS component shall have a BIT.
10. Each I-MILES VTESS component shall have a visual indication of BIT results to the user.

3.10 User Interface

I-MILES VTESS shall use MILES Code 35 PID E0315 Controller Mode On to enter the Controller Mode. In Controller Mode, I-MILES VTESS shall permit the operator to select and change PID, vehicle type, number of detectors (0-N), number of components (0-N), MILES code and encoding sequence to be transmitted, rate of fire, and vehicle configuration to be sent to the IS, IS ICD, and permit the capability to modify and mix the basic ammunition load up to the maximum allowable capacity per vehicle variant.. The I-MILES VTESS User Interface shall:

1. Provide a graphical, step-by-step, prompt driven start up process.
2. Provides graphical, step-by-step, prompt driven, installation instructions and configuration of I-MILES VTESS.
3. Display the Operator User Manuals (OUMs) to the user. The user shall be able to scroll and read the OUMs.
4. Display step-by-step un-installation guide (video and interactive)
5. Play audio cues as a result of engagements, BIT
6. Display the IS connection status.

7. Display step-by-step troubleshooting procedures.
8. Display all weapon data and ammunition loads.
9. Be able to adjust the brightness of the display.

3.10.1 User Interface Messages

The scrolled messages shall remain displayed for 7.5 ±2.5 seconds. The date display format shall be DDMMMYYYY, where DD represents day of the month (01-31), MMM represents the month (JAN-DEC), and YYYY represents the year. The time display format shall be XX:YY:ZZ, where XX represents hours (00-23), YY represents minutes (00-59), and ZZ represents seconds (00-59). For example, 02SEP2010 04:54:17. At a minimum, the following information shall be available for display.

1. Results of last event (Kill/hit/near-miss), to include weapon type causing casualty, the physical location of the hit zone of attack, and the casualty assessment.
2. PID of attacking player/weapon system when killed.
3. Battery status level for all I-MILES VTESS components.
4. Low battery indication by component. Low Battery is defined when the component has less than 12 hours of operational use for all wireless components.
5. BIT failure (by type and location).
6. Components status (Software Version ID, Battery life status and BIT).
7. Ammunition remaining by weapon, quantity and type.
8. Platform type and PID Vehicle status (Alive, Dead, Mobility Kill, Etc).
9. Synchronized time and date of an event in military format to the nearest second.
10. Display the hours of operation for every component.

3.11 System Computational Requirements

The I-MILES VTESS computational systems shall be capable of running the LTEC software. Minimum computational requirements to run LTEC are defined in the LTEC Interface Control Document, PRF-PT-00608.

3.11.1 Computer Systems

3.11.1.1 Software Development

Software procured under this Contract shall have been developed using recognized modern software engineering methods, and using a commercial item programming language and compiler. All machine dependent code and compiler dependent code shall be logically grouped into separate packages with meaningful names. Adaptation of previously-developed software to make it fully compliant with the I-MILES VTESS requirements shall also be

accomplished using recognized modern software engineering methods. I-MILES VTESS shall have an Information Assurance (IA) capability that provides adequate protection from user attempts to circumvent system access controls, accountability or procedures for purpose of performing unauthorized system operations.

3.11.1.2 Software Upgrades

I-MILES VTESS shall have the capability to be upgraded with future software revisions. It shall be programmable using an external programming source that does not require opening system devices or removing system components. All I-MILES VTESS wireless components shall be software upgradable IAW PRF-PT-00549.

3.11.1.3 Run-Time Environment

The run time environment shall consist of a commercial item real-time operating system that can support the LTEC software.

3.11.1.4 Firmware

Firmware shall be incorporated into the appropriate Computer Software Configuration Items (CSCI) with the same requirements as other software.

3.12 False Alarm

A false alarm is the decoding and processing of noise as a valid MILES code. A false alarm is considered a failure. I-MILES VTESS shall have a cumulative false alarm rate of not more than one false alarm per 100 hours of field operations for 100 I-MILES VTESS kits.

3.13 Installation and Removal

All I-MILES VTESS training systems, sub-systems, and assemblies shall be installed, operated, aligned and removed without physical damage to or permanent modification of the host vehicle and crew-served weapon system. Shall be installed and ready for training by an unaided crew, organic to the vehicle, within 60 minutes and only with use of the targeted vehicle's BII. LTs alignment shall be included in the 60 minute installation time. I-MILES VTESS platforms that do not have BII shall require no tools for installation. The time required for a crew to remove and stow the I-MILES VTESS shall take 30 minutes or less.

3.14 Mounting

I-MILES VTESS components that are mounted on host vehicles shall be out of the way of crew operators; shall not interfere with the operation of any of the vehicle system components; and shall not pose a hazard to the Soldier. All components mounted on the vehicle shall have a primary and secondary means of attachment to prevent loss of I-MILES VTESS components in the training environment.

3.14.1 Mounting Devices

Mounting devices shall include all devices required to secure I-MILES VTESS components to the host platform. For vehicles, mounting devices shall be electronically (if applicable) and mechanically attached to the host vehicle. Fasteners manipulated by the Soldiers in the field shall be of the captive type.

3.14.2 Interconnecting Cables

The cables, connectors, and couplers to interconnect I-MILES VTESS components to the host vehicle systems shall be provided. I-MILES VTESS power cables shall be universe and shall connect to Common connector of Common Power Supply as defined in the Live Training Transformation (LT2) Component Specification for the Common Power Supply (CPS), LT2 TESS CPS-001. All cables attached to the vehicle shall be by temporary means. All I-MILES VTESS cables shall be clearly marked with designated function, cable part number, connector numbers, and reference designator. Connectors shall be color coded for installation when both mating connectors are being provided within the I-MILES VTESS. Cable ends shall employ cable shells that protect cable signal pins from being bent or broken when Soldiers attach/detach cable ends. Cable wires shall be properly grounded and Electromagnetic Interference (EMI) leakage-radiated/susceptance resistant cable inserts gaskets used. If the routing of the cable requires a bend greater than 45 degree the cable connector back shell shall use a 90 degree connector backshell.

3.15 Physical Characteristics

The I-MILES VTESS shall not alter the visual aspect of the vehicle. The I-MILES VTESS's physical appearance shall not enhance acquisition, detection, and engagement of the I-MILES VTESS equipped/kitted vehicle.

3.15.1 Weight

All I-MILES VTESS component assemblies shall be transportable and maneuverable by one person. When assembled in their respective operating configuration, the weight of each I-MILES VTESS component shall not exceed that prescribed by the lift and carry requirements. The weight and center of gravity of the I-MILES VTESS devices shall not impede the carrying, movement and functioning abilities of the individual or crew in conducting training.

3.15.2 Finish

All exterior surfaces of I-MILES VTESS components and devices shall be treated to resist corrosion from exposure from all environmental conditions in Environmental, Safety, and Electromagnetic Environmental Effects (E3) Requirements Specification.

3.15.3 Color

Selection of color for all painted surfaces shall be the low visibility, lusterless, non-reflective type. The color of the components mounted on vehicles shall be International Green: 34108

or Black 37038 IAW FED-STD-595C; with the exception of (1) surfaces required for the transmission or reception of electromagnetic signals. Non-standard colors (other than green or black) may be used only where necessary for proper operation of the device, for safety (warning labels), component identification (ID labels and reference designators). Such exempted items shall not exhibit a highly reflective or polished surface, and in no case shall the area of the non-standard color exceed 1 square inch on the same reflective plane.

3.15.4 Size

The I-MILES VTESS components and devices shall be minimized such that they do not impede the carrying, movement, and functioning abilities of the individual, crew, and host platform in conducting training.

3.15.5 Power

All I-MILES VTESS components, except for any wireless components, shall be powered by the Common Power Supply (CPS) via the VMC. The VMC shall have an on/off function which restores/inhibits the power from the CPS to the system. The VMC on/off function shall have a guard to prevent accidental actuation. In the off position, the VMC shall not draw any current i.e. the Unit shall be completely off.

I-MILES VTESS shall continuously operate a minimum of 100 hours when running off the CPS internal battery. While meeting the continuous operation goals, the I-MILES VTESS shall be capable of sustaining at least 20 near miss assessments per day, 2 catastrophic kills per day, firing 167 rounds of the M240 MRLT, 34 rounds of the M2 MRLT, two alignments per day per MRLT, and providing power to the IS radio.

3.15.5.1 Common Power Supply (CPS)

I-MILES VTESS shall have a CPS IAW the LT2 Component Specification for the Common Power Supply (CPS), LT2 TESS CPS-001.

3.15.5.2 Wireless Component Batteries

All I-MILES VTESS wireless components shall provide a minimum of 528 hours (22 days) of continuous operation under the high temperature and low temperatures operational requirement in the Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647. While meeting the continuous operation goals, the I-MILES VTESS shall be capable of sustaining at least 20 near miss assessments per day, 2 catastrophic kills per day, and two alignments per day. The minimal laser transmitter expended rounds per 528 hour exercise are shown in Table 11. All I-MILES VTESS wireless components shall use the L91 AA battery.

Laser Transmitter	ROUNDS EXPENDED/ 528 HR EXERCISE
M240 or M249 MG	21,000
M2 MG	4,400

LRLT	211
Missile	53

Table 11. Minimal MRLT Rounds Expended per 528 Hour Exercise

3.15.5.3 Field Replaceable Batteries

All I-MILES VTESS wireless components shall have field replaceable batteries. The battery (ies) shall take no more than one minute to replace without any tools. The components shall retain configuration information when replacing the batteries.

3.15.6 Transportability

I-MILES VTESS shall have transit cases to protect I-MILES VTESS components during transportation, storage, and handling. The transit cases shall be built to comply with ATA SPEC 300, Category I container. The transit case shall provide protected areas for attachment of all hardware. Top and bottom case surfaces shall be interlocking. Transit cases shall have handles on all four sides. It is desired that the Transit Case, with all I-MILES VTESS components, be a one person lift. Transit cases shall be designed to facilitate accountability without removing components, such as packing components with the serial numbers up/visible. A component list of what components are in the transit case shall be affixed to the top interior of the transit case. Lift limits for transit cases, with all I-MILES VTESS components, shall be IAW MIL-STD-1472 person lift-five foot lift distance. Transit cases shall be prominently labeled with the total weight and required number of handlers for lifting and movement of cases. I-MILES VTESS, when packed in its transit cases, shall withstand damage due to stresses incidental to movement, handling in transit, and tie-down aboard common carrying vehicles such as aircraft or trucks. The goal shall be to reduce the logistics footprint for transporting, setup and storage of the system, components and ancillary items used.

3.15.7 Reliability

Each I-MILES VTESS component shall have a minimum acceptable Mean Time Between Failure (MTBF) requirement of 1660 hrs. The operational availability (A_o) shall be, at a minimum, 90% system level.

3.15.8 Maintainability

The Mean Time to Repair (MTTR) for each I-MILES VTESS component shall be 60 minutes. Maximum time to diagnose component failure in the operational training environment shall be 15 minutes or less. All equipment shall be designed to minimize personnel, materiel, parts, special tools, and equipment needed to maintain and service components.

3.15.9 Logistic Data

The contractor shall incorporate component level counters to track I-MILES VTESS logistic performance. The data collected shall include: cumulative operational hours, hours since last

failure, cumulative number of failures, and hours since last essential function failure. The I-MILES VTESS shall provide the capability to retrieve the data via the LPAN.

3.15.10 Environmental Conditions / Electromagnetic Environmental Effects (E^3) / System Safety

All I-MILES VTESS components shall meet the requirements IAW Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647.

3.16 Construction

3.16.1 Materials and Parts

The I-MILES VTESS device shall be a Non-Developmental Item (NDI) and the delivered training solution either Commercial-Off-The-Shelf (COTS) or modified COTS.

3.16.2 Nameplates and Product Marking

All I-MILES VTESS components nameplates and product marking shall meet the requirements IAW Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647.

3.16.3 Interchangeability

All I-MILES VTESS components shall meet the interchangeability requirements IAW Environmental, Safety, and Electromagnetic Environmental Effects (E3) Requirements Specification.

3.16.4 Human Engineering

All I-MILES VTESS components shall meet the Human Engineering requirements IAW Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647.

4.0 Verification

4.1 Design Verification

The matrix in Table 12 specifies the methods of verification for each of the requirements of Section 3.0. The Qualification Methods of the Table are defined as follows:

1. **Examination (E)**. Examination is an element of inspection consisting of investigation, without the use of special laboratory appliances or procedures, of supplies and services to determine conformance to those specified requirements that can be determined by such investigations. Examination is generally nondestructive and includes, but is not limited to, the use of sight, hearing, smell, touch, and taste; simple physical manipulation; mechanical and electrical gauging and measurement; and other forms of investigation.

2. **Testing (T)**. Testing is an element of inspection and generally denotes the determination, by technical means, of the properties or elements of supplies, or components thereof, including functional operation, and involves the application of established scientific principles and procedures. Test shall consist of measurement, calculation, and other accepted scientific means to establish that the performance requirements of this Specification are met.

3. **Analysis (A)**. Analysis shall be performed through the review of applicable and adequate documentation to verify that the specified requirements have been met. Verification shall be by mathematical analysis, statistical analysis, sampling the correlation of measured data, and observing test results with calculated expected values, conformance of end items with Contractor-generated specifications and documentation from lower tier supplies, as well as Government-approved configuration item specifications and documentation.

4. **Demonstration (D)**. Demonstrations shall be performed through actual exercise of the item to verify that the specified requirements have been met.

5. **Certification (C)**. Certification is an element of inspection to verify that the requirement has been met. Certifications must include documented test results, performance data, analytical data, or vender documentation. The certifications must be made available to Government representatives immediately upon request for review during inspections.

Table 12 - Method of Verification

Requirement Paragraph	Paragraph Title	Test Paragraph	Qualification Methods				
			A	D	E	T	C
3.1	I-MILES VTESS Training System Definition	4.2.1 - 4.2.8	X	X	X	X	
0	Table 1. I-MILES VTESS Configurations I-MILES VTESS System Architecture	4.2.1 - 4.2.8	X	X	X	X	X
Error! Reference source not found.	**Error! Reference source not found.**	N/A	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.3, 4.2.5, 4.2.8, 4.3.1	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	
Error! Reference source not found.	**Error! Reference source not found.**	4.2.5, 4.2.8	X	X	X	X	

Table 12 - Method of Verification							
Requirement Paragraph	**Paragraph Title**	**Test Paragraph**	**Qualification Methods**				
			A	**D**	**E**	**T**	**C**
3.3	I-MILES VTESS Characteristics	4.2.1 - 4.2.8	X	X	X	X	
3.3.1	Lethality Effects Assessment Routine (LEAR)	4.2.1 - 4.2.8	X	X	X	X	
3.3.1.1	Audio and Visual Signals	4.2.3 - 4.2.7	X	X	X	X	
3.3.1.1.1	Intercom Audio Signals	4.2.3 - 4.2.7	X	X	X	X	
3.3.1.2	Actions For Kill Conditions	4.2.3 4.2.7	X	X	X	X	
3.3.2	Collateral Damage	4.2.1 - 4.2.8	X	X	X	X	
3.3.3	Other Basic MILES Controls	4.2.1 - 4.2.8	X	X	X	X	
3.3.4	Cheat Events	4.2.1 - 4.2.8	X	X	X	X	
3.3.5	Transferred Data	4.3.2	X	X	X	X	
3.3.6	Visual Indication	4.3.3	X	X	X	X	
3.3.7	Recorded Events	4.2.3	X	X	X	X	
3.3.7.1	Initiation Events	4.2.3	X	X	X	X	
3.3.7.2	Firing Events	4.2.3, 4.2.5	X	X	X	X	
3.3.7.3	Lethality Assessment Events	4.2.3 - 4.2.7	X	X	X	X	
3.3.7.4	Cheat Events	4.2.3- 4.2.7	X	X	X	X	
3.3.7.5	Administrative Events	4.2.3 - 4.2.7	X	X	X	X	
3.3.8	Viewing Events	4.2.3 - 4.2.7	X	X	X	X	
3.6	Shooting System	4.2.3 - 4.2.7	X	X	X	X	
3.6.1	Pairing Probabilities	4.2.3	X	X	X	X	
0	Table 8. Weapon Effective Range Shooter Hit Profile	4.2.3	X	X	X	X	
3.6.1.2	Near Miss Profile	4.2.3 - 4.2.7	X	X	X	X	
3.7	Target System	4.2.3 - 4.2.7	X	X	X	X	
3.7.1	Target Hit Profile	4.2.3		X	X	X	

0	Table 10. Laser Transmitters vs. I-MILES VTESS Target System **4.2 <u>Force-on-Target (FOT)</u>** I-MILES VTESS shall support a Force-on-Target operational mode. I-MILES VTESS shall retain all performance requirements in FOT mode. All components needed for the I-MILES Target System shall be able to withstand the actual firing of live ammunition from a M1 Abrams main gun and a M2 Bradley main gun. Selection of the FOT mode shall require Controller Mode On. The I-MILES VTESS FOT mode shall allow for the option of firing the simulation of the missile to include the use of the ATWESS. Built-In Test (BIT) Characteristics	4.3.3 - 4.3.7	X	X	X	X	
3.10	User Interface	4.3.2 - 4.3.8	X	X	X	X	
3.10.1	User Interface Messages	4.3.2 - 4.3.8	X	X	X	X	

I-MILES VTESS 120mm	v
I-MILES VTESS 25mm	v
I-MILES VTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	v
MILES XXI 120mm	v
MILES XXI 25mm	v
MILES XXI vehicle Tube-launched Optically-tracked Wire-guided Missile	v
MILES CVTESS 120mm	v
MILES CVTESS 25mm	v
MILES CVTESS vehicle Tube-launched Optically-tracked Wire-guided Missile	v

Table 12 - Method of Verification

Requirement Paragraph	Paragraph Title	Test Paragraph	Qualification Methods				
			A	D	E	T	C
3.11	System Computational Requirements	4.5	X	X	X		
3.11.1	Computer Systems	4.5.1	X	X	X		
3.11.1.1	Software Development	4.5.1	X	X	X		
3.11.1.2	Software Upgrades	4.5.1	X	X	X		
3.11.1.3	Run-Time Environment	4.5.2	X	X	X		
3.11.1.4	Firmware	4.5.3	X	X	X		
3.12	False Alarm	4.3.2- 4.3.7	X	X		X	
3.13	Installation and Removal	4.6	X	X	X		
3.14	Mounting	4.7	X	X	X		
3.14.1	Mounting Devices	4.7	X	X	X		
3.14.2	Interconnecting Cables	4.3.3	X	X	X		
3.15	Physical Characteristics	4.8			X		
3.15.1	Weight	4.8	X			X	
3.15.2	Finish	4.8			X		
3.15.3	Color	4.8					
3.15.4	Size	4.8	X	X		X	
3.15.5	Power	4.8.1	X	X		X	
3.15.5.1	Common Power Supply (CPS)	4.8.1	X	X		X	
Error! Reference source not found.	**Error! Reference source not found.**	4.8.1.1	X	X		X	
3.15.5.2	Wireless Component Batteries	4.8.1	X	X		X	
0	<table><tr><td>LRLT</td><td></td></tr><tr><td>Missile</td><td></td></tr></table> Table 11. Minimal MRLT Rounds Expended per 528 Hour Exercise Field Replaceable Batteries	4.8.1	X	X		X	
3.15.6	Transportability	4.8.2	X	X	X		X
3.15.7	Reliability	4.9				X	
3.15.8	Maintainability	4.104.11	X	X			
3.15.9	Logistic Data	4.3.3, 4.3.5	X	X	X	X	
3.15.10	Environmental Conditions / Electromagnetic Environmental Effects (E3) / System Safety	4.11			X		
3.16	Construction	N/A					

Table 12 - Method of Verification							
Requirement Paragraph	Paragraph Title	Test Paragraph	Qualification Methods				
			A	D	E	T	C
3.16.1	Materials and Parts	**Error! Reference source not found.**N/A			X		
3.16.2	Nameplates and Product Marking	4.3.7			X		
3.16.3	Interchangeability	4.3.3 - 4.3.7		X	X		
3.16.4	Human Engineering	4.3.3 - 4.3.7	X	X	X		

Table 12. Method of Verification

4.3 Verification Methods

The verification methods shall be on hardware systems and subsystems to ensure compliance with the following characteristics. If a specification characteristic is identical for several subsystems, approval may be obtained to perform qualification on a representative subsystem.

4.3.1 First Article Test

First Article Test for Low Rate Initial Production (LRIP) units shall consist of Environmental Tests [High Temperature, Low Temperature, Shock, Vibration, Humidity, Rain, Sand and Dust, Immersion, and Salt Fog], System Verification Tests, and Electromagnetic Environmental Effects (E^3) Tests [Radiated Emissions, Radiated Susceptibility, Conducted Emissions, Conducted Susceptibility, and Electrostatic Discharge testing].

First article inspection shall be performed on initial production samples. Approval of the first article by the Government shall not relieve the contractor of the obligation to supply I-MILES VTESS that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

4.3.2 MILES Communication Code (MCC) Compliance Test

MCC Compliance Test shall be Contractor conducted/ Government witnessed tests at the Contractor facility and/or the Government MILES testbed. All the required MILES encoding timing shall be verified to be within the required tolerances. All the required MILES decoding timing shall be verified to be within the required tolerances. Near Miss Truncation for all machine guns shall be tested. The correct values of P_k vs P_w based on the number of transmitted words shall be verified. The MILES LEAR shall be verified for all decoding methods. The MILES Word Count shall be tested to be exactly the same number of transmitted MILES Words for corner shots. MILES Word Count shall be tested to be exactly the same number of transmitted MILES Words for all vehicles with turret when the turret is in rotation.

4.3.3 System Verification Test (SVT)

System Verification Tests (SVT) shall be Contractor conducted/ Government witnessed tests at the Contractor facility and/or at a Government selected CONUS test site that allows access to the appropriate vehicles. SVTs will demonstrate that the I-MILES VTESS is compliant with the requirements in this specification. During these tests, various I-MILES VTESS kits will be used in multiple configurations with other training devices to determine if there are any deviations requiring fixing.

4.3.3.1 Component Testing

The Contractor shall test each component to ensure all derived requirements for that component are met.

4.3.4 Independent Government Component Validation

The Government will require each VTESS component and their corresponding component agreements to be validated by a Government selected third party validation team. The components performance will be compared to the supplied HCA and CA documentation. The Contractor shall coordinate with the validation team to ensure that the latest software updates are provided to the test beds. The Contractor shall provide assistance as needed with the installation, operation and collection of data during component testing.

4.3.5 Government Acceptance Test (GAT)

Government Acceptance Test (GAT) shall be a Government conducted/Contractor supported test at a Government facility. GAT shall be used to determine if the I-MILES VTESS works in a FOF exercise. This test is a large scale test that will fully exercise the devices. This test shall be used as part of the on-site acceptance testing for the I-MILES VTESS. The test shall capture training data from all players (BLUFOR and OPFOR) and validate that the correct data is transmitted between the players. The test shall ensure that the I-MILES VTESS interoperate with Legacy MILES Systems. (E.g. VTESS Laser Transmitters with Legacy MILES Manworn vests/halos and vehicle laser detectors; I-MILES VTESS laser detectors with Legacy MILES Laser Transmitters; etc.)

4.3.6 Functional Configuration Audit (FCA)

A Functional Configuration Audit (FCA) shall be conducted after FAT and prior to SVT to validate the implementation of the system/sub-system Hardware Configuration Items (HWCI) and Computer Software Configuration Items (CSCI). The FCA shall also validate that the HWCIs and CSCIs satisfy the specified performance and functional characteristics and that the required documentation supports the functional configuration item (CI) delivered.

4.3.7 Physical Configuration Audit (PCA)

A Physical Configuration Audit (PCA) shall be conducted after SVT and prior to GAT to validate the implementation of the system/sub-system HWCI and CSCI. The PCA shall also validate that the HWCIs and CSCIs satisfy the specified performance and functional characteristics and that the required documentation supports the functional CI delivered.

A PCA is the formal technical examination of the system equipment to ensure that all documentation, hardware, and software comply with the technical documentation. The documentation and equipment shall be examined to verify that the applicable safety labels along with incorporating applicable warnings are incorporated.

Upon successful completion of both the FCA and PCA the base line for the I-MILES VTESS shall be established.

4.3.8 I-MILES VTESS Software Implementation Tests

The I-MILES VTESS software shall be tested to verify it meets the I-MILES VTESS requirements. The software shall be visually reviewed during informal reviews to validate that the software follows best engineering practices using software folders, configuration management, commenting, etc. I-MILES VTESS shall be tested to verify that it meets all the VTESS requirements, including working with the LTEC software baseline and any required modifications.

4.4 I-MILES VTESS Interface

The contractor shall verify that all I-MILES VTESS interfaces are compliant during SVT.

4.4.1 MILES Interface

The contractor shall verify that the I-MILES VTESS interoperates with currently fielded MILES equipment including controller devices.

4.4.2 Data Transfer Interface

The contractor shall verify that the download of engagement data and upload of software requirement is met using LPAN.

4.4.3 Target Visual Observation

The Visual Kill Indicator shall be visible 360 degrees at 1800m from all sides. Observation for flash shall be independently verified by Government and non-contractor personnel.

4.5 Computational System Requirements

4.5.1 Software Development Requirements

The contractor shall certify that the software developed for the I-MILES VTESS uses established software engineering methodologies.

4.5.2 Run-Time Environment

The contractor shall certify that the run time environment, if used, consists of a commercial item real-time operating system.

4.5.3 Firmware

The contractor shall certify that any firmware developed meets the same developmental requirements as the software. The code and documentation shall be visually examined to ensure compliance.

4.6 Installation and Removal Requirements

All I-MILES VTESS shall be installed, operated, and removed without physical damage to or permanent modification of the host vehicle and weapon systems. Cables shall not be damaged with proper installation, removal, and normal usage by operators. The contractor shall verify the power requirements by analysis, demonstration, and examination.

4.7 Mounting

The contractor shall verify that all I-MILES VTESS components that are mounted on host vehicles are out of the way of vehicle occupants and do not interfere with the operation of any of the vehicle system components.

4.8 Physical characteristics

The finish and color shall be verified by examination. The weight and size shall be measured.

4.8.1 Power

The contractor shall verify the power requirements by analysis, demonstration, and test.

4.8.1.1 CPS Internal Battery

The contractor shall verify the battery requirements by demonstration and test. Recharge time shall be verified to be not more than 8 hours (from fully discharged to fully (100%) charged). The I-MILES VTESS shall be connected and supply power to the IS radio. The I-MILES VTESS shall be operated in the following manner during the 100 hour CPS backup battery test.

On hour zero:

1. The I-MILES VTESS shall be shot 10 times with a MILES code 28 (Near Miss).
2. Manual BIT shall be run on the I-MILES VTESS.
3. MILES code 00 (Universal Kill) shall be shot at the I-MILES VTESS.
4. The I-MILES VTESS Visual indicator shall flash for ten minutes.
5. MILES code 36 (Reset) shall be shot at the I-MILES VTESS.
6. Alignment of all LTs.

These steps shall be repeated every 12 hour period, and at the conclusion of the 100 hour test.

4.8.1.2 Wireless Component Batteries

The contractor shall verify the battery requirements by demonstration and test.

4.8.1.2.1 Wireless Detector Test

The I-MILES VTESS shall be operated in the following manner during the 528 hour wireless component battery test for detectors.

1. The I-MILES VTESS shall be shot 10 times with a MILES code 28 (Near Miss).
2. Manual BIT shall be run on the I-MILES VTESS.
3. MILES code 00 (Universal Kill) shall be shot at the I-MILES VTESS.
4. MILES code 36 (Reset) shall be shot at the I-MILES VTESS.

These steps shall be repeated every 12 hour period. The test shall be repeated under the high temperature and low temperatures operational requirement in the Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647.

4.8.1.2.2 Wireless MRLT Test

The I-MILES VTESS shall be operated in the following manner during the 528 hour wireless component battery test for MRLTs.

1. The I-MILES VTESS shall shoot 1,250 rounds of the M240.
2. The I-MILES VTESS shall shoot 100 rounds of the M2.
3. Manual BIT shall be run on the I-MILES VTESS.

These steps shall be repeated every 12 hour period. The test shall be repeated under the high temperature and low temperatures operational requirement in the Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647.

4.8.2 Transportability

The transportability requirements shall be verified by analysis, demonstration, certification, and examination. Verification that the I-MILES VTESS hardware does not exceed the weight and balance envelope shall be by demonstration and analysis. Verification that the I-MILES

VTESS components and support equipment are housed in designated containers shall be by analysis and examination. Label requirements shall be verified by examination. The I-MILES VTESS transit cases shall be certified or tested to ensure protection of I-MILES VTESS unit components during transportation, storage, and handling. The transit cases shall be verified by testing to ensure they meet the requirements of the Drop Test.

4.9 Reliability

The reliability requirements shall be verified by a Reliability Qualification Test and validated during the Government conducted GAT.

4.10 Maintainability

A MTTR of 60 minutes or less for each I-MILES VTESS device shall be verified by demonstration.

4.11 Environmental Conditions / Electromagnetic Environmental Effects (E^3) / System Safety

All I-MILES VTESS components shall meet the testing requirements Environmental, Construction, Safety, and E^3 Requirements Specification PRF-PT-00647.

4.12 Packaging

For acquisition purposes, the packaging requirements shall be as specified in the contract. When actual packaging of materiel is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.0 Appendix A - Abbreviations and Acronyms

The following list of abbreviations and acronyms are stated in this Specification.

Abbreviation	Defintion
ANSI	American National Standards Institute
ATA	Air Transport Association of America
BII	Basic Issue Items
BIT	Built In Test
BLUFOR	Blue Force/Friendly Force
CECOM	Communications-Electronics Command
CFR	Code of Federal Regulations
CI	Configuration Item
CONUS	Continental United States
COTS	Commercial-Off-The-Shelf
CSCI	Computer Software Configuration Item
CTC-IS	Combat Training Center-Instrumentation Systems
CVTESS	Combat Vehicle Tactical Engagement System
DCIU	Data Communication Interface Unit
DIACAP	DoD Information Assurance Certification and Accreditation Process
DIFCUE	Direct/Indirect Fire Cue
DOD	Department of Defense
E^3	Electromagnetic Environmental Effects
EMC	Electromagnetic Compatible
EMI	Electromagnetic Interference
EMR	Electromagnetic Radiation (Radiated Emissions)
EMRADHAZ	Electromagnetic Radiation Hazards
EPA	Environmental Protection Agency
ESD	Electrostatic Discharge
FAT	First Article Test
FCA	Functional Configuration Audit
FOF	Force-on-Force
FOT	Force-on-Target
GAT	Government Acceptance Test
HITS	Homestation Instrumentation and Training System
HWCI	Hardware Configuration Item
I/O	Input/Output
IA or I/A	Information Assurance
IAW	In Accordance With
ICD	Interface Control Document
IR	Infrared Red
IWS	Individual Weapons System
IS	Instrumentation/Instrumented System
ISU	Integrated Sight Unit
LEAR	Lethality Effects Assessment Routine
LPAN	Live Player Area Network

Abbreviation	Defintion
LRIP	Low Rate Initial Production
LTEC	Live Training Engagement Composition
LRU	Line Replaceable Units
MCC	MILES Communication Code
MILES	Multiple Integrated Laser Engagement System
mR	Mill roentgen
MTBFF	Mean Time Between Functional Failure
MTTR	Mean Time to Repair
NDI	Non-Developmental Item
NOHD	Normal Ocular Horizontal Distance
NTIA	National Telecommunications and Information Administration
NTC-IS	National Training Center Instrumentation System
OPFOR	Opposition Force or Red Force or Orange Force (adversary)
OSHA	Occupational Health and Safety Administration
OUM	Operator's User Manual
P^3I	Pre-Planned Product Improvements
PC	Personal Computer
PCA	Physical Configuration Audit
PDA	Personal Digital Assistant
PEO STRI	Program Executive Office for Simulation, Training and Instrumentation
PID	Player Identification – Player ID
P_K	Kill Probability given all Hit Words were received and successfully decoded.
PU	Player Unit
PVC	Polyvinyl chloride
P_w	Kill Probability given a single pair of Hit Words were received and successfully decoded. This is the probability used for each LEAR.
RF	Radio Frequency
SAIB	Small Arms Integration Book
SAR	Safety Assessment Report
SAT	Small Arms Transmitter
SEI	CMU- Software Engineering Institute
SoS	System-of-Systems
SVT	System Verification Tests
TDTD	Training Data Transfer Device
TES	Tactical Engagement System
TM	Technical Manuals
TOW	Tube-launched Optically-tracked Wire-guided Missile
VTESS	Vehicle Tactical Engagement System
VKI	Vehicle Kill Indicator

6.0 Appendix B - Definitions

This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.

Adaptability	Adaptable to weapon systems currently under development and future weapon systems for which detailed data on configuration, lethality, and other weapon/platform data is not yet available.
Alignment	Association of the laser transmitter to a bore sighted weapon sighting system.
Basic Issue Items	Basic Issue Items are defined in the operator's manual of the platform.
Modular	An independently operable unit, or a compartmental unit, that is a part of the total system.
Special Tools	Any tool that is not contained in the vehicles basic issue items (basic tool kit).

7.0 Appendix C - I-MILES VTESS Configuration Data

It is anticipated this system will also be utilized as a universal system on the Army's tactical platforms and fixed structures.

The below categories represent those platforms/structures to be included in the formal testing requirements for I-MILES VTESS.

Light	Medium	Heavy
Armored Combat Earthmover (ACE) - M9	Armored Security Vehicle (ASV) - M1117	Fixed Structure (MOUT) (110/220 volt)
Civilian Commercial Automobiles (12 volt)	Armored High Mobility Multi-purpose Wheeled Vehicle (HMMWV) – M1151/M1161	Heavy Expanded Mobility Tactical Truck (HEMTT)
	High Mobility Multi-purpose Wheeled Vehicle (HMMWV) - M998	Mine Resistant Armor Protection (MRAP)
	Standard Cargo Truck LMTV – M1078A0/A1	M113 Personnel Carrier
		Stryker - Nuclear Biological and Chemical Reconnaissance Vehicle (NBCRV)

Table 1 - I-MILES VTESS Configuration Data Testing

8.0 Appendix D - Range Correction Due To Visibility

The following tables provide the range corrections due to visibility (to be used during range pairing verifications – Requirements from Section 3.6.1) for the weapons of the I-MILES VTESS. The highlighted row in the following tables indicate a standard clear day as defined by the I-MILES VTESS specification.

The attenuation of laser power through the atmosphere is described below by the Exponential Beers-Lambert Law.

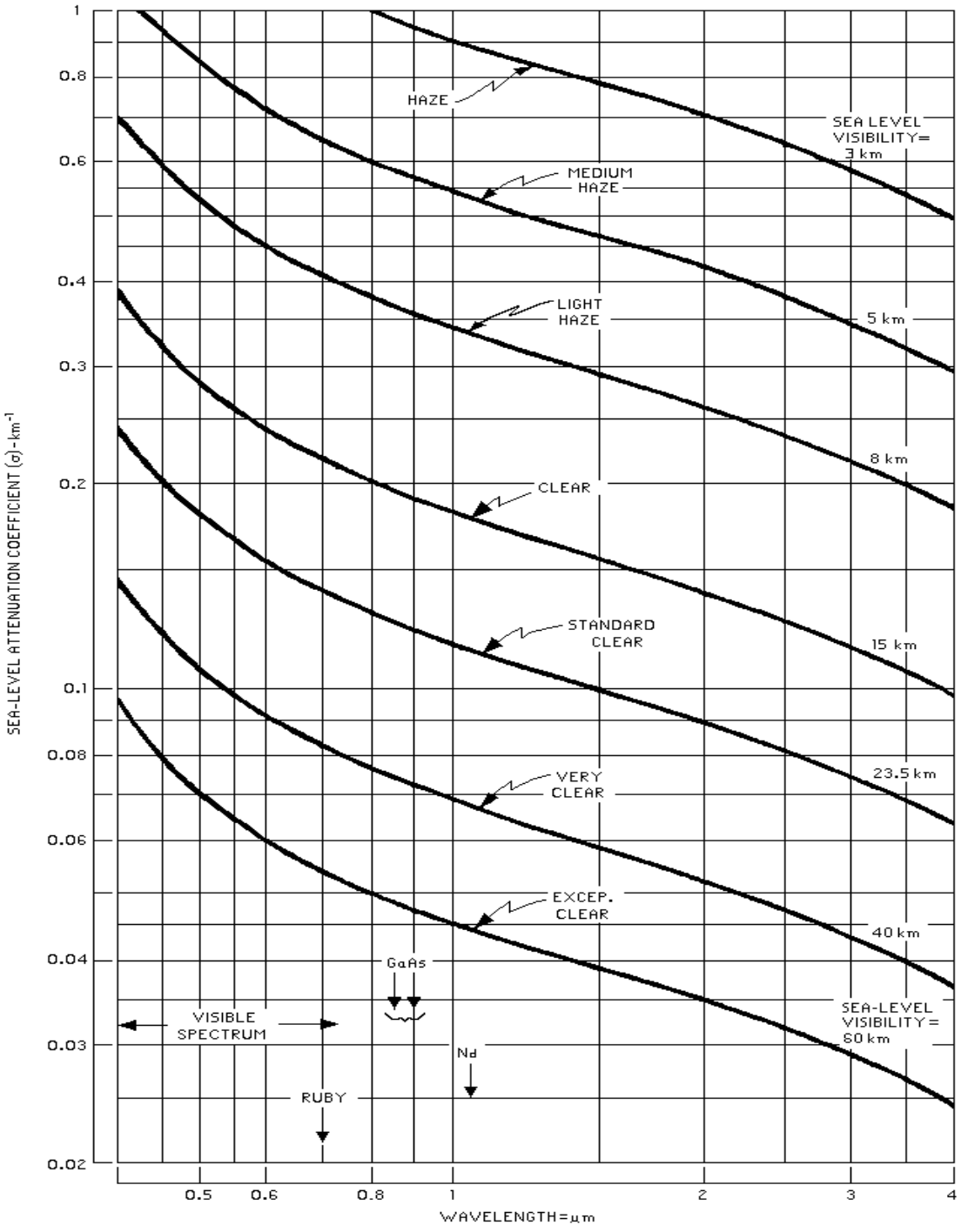
$$\tau(R) = P(R)/P(0) = e^{-\sigma R}$$

Where:

$\tau(R)$ = Transmittance at range, *R.*
$P(R)$ = Laser power at range, *R*.
$P(0)$ = Laser power at source.
e = Euler's number, ~2.718.
σ = Attenuation or total extinction coefficient (per unit length). Values derived from Figure of this document.

Equation 1 – Exponential Beers-Lambert Law

Figure 3 – Attenuation Coefficient Vs. Wavelength



1. M1 Abrams series tanks (M1A1, M1A1 AIM, M1A1 AIM SA, M1A1 FEP, M1A2 SEP V1, and M1A2 SEP V2 configurations) and OSTV:

   a. M1 120 mm APFSDS, HEAT, and MPAT; T-72, T-80, T-90 125mm APDS; Chieftain 120mm APDS, Heat – Max Effective Range = 3000m

Max Eff Range = 3000M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	2700	5100	Visibility (MI)
8000	1966	2801	5
16000	2501	4412	10
23500	2700	5100	15
32000	2820	5537	20
40000	2889	5794	25
48000	2935	5972	30
56000	2969	6103	35
64000	2995	6202	40

   b. T-55 100mm HEAT; T-62 115mm HEAT; T-72, T-80, T-90 125mm HEAT – Max Effective Range = 2500m

Max Eff Range = 2500M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	2250	4250	Visibility (MI)
8000	1731	2590	5
16000	2113	3774	10
23500	2250	4250	15
32000	2333	4551	20
40000	2380	4727	25
48000	2412	4847	30
56000	2435	4936	35
64000	2453	5003	40

c. T-62 115mm APDS – Max Effective Range = 1600m

Max Eff Range = 1600M Visibility (M)	90% Max Effective Range (M) 1440	170% Max Effective Range (M) 2720	 Visibility (MI)
8000	1218	1981	5
16000	1383	2521	10
23500	1440	2720	15
32000	1474	2842	20
40000	1493	2911	25
48000	1506	2959	30
56000	1515	2993	35
64000	1522	3019	40

d. T-55 100mm APDS – Max Effective Range = 1500m

Max Eff Range = 1500M Visibility (M)	90% Max Effective Range (M) 1350	170% Max Effective Range (M) 2550	 Visibility (MI)
8000	1154	1895	5
16000	1300	2375	10
23500	1350	2550	15
32000	1380	2657	20
40000	1396	2718	25
48000	1408	2759	30
56000	1416	2789	35
64000	1422	2812	40

e. T-72, T-80 COAX – Max Effective Range = 1000m

Max Eff Range = 1000M Visibility (M)	90% Max Effective Range (M) 900	170% Max Effective Range (M) 1700	 Visibility (MI)
8000	810	1395	5
16000	878	1621	10
23500	900	1700	15
32000	913	1747	20
40000	920	1774	25
48000	925	1792	30
56000	929	1805	35
64000	932	1815	40

f. T-55, T-62, T-90, Chieftain COAX – Max Effective Range = 800m

Max Eff Range = 800M Visibility (M)	90% Max Effective Range (M) 720	170% Max Effective Range (M) 1360	 Visibility (MI)
8000	662	1161	5
16000	706	1309	10
23500	720	1360	15
32000	728	1390	20
40000	733	1407	25
48000	736	1418	30
56000	738	1427	35
64000	740	1433	40

g. M1028 – Canister Round -- Max Effective Range = 500m

Max Eff Range = 500M	RANGES (M)											
Visibility (M)	100	200	300	400	500	600	700	800	900	1000	1100	Visibility (MI)
8000	99	195	290	382	471	559	645	729	810	890	968	5
16000	100	199	297	395	493	590	686	782	878	972	1067	10
23500	100	200	300	400	500	600	700	800	900	1000	1100	15
32000	100	201	301	403	504	606	708	810	913	1016	1120	20
40000	100	201	302	404	506	609	712	816	920	1025	1131	25
48000	100	201	303	405	508	611	715	820	925	1031	1138	30
56000	100	201	303	406	509	613	717	823	929	1036	1143	35
64000	100	202	303	406	510	614	719	825	932	1039	1147	40

h. M240(B and C) – Max Effective Range = 1100m

Max Eff Range = 1100M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	990	1870	Visibility (MI)
8000	881	1504	5
16000	963	1775	10
23500	990	1870	**15**
32000	1006	1927	20
40000	1015	1960	25
48000	1021	1981	30
56000	1025	1997	35
64000	1028	2009	40

i. M2 – Max Effective Range = 1830m

Max Eff Range = 1830M Visibility (M)	90% Max Effective Range (M) 1647	170% Max Effective Range (M) 3111	 Visibility (MI)
8000	1357	2165	5
16000	1572	2852	10
23500	1647	3111	**15**
32000	1691	3271	20
40000	1716	3363	25
48000	1733	3425	30
56000	1745	3471	35
64000	1754	3505	40

j. T-80, T-90 Missile – Max Effective Range = 4000m

Max Eff Range = 4000M Visibility (M)	90% Max Effective Range (M) 3600	170% Max Effective Range (M) 6800	 Visibility (MI)
8000	2367	3080	5
16000	3256	5624	10
23500	3600	6800	15
32000	3815	7587	20
40000	3939	8061	25
48000	4024	8393	30
56000	4086	8638	35
64000	4133	8827	40

2. M2/M3/M7 Bradley series fighting vehicles and OSV:

a. BMP-1 73mm HE – Max Effective Range = 700m

Max Eff Range = 700M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	630	1190	Visibility (MI)
8000	585	1036	5
16000	619	1151	10
23500	630	1190	15
32000	636	1213	20
40000	640	1226	25
48000	642	1235	30
56000	644	1241	35
64000	645	1246	40

b. BMP-1, BMP-3 COAX – Max Effective Range = 800m

Max Eff Range = 800M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	720	1360	Visibility (MI)
8000	662	1161	5
16000	706	1309	10
23500	720	1360	15
32000	728	1390	20
40000	733	1407	25
48000	736	1418	30
56000	738	1427	35
64000	740	1433	40

c. BMP-2, BMP-3 30mm AP and HE – Max Effective Range = 1500m

Max Eff Range = 1500M Visibility (M)	90% Max Effective Range (M) 1350	170% Max Effective Range (M) 2550	 Visibility (MI)
8000	1154	1895	5
16000	1300	2375	10
23500	1350	2550	15
32000	1380	2657	20
40000	1396	2718	25
48000	1408	2759	30
56000	1416	2789	35
64000	1422	2812	40

d. 25 mm APDS-T – Max Effective Range = 2000m

Max Eff Range = 2000M Visibility (M)	90% Max Effective Range (M) 1800	170% Max Effective Range (M) 3400	 Visibility (MI)
8000	1457	2288	5
16000	1710	3092	10
23500	1800	3400	15
32000	1853	3591	20
40000	1883	3702	25
48000	1903	3777	30
56000	1918	3832	35
64000	1929	3874	40

e. 25 mm APFSDS-T – Max Effective Range = 2500m

Max Eff Range = 2500M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	2250	4250	Visibility (MI)
8000	1727	2590	5
16000	2111	3774	10
23500	2250	4250	15
32000	2333	4551	20
40000	2380	4727	25
48000	2412	4847	30
56000	2435	4936	35
64000	2453	5003	40

f. 25 mm HEI-T – Max Effective Range = 3000m

Max Eff Range = 3000M	90% Max Effective Range (M)	170% Max Effective Range (M)	
Visibility (M)	2700	5100	Visibility (MI)
8000	1966	2815	5
16000	2501	4423	10
23500	2700	5100	15
32000	2820	5537	20
40000	2889	5794	25
48000	2935	5972	30
56000	2969	6103	35
64000	2995	6202	40

g. BMP-3 100mm HE – Max Effective Range = 3500m

Max Eff Range = 3500M Visibility (M)	90% Max Effective Range (M) 3150	170% Max Effective Range (M) 5950	 Visibility (MI)
8000	2182	2975	5
16000	2885	5039	10
23500	3150	5950	15
32000	3314	6548	20
40000	3408	6905	25
48000	3473	7153	30
56000	3519	7336	35
64000	3555	7476	40

h. TOW Missile – Max Effective Range = 3750m

Max Eff Range = 3750M Visibility (M)	90% Max Effective Range (M) 3375	170% Max Effective Range (M) 6375	 Visibility (MI)
8000	2270	3034	5
16000	3066	5335	10
23500	3375	6375	15
32000	3564	7064	20
40000	3672	7477	25
48000	3747	7766	30
56000	3801	7978	35
64000	3842	8142	40

i. M240(B and C); BMP-2 COAX – Max Effective Range = 1100m

Max Eff Range = 1100M Visibility (M)	90% Max Effective Range (M) 990	170% Max Effective Range (M) 1870	 Visibility (MI)
8000	881	1504	5
16000	963	1775	10
23500	990	1870	**15**
32000	1006	1927	20
40000	1015	1960	25
48000	1021	1981	30
56000	1025	1997	35
64000	1028	2009	40

j. BMP-1, BMP-2, BMP-3 Missile – Max Effective Range = 4000m

Max Eff Range = 4000M Visibility (M)	90% Max Effective Range (M) 3600	170% Max Effective Range (M) 6800	 Visibility (MI)
8000	2367	3080	5
16000	3256	5624	10
23500	3600	6800	15
32000	3815	7587	20
40000	3939	8061	25
48000	4024	8393	30
56000	4086	8638	35
64000	4133	8827	40