

APPENDIX G

M2A2/M3A2 MANNED MODULE

G.1. SCOPE.

This appendix establishes requirements for the M2A2/M3A2 manned module. This ~~A~~appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

G.2. APPLICABLE DOCUMENTS.

(This section is not applicable to this appendix.)

G.3. REQUIREMENTS.**G.3.1 M2A2/M3A2 Simulator Module.**

The M2A2/M3A2 simulator shall be designed to replicate the performance characteristics of the M2A2/M3A2 vehicle and associated systems as described in G.3.1.1 through G.3.1.2.2. These characteristics shall enable the M2A2/M3A2 simulators to operate in the CCTT environment and shall provide the manned crew the system performance specified herein. The M2A2/M3A2 module shall be either an M2A2 or M3A2 vehicle as determined during initialization by the MCC. The difference between the M2A2 and the M3A2 shall be the mounted infantry, missile and ammunition allocations.

G.3.1.1 Performance Characteristics.

The following paragraphs contain the unique performance requirements that shall be provided for the M2A2/M3A2 BFV simulator system.

G.3.1.1.1 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A. The M2A2/M3A2 BFV shall be able to mount and dismount an infantry unit in the visual database.

G.3.1.1.2 Fire Control System.

The fire control system for the M2A2/M3A2 simulation system shall replicate the ability for target acquisition, tracking, aiming and firing of the M242 25 mm Automatic Gun, the Tube-launched, Optically-tracked, Wire-guided (TOW) weapon system, the M240C 7.62 mm Coaxial Machine Gun, and the M257 Smoke Grenade Launcher. The simulated fire control system components shall replicate the operational equipment in both design and performance. The simulated fire control system shall accurately incorporate sighting reticles and fire control models and shall enable precision gunnery techniques in simulated battlefield environments. The fire control system shall consist of:

- a. Gunner's Integrated Sight Unit (ISU) and controls.
- b. Backup Sight.
- c. Commander's ISU relay.
- d. Weapon control box.

- e. TOW control box.

These components in combination with the other simulated systems in the M2A2/M3A2 simulation system shall provide the crew the ability to engage targets from both stationary and on the move positions with a precision that matches real world results.

G.3.1.1.3 M2A2/M3A2 Weapons and Ammunition.

G.3.1.1.3.1 M2A2/M3A2 Ammunition

The M2A2/M3A2 simulation system shall simulate the following weapons and ammunitions:

- a. M242 25 mm Automatic Gun, using the following ammo:
 - (1) M792, High-Explosive Incendiary with Tracer (HEI-T).
 - (2) M919, Armor-Piercing Fin-Stabilized Discarding SABOT with Tracer (APFSDS-T).
- b. M240C 7.62 mm coaxial machine gun, using the A141, Ball, Tracer, ammo.
- c. TOW 2 missile system, using the TOW 2 BGM71D with maximum range of 3750 meters.
- d. M257 Smoke Grenade Launcher system, using the L8A3 RP smoke grenades.

G.3.1.1.3.2 M2A2/M3A2 DI Stowed Ammunition

The M2A2/M3A2 simulation system shall simulate stowage of the following ammunition for DI battlefield resupply:

- a. Javelin and ~~or~~ Dragon Anti-Tank Missiles.
- b. AT-4 (84mm, M136).
- c. 5.56mm Ball & linked Tracer (A064).
- d. 5.56mm Ball (M855), Tracer (M856).
- e. 7.62mm, A141 Ball, Tracer.
- f. 40mm Grenades (M433 single grenades).
- g. Claymore Anti-personnel mines (M18), Anti-personnel mines (M16A1) and Anti-tank mines (M21).

G.3.1.1.4 Support Systems.**G.3.1.1.4.1 Electrical System.**

The electrical system shall be able to simulate the following operating states:

- a. Engine off, master power off, turret power off.
- b. Engine off, master power on, turret power off.
- c. Engine running, alternator working, turret power off.
- d. Engine running, alternator not working, turret power off.
- e. Engine off, master power on, turret power on, turret drive on, stabilizer on.
- f. Engine off, master power on, turret power on, turret drive on, stabilizer off.
- g. Engine running, alternator working, turret power on, turret drive on, stabilizer on.
- h. Engine running, alternator working, turret power on, turret drive on, stabilizer off.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M2A2/M3A2 simulation system. These problems and abilities shall be replicated in the M2A2/M3A2 simulation systems just as they would occur in the operational equipment.

G.3.1.1.4.2 Hydraulic System.

The ramp hydraulic pump shall be virtual (no physical pump). The effect of the ramp hydraulic pump on raising and lowering the virtual BFV ramp shall be simulated.

G.3.1.1.5 Depletable Resource Management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M2A2/M3A2 BFV simulation system shall be based on the usable fuel (175 gallon) contained in the fuel tanks. The resupply of fuel shall be accomplished through coordination with the ALOC and shall occur with the use of a fuel carrier. The ammunition load for the M2A2/M3A2 simulation system shall be based on the storage capacities of the actual M2A2/M3A2 BFV for the weapons and ammunition identified in paragraph G.3.1.1.3. The identification, transfer and resupply of ammunition shall be the responsibility of the vehicle commander. The resupply of all ammunition shall be coordinated through the ALOC. In all cases, the monitoring of, use of and resupplying of the M2A2/M3A2 BFV's fuel and ammunition shall be based on the implementation of representative time and depletion parameters obtained from the operational BFV. The Resupply Operations shall include:

- a. Simulated Transfer of:
 - (1) Fuel from a fuel carrier to the M2A2/M3A2 BFV.

- (2) Fuel from fuel pre-stock to the M2A2/M3A2 BFV.
- (3) Ammunition from ready rack of the TOW to the launcher.
- (4) Ammunition from an ammunition truck.
- (5) Ammunition from 25 mm storage to the ready box (ammo can).
- (6) 7.62 ammunition from storage to ready.
- (7) Reload times for the weapons listed in paragraph G.3.1.1.3.
- (8) Ammunition from another module with compatible ammunition.

b. Depletion rates:

- (1) Fuel quantity and usage related to BFV consumption rate.

The depletion rate shall be based on actual expenditure rates.

G.3.1.1.6 Damage and Failure.

The list of components that are modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table G-I.

Table G-I. M2A2/M3A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Antenna A and B			X
Cmdr's Power Control Handle		X	
Coax Gun Boresight		X	
Coax Gun Inoperative		X	X
Commander			X
Driver			X
Drown	X		
Engine Assembly		X	X
Engine Loss of Power		X	
Engine Starter		X	X
Fuel Filter		X	
Gun Elevation Drive	X	X	

Table G-I. M2A2/M3A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Gunner			X
Gunner's Auxiliary Sight			X
Gunner's Power Control Handles		X	
Intercom		X	X
ISU Day		X	X
ISU Thermal		X	X
Left Idler Wheel		X	X
Left Roadwheel 1		X	X
Left Roadwheel 2		X	X
Left Roadwheel 3		X	X
Left Roadwheel 4		X	X
Left Roadwheel 5		X	X
Left Roadwheel 6		X	X
Left Sprocket		X	X
Left Track	X	X	X
Main Gun Ammunition			X
Main Gun Boresight		X	
Main Gun Inoperative		X	
Main Gun Misfire		X	
Radio A		X	X
Radio B		X	X
Right Idler Wheel		X	X
Right Roadwheel 1		X	X
Right Roadwheel 2		X	X
Right Roadwheel 3		X	X
Right Roadwheel 4		X	X
Right Roadwheel 5		X	X
Right Roadwheel 6		X	X

Table G-I. M2A2/M3A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Right Sprocket		X	X
Right Track	X	X	X
Rollover	X		
Service Brake		X	
TOW Elevation Drive		X	
TOW Launcher Misfire		X	
Transmission Assembly		X	X
Turret Azimuth Drive	X	X	
Turret Stabilization		X	

G.3.1.1.7 Sound Generation System.

A sound and vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system. The sounds and vibrations shall be of such fidelity, quality, realism, and volume that crew members shall experience the cues, stresses, and distractions of a “real life” combat situation. Vibrations shall only be provided for the commander, gunner, and driver positions. The sounds shall be of sufficient volume so that the distractions provided to the crew members shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M2A2/M3A2 simulation system.

Table G-II. M2A2/M3A2 Sound Cues
SOUND CUE
Engine cranking
Engine start to idle
Engine stop
Engine noise related to Revolutions Per Minute (RPM)
Transmission noise related to RPM
Release hand brake
Set hand brake
Track noise related to speed for terrain types simulated in CCTT
Track popping (about to be thrown)

Table G-II. M2A2/M3A2 Sound Cues
SOUND CUE
Turret traverse noise related to turret RPM - slow mode
Turret traverse noise related to turret RPM - fast mode
Palm switch depress (turret drive engage)
Palm switch release (turret drive release)
Lower ramp - begin
Lower ramp - continuous
Lower ramp - end
Raise ramp - begin
Raise ramp - continuous
Raise ramp - end
Cargo hatch opening and closing
25 mm gun elevate and depress
25 mm gun hitting upper and lower limits
Gun exhaust fan
TOW launcher up
TOW launcher down
Horn
Collisions with objects (scraping and hard collisions)
Fire TOW
Fire 25 mm gun
Fire 7.62 mm coaxial machine gun
Fire smoke grenade launcher
NBC System main blower
Driver's Warning Tone
Bilge Pumps
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive round (main gun, missile, rocket) hit
Generic explosive round (main gun, missile, rocket) miss
Generic kinetic round hit

Table G-II. M2A2/M3A2 Sound Cues
SOUND CUE
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Aircraft - rotary wing class
Aircraft- fixed wing class

G.3.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M2A2/M3A2 controls within the system latency requirements as defined in paragraph 3.2.2.1 and within the module latency requirement as defined in paragraph 3.2.2.2.

G.3.1.1.7.2 Sound Generator.

The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. The sound generation system shall meet the spare input and output channel requirements of 3.7.3.1.4.

G.3.1.1.7.3 Spatial Positioning.

The sound system shall provide spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds. For the Popped Hatch speakers, the sounds shall be synchronized with the actions causing the sounds and shall also be presented to allow personnel the ability to identify the direction of the events causing the sounds.

G.3.1.1.7.4 Sound Quality.

The sound generator shall provide sound cues over a frequency range of 30 Hz to a minimum of 12,000 Hz., +/- 3 dB.

G.3.1.1.8 Communication System.

A communication system shall be provided for the M2A2/M3A2 manned module as described in section 3.7.6 of this specification.

G.3.1.2 Physical Characteristics.

The M2A2/M3A2 crew compartment shall exist as two separate enclosures: an enclosure for the driver's station, and an enclosure for the commander and gunner stations, and the troop compartment. The base for each enclosure shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. The driver, commander, and gunner positions shall each include a seat replicating the respective seats found in the operational M2A2/M3A2 BFV. The troop compartment shall provide seating for three troops and shall provide the ability for the individuals in the troop compartment to monitor all communications within the vehicle simulator. The modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while the others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. Functional controls, indicators and other pieces of equipment shall have proper coloring and labels.

G.3.1.2.1 Controls and Indicators.

The following paragraphs list the controls and indicators that shall be provided for the individual crew stations within each M2A2/M3A2 simulator system. These controls and indicators shall replicate in design, performance, and function their real world counter-parts that are found in the operational M2A2/M3A2 Bradley Fighting Vehicle (BFV). Realistic control loading and physical limits of travel shall be provided for simulated crew member controls.

G.3.1.2.1.1 Driver's Station.

The following controls, switches, gauges, and lights shall be provided at the Driver's station in the locations and panels as found in the actual M2A2/M3A2 BFV.

- a. The following controls, indicators, and other pieces of equipment shall be simulated (functional).
 - (1) Smoke Screen Generator switch - shall be a 2-position pull-to-toggle switch which shall have positions labeled ON and OFF. This switch shall replicate the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.
 - (2) Lights switch.
 - (a) LIGHTS UNLOCK switch - shall be a 2-position lever which shall be labeled UNLOCK above. The switch shall return to the locked position when released. When held in the UNLOCK position, this lever ~~shall~~ allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS to SERVICE DRIVE.
 - (b) Panel Lights switch - shall be a 4-position rotary switch which shall have positions labeled PANEL BRIGHT, DIM, OFF, and PARK. This switch shall replicate the functionality of the corresponding actual switch (which controls the panel lights) as follows :

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- 1) The PANEL BRIGHT position shall turn panel lights on at highest level.
- 2) The OFF position shall turn panel lights off.
- 3) The DIM position shall be turn panel lights on at the lowest (dim) level.
- 4) The PARK position shall turn the tail lights off and on.

Master power must be on for BRIGHT and DIM positions to produce an observable effect, in other words, for the lights to be illuminated on the panel.

- (3) Driving Lights switch - shall be a 5-position rotary switch which shall have positions labeled BO DRIVE, BO MARKER, OFF, STOP LIGHT, and SER DRIVE and shall be locked in the BO MARKER position unless the unlock switch is in the UNLOCK position. This switch shall replicate the functionality of the corresponding actual switch (which controls vehicle exterior lights) in the following manner:
 - (a) The BO DRIVE position shall turn on the blackout driving lights, the outside front white blackout markers, and the outside rear red blackout markers.
 - (b) The BO MARKER position shall turn on all blackout markers and activate white blackout stop lights.
 - (c) The OFF position of the switch shall turn off all exterior lights.
 - (d) The STOP LIGHT position shall enable stoplights when brakes are applied.
 - (e) The SER DRIVE position shall turn on headlights and enable use of conventional stoplights.
- (4) Fuel gauge - This indicator shall be a gauge with a range of 0 to 150 gallons. The amount of fuel remaining in the lower fuel cell shall be indicated on this gauge such that the needle shall be positioned in the green zone for levels above 30 +/- 5 gallons and in red zone for lower levels. The needle shall be positioned at the far right of the green zone for fluid levels of 150 gallons and greater (the fuel sending unit is in the lower, 150 gallon, tank).
- (5) Turret Power indicator - shall be a red lamp which shall be illuminated when turret power is on.
- (6) Launcher Up indicator - shall be a red lamp which shall be flashed at a 1.6 Hz +/- 10 percent rate when the tow launcher is in the firing position and the vehicle is moving at a speed of 3 mph and faster.

- (7) Air Cleaner Clogged indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 5 percent when engine is running and the air cleaner is clogged.
- (8) Speedometer with Odometer - The speedometer shall replicate the speedometer on the BFV both physically and functionally. The rotational speed of the transmission shall drive this gauge to indicate vehicle speed. The gauge shall have scale markings for both miles per hour and kilometer per hour with ranges of 0-60 and 1-100 respectively and a full-scale accuracy of +/- 10 percent. The odometer shall consist of a display which shall indicate the distance the vehicle has traveled in kilometers.
- (9) Volts gauge - This indicator shall be a gauge with a range of 16.5 to 32.0 +/- 0.5 volts and shall indicate battery and generator conditions as follows:
 - (a) The needle shall be positioned in the Left Red Zone when the battery is between 17.5 +/- 1.5 and 23.5 +/- 1.0 volts.
 - (b) The needle shall be positioned in the Yellow Zone when battery voltage is between 23.5 +/- 1.0 and 27.5 +/- 1.0 volts.
 - (c) The needle shall be positioned in the Green Zone when the battery voltage is between 27.5 +/- 1.0 volts and 30.5 +/- 0.5 volts.
 - (d) The needle shall be positioned in the Right Red Zone when the battery voltage is between 30.5 +/- 0.5 and 32.0 +/- 0.5 volts.
- (10) Trans Oil Press indicator - shall be a red lamp indicator which shall illuminate when the transmission is damaged or a lamp test is executed.
- (11) Trans Oil Temp indicator - shall be a red lamp indicator which shall illuminate when the transmission is damaged or a lamp test is executed.
- (12) Fuel Filter Clogged indicator - shall be a red lamp indicator which shall be flashed at 1.6 Hz +/- 10 percent when the engine is running and the fuel filter is clogged.
- (13) Engine Coolant Temperature gauge - shall be a gauge with a range of 100 to 280 degrees +/- 5 percent, which shall indicate engine coolant temperature range as follows:
 - (a) The needle shall be positioned in the red zone when the engine coolant temperature is greater than 220 and less than or equal to 280 degrees F.
 - (b) The needle shall be positioned in the yellow zone when the engine coolant temperature is greater than 190, and less than or equal to 220 degrees F.

- (c) The needle shall be positioned in the green zone when the engine coolant temperature is less than or equal to 190 degrees F.

(14) Gear Selector Panel.

- (a) Gear Selector lever - shall be an 8-position lever which shall have positions labeled REVERSE, N, START, PIVOT STEER, DRIVE, LOW, TOW START, and TOW, and shall have a spring-loaded gate which prevents accidental movement into the TOW START position. The functionality of the corresponding actual lever shall be replicated as follows:
 - 1) The REVERSE position shall put the transmission in reverse.
 - 2) The N (neutral) position shall disengage the transmission.
 - 3) The START position shall engage the engine starting system.
 - 4) The PIVOT STEER position shall enable pivoting the vehicle about its center with vehicle stopped.
 - 5) The DRIVE position shall put the transmission in the normal forward operating range.
 - 6) LOW shall put the transmission in low range if the vehicle speed is less than 8 mph, and shall have no effect when selected at speeds of 8 mph and faster.
 - 7) TOW START shall be non-functional.

Transmission selections shall modify the action of the engine output. The transmission control shall only be functional when the engine is running.

- (b) Tow Start Lockout - shall be a spring-loaded gate which shall prevent the gear selector from being moved to the TOW START position when engaged.

- (15) Parking brake handle - shall be a 2 position handle assembly interlocked with the gear selector to restrict movement of gear handle when parking brake is engaged. Parking brake shall be engaged when handle is pulled out. The force required to pull the handle out shall increase from 4 pounds +/- 10 percent to 25 pounds +/- 10 percent as the handle is pulled. The force required to release the handle shall be 4 pounds +/- 1 pound. The travel distance of the handle shall be 0.9 inches +/- 10 percent.

- (16) Driver's Night Vision Viewer (NVV) - shall be simulated version of the AN/VVS-2 NVV and shall interface to the visual system. Installing the simulated NVV shall

cause the visual system to display a graphical night vision replication of the surrounding terrain which shall be presented whenever simulated power is available to the viewer. The driver shall be able to install and remove the driver's night viewer.

- (a) Off-Bright Rotary switch - shall be a rotational control that shall simulate the removal of power from the NVV when in the OFF position (rotated fully counter-clockwise), and shall increase the level of brightness of Driver's Night Vision Viewer when rotated clockwise.
- (b) Electrical Hookup - shall be a connector which allows connection of the Driver's Night Vision Viewer to vehicle master power. The status of this connection shall be used to determine whether display of night vision or normal vision terrain is to be simulated.
- (c) NVV stowage bracket and strap - shall allow for stowage of the simulated NVV.
- (d) NVV Rotate - shall be a trainer unique active control that shall simulate slewing the NVV imagery +/- 45 degrees in azimuth.

(17) Steering yoke and pedals.

- (a) Driver's Intercom switch - shall be a pushbutton on the steering handle, which, when depressed, shall function as push-to-talk switch to allow the driver to speak over the intercom while steering.
- (b) Brake pedal - shall be a control assembly, which, when operated, shall slow and stop the simulated motion of the vehicle. The force required for pedal movement shall be 16 pounds. The travel distance of the pedal shall be 6 inches +/- 10 percent. The simulated braking distances and deceleration rates provided by brake pedal depression shall be within 15 percent of the actual forces in the M2A2/M3A2 BFV.
- (c) Accelerator pedal - shall be a control assembly, which, when operated, shall increase the simulated speed of the engine. The force required for pedal movement shall be 12 pounds +/- 3 pounds breakaway and 30 pounds +/- 5 pounds ending. The travel distance of the pedal shall be 3 inches +/- 10 percent.
- (d) Steering Yoke assembly - shall be a rotational control assembly which shall replicate the functionality of the corresponding actual control in providing steering inputs to the vehicle. Rotation of the yoke to the left shall cause the vehicle to turn left; right rotation shall turn the vehicle to the right. Steering control deadband shall be 10 degrees +/- 5 degrees. Range of travel of the

yoke assembly shall be from 48 degrees +/- 5 degrees in either direction. Breakaway force of the steering mechanism shall be 6 pounds (+/- 2 pounds) applied 5.5 inches from the centerline of the Steering Yoke assembly. Ending force shall be 27 pounds (+/- 10 percent) applied 5.5 inches from the pivot axis of the assembly. Specified breakaway and ending forces shall apply to rotation in either direction.

- (e) Brake pedal adjuster - shall be a mechanical component, which shall replicate the functionality of the corresponding control in the actual vehicle by adjusting the height of the brake pedal.
- (f) Beam Selector button - shall be a pushbutton on the floor, which toggles from high to low beam headlights when depressed.

(18) Fuel and Throttle Control panel.

- (a) Fuel Control Handle - shall be a 2 position handle, which, when pulled, shall stop fuel flow to the engine and when pushed shall start fuel flow to engine. The force required for handle movement shall be 18 pounds. The travel distance of the handle shall be 2.25 inches +/- 0.5 inches.
- (b) Throttle control and Push to Release Button - shall be a push-pull handle and pushbutton assembly. The throttle control, when pulled, shall increase engine speed and, when pushed, shall decrease engine speed. The throttle control shall have a deadband of 1.25 inches +/- 0.5 inches. Maximum deflection shall be 2 inches +/- 0.5 inches. The force required to move the handle shall be 3 pounds +/- 2 pounds. The force required to push the Push to Release button shall be 15 pounds +/- 2 pounds. The throttle control shall only be functional when the engine is running. The Push to Release button shall, when depressed, allow the Throttle Control to be pushed in to the handle's limit.

(19) Slope Indicator - shall be a simulated bubble assembly which indicates simulated vehicle angle from level to 10 degrees. Bubble shall be positioned in center of black circle when the vehicle is level, and shall move outward as slope increases. The bubble shall touch the blue circle at 5 degrees and the red circle at 10 degrees and greater.

(20) Driver's Vision Blocks - 4 vision blocks (periscopes) shall be provided to the driver which shall display scenes generated by the visual system as specified in Appendix A. The driver's center vision block (periscope) shall be removable to allow installation of the driver's NVV. The driver's periscope clamps and thumbs screws shall be replicated.

(21) Domelight.

- (a) Light Selector switch - shall be a 3 position rotary switch with blackout and white light positions. In the off position this switch shall turn off both the blackout and white lights. The other two positions shall turn on the associated lights.
 - (b) Blackout Release button - shall be a pushbutton switch, which when depressed allows moving the Light Selector switch from blackout to white light position.
 - (c) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.
 - (d) Blackout lamp - shall be one discrete output which shall be illuminated when the Light Selector switch is in the blackout position and vehicle power is on.
- (22) Ramp lever (locking lever)- shall be a 2-position lever with pushbutton. The Ramp lever shall lock the ramp in the raised position when up, and shall unlock the ramp for lowering when down (raising and lowering the ramp shall be controlled by the Ramp switch), Depressing the pushbutton shall allow the Ramp lever to be moved into the down position.
- (23) Vehicle Distribution Box.
- (a) NBC switch shall be a 2 position pull-to-toggle switch which shall turn the NBC system on and off.
 - (b) NBC indicator shall be a green lamp which shall be illuminated when the NBC switch is in the ON position.
- (24) Master Power indicator - shall be a green lamp which shall be illuminated when the Master Power switch is in the ON position.
- (25) Engine Accessory indicator - shall be a green dome lamp which shall be illuminated when the Engine Accessory switch is in the ON position.
- (26) Cold Start indicator - shall be a red lamp which shall be illuminated when the Cold Start switch is in the ON position.
- (27) Fwd Bilge Pump indicator - shall be a green lamp which shall be illuminated when the Fwd Bilge Pump switch is in the ON position and master power is on.
- (28) Rear Bilge Pump indicator - shall be a green lamp which shall be illuminated when the Rear Bilge Pump switch is in the ON position and master power is on.

- (29) Smoke Screen indicator - shall be a yellow lamp which shall be illuminated when the Smoke Screen Generator switch is in the ON position and the master power is on.
- (30) Engine Oil Low Press indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 10 percent when engine oil pressure is below 5 psi.
- (31) Left Turn indicator - shall be a green indicator which shall flash at 1.6 Hz +/- 10 percent when the Turn indicator switch is in the left turn position and also when in the hazard position.
- (32) Right Turn indicator - shall be a green indicator which shall flash at 1.6 Hz +/- 10 percent when the Turn indicator switch is in the right turn position and also when in the hazard position.
- (33) High Beam indicator - shall be an indicator which shall be illuminated when the headlight highbeams are on.
- (34) Ramp Unlocked indicator - shall be a red lamp which shall be illuminated when the ramp is unlocked.
- (35) Master Power switch - shall be a 2-position pull-to-toggle switch which shall have positions labeled ON and OFF and shall control vehicle master power. The switch set to the ON position shall illuminate the vehicle master power indicator and all gauge lights, and shall cause simulated vehicle master power to be on. Setting the Vehicle Master Power switch to the OFF position shall inhibit the functioning of all driver compartment switches and indicators and shall remove simulated master power.
- (36) Starter Cutout Override switch - shall be a 2-position pull-to-toggle switch which shall have positions labeled ON and OFF. In the ON position, the starter automatic cutout is overridden to allow longer crank in cold conditions.
- (37) Engine Accessory switch - shall be a 2-position pull-to-toggle switch which shall have positions labeled ON and OFF, and shall control engine accessory power. This switch shall activate a warning tone when moved to ON.
- (38) Cold Start switch - shall be a 2-position toggle switch which shall have positions labeled ON and OFF. The switch shall replicate the operation of the cold start switch on the BFV.
- (39) Fwd Bilge Pump switch - shall be a 2-position toggle switch which shall have positions labeled ON and OFF. This switch shall control power to 2 forward bilge pumps and shall cause the aural cue to be activated and the FWD Bilge Pump indicator to be illuminated.

- (40) Rear Bilge Pump switch - shall be a 2-position toggle switch which shall have positions labeled ON and OFF. This switch shall control power to 2 rear bilge pumps and shall cause the aural cue to be activated and the REAR Bilge Pump indicator to be illuminated.
- (41) Turn Indicator switch - shall be a 5-position lever switch. The center position shall turn the indicators off; the far left and right positions shall turn on the hazard lights; the middle left shall turn on the left turn indicator; the middle right shall turn on the right turn indicator.
- (42) Horn button - shall be a 2-position pushbutton switch which shall activate the horn aural cue when depressed.
- (43) Test Sensor switch - shall be a 2-position pushbutton switch. When depressed, the Coolant Low Level Indicator light shall flash at 1.6 Hz +/- 10 percent.
- (44) Coolant Hi Temp indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 10 percent when engine coolant temperature is greater than 225 +/- 5 degrees F.
- (45) Coolant Low Level indicator - shall be a red lamp which shall be flashed at 1.6 Hz +/- 10 percent when the engine coolant level is less than the minimum required to activate the lamp.
- (46) Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead.
- (47) Driver's Head Tracker - is a trainer unique item which shall provide feed back indicating the orientation of the driver's head and shall be used for vision block control.
- (48) Driver's Seat - shall be a functional replica of the vehicle seat with full range of motion and adjustment as in the actual M2A2/M3A2 BFV. The driver's seat assembly shall include a control knob, a control lever, a backrest release handle, and a mechanically operative seat belt (lap belt).
- (49) Engine Oil Pressure gauge - shall replicate the engine oil pressure gauge in the BFV both physically and functionally. Gauge face shall be marked with 2 red and green bands, the lower band labeled IDLE, and the upper labeled NORMAL OPERATING. The position of the needle shall be a function of the calculated engine oil pressure, such that, with engine at idle, the needle shall be in the green zone of the lower band when oil pressure is between 10 and 150 PSI and in the red zone of the lower band when the oil pressure is less than 10 PSI, and with engine at normal operating speed, the needle shall be in the green zone of the upper band

when the oil pressure is between 25 and 150 PSI and in the red zone of the upper band when the oil pressure is less than 25 PSI.

(50) Ramp switch - shall be a 3 position pull-to-toggle switch labeled UP above and DOWN below, and shall be momentary in both up and down positions. This switch shall raise the ramp while in the UP position, and shall lower the ramp while in the DOWN position.

(51) Driver's Intercom Control box.

(a) MONITOR switch - shall be a 5 position rotary switch with positions labeled ALL, A, INT ONLY, B, and C (clockwise from left position). ALL position shall allow monitor of all channels, INT ONLY shall cause only the intercom to be monitored, and in A, B, C positions shall select the corresponding radio channel for monitoring.

(b) Volume knob - shall be a rotational control with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume; rotating the knob, counterclockwise shall decrease the intercom volume.

(c) Right connector (J802) - shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(d) Left connector (J803) - shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

(52) Fire Suppression switch - shall be a two-position pull-to-toggle switch which shall be labeled "MANUAL" in the up position and "AUTO" in the down position. In the up position, the switch shall select MANUAL mode of operation for the fire suppression system. In the down position, the switch shall select AUTO mode of operation.

(53) Driver's NBC hookups are as follows:

(a) NBC system air intake hoses and spring clip shall be physically and functionally replicated.

(b) Driver's NBC air hose shall be physically and functionally replicated.

(c) Driver's NBC quick disconnect shall be physically and functionally replicated.

- (54) Tone Cancel switch - shall be a 3-position toggle switch which shall have positions labeled TONE CANCEL and PUSH TO TEST. The TONE CANCEL position shall disable the Driver's audio Warning Tone. The PUSH TO TEST position shall illuminate all Driver instrument panel indicators except for the Turret Power indicator.
 - (55) Driver's Audio Warning Tone - shall be active and heard in the Driver's CVC helmet.
 - (56) NVV Power Cable - shall be functionally replicated. The cable shall interface with the power receptacle on the simulated NVV.
 - (57) Hatch Cover Adapter - shall be physically replicated and shall interface with the NVV power cable for stowage.
- b. The following controls, indicators, and other pieces of equipment shall be physically represented (operational but nonfunctional):
- (1) Personnel Heater Control Box.
 - (a) Hi/Lo switch - shall be a dummy 2 position toggle switch labeled HI above and LO below.
 - (b) Run-Off-Start switch - shall be a dummy 3 position toggle switch labeled RUN at upper right, OFF at center right and START at lower right.
 - (c) Personnel Heater light - shall be a dummy amber indicator.
 - (2) Vehicle Distribution Box.
 - (a) STEICE - shall be an inactive, dummy receptacle.
 - (b) TMDE - shall be an inactive, dummy receptacle.
 - (c) Slave Receptacle - shall be an inactive, dummy receptacle.
 - (d) Power Ind light - shall be an dummy green indicator.
 - (e) Energize Slave Receptacle pushbutton - shall be an inactive, dummy pushbutton.
 - (3) NBC heater.
 - (a) NBC System Control Knob - shall be a dummy 2-position rotary knob.

- (b) NBC Heater Indicator light - shall be a dummy green dome indicator.
- (4) Driver's Intercom Switch Box.
- (5) DISCH indicator - shall be a red lamp and shall be illuminated when the simulated fire suppression system halon has been discharged.
- (6) MANUAL indicator - shall be a red lamp and shall be illuminated when the simulated fire suppression system is operating in manual mode.

G.3.1.2.1.2 Vehicle Commander's Station.

The following switches, controls, gauges, and lights shall be provided at the M2A2/M3A2 Vehicle Commanders station in the locations and panels as found in the actual M2A2/M3A2 BFV.

- a. The following controls, indicators, and other pieces of equipment shall be simulated (functional).
 - (1) Turret Drive Warning lights - shall be 2 push-to-test red indicators. Each indicator shall be illuminated when turret power is on and either turret power is on and the indicator is pressed.
 - (2) Turret Position Indicator - shall be an assembly of 13 yellow indicators that replicates the corresponding actual display in the BFV. The indicator shall consist of an arrow shaped indicator in the center of 12 circular indicators arranged at 30 degrees intervals (like the hours on a clock face), each of which shall be labeled with a number from 1 to 12 corresponding to the clock position. The center arrow indicator and one of the 12 circular indicators shall be illuminated when turret power is on. The circular indicator illuminated shall be a function of the turret position relative to the hull: with 0 degrees turret rotation, the indicator labeled "12" shall be illuminated; with 30 degrees turret rotation, the indicator labeled "1" shall be illuminated, and so on.
 - (3) Stabilization indicator - shall be a yellow indicator which is on when turret power, turret drive, and stabilization switches are all on. The indicator shall also illuminate when turret power is on and the Fan-Lamp Test switch is in the LAMP TEST position.
 - (4) Slope Indicator - shall be a simulated 1/2 moon assembly which shall indicate simulated vehicle angle from level to 20 degrees. The assembly shall consist of 9 indicators positioned at 20, 15, 10, 5, 0, 5, 10, 15, and 20 degrees.
 - (5) Commander's Control Handle - shall be a control assembly with left, right forward, and reverse motion. Movement of the handle left shwill cause the turret to rotate to the left (counterclockwise); moving the handle to the right shwill cause

the turret to rotate to the right; moving the handle assembly forward ~~sh~~will lower the turret elevation; and moving the handle assembly to the rear ~~wi~~shall raise the elevation of the turret.

- (a) Trigger switch - shall be a red trigger -shaped pushbutton switch on top front of handle (above palm switch). When depressed this switch fires the selected weapon: 25mm gun; coax machine gun; TOW missile.
 - (b) Fast Turret switch (slew button) - shall be a pushbutton switch on the back of the handle which increases the speed of turret traverse from a range of 0.1 to 89 mils per second to a range of 0.1 to 1067 mils per second, the speed of the gun elevation from a range of 0.05 to 89 mils per second to a range of 0.05 to 1067 mils per second, and the speed of the TOW elevation from a range of 0.05 to 89 mils per second to a range of 0.05 to 267 mils per second.
 - (c) Palm switch - shall be a finger grip pushbutton switch on bottom front of handle which activates turret drive and releases turret drive brakes.
 - (d) Drift button - shall be a pushbutton on left side of handle base. When depressed this switch reduces the drift in the turret stabilization system.
 - (e) Commander's Arm Rest - shall replicate the Commander's Arm Rest in the BFV.
- (6) Commander's Intercom Control Box - shall consist of the following:
- (a) Intercom Monitor switch - shall be a 5 position rotary switch with positions labeled ALL, A, INT ONLY, B, and C (clockwise from left position). In ALL position, allows monitor of all channels, in INT ONLY causes only the intercom to be monitored, and in A, B, C positions shall select the corresponding radio channel for monitoring.
 - (b) Volume knob - shall be a rotational control with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume, rotating the knob counterclockwise shall decrease the intercom volume.
 - (c) Right connector (J802) - shall allow for connection of an CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
 - (d) Left connector (J803) - shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.

- (7) Radio-Intercom switch - shall be a 3 position toggle labeled RADIO above and INTERCOM below and momentary in the RADIO position. This switch shall replicate the functionality of the corresponding switch in the actual M2A2/M3A2, which selects between the radio and the intercom.
- (8) Turret Control Box.
 - (a) Turret Power switch - shall be a 2 position pull-to-toggle switch labeled ON above and OFF below and lever locked in the down (OFF) position. This switch shall replicate the functionality of the corresponding actual switch which controls power to the turret.
 - (b) Turret Power indicator - shall be a yellow indicator which shall be on when turret is on. The indicator shall also light when the Fan-Lamp Test switch is in the LAMP TEST position and vehicle power is on.
 - (c) Turret Drive System and Stabilization switches -
 - 1) Turret Drive System switch - shall be a 2 position toggle switch labeled OFF below. This switch shall replicate the functionality of the corresponding actual switch which controls power for turret traverse, TOW launcher, and 25mm gun system.
 - 2) Turret Drive System indicator - shall be a yellow indicator and shall be on when turret power and turret drive switches are on and vehicle master power is on. This indicator shall also be on when the Fan-Lamp Test switch is in the LAMP TEST position, and turret power is on.
 - 3) Stabilization switch - shall be a 2 position toggle switch labeled STAB OFF below. In the on position, this switch shall turn on the stabilization control for turret drive and elevation which maintains turret on target while vehicle is moving.
 - (d) TOW Abort switch - shall be a 2 position pull-to-toggle switch which is momentary in the up position and locked in the down position, labeled TOW ABORT above. In the TOW ABORT position, this switch shall cause TOW missile wires to be cut, aborting the missile.
 - (e) Warning Indicators - the following annunciator indicators shall be illuminated when the Fan-Lamp Test switch is in the LAMP TEST position and turret power is on in addition to the conditions described below:
 - 1) Open Hatch - shall be a yellow indicator labeled OPEN HATCH in center of indicator and shall be illuminated when turret power is on and any of the following are open: cargo hatch cover (virtual); turret shield door.

- 2) Back Up Power - shall be a yellow indicator labeled BACK UP PWR in center of indicator, illuminated when emergency battery power is being used to operate firing control system, gunner's handstation triggers, and communications systems and turret power is on. When this indicator is ON the turret drive shall not be able to be operated electrically.
 - 3) No Fire Zone - shall be a yellow indicator labeled in center of indicator. Illuminated when turret power is on and one or more weapons are in a position such that, if fired, damage to vehicle and injury to personnel could result. When this indicator is ON the trigger switches shall be inoperative.
 - 4) Manual Drive - shall be a yellow indicator labeled in center of indicator. Illuminated when a select lever is in manual mode and turret power is on.
 - 5) Drive Malfunction - shall be a yellow indicator labeled in center of indicator, illuminated when drive system malfunction is active and turret power is on.
 - 6) Fan ~~and~~ Lamp Test switch - shall be a 3 position toggle switch labeled FAN above and LAMP TEST below and momentary down. In the FAN position this switch shall turn on the gun fans continuously. In center position, the gun fans shall be activated whenever gun fires. In LAMP TEST position, all indicator lights in turret shall be turned on, providing turret power is on.
- (9) Commander's ISU
- (a) Commander's sight extension with eye piece - shall replicate the commander's sight extension with eyepiece on the BFV. The eyepiece shall display scenes generated by the visual system as specified in Appendix A.
 - (b) Commander's ISU Focus barrel - shall replicate the appearance and movement of the corresponding actual control on the BFV and shall simulate focusing of the Commander's ISU sight.
 - (c) Brow pad - shall replicate the commander's ISU Brow Pad on the BFV. A sensor shall be provided to determine when the sight is in use. When activated, the Commander's ISU shall display simulated ISU imagery.
- (10) Sight Reticle for 25mm Automatic Gun and 7.62 Coaxial Machine Gun with range and ammo indicators - shall be a graphics display which shall be overlaid on the graphical replication of the surrounding terrain viewed on the commander's ISU sight extension.

- (11) TOW Sight Reticle with ammo indicators - shall be a graphics display which shall be overlaid on the graphical replication of the surrounding terrain.
- (12) Dome light -
- (a) Light Selector switch - shall be a 3 position rotary switch with blackout, white light and off positions. In the off position this switch shall turn off both the blackout and white lights. The other two positions shall turn on the associated lights.
 - (b) Blackout Release button - shall be a pushbutton switch, which, when depressed allows moving the Light Selector switch from blackout to white light position.
 - (c) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.
 - (d) Blackout lamp - shall be illuminated whenever the Light Selector switch is in the blackout position.
- (13) Turret Azimuth Indicator - shall be a trainer unique panel with the following components:
- (a) Azimuth shall be a 4 digit display used to indicate the simulated position of the turret relative to the hull in the range of 10 to 6400 mils. The display shall indicate 6400 mils when the simulated position of the turret is aiming down the centerline of the vehicle.
 - (b) Text indicator shall consist of eight ~~5~~ by 7 dot matrix characters used to display text corresponding to the position ranges on the actual vehicle.
- (14) Turret travel lock - shall be a 2 position lever. When in the LOCK position, shall prevent movement of turret.
- (15) Combat Override - shall be a 2 position toggle switch labeled ON above and OFF below and magnetically held in ON position. Switch shall have a red safety cover. The magnetic hold for the ON position shall be turned off when Turret Power switch is in the OFF position. In the ON position, this switch shall disable the Turret Door, Driver's Hatch, and Cargo Hatch Interlock switches and allow turret operation when any of these are open.
- (16) Commanders Hatch Assembly (Hatch cover, handle). For the Commander's Popped Hatch (CPH) version, the hatch cap, when closed, shall be able to be opened by handles. A hinging mechanism shall cause the cap to move to an opening of approximately four inches (this spacing shall replicate the actual vehicle). The popped hatch view shall cover a 360-degree field of view and shall be obstructed by

structures replicating the vision block housings, machine gun mounts, commander's weapon sight tube, hatch hinge mechanisms, and a modified machine gun.

- (17) Commander's Seat - shall be a functional replica of the vehicle seat with the full range of motion and adjustment as in the actual M2A2/M3A2 BFV. The commander's seat assembly shall include a control handle, which, when pulled, releases the seat for height adjustment. The commander's seat shall be provided with a mechanically operative seatbelt.
- (18) Audio frequency amplifier (AM 1780/VRC) shall be functionally replicated as follows:
- (a) Main Power switch - shall be a 3 position rotary switch with positions labeled NORM, INT ONLY, and OFF. This switch shall replicate the functionality of the corresponding actual switch which controls the mode of the amplifier. With the switch in NORM, the radio and intercom audio shall be amplified; with the switch in INT ONLY, the intercom audio only is amplified; with the switch in OFF, amplification is deactivated.
 - (b) Int Accent switch - shall be a 2 position rotary switch with positions labeled ON and OFF. In the ON position, this switch shall reduce the volume of radio traffic below the volume of intercom traffic; while in the OFF position, the volumes shall be equal.
 - (c) Radio Trans switch - shall be a 3 position rotary switch with positions labeled CDR CREW, CDR ONLY, and LISTENING SILENCE. This switch shall replicate the functionality of the corresponding actual switch which controls radio transmission access. With the switch in CDR CREW position, all crew positions shall have the capability to transmit; with the switch in CDR ONLY, only the commander's position shall be able to transmit; with the switch in LISTENING SILENCE, no positions may transmit.
 - (d) Power Ckt Bkr switch - shall be a 2 position trippable toggle-type circuit breaker. This switch shall replicate the functionality of the corresponding actual switch which controls power to the amplifier. With this switch not tripped and master power on, the amplifier shall be operational.
 - (e) Power light - shall be a green lamp which shall be illuminated when master power is on and the Power Ckt Bkr switch is on (not tripped).
 - (f) Installation switch - shall be a 3 position rotary switch with positions labeled INT ONLY, OTHER, and RETRANS.
- (19) Commander's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be

wounded; a red lamp shall be illuminated when the commander is considered to be dead.

(20) Commander's Head Tracker - a trainer unique item which shall provide feedback indicating the commander's head orientation and shall be used for vision block control.

(21) Binoculars (7X).

(a) Binocular capability shall be provided with each popped hatch module by a trainer unique device. A momentary pushbutton switch shall be provided which, when depressed, ~~sh~~will enable the binocular capability on the CPH display.

(b) A two axis joystick shall be provided which, when the momentary pushbutton is depressed, shall slew the binocular reticle in azimuth and the CPH imagery in elevation.

(22) Night Vision Goggles (NVG).

Night vision goggles shall be functionally replicated as follows:

A trainer unique momentary pushbutton switch shall be provided which ~~wi~~shall enable and disable the night vision capability. When the night vision capability is activated, the CPH shall display night vision imagery.

(23) Commander's Vision Blocks - 7 vision blocks (periscopes) shall be provided to the commander which shall display scenes generated by the visual system as specified in Appendix A.

(24) Two SINCGARS radios (RT-1523A) shall be functionally and physically replicated. The SINCGARS radios shall be compatible with organizational requirements, except as indicated in 3.7.6, for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. Each radio shall simulate the following controls:

(a) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. On vehicular installations that provide a long range (lower) radio the dummy cable shall connect to the RF power amplifier. On the short range (upper) radio the dummy cable shall connect to the chassis (representing connecting to vehicle antenna).

(b) CHAN (channel) switch shall select manual, preset and cue channels. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:

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- 1) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.
 - 2) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.
 - 3) 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 4) 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 5) 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 6) 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 7) 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 8) 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
- (c) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:

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- 1) LO - This position shall set the transmission power to low.
 - 2) M - This position shall set the transmission power to medium.
 - 3) HI - This position shall set the transmission power to high.
 - 4) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.
- (d) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:
- 1) SC - This position shall set the receiver/transmitter to SC (single channel) mode.
 - 2) FH - This position shall set the receiver/transmitter to FH (frequency hopping) mode.
 - 3) FH-M - This position shall set the receiver/transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.
- (e) RXMT connector shall be a dummy 3-D connector which shall have a dummy cable connected to the RXMT on the other RT in the radio mount.
- (f) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:
- 1) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go into the STBY position.
 - 2) TST - This position shall cause the normal self test indications to be displayed on the keyboard display.
 - 3) LD - This position shall allow the operator to load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in FH-M mode.
 - 4) SQ ON - This position shall turn on the RT and activate the squelch.
 - 5) SQ OFF - This position shall turn on the RT and deactivate the squelch.
 - 6) RXMT - This position shall be non-functional.

- 7) REM - This position shall disable the RT's front panel controls.
 - 8) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go into the Z-FH position.
 - 9) OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go into the OFF position.
- (g) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.
- (h) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 ~~X~~by 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 ~~X~~by 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.
- (i) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:
- 1) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.
 - 2) * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.
 - 3) SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.
 - 4) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.
 - 5) DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.
 - 6) 5 - Shall enter the number '5' into the system.
 - 7) 6 - Shall enter the number '6' into the system.

- 8) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load and/ check SC offset frequencies.
 - 9) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.
 - 10) 8 - Shall enter the number '8' into the system.
 - 11) LOUT 9 - Shall enter the number '9' into the system. Shall also retrieve frequency lockout sets from permanent memory if the RT is operating as Frequency HopMaster.
 - 12) TIME - Shall be used to check RT FH sync time clock.
 - 13) CLR - Shall clear data from display if error was made during entry. Shall also clear data from RT memory.
 - 14) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also enter the number '0' into the system.
 - 15) STO - Shall transfer data from RT holding memory onto permanent memory.
 - 16) BATT CALL - Shall be non-functional.
- (j) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:
- 1) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.
 - 2) CT - This position shall place the RT into cipher text mode.
 - 3) TD - This position shall be non-functional.
 - 4) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.
 - 5) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.

- (k) VOL/WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.
- (l) HUB Connector - Dummy cover that shall not be removable.
- (m) AUD/FILL connector shall be a dummy 3-D connector.
- (n) AUD/DATA connector shall be a dummy 3-D connector. In vehicular installations, a dummy 3-D cable shall connect to the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter.

(25) SINCGARS Radios shall be mounted in a short/long range radio configuration.

- (a) This mounting shall replicate the AN/VRC-89A configuration which contains the following:
 - 1) Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
 - 2) Amplifier, Radio Frequency AM-7238A/VRC.
 - 3) Receiver-Transmitter, Radio RT-1523 A.
 - 4) Receiver-Transmitter, Radio RT-1523 A.
 - 5) Loudspeaker Control Unit, LS-671/U.

~~(a)~~(b) The mounting adapter shall have two (2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

- 1) CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.
- 2) Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.
- 3) The (AUD/DATA B J2) connector shall be a 3-D dummy connector.
- 4) The (AUD/DATA A J3) connector shall be a 3-D dummy connector.
- 5) The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.

- 6) The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.
 - 7) The (SPKR J6) connector shall be a 3-D dummy connector.
- (c) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components.
- 1) The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.
 - 2) The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.
- (26) Commander's NBC hookups are as follows:
- (a) Commander's NBC air hose shall be physically and functionally replicated.
 - (b) Commander's NBC quick disconnect shall be physically and functionally replicated.
 - (c) Commander's NBC air outlet hose clip shall be physically and functionally replicated.
- b. The following controls, indicators, and other pieces of equipment shall be physically represented (operational but nonfunctional):
- (1) NBC Heaters.
 - (a) Left NBC Heater knob - shall be a rotary switch which is labeled WARMER on right with an arrow wrapping clockwise, and labeled OFF on the left.
 - (b) Left NBC Heater lamp - shall be a dummy green lamp.
 - (c) Right NBC Heater knob - shall be a rotary switch which is labeled WARMER on right with an arrow wrapping clockwise, and labeled OFF on the left.
 - (d) Right NBC Heater lamp - shall be a dummy green lamp.
 - (2) Intercom Amplifier Box.
 - (a) Audio Input jacks - shall be a dummy 2 jack assembly labeled "AUDIO INPUT".

- (b) Line jacks - shall be a dummy 2 jack assembly labeled "TEL/REMOTE".

G.3.1.2.1.3 Gunner's Station.

The following switches, controls, gauges, and lights shall be provided at the Gunner's station in the locations and panels as found in the actual M2A2/M3A2 BFV.

- a. The following controls, indicators, and other pieces of equipment shall be simulated (functional).
 - (1) Switches, controls, and associated lights and indicators.
 - (a) Weapon Control Box - shall be functionally replicated. The following switches and indicators on the Weapon Control Box shall be replicated and function as described:
 - 1) Arm-Safe-Reset switch - shall be a 3 position pull-to-toggle switch, lever-locked in center position and labeled ARM above, SAFE in center, RESET below. In the ARM position, this switch shall arm the 25mm gun, coax machine gun, and TOW missiles; SAFE position shall prevent firing; RESET shall clear all weapons selected. This switch shall be mechanically held in the ARM position and momentary in the RESET position.
 - 2) Sear Misfire button - shall be a pushbutton switch which when depressed shall bring 25mm gun bolt back to the SEAR position after trigger is depressed when the 25mm gun misfires.
 - 3) AP SS button - shall be a pushbutton switch which when depressed shall select 25mm gun AP single shot mode.
 - 4) AP SS indicator - shall be a yellow indicator which shall be illuminated only when AP single shot is selected.
 - 5) AP LO button - shall be a pushbutton switch which when depressed shall select 25mm gun AP low rate (100 rounds per minute) mode.
 - 6) AP LO indicator - shall be a yellow indicator which shall be illuminated only when AP low rate is selected.
 - 7) AP HI button - shall be a pushbutton switch which when depressed shall select 25mm gun AP high rate (200 rounds per minute) mode.
 - 8) AP HI indicator - shall be a yellow indicator which shall be illuminated only when AP high rate is selected.

- 9) HE SS button - shall be a pushbutton switch which when depressed shall select 25mm gun HE single shot mode
- 10) HE SS indicator - shall be a yellow indicator which shall be illuminated only when HE single shot is selected.
- 11) HE LO button - shall be a pushbutton switch which when depressed shall select 25mm gun HE low rate (100 rounds per minute) mode.
- 12) HE LO indicator - shall be a yellow indicator which shall be illuminated only when HE low rate is selected.
- 13) HE HI button - shall be a pushbutton switch which when depressed shall select 25mm gun HE high rate (200 rounds per minute) mode.
- 14) HE HI indicator - shall be a yellow indicator which shall be illuminated only when HE high rate is selected.
- 15) 7.62 button - shall be a pushbutton switch which when depressed shall select 7.62mm machine gun
- 16) 7.62 indicator - shall be a yellow indicator which shall be illuminated only when 7.62mm machine gun is selected
- 17) LO Ammo Ovr button - shall be a pushbutton switch which when depressed, shall allow the currently selected gun (25 mm, 7.62 mm) to fire the remaining ammo when LO AMMO indicator is flashing.
- 18) LO Ammo Ovr indicator - shall be a yellow indicator which shall be illuminated and flashing at 1.6 Hz +/- 10 percent only when the end of the ammo belt passes the sensors on the ammo can. The indicator shall stop flashing when the LO AMMO OVRD button is pressed.
- 19) Trigger button - shall be a pushbutton switch which when depressed shall fire all eight smoke grenades.
- 20) Grenade Launcher ON/OFF switch - shall be a 2 position pull-to-toggle switch which shall arm and disarm the launcher by selecting power ON and OFF to the smoke grenade launcher.
- 21) GRENADE LAUNCHER indicator - shall be a yellow indicator which shall be illuminated only when the smoke grenade launcher is armed.
- 22) Arm indicator - shall be a red indicator which shall be illuminated only when a weapon is armed.

- 23) SEAR indicator - shall be a yellow indicator which shall be illuminated only when 25mm gun bolt is in the SEAR position. This indicator shall blink at 1.6 Hz +/- 10 percent indicating the 25mm gun bolt is in the MISFIRE position.
 - 24) TRIGGER indicator - shall be a red indicator which shall be illuminated when the TRIGGER button is pressed.
 - 25) PNL Light Dimmer knob - shall be a knob which shall replicate the appearance, movement, and function of the corresponding actual control. This knob shall variably adjust the panel lights on the Weapon Control Box, Turret Control Box, TOW Control Box, and Turret Position Indicators from bright to dim.
- (b) TOW Control Box.
- 1) TOW Test button - shall be a pushbutton switch which shall activate the TOW test mode for 20 seconds.
 - 2) TOW TEST indicator - shall be a yellow indicator which shall be illuminated while the TOW test mode is activated.
 - 3) Launcher UP/DN switch - shall be a 2 position pull-to-toggle switch which shall raise and lower TOW missile launcher when the palm switch on the commander's or gunner's control handles are pressed.
 - 4) Launcher UP/DN indicator - shall be a yellow indicator which shall be illuminated only when the missile launcher is raised.
 - 5) TOW button - shall be a pushbutton switch which shall select the TOW mode. When the TOW mode is selected the TOW indicator shall be illuminated and the TOW test mode shall be activated for 20 seconds.
 - 6) TOW indicator - shall be a yellow indicator which shall be illuminated while the TOW mode is selected.
 - 7) MSL 1 button - shall be a pushbutton switch which shall select TOW missile launcher tube No. 1 for firing.
 - 8) MSL 2 button - shall be a pushbutton switch which shall select TOW missile launcher tube No. 2 for firing.
 - 9) Missile Tube 1 indicator - shall be a yellow indicator which shall be illuminated when TOW missile launcher tube No. 1 is selected and shall flash when the selected missile launcher tube is empty.

- 10) Missile Tube 2 indicator - shall be a yellow indicator which shall be illuminated when TOW missile launcher tube No. 2 is selected and shall flash when the selected missile launcher tube is empty.
- 11) TOW 2 missile indicator - shall be a yellow indicator which shall be illuminated when a TOW 2 missile is loaded in the selected missile tube.

(2) Switches and Controls.

- (a) Gunner's Handstation shall be functionally replicated with left and right Gunner's Control Handles. The following switches on the Gunner's Handstation shall be replicated and shall function as described :

- 1) Left and Right Trigger switches - shall be red momentary pushbutton switches which shall fire the currently selected weapon (25mm gun; coax machine gun; TOW missile).
- 2) Left and Right Palm switches - shall be momentary pushbutton switches which shall activate turret drive system and release the turret drive brakes.
- 3) Left and Right Fast Turret switches - shall be momentary pushbutton switches which shall activate turret drive system in fast mode.
- 4) Drift button - shall be a pushbutton switch which shall reduce the drift in the turret stabilization system when depressed.
- 5) Handle Elevation control - shall be a rotational control which shall rotate forward and aft to control elevation of the 25mm gun, 7.62mm machine gun, and the TOW launcher. When the Gunner's Control Handles are moved forward the elevation shall be decreased; when moved aft, the elevation shall be increased.
- 6) Handle Traverse control - shall be a rotational control which shall rotate left and right for control of turret azimuth. When the Gunner's Control Handles are rotated left and right, the turret shall traverse in the direction the handles were moved.

- (b) Gunner's ISU and controls shall be functionally replicated. The following switches shall be replicated and function as described:

- 1) Gunner's ISU brow pad - shall replicate the gunner's ISU brow pad in the BFV.
- 2) A sensor shall be provided to determine when the sight is in use and when activated, the gunner's ISU shall display simulated ISU imagery.

- 3) Ret Brt knob - shall be a rotational control which shall adjust the brightness of the reticule in the gunner's ISU eyepiece.
- 4) Sensor Select switch - shall be a three position rotary switch which shall select the light filter settings for the ISU. "NIGHT" setting is for night vision system, and "CLEAR" and "NEUTRAL" are for daytime conditions.
- 5) Range Control knob and indicator - Range Control knob shall be a 16 position rotary switch which shall select the range of the 25mm and 7.62mm guns from 0 to 3000 meters. The range control knob shall be incremented from 0 to 30 by twos (0, 2, 4 . . . 30). The "0" marker shall be encircled. The "12" marker shall be enclosed in a diamond. The Range Control indicator shall be a yellow lamp at top of dial and shall illuminate the currently selected range. The Range Control knob shall replicate the Range Control knob on the BFV.
- 6) Gun Boresight Controls - Azimuth control shall be a knob with 240 degrees of movement. The Azimuth control shall adjust the gun reticle in azimuth when in GUN (25mm or 7.62mm selected) mode. Elevation control shall be a knob with 350 degrees of movement. The Elevation control shall adjust the gun reticle in elevation when in GUN mode.
- 7) Night Boresight Controls - Azimuth control shall be a knob with $7/8 \pm 1/8$ revolutions of movement. The Azimuth control shall adjust the azimuth of the night vision scene. Elevation control shall be knob with $7/8 \pm 1/8$ revolutions of movement. The Elevation control shall adjust the elevation of the night vision scene.
- 8) Night Vision PLRT switch - shall be a 2 position toggle switch which shall select between "W/H" and "B/H" polarity setting for the night vision scene. "W/H" shall produce red images on black background and "B/H" shall produce black images on red background.
- 9) Night Vision BRT knob - shall be a push-to-turn knob with 270 degrees of rotation which shall adjust night vision scene brightness.
- 10) Night Vision PWR switch - shall be a 3 position toggle which shall be labeled "ON", "OFF", and "BRSIT". The switch shall turn on the night vision system in the "ON" position, turn off the night vision system in the "OFF" position, and turn on the boresight lamp in the "BRST" position. The switch shall be pulled to be moved to the "ON" position.
- 11) Night Vision CON knob - shall be a push-to-turn knob with 270 degrees of rotation which shall adjust night vision scene contrast.

- 12) Mag switch (4X, 12X) - shall be a 2 position rotary switch which shall select a HIGH and LOW magnification of both day and night vision scenes. LOW magnification shall be 4X and HIGH magnification shall be 12X.
 - 13) Gun Reticle, TOW Reticle, Status indicator and Air Defense Reticle - shall be a graphics display which shall be overlaid on the display of the surrounding terrain.
 - 14) RELAY AZ ADJ - shall be a knob which shall adjust the TOW reticle to EAR in azimuth.
 - 15) Day Sight Actuator handle - which rotates between two discrete positions to simulate opening and closing the day sight ballistic shield door. The handle shall be spring-loaded and lock in each of the two positions. The force required to move the handle to open position shall be 6 pounds +/- 2 pounds.
 - 16) Night Sight Actuator handle - which rotates between two discrete positions to simulate opening and closing the night sight ballistic shield door. The handle shall be spring-loaded and lock in each of the two positions. The force required to move the handle to the open position shall be 10 pounds +/- 2 pounds.
 - 17) Eye piece - shall replicate the gunner's ISU eyepiece on the BFV. The eye piece shall display scenes generated by the visual system as specified in Appendix A.
 - 18) Unity Window - shall be a graphics display which replicates the Unity Window on the BFV. The simulated Unity Window shall display scenes generated by the visual system as specified in Appendix A.
- (c) Gunner's Intercom Controls shall be functionally replicated. The following components shall be replicated and shall function as described:
- 1) Intercom Monitor switch - shall be a 5 position rotary switch with positions labeled ALL, A, INT ONLY, B, and C (clockwise from left position). ALL position shall allow monitor of all channels, INT ONLY shall cause only the intercom to be monitored, and in A, B, C positions shall select the corresponding radio channel for monitoring.
 - 2) Volume knob - shall be a rotational control with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume; rotating the knob counterclockwise shall decrease the intercom volume.

- 3) Gunner's Floor switch - shall be a pushbutton switch which, when depressed, shall allow the gunner to speak over the intercom.
- 4) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
- 5) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).

(3) Lights.

- (a) Annunciator Box shall be functionally replicated. The following switches and indicators on the Annunciator Box shall be replicated and function as described:
 - 1) TOW CKT OPEN indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction exists in the TOW electrical system.
 - 2) AMMO SW REVERSE indicator - This yellow indicator shall be illuminated only when the "AP" and "HE" ammo switches are reversed.
 - 3) OPEN HATCH indicator - This yellow indicator shall be illuminated only when any of the following are open: the driver's hatch cover; cargo hatch cover; turret shield door.
 - 4) NO FIRE ZONE indicator - This yellow indicator shall be illuminated only when weapons are in a position where they could damage the vehicle or personnel. When the "NO FIRE ZONE" annunciator indicator is on, the trigger switches shall be inoperable.
 - 5) 25 FDR MALF indicator - This yellow indicator shall be one discrete output and illuminated only when a malfunction occurs in the 25mm gun feeder.
 - 6) 25 GUN MALF indicator - This yellow indicator shall be one discrete output and shall be illuminated only when a malfunction occurs with the 25mm gun.

- 7) MANUAL DRIVE indicator - This yellow indicator shall be one discrete output and shall be illuminated only when a drive selector lever is in the manual mode.
 - 8) DRIVE MALF indicator - This yellow indicator shall be one discrete output and shall be illuminated only when a malfunction occurs in the drive system.
- (b) TOW Control Box.
- 1) ISU indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the Integrated Sight Unit.
 - 2) DCGE indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the Digital Command Guidance Electronics.
 - 3) PCU indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the Power Control Unit.
 - 4) BAT indicator - This yellow indicator shall be one discrete output and shall be illuminated when a malfunction occurs in the batteries.
- (c) Dome light.
- 1) Light Selector switch - shall be a 3 position rotary switch with blackout, white light and off positions. In the off position this switch shall turn off both the blackout and white lights.
 - 2) Blackout Release button - shall be a pushbutton switch which, when depressed, allows moving the Light Selector switch from blackout to white light position.
 - 3) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.
 - 4) Blackout lamp - shall be illuminated whenever the Light Selector switch is in the blackout position.
- (4) Select Lever Controls.
- (a) Turret Traverse Drive Select Lever - shall be a two position lever switch with pushbutton lock at end of lever, which shall select between power and manual mode for turret traversing. In manual mode, the electrical motor shall be functionally disabled. The force required to move the lever from the power

position to the manual position shall be 7 +/- 4 pounds. The force required to move the lever from the manual position to the power position shall be 5 +/- 2 pounds. The force required to push the pushbutton lock shall be 6 pounds +/- 2 pounds.

- (b) TOW Elevation Drive Select Lever - shall be a two position lever switch with pushbutton lock at end of lever, which shall select between power and manual mode for TOW elevation and depression. In manual mode, the TOW electrical motor shall be functionally disabled. The force required to move the lever from the power position to the manual position shall be 4 pounds +/- 2 pounds. The force required to move the lever from the manual position to the power position shall be 4 pounds +/- 2 pounds. The force required to push the pushbutton lock shall be 6 pounds +/- 1 pound.
 - (c) Gun Elevation Drive Select Lever - shall be a two position lever switch with pushbutton lock at end of lever, which shall select between power and manual mode for elevation and depression of the 25mm gun and 7.62mm machine gun. In manual mode, the electrical motor shall be functionally disabled. The force required to move the lever from the power position to the manual position shall be 10 pounds +/- 2 pounds. The force required to move the lever from the manual position to the power position shall be 10 pounds +/- 2 pounds. The force required to push the pushbutton lock shall be 6 pounds +/- 1 pound.
 - (d) Turret Position indicator - shall be an assembly of 13 yellow indicators replicating the turret position indicator in the BFV. The indicator shall consist of an arrow shaped indicator in the center of 12 circular indicators arranged at 30 degree intervals (like the hours on a clock face), each of which shall be labeled with a number from 1 to 12 corresponding to the clock position. The center arrow indicator and one of the 12 circular indicators shall be illuminated when turret power is on. Which of the 12 circular indicators is illuminated shall be a function of the turret position relative to the hull. With 0 degree turret rotation, the indicator labeled "12" shall be illuminated; with 30 degree turret rotation, the indicator labeled "1" shall be illuminated, and so on.
 - (e) Gun Elevation indicator - shall be a 4 digit display and shall have the ability to indicate the gun elevation from -160 to 1049 mils. The gun elevation indicator shall indicate the simulated elevation of the 25mm gun and coax machine gun in tens of mils.
- (5) Gunner's Handwheel Controls.
- (a) Turret Traverse Handwheel and Trigger switch - Turret Traverse Handwheel shall be a 360 degree continuous rotation assembly with handle and spring, which shall simulate manually traversing the turret right or left. The force required for handwheel movement shall be 4.0 +/- 1 pound measured at the

handle. Trigger switch shall be a pushbutton which shall fire the selected weapon (25mm, coax machine gun, TOW missile).

- (b) Gun Elevation Handwheel - shall be a 360 degree continuous rotation assembly with handle and spring, which shall simulate manually elevating and depressing the 25mm gun, coax machine gun, and the TOW missile. The force required for handwheel movement shall be 7 pounds +/- 1 pound measured at the handle.
- (6) Gunner's Vision Blocks - 2 vision blocks (periscopes) shall be provided to the gunner. Each vision block shall be provided with an "In-use" sensor. When either sensor is activated, the associated vision block shall display scenes generated by the visual system as specified in Appendix A
- (7) Backup Sight - shall replicate the appearance and movement of the backup sight on the BFV. The backup sight shall be a display assembly with lock lever, flange joint, eyecup, eyepiece assembly, focus barrel, and sight reticle. The eyepiece shall be rotatable to either gunner's or commander's position. The eyepiece assembly shall simulate focus adjustment of the backup sight +/- 4 diopters. The sight shall display scenes generated by the visual system as specified in Appendix A.
 - (a) A sensor shall be provided to determine when the sight is in use and when activated, the gunner's Backup Sight shall display simulated Backup Sight imagery.
- (8) Gunner's seat - shall be a functional replica of the vehicle seat with full range of motion and adjustment as in the actual M2A2/M3A2 BFV. The gunner's seat assembly shall include a control handle which, when pulled, releases the seat for height adjustment. The gunner's seat shall be provided with a mechanically operative seat belt.
- (9) Gunner's Condition indicator - shall be a trainer unique 2 lamp assembly with one discrete output per each lamp. An amber lamp shall be illuminated when the gunner is considered to be wounded; a red lamp when the gunner is considered dead.
- (10) Gunner's ISU Focus barrel - shall replicate the appearance and movement of the corresponding actual control on the BFV and shall simulate focusing of the Gunner's ISU sight.
- (11) Gunner's ISU Focus knob shall be non-functional.
- (12) Gunner's NBC hookups are as follows:
 - (a) Gunner's NBC air hose shall be physically and functionally replicated.

(b) Gunner's NBC quick disconnect shall be physically and functionally replicated.

(c) Gunner's NBC air outlet hose clip shall be physically and functionally replicated.

(13) Left and right machine gun door handles - shall replicate the operation of the left and right machine gun door handles on the BFV.

(14) Turret Shield Door and latch - shall be physically and functionally replicated.

b. The following controls, indicators, and other pieces of equipment shall be physically represented (operational but nonfunctional): Gunner's ISU and controls - Fan Defogger Box with switch shall be a dummy replica of the corresponding actual switch.

~~(1) Switches and controls.~~

~~(a) Gunner's ISU and controls.~~

~~Fan Defogger Box with switch shall be a dummy replica of the corresponding actual switch.~~

The gunner's station shall be provided the current status of the available ammunition for the weapons listed in G.3.1.1.3. This ammunition status shall be based on the initialization ammunition minus the expended ammunition plus any resupplied and re-stocked ammunition. Reloading of the weapons shall be simulated by activation of a switch or button and then waiting the appropriate time delay for actually reloading the weapon. During this time delay the particular weapon shall not be capable of firing.

G.3.1.2.1.4 Troop Compartment.

The following controls, switches, gauges, and lights shall be provided in the troop compartment at the locations as found in the actual M2A2 BFV. The troop compartment shall be a framework that supports the replicated crew compartment equipment.

a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):

(1) Dome Lights - three dome lights shall be replicated in the crew compartments. The dome lights shall be located in positions similar to the M2A2 BFV. Each crew dome light shall include the following:

(a) Light Selector switch - shall be a 3 position rotary switch with blackout, whitelight and off positions. In the off position this switch shall turn off both the blackout and white lights. The other two positions shall turn on the associated lights.

- (b) Blackout Release button - shall be a pushbutton switch, which, when depressed allows moving the Light Selector switch from blackout to white light position.
 - (c) White lamp - shall be illuminated whenever the Light Selector switch is in the white light position.
 - (d) Blackout lamp - shall be illuminated whenever the Light Selector switch is in the blackout position.
- (2) Fuel Filler Combat lock handle - shall be a mechanical component which replicates the appearance and movement of the corresponding actual handle. In the “IN” position, the handle shall simulate unlocking the fuel filler cover. In the “OUT” position, the handle shall simulate locking the fuel filler cover.
- (3) Crew Intercom - shall consist of 3 intercom control boxes, each of which shall allow connection to a CVC helmet or a squad headset. Each intercom control box shall include the following:
- (a) MONITOR switch - shall be a 5 position rotary switch with positions labeled ALL, A, INT ONLY, B, and C (clockwise from left position). ALL position, shall allow monitor of all channels, INT ONLY shall cause only the intercom to be monitored, and in A, B, C positions selects the corresponding radio channel for monitoring.
 - (b) Volume knob - shall be a rotational control with 270 degrees of rotation. Rotating the knob clockwise shall increase intercom volume; rotating the knob, counterclockwise shall decrease the intercom volume.
 - (c) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect the forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
 - (d) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.
- (4) Troop seats - shall consist of seating for 3 individuals.
- (5) CARGO DOOR - shall be a trainer unique pushbutton switch. When depressed, this switch shall initiate the virtual task of opening the cargo door when closed or closing the cargo door when open. This switch shall also activate the cargo hatch opening and closing sound cues.

G.3.1.2.1.5 Vehicle Weapons.

The following additional controls, switches, gauges, and lights shall be provided at the locations as found in the actual M2A2 /M3A2 BFV.

- a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):
 - (1) M242 25mm Machine Gun manual controls.
 - (a) Ammo selector switch - shall be two 2 position toggle switches on turret basket labeled HE above and AP below which signal to the ISU which type of ammo is loaded in the corresponding ammo ready box.
 - (2) M240C 7.62mm Machine Gun manual controls.
 - (a) Firing Solenoid - shall be a non-functional space constraint.
 - (b) Coaxial machine gun charging cable and handle shall be physically replicated. Activation of the handle shall clear a 7.62mm machine gun misfire.
 - (3) TOW missile system shall be simulated functionally. The TOW launcher and missiles shall be virtual (no physical hardware). The TOW missile guidance shall take into account loss of control and wire breaks when gunner control inputs cause missile flight corrections which exceed tracking and guidance limitations. TOW missile dynamics shall accurately simulate the actual missile's response to the flight corrections from the gunner controls inputs. TOW controls are listed in section 3.1.2.1.3 (Gunner's Station).
 - (4) M257 smoke grenade launcher system shall be simulated functionally. The launcher and grenades shall be virtual (no physical hardware).
- b. The following trainer unique controls shall be provided within the simulator module to allow loading of weapons with ammunition:
 - (1) AP AMMUNITION BOX STATUS Panel - shall be a trainer unique panel used to monitor the ammo status and control the loading of the 25mm AP ammo ready box. The panel shall contain the following:
 - (a) ROUNDS IN AP AMMO BOX shall be a 3 digit display used to indicate the number of rounds loaded in the 25mm AP ammo ready box.
 - (b) LOAD ~~and~~ UNLOAD shall be a pushbutton switch that indicates the virtual task of loading the 25mm gun with the ammunition in the AP ammo ready box. This switch shall be active only when the turret is stationary and within the range of 4000 to 4533 mils.

- (c) HE LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the AP ammo ready box. The indicator shall flash during the simulated load time.
 - (d) AP LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the AP ammo ready box. The indicator shall flash during the simulated load time.
 - (e) UNLOADED shall be a green indicator that illuminates when the 25mm gun is unloaded from AP ammo ready box. This indicator shall flash during the simulated unload time.
- (2) TOW STATUS PANEL - shall be a trainer unique panel that is used to monitor the status of the number of TOW rounds in storage and control the loading and unloading of the TOW launcher. The panel shall contain the following:
- (a) TOW ROUNDS IN STORAGE shall be a two digit indicator which indicates the number of tow rounds in storage.
 - (b) LAUNCHER 1 LOAD ~~and~~ UNLOAD shall be a pushbutton switch that when depressed ~~sh~~ will initiate the virtual task of loading a round in the Number 1 TOW launcher tube if unloaded and unloading the Number 1 TOW launcher if loaded. This switch shall be active only when the cargo door is open and the launcher is in the load position.
 - (c) LAUNCHER 2 LOAD ~~and~~ UNLOAD shall be a pushbutton switch that when depressed ~~sh~~ will initiate the virtual task of loading a round in the Number 2 TOW launcher tube if unloaded and unloading the Number 2 TOW launcher if loaded. This switch shall be active only when the cargo door is open and the launcher is in the load position.
 - (d) LAUNCHER 1 LOADED shall indicate that the Number 1 TOW launcher is loaded. The indicator shall flash during the simulated TOW load time.
 - (e) LAUNCHER 1 UNLOADED shall indicate that the Number 1 TOW launcher tube is unloaded. During a virtual TOW unload task, the indicator shall flash during the simulated TOW unload.
 - (f) LAUNCHER 2 LOADED shall indicate that the Number 2 TOW launcher is loaded. The indicator shall flash during the simulated TOW load time.
 - (g) LAUNCHER 2 UNLOADED shall indicate that the Number 2 TOW launcher tube is unloaded. During a virtual TOW unload task, the indicator shall flash during the simulated TOW unload.

- (3) HE AMMUNITION BOX STATUS Panel - shall be a trainer unique panel used to monitor the ammo status and control the loading of the 25mm HE ammo ready box. The panel shall contain the following:
- (a) ROUNDS IN HE AMMO BOX shall be a 3 digit display used to indicate the number of rounds loaded in the 25mm HE ammo ready box.
 - (b) LOAD ~~and~~ UNLOAD shall be a pushbutton switch that indicates the virtual task of loading the 25mm gun with the ammunition in the HE ammo ready box. This switch shall be active only when the turret is stationary and within the range of 1867 to 2400 mils.
 - (c) HE LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the HE ammo ready box. The indicator shall flash during the simulated load time.
 - (d) AP LOADED shall be a green indicator that illuminates when HE rounds are loaded in the 25mm gun from the HE ammo ready box. The indicator shall flash during the simulated load time.
 - (e) UNLOADED shall be a green indicator that illuminates when the 25mm gun is unloaded from HE ammo ready box. This indicator shall flash during the simulated unload time.
- (4) 25mm ROUNDS IN STORAGE Panel - shall be a trainer unique panel that is used to monitor the status and initiate the transfer of rounds from the ammo storage area to the ammo ready boxes. The panel shall contain the following:
- (a) AP indicator shall be a four digit display used to indicate the number of AP rounds in storage.
 - (b) AP FILL ACTIVE AMMO BOX shall be a pushbutton switchlamp that when depressed shall initiate transfer of AP rounds to the currently selected ammo box (based on turret position). The switchlamp shall flash during the simulated transfer time.
 - (c) HE indicator shall be a four digit display used to indicate the number of HE rounds in storage.
 - (d) HE FILL ACTIVE AMMO BOX shall be a pushbutton switchlamp that when depressed shall initiate transfer of HE rounds to the currently selected ammo box (based on turret position). The switchlamp shall flash during the simulated transfer time.

G.3.1.2.1.6 Trainer Unique - Common.

a. The following ~~controls, indicators, and other pieces of equipment~~ shall be trainer unique equipment, common to all manned modules, and shall be provided in the M2A2/M3A2 simulator module:

Simulated compass (grid azimuth indicator) - shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

G.3.1.2.2 External Interface Unit.

The M2A2/M3A2 manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The following information shall be displayed:

- a. Exercise number.
- b. Vehicle identification number.

The EIU shall be used to control and monitor the following M2A2/M3A2 functions:

- a. Assessment of damages.
- b. Initiation and termination of self-repairs.
- c. Initiation and termination of fuel transfers.
- d. Initiation and termination of ammo transfers.
- e. Activate TOW MANUAL LIFT release handle.
- f. Connection and disconnection of a tow kit to another vehicle.
- g. External munition loading.
- h. Load SINCGARS hopset and COMSEC data.

APPENDIX H
M1A2 MANNED MODULE

H.1. SCOPE.

This appendix establishes requirements for the M1A2 manned module. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

H.2. APPLICABLE DOCUMENTS.

H.2.1 Government Documents.

TA950101-2 - Abrams Common Software Library Interface Control Document

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions shall be obtained from the procuring activity or as directed by the Procuring Contracting Officer (PCO).)

H.3. REQUIREMENTS.

H.3.1 M1A2 Simulator Module.

The M1A2 simulator shall be designed to replicate the performance characteristics of the M1A2 vehicle and associated systems as described in paragraphs H.3.1.1 through H.3.1.2.3. These characteristics shall enable the M1A2 simulators to operate in the CCTT environment and shall provide the manned crew the system performance specified herein.

H.3.1.1 Performance Characteristics.

The following paragraphs contain the unique performance requirements that shall be provided with the M1A2 manned module. The M1A2 manned module shall also meet the generic design requirements of paragraph 3.6.

H.3.1.1.1 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A.

H.3.1.1.2 Fire Control System.

The vehicle weapons system for the M1A2 manned module shall have the capability for target sighting, aiming and firing of the 120mm Main Gun, M240 7.62mm Coaxial Machine Gun, M2 .50 Cal. Machine Gun and M250 Smoke Grenade Launchers. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. The simulated fire control system shall accurately incorporate sighting reticles and fire control models and shall enable precision gunnery techniques in simulated battlefield environments. The fire control system shall consist of:

- a. Gunner's Primary Sight (GPS).
- b. Gunner's Auxiliary Sight (GAS) with browpad.

- c. Gunner's Control and Display Panel (GCDP).
- d. Gunner's control handle assembly (GCHA).
- e. Laser Range Finder (LRF).
- f. Commander's GPS Extension (GPSE).
- g. Commander's control handle assembly (CCHA).
- h. Improved Commander's Weapon Station (ICWS).
- i. Commander's Independent Thermal Viewer (CITV).

These components in combination with the other simulated systems in the M1A2 simulation system shall provide the crew the capability to engage targets from a stationary position with a precision that matches real world results.

H.3.1.1.3 M1A2 Weapons and Ammunition.

The M1A2 simulation system shall simulate the following weapons and ammunition:

- a. 120mm Main Gun.
 - (1) M829 APFSDS-T Cartridge.
 - (2) M830 HEAT-MP-T Cartridge.
- b. M240 7.62mm Coaxial Machine Gun, A141, Ball, Tracer.
- c. M2 0.50 caliber Machine Gun, (A534 API-T).
- d. M250 smoke grenade launcher system, using the L8A3 RP smoke grenades.

H.3.1.1.4 Support Systems.

H.3.1.1.4.1 Electrical System.

The electrical system shall be capable of the following operating states:

- a. Engine off, master power off.
- b. Engine off, master power on, turret power on.
- c. Engine running, alternator working, turret power on.
- d. Engine running, alternator broken, turret power on.
- e. Engine off, master power on, turret power off.

- f. Engine running, alternator working, turret power off.
- g. Engine running, alternator broken, turret power off.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M1A2 simulation system. These problems and abilities shall be replicated in the M1A2 simulation systems just as they would occur in the operational equipment.

H.3.1.1.4.2 Hydraulic System.

The hydraulic system shall cover the use of both the main and the auxiliary hydraulic pumps. The operation of slewing of the turret, elevation of the gun, the opening and closing of the ammunition door, and the setting of the parking brake shall take into account the status of the hydraulic system. The operation of the two hydraulic pumps and associated systems shall be reflected in the M1A2 simulation system replications of the operational equipment.

H.3.1.1.5 Depletable Resource Management.

Depletable resources management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M1A2 simulation system shall be based on the use of three fuel tanks as found in the actual M1A2 tank. The management of maintaining fuel in the rear tank and the associated transfer of fuel from the own fuel tanks shall be the responsibility of the tank crew through normal operations at their respective stations. The resupply of fuel shall be accomplished through coordination with the ALOC and shall occur with the use of a fuel carrier. The ammunition for the M1A2 simulation system shall be based on the storage capabilities of the actual M1A2 tank for weapons and ammunition identified in paragraph H.3.1.1.3. The identification, transfer and resupply of ammunition shall be the responsibility of the Loader. In all cases, the monitoring of, use of and resupplying of the M1A2 tank's fuel and ammunition shall be based on the implementation of representative time and depletion parameters. The resupply operations shall include:

- a. Simulated transfer for:
 - (1) Fuel from one internal tank to another within a module.
 - (2) Fuel from a fuel carrier and pre-stock to the M1A2 tank.
 - (3) Ammunition from the ready rack to the breach.
 - (4) Ammunition from the semi-ready rack to the ready rack.
 - (5) Ammunition from the hull storage rack to the ready rack.
 - (6) Ammunition from an ammunition truck, M1A1, another M1A2, and Manned Module with comparable ammunition.
 - (7) Ammunition from prepositioned ammunition stocks.

(8) Reload times for the weapons listed in paragraph H.3.1.1.3.

b. Depletion rates.

(1) Fuel quantity and usage related to tank usage.

(2) Ammunition quantity for the various weapons listed in paragraph H.3.1.1.3.

H.3.1.1.6 Damage and Failure.

The list of components that are modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table H-I.

Table H-I. M1A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Alternator		X	X
Antenna A and B			X
Auxiliary Hydraulic Pump		X	
Batteries		X	X
CITV		X	X
Commander's Integrated Display		X	
Cmdr's Power Control Handle		X	
Coax Gun Inoperative			X
Commander			X
Driver			X
Driver's Integrated Display		X	
Drown	X		
Electronics			X
Engine Assembly			X
Engine Loss of Power		X	
Engine Oil Filter		X	
Engine Oil Pump		X	
Engine Oil System			X

Table H-I. M1A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Engine Pilot Relay		X	
Engine Shutdown		X	
Engine Starter	X	X	X
Fire Control Electronics Unit		X	
Fuel Filter		X	
Fuel Transfer Motor		X	
GPS Both		X	X
GPS Day		X	X
GPS Thermal		X	X
Gun Azimuth Gyro	X	X	
Gun Elevation Gyro	X	X	
Gun Turret Hydraulics		X	
Gunner			X
Gunner's Control Display Panel		X	
Gunner's Power Control Handles		X	
Hull Ammunition			X
Hydraulics			X
Ignitor		X	
Intercom			X
IVIS Core		X	X
Left Idler Wheel			X
Left Roadwheel 1			X
Left Roadwheel 2			X
Left Roadwheel 3			X
Left Roadwheel 4			X
Left Roadwheel 5			X
Left Roadwheel 6			X
Left Roadwheel 7			X

Table H-I. M1A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Left Sprocket			X
Left Track	X	X	X
Loader			X
Machine Gun Inoperative			X
Main Gun Inoperative		X	X
NBC			X
Normal Mode			X
Oil Cooler		X	
Oil Cooler Fan		X	
Parking Brake		X	
Posnav		X	X
Radio A			X
Radio B			X
Regulator		X	
Right Idler Wheel			X
Right Roadwheel 1			X
Right Roadwheel 2			X
Right Roadwheel 3			X
Right Roadwheel 4			X
Right Roadwheel 5			X
Right Roadwheel 6			X
Right Roadwheel 7			X
Right Track	X	X	X
Rollover	X		
Transmission Assembly		X	X
Transmission Oil Filter		X	
Transmission Oil System			X
Turret Ammo Ready			X

Table H-I. M1A2 Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Turret Ammo Semi			X
Turret Ammunition			X

H.3.1.1.7 Sound Generation System.

A sound and vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system. The sounds and vibrations shall be of such fidelity, quality, realism, and volume that the commander, gunner, loader, and driver shall experience the cues, stresses, and distractions of a “real life” combat situation. The sounds shall be of sufficient volume so that the distractions provided shall equal that found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table H-II lists the sound cues that shall be provided in the M1A2 simulation system.

Table H-II. M1A2 Sound Cues
SOUND CUE
Engine start to idle
Engine stop
Engine noise related to Revolutions Per Minute (RPM)
Transmission noise related to RPM
Parking brake set
Parking brake release
Track noise related to speed for terrain types simulated in CCTT.
Track popping (about to be thrown)
Turret traverse noise related to turret RPM
Main gun couple
Main gun uncouple
Gun elevate
Gun hitting upper or lower limits
Open Breech/ load round/ close breech
Close Breech/ unload round/ close breech
Fuel transfer pump
Auxiliary hydraulic pump

Table H-II. M1A2 Sound Cues
SOUND CUE
NBC system main and coax blower
Collisions with objects (scraping and hard collisions)
Commander's Independent Thermal Viewer (CITV) Power Up
CITV Power Down
CITV Running
Forward Area Air Defense (FAAD) Alert Tone
General Warning Tone
Gyros spinning/powered up
Fire main gun / discharge casing
Fire .50 caliber machine gun
Fire 7.62 mm machine gun
Fire smoke grenade launcher
Friendly and hostile main gun fire
Friendly and hostile missile launch
Friendly and hostile rocket launch
Generic explosive round (main gun, missile, rocket) hit
Generic explosive round (main gun, missile, rocket) miss
Friendly and hostile machine gun fire - large caliber
Friendly and hostile machine gun fire - small caliber
Friendly and hostile mine hit
Friendly and hostile bomb hit
Friendly and hostile bomb miss
Friendly and hostile artillery hit
Friendly and hostile artillery miss
Wheeled vehicle - large class
Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class
Bilge pump

H.3.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M1A2 controls within the system latency requirements, as defined in paragraph 3.2.2.1, and within the module latency requirements, as defined in paragraph 3.2.2.2.

H.3.1.1.7.2 Sound Generator.

The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. The sound system shall meet the spare ~~input and output~~ channel requirements of 3.7.3.1.4.

H.3.1.1.7.3 Spatial Positioning.

The sound system shall provide for spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds. For the Popped Hatch speakers, the sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the direction of the events causing the sounds.

H.3.1.1.7.4 Sound Quality.

The sound generator shall provide sound cues over a frequency range of 30 Hz to a minimum of 12,000 Hz, +/- 3 dB.

H.3.1.1.8 Communication System.

A communication system shall be provided to the M1A2 manned module as described in section 3.7.6 of this specification.

H.3.1.2 Physical Characteristics.

The M1A2 crew compartment shall exist as two separate enclosures: an enclosure for the driver's station, and an enclosure for the tank commander, the gunner, and the loader stations. Each of these stations shall include seats replicating those respective seats (including full range of motion and adjustments) found in the operational M1A2 tanks as well as the controls, indicators and other pieces of equipment. The module enclosure base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. Functional controls, indicators, and other pieces of equipment shall have proper coloring and labels. All items must be located in the same position as the actual vehicle within the tolerance of this specification. The modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. The controls and indicators shall replicate in design, performance, and function their real world counter-parts that are found in the operational M1A2. Realistic control loading and physical limits of travel shall be provided for simulated crew member controls, such as pedals, handles, and steering controls.

H.3.1.2.1 Driver's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver's station in the locations and panels as found in the actual M1A2.

- a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):
 - (1) Service brake when depressed shall control simulated hydraulic operation of brakes in the transmission. The service brake pedal assembly shall simulate the M1A2 tank service brake pedal assembly. The service brake shall only be functional when the engine is running. In the event of an engine shutdown, the service brake shall be non-functional when vehicle speed is below 3 MPH. Maximum deflection of the service brake pedal shall be 15 degrees (+/- 2.25 degrees). Breakaway force shall be 12.5 pounds (+/- 4 pounds) and ending force shall be 54 pounds (+/- 8 pounds), both measured 10 inches from the pivot point.
 - (2) Parking brake assembly shall consist of the Parking brake pedal and the Parking brake release handle.
 - (a) The Parking brake pedal when depressed shall operate the brakes in the transmission. The parking brake pedal shall simulate the M1A2 tank parking brake pedal. Pressing the parking brake when it is not already engaged and the parking brake release handle is not pulled shall activate the parking brake inhibiting movement of the tracks. The parking brake shall take into account the current state of the hydraulic system. Maximum deflection of the parking brake pedal shall be 13 degrees (+/- 5 degrees). Ending force shall be 51 pounds (+/- 8 pounds) measured on the pedal 7.25 inches from the parking brake pivot axis.
 - (b) The parking brake release handle shall release the parking brake. The parking brake release handle shall simulate the M1A2 tank parking brake release handle. Pulling the release handle shall disengage the parking brake, allowing the tracks to rotate. The parking brake release shall be functional at all times. The force required to disengage the parking brake shall be 53 pounds (+/- 8 pounds). Total travel of the parking brake release shall be 5.75 in (+/- 0.9 in). The parking brake shall disengage at 5.5 in (+/-0.8 inch).
 - (3) Steering ~~and~~ and throttle control assembly shall consist of the steering control, the throttle control, the transmission shift control, intercom buttons and adjustment knob.
 - (a) The steering control shall be physically and functionally replicated. Deflection of the steering control from center position shall cause the vehicle to turn. Clockwise deflection shall cause the vehicle to turn to the right. Counterclockwise deflection shall cause the vehicle to turn to the left. The

steering control shall only be functional when the engine is running and the loss of steering malfunction is not active. In the event of an engine shutdown or activation of the loss of engine power malfunction while the vehicle is moving, the steering control shall be non-functional when vehicle speed is below 3 MPH. Steering control deadband shall be 14 degrees +/- 3 degrees. Breakaway force of the steering mechanism shall be 17 pounds (+/- 3 pounds) applied 7.5 inches from the centerline of the steering assembly. Ending force shall be 35 pounds (+/- 7 pounds) applied 7.5 inches from the steering assembly pivot axis. Specified breakaway and ending forces shall apply to deflection in either direction.

- (b) The throttle control shall have a deadband of 2.5 degrees +/- 1.5 degrees. Maximum deflection shall be 62 degrees (+/- 9.3 degrees). Breakaway torque of the throttle control shall be 4 in-lbs (+/- 2 in-lbs). Ending torque shall be 10 in-lbs (+/- 5 in-lbs). Deflection of the throttle control from the full forward position shall cause additional fuel flow in the engine dynamics model. The throttle control shall only be functional when the engine is running and the loss of engine power malfunction is not active.
 - (c) The transmission shift control shall provide 5 gear selections: neutral(N), pivot(PVT), reverse(R), drive(D) and low(L). Transmission selections shall modify the action of the engine output. The transmission control shall only be functional when the engine is running.
 - (d) The Left and Right intercom press to talk buttons shall enable the driver to talk over the communications subsystem without removing his hands from the steering ~~and~~/throttle control.
 - (e) The steering ~~and~~/throttle control adjustment knob shall be functional and shall provide the capability to adjust steering ~~and~~/throttle assembly's position.
- (4) Driver's Integrated Display (DID) panel shall be functionally and physically replicated. The display shall depict: warning and caution indications as they occur, menus, fuel level indicator, electrical system charge, vehicle speed, steer-to indicator, vehicle heading indicator and engine RPM. The following switches and indicators on the Driver's Integrated Display panel shall be physically replicated and function as described:
- (a) MAIN MENU button - This button shall return the DID to its main menu.
 - (b) Menu Option ~~and~~/Select buttons - These shall perform the selected operation for that particular menu and system mode.
 - (c) MASTER POWER button - This button shall turn vehicle master power on and off.

- (d) PANEL LIGHTS button - This button shall enter or exit DID PANEL LIGHTS mode. While in PANEL LIGHTS mode, the brightness of the DID display shall be adjustable using the 4-way switch.
 - (e) PUSH TO START button - This button shall initiate an engine start up sequence to begin if vehicle master power is on, there is fuel in the rear fuel tank, and the engine is not already running.
 - (f) STARTER ONLY button - This button, when vehicle master power is on and the engine is not running, shall activate the starter motor and its aural cue.
 - (g) DECU RESET button - This button shall reset the DECU error list.
 - (h) SHUT OFF button - This button shall initiate a two minute engine cool-down process if pressed once, or an immediate engine shutdown sequence if pressed twice.
 - (i) TACTICAL IDLE switch - This switch, when in the ON position, shall cause the engine idle speed to increase from 900 RPM (+/- 30 RPM) to 1300 (+/- 50 RPM).
 - (j) 4-way, center position off switch - This switch shall move the cursor and scroll through selections on the DID display, or adjust the brightness of the display while in PANEL LIGHTS mode.
 - (k) FIRE EXTINGUISHER 2ND SHOT switch - This switch shall be a 2-position toggle switch with red guard ~~and cover~~. Setting this 2-position toggle switch to the ON position shall cause the engine to be shutdown and the engine shutdown sequence aural cue to be activated. Any existing fire shall be extinguished.
 - (l) DID displays shall replicate the ~~P~~Pre~~Post~~ and ~~C~~Combat mode displays found in the actual M1A2 vehicle and as described in, ~~(refer to TA950101-2 for further details)~~.
- (5) Driver's Night Vision Viewer (NVV) shall be simulated version of the AN/VVS-2 NVV and shall interface to the visual system. Installing the simulated NVV shall cause the visual system to display a graphical night vision replication of the surrounding terrain which shall be presented whenever simulated power is available to the viewer. The driver shall be able to install and remove the driver's night viewer.
- (a) Off-Bright Knob - shall be an active rotational control which shall simulate the removal of power from the NVV when in the OFF position (rotated fully

counter-clockwise), and shall increase the level of brightness of Driver's Night Vision Viewer when rotated clockwise.

- (b) Power jack - shall be a connector which allows connection of the Driver's Night Vision Viewer to vehicle power. The status of this connection shall be used to determine whether display of night vision or normal vision terrain is to be simulated.
 - (c) NVV stowage - A trainer unique stowage location shall be provided in the driver compartment.
 - (d) NVV Rotate - shall be a trainer unique active control that shall simulate slewing the NVV imagery +/- 45 degrees in azimuth.
- (6) Intercom ~~and~~ Radio Box - This component shall be functionally replicated. The following switches and indicators on the ~~I~~ntercom ~~and~~ ~~R~~adio box shall be replicated and function as described:
- (a) Monitor switch - This switch shall be a 5-position switch. Active switch positions shall be labeled "ALL", "A", "INT ONLY", "B" and "C".
 - (b) Volume control - This switch shall control the sound volume.
 - (c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.
 - (d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
 - (e) Remote cable - This cable shall be a fixed dummy cable representing the interconnect of the driver's intercom switches on the ~~S~~teering ~~and~~ ~~T~~hrottle control (T-Bar) to the Intercom Control ~~B~~ox.
- (7) Domelight assembly - shall be functionally replicated as described:
- (a) Domelight lamp - The domelight lamp shall be a bright light capable of illuminating driver's position.
 - (b) On ~~and~~ Off ~~and~~ brightness control shall be a rotational control with a switch and shall control the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.

- (8) Hatch Opening Crank - This shall be provided as a space constraint (except for the handcrank).
- (9) Driver's Seat - This seat shall be functionally replicated. The seat shall have a full range of motion and adjustments except for the ability to move the seat into the open hatch position. The seat shall function as follows:
 - (a) Seat Height Control Lever - This shall allow for adjustment of seat height,
 - (b) Upper Seat Back Lever - This shall allow for adjustment of upper seat back,
 - (c) Seat manual control lever shall not be functional.
 - (d) The seat shall have the capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in H.3.1.1.7.6.
- (10) Driver's Headrest - This headrest shall be functionally replicated. The headrest shall have a full range of motion and adjustments. Adjustment controls shall be as follows.
 - (a) Headrest adjustment knob.
 - (b) Headrest Spring Latch.
- (11) Driver's Vision Blocks - 3 vision blocks (periscopes) shall be provided to the driver which shall display scenes generated by the visual system as specified in Appendix A.
 - (a) Periscope adjustment knobs - These knobs are located on either side of the driver's periscopes and shall be functionally replicated. When loosened, they allow the mirror on the periscope to be adjusted.
- (12) Driver's NBC hookups are as follows:
 - (a) Mask air duct socket shall be physically and functionally replicated.
 - (b) Cooling Vest air duct socket shall be physically replicated.
 - (c) Cooling Vest air duct socket cap shall be physically and functionally replicated.
- (13) Driver's Head Tracker - This is a trainer unique item which shall provide feedback indicating where driver's head is located and shall be used for vision block control in the driver's periscopes.

- (14) Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead.
- (15) Driver's Parking Brake System Hydraulic Pressure Gauge - shall be functionally replicated, shall indicate parking brake system hydraulic pressure, and shall have a range of 0 - 2000 psi.
- (16) NVV Power Cable - shall be functionally replicated. The cable shall interface with the power receptacle on the simulated NVV.
- (17) NVV Power Cable Stowage receptacle - shall be physically replicated and shall interface with the NVV power cable for stowage.

H.3.1.2.2 Turret Compartment.

H.3.1.2.2.1 Tank Commander's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the commander's station in the locations and panels as found in the actual M1A2.

- a. The following controls, indicators, and other pieces of equipment shall be simulated(functional):

- (1) Commander's Integrated Display (CID). The CID shall consist of three parts: the CITV display and control panel, the tactical display and control panel, and the CID switch panel.

- (a) Commander's Independent Thermal Viewer (CITV) display and control panel. The CITV display, (left portion of the commander's integrated display) shall be simulated. It shall provide the commander with simulated real time video imagery for surveillance and for target servicing when operated in the CITV gun LOS mode. The CITV shall display scenes generated by the visual system as specified in Appendix A. The CITV control panel shall provide the following input controls and status indications via the illuminated pushbuttons with dimmable outputs to the commander:

- ii.1) WHOT/BHOT pushbutton - This pushbutton shall permit selection of polarity of how objects are detected by the CITV sensor (either white hot or black hot) and shall illuminate to indicate its operating mode.

- ii.2) BRIGHT/CTRS pushbutton - This pushbutton, in conjunction with the four-way switch, shall be used to adjust the brightness or contrast of the CITV display in 16 definable increments.

- ii.3) ANTI-GLARE pushbutton - This pushbutton shall toggle through the four filters. Filter selection is 1 to 4 and then wraps around back to 1. When

this pushbutton is pressed, the filter number shall appear on the CITV for a few seconds then disappear.

- ~~iv.~~4) CITV POWER pushbutton - This pushbutton shall turn electrical power to the CITV on and off and shall illuminate when ON.
- ~~v.~~5) AUTO SCAN pushbutton - This pushbutton shall select CITV AUTO SCAN mode. AUTO SCAN mode allows the CITV to scan a preset sector at a preset rate as in the M1A2 tanks without using the commander's handle. The pushbutton shall illuminate when in the AUTO SCAN mode.
- ~~vi.~~6) SEARCH pushbutton - This pushbutton shall select CITV SEARCH mode. SEARCH mode allows 360 degree movement of the CITV, independent of the GPS and main gun, by the commander using the control handle with the palm switch depressed.
- ~~vii.~~7) CITV/GPS pushbutton - This pushbutton shall toggle the CITV Line-Of-Sight between GPS and CITV LOS. When the CITV is selected the CITV thermal image video is displayed, and all CITV controls and functions ~~wi~~shall be available. When the GPS is selected, the commander has the capability to engage targets through the GPS extension. The pushbutton shall illuminate to indicate its operating mode.
- ~~viii.~~8) GUN LOS pushbutton - This pushbutton shall, when activated, move the CITV to the gun line of sight. If CITV sight mode is selected, the main gun ~~sh~~will follow the CITV line of sight. If GPS sight mode is selected, the main gun and CITV ~~sh~~will follow the GPS line of sight. The pushbutton shall illuminate to indicate its operating mode.
- ~~ix.~~9) Four - way switch - This switch shall provide input to various CITV adjustment functions and tactical control and display functions as in the M1A2 tank. It is a four way switch with center off position, moveable in the up, down, left and right directions, with graphic arrows pointing in the 4 directions.
- ~~x.~~10) SCTR/RATE pushbutton - This pushbutton shall set sector (SCTR) limits and/or scan RATE to be used in AUTO SCAN mode. When SCTR has been selected, the commander can set the right and left limits using the four-way switch once the commander has moved the CITV to these right and left limits via the control handle. When RATE has been selected, the rate of scan of the CITV can be adjusted using the four-way switch when in the AUTO SCAN mode. The pushbutton shall illuminate to indicate its operating mode.

~~xi.11~~ xi.11) SYM/RTCL pushbutton - This pushbutton shall be used to select the brightness of either the CITV symbols (SYM) or reticle (RTCL). When SYM has been selected, all symbology brightness can be adjusted on the CITV display using the four-way switch. When RTCL has been selected, reticle brightness can be adjusted using the four-way switch. The pushbutton shall illuminate to indicate its operating mode.

~~xi.12~~ xi.12) SENS/CTRS pushbutton - This pushbutton shall be used to select either CITV sensitivity (SENS) or contrast (CTRS). Pressing the four-way switch up or down ~~sh~~aw will adjust the sensitivity of the CITV video, while pressing the four-way switch left or right ~~sh~~aw will adjust the contrast of the CITV video. The pushbutton shall illuminate to indicate its operating mode.

~~xi.13~~ xi.13) FOCUS/DRIFT pushbutton - This pushbutton shall be used to select either the CITV FOCUS or DRIFT. When FOCUS has been selected, use the four-way switch to adjust (focus) CITV scene. When DRIFT has been selected, use the four-way switch to null out drift. The pushbutton shall illuminate to indicate its operating mode.

- (b) Tactical display and control panel. The CID tactical display (center portion of the commander's integrated display) shall be simulated. It shall provide the commander with real time tactical data, including warning and caution messages as they occur. The display shall simulate the same operating characteristics as the actual system. The CID tactical control panel shall provide the following input controls and status indications via the illuminated pushbuttons with dimmable outputs to the commander:

~~i.1~~ i.1) ~~Option and /S~~Menu Option and /S select pushbuttons - Allows the commander to initiate functions for the CID.

~~ii.2~~ ii.2) PANEL LIGHTS pushbutton - This pushbutton switch shall be used to vary the overall brightness of the entire tactical display, using the four-way switch to increase or decrease brightness.

~~iii.3~~ iii.3) PRE/POST mode pushbutton - This pushbutton shall be used to access the Pre and Post Combat mode menu structure. The light on the switch shall illuminate when the mode transition is complete.

~~iv.4~~ iv.4) Combat mode pushbutton - This pushbutton shall be used to access the Combat mode menu structure. The light on the switch shall illuminate when mode transition is complete. During vehicle power up the system ~~sh~~aw will default to Combat mode.

~~v.5)~~ 5) DIAG mode pushbutton - This pushbutton switch is used to access the diagnostic mode menu structure. This switch shall be physically replicated and shall function as needed for simulated vehicle maintenance procedures.

~~vi.6)~~ 6) CID tactical displays shall replicate the Pre and Post mode displays found in the actual M1A2 vehicle, (refer to TA950101-2 for further details).

7) CID tactical displays shall replicate the Combat mode displays found in the actual M1A2 vehicle, as described in, ~~(refer to TA950101-2 for further details).~~

(c) The CID switch panel (right portion of the commander's integrated display) shall be simulated and shall provide the following input controls and status indications via the illuminated pushbuttons to the commander:

1) Keypad - The keypad shall be physically and functionally replicated. It shall be a dedicated 16-key keypad to permit entry of alphanumeric data required for various menu functions within the CID. It is a 4x4 keypad with the following labels (listed in top to bottom, left to right order) on it: "ABC 1", "DEF 2", "GHI 3", "CLR", "JKL 4", "MNO 5", "PQR 6", "LTR", "STU 7", "VWX 8", "YZ 9", "->", ".", "0", "-", "ENT".

2) MASTER POWER pushbutton - This pushbutton shall turn vehicle electrical power on and off and shall illuminate when master power is ON.

3) TURRET POWER pushbutton - This pushbutton shall turn turret power on and off and shall illuminate when turret power is ON. If master power is on and turret power is transitioned from on to off or off to on then the LED shall blink while turret power is transitioning. If both turret and master power are off, then the turret power switch shall turn on both master and turret power.

4) BATTLE SIGHT pushbutton - This pushbutton shall be used to manually update target range for selected ammunition. When pressed, battle sight causes the preset battle range for the current ammo set by the gunner to be displayed and can be updated using the four-way switch.

5) NBC MAIN pushbutton - This pushbutton controls the on and/ off functions of the main NBC system and shall only function to operate the NBC MAIN blower. The blower used by the NBC mode main shall be the same blower that is used by the NBC backup mode.

6) NBC BACKUP pushbutton - This pushbutton controls the on and/ off function of the backup NBC system and shall only function to operate the

NBC BACKUP blower. The blower used by the NBC mode backup shall be the same blower that is used by the NBC main mode.

- 7) ALARM MUTE pushbutton - This pushbutton turns the NBC warning alarm off and shall be physically and functionally replicated.
 - 8) TEMP pushbutton - This pushbutton controls the filtered air temperature and shall be physically and functionally replicated with the exception of modifying the actual air temperature.
 - 9) READY pushbutton - This pushbutton shall arm the smoke grenade launchers. It must be pressed and held to fire the smoke grenades. Releasing the switch disarms the grenade launchers.
 - 10) Smoke grenade SALVO 1 pushbutton - This pushbutton shall simulate firing the first salvo of six smoke grenades, three from each side, if the launchers are armed.
 - 11) Smoke grenade SALVO 2 pushbutton - The pushbutton shall simulate firing the second salvo of six smoke grenades, three from each side, if the launchers are armed.
- (2) Commander's control handle assembly (CCHA) shall be functionally replicated. The CCHA shall control main gun elevation and turret traverse during powered operation. When operated in conjunction with either the AUTO SCAN or SEARCH switches located on the CITV switch panel, the commander's handle shall control the CITV movement and functions. It shall control the turret and main gun/coax to include ranging and firing when operated with either the CITV GUN LOS or GPS mode. Handle movement and functionality of all switches shall simulate those of the M1A2 tank. Directional movement of the handle (left, right, forward, and back) and the six switches shall be functionally simulated. The handle and switches shall return to normal (de-energized) position when the force on them is removed.
- (a) Commander's control handle assembly traverse throw shall be 91 +/- 8 degrees in both directions. Elevation throw shall be 28 +/- 8 degrees. Depression throw shall be 30 +/- 8 degrees. CCHA neutral position shall be within 2 degrees of mechanical center. Turret azimuth and elevation movement as a function of handle deflection shall reflect that of the M1A2 tank. The ending force for traverse torque and elevation torque shall be 40 +/- 10 in-lbs and 25 +/- 10 in-lbs, respectively.
- 1) Elevation rate versus handle deflection shall be as follows:

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- a) An elevation rate of 0.0 +/- 0.0 mils/second for a deflection of 0.0 degrees.
 - b) An elevation rate of 0.0 +/- 1.0 mils/second for a deflection of 2.8 degrees.
 - c) 3. An elevation rate of 24.3 +/- 2.4 mils/second for a deflection of 19.6 degrees.
 - d) An elevation rate of 44.5 +/- 4.5 mils/second for a deflection of 21.2 degrees.
 - e) An elevation rate of 450.0 +/- 45.0 mils/second for a deflection of 30.0 degrees.
 - f) The elevation rate plotted as a function of handle deflection shall be linear (constant slope) between the breakpoints specified above. The tolerance for elevation rates between the breakpoints specified above is +/- 10 percent of the expected elevation rate.
- 2) Traverse rate versus handle deflection shall be as follows:
- a) A traverse rate of 0.0 +/- 0.0 mils/second for a deflection of 0.0 degrees.
 - b) A traverse rate of 0.0 +/- 1.0 mils/second for a deflection of 1.7 degrees.
 - c) A traverse rate of 20.4 +/- 2.0 mils/second for a deflection of 30.0 degrees.
 - d) A traverse rate of 48.2 +/- 3.5 mils/second for a deflection of 34.5 degrees.
 - e) A traverse rate of 750.0 +/- 75.0 mils/second for a deflection of 90.0 degrees.
 - f) The traverse rate plotted as a function of handle deflection shall be linear (constant slope) between the breakpoints specified above. The tolerance for traverse rates between the breakpoints specified above is +/- 10 percent of the expected traverse rate.
- (b) Commander's control handle assembly controls are as follows:

- 1) Palm switch shall be a pushbutton switch and shall remove control of turret from gunner's handles and shall give control to the commander when in Gun LOS mode. If in non-Gun LOS mode (SEARCH or AUTO SCAN) then this switch shall enable control of the CITV sensor LOS. Squeezing the palm switch enables the operation of the following switches and/ ~~buttons~~ on the commander's handle: Target Designate, Trigger, and Range. Squeezing the palm switch shall control the gun when in the Gun LOS mode and the CITV when in a non-Gun LOS mode.
 - 2) Stadia Range / Lase button is a pushbutton switch that shall control the laser rangefinder if in GUN LOS mode, or shall control the display of the stadia ranging reticle if in SEARCH or AUTO SCAN mode.
 - 3) Trigger switch shall be a pushbutton switch and shall fire the main gun or coaxial machinegun.
 - 4) iv. Field of View button shall be a pushbutton and shall be used to toggle the CITV field of view between wide FOV and narrow FOV.
 - 5) Target Designate pushbutton shall align the main gun and coax machinegun with the CITV reticle, when the CITV is in AUTO SCAN or SEARCH mode.
 - 6) Cursor controller shall be an omni-directional depressible switch and shall be used for tactical display cursor operations.
 - 7) Left and/~~right~~ deflection sensor shall control turret azimuth movement.
 - 8) Elevation~~/~~ and depression deflection sensor shall control gun elevation movement.
- (3) Domelight shall function as described:
- (a) Domelight lamp shall be a bright light capable of illuminating commander's position.
 - (b) On, ~~/off~~ and brightness control shall be a rotational control with a switch and shall control the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.
- (4) Intercom and/~~radio~~ box shall be functionally replicated. The following switches, ~~/connectors~~ and/~~controls~~ shall be replicated and function as described:

- (a) Monitor switch - This switch shall be a 5-position switch. Active switch positions shall be labeled "ALL", "A", "INT ONLY", "B" and "C".
 - (b) VOLUME control shall control the sound volume.
 - (c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.
 - (d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
- (5) Commander's GPS extension shall display scenes generated by the visual system as specified in Appendix A. The GPS shall show tank commander the target, gun sighting view and data.
- (a) Diopter adjustment shall allow for simulated focusing of the GPS extension eyepiece on reticle pattern.
 - (b) A sensor shall be provided to determine when the sight is in use and when activated, the GPS Extension sight shall display simulated GPS imagery. Browpad shall have an adjusting screw.
- (6) Improved Commander's Weapon Station (ICWS) shall be simulated as follows:
- (a) The 0.50 caliber machine gun shall be simulated functionally but not physically.
 - (b) The 0.50 caliber machine gun ammo supply, load and unload functions are as follows:
 - 1) ROUNDS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of ammo cans from the 0.50 caliber ammo storage area. The following components shall be provided:
 - a) ROUNDS IN STORAGE shall be a 4 digit display that indicates the simulated number of ammo cans in the ammo storage area.
 - b) FILL WEAPON AMMUNITION BOX shall be a pushbutton switch that initiates the simulated transfer of a can from the storage area to the 0.50 caliber machine gun ammunition box.

- 2) ROUNDS IN AMMUNITION BOX - shall be a trainer unique panel indicating the number of rounds in the ammunition box.
- 3) MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 0.50 caliber machine gun. The following components shall be provided:
 - a) LOAD and/ UNLOAD shall be a pushbutton switch that when depressed shwill initiate the loading of the 0.50 caliber machine gun if unloaded or unload the 0.50 caliber machine gun if loaded.
 - b) LOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is loaded. The indicator shall flash during the simulated load time.
 - c) UNLOADED indicator shall be a green indicator that illuminates when the 0.50 caliber machine gun is unloaded. The indicator shall flash during the simulated unload time.
- (c) Trainer unique ICWS aiming controls shall allow for the simulated movement of the gun ring and control of the M2 .50 caliber machine gun.
 - 1) A two-axis joystick shall be provided which allows for the movement of a simulated 0.50 caliber machine gun horizontally and vertically within the commander vision blocks.
 - 2) A fire button shall be provided that allows for the simulated firing of the 0.50 caliber machine gun.
- (7) Commander's seat assembly shall replicate the actual M1A2 commander's seat including full range of motion and adjustments. The seat shall function as follows:
 - (a) Footrest bar - shall be capable of being placed in the stowed and non-stowed positions.
 - (b) Height adjustment knob - shall allow for adjustment of seat height.
 - (c) The seat shall have the capability of simulating vehicle vibrations.
- (8) Commander's lower platform shall be functionally replicated.
- (9) Tank Commander's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be wounded; a red lamp shall be illuminated when the commander is considered dead.

- (10) Commander's NBC hookups are as follows:
- (a) Mask air duct socket shall be physically and functionally replicated.
 - (b) Cooling Vest air duct socket shall be physically replicated.
 - (c) Cooling Vest air duct socket cap shall be physically and functionally replicated.
- (11) Commander's head tracker is a trainer unique item which shall provide feedback indicating where commander's head is located and shall be used for vision block control in the commander's cupola.
- (12) Commander's arm guard shall be physically and functionally replicated. The following related items ~~shall~~ will be replicated as follows:
- (a) Hook shall be physically and functionally replicated.
 - (b) Latch shall be physically and functionally replicated.
- (13) Commander's knee guard shall be physically and functionally replicated.
- (14) Commander's arm rest shall be physically replicated.
- (15) Commander's Vision Blocks - 8 vision blocks (periscopes) shall be provided to the commander which shall display scenes generated by the visual system as specified in Appendix A.
- (16) Commanders Hatch Assembly (Hatch cover, handle). For the Commander's Popped Hatch (CPH) version the hatch cap, when closed, shall be able to be opened by the handles. A hinging mechanism shall cause the cap to move to an opening of approximately four inches (this spacing shall replicate the actual vehicle). The popped hatch view shall cover a 360-degree field of view and shall be obstructed by structures replicating the vision block housings, machine gun mounts, hatch hinge mechanisms, and a modified machine gun; when the cap is closed the module vision blocks shall use the same monitors to the same degree as in popped hatch mode.
- (a) Hatch ~~Open or Closed~~ switch - For the CPH version, this shall be a trainer unique switch used to detect when the hatch is in the opened position or the closed position.
- (17) Commander's Curtain Assembly - shall be physically replicated.

H.3.1.2.2.2 Gunner's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the gunner's station in the locations and panels as found in the actual M1A2.

- a. The following controls, indicators, and other pieces of equipment shall be simulated(functional):
 - (1) Gunner's Power Control handle assembly (GCHA) shall contain the following operational and functional components. Traverse throw shall be 91 degrees +/- 8 degrees in both directions. Elevation throw shall be 28 degrees +/- 8 degrees in both directions. Depression throw shall be 30 degrees +/- 8 degrees in both directions. Elevation and traverse rates versus handle deflection shall be same as commander's control handle. Traverse torque and elevation torque shall be 40 +/- 10 in-lbs and 25 +/- 5 in-lbs, respectively. GCHA neutral position shall be within 2 degrees of mechanical center. The switches shall return to normal (de-energized) position when the force on the switch is removed.
 - (a) Palm switches shall function as follows:
 - 1) Left palm switch shall be physically and functionally replicated and shall enable the gunner's control handles.
 - 2) Right palm switch shall be physically and functionally replicated and shall enable the gunner's control handles.
 - (b) Trigger switches shall function as follows:
 - 1) Left trigger switch shall be a red pushbutton switch. Squeezing this switch with gunner's station powered up and either palm switch depressed shall fire main gun or coaxial machine gun.
 - 2) Right trigger switch shall be a red pushbutton switch. Squeezing this switch with gunner's station powered up and either palm switch depressed shall fire main gun or coaxial machine gun.
 - (c) Laser switches shall function as follows:
 - 1) Left laser switch shall be a red pushbutton switch. Pressing this switch with gunner's station powered up and either palm switch depressed shall operate laser rangefinder.
 - 2) Right laser switch shall be a red pushbutton switch. Pressing this switch with gunner's station powered up and either palm switch depressed shall operate laser rangefinder.

- (d) Power elevation and traverse shall be simulated as follows:
 - 1) Rotating gunner's handles backward shall elevate the weapons whereas rotating gunner's handles forward shall depress the weapons.
 - 2) Rotating gunner's handles clockwise shall traverse turret right whereas rotating gunner's handles counterclockwise shall traverse turret left.
- (e) Manual elevation shall be simulated as follows:
 - 1) Cranking the manual elevation handle clockwise shall elevate main gun and coaxial machine gun whereas cranking handle counterclockwise shall lower main gun and machinegun. The manual elevation assembly shall drive the simulated gun at a rate of 10.175 mils +/- 5 percent per revolution of the handcrank. With main gun pointed to the front of the vehicle, gun depression shall be limited to 10 degrees. Gun elevation shall be limited to 20 degrees for 360 degrees turret travel while operating the manual elevation handle assembly.
 - 2) Squeezing the manual elevation palm switch shall allow for rotation of manual elevation handle.
 - 3) Emergency trigger shall be a red pushbutton and shall fire main gun or machinegun in the normal, emergency, or manual mode of operation.
- (f) Manual traverse shall be simulated as follows:
 - 1) Cranking the manual traverse handle clockwise shall traverse turret right whereas cranking handle counterclockwise shall traverse turret left. Nominal rates of 5 and 10 mils per crank revolution shall be simulated. One revolution of the hand traverse crank shall rotate the turret 10.561 mils +/- 5 percent when the 10 mil rate is selected and 5.28 mils +/- 5 percent when the 5 mil rate is selected. The manual handcrank shall provide 360 degrees of simulated turret traverse rotation.
 - 2) Squeezing the manual traverse palm switch shall allow for rotation of manual drive handle.
 - 3) iii. Blasting machine shall be physically and functionally replicated.
- (2) Gunner's Primary Sight (GPS) shall contain operational and functional components as follows:
 - (a) GPS eyepiece shall display scenes generated by the visual system as specified in Appendix A.

- 1) Diopter ring shall allow for simulated focusing of the reticle in the GPS eyepiece for clearer viewing.
 - 2) A sensor shall be provided to determine when the sight is in use and when activated, the GPS sight shall display simulated GPS imagery. The browpad shall have an adjusting thumbscrew and shall have left and right holding grooves.
- (b) GPS upper panel assembly shall contain operational and functional components as follows:
- 1) FIRE CONTROL MODE switch shall be a three position magnetically held (EMERGENCY and MANUAL positions) toggle switch. Active switch positions shall be labeled “NORMAL”, “EMERGENCY” and “MANUAL”.
 - 2) FIRE CONTROL MODE lights shall be simulated as follows:
 - a) EMERGENCY lamp shall be a amber dome lamp and shall illuminate when FIRE CONTROL MODE switch is set to the EMERGENCY position or PANEL LIGHTS TEST pushbutton is pressed.
 - b) NORMAL lamp shall be a green dome lamp and shall illuminate when FIRE CONTROL MODE switch is set to the NORMAL position or PANEL LIGHTS TEST pushbutton is pressed.
 - c) MANUAL lamp shall be a white dome lamp and shall illuminate when FIRE CONTROL MODE switch is set to the MANUAL position or PANEL LIGHTS TEST pushbutton is pressed.
 - 3) PANEL LIGHTS TEST switch shall be a black pushbutton switch with skirt and shall turn on all GPS and Thermal Imaging System (TIS) indicator lights to full brightness.
 - 4) PANEL LIGHTS control shall be a rotational control for lamp dimming and shall control brightness of GPS (upper and lower panels) and TIS indicator lights.
 - 5) DEFROSTER switch shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.
 - 6) DEFROSTER lamp shall be a green dome lamp and shall illuminate only when PANEL LIGHTS TEST pushbutton is pressed.

- 7) RETICLE knob shall be a rotational control and shall control the brightness of the GPS day sight reticle.
 - 8) Unity window shall display scenes generated by the visual system as specified in Appendix A.
 - 9) GPS ballistic door handles shall be replicated and function as follows:
 - a) DAY handle shall be a two position handle assembly with “DAY” written on the handle and shall simulate opening the left ballistic door by squeezing finger lever on top and turning clockwise.
 - b) THERMAL handle shall be a two position handle assembly with “THERMAL” written on the handle and shall simulate opening the right ballistic door by squeezing finger lever on top and turning counterclockwise.
- (c) GPS lower panel assembly shall contain operational and functional components as follows:
- 1) NORMAL MODE DRIFT AZ knob shall correct for turret azimuth drift in stabilized (normal) sighting system. This knob shall have “PUSH TO TURN” written on it in white letters.
 - 2) NORMAL MODE DRIFT EL knob shall correct for elevation drift in stabilized (normal) sighting system. This knob shall have “PUSH TO TURN” written on the it in white letters.
 - 3) FLTR/CLEAR/SHTR switch shall be a three position 120 degree rotary switch and shall have a pointer knob with active positions labeled “FLTR”, “CLEAR”, and “SHTR”. This switch shall position clear window or shutter in the GPS day optic system, and shall have no effect in the filter position.
 - 4) GUN SELECT switch shall be a three position magnetically held (MAIN and COAX positions) toggle switch with active positions labeled “MAIN”, “TRIGGER SAFE” and “COAX”. This switch shall select main gun or coaxial machinegun firing circuit for firing or trigger safe so neither gun will fire. Switch shall reset to safe when power is turned off. If switch is set to COAX with engine running, the NBC MAIN system shall turn on (blower only).
 - 5) GUN SELECT lamps shall be simulated as follows:

- a) MAIN lamp shall be a green dome lamp and shall illuminate when GUN SELECT switch is set to MAIN or PANEL LIGHTS TEST pushbutton is pressed.
 - b) TRIGGER SAFE lamp shall be a white dome lamp and shall illuminate when GUN SELECT switch is in the TRIGGER SAFE position or PANEL LIGHTS TEST pushbutton is pressed.
 - c) COAX lamp shall be a green dome lamp and shall illuminate when GUN SELECT switch is set to COAX or PANEL LIGHTS TEST pushbutton is pressed.
- 6) AMMUNITION SELECT pushbuttons shall be five pushbuttons with back lights. These pushbuttons shall input ammunition type data into the Fire Control Electronics Unit and the Turret Electronics Unit when GUN SELECT switch is set to MAIN.
- a) SABOT pushbutton shall have a square green LED on a backlit pushbutton with the label "SABOT" and a partial guard and shall illuminate when pressed, or if PANEL LIGHTS TEST pushbutton is pressed.
 - b) HEAT pushbutton shall have a square green LED on a backlit pushbutton with the label "HEAT" and a partial guard and shall illuminate when pressed, or if PANEL LIGHTS TEST pushbutton is pressed.
 - c) MPAT pushbutton shall be physically replicated but non-functional.
 - d) STAFF pushbutton shall be physically replicated but non-functional.
 - e) AIR/GROUND pushbutton shall have dual square green LEDs on a backlit pushbutton with the labels "AIR" and "GROUND" and partial guards. The upper LED is to the left of the AIR label and the lower LED is to the left of the GROUND label. The LEDs shall toggle when pressed, or if PANEL LIGHTS TEST pushbutton is pressed.
- 7) MAGNIFICATION switch shall be a two position lever assembly with positions "3X" and "10X" active. This switch shall select optical 3X or 10X magnification for the GPS day optical system.
- (d) Laser Rangefinder (LRF) shall contain the following components:
- 1) RANGE switch shall be a three position toggle switch with active positions labeled "SAFE", "ARM 1ST RTN", and "ARM LAST RTN".

This switch shall set first or last return, or safe mode of LRF. The LRF shall return to safe when turret power is turned off, but switch shall not trip to safe position.

- 2) Test shall be a dummy connector with cover.
- (e) Image Control Unit (ICU) shall contain operational and functional components as follows:
- 1) CONTRAST shall adjust the contrast of TIS image.
 - 2) POLARITY shall be a two position toggle switch with active positions labeled “WHITE HOT” and “BLACK HOT”. This switch shall select white or black presentation of hot objects in TIS image.
 - 3) RETICLE shall be used to adjust reticle intensity from white to black in TIS image.
 - 4) TRU READY lamp shall be a green dome lamp and shall illuminate when thermal receiver is ready for operation or shall illuminate if PANEL LIGHTS TEST pushbutton is pressed.
 - 5) FAULT lamp shall be a yellow dome lamp and shall illuminate if PANEL LIGHTS TEST pushbutton is pressed.
 - 6) SYMBOLS shall be used to adjust brightness of range, multiple returns, ready-to-fire symbol, and fire control fault “F” symbol in the GPS field of view. This knob shall be used for both day and TIS operation.
 - 7) SENSITIVITY shall adjust the brightness of the TIS image.
 - 8) THERMAL MODE shall be a three position toggle switch with active positions labeled “OFF”, “STBY”, and “ON”. This switch shall select OFF, ON, or STBY mode of TIS.
 - 9) THERMAL TEST UNIT TEST PATTERN shall be a five position rotary switch with active positions labeled “OFF”, “PCU”, “ICU”, “EU” and “TRU”. Each switch position, excluding OFF position, shall bring up a specific test pattern in the GPS.
 - 10) BORESIGHT shall be replicated and function as follows:
 - a) AZ knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.

- b) 2. EL knob shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.
- (f) Thermal Receiving Unit (TRU) shall contain operational and functional components as follows:
 - 1) THERMAL MAGNIFICATION control shall be a two position lever assembly with “3X” and “10X” positions active. This lever shall select 3X or 10X magnification for TIS image.
 - 2) FOCUS control shall be a mechanical control which replicates the appearance and movement of the corresponding actual control. This control shall be physically replicated but non-functional.
 - 3) ANTI-GLARE switch shall be a five position rotary switch with active positions labeled “1”, “2”, “3”, “4” and “5” and shall have a pointer knob. Position 1 shall be no filter; filter positions 2, 3, and 4 shall have no effect on thermal image; and position 5 shall be shutter and shall be used when TIS is in standby and off.
- (3) Intercom and /radio box shall be functionally replicated. The following switches, and /connectors and /controls shall be replicated and function as described:
 - (a) MONITOR switch shall be a five position rotary switch and shall allow the crew member to select the channel to be used. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.
 - (b) VOLUME control shall be one rotational control which shall control the sound volume.
 - (c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.
 - (d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
 - (e) Gunner’s remote (foot) intercom switch shall enable the gunner to talk over the intercom.

- (f) Remote cable - This cable shall be a fixed dummy cable representing the interconnect of the gunner's remote (foot) intercom switch to the Intercom Control Box.
- (4) Domelight shall function as described:
- (a) Domelight lamp shall be a bright light capable of illuminating gunner's position.
 - (b) On, ~~off~~ and -brightness control shall be a rotational control with a switch which shall be capable of controlling the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.
- (5) Gunner's Auxiliary Sight (GAS) shall contain operational and functional components as follows:
- (a) A sensor shall be provided to determine when the sight is in use and when activated the GAS sight shall display simulated GAS imagery. The browpad shall have an adjusting screw and shall have left and right holding grooves.
 - (b) GAS browpad adjustment knob shall be physically replicated.
 - (c) Boresight AZ adjustment - shall be a pictorial representation of the actual control. This control shall not be required because the reticles will be in correct alignment.
 - (d) Boresight EL adjustment - shall be a pictorial representation of the actual control. This control shall be physically replicated but non-functional.
 - (e) RETICLE select switch shall be a two position rotary switch with active positions labeled "APFSDS" and "HEAT" and shall have a pointer knob. This switch shall select between two separate focal plane ballistics reticles (SABOT and HEAT).
 - (f) Reticle brightness adjust shall adjust the reticle to desired brightness.
 - (g) FILTER select switch shall be a two position rotary switch with "IN" and "OUT" positions active and shall have a pointer knob. Filter knob shall provide for normal viewing in both the IN (left) and OUT (right) positions.
 - (h) Eyepiece shall display scenes generated by the visual system as specified in Appendix A.

- (i) Focus (diopter) ring adjustment shall allow for simulated focusing of the GAS eyepiece on reticle pattern.
- (6) Gunner's Control Display Panel (GCDP) shall contain operational and functional components as follows:
- (a) MAIN MENU display - This menu appears during power up and is used to initiate all functions available to the gunner. The choices are: "COMBAT", "ADJUST", "METRL DATA", "SENSOR", "MAINT", "BACKUP".
 - (b) Four-way switch - This switch shall be used to adjust panel lights and various input functions throughout the GCDP menu structure. It is a 5 position thumb switch with up, down, left, right and center positions.
 - (c) Keypad - The 4x4 keypad allows for alpha characters and numeric entries to be made when required for various menu functions within the GCDP. The keys are (listed in top to bottom, left to right order) - "ABC 1", "DEF 2", "GHI 3", "CLR", "JKL 4", "MNO 5", "PQR 6", "LTR", "STU 7", "VWX 8", "YZ 9", "->", ".", "0", "-", "ENT".
 - (d) PANEL LIGHTS pushbutton - This pushbutton provides for brighten and/dim adjustment of the panel display. The four-way switch is used for adjustments.
 - (e) Menu ~~Option~~ and/ ~~Select~~ Ppushbuttons - These pushbuttons allow the gunner to initiate functions for the GCDP.
 - (f) GCDP displays shall replicate the Pre, Post and Combat mode displays, including warning and caution messages, found in the actual M1A2 vehicle and described in, ~~(refer to TA 950101-2 for further details).~~
- (7) Gunner's seat assembly shall replicate the actual M1A2 gunner's seat and shall include the full range of motion and adjustments. The seat shall function as follows:
- (a) Height adjustment lever - shall allow for adjustment of seat height.
 - (b) Forward and/back adjusting lever - shall allow for adjustment in the forward and backward direction.
 - (c) The seat shall have the capability of simulating vehicle vibrations.
- (8) Gunner's NBC hookups are as follows:
- (a) Mask air duct socket shall be physically and functionally replicated.
 - (b) Cooling Vest air duct socket shall be physically replicated.

- (c) Cooling Vest air duct socket cap shall be physically and functionally replicated.
- (9) Gunner's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the gunner is considered to be wounded; a red lamp shall be illuminated when the gunner is considered dead.
- (10) Hydraulic pressure gage shall be a mechanical indicator which replicates the appearance of the corresponding actual indicator. This indicator shall be physically replicated but non-functional.
- (11) Gunner's chest rest shall be functionally replicated and shall have a chest rest adjustment knob.
- (12) Coaxial machine gun charging cable and handle shall be physically replicated. Activation of the handle shall clear a 7.62mm machine gun misfire.
- (13) Spent ammunition box shall be a partial mock-up for a space constraint.
- (14) Ammunition Temperature Gauge - shall be physically replicated and non-functional.

H.3.1.2.2.3 Loader's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the loader's station in the locations and panels as found in the actual M1A2.

- a. The following controls, indicators, and other pieces of equipment shall be simulated(functional):
 - (1) Loader's Panel (LP) shall contain operational and functional components as follows:
 - (a) MAIN GUN STATUS lights shall be functionally replicated as follows:
 - 1) ARMED light shall be a amber dome lamp and shall illuminate when main gun firing circuit is armed or when PANEL LIGHTS TEST pushbutton on the GPS Panel is pressed.
 - 2) SAFE light shall be a white dome lamp and shall illuminate when turret power is applied and main gun firing circuit is not armed or when PANEL LIGHTS TEST pushbutton on the GPS Panel is pressed.
 - (b) TURRET BLOWER switch shall be a two position switch with active positions labeled "ON" and "OFF". This switch shall provide the loader the ability to control the NBC main system (turn on or /off the blower) provided it is not already operating.

- (c) GUN/TURRET DRIVE switch shall be a three position lock lever toggle switch with active positions labeled “EL UNCPL”, “POWERED”, and “MANUAL”. This switch shall set gun and turret drive system to powered, manual, or elevation uncoupled mode.
 - (d) EL UNCPL light shall be a white dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to EL UNCPL position.
 - (e) POWERED light shall be a amber dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to POWERED position. POWERED position shall allow gunner and tank commander to operate fire control system in stabilized mode.
 - (f) MANUAL light shall be a white dome lamp and shall illuminate when GUN/TURRET DRIVE switch is set to MANUAL.
- (2) Knee switch shall be pushbutton activated knee guard switch. Actuation of the knee switch shall cause the ammo door to open (under normal conditions). Release of the knee switch shall cause the door to close. The knee switch shall be capable of being stowed in the up position.
- (3) Ready ammunition door shall be functionally and physically replicated. The door shall automatically open and close when the ammunition door knee switch is activated. The weight of the door shall be less than that of the actual M1A2 ready ammunition door for safety reasons. Full door travel from closed to open shall take 1.5 seconds +/- 0.5 seconds and 2.0 seconds +/- 0.5 seconds from open to closed.
- (a) Safety switch shall be an edge activated switch. This switch shall be capable of stopping the movement of the ready ammunition door.
 - (b) Door Closure assurance latch and lock shall be functionally but not physically replicated. The functionality of the lock and latch can be simulated based upon the door position.
 - (c) Door closing actuator shall be functionally but not physically replicated. The door shall be opened and closed by a trainer unique actuator located behind the door.
 - (d) Ammo Door Deactivation switch shall be a lever locked toggle switch with active positions labeled “ON” and “OFF” mounted on the ammunition closure assurance latch bracket and shall deactivate ready ammo door operation.
 - (e) Door closing actuator release pin shall not be replicated.
 - (f) Door lockshaft shall not be replicated.

- (4) Intercom and radio box shall be functionally replicated. The following switches, ~~connectors~~ and controls shall be replicated and function as described:
 - (a) MONITOR switch shall be a five position rotary switch and shall allow the crew member to select the channel to be used. Active switch positions shall be labeled “ALL”, “A”, “INT ONLY”, “B” and “C”.
 - (b) VOLUME control shall be one rotational control which shall control the sound volume.
 - (c) Left connector (J803) shall allow for connection of an actual CVC helmet. The left connector shall also be used to detect the rear (intercom) CVC helmet switch position.
 - (d) Right connector (J802) shall allow for connection of an actual CVC helmet. The right connector shall also be used to detect forward (radio) CVC helmet switch position and interface to the CVC helmet microphone and earphones (for both simulated intercom and radio).
- (5) Domelight shall function as described:
 - (a) Domelight lamp shall be a bright light capable of illuminating loader’s position.
 - (b) On, ~~off~~ and brightness control shall be a rotational control with a switch, which shall be capable of controlling the level of brightness of the domelight lamp. Turning knob clockwise shall turn domelight on. Turning knob counterclockwise shall dim light. Turning knob all the way counterclockwise shall turn domelight off.
- (6) Loader’s periscope shall rotate through 360 degrees in either direction and shall display scenes generated by the visual system as specified in Appendix A.
 - (a) Periscope adjustment knobs - These knobs are located on either side of the loader’s periscopes and shall be functionally replicated. When loosened, they allow the mirror on the periscope to be adjusted.
 - (b) Vertical Field-Of-View (FOV) Switch - shall be a three position switch which controls the pitch of Loader’s periscope FOV. The three positions shall move the Loader’s vertical FOV up and down between -4.5 degrees and +4.5 degrees. The three positions shall place the Loader’s vertical FOV at +4.5 degrees, 0 degrees, and -4.5 degrees.
- (7) Audio frequency amplifier (AM 1780/VRC) shall be functionally replicated as follows:

- (a) MAIN PWR switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “NORM”, “INT ONLY” and “OFF”. No radio transmission shall be possible when MAIN PWR switch is in INT ONLY position. The entire communications system shall be turned off when MAIN PWR switch is in OFF position.
 - (b) INT ACCENT switch shall be two position rotary switch with pointer knob and active positions labeled “ON” and “OFF”. Intercom and radio sound levels shall be equal when INT ACCENT switch is set to OFF. Radio sound level shall be lower than intercom when INT ACCENT switch is set to ON.
 - (c) RADIO TRANS switch shall be a three position rotary switch with pointer knob and active positions labeled “CDR + CREW”, “CDR ONLY”, and “LISTENING SILENCE”. Entire crew shall be able to transmit on radio with RADIO TRANS switch in CDR + CREW position. Only tank commander shall be able to transmit on radio with RADIO TRANS switch in CDR ONLY position. No radio transmission shall be possible with RADIO TRANS switch in LISTENING SILENCE position.
 - (d) POWER CKT BKR switch shall be a two position trippable toggle type circuit breaker with active positions labeled “ON” and “OFF”.
 - (e) POWER light shall be a green lamp and shall indicate when power is applied to the communications system.
 - (f) INSTALLATION switch shall be a three position rotary switch requiring flat blade screwdriver to change switch setting and shall have active positions labeled “INT ONLY”, “OTHER”, and “RETRANS”.
 - (g) AUDIO INPUT jacks shall be functionally replicated as follows:
 - 1) Left jack shall be non-operational and non-functional.
 - 2) Right jack shall be non-operational and non-functional.
 - (h) LINE jacks shall be functionally replicated as follows:
 - 1) Left jack shall be non-operational and non-functional.
 - 2) Right jack shall be non-operational and non-functional.
 - (i) Amplifier cover shall be physically and functionally replicated.
- (8) Two SINCGARS radios (RT-1523A) shall be functionally and physically replicated. The SINCGARS radios shall be compatible with organizational

requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. It shall simulate the following controls:

- (a) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. On the long range (lower) radio the dummy cable shall connect to the RF power amplifier. On the short range (upper) radio the dummy cable shall connect to the chassis (representing connecting to vehicle antenna).
- (b) CHAN (channel) switch shall select manual, preset and cue channels. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:
 - 1) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.
 - 2) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.
 - 3) 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 4) 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 5) 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 6) 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - 7) 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in

SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.

- 8) 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
- (c) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:
- 1) LO - This position shall set the transmission power to low.
 - 2) M - This position shall set the transmission power to medium.
 - 3) HI - This position shall set the transmission power to high.
 - 4) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.
- (d) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:
- 1) SC - This position shall set the receiver/transmitter to SC (single channel) mode.
 - 2) FH - This position shall set the receiver/transmitter to FH (frequency hopping) mode.
 - 3) FH-M - This position shall set the receiver/transmitter to FH-M(frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.
- (e) RXMT connector shall be a dummy 3-D connector with a dummy cable connected to the RXMT on the other RT in the radio mount.
- (f) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:
- 1) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.

- 2) TST - This position shall cause the normal self test indications to be displayed on the keyboard display.
 - 3) LD - This position shall allow the operator to load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in FH-M mode.
 - 4) SQ ON - This position shall turn on the RT and activate the squelch.
 - 5) SQ OFF - This position shall turn on the RT and deactivate the squelch.
 - 6) RXMT - This position shall be non-functional.
 - 7) REM - This position shall disable the RT's front panel controls.
 - 8) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.
 - 9) OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.
- (g) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.
- (h) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 ~~by~~ 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 ~~by~~ 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eight dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.
- (i) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:
- 1) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.
 - 2) * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.

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- 3) SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.
 - 4) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.
 - 5) DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.
 - 6) 5 - Shall enter the number '5' into the system.
 - 7) 6 - Shall enter the number '6' into the system.
 - 8) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load and/ check ~~-~~SC offset frequencies.
 - 9) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.
 - 10) 8 - Shall enter the number '8' into the system.
 - 11) LOUT 9 - Shall enter the number '9' into the system. Shall also retrieve frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.
 - 12) TIME - Shall be used to check RT FH sync time clock.
 - 13) CLR - Shall clear data from display if error was made during entry. Shall also clear data from RT memory.
 - 14) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also enter the number '0' into the system.
 - 15) STO - Shall transfer data from RT holding memory onto permanent memory.
 - 16) BATT CALL - Shall be non-functional.
- (j) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:

- 1) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.
 - 2) CT - This position shall place the RT into cipher text mode.
 - 3) TD - This position shall be non-functional.
 - 4) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.
 - 5) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.
- (k) VOL/WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.
- (l) HUB Connector - Dummy cover that shall not be removable.
- (m) AUD/FILL connector shall be a dummy 3-D connector.
- (n) AUD/DATA connector shall be a dummy 3-D connector. A dummy 3-D cable shall connect to the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter.
- (9) SINCGARS Radios shall be mounted in a short/long range radio configuration.
- (a) This mounting shall replicate the AN/VRC-89A configuration which contains the following:
- 1) Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
 - 2) Amplifier, Radio Frequency AM-7238A/VRC.
 - 3) Receiver-Transmitter, Radio RT-1523A.
 - 4) Receiver-Transmitter, Radio RT-1523A.
 - 5) Loudspeaker Control Unit, LS-671/U.
- (b) The mounting adapter shall have two(2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

- 1) CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.
 - 2) Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.
 - 3) The (AUD/DATA B J2) connector shall be a 3-D dummy connector.
 - 4) The (AUD/DATA A J3) connector shall be a 3-D dummy connector.
 - 5) The (DATA B J4) connector shall be a dummy 3-D connector with a dummy cable connected to the AUD/DATA connector on the top radio.
 - 6) The (DATA A J5) connector shall be a dummy 3-D connector with a dummy cable connected to the AUD/DATA connector on the top radio.
 - 7) The (SPKR J6) connector shall be a 3-D dummy connector.
- (c) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components.
- 1) The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.
 - 2) The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.
- (10) MAIN GUN LOAD and/ UNLOAD switch shall be a trainer unique switch. When depressed, this switch shall initiate the virtual task of loading the main gun when unloaded and unloading the main gun when loaded.
- (11) BREECH OPEN and/ CLOSE switch shall be a trainer unique, three position, spring-loaded to center switch. Activating the switch to the upper position shall initiate the virtual task of opening the main gun breech and activating the switch to the lower position shall initiate the virtual task of closing the breech.
- (12) MAIN GUN STATUS - shall be a trainer unique panel that is used to monitor the status of the 120mm main gun. The panel shall contain the following:
- (a) ROUND LOADED shall indicate that a virtual round is loaded in the breech.

- (b) ROUND UNLOADED shall indicate that the breech is unloaded.
- (c) BREECH CLOSED shall indicate that the breech is closed.
- (d) BREECH ACCESSIBLE shall indicate that the breech is in a position to be opened.
- (e) BREECH OPENED shall indicate that the breech is opened.
- (f) STUB DEFLECTOR UP shall indicate that the stub deflector is in the up position.
- (g) STUB DEFLECTOR DOWN shall indicate that the stub deflector is in the down position.

(13) The coax machine gun ammo supply, load and unload functions as follows:

- (a) CANS IN STORAGE - shall be a trainer unique panel used to monitor the storage and control the removal of cans of ammo from the 7.62mm ammo storage area. The following components shall be provided:
 - 1) CANS IN STORAGE shall be a 2 digit display that indicates the simulated number of ammo cans in the ammo storage area.
 - 2) TRANSFER A CAN TO READY shall be a pushbutton switch that initiates the simulated transfer of a ammo can from the storage area to the 7.62mm coaxial machine gun feed chute.
- (b) ROUNDS IN READY BOX - shall be a trainer unique panel indicating the number of rounds in the ready box.
- (c) MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the 7.62mm coaxial machine gun. The following components shall be provided:
 - 1) LOAD and/ UNLOAD shall be a pushbutton switch that when depressed initiates the loading of the 7.62mm coaxial machine gun if unloaded or the simulated unloading of the 7.62mm coaxial machine gun if loaded.
 - 2) LOADED indicator shall be a red indicator that illuminates when the 7.62mm coaxial machine gun is loaded. The indicator shall flash during the simulated load time.

- 3) UNLOADED indicator shall be a green indicator that illuminates when the 7.62mm coaxial machine gun is unloaded. The indicator shall flash during the simulated unload time.
- (14) Coax ammunition ready box shall be a mock-up.
- (15) Coax ammunition feed chute shall not be replicated.
- (16) Azimuth travel lock shall not be replicated.
- (17) Loader's seat assembly shall replicate the actual M1A2 loader's seat and shall include the full range of motion and adjustments except that the seat back shall not fold down. The seat shall include the following:
 - (a) Height adjustment lever,
 - (b) Swing latch,
 - (c) The capability of simulating vehicle vibrations via an embedded speaker or transducer as specified in H.3.1.1.7.6.
- (18) Ready rack ammo status shall be eighteen trainer unique indicators. These indicators shall indicate the number of virtual rounds being stored. If rounds are being stored, these indicators shall indicate what type, "SABOT" or "HEAT".
- (19) SEMI-READY AMMUNITION RACK - shall be a trainer unique panel used to monitor the storage and control the removal of rounds from the semi-ready rack. The following components shall be provided:
 - (a) AMMO DOOR OPEN ~~and~~ CLOSE switch shall be a pushbutton switch that when depressed initiates the simulated opening of the semi-ready rack door if closed or the simulated closing of the semi-ready rack door if open.
 - (b) AMMO DOOR OPEN indicator shall be a red indicator that illuminates when the semi-ready rack is open. The indicator shall flash during the simulated opening time.
 - (c) AMMO DOOR CLOSED indicator shall be a green indicator that illuminates when the semi-ready rack is closed. The indicator shall flash during the simulated closing time.
 - (d) HEAT indicator shall be a two digit display that indicates the number of virtual HEAT rounds stored in the semi-ready rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

- (e) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual HEAT round from the semi-ready rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.
 - (f) APFSDS indicator shall be a two digit display that indicates the number of the virtual SABOT rounds stored in the semi-ready rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.
 - (g) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of virtual SABOT round from the semi-ready rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.
- (20) HULL AMMUNITION RACK - shall be a trainer unique panel used to monitor the storage and control the removal of rounds from the hull ready rack. The time delays associated with the manual operation of the ammunition door, door clamps, and clamp bar shall be simulated in the design of the ammunition transfer. The panel shall be active only when the turret is positioned between 300 and 310 degrees (0 degrees is when the main gun is pointing forward and aligned with the vehicle centerline). The following components shall be provided:
- (a) AMMO DOOR OPEN and/ CLOSE switch shall be a pushbutton switch that when depressed initiates the simulated opening of the hull ammo rack door if closed or the simulated closing of the hull ammo door if open.
 - (b) AMMO DOOR OPEN indicator shall be a red indicator that illuminates when the hull ammo door is open. The indicator shall flash during the simulated opening time.
 - (c) AMMO DOOR CLOSED indicator shall be a green indicator that illuminates when the hull ammo door is closed. The indicator shall flash during the simulated closing time.
 - (d) HEAT indicator shall be a two digit display that indicates the number of virtual HEAT rounds stored in the hull ammo rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.
 - (e) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of a virtual HEAT round from the hull ammo rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.
 - (f) APFSDS indicator shall be a two digit display that indicates the number of the virtual SABOT rounds stored in the hull ammo rack. The display shall be blank when the AMMO DOOR CLOSED indicator is illuminated.

- (g) REMOVE FROM RACK switch shall be a pushbutton switch that initiates the removal of virtual SABOT round from the hull ammo rack. The switch shall be inoperative when the AMMO DOOR CLOSED indicator is illuminated.
- (21) Loader's NBC hookups are as follows:
 - (a) Mask air duct socket shall be physically and functionally replicated.
 - (b) Cooling Vest air duct socket shall be physically replicated.
 - (c) Cooling Vest air duct socket cap shall be physically and functionally replicated.
- (22) Loader's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the loader is considered to be wounded; a red lamp shall be illuminated when the loader is considered dead.
- (23) Shoulder guard shall be physically and functionally replicated.
- (24) Knee guard shall be physically and functionally replicated.
- (25) Safety guard shall be physically and functionally replicated. The following related items shall be replicated as follows:
 - (a) Frame shall be physically and functionally replicated.
 - (b) Latch bolt shall be physically and functionally replicated.
- (26) Foot guard shall be physically and functionally replicated.

H.3.1.2.2.4 120 mm Main Gun.

The following controls, indicators, and other pieces of equipment shall be provided in the locations as found in the actual M1A2.

- a. The following controls, indicators, and other pieces of equipment shall be simulated as follows:
 - (1) Breechblock shall be a mock-up.
 - (2) SAFE/ARMED switch handle shall be a two position handle assembly for arming and disarming main gun firing circuit.
 - (3) Coaxial machine gun mount shall be a mock-up.
 - (4) Ejection chute shall be a mock-up.
 - (5) Machine gun firing solenoid shall be a mock-up.

- (6) 7.62 mm coaxial machine gun shall be a partial mockup. The forward portion of the 7.62 mm coaxial machine gun shall not be replicated due to the fact that it falls outside of the boundaries of the M1A2 module.
- (7) The following items ~~sh~~will not be replicated due to the fact that they would fall behind these shields and guards:
 - (a) Fire Control Electronics Unit (FCEU).
 - (b) Thermal Imaging Control Unit (TEU).
 - (c) Thermal Imaging Control Power Control Unit (PCU).
- (8) Hull ~~to/ T~~turret ~~S~~slipping guards shall be mockups. The ~~H~~hull ~~to/ T~~turret slipping shall not be replicated due to the fact that it falls behind these shields.

H.3.1.2.2.5 Trainer unique - Common.

The following controls, indicators, and other pieces of equipment shall be trainer unique equipment common to all M1A2 simulation systems.

- a. The following controls, indicators, and other pieces of equipment shall be simulated as follows:
 - (1) Simulated compass (grid azimuth indicator) shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.
 - (2) Turret ~~to/~~ hull reference indicator shall be a series of indicators displaying the ~~direction/~~orientation of the turret relative to the hull, +/- 15 degrees.

H.3.1.2.2.6 Commander’s Popped Hatch Unique Components.

The following controls, indicators, and other pieces of equipment shall be provided in the locations as found in the actual M1A2, except as stated otherwise.

- a. The following controls, indicators, and other pieces of equipment shall be simulated (functional):
 - (1) Binocular capability shall be provided by a trainer unique device as follows:
 - (a) A momentary pushbutton switch shall be provided which, when depressed, ~~will~~shall enable the binocular capability on the CPH display.
 - (b) A two axis joystick shall be provided which, when the momentary pushbutton is depressed, shall slew the binocular reticle in azimuth and the CPH imagery in elevation.

(2) Night vision goggles shall be functionally replicated as follows:

- (a) A trainer unique momentary pushbutton switch shall be provided which ~~will~~shall enable and disable the night vision capability.
- (b) When the night vision capability is activated, the CPH shall display night vision imagery.

H.3.1.2.3 External Interface Unit.

The M1A2 manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device.

The EIU shall be used to display the following information:

- a. Exercise number.
- b. Vehicle identification number.

The EIU shall be used to control and monitor the following M1A2 functions:

- a. Initiation and termination of self-repairs.
- b. Initiation and termination of fuel transfers.
- c. Initiation and termination of ammo transfers.
- d. Connection and disconnection of a tow kit to another vehicle.
- e. External munitions loading.
- f. Damage assessment.
- g. Load SINCGARS hopset and COMSEC data.

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APPENDIX I

M981 FIST-V MANNED MODULE

I.1. SCOPE.

This appendix establishes requirements for the M981 Fire Support Team Vehicle (FIST-V) manned module. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

I.2. APPLICABLE DOCUMENTS.

(This section is not applicable to this appendix.)

I.3. REQUIREMENTS.

I.3.1 M981 FIST-V simulator module.

The M981 FIST-V simulator shall be designed to replicate the performance characteristics of the M981, full tracked armored fire support personnel carrier and associated systems based on a M113A3 chassis as described in paragraphs I.3.1.1 through I.3.1.2.6.

I.3.1.1 Performance characteristics.

The following paragraphs contain the unique performance requirements that shall be provided with the M981 FIST-V manned module.

I.3.1.1.1 Visual display system.

The visual display system shall meet the requirements stated in Appendix A.

I.3.1.1.2 Vehicle weapon systems.

The vehicle weapons system for the M981 FIST-V manned module shall have the capability for target sighting, aiming and firing of the M60 7.62 MM Machine Gun and the M257 Smoke Grenade Launcher. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. The vehicle weapons system shall consist of:

- a. M60 7.62 MM Machine Gun.
- b. M257 Smoke Grenade Launcher.

The components in combination with other simulated systems in the M981 FIST-V simulation systems shall provide the crew the capability to engage targets from a stationary position with a precision that matches real world results.

I.3.1.1.3 M981 FIST-V Weapons and Ammunition.

The M981 FIST-V simulation system shall simulate the following weapons and ammunition:

- a. M60 7.62 MM Machine Gun (A141, Ball, Tracer).
- b. M257 Smoke Grenade Launcher System (Smoke Grenade Arming Firing Unit) using the L8A3 RP smoke grenades.

I.3.1.1.4 Support Systems.

I.3.1.1.4.1 Electrical System.

The electrical system shall be capable of the following states:

- a. Engine off, master power off.
- b. Engine off, master power on.
- c. Engine running, alternator working.
- d. Engine running, alternator not working.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the M981 simulation system. These problems and abilities shall be replicated in the M981 simulation systems just as they would occur in the operational equipment.

I.3.1.1.4.2 Hydraulic System.

The hydraulic system shall simulate the control of the elevation and azimuth of the targeting head and erecting and stowing the turret head.

I.3.1.1.5 Depletable resource management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The fuel for the M981 FIST-V manned module shall be based on the fuel contained in a M113A3's fuel tanks. The resupply of fuel from a fuel carrier (M1091 MTV or M978 HEMITT) shall be accomplished through coordination with the ALOC. The maximum ammunition capacity for the M981 FIST-V simulation system shall be based on the internal storage capabilities of the actual M981 FIST-V for the weapons identified in I.3.1.1.3. The identification, transfer, and resupply of ammunition shall be the responsibility of the vehicle commander. The resupply of ammunition from a M977/M985 HEMITT shall be coordinated through the ALOC. In all cases, the monitoring of, use of, and resupplying of the M981's fuel and ammunition shall be based on the implementation of representative time and depletion parameters. These parameters shall include:

- a. Transfer times.
 - (1) Fuel from a fuel carrier and fuel pre-stock to the M981 FIST-V.
 - (2) Ammunition from an ammunition truck, another M981 FIST-V, and Manned Module with comparable ammunition.
 - (3) Ammunition from prepositioned ammunition stocks to the M981 FIST-V.
 - (4) Reload times for the weapons listed in paragraph I.3.1.1.3.
- b. Depletion rates.

- (1) Fuel available related to the M981 FIST-V consumption rate.
- (2) Ammunition basic allowance for the various weapons listed in I.3.1.1.3.

I.3.1.1.6 Damage and Failure.

The list of components that shall be modeled for combat damage, stochastic failure, and deterministic failure shall be as defined in Table I-I.

Table I-I. M981 FIST-V Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Alternator		X	X
Antenna A, B, C, and D			X
Batteries		X	X
Bilge Pump		X	
Commander			X
FED			X
Driver			X
Drown	X		
Engine Assembly			X
Engine Cooling System		X	X
Engine Oil System		X	X
Engine Starter	X	X	X
Erection Arm			X
Fuel Filter		X	
Gunner			X
Intercom		X	X
Laser Designator Range Finder			X
Left Idler Wheel			X
Left Roadwheel 1			X
Left Roadwheel 2			X
Left Roadwheel 3			X
Left Roadwheel 4			X

Table I-I. M981 FIST-V Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Left Roadwheel 5			X
Left Sprocket			X
Left Track	X	X	X
North Seeking Gyro			X
Observer			X
Radio A		X	X
Radio B		X	X
Radio C		X	X
Radio D		X	X
Right Idler Wheel			X
Right Roadwheel 1			X
Right Roadwheel 2			X
Right Roadwheel 3			X
Right Roadwheel 4			X
Right Roadwheel 5			X
Right Sprocket			X
Right Track	X	X	X
Rollover	X		
Service Brake		X	
Targeting Station Hydraulic Electric Power			X
Transmission Assembly		X	X
Transmission Oil Filter		X	

I.3.1.1.7 Sound generation system.

A sound and acoustic vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system. The sounds and vibrations shall be of such fidelity, quality, realism, and volume that the driver, targeting station, communication station, and observer station crew members shall experience the cues, stresses, and distractions of a “real life” combat situation. The sounds shall be of sufficient volume so that the distractions provided

to the crew members shall equal those~~at~~ found in an actual situation, but in no case shall 95 dB be exceeded for steady state noise (measured external to the CVC helmet). Table G-II lists the sound cues that shall be provided in the M981 simulation system.

Table I-II. M981 FIST-V Sound Cues	
SOUND CUE	
Engine noise related to Revolutions Per Minute (RPM)	
Starter	
Collisions with objects (scraping and hard collisions)	
Track noise related to speed for terrain types simulated in CCTT	
Track popping (about to be thrown)	
Horn	
Bilge pumps	
Transmission noise related to RPM	
Target Head Erect and Stow	
M60 Machine Gun firing	
M257 Smoke Grenade Launcher firing	
Changes in target head elevation and azimuth based on speed	
Engine start to idle	
Engine stop	
Friendly and hostile main gun fire	
Friendly and hostile missile launch	
Friendly and hostile rocket launch	
Generic explosive sound (main gun, missile, rocket) hit	
Generic explosive sound (main gun, missile, rocket) miss	
Generic kinetic round hit	
Friendly and hostile machine gun fire - large caliber	
Friendly and hostile machine gun fire - small caliber	
Friendly and hostile mine hit	
Friendly and hostile bomb hit	
Friendly and hostile bomb miss	
Friendly and hostile artillery hit	
Friendly and hostile artillery miss	
Wheeled vehicle - large class	

Wheeled vehicle - small class
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class

I.3.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the M981 FIST-V controls within the system latency requirements, as defined in paragraph 3.2.2.1, and within the module latency requirements, as defined in paragraph 3.2.2.2.

I.3.1.1.7.2 Sound generator.

The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. The sound generation system shall meet the spare input and I/O output channel requirements of 3.7.3.1.4.

I.3.1.1.7.3 Spatial positioning.

The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the distance (amplitude and time delay) of the events causing the sounds.

I.3.1.1.7.4 Sound quality.

The sound generator shall provide sound cues over a frequency range of 30 Hz to a minimum of 12,000 Hz, +/- 3 dB.

I.3.1.1.8 Communication system.

A communication system shall be provided to the M981 FIST-V manned module as described in section 3.7.6 of this specification.

I.3.1.2 Physical characteristics.

The following paragraphs contain the detailed physical requirements for the individual crew stations within each M981 FIST-V simulator system. The M981 FIST-V crew compartment shall exist as a consolidated enclosure for the driver's station, targeting station, communications station, and observation station. The crew stations shall be located relative to each other as they are in the actual vehicle. Each crew station shall include a seat replicating the respective seat found in the operational M981 FIST-V vehicle. The module base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. The M981 FIST-V manned modules shall provide the controls, switches, indicators and space constraints required to meet the training tasks, while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constraints of the actual vehicle. These controls and indicators shall replicate in design, performance, and function their real world counter-parts that are found in the operational M981 FIST-V based on a M113A3 chassis. Functional controls, indicators and other pieces of equipment shall have proper coloring and labeling.

I.3.1.2.1 Driver's Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver's station in the locations and panels as found in the actual M981 FIST-V based on a M113A3 chassis.

- a. Driver's distribution box shall be functionally replicated as follows:
 - (1) EQPT BAT voltage indicator shall display the output voltage of the equipment batteries. This voltage shall be displayed when the EQPT BAT switch is in the "ON" position, and the VEHICLE BAT switch is in the "OFF" position. The output voltage of the alternator shall be displayed when the engine is running. This gauge shall indicate battery and alternator condition as follows:
 - (a) The needle shall be positioned in the Lower Red Zone (low voltage) when the voltage is below 22 volts.
 - (b) The needle shall be positioned in the Yellow Zone (intermediate voltage) when the voltage is between 22 -26 volts.
 - (c) The needle shall be positioned in the Green Zone (operating voltage) when the voltage is between 26 - 30 volts.
 - (d) The needle shall be positioned in the Upper Red Zone (excessive voltage) when the voltage is greater than 30 volts.
 - (2) EQPT BAT switch shall be a three position pull to turn rotary switch. This switch shall connect the equipment batteries to electric circuits for powering the communications equipment and the targeting station when in the "ON" position.
 - (3) EMERGENCY switch shall be a three position pull to turn rotary switch. This switch which shall connect the equipment batteries to the vehicle battery circuit when in the "ON" position and the EQPT BAT switch is also in the "ON" position. VEHICLE BAT switch shall be a three position pull to turn rotary switch. This switch shall connect the vehicle batteries to electric circuits for power vehicle loads when in the "ON" position. This switch shall allow the alternator to charge the equipment batteries when in the "ON" position and the engine is running. UTILITY outlet shall be a mockup of the real connector and shall be nonoperational and nonfunctional. AUX POWER receptacle shall be a full size mockup of the real receptacle and shall be operational but nonfunctional.
- b. Driver's instrument panel shall be simulated and shall contain the following active switches and indicators:
 - (1) START switch shall be a momentary pushbutton which shall engage the engine starter.

- (2) BATTERY GENERATOR INDICATOR shall be a functional gauge which shall indicate battery and generator conditions as follows:
 - (a) Left red zone: Indicates low battery charge with engine off.
 - (b) Yellow zone: Indicates normal battery voltage with engine off. Indicates generator not charging with engine running.
 - (c) Green zone: Indicates generator charging normally with engine running.
 - (d) Right red zone: Indicates generator overcharging with engine running.
- (3) FUEL TANK switch shall be a two position toggle switch which allows the driver to read fuel in the LEFT and RIGHT external fuel tanks.
- (4) FUEL LEVEL indicator shall be a meter assembly with the following positions (E, 1/4, 1/2, 3/4, F) which shall indicate level of fuel in LEFT and RIGHT external fuel tanks as selected using the FUEL TANK switch.
- (5) Light switch assembly shall be simulated and fully functional.
 - (a) Panel light switch shall be a four position rotary switch which shall control the panel lights as follows:
 - 1) PANEL BRT position: Panel lights are brightly lit.
 - 2) OFF position: Panel lights are off.
 - 3) DIM position: Panel lights are dimly lit.
 - 4) PARK position: Stop lights and tail lights are lit.
 - (b) Lights UNLOCK switch shall be a spring-loaded, two-position lever. When held in the UNLOCK position, this lever ~~will~~shall allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS to SERVICE DRIVE. The lever shall return to the locked position when released.
 - (c) Driving lights/main light switch shall be a five position rotary switch which shall control exterior lights as follows:
 - 1) B.O. DRIVE position: Enables the I.R. - B.O. SELECT switch to choose either infrared (non-functional) or blackout mode (functional) for night driving.

- 2) B.O. MARKER position: Blackout marker lights are lit. Blackout stoplight lights when brakes are applied.
- 3) OFF position: All exterior lights are off.
- 4) STOPLIGHT position: Stoplight lights when brakes are applied.
- 5) SERVICE DRIVE position: Service headlights and taillights are lit. Stoplight lights when brakes are applied.
- (6) Speedometer and Odometer shall be an active gauge and an active 6 digit display. The speed gauge shall represent the carrier speed in miles per hour, and the odometer shall indicate total carrier distance traveled in miles.
- (7) MASTER SWITCH ON indicator shall be a red colored indicator which shall come on when Master Power is available.
- (8) Engine coolant TEMPERATURE indicator shall be a functional gauge which shall indicate the engine operating temperature in degrees Fahrenheit.
- (9) RPM HUNDREDS gauge (tachometer) shall be a functional gauge indicating the engine speed in revolutions per minute (RPM). The engine hour meter shall be a six digit inactive display.
- (10) TRANSMISSION FILTER CLOGGED warning light shall be a red colored indicator which shall come on when the transmission filter is clogged and the engine is running.
- (11) PARKING BRAKE indicator light shall be a red colored indicator which shall come on when the parking brake is set.
- (12) Instrument panel lights shall be two red colored indicators which are controlled by the panel lights switch.
- (13) I.R. POWER switch shall be a two position toggle switch which shall be operational but nonfunctional.
- (14) I.R.-B.O. SELECT switch shall be a two position toggle switch which shall be functional only in the BO position.
- (15) AIR BOX HEATER switch shall be operational but nonfunctional.
- (16) BILGE PUMPS switch (FRONT and REAR) shall be a two position toggle switch which shall turn front and rear bilge pumps on and off..

- (17) BILGE PUMPS lights shall be two red colored indicators which shall light when the BILGE PUMPS switch is moved to the ON position..
 - (18) HEADLIGHTS HI BEAM indicator light shall be a red colored indicator which shall light when headlight high beams are on.
 - (19) TRANSMISSION OIL LOW PRESSURE warning light shall be a red colored indicator which shall come on when the transmission oil pressure is low.
- c. Driver's Front Warning Light Panel shall be simulated and contain the following switches and indicators:
- (1) ENGINE COOLANT LOW PRESSURE warning light shall be a red colored indicator which shall come on when the coolant level is too low for safe operation.
 - (2) TRANS OIL-HI TEMP warning light shall be a red colored indicator which shall come on when the transmission oil temperature is too high for safe operation.
 - (3) ENGINE OIL-LOW PRESSURE warning light shall be a red colored indicator which shall come on when the oil pressure is too low for safe operation. Light shall go off 10 +/- 1 seconds after the engine starts.
 - (4) STEERING LOCKED indicator light shall be a red colored indicator which shall come on when steering wheel is locked in center position.
 - (5) HORN Button shall be a pushbutton which shall sound the carrier horn internal to the carrier.
- d. Intercommunication Unit Control shall be replicated and function as described:
- (1) Talk switch shall be a five position rotary switch. This switch shall allow the driver to select one of the four radios to transmit and receive on, or to select the intercom only.
 - (2) Listen switches shall be four 2-position toggle switches. These switches allow the driver to select up to four radios to receive only. When the switch is in the up position, that radio ~~will~~shall be monitored.
 - (3) Volume switch shall be a rotational control. This switch shall control the volume level of the intercom control unit.
 - (4) The intercom panel shall contain two jacks to allow connection of a real CVC helmet to the intercom system.

- e. Steering wheel shall be a functional assembly and when rotated shall provide the range of motion of the M981 FIST-V steering wheel assembly based on a M113A3 steering wheel assembly. Deflections of the steering wheel from the center position shall cause the carrier to turn. Clockwise deflection (as viewed from above) shall cause the carrier to turn to the right. Counterclockwise deflection shall cause the carrier to turn to the left. Steering control deadband shall be 10 degrees +/- 5 degrees. Amount of travel of the steering wheel assembly shall be 60 degrees +/- 9 degrees. Breakaway force of the steering mechanism shall be 4.0 pounds +/- 2.5 pounds. Ending force shall be 24.0 pounds +/- 4.0 pounds. Specified breakaway and ending forces shall apply to deflection in either direction.
- f. Fuel cutoff control shall be a two position handle assembly that when pulled shall stop fuel flow and when pushed in shall start fuel flow to the engine. The force required for handle movement shall be constant force of 20.0 pounds +/- 4.0 pounds. The travel distance for handle movement shall be 1.25 inches +/- 0.5 inches.
- g. Transmission controller shall be a seven position lever assembly that selects the driving range of the carrier automatic transmission. The SL (steering lock) position shall lock the steering wheel in the center position. This position shall be used during starting, idling, and engine shut down. The R (reverse) position shall be used for backing the carrier on land or in the water. The PV (pivot carrier) position shall be used to turn the carrier on it's own center. The 1-4 position shall be used to drive the carrier in normal forward operation. The 1-3 position shall be used when climbing and going down slight grades, driving cross country at high speeds, and driving on roads at moderate speeds. The 1-2 position shall be used when climbing and going down medium grades, driving cross country at slow speeds, and while in the water. The 1 position shall be used when climbing and going down steep grades, and when entering and leaving the water. This range shall provide maximum traction, low speed maneuvering, and engine braking. The transmission controller shall be actual equipment.
- h. Accelerator pedal upper and lower shall be simulated as follows:
 - (1) Upper accelerator pedal shall be operational and functional.
 - (2) Lower accelerator pedal shall be a functional assembly that when operated shall control engine speed. The force required for pedal movement shall be 8.0 pounds +/- 2.0 pounds breakaway and 22.0 pounds +/- 4.0 pounds ending. The travel distance for pedal movement shall be 2.0 inches +/- 0.5 inches at the center of the pedal.
- i. Driver's Periscopes - Four vision blocks (periscopes) shall be provided to the driver and shall display scenes generated by the visual system as specified in Appendix A.
- j. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a

spring loaded, mechanical only, release button which shall prevent motion from blackout to white, by using a physical block, until button is pressed allowing traversal. The panel shall contain a blackout light and a white light. The dome light shall be located on the left side of the carrier near the driver.

- (1) Ramp control handle shall be a two position lever assembly that when operated simulates raising and lowering the ramp. The force required for handle movement shall be 1.0 pound +/- 0.5 pounds breakaway and 6.0 pounds +/- 1.0 pound ending. The amount of travel for handle movement shall be 45.0 degrees +/-7.0 degrees.
- k. Night vision goggles shall be functionally replicated as follows: A trainer unique momentary pushbutton switch shall be provided to the driver which ~~will~~shall enable and disable the night vision capability for both the driver and the commander. The commander ~~will~~shall not have independent control of his night vision capability.
- l. Drivers seat shall be fully simulated in the functionality of the operational M981 FIST-V.
- (1) Driver's seat assembly shall be a seat assembly to provide all adjustments and range of motion required for closed hatch driving as on the M981 FIST-V driver's seat assembly. The back rest shall provide back support as on the M981 FIST-V driver's seat back rest.
 - (2) Horizontal control handle shall be a two position lever assembly mechanically connected to lock and release the driver's seat. The horizontal control handle shall mechanically allow the seat to be moved to the front or the rear. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.
 - (3) Vertical control handle shall be a two position lever assembly mechanically connected to lock and release the driver's seat. The vertical control handle shall mechanically allow the seat to be raised or lowered. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.
 - (4) The drivers seat assembly shall be provided with a mechanically operable seat belt.
- m. Brake pedals upper and lower shall be simulated as follows:
- (1) Upper brake pedal shall be operational and functional. The travel distance for pedal movement shall be 4.0 inches +/- 2.0 inches.
 - (2) Lower brake pedal shall be a functional assembly that when operated shall slow and stop the carrier. The force required for pedal movement shall be 4.0 pounds +/- 1.0

pound breakaway and 45.0 pounds +/- 10.0 pounds ending. The travel distance for pedal movement shall be 4.0 inches +/- 2.0 inches.

- n. Beam selector switch shall be a push button switch that when operated shall select high or low headlight beams.
- o. Parking brake handle shall be a two position handle assembly that when operated shall engage and disengage the parking brake. The force required for handle movement shall be 2.0 pounds +/- 1.0 pound breakaway and 12.0 pounds +/- 3.0 pounds ending. The travel distance for handle movement shall be 90 degrees +/- 5 degrees.
- p. Tow start handle shall be a two position handle assembly that is operational but nonfunctional.
- q. Air cleaner indicator shall be simulated using a functional gauge which shall show the status of the air cleaner element with green to red indications.
- r. Hand throttle control shall be a push -pull assembly that when operated shall allow engine speed to be controlled by hand. The force required for handle movement shall be 4.5 pounds +/- 1 pound. The travel distance for handle movement shall be 1.5 inches +/- 0.5 inches.
- s. Driver's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered to be dead.
- t. Driver's Head Tracker - is a trainer unique item which shall provide feedback indicating where the driver's head is located and shall be used for vision block control in the driver's periscopes.
- u. Driver's Level indicator shall be functionally replicated by the following components:
 - (1) Degree scale and dial shall be a gauge indicating the sideward slope of the vehicle. This gauge shall indicate sideslopes up to 20 degrees.
 - (2) Light switch shall be a push and pull switch. This switch shall turn the light above the degrees scale on and off.
 - (3) Lamp shall be a red lamp used to illuminate the dial scale and degree scale.
- v. VFM POWER switch shall be 2-position toggle switch. This switch shall turn the blower in the precleaner and particulate filter assembly on and off.
- w. Ventilated Face Mask Heater shall be functionally replicated as described:

- (4) CONTROL KNOB shall control the status of the Ventilated Face Mask heater lamp.
- (5) POWER LIGHT shall be a green colored indicator. This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.

I.3.1.2.2 Targeting station.

The following buttons, controls, gauges, lights, and switches shall be provided at the Targeting station in the locations and panels as found in the actual M981 FIST-V.

- a. Targeting Station Controls and Display(TSCD) shall be functionally replicated as described:
 - (1) Targeting station display shall be a 12 character 5 ~~by~~ 7 dot matrix display -used to provide information to the targeting station operator.
 - (2) VEH GRID key shall be a pushbutton switch. This switch shall be used to view, modify, and send vehicle position data to the NSG.
 - (3) TGT GRID key shall be a pushbutton switch. This switch shall be used to view and modify target position data stored in the TSCD.
 - (4) '1' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
 - (5) '2' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
 - (6) '3' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
 - (7) HDG key shall be a pushbutton switch. This switch shall be used to display heading (azimuth) and vertical angle of the targeting head when erect and to enter this data into DMD WORD memory. This switch shall be used to display vehicle heading when targeting head is stowed.
 - (8) Blank key shall be a pushbutton switch. This switch shall be nonfunctional.
 - (9) '4' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
 - (10) '5' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.

- (11) '6' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
- (12) DMD WORD key shall be a pushbutton switch. This switch shall be used to view, modify, and send (to the FED) target azimuth (direction), range (slant distance), and elevation (vertical angle) data (known as a DMD word).
- (13) GLLD CODE key shall be a pushbutton switch. This switch shall be used to enter and display the three digit GLLD code required for target designation.
- (14) '7' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
- (15) '8' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
- (16) '9' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
- (17) CALC key shall be a pushbutton switch. This switch shall be used to calculate target position and vehicle position using Universal Traverse Mercator(UTM) Map System.
- (18) CLR key shall be a pushbutton switch. This switch shall be used to clear error messages from the TSCD display. This switch shall also be used to clear a data entry which has not been terminated with ENTR key.
- (19) '+/-' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
- (20) '0' key shall be a pushbutton switch. This switch shall be used to enter numeric instructions or values into the TSCD.
- (21) ENTR key shall be a pushbutton switch. This switch shall be used to enter data into the TSCD memory or to initiate action within the TSCD.
- (22) LAMP TEST/BRT key shall be a pushbutton switch. This switch shall be used to test all labeled TSCD lights including the TSCD display. This switch shall also be used to set lamp brightness.
- (23) Blank key shall be a pushbutton switch. This switch shall be nonfunctional.
- (24) GLLD RET BRT key shall be a pushbutton switch. This switch shall be used to adjust the brightness of LD/R reticle and to control when azimuth and elevation data appears in LD/R reticle display.

- (25) NSG ALIGN key shall be a pushbutton switch. This switch shall be used to initiate NSG alignment.
- (26) TEST key shall be a pushbutton switch. This switch be used to test the operation of the TSCD, LD/R, NSG, and associated circuitry. This switch shall also allow the operator to turn off the fault indicators (VEH BAT, EQP BAT, TSCD FAULT, GLLD FAULT, NSG FAULT) after fault condition has been removed.
- (27) CARGO HATCH lamp shall be a yellow indicator. This lamp shall illuminated during a lamp test.
- (28) EL ABOVE lamp shall be a yellow indicator. This lamp shall illuminate when the targeting head is above proper elevation position for stowing.
- (29) HEAD STOW lamp shall be a white indicator. This lamp shall illuminate when the targeting head is in the stowed position.
- (30) EQP BAT lamp shall be a red indicator. This lamp shall illuminate when the voltage of equipment batteries falls below 21 volts. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.
- (31) VEH BAT lamp shall be a red indicator. This lamp shall illuminate when the voltage of the vehicle batteries falls below 17.5 volts. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.
- (32) NSG FAULT lamp shall be a red indicator. This lamp shall illuminate when a fault occurs in the NSG. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.
- (33) TSCD FAULT lamp shall be a red indicator. This lamp shall illuminate when a fault occurs in the TSCD. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key.
- (34) WPN HATCH lamp shall be a yellow indicator. This lamp shall illuminated during a lamp test.
- (35) LASER INTRPT lamp shall be a yellow indicator. This lamp shall illuminate when any of the following laser interrupt conditions exist:
 - a. ~~A~~ hatch is open.
 - b. ~~S~~
~~sight select switch on the hand controls is set to 3X.~~

c.
~~E~~rect confirm switch within erection arm is not actuated (head not erect)

- (36) EL STOW lamp shall be a white indicator. This lamp shall illuminate when the targeting head is in the proper elevation position for stowing.
- (37) AZ STOW lamp shall be a white indicator. This lamp shall illuminate when the targeting head is in the proper azimuth position for stowing.
- (38) NSG ALIGN lamp shall be a yellow indicator. This lamp shall illuminate when the NSG is in initialization, re-initialization, or realignment mode. This lamp ~~will~~shall flash on and off if the vehicle coordinates have not been entered into the VEH GRID memory since power was last applied to the TSCD.
- (39) GLLD FAULT lamp shall be a red indicator. This lamp shall illuminate when a fault occurs in the LD/R. The lamp shall remain illuminated until turned off via the Error Clear function of the TEST key. This lamp ~~will~~shall flash on and off until the GLLD CODE is entered after TSCD power is applied.
- (40) DRIVER HATCH lamp shall be a yellow indicator. This lamp shall illuminated during a lamp test.
- (41) EL BELOW lamp shall be a yellow indicator. This lamp shall illuminate when the targeting head is below the proper elevation position for stowing.
- (42) HEAD ERECT lamp shall be a green indicator. This lamp shall illuminate when the targeting head is fully erect.
- (43) HEAD READY lamp shall be a green indicator. This lamp shall illuminate when the erection arm locks and the GLLD locks are engaged.
- (44) NSG ON lamp shall be a green indicator. This lamp shall illuminate when the NSG switch is set to ON.
- (45) NSG READY lamp shall be a green indicator. This lamp shall illuminate when the NSG is in the operational mode.
- (46) GLLD ON lamp shall be a green indicator. This lamp shall illuminate when the GLLD switch is set to the RNG 2, RNG 1, or the DES position.
- (47) INTERRUPT switch shall be a two position toggle switch. This switch ~~will~~shall override the laser interrupt conditions when placed in the OVERRIDE position. The switch shall be protected by a hinged cover to prevent accidental activation.

- (48) HEAD switch shall be a two position toggle switch. This switch shall select the position of the targeting head (ERECT or STOW) when DRIVE switch is held in the ON position.
 - (49) DRIVE switch shall be a two position toggle switch spring-loaded to the OFF position. This switch shall turn on the erection drive causing the targeting head to move to the position selected by the HEAD switch when held in the ON position.
 - (50) NSG switch shall be a two position toggle switch. This switch shall turn the NSG on and off. This switch shall be pulled out to set to the ON or OFF positions.
 - (51) TSCD POWER switch shall be a two position toggle. This switch shall turn the TSCD on and off. This switch shall be pulled out to set to the ON or OFF positions.
 - (52) GLLD switch shall be a four position rotary switch. This switch shall control the operating mode of the LD/R as follows:
 - (a) OFF - The OFF position shall remove power from the LD/R.
 - (b) RNG 2 - The RNG 2 position shall be used for determining the position of hard targets.
 - (c) RNG 1 - The RNG 1 position shall be used for determining the position of soft targets.
 - (d) DES - The DES position shall cause the LD/R to operate as a continuous-pulsed laser designator.
 - (53) PUMP switch shall be a two position toggle switch. This switch shall remove power from the targeting station hydraulic pump when set to the DISABLE position. This switch shall be protected by a hinged cover to prevent accidental activation.
- b. Hand Control Assembly shall be functionally replicated as described:
- (1) HAND CONTROL shall be a rotational control assembly and when rotated shall provide the range of motion of the M981 FIST-V hand control assembly. Deflections of the hand control from the center position shall cause the targeting head to rotate. Clockwise deflections (as viewed from above) shall cause the targeting head to rotate in a clockwise direction. Counterclockwise deflections shall cause the targeting head to rotate in the counterclockwise direction. Hand control deadband shall be 12 degrees +/- 4 degrees. Breakaway force of the hand control shall be 0.5 pounds +/- 0.2 pounds applied at the bottom of either handgrip. Ending force shall be 3.75 pounds +/- 1.0 pound applied at the bottom

of either handgrip. Specified breakaway and ending forces shall be apply to deflection in either direction.

- (2) LEFT CONTROL GRIP shall be a rotational control assembly and when rotated shall provide the range of motion of the M981 FIST-V left control grip assembly. Deflections of the left control grip from the center position shall cause the targeting head to elevate or depress. Forward deflections shall cause the targeting head to depress. Rearward deflections shall cause the targeting head to elevate. Left control grip deadband shall be 8 degrees +/- 3 degrees. Breakaway force of the left control grip shall be 1.0 pound +/- 0.5 pounds applied at the highest point on the front of the left control grip. Ending force of the left control grip shall be 3.5 pounds +/- 1.0 pound applied at the highest point on the front of the left control grip. Specified breakaway and ending forces shall be apply to deflection in either direction.
- (3) LEFT LASER FIRING TRIGGER shall be a momentary pushbutton switch. This switch shall be used to fire the LD/R laser when depressed along with the right laser firing trigger.
- (4) LEFT HANDGRIP ACTUATOR SWITCH shall be a momentary pushbutton switch. This switch shall activate the hydraulic system permitting the targeting head to be elevated and/depressed, and turned in azimuth at a slow rate. The switch shall also cause the LD/R to enter the AZ ADJ mode.
- (5) LEFT SLEW SWITCH shall be a momentary pushbutton switch. This switch shall increase the targeting head traversing rate four times.
- (6) RIGHT CONTROL GRIP shall be a rotational control assembly and when rotated shall provide the range of motion of the M981 FIST-V right control grip assembly. Deflections of the right control grip from the center position shall cause the targeting head to elevate or depress. Forward deflections shall cause the targeting head to depress. Rearward deflections shall cause the targeting head to elevate. Right control grip deadband shall be 8 degrees +/- 3 degrees. Breakaway force of the right control grip shall be 1.0 pound +/- 0.5 pounds applied at the highest point on the front of the right control grip. Ending force of the right control grip shall be 3.5 pounds +/- 1.0 pound applied at the highest point on the front of the right control grip. Specified breakaway and ending forces shall be apply to deflection in either direction.
- (7) RIGHT LASER FIRING TRIGGER shall be a momentary pushbutton switch. This switch shall be used to fire the LD/R laser when depressed along with the left laser firing trigger.
- (8) RIGHT HANDGRIP ACTUATOR SWITCH shall be a momentary pushbutton switch. This switch shall activate the hydraulic system permitting the targeting head

to be elevated and/depressed, and turned in azimuth at a slow rate. The switch shall also cause the LD/R to enter the AZ ADJ mode.

- (9) RIGHT SLEW SWITCH shall be a momentary pushbutton switch. This switch shall increase the targeting head traversing rate four times.
 - (10) SIGHT SELECT SWITCH shall be a three position rotary switch. This switch shall select the optics to be viewed through the tank periscope eyepiece. The 13X position shall select the LD/R. The 3X position select the 3X telescope. The NIGHT position shall select the nightsight.
 - (11) TRIGGER LIGHT shall be a red colored lamp. The lamp shall illuminate when both laser firing triggers are depressed.
- c. Azimuth Position Indicator shall indicate the azimuth position of the turret in relation to the vehicle hull.
 - d. Laser Designator/Range Finder shall be functionally replicated as described:
 - (1) RETICLE shall be a visual graphics representation containing the following elements:
 - (a) BURST RESOLUTION SCALE shall be represented. This scale shall measure the error (in mils) of the artillery burst from the target.
 - (b) CROSSHAIRS shall be represented. The crosshairs shall indicate the line-of-sight of the laser beam (where the crosshairs intersect) providing the aiming reference.
 - (c) AZ READOUT shall be represented. This readout shall indicate the azimuth angle in mils (four digits) of LD/R line-of-sight relative to G/VLLD zero azimuth. G/VLLD zero azimuth shall be grid north as determined by the NSG. This function shall be active in RNG 1, RNG 2, and AZ ADJ modes.
 - (d) RNG READOUT shall be represented. This readout shall indicate line-of-sight distance in meters (four digits) between LD/R and the target. This function shall be active in RNG 1 and RNG 2 modes.
 - (e) EL READOUT shall be represented. This readout shall indicate elevation angle in mils (sign and three digits) of LD/R line-of-sight relative to G/VLLD zero elevation. G/VLLD zero elevation shall be horizontal as determined by the NSG. Negative angles shall be preceded by a minus(-), positive angles by a space. EL readout shall be active in RNG 1, RNG 2, and the AZ ADJ modes.

- (f) LASER FAIL INDICATOR shall be represented. This indicator shall be red in color. The indicator ~~will~~shall illuminate when laser output is low. The indicator shall blink on and off when the laser is overheating.
 - (g) BATTERY FAIL INDICATOR shall be represented. This indicator shall be amber in color. This indicator shall illuminate when low battery voltage is detected.
 - (h) FIRE COMMAND INDICATOR shall be represented. This indicator shall be green in color. This indicator shall illuminate when designate signal is received from the FED.
- e. Targeting sight eyecup shall be provided.
- f. Cupola Circuit Breaker Box Controls shall be functionally replicated as described:
- (1) ITU CIRCUIT BRKR SWITCH shall be a two position toggle switch. This switch shall have a safety cover. This switch shall be nonfunctional.
 - (2) TSCD CIRCUIT BRKR SWITCH shall be a two position toggle switch. This switch shall have a safety cover. This switch shall control the power to the TSCD microprocessor and the TSCD internal power supply.
 - (3) TURRET CIRCUIT BRKR SWITCH shall be a two position toggle switch. This switch shall have a safety cover. This switch shall control the power to all turret, erection arm, and targeting head components except the TSCD microprocessor and the TSCD internal power supply.
- g. Fire Interrupt ~~and~~ Intercom Assembly shall be functionally replicated as described:
- (1) EARPHONE VOLUME CONTROL shall be a rotational control. This control shall adjust the volume to the CVC helmet earphone.
 - (2) FIRE INTERRUPT ALARM shall be a audible alarm. This alarm shall sound when the INTERRUPT switch is set to OVERRIDE, or when the GLLD cover is closed and the TSCD is set to RNG 1, RNG 2, or DES.
 - (3) The intercom panel shall contain two jacks to allow connection of a real CVC helmet to the intercom system.
- h. ELAPSED TIME METER shall be a pictorial component which shall provide an example display of the total operating time of the turret in hours.
- i. Targeting Station sight shall display scenes generated by the visual system as specified in Appendix A. The view displayed shall be determined by the position of the SIGHT

SELECT switch on the hand control assembly. When the SIGHT SELECT switch is in the 13X position, the view displayed shall be as if looking through the LD/R. When the SIGHT SELECT switch is in the 3X position, the view displayed shall be as if looking through the 3X telescope. When the SIGHT SELECT switch is in the NIGHT position, the view displayed shall be as if looking through the nightsight. A sensor shall be provided to determine when the sight is in use and when activated, the sight shall display simulated targeting sight imagery.

- j. Targeting Station Cupola Vision Blocks - 7 vision blocks (periscopes) shall be provided to the targeting station which display scenes generated by the visual system as specified in Appendix A.
- k. Smoke Grenade Launcher Controls shall be functionally replicated as described:
 - (1) SMOKE grenade ARM-OFF switch shall be a two position toggle switch. This switch shall energize the smoke grenade circuits when in the ARM position. This switch shall be lever locked in the OFF position.
 - (2) SMOKE grenade POWER ON (ARM) indicator shall be a red colored light. This light shall illuminate when the ARM-OFF switch is in the ARM position.
 - (3) SMOKE grenade FIRE switch shall be a pushbutton switch with a protective skirt. This switch shall fire smoke grenades from the discharger tubes on the exterior of the vehicle.
- l. Nightsight Remote Control Panel shall be functionally replicated as described:
 - (1) ON/OFF SWITCH shall be a two position toggle switch. This switch shall control power to the NIGHTSIGHT FOCUS, CTRS, and BRT controls; and the nightsight remote control panel light.
 - (2) FOV CONTROL shall be a push and pull switch. This switch shall control the FOV(field-of-view) through the nightsight from the targeting station. The FOV shall be set to narrow when the switch is pulled out. The FOV shall be set to wide when the switch is pushed in.
 - (3) FOCUS CONTROL shall be a spring-loaded toggle switch. This switch shall be non-functional.
 - (4) CTRS CONTROL shall be a spring-loaded toggle switch. This switch shall control the contrast of the nightsight from the targeting station.
 - (5) GLLD COVER CONTROL shall be a push and pull switch. This switch shall control operation of the GLLD dust cover. This switch shall open the dust cover when pulled out. This switch shall close the dust cover when pressed in.

- (6) BRT CONTROL shall be a spring-loaded toggle switch. This switch shall control the brightness of the nightsight display from the targeting station.
 - (7) NIGHTSIGHT POWER LIGHT shall be a red colored light. This light shall illuminate the nightsight remote controls when the ON/OFF switch is set to ON.
 - (8) FILTER RESET/STEP switch shall be an operational and non-functional control.
- m. Intercommunication Unit Control shall be replicated and function as described:
- (1) Talk switch shall be a five position rotary switch. This switch shall allow the targeting station operator to select one of the four radios to transmit and receive on, or to select the intercom only.
 - (2) Listen switches shall be four 2-position toggle switches. These switches allow the targeting station operator to select up to four radios to receive only. When the switch is in the up position, that radio ~~will~~shall be monitored.
 - (3) Volume switch shall be a rotational control. This switch shall control the volume level of the intercom control unit.
- n. Ventilated Face Mask Heater shall be functionally replicated as described:
- (1) CONTROL KNOB shall control the status of the Ventilated Face Mask heater lamp.
 - (2) POWER LIGHT shall be a green colored indicator. This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.
- o. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to while, by using a physical block, until button is pressed allowing transversal. The panel shall contain a blackout light and a white light.
- p. Commander's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the commander is considered to be wounded; a red lamp shall be illuminated when the commander is considered to be dead.
- q. Commander's Head Tracker is a trainer unique item which shall provide feedback indicating where the commander's head is located and shall be used for vision block control in the commander's cupola.
- r. Targeting Station seat shall be fully simulated in the functionality of the operational M981 FIST-V.

- (1) Targeting station seat assembly shall be a seat assembly to provide all adjustments and range of motion required as on the M981 FIST-V targeting station seat assembly.
 - (2) Seat adjustment handle shall mechanically allow the seat to be moved to be raised or lowered. When positioned correctly, the handle shall be released to lock the seat in place.
- s. Cupola controls shall allow for the simulated movement of the commanders cupola gun ring and control of the M60 machine gun.
- (1) A trainer unique device shall be provided which allows for the movement of a simulated M60 machine gun sight horizontally and vertically within the commander vision blocks.
 - (2) A fire button shall be provided that allows for the simulated firing of the M60 machine gun.
- t. ROUNDS IN STORAGE - Shall be a trainer unique panel used to monitor the storage and control the removal of ammo cans from the 7.62 mm ammo storage area. The following components shall be provided:
- (1) ROUNDS IN STORAGE shall be a 4 digit display that indicates the simulated number of ammo cans in the ammo storage area.
 - (2) FILL WEAPON AMMUNITION BOX shall be a pushbutton switch that initiates the simulated transfer of ammo from the storage area to the M60 machine gun ammunition box.
- u. ROUNDS IN AMMUNITION BOX - shall be a trainer unique panel indicating the number of rounds in the ammunition box.
- v. MACHINE GUN - shall be a trainer unique panel used to control and monitor the loading and unloading of the M60 machine gun. The following components shall be provided:
- (1) LOAD and/ UNLOAD shall be a pushbutton switch that when depressed ~~will~~shall initiate the loading of the M60 machine gun if unloaded and unload the M60 machine gun if loaded.
 - (2) LOADED indicator shall be a green indicator that illuminates when the M60 machine gun is loaded. The indicator shall flash during the simulated load time.

- (3) UNLOADED indicator shall be a green indicator that illuminates when the M60 machine gun is unloaded. The indicator shall flash during the simulated unload time.
- w. Utility light shall be functional as follows:
 - (1) Brightness Selector shall vary the light intensity from OFF to full brightness.
 - (2) Momentary On Switch shall, when depressed, turn the light to maximum brightness
 - (3) Light Selector shall rotate to select white floodlight, white spotlight, red floodlight or red spotlight.
- x. Hydraulic pressure gauge shall be functional assembly. Hydraulic pressure gauge shall display current system hydraulic pressure. The gauge is divided into 0 to 3 with 10 dashes between each number, numbers are X1000 PSI.
- y. Manual Hydraulic Pump Handle shall be a functional assembly. The handle shall increase the pressure by 100 psi each time it is moved the full distance to a max of 1900 psi.

I.3.1.2.3 Communication station.

The following buttons, controls, gauges, lights, and switches shall be provided at the Communication station in the locations and panels as found in the actual M981 FIST-V.

- a. Audio Frequency Amplifier (AM 1780/VRC) shall be functionally replicated as follows:
 - (1) MAIN PWR switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “NORM”, “INT ONLY”, and “OFF”. No radio transmission shall be possible when MAIN PWR switch is in INT ONLY position. The entire communications system shall be turned off when MAIN PWR switch is in OFF position.
 - (2) INT ACCENT switch shall be a two position rotary switch with pointer knob and active positions labeled “ON” and “OFF”. Intercom and radio sound levels shall be equal when INT ACCENT switch is set to OFF. Radio sound levels shall be lower than intercom when INT ACCENT switch is set to ON.
 - (3) RADIO TRANS switch shall be a three position rotary switch with pointer knob and shall have active positions labeled “CDR + CREW”, “CDR ONLY”, and “LISTENING SILENCE”. Entire crew shall be able to transmit on radio with RADIO TRANS switch in CDR + CREW position. Only tank commander shall be able to transmit on radio when RADIO TRANS switch is in CDR ONLY position. No radio transmission shall be possible with RADIO TRANS switch in LISTENING SILENCE position.

- (4) POWER CKT BKR switch shall be a two position trippable toggle type circuit breaker.
 - (5) POWER light shall be a green lamp and shall indicate when power is applied to the communication system.
 - (6) INSTALLATION switch shall be a three position rotary switch requiring a flat blade screwdriver to change switch setting and shall have active positions labeled "INT ONLY", "OTHER", and "RETRANS".
 - (7) AUDIO INPUT jacks shall be non-operational and non-functional.
 - (8) LINE jacks shall be non-operational and non-functional.
- b. Intercommunication Unit Control shall be replicated and function as described:
- (1) Talk switch shall be a five position rotary switch. This switch shall allow the communication station operator to select one of the four radios to transmit and receive on, or to select the intercom only.
 - (2) Listen switches shall be four 2-position toggle switches. These switches allow the communication station operator to select up to four radios to receive only. When the switch is in the up position, that radio ~~will~~shall be monitored.
 - (3) Volume switch shall be a rotational control. This switch shall control the volume level of the intercom control unit.
- c. Forward Entry Device (FED) shall provide the ability to send and receive messages. The FED shall interface with the SINCGARS radio to send and receive messages. The FED shall interface with the FIST-V TSCD to locate and laser designate targets.
- d. The SINCGARS (RT-1523A) shall be compatible with organizational requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units. The M981 FIST-V shall have four (4) SINCGARS radios. Each radio shall simulate the following controls:
- (1) ANT connector shall be a dummy 3-D connector which shall have a dummy cable. On vehicular installations that provide a long range (lower) radio the dummy cable shall connect to the RF power amplifier. On the short range (upper) radio the dummy cable shall connect to the chassis (representing connecting to vehicle antenna).

- (2) CHAN (channel) switch shall select manual, preset and cue frequencies. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:
- (a) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.
 - (b) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.
 - (c) 1 - This position shall allow the operator to preset an SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (d) 2 - This position shall allow the operator to preset an SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (e) 3 - This position shall allow the operator to preset an SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (f) 4 - This position shall allow the operator to preset an SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (g) 5 - This position shall allow the operator to preset an SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (h) 6 - This position shall allow the operator to preset an SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
- (3) RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:
- (a) LO - This position shall set the transmission power to low.

- (b) M - This position shall set the transmission power to medium.
 - (c) HI - This position shall set the transmission power to high.
 - (d) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.
- (4) MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:
- (a) SC - This position shall set the receiver/transmitter to SC (single channel) mode.
 - (b) FH - This position shall set the receiver/transmitter to FH (frequency hopping) mode.
 - (c) FH-M - This position shall set the receiver/transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.
- (5) RXMT connector shall be a dummy 3-D connector with a fixed dummy cable connected to the RXTM on the other RT (if it exists) in the radio mount.
- (6) FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:
- (a) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.
 - (b) TST - This position shall cause the normal self-test indications to be displayed on the keyboard display.
 - (c) LD - This position shall load SC frequencies, and shall also allow the operator to receive ERF data from an RT operating in the FH-M mode.
 - (d) SQ ON - This position shall turn on the RT and activate the squelch.
 - (e) SQ OFF - This position shall turn on the RT and deactivate the squelch.
 - (f) RXMT - This position shall be non-functional.
 - (g) REM - This position shall disable the RT's front panel controls.

- (h) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.
 - (i) OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.
- (7) DIM Control - This shall be an active control which replicates the appearance and function of the corresponding actual knob.
- (8) Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 X 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 X 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. An eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.
- (9) Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:
- (a) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.
 - (b) * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.
 - (c) SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.
 - (d) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.
 - (e) DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.
 - (f) 5 - Shall enter the number '5' into the system.
 - (g) 6 - Shall enter the number '6' into the system.
 - (h) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load and/ check SC offset frequencies.

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- (i) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.
 - (j) 8 - Shall enter the number '8' into the system.
 - (k) LOUT 9 - Shall enter the number '9' into the system. ~~Shall also and~~ retrieve frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.
 - (l) TIME - Shall be used to check RT FH sync time clock.
 - (m) CLR - Shall clear data from display if error was made during entry. Shall also be used to clear data from RT memory.
 - (n) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also be used to enter the number '0' into the system.
 - (o) STO - Shall transfer data from RT holding memory onto permanent memory.
 - (p) BATT CALL - Shall be non-functional.
- (10) COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:
- (a) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.
 - (b) CT - This position shall place the RT into cipher text mode.
 - (c) TD - This position shall be non-functional.
 - (d) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.
 - (e) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.
- (11) VOL WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.
- (12) HUB Connector - Dummy cover that shall not be removable.
- (13) AUD/FILL connector shall be a dummy 3-D connector.

- (14) AUD/DATA connector shall be a dummy 3-D connector. In vehicular installations, a dummy cable shall connect the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter. In the M981 FIST-V radios which are used by the FED, dummy cables shall not connect to the DATA A or DATA B connectors on the mounting adapter.
- e. Each SINCGARS radio shall be mounted in a short/long range radio configuration. The M981 FIST-V shall contain two of the short/long radio configurations.
- (1) Each mounting shall replicate the AN/VRC-89A configuration which contains the following components:
- (a) Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
 - (b) Amplifier, Radio Frequency AM-7238A/VRC.
 - (c) Receiver-Transmitter, Radio RT-1523A.
 - (d) Receiver-Transmitter, Radio RT-1523A.
 - (e) Loudspeaker Control Unit, LS-671/U (only 1 per four radios).
- (2) The mounting adapter shall have two (2) SINCGARS receiver-transmitters as described above. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components.
- (a) CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.
 - (b) Indicator lamp and lens shall be a green colored dimmable indicator. The indicator shall flash for 3 +/- 1 second after CB1 switch is moved to ON position, then stay lit. The lens shall allow the indicator to be dimmed by turning clockwise.
 - (c) The (AUD/DATA B J2) connector shall be a 3-D dummy connector.
 - (d) The (AUD/DATA A J3) connector shall be a 3-D dummy connector.
 - (e) The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.
 - (f) The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.
 - (g) The (SPKR J6) connector shall be a 3-D dummy connector.

- (3) The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components.
 - (a) The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.
 - (b) The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the mounting adapter shall be connected to the J2 connector.
- f. Ventilated Face Mask Heater shall be functionally replicated as described:
 - (1) CONTROL KNOB shall control the status of the Ventilated Face Mask Heater lamp.
 - (2) POWER LIGHT shall be a green colored indicator. This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.
- g. Dome light shall be simulated and fully functional. The panel shall have a three position rotary switch which selects blackout or white light. The switch shall have a spring loaded, mechanical only, release button which shall prevent motion from blackout to white, by using a physical block, until button is pressed allowing traversal. The panel shall contain a blackout light and a white light.
- h. Communication station seat shall be fully simulated in the functionality of the operational M981 FIST-V.
 - (1) Communication station seat assembly shall be a seat assembly to provide all adjustments and range of motion required as on the M981 FIST-V seat assembly.
 - (2) Horizontal control handle shall be a two position lever assembly mechanically connected to lock and release the seat. The horizontal control handle shall mechanically allow the seat to be moved to the front or the rear. The handle shall be pulled up while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.
 - (3) Vertical control handle shall be a two position lever assembly mechanically connected to lock and release the seat. The vertical control handle shall mechanically allow the seat to be moved to be raised or lowered. The handle shall be pulled out while the correct position is being selected. When positioned correctly, the handle shall be released to lock the seat in place.
- i. Communication Officer's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the communication officer is

considered to be wounded; a red lamp shall be illuminated when the communication officer is considered dead.

- j. Utility light shall be functional.
 - (1) Control knob shall be a functional assembly which controls light intensity.
- k. Electrical Transient Suppressor shall be functionally simulated as follows:
 - (1) Circuit Breaker Switch shall be a two position toggle switch. The ON position shall enable use of the intercom system and SINCGARS radios. The OFF (circuit breaker tripped) position shall disable use of the intercom system and SINCGARS radios.
 - (2) Battle Override Switch shall be a two position guarded toggle switch. When the Circuit Breaker Switch is in the OFF (circuit breaker tripped) position, placing the Battle Override Switch in the OVERRIDE position shall enable use of the intercom system and the SINCGARS radios.

I.3.1.2.4 Observation Station.

The following buttons, controls, gauges, lights, and switches shall be provided at the observation station in the locations and panels as found in the actual M981 FIST-V.

- a. Panoramic Telescope shall display scenes generated by the visual system as specified in Appendix A. The panoramic telescope shall be functionally replicated as described:
 - (1) Azimuth Handwheel control shall be an active assembly and shall rotate the telescope line-of-sight to the left and right.
 - (2) Elevation Handwheel control shall be an active assembly and shall rotate the telescope line-of-sight up and down.
 - (3) Eyecup shall be provided.
 - (4) Humidity indicator shall be operational but nonfunctional.
 - (5) Focus control shall be a functional assembly allowing for the simulated focus of the panoramic telescope.
- b. Intercommunication Unit Control shall be replicated and function as described:
 - (1) Talk switch shall be a five position rotary switch. This switch shall allow the observation station operator to select one of the four radios to transmit and receive on, or to select the intercom only.

- (2) Listen switches shall be four 2-position toggle switches. These switches allow the observation station operator to select up to four radios to receive only. When the switch is in the up position, that radio ~~will~~shall be monitored.

Volume switch shall be a rotational control. This switch shall control the volume level of the intercom control unit.

- c. Ventilated Face Mask Heater shall be functionally replicated as described:
 - (1) CONTROL KNOB shall control the status of the Ventilated Face Mask Heater lamp.
 - (2) POWER LIGHT shall be a green colored indicator.
 - (3) This light shall illuminate when the Ventilated Face Mask Heater control knob is in the on position.
- d. Observation station seat shall be fully simulated in the functionality of the operational M981 FIST-V.
 - (1) Observation station seat assembly shall be a seat assembly to provide all adjustments and range of motion required as on the M981 FIST-V.
 - (2) Height adjustment pin shall be a mechanical pin to lock the observation station seat in any of five different heights.
- e. Observer's Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the observer is considered to be wounded; a red lamp shall be illuminated when the observer is considered dead.

I.3.1.2.5 Other Controls.

The following buttons, controls, gauges, lights, and switches shall be provided in the locations and panels as found in the operational M981 FIST-V.

- a. Ventilating Fan shall be replicated and function as described:
 - (1) Power receptacle - This connector shall be a dummy receptacle with one discrete input which shall provide hookup for power cable.
 - (2) ON/OFF switch - This switch shall be a two position toggle switch with two discrete inputs which shall be used to turn on and off the ventilating fan.

I.3.1.2.6 Trainer Unique.

Simulated Compass (grid azimuth indicator) shall be a four digit display depicting the orientation, in mils, of the long axis of the vehicle on the simulated terrain referenced to grid

north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

I.3.1.2.7 External interface unit.

The M981 FIST-V manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The EIU shall be used to control and monitor the following functions:

- a. Exercise number.
- b. Vehicle identification number.
- c. Notification of self-repairs being completed.
- d. Initiation and termination of fuel transfers.
- e. Initiation and termination of ammo transfers.
- f. Connection and disconnection of a tow kit to another vehicle.
- g. External munitions loading.
- h. Damage assessment.
- i. Load SINCGARS hopset and COMSEC data.

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APPENDIX J

HMMWV MANNED MODULE

J.1. SCOPE.

This appendix establishes requirements for the High Mobility Multipurpose Wheeled Vehicle (HMMWV) manned module. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

J.2. APPLICABLE DOCUMENTS.

(This section is not applicable to this appendix.)

J.3. REQUIREMENTS.

J.3.1 HMMWV Simulator Module.

The HMMWV simulator shall be designed to replicate the performance characteristics of the HMMWV and associated system as described in J.3.1.1 through J.3.1.2.2. The HMMWV module shall operate in two modes the driver mode and the observer mode. The driver's position shall be the primary function when the HMMWV is in the driver mode and the observer's position shall be the primary function when the HMMWV is in the observer mode. The visual system shall function in either mode with the restrictions indicated in paragraph J.3.1.1.1. The Unit Maintenance Collection Point (UMCP) shall have the ability to tether a designated HMMWV to the Combat Service Support (CSS) supply vehicles. Then, the HMMWV provide "leader-follower" capability through the use of tethering. When the designated HMMWV is within a 200 +/- 10 meter radius of a fuel truck, ammunition truck, or maintenance truck, the HMMWV shall be able to tether to the vehicle and lead one or more of these vehicles to a desired location. The HMMWV module shall be either a M1025 or a M1043 vehicle as determined during initialization by the Master Control Console (MCC).

J.3.1.1 Performance Characteristics.

The following paragraphs contain the detailed performance requirements that shall be provided with the HMMWV simulator system. The HMMWV manned module shall also meet the generic design requirements of section 3.6.

J.3.1.1.1 Visual Display System.

The visual display system shall meet the requirements stated in Appendix A. The HMMWV simulator visual system shall function in both the driving mode and the dismounted mode, as indicated in the following ~~statements~~:

- a. In the driver mode the HMMWV simulator shall have 108 degrees horizontal field of view and 30 degrees vertical field of view.
- b. In the observer mode the HMMWV simulator shall have 108 degrees horizontal field of view and 30 degrees vertical field of view. The visual shall be able to slew 360 degrees to the right or to the left and slew in pitch 90 degrees up and 45 degrees down. The eye point shall be from either the standing, kneeling, or

prone position. In the dismounted mode the observer shall have the ability to move across the terrain in any direction. The observer shall have the ability to move away from the HMMWV and turn around and see the HMMWV in the visual. The observer shall have the ability to fire the weapons listed in paragraph J.3.1.1.2.1 in the dismounted mode that were initiated. The observer position shall have a digital direction indicator available while in the dismounted mode.

J.3.1.1.2 HMMWV Weapons System.

The vehicle weapons system for the HMMWV simulation system shall have the capability for target sighting, aiming, firing and reloading of the weapons listed in paragraph J.3.1.1.3. The HMMWV shall be initialized with one or a combination of the weapons listed in paragraph J.3.1.1.3. The simulated vehicle weapons system components shall replicate the operational equipment in both design and performance. These components in combination with the other simulated systems in the HMMWV simulation system shall provide the crew the capability to engage targets from a stationary position and in the dismounted mode.

J.3.1.1.3 HMMWV Weapons and Ammunition.

The HMMWV simulation system shall simulate the following weapons and ammunition during vehicle stationary operations:

- a. MK-19 40 mm automatic gun (M430 linked grenades).
- b. M249 SAW (5.56mm ball and linked tracer A064).
- c. M60 Machine Gun (7.62mm A141 Ball, Tracer).
- d. .50 caliber machine gun (A534 API-T).

J.3.1.1.3.1 Dismount Weapons and Ammunition.

The HMMWV simulation system shall simulate the following weapons and ammunition during Dismounted Infantry (DI) operations:

- a. M249 SAW (5.56mm ball and linked tracer A064).
- b. M60 Machine Gun (7.62mm A141 Ball, Tracer).

J.3.1.1.4 Support Systems.

J.3.1.1.4.1 Electrical Systems.

The electrical system shall be capable of the following operation states:

- a. Engine off.
- b. Engine running, alternator working.

- c. Engine running, alternator not working.

Based on which operating state the electrical system is in, the associated problems and abilities shall be reflected in the HMMWV simulation system. These problems and abilities shall be replicated in the HMMWV simulation systems just as they would occur in the operational equipment.

J.3.1.1.5 Depletable Resource Management.

Depletable resource management shall cover the management, consumption, and resupply of both fuel and ammunition. The HMMWV shall be resupplied from an infantry vehicle, a scout vehicle or a supply vehicle. Resupply shall be coordinated through the Administrative Logistics Center (ALOC). The fuel for the HMMWV simulation system shall be based on the fuel contained in the HMMWV's fuel tank. Resupply of fuel shall be accomplished through coordination with the ALOC. The maximum ammunition capacity for the HMMWV simulation system shall be based on the storage capabilities of the actual HMMWV for the weapons listed in paragraph J.3.1.1.3. The identification, transfer, and resupply of ammunition shall be the responsibility of the squad leader. Resupply of ammunition shall be coordinated through the ALOC. In all cases, the monitoring of, use of, and resupplying of the HMMWV's fuel and ammunition shall be based on the implementation of representative time and depletion parameters.

J.3.1.1.5.1 Depletable Resource Management Parameters.

These parameters shall include:

- a. Transfer times.
 - (1) Fuel from a fuel carrier or fuel pre-stock to the HMMWV.
 - (2) Ammunition from an ammunition truck.
 - (3) Reload times for the weapons listed in paragraph J.3.1.1.3.
 - (4) Ammunition transfer from a manned module with compatible ammunition.
- b. Depletions rates.
 - (1) Fuel available related to HMMWV consumption rate.
 - (2) Ammunition basic allowance for the various weapons in paragraph J.3.1.1.3.

J.3.1.1.6 Damage and Failure.

The list of components that shall be modeled for combat damage, stochastic failures and deterministic failure shall be as defined in Table J-I.

Table J-I. HMMWV Failures and Damage			
Component/System	Deterministic	Stochastic	Combat Damage
Air Filter		X	
Alternator		X	X
Antenna A and B			X
Batteries		X	X
Brake Non-hydraulic		X	
Driver			X
Drown	X		
Engine Assembly		X	X
Engine Cooling System		X	
Fuel System		X	
Glow Plug	X	X	
Hydraulic Steering		X	X
Left Roadwheel 1		X	X
Left Roadwheel 2		X	X
Machine Gun Inoperative		X	
Observer			X
Radio A		X	X
Radio B		X	X
Right Roadwheel 1		X	X
Right Roadwheel 2		X	X
Rollover	X		
Transfer Case		X	X
Transmission Assembly		X	X

J.3.1.1.7 Sound Generating System.

A sound and vibration generation system shall be provided. The sound system shall be completely separate from the communication system, and the sounds and vibrations shall be presented independently from any headphone system. The sounds and vibrations shall be of such fidelity, quality, realism, and volume that the driver and observer shall experience the cues, stresses, and distractions of a “real life” combat situation. The

sounds shall be of sufficient volume so that the distractions provided equal that found in an actual situation, but in no case shall 81 dB be exceeded for steady state noise (measured external to the CVC helmet). Table J-II lists the sound cues that shall be provided in the HMMWV simulation system.

Table J-II. HMMWV Sound Cues	
SOUND CUE	
Engine cranking	
Engine start to idle	
Engine stop	
Engine noise related to Revolutions Per Minute (RPM)	
Transmission noise related to RPM	
Horn	
Collisions with objects (scraping and hard collisions)	
.50 Caliber Machine Gun firing	
MM-19 40mm automatic weapon firing	
M60 Machine gun firing	
M249 SAW firing	
Tire noise related to wheel speed for terrain types simulated in CCTT	
Friendly and hostile main gun fire	
Friendly and hostile missile launch	
Friendly and hostile rocket launch	
Generic explosive sound (main gun, missile, rocket) hit	
Generic explosive sound (main gun, missile, rocket) miss	
Generic kinetic round hit	
Friendly and hostile machine gun fire - large caliber	
Friendly and hostile machine gun fire - small caliber	
Friendly and hostile mine hit	
Friendly and hostile bomb hit	
Friendly and hostile bomb miss	
Friendly and hostile artillery hit	
Friendly and hostile artillery miss	
Wheeled vehicle - large class	
Wheeled vehicle - small class	

Table J-II. HMMWV Sound Cues
SOUND CUE
Tracked vehicle
Aircraft - rotary wing class
Aircraft - fixed wing class

J.3.1.1.7.1 Sound Synchronization.

The sound system shall be synchronized with the visual displays and the HMMWV controls within the system latency requirements, as defined in paragraph 3.2.2.1 and within the module latency requirements, as defined in paragraph 3.2.2.2.

J.3.1.1.7.2 Sound Generator.

The sound generation system shall have the ability of generating a minimum of eight sounds simultaneously with full parametric control of frequency and volume. The sound generation system shall meet the spare input and I/O output channel requirements of 3.7.3.1.4.

J.3.1.1.7.3 Spatial Positioning.

The sound system shall provide for spatial positioning of the sound cues. The sounds shall be synchronized with the actions causing the sounds and shall be presented to allow personnel the ability to identify the spatial positioning (direction, amplitude as a function of distance and time delay as a function of distance) of the events causing the sounds.

J.3.1.1.7.4 Sound Quality.

The sound generator shall provide sound cues over a frequency range of 30 Hz to a minimum of 12,000 Hz, +/- 3 dB.

J.3.1.1.8 Communication System.

A communication system shall be provided to the HMMWV simulation system as described in section 3.7.6 of this specification.

J.3.1.2 Physical Characteristics.

The following paragraphs contain the detailed physical requirements for the individual crew positions within each HMMWV simulator module. The HMMWV crew compartment shall exist as a consolidated enclosure for the driver, and observer positions. The module enclosure base shall provide support for all module components and shall incorporate forklift provisions to facilitate handling and transportation. The HMMWV modules shall provide the controls, switches, indicators, and space constraints required to meet the training tasks while avoiding negative training. Some of these items shall be fully replicated while others shall be mock-ups to provide the tactile sensations and space constants of the actual vehicle.

J.3.1.2.1 Controls and Indicators.

The following paragraphs list the controls and indicators that shall be provided for the individual crew position within each HMMWV simulator. Realistic control loading and physical limits of travel shall be provided for simulated crew member controls, such as pedals, handles, and steering wheel. The functional controls, indicators, and other pieces of equipment shall have the proper coloring and labels.

J.3.1.2.1.1 Driver's Position.

The following buttons, controls, gauges, lights, and switches shall be provided at the driver's position in the locations and panels as found in the actual HMMWV.

- a. The following controls, indicators and other pieces of equipment shall be simulated as follows:
 - (1) Panel gauges:
 - (a) Speedometer ~~and~~ Odometer - This indicator shall be a gauge with a range of 0 - 60 MPH (0 - 100 KPH) and shall indicate the vehicle speed. The Odometer shall simulate the distance the vehicle has traveled in miles.
 - (b) Engine Temperature gauge - This indicator shall be a gauge with a range of 120 - 240 degrees Fahrenheit and shall indicate the engine temperature of the vehicle.
 - (c) Vacuum gauge - This indicator shall have the following components:
 - 1) Vacuum gauge meter - This gauge shall indicate the air flow restriction in the vehicle's engine air intake system.
 - 2) Reset button - This button shall reset the vacuum gauge meter.
 - (d) Fuel gauge - This indicator shall be a gauge with a range of E - F that shall indicate the fuel level in the vehicle's fuel tank.
 - (e) Oil Pressure gauge - This indicator shall be a gauge with a range of 0 - 120 that shall indicated the oil pressure of the vehicle.
 - (f) Electrical System Indicator - This indicator shall be a gauge that indicates the condition of the vehicle's electrical system.
 - (2) Parking Brake Lever - This lever shall utilize a functional assembly used to engage and disengage the parking brake for the vehicle. The force required for activation shall be 5.0 pounds +/- 2.0 pounds breakaway and 35.0

pounds +/- 5.0 pounds ending. The release force shall be 12.0 pounds +/- 3.0 pounds

- (3) Parking Brake Light - This indicator shall illuminate when the parking brake has been applied. It shall be a red lamp.
- (4) Steering Control - The steering control shall utilize a control assembly with 5.0 pounds +/- 1.0 pound steering force. Deflection of the control from center position shall command the vehicle to turn. This assembly shall also simulate the actual force necessary to turn the wheel as in the real vehicle.
- (5) Transmission Shift Lever - This lever shall have five positions simulating the movement of the transmission range selector for the actual vehicle. The lever shall simulate the reverse, neutral, drive, second and first positions including a push button on the end of the handle which ~~will~~shall engage ~~and~~disengage the locking feature of the handle. The handle's position shall be monitored by discrete inputs.
- (6) Transfer Case Shift Lever - This lever shall have four positions simulating the movement of the transfer case shift lever. This lever shall be used to select the following driving ranges:
 - (a) H - High range,
 - (b) H/L - High Locked range,
 - (c) L - Low range,
 - (d) N - Neutral.
- (7) Accelerator Pedal - This pedal shall incorporate a control assembly providing 2.5 pounds +/- 1.0 pound breakaway and 35.0 pounds +/- 5.0 pounds ending force.
- (8) Brake Pedal - This pedal shall be a functional assembly used to activate the braking action of the vehicle. A 5.0 pounds +/- 2.0 pounds breakaway and 35.0 pounds +/- 5.0 pounds ending force shall be provided.
- (9) Engine Function Switch - This three position switch shall provide the following engine control functions: These positions shall provide the computer system with one digital input for each position to allow the system to determine which function is being selected.
 - (a) "ENG STOP" - Shall stop the engine.

- (b) “RUN” - Shall simulate the activation of the engine’s glow plugs.
- (c) “START” - Shall simulate the engine’s starter and starting sequences.
- (10) Wait-to-Start Lamp - shall be an amber lamp that illuminates when the glow plugs are activated and is extinguished when the vehicle’s engine is ready to be started.
- (11) Manual Throttle Control - This handle shall utilize a control assembly that shall change the speed of the engine when forces are applied to the handle.
- (12) Night Vision Capability (Driver) - Night vision shall be implemented utilizing the existing visual displays. A trainer unique momentary pushbutton switch shall be provided to the driver which ~~will~~shall enable and disable the night vision capability for the driver.
- (13) Driver’s Seat - Shall be functionally replicated. The seat shall have a full range of motion and adjustments as on the actual vehicle.
- (14) Driver’s Seat belt - The driver’s seat shall be provided a mechanically operable seat belt
- (15) Inside Light - The driver’s position shall include a lamp in which the inside of the vehicle module can be illuminated.
- (16) Driver ~~or~~ Observer - This switch shall be used to switch the trainer between driver’s mode and observers mode. Each mode shall only be activated when the vehicle/observer is in the proper configuration.
- (17) Windshield Wiper Control - This device shall be a three position rotary knob for HIGH, LOW and OFF operations of the windshield wipers. The windshield wiper control shall be physically replicated, but non-functional.
- (18) Driver’s Condition indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the driver is considered to be wounded; a red lamp shall be illuminated when the driver is considered dead. Indicators shall be located in a position where both the observer and driver can observe the indicators.
- (19) Light switch assembly - shall be simulated and fully functional.
 - (a) Panel light switch shall be a four position rotary switch which shall control the panel lights as follows:
 - 1) PANEL BRT position: Panel lights are brightly lit

- 2) OFF position: Panel lights are off.
 - 3) DIM position: Panel lights are dimly lit.
 - 4) PARK position: Stop lights and tail lights are lit.
- (b) Lights UNLOCK switch shall be a spring-loaded, two-position lever. When held in the UNLOCK position, this lever ~~will~~shall allow Driving Lights switch to be moved from BO MARKER to BO DRIVE, from OFF to STOP LIGHTS, and from STOP LIGHTS to SERVICE DRIVE. The lever shall return to the locked position when released.
- (c) Driving lights ~~and/~~ main lights switch shall be a five position rotary switch which shall control exterior lights as follows:
- 1) B.O. DRIVE position: Enables the I.R. - B.O. SELECT switch to choose either infrared or blackout mode for night driving
 - 2) B.O. MARKER position: Blackout marker lights are lit. Blackout stoplight lights when brakes are applied
 - 3) OFF position: All exterior lights are off
 - 4) STOPLIGHT position: Stoplight lights when brakes are applied
 - 5) SERvice DRIVE position: Service headlights and taillights are lit. Stoplight lights when brakes are applied.

(20)Horn Button - shall be physically and functionally replicated. Horn sound shall only be audible within the HMMWV module.

b. The following controls, indicators and other pieces of equipment shall be physically represented (operational but non-functional):

- (1) Foot activated dimmer switch,
- (2) Turn Signal lever.

J.3.1.2.1.2 Observer Position.

The observer position shall have the following controls, switches, gauges, buttons and lights:

J.3.1.2.1.2.1 Dismounted Mode.

The observer position shall have the following controls, functional during the dismounted mode:

- a. There shall be a control device for movement across the terrain and slewing the visual display.
- b. There shall be a control device for selecting the eye points specified in J.3.1.1.9.b.
- c. There shall be a digital direction indicator.
- d. There shall be a control device to employ the weapons listed in paragraph J.3.1.1.3 (means for sighting the weapons in the visual display).
- e. Shall have a seven power binocular and night vision capability. The seven power binocular viewing and night vision capability shall be active only in the dismounted mode.
- f. A Plan View Display (PVD) shall be provided.

J.3.1.2.1.2.2 Mounted and /Dismounted Controls.

The observer position shall have the following controls, functional during the mounted and dismounted mode:

J.3.1.2.1.2.2.1 SINCGARS Radio.

SINCGARS Radio - The SINCGARS (RT-1523A) shall be compatible with organizational requirements except as indicated in 3.7.6 for vehicle and headquarters radio configurations and shall allow for communication with the Operations Center (OC) and other desired units.

J.3.1.2.1.2.2.1.1 Radio Controls.

It shall simulate the following controls:

- a. ANT connector shall be a dummy 3-D connector which shall have a dummy cable. The long range (lower) radio shall connect to the RF power amplifier. The short range (upper) radio shall connect to the chassis (representing connecting to the vehicle antenna).
- b. CHAN (channel) switch shall select manual, preset and cue frequencies. This switch shall be an 8 - position rotary switch with pointer knob which utilizes the following positions:
 - (1) CUE - This position shall allow the operator to preset SC frequency for the CUE channel or select the preset CUE frequency.
 - (2) MAN - This position shall allow the operator to preset SC frequency for the MAN channel or select the preset MAN frequency.

- (3) 1 - This position shall allow the operator to preset a SC frequency for channel 1. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 1. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (4) 2 - This position shall allow the operator to preset a SC frequency for channel 2. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 2. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (5) 3 - This position shall allow the operator to preset a SC frequency for channel 3. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 3. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (6) 4 - This position shall allow the operator to preset a SC frequency for channel 4. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 4. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (7) 5 - This position shall allow the operator to preset a SC frequency for channel 5. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 5. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
 - (8) 6 - This position shall allow the operator to preset a SC frequency for channel 6. This position shall also select the preset SC frequency when in SC mode and the FH hopset when in FH mode for channel 6. The loading of preset FH channels or COMSEC keys shall be simulated using the external interface unit.
- c. RF PWR switch shall be a 4 position rotary switch with pointer knob, with the following positions:
- (1) LO - This position shall set the operation of transmission power to low.
 - (2) M - This position shall set the operation of transmission power to medium.
 - (3) HI - This position shall set the operation of transmission power to high.

- (4) PA - This position shall set the operation of transmissions for use with the power amplifier, or high power if power amplifier is not connected to the RT.
- d. MODE Switch - This switch shall be a 3 - position rotary switch with pointer knob, with the following positions:
 - (1) SC - This position shall set the receiver/transmitter to SC (single channel) mode.
 - (2) FH - This position shall set the receiver/transmitter to FH (frequency hopping) mode.
 - (3) FH-M - This position shall set the receiver/transmitter to FH-M (frequency hopping master) mode. The operator shall be required to pull the switch to go into the FH-M position.
 - e. RXMT connector shall be a dummy 3-D connector.
 - f. FCTN(function) Switch - This switch shall be a 9 - position rotary switch with pointer knob, with the following positions:
 - (1) STBY - This position shall turn off receiver/transmitter (RT) while maintaining memory. The operator shall be required to pull the switch knob in order to go to the STBY position.
 - (2) TST - This position shall cause the normal self test indicators to be displayed on the keyboard display.
 - (3) LD - This position shall load SC frequencies, and shall also allow the operator to receive ERF data from a RT operating in FH-M mode.
 - (4) SQ ON - This position shall turn on the RT and activate the squelch.
 - (5) SQ OFF - This position shall turn on the RT and deactivate the squelch.
 - (6) RXMT - This position shall be nonfunctional. The retransmit mode of the RT shall not be simulated.
 - (7) REM - This position shall disable the RT's front panel controls.
 - (8) Z-FH - This position shall clear the RT of all FH data. The operator shall be required to pull the switch knob in order to go to the Z-FH position.

- (9) OFF - This position shall turn off all power to the RT. This function shall also erase the RT's memory. The operator shall be required to pull the switch knob in order to go to the OFF position.
- g. DIM Control - This shall be a active control which replicates the appearance and function of the corresponding actual knob.
- h. Keyboard Display shall display all information concerning the operation of the RT including SC frequencies, FH data, error messages, data rates as well as keyboard entries. The display shall consist of 8 full 5 ~~by~~ 7 dot matrix characters that are alphanumeric with the capability to display special characters. The seventh 5 ~~by~~ 7 dot matrix character shall be capable of displaying no dots on column number one, on column number two only displaying dots on rows one, three, five, and seven that have the capability to be lighted individually, no dots on column number three, and capable of lighting all the dots on columns four and five at the same time. The eighth dot matrix character shall also be capable of displaying dots arranged in the form of a diamond. All displays shall be dimmable. Color of display shall be green.
- i. Keypad shall be responsible for the entering data into the RT. The keypad shall consist of the following 16 pushbutton keys:
- (1) CMSC 1 - Shall display the COMSEC key identifier number on the display and enter the number '1' into the system.
 - (2) * 2 - Shall enter the number '2' into the system. The special feature activated by this key on the actual RT shall not be selectable or simulated.
 - (3) SYNC 3 - Shall place the RT into 'late entry' status allowing the RT to re-enter the network. Also shall enter the number '3' into the system.
 - (4) FREQ - Shall allow the operator to load and clear SC frequencies in the RT.
 - (5) DATA 4 - Shall display the RT's operational data rate and enter the number '4' into the system.
 - (6) 5 - Shall enter the number '5' into the system.
 - (7) 6 - Shall enter the number '6' into the system.
 - (8) ERF OFST - Shall transmit ERF data to net members when RT is operating in FH-M mode. Also shall load and/ check SC offset frequencies.

- (9) CHG 7 - Shall change current information on display to another available selection. Shall also enter the number '7' into the system.
 - (10) 8 - Shall enter the number '8' into the system.
 - (11) LOUT 9 - Shall enter the number '9' into the system. Shall also retrieve the frequency lockout sets from permanent memory if the RT is operating as Frequency Hop Master.
 - (12) TIME - Shall be used to check RT FH sync time clock.
 - (13) CLR - Shall clear data from display if error was made during entry. Shall also be used to clear data from RT memory.
 - (14) LOAD 0 - Shall load data into holding memory in RT and to retrieve data from permanent memory into holding memory. Shall also be used to enter the number '0' into the system.
 - (15) STO - Shall transfer data from RT holding memory onto permanent memory.
 - (16) BATT CALL - Shall be non-functional.
- j. COMSEC switch shall be responsible for controlling the communication security modes of the RT. It shall be a 5 - position rotary switch with pointer knob, with the following positions:
- (1) PT - This position shall place the RT into plain text mode. The operator shall be required to pull the knob in order to place the knob into this position.
 - (2) CT - This position shall place the RT into cipher text mode.
 - (3) TD - This position shall be non-functional.
 - (4) RV - This position shall prepare the RT to receive a remote fill of COMSEC variables from the NCS.
 - (5) Z - This position shall clear COMSEC keys. The operator shall be required to pull the knob in order to place the knob into this position.
- k. VOL WHSP control shall be a rotational knob used for audio volume control. The knob shall also provide a pullout position which shall be non-functional.
- l. HUB Connector - Dummy cover that shall not be removable.

- m. AUD/FILL connector shall be a dummy 3-D connector.
- n. AUD/DATA shall be a dummy 3-D connector. A dummy cable shall connect to the AUD/DATA connector and the DATA A or DATA B connector of the mounting adapter.

J.3.1.2.1.2.2.1.2 Radio Mounting.

Radio Mounting - the SINCGARS shall be mounted in a short/long range radio configuration. This mounting shall replicate the AN/VRC-89A configuration which contains the following components:

- a. Amplifier-Adapter, Vehicular (mounting adapter) AM-7239B/VRC.
- b. Amplifier, Radio Frequency AM-7238A/VRC.
- c. Receiver-Transmitter, Radio RT-1523 A.
- d. Receiver-Transmitter, Radio RT-1523 A.
- e. Loudspeaker Control Unit, LS-671/U, and a handset, and a handset mounting bracket.
- f. Loudspeaker Control Unit, LS-671/U, and a handset, and a handset mounting bracket.

J.3.1.2.1.2.2.1.2.1 Mounting Adapter.

The mounting adapter shall have two SINCGARS receiver-transmitters as described in 30.1.2.1.2.g.1. The mounting adapter shall have a simulated Radio Frequency Amplifier connected, and shall also have the following components:

- a. CB1 (power) switch shall be a two position trippable toggle switch with an ON and OFF position.
- b. Indicator lamp and lens shall be a green dimmable indicator. The indicator shall flash for 3 +/- 1 seconds after the CB1 switch is moved to the ON position, then stays lit. The lens shall allow the indicator to be dimmed by turning clockwise.
- c. The (AUD/DATA B J2) connector shall be a 3-D dummy connector.
- d. The (AUD/DATA A J3) connector shall be a 3-D dummy connector.
- e. The (DATA B J4) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the top radio.
- f. The (DATA A J5) connector shall be a 3-D dummy connector with a dummy cable connected to the AUD/DATA connector on the bottom radio.

- g. The (SPKR J6) connector shall be a 3-D dummy connector.

J.3.1.2.1.2.2.1.2.2 Radio Frequency Amplifier.

The Radio Frequency Amplifier shall be connected to the mounting adapter. The Radio Frequency Amplifier shall have the following components:

- a. The (J1) connector shall be a dummy connector. A dummy cable which represents the connection to a vehicle antenna shall be connected to the J1 connector.
- b. The (J2) connector shall be a dummy connector. A dummy cable which also connects to the ANT connector of the RT mounted in the bottom position of the mounting adapter shall be connected to the J2 connector.

J.3.1.2.1.2.2.2 Observer's Seat.

Observer's Seat - Shall be functionally replicated. The seat shall have the full range of motion and adjustments as on the actual vehicle. A mechanically operable lap seat belt shall be provided.

J.3.1.2.1.2.2.3 Observer's Condition Indicator.

Observers Condition Indicator - shall be a trainer unique 2 lamp assembly. An amber lamp shall be illuminated when the observer is considered to be wounded; a red lamp shall be illuminated when the observer is considered dead. Indicators shall be located in a position where both the observer and driver can observe the indicators.

J.3.1.2.1.3 Trainer Unique.

Simulated compass (grid azimuth indicator) - shall be a three digit display depicting the orientation of the long axis of the vehicle on the simulated terrain referenced to grid north. The simulated compass shall be available inside the compartment only after the vehicle has been stationary for 15 seconds.

J.3.1.2.2 External Interface Unit.

The HMMWV manned module shall be provided with an External Interface Unit (EIU) that consists of an entry device and display device. The EIU entry device shall be used to control and monitor the following functions:

- a. Exercise number.
- b. Vehicle identification number.
- c. Notification of self-repair being completed.
- d. Initiation and termination of fuel transfers.
- e. Initiation and termination of ammo transfers.

- f. Connection and disconnection of a tow kit to another vehicle.
- g. External munitions loading.
- h. Damage assessment.
- i. Load SINGARS hopset and COMSEC data.