

**ANNEX D  
APPENDIX C**

**M915A3, LINE HAUL TRACTOR TRUCK KIT**

**SPECIFIC REQUIREMENTS**

<b>Revision</b>	<b>Date</b>	<b>Pages</b>	<b>Description</b>
Draft 1.0	9 April 2012	ALL – Ron Swanson	Formating, insert revision table and acronyms. Verified references.
Draft 1.1	30 April 2012	6 – Don Jones	Spelling correction
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1.2	23Aug 2012	CDT Team	CDT Team input from Draft RFP
1.3	22 Jan 2013	2.0 Reference	Pat Hart - Update Common SRD reference
2.0	27 Jan 2016	ALL – Pat Hart	Match currently fielded TWV vehicles

## **A-1.0 Scope**

This appendix to the CDT TWV SRD describes the requirements for the M915A3 Line Haul Tractor Truck specific kit. Each kit includes the vehicle specific driver's compartment hardware and simulation software needed to convert the base CDT TWV to match a specific vehicle's physical and functional characteristics.

## **A-2.0 Applicable Documents**

- TM 9-2320-302-10, Technical Manual Operator's Manual, Truck, Tractor, Line Haul, 52,000 GVWR, 6 X 4, M915A3 , dated December 2005.
- TM 9-2330-331-14&P, Technical Manual, Semitrailer, Flatbed: Breakbulk/Container, Transporter, 34 Ton, M872A4, dated December 2005
- System Requirements Document for the Common Driver Trainer System, PRF-PT-00430, Version 6.0, dated 27 Jan 2016.
- System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580, Version 2.0 dated 27 Jan 2016.

In the event of a conflict between the requirements of this document and those contained in the documents above, the requirements contained in this document take precedence.

## **A-3.0 Requirements**

### **A-3.1 System Level Requirements**

The M915A3 kit shall consist of hardware and software components which will reconfigure the CDT TWV to support driver training for drivers of the M915A3 vehicle. The M915A3 specific modules shall consist of the simulated reconfigurable driver's compartment, the instruments and controls for the driver and the software required to operate the driver's compartment, and the software to provide the specific vehicle performance in response to driver inputs and interaction with the Common Modules.

Unless specifically modified in this appendix, the requirements specified for the CDT TWV baseline vehicle shall apply when the CDT TWV is configured as a M915A3. In case of a conflict between the requirements of the CDT TWV SRD and the requirements of this appendix for the M915A3, the requirements of this appendix shall take precedence when testing the M915A3 configuration.

#### **A-3.1.1 Common Module Requirements**

##### **A-3.1.1.1 Instructor Operator Station (IOS)**

The IOS shall control the operation of the CDT TWV, select/modify training scenarios, monitor simulated vehicle status (e.g., instruments, switches, etc.) monitor driver trainee

performance and manage student records in accordance with the requirements of the System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

### **A-3.2 Variant Requirements**

The M915A3 kit shall include simulation hardware and software that replicates the controls, instruments, vehicle operation and vehicle dynamics of the M915A3 truck and the M872A4 trailer. The main components of the driver's compartment are the controls, instruments, switches, panels, seating and physical structure of the M915A3 necessary to accomplish the required training tasks. When configured as a M915A3 driver's compartment, the simulation software shall provide the driver's compartment control and switch interaction and simulator response for the controls, instruments, switches and panels necessary to accomplish the required TWV training tasks. The simulation software shall provide realistic vehicle dynamic responses to driver control inputs and simulated training environment interactions. The driver's compartment shall provide the status of hardware and software to the CDT system through the defined interfaces during CDT daily readiness tests. During initialization, the system shall check the installed configuration and provide an indication to the instructor/operator at the IOS the specific TWV configuration, and the loading condition of the primary vehicle, and any trailer loading if attached. Loading conditions shall be adjustable for discrete loading of empty, half full and full states. The default condition shall be empty loading for all adjustable loads. An error message shall be displayed if there are any reconfigurable component mismatches or components not installed.

#### **A-3.2.1 Variant Training Requirements**

The training requirements for the M915A3 shall be the same as the training requirements specified in paragraph 3.2.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

##### **A-3.2.1.1 Malfunction/Emergency Condition Training Requirements**

The malfunction/emergency condition training requirements for the M915A3 shall be the same as the malfunction/emergency condition training requirements specified in paragraph 3.2.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2 Specific Reconfigurable TWV Module Requirements**

##### **A-3.2.2.1 Simulated Driver Compartment**

The simulated driver compartment for the M915A3 shall be the same as the simulated driver compartment specified in paragraph 3.2.2.1 of System Requirements Document for

the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.1.1 Driver's Compartment Subsystem Common Components**

The driver's compartment subsystem common components for the M915A3 shall be the same as the driver's compartment subsystem common components specified in paragraph 3.2.2.1.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

##### **A-3.2.2.1.1.1 Driver's Door**

The driver's door for the M915A3 shall be the same as the driver's door specified in paragraph 3.2.2.1.1.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

##### **A-3.2.2.1.1.2 Steering Column and Wheel**

The steering column and wheel configuration for the M915A3 shall be the same as the steering column and wheel specified in paragraph 3.2.2.1.1.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580. The turn signal control stalk shall move up for right turns and down for left turns. The pull switch capability of the turn signal stalk shall be programmed to switch between high and low beam service lights (i.e., service light dimmer switch). The steering wheel center button shall be programmed to activate the vehicle horn when pushed. The hazard lights switch shall be located under the turn signal lever (away from the steering wheel). A Trailer Handbrake control Lever is found on the right side of the steering column.

##### **A-3.2.2.1.1.3 Throttle**

The throttle for the M915A3 shall be the same as the throttle specified in paragraph 3.2.2.1.1.3 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

##### **A-3.2.2.1.1.4 Service Brake Pedal**

The service brake pedal for the M915A3 shall be the same as the service brake pedal specified in paragraph 3.2.2.1.1.4 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.1.1.5 Driver's Seat**

The driver's seat for the M915A3 shall be the same as the driver's seat specified in paragraph 3.2.2.1.1.5 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.1.1.6 DVE Night Vision Device**

The DVE night vision device for the M915A3 shall be the same as the DVE night vision device specified in paragraph 3.2.2.1.1.6 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.1.1.7 Interchangeable Dashboard Panels and Equipment**

The dash panel(s) for the M915A3 shall be a removable assembly or assemblies that replicated the form and function of the M915A3 TM 9-2320-302-10, Technical Manual Operator's Manual, Truck, Tractor, Line Haul, 52,000 GVWR, 6 X 4, M915A3 , dated December 2005. Unless specified, the items below are to be functional. The panels/clusters that are replicated are as follows:

- a. Voltmeter
- b. Engine Oil Pressure Gauge
- c. Engine Water Temperature Gauge
- d. Speedometer / Odometer
- e. Tachometer
- f. Primary Air Pressure Gauge
- g. Secondary Air Pressure Gauge
- h. Air Filter Restriction Indicator
- i. Fuel Gauge
- j. Trans Oil Temp Gauge
- k. Fan Speed Knob(non-functional)
- l. Temperature Control Knob (non-functional )
- m. Air Flow Direction Knob (non-functional)
- n. Trailer Air Supply Switch
- o. Parking Brake Switch
- p. Utility Light Switch (non-functional )
- q. Panel Lights Control Knob Switch (non functional)
- r. Fog Lights Switch (non functional)
- s. Beacon Light Switch (non functional)
- t. Main Light Switch
- u. Engine Brake Switch (2 Cycle)
- v. Engine Brake Switch (4 Cycle)

- w. Wiper/Washer Control Switch (non-functional)
- x. Mirror Pwr Switch (Left) (non-functional )
- y. Mirror Pwr Switch (Right) (non-functional)
- z. Mirror Heat Switch (non functional)
- aa. Inter Axle Lock/Unlock Switch
- bb. 5<sup>th</sup> Wheel Slide Control Switch (non functional)
- cc. Ignition Switch
- dd. Engine Start Button
- ee. Parking Brake Indicator
- ff. Tractor ABS Indicator
- gg. Trailer ABS Indicator
- hh. High Beam Indicator
- ii. Check Transmission Indicator
- jj. STOP Engine Indicator
- kk. Check Engine Indicator
- ll. Low Air Pressure Indicator
- mm. Left Turn Signal Indicator
- nn. Right Turn Signal Indicator
- oo. Engine Oil Warning Indicator
- pp. Water Level Indicator
- qq. Engine Temp Warning Indicator
- rr. Shut Down Indicator
- ss. Mirror Heater Indicator (non functional)
- tt. Axle Lock Indicator
- uu. Utility Light Indicator (non functional)
- vv. Beacon Light Indicator (non functional)
- ww. Collision Warning System (CWS) System
- xx. 12 Volt Power Outlet (non functional)
- yy. Air Vent (non-functional)
- zz. Trans selector

#### **A-3.2.2.1.2 M915A3 Specific Driver's Compartment Components**

The CDT TWV M915A3 cab shall replicate the M915A3 cab.

##### **A-3.2.2.1.2.1 Specific Driver's Compartment Hardware Components**

The M915A3 kit shall include the specific hardware components listed in paragraph 3.2.2.1.1.7, Interchangeable Dashboard Panels and Equipment above.

##### **A-3.2.2.1.2.2 Specific Driver's Compartment Software Components**

The reconfigurable Driver's assembly software shall stimulate or simulate all required M915A3 dashboard controls and indicators through the cab I/O subsystem.

All controls and indicators shall operate in accordance with TM 9-2320-302-10 operator's manual.

### **A-3.2.2.2 Vehicle Simulation**

#### **A-3.2.2.2.1 Vehicle Dynamics Performance**

The M915A3 kit software shall simulate the M915A3 vehicle dynamics to the level of detail required to support the training tasks in paragraph 3.2.1. Vehicle dynamics shall include steering feel, steering response, acceleration, deceleration, braking and suspension response. The vehicle dynamics simulation shall provide models of the power train (e.g., engine, transmission, etc.), suspension (e.g., springing, damping, range of travel, etc.), and the hull of the M915A3 vehicle. The default M915A3 configuration with the trailer shall be an unloaded trailer. The parameters for these models shall be evaluated at 60 Hz to assure smooth and accurate simulation. Terrain topography and surface characteristics shall be determined and combined with control inputs from the driver compartment to provide inputs to the models of the engine, transmission, steering, brakes, suspension, trailer and hull. The vehicle dynamics simulation results shall drive the visual displays, motion cues, aural cues, and instrumentation in the driver's cab.

##### **A-3.2.2.2.1.1 Engine Model**

The engine model for the M915A3 shall be the same as the engine model specified in TM 9-2320-302-10, Technical Manual Operator's Manual, Truck, Tractor, Line Haul, 52,000 GVWR, 6 X 4, M915A3, dated December 2005.

##### **A-3.2.2.2.1.2 Transmission Model**

The transmission model for the M915A3 shall be the GEN 4 (5 speed) transmission as specified in TM 9-2320-302-10, Technical Manual Operator's Manual, Truck, Tractor, Line Haul, 52,000 GVWR, 6 X 4, M915A3, dated December 2005.

##### **A-3.2.2.2.1.3 Steering and Brake Model**

The steering and brake models shall be a physics-based model of the actual real world performance of the M915A3 vehicle. The position of the service brake pedal and the engaged/disengaged status of the parking brake shall be input to the brake model. Appropriate real time brake force parameters shall be determined and applied to the CDT motion control software.

##### **A-3.2.2.2.1.4 Suspension Model**

The model of the suspension system shall include computation of the forces acting on the suspension components. The effects of the terrain, including slope, height and surface roughness shall be combined with the forces due to the mass and momentum of the hull

to determine the suspension force at each wheel acting on the hull. Pitch torque and roll torque shall be computed as inputs to the hull model by transferring the combined forces on the own vehicle through the damping and spring characteristics of the suspension.

#### **A-3.2.2.2.1.5 Hull Model**

The position, velocity, and acceleration of the own vehicle center of gravity shall be determined in six degrees of freedom by the hull model. Inputs from the power train, suspension, and terrain models shall be combined to resolve the updated vehicle position and derive the accelerations, velocities and attitude of the motion system/driver's compartment.

#### **A-3.2.2.2.2 Trailer Dynamics Performance**

The M915A3 kit software shall simulate the vehicle dynamics of the 872A4 Flatbed Semitrailer. The trailer vehicle dynamics shall include the trailer size, weight, Center of Gravity (CG) suspension characteristics and attachment to tow vehicle. The trailer tracking and turning shall respond correctly to the tow vehicle dynamics in both forward and reverse movement. The trailer shall be modeled in an empty, half and full load configurations with weight evenly distributed. The parameters for the trailer dynamic model shall be evaluated at 60 Hz to assure smooth and accurate simulation. Terrain topography and surface characteristics shall be determined and combined with inputs from the tow vehicle to determine trailer vehicle dynamics. The trailer vehicle dynamics simulation results shall drive the visual displays, motion cues, aural cues, and instrumentation in the driver compartment as applicable.

#### **A-3.2.2.2.3 Malfunctions and Emergency Conditions**

The malfunctions and emergency conditions for the M915A3 shall be the same as the malfunctions and emergency conditions specified in paragraph 3.2.2.2.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.3 Visual Simulation**

The visual simulation for the M915A3 shall be the same as the visual simulation specified in paragraph 3.2.2.3 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System.

#### **A-3.2.2.3.1 Visual Scenes**

The M915A3 kit shall utilize the CDT visual environment data base as specified in the System Requirements Document for the Common Driver Trainer System, PRF-PT-

00430. When configured as a M915A3, the CDT TWV shall have any fixed obstructions (e.g., hull, hood or structural components of the M915A3) visible in the driver's field of view (FOV) displayed in the visual scene as a fixed entity. The simulated eye point height of the displayed image shall be the same as that realized by the driver in the operational vehicle.

#### **A-3.2.2.3.2 Display Configuration**

The display configuration for the M915A3 shall be the same as the display configuration specified in paragraph 3.2.2.3.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.3.3 Sensor Image Simulation**

The sensor image simulation for the M915A3 shall be the same as the sensor image simulation specified in paragraph 3.2.2.3.3 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.3.4 Visual Effects**

The visual effects for the M915A3 shall be the same as the visual effects specified in paragraph 3.2.2.3.4 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.4 Aural Cue and Communications**

The aural cues and communications for the M915A3 shall be the same as the aural cues and communications specified in paragraph 3.2.2.4 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

#### **A-3.2.2.5 Scoring Criteria**

The scoring criteria for the M915A3 shall be the same as the scoring criteria specified in paragraph 3.2.2.5 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

**A-4.0 Acronyms List**

CDT	Common Driver Trainer
CG	Center Gravity
FOV	Field of View
GVWR	Gross Vehicle Weight Rating
Hz	Hertz
I/O	Input / Output
IOS	Instructor Operator Station
SRD	System Requirements Document
TWV	Tactical Wheeled Variant
TM	Technical Manual