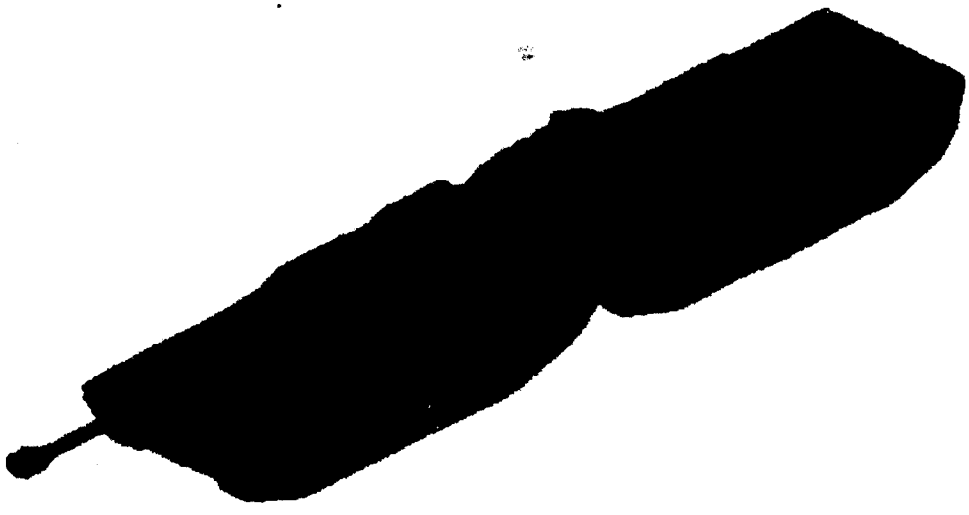
Advanced Distributed Simulation Technology

Advanced Field Artillery System (AFAS) / Future Armored Resupply Vehicle (FARV) Simulation Feasibility Analysis Study (FAS)

APPENDIX
C - F

18 July 1994
Revision 1.0



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Contract N61339-91-D-0001
AFAS/FARV DO
Delivery Order 0055
CDRL A001

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APPENDIX C

SIMULATOR/SIMULATION PERFORMANCE REQUIREMENTS

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AFAS VEHICLE ATTRIBUTES

30. SIMULATOR/SIMULATION PERFORMANCE REQUIREMENTS.

30.1 AFAS Vehicle Characteristics.

30.1.1 Crew, Crew size: 3.

- The crew members must be able to be viewed directly by each other.
- The system must be able to be operated by two crew members for up to 4 hours.
- The system must be operable by 3 crewmen over a 48 hour scenario.
- Provision for crew rest (one person).
- Provision for ration heater, and storage for 2 -3 day supply of water.

30.1.2 Decision Aids. See paragraph 4.1.4 in basic report.

30.1.3 Auxiliary Power Requirements:

- Must be able to power all on-board systems for at least 6 hours. (Except NBC over pressure and main armament.)
- Must be able to start the main engine.
- External power receptacle to start engines, run diagnostics and run ammunition handling systems (download).

30.1.4 Vision Requirements:

- Provide the crew adequate vision capability for ground and air surveillance, 360 degree coverage, from ground level at 25 meters from the vehicle to infinity at 45° above the horizon.
- Provide the driver with a close-in capability. 180 degrees horizontal, from within 5 meters of the vehicle to 45 degrees above the horizon.
- Provide the driver sufficient rearward visibility to enable him to perform docking maneuvers.

- Provide the Chief of Section sufficient visibility to confirm the driver's maneuver decisions and to verify surveillance sightings.
- Provide the capability to identify people at 800 meters and identify vehicles at 1500 meters under day, night and reduced visibility conditions.

30.1.5 Mobility.

- Responsiveness. Be able to move 750 meters within 90 seconds after identifying a potential threat.
- Maximum on/off road- grade, in percent grade.
- Climbing or descending straight up the slope. 60% Grade. Wet and dry (hard) surface.
- Traversing the slope: 40% Grade. (90 Degrees to the fall line, on a dry hard surface.)

30.1.5.3 Minimum Required Speeds in kilometers per hour
(Based on the criteria to be able to keep up with the maneuver forces; the mobility criteria same as an M-1A2 tank and M-2A2 or M-3A2 IFV.)

- On level hard surfaced roads:
- Sustained Forward Speed: 78 km/h (desired), 67 km/h (required).
- Minimum Forward Sustained Speed: 4 km/h
- In reverse: 20 km/h
- On Hills. At full combat weight the vehicle must be able to maintain forward downhill speeds of not less than uphill speeds on long primary road grades of up to 15% without overheating when operated at 40° C and 1800 meters elevation.
- On slopes of 2% to 60%, see the following table.

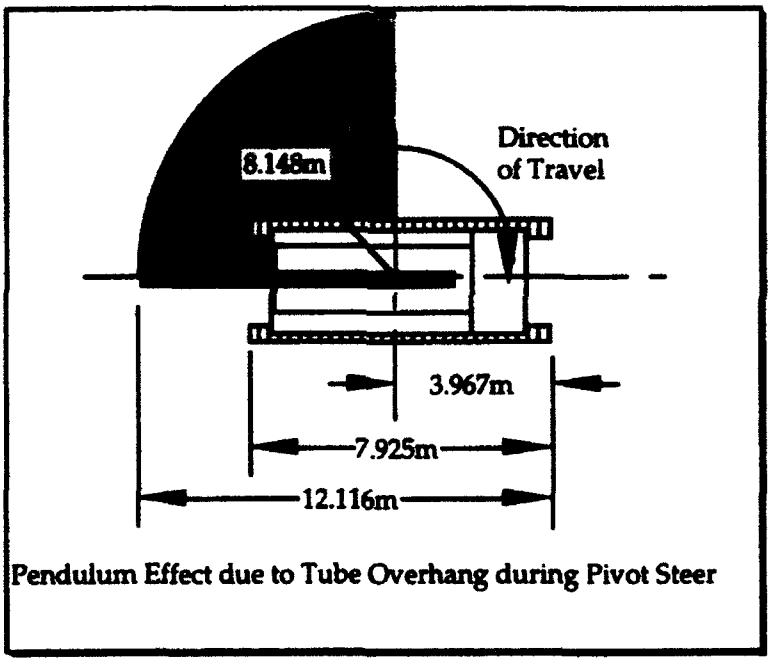
02%	65.0 km/h
05%	47.4 km/h
10%	32.0 km/h
15%	23.7 km/h
20%	19.5 km/h
30%	13.5 km/h
40%	9.5 km/h
50%	8.3 km/h
60%	7.0 km/h

- Decelerate fully loaded vehicle at $5 m/s^2$.
- Accomplish 25 consecutive stops, at five minute intervals, from 80% max speed at a rate of 3.3 m/s^2 minimum deceleration.
- Service Brake will hold vehicle motionless on 60% slope (facing uphill or downhill).

- Parking Brake will hold the vehicle motionless on 60% slope.
- Minimum sustained cross country speeds: 48 (desired), 39 km/h. (required) 30.1.5.4 Braking.
- Braking and Steering will be possible without engine power.

30.1.5.4 Turning.

- Pivot steer (meters): 16.3 meter diameter "spot" circle.
  Note: This value was obtained by subtracting 1/2 of the chassis length (7925mm) from the total vehicle length including the gun tube (12,116mm), to get a radius equal to the distance from the center of the chassis to the end of the gun tube, then doubling the result and rounding up to the nearest whole meter, to compensate for the pendulum effect of the gun tube. See Figure 1 below.



Pendulum Effect due to Tube Overhang during Pivot Steer

Figure 30.1.5.1 Pivot Steer Turn

- Lateral steer 16.64 meter diameter "doughnut" circle. See Figure 2 below.

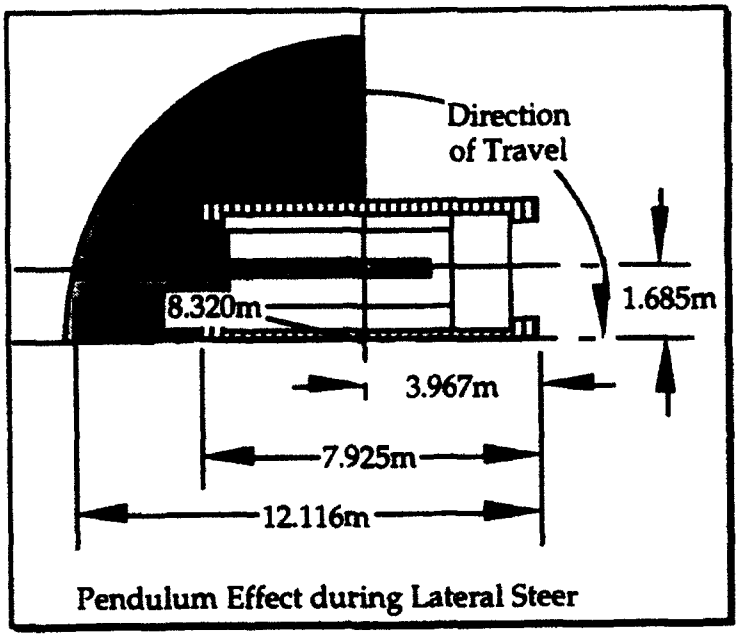


Figure 30.1.5.2. Minimum Lateral Steer Turn

Above numbers contain an allowance for the pendulum effect of the gun tube, which extends beyond the end of the chassis.

- Minimum Required Radius of Turn No greater than 1.5 times the chassis length. See Figure 3 below. The vehicle must be able to accomplish a 0.7g (lateral) turns on a dry pavement as speeds of 20 to 100% of its maximum speed.

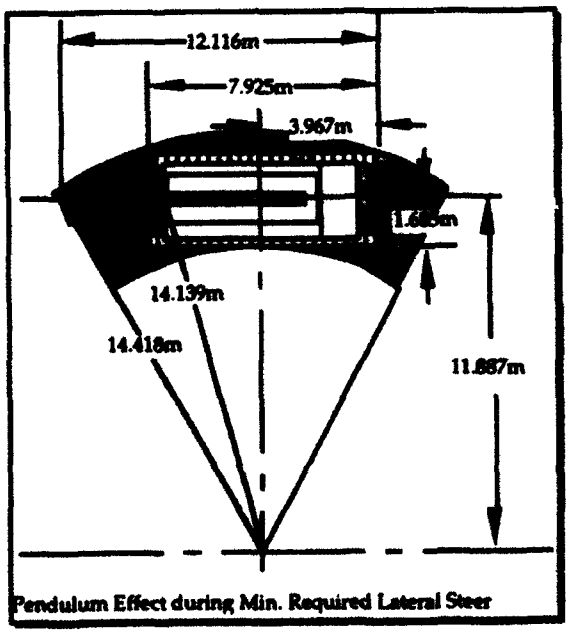


Figure 30.1.5.3 Minimum Required Lateral Steer Turn

30.1.5.5 Maximum tree knockdown and drive-over (diameter in meters). Trunk diameters of less than 5 centimeters (2 inches) generally do not hinder tracked vehicles. The practical upper limit for a medium tank is 15 to 20 centimeters in diameter (6 to 8 inches). Groups of trees with stem diameters less than six inches may be obstacles if they are close together. The average distance between trees (stem spacing) is 4.5 to 6 meters for both wheeled and tracked vehicles. This distance is greater than the width of standard military vehicles, but allowance is made for individual vehicle maneuver. (Ref. FM 5-36, page 6-3)

30.1.5.6 Maximum vertical step climb height (meters): 0.91 meters

30.1.5.7 Maximum trench/ditch crossing width (meters): 2.5 meters

30.1.5.8 Maximum fording depth (without floatation/snorkeling kit, in meters): 1.22 meters. Hard surfaced entrance and exit slopes of 40% shall be negotiable.

30.1.5.9 Maximum snorkeling depth with snorkeling kit (in meters): 2.5 meters.

30.1.5.10 Maximum stream velocity when fording/floating/snorkeling: *Not available.*

Note: The vehicle is not designed to swim/float. At a maximum snorkeling depth of 2.5 meters, the vehicle displaces approximately 34.7 metric tons. If the average coefficient of friction for wet rock is the same as wet concrete, (0.25), then a side force greater than or equal to 472 kg/m^2 would cause the vehicle to begin to slide sideways and the driver may lose control of the vehicle.

30.1.5.11 Untrafficable Terrain. Average percentage of the terrain that would be untrafficable by the vehicle under the following conditions in the following geographical areas:

	Central Europe	Middle East
Dry	05.0%	05.0%
Wet	10.0%	05.0%
Snow	14.0%	10.0%

30.1.5.12 Vehicle cone index :

- Pass: 26.6 (in fine-grain soil).
- 50 Passes: 60.0 (estimate based on similar vehicle)
- Towing Capabilities Must tow another vehicle (AFAS or FARV) at least 15 km at a minimum speed of 20 km/h on a dry hard surface.

30.1.6 Fuel.

- Primary Fuel: JP-8.
- Alternate Fuel: MIL-F-5380
- Capacity: 1100 liters / 280 gallons.
- Consumption Rates. Idle, maximum 15kg/hr.

	Gallons/Hour	Liters/Hour	Miles/Gallon	Kilometers/Liter
Idle	2	7.5	N/A	N/A
Cross Country (Avg. Speed)	26.53 (32 km/h) (20 mph)	100	0.76	0.32
On Roads (Avg. Speed)	18.79 (65 km/h) (40 mph)	71	2.12	0.91

Based on FM 101-10-1/2, "Staff Officer's Field Manual Organizational, Technical and Logistical Planning Factors," Vols. 1 & 2. Fuel consumption rates for 60-ton vehicles were used. The fuel used to develop the tables in the FM was diesel fuel, which may have a different energy density content than the new fuel, JP-8. The ratio of consumption of JP-8 to Diesel Fuel will be roughly proportional to the ratio of the API numbers for JP-8 and Diesel Fuel. Average speeds are derived from above tables in lines 4 and 5.

30.1.6.5 Maximum Unrefueled Travel Distance:

- Minimum required unrefueled travel distance, using roads: 405 km (at 47km/h.)
- Approx. max. travel distance without refueling, cross country: 320 km

30.1.7 Physical Dimensions.

30.1.7.1 Vehicle length

- Chassis (Without Gun Tube): 7.925 meters, maximum.
- Total length (Includes Gun Tube): 12.116 meters, maximum.
- Vehicle width (meters): 3.37 meters, maximum.
- Vehicle Weight:
- Combat weight: 55 tons.
- Curb weight: 50 tons.

30.1.7.2 Vehicle wheel base (track foot print length in meters): Approximately 3.9 meters

30.1.7.3 Minimum Ground Clearance: 0.43 meters.

30.1.7.4 Vehicle height (meters): 2.883 meters, without Ancillary Equipment

30.1.7.5 Ancillary Equipment. The following items are either an integral part of the vehicle or routinely carried on all armored vehicles. These items are normally loaded or mounted on top of the vehicle, which when present or in use, will increase the apparent size of the vehicle.

ITEM	HEIGHT
Antenna (upright)	3.0 meters
Antenna (tied down)	1.3 meters
Antenna Mount	0.3 meter
Rolled camouflage net	0.6 meter
Camouflage pole bag	0.3 meter
Duffel bag	0.4 meter
50 cal machine gun mount	0.4 meter
50 cal machine gun, on mount	1.2 meters (tilted full up)
Crew hatch, open, unsecured	0.8 meter
Crew hatch, open, secured	0.3 meter
IFF device	1.0 meters
Pantel Ballistic shield	0.6 meters
Pioneer Tools	0.1 meter
Lifting eyes	0.2 meter

30.1.8 Engine Type: Diesel, 1500 HP.

30.1.9 Armament.

30.1.9.1 Main Gun. The Main Gun will be a 155mm Cannon

- Required Maximum Range: 30 km (unassisted projectile).
  40 km (rocket-assisted projectile).
- Desired Maximum Range: 40 km (unassisted projectile).
  50 km (rocket-assisted projectile).
- Minimum Required Range: 6 kilometers (at 200 mils QE).
  Desired: 4 kilometers.
- Minimum Number of Rounds on board: 60, plus 2 Copperhead rounds.
- Maximum Rate of Fire: 10 -12 Rounds per Minute for 3 -5 minutes.
  Desired: 16 Rounds per Minute for 5 minutes.
  Required: 10 Rounds per Minute for 3 Minutes.

Sustained Rate of Fire: 3-6 Rounds per minute.
Desired: 6 Rounds per Minute for 10 minutes.
Required: 3 Rounds per Minute for 10 minutes.

- Rounds per TOT: 4-8 Rounds on target, from 8 - 36 km, within 4 seconds.

- Maximum allowable slope/grade for firing: 17% (10 degrees to the fall line).

- Gun Elevation Limits: -3 Degrees from AFAS longitudinal center line to +75 degrees above the center line.

- Maximum time to fire

  - Emplaced, 15 -20 seconds. 20 seconds.
  - On the Move, 30-45 seconds. 45 seconds.
  - After being re supplied, 90 seconds, maximum.
  - From a warm section status: 45 seconds. 9.

- Accuracy of Fires:

Range	Bias	Precision CEP
Min. to 15 km	55m	40m
16 to 25km	80m	75m
26 to 35 km	140m	120m
36 to max	215m	200m

- Weapon Capabilities: Fully functional within 15 minutes after start-up; when OAT is -46°F

30.1.9.2 Safety Devices.

- Previously Rammed Round Check Device. Device to ensure that any previously rammed round is detected before another round is rammed.

- Bore Clear Check Device. Device to ensure that the bore is clear of obstructions, primarily previously fired rounds which may have become stuck in the tube.

- Round Fall-Back Check Device. Device to ensure that the round is firmly engaged in the lands and has not fallen back onto the propellant.

30.1.9.3 Upload and Download Criteria. After both vehicles are within 8 meters of each other, their resupply ports facing each other and within 10° of being on the same horizontal plane, the AFAS must be able to:

- Automatic Up-load

  - •• Accept 60 complete rounds in less than 12 minutes.
  - •• Accept fuel at the rate of 132 - 190 liters per minute.
  - •• Control the loading process.
  - •• Automatically download 60 complete rounds to the FARV in 20 minutes.
  - •• Manual Up-load.
  - •• Up-load Ammunition at one round per minute from flatracks.
  - •• Up-load 60 rounds in 45 minutes from FARV.
  - •• Up-load liquid propellant without special material handling equipment.
  - •• Download Liquid Propellant:
  - •• 20 minutes into the FARV.
  - •• 30 minutes into containers (barrels).

30.1.10 Self Defense Armament.

30.1.10.1 Maximum Effective Range: (Depends on Weapon Type.)

20 mm. Approx. 2,000 meters.
25 mm. Approx. 2,500 meters.
30 mm. Approx. 3,000 meters
Minimum Range: N/A.

30.1.10.2 Rate of Fire: TBD

30.1.10.3 Ammunition Capacity: TBD

30.1.11 Communications:

30.1.11.1 Crew Internal. Voice Intercom System.

30.1.11.2 Crew External.

- Remote voice intercom with range of 15 meters.
- Connection to AFAS/other FARV intercom system when docked.

30.1.11.3 Tactical Communications. Two SINGARS radios.

- Advanced Field Artillery Tactical Data System (AFATDS) Interface.

- Army Tactical Command and Control System (ATCCS).

30.2 FARV System Characteristics.

30.2.1 Crew Size 3 People. Reduced Manning: Must be able to be operated by two people for four hours.

30.2.2 Decision Aids. These types of decision aids are specified for the system:

GUI with Digital Map.
POS/NAV
IFF
Embedded Training.
BIT/BITE

30.2.3 Auxiliary Power Systems:

30.2.3.1 Provide power for 6 hours for on-board computer systems, communication systems, Pos/Nav Systems, and survivability systems.

30.2.3.2 Provide enough power to start the FARV's engine.

30.2.3.3 Possess capability to accept/provide external power to download ammunition, run diagnostics and start the engine.

30.2.4 Vision Requirements:

30.2.4.1 Driver:

30.2.4.1.1 90° Left and Right of vehicle centerline, and 0 to 45° in the vertical, and all of that area included in the sector from 5 meters from the vehicle, out.

- Sufficient rearward vision to allow positioning and docking with the AFAS.
- Sufficient rearward vision to allow the backing of the trailer.
- Chief of Section:
- Capability to monitor the driver's maneuver decisions.
- Capability to monitor/verify surveillance sightings.

30.2.4.3 Crew Vision. (everyone)

- Capability to view 360 degrees within 25 meters of the vehicle and upward to +45° above the horizontal plane of the vehicle.
- Capability to recognize humans out to 800 meters and identify vehicles at 1500 meters.

30.2.5 Mobility. Mobility should be the same as the AFAS, except the FARV will not have the problems associated with the cannon tube's pendulum effect. The following list summarizes the mobility requirements. The FARV mobility may be hindered when pulling a trailer.

Road Speed.	67-78 km/hr sustained.
Cross-Country Speed.	39-48 km/hr.
Lateral Slope.	40%.
Ascend/Descend.	60%/60%.
Gap Crossing.	2.5 - 2.7 meters.
Fording.	122 - 150 cm.
Reverse Speed.	20 -25 km/hr.
Vertical Wall.	91 - 107 cm.
Cruising Range.	405 to 450 km at 47 km/hr on a dry hard surfaced road.
Stopping.	Max speed to full stop at 5 m/s^2.

- Pivot Turn Radius. N/A. (Same as AFAS, unless pulling a trailer.)
- Trailer Requirements. The FARV bust be equipped to tow and Backup a Trailer.
- Tow another AFAS or FARV at 20 km/h for 15 km.
- Maximum Towing Capacity. 50 tons.

30.2.6 Response Times:

- Cold Start. 15 minutes after application of power the FARV will be fully mission capable.
- Warm Start. 45 seconds after notification.

30.2.7 Physical Dimensions.

- Length: 7.925 meters.
- Width: 3.37 meters.
- Weight.
  Curb. 50 tons.
  Combat. 55 tons.

- Wheel Base. (track foot print length in meters): Approximately 3.9 meters
- Minimum Ground Clearance: 0.43 meters.
- Vehicle Height 2.88 meters.
- Ancillary Equipment. The following items are either an integral part of the vehicle or routinely carried on all armored vehicles. These items are normally loaded or mounted on top

of the vehicle, which when present or in use, will increase the apparent size of the vehicle.

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Crew hatch, open, unsecured	0.8 meter
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IFF device	1.0 meters
Pioneer Tools	0.1 meter
Lifting eyes	0.2 meter

30.2.8 Engine Type: Diesel, 1500 HP.

30.2.9 Fuel.

- Primary Fuel: JP-8.
- Alternate Fuel: MIL-F-5380
- Capacity: 1100 liters / 280 gallons.
- Consumption Rates. Idle, maximum 15kg/hr.

	Gallons/Hour	Liters/Hour	Miles/Gallon	Kilometers/Liter
Idle	2	7.5	N/A	N/A
Cross Country (Avg. Speed)	26.53 (32 km/h) (20 mph)	100	0.76	0.32
On Roads (Avg. Speed)	18.79 (65 km/h) (40 mph)	71	2.12	0.91

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- Maximum Unrefueled Travel Distance:

  - •• Minimum required unrefueled travel distance, using roads: 405 km (at 47km/h.)
  - •• Approx. max. travel distance without refueling, cross country: 320 km

30.2.10 Storage and Transfer Capabilities.

30.2.10.1 Fuel Transfer Rates:

Self. N/A.

To another vehicle. 132 - 190 liters/min.

Resupply Distances. 2-12 km from reload point to AFAS and back again.

30.2.10.2 LP Storage. 75% Full Charge for 130 - 200 rounds.

30.2.10.3 Ammunition Storage Capability.

- Conventional 130 - 200
- Copperhead 2

30.2.10.4 Ammunition Transfer System. Must handle all current and planned ammunition types, except copperhead and rounds over one meter long. Will be controlled from the receiving vehicle after docking.

- Manual Loading Criteria: Ground to FARV. 130 rounds within 65 minutes.
- Automatic FARV to AFAS Transfer. 60 rounds within 12 Minutes.
- Automatic AFAS to FARV Transfer. 60 rounds in 30 minutes.
- Automatic Unloading Criteria: FARV to FARV. 130 rounds within 20 minutes.
- Automatic Unloading Criteria: FARV to Ground. 130 rounds within 30 minutes.
- Manual Unloading Criteria: FARV to Ground. 130 rounds in 90 minutes.
- Angle between Vehicles: 10 degrees maximum resultant angle.
- Distance between Vehicles: 8 meters maximum.
- Download from AFAS: 60 rounds in 30 minutes.

30.2.10.5 Fuel Transfer System:

- Transfer fuel at a rate of 132 - 190 liters per minute.
- Disconnect within 10 seconds without spillage.

- Capable of disconnecting and moving 750 meters within 90 seconds of threat detection. (Without dropping any ammunition or spilling fluids.)

30.2.11 Self Defense Armament.

- Maximum Effective Range: (Depends on Weapon Type.)

  20 mm. Approx. 2,000 meters.
  25 mm. Approx. 2,500 meters.
  30 mm. Approx. 3,000 meters
  Minimum Range: N/A.

- Rate of Fire: TBD
- Ammunition Capacity: TBD

30.2.12 Communications:

- Crew Internal. Voice Intercom System.
- Crew External.

- Remote voice intercom with range of 15 meters.
- Connection to AFAS/other FARV intercom system when docked.
- Two SINGARS radios.
- Tactical Communications.
- Advanced Field Artillery Tactical Data System (AFATDS) Interface.
- Army Tactical Command and Control System (ATCCS).

30.3 AFAS/FARV Task Matrixes. The tasks that the simulations must represent or support were derived from the "Advanced Field Artillery System (AFAS) Task List (Draft)" by CAE-Link Corporation, for U.S. Army Research Institute's Ft Sill Unit, July 31, 1992.

30.3.1 Concept. The AFAS-FARV-FAAPS simulators/models will consist of an integrated system of model devices. The devices that are candidates for simulation will be defined in generic terms and assigned fidelity values. I attempted to relate the fidelity values to those found in the proposed IEEE draft standard, "Fidelity Description Requirements for Distributed Interactive Simulation", prepared by the Institute for Simulation and Training for STRICOMM-DMSO, 22 March, 1993, but was unable to do so because the fidelity for vehicle representations and device level objects have not been defined.

30.3.1.1 Fidelity. Devices in the simulator will have to have varying degrees of fidelity, depending on the way that the crew interacts with them. Devices that the crew must manipulate or interact with should have the highest possible fidelity. Devices that only provide information to the crew could have lower levels

of fidelity, while devices that only maintain the illusion of reality could have less. For simplicity, I have defined devices into three categories of fidelity: high, medium and low. See the following paragraphs for examples of each.

- **High.** Functions like the real vehicle/device. Is a full scale model. Allows the user full interaction with all aspects of the device. User inputs get realistic and reasonable responses from the device. Simulation provides realistic tactile, auditory, and visual feedback to the user. For example, a circuit breaker panel, that is within sight of the crew, and is actually wired into the simulator so that the crew can pull and reset individual circuit breakers to disable or enable other real or simulated devices in the simulator, is high fidelity.

- **Medium.** Visually, it looks like the real vehicle/device, may even be a full scale model. It allows the user to touch and manipulate controls. User input gets no response from the simulator. Using the previously mentioned circuit breaker panel as an example, if the panel was not wired to any devices and pulling and resetting the circuit breakers had no effect on devices on the simulator, but had to be included for realism, that would be medium fidelity.

- **Low.** Visually, it may barely resemble the real object. Controls do not work and cannot be manipulated. The device may consist of graphical depictions only. Indicator panels/lights do not work. Using the circuit breaker panel for an example again, a low fidelity circuit breaker panel would be a single solid molded representation of the panel, or a life size picture of the panel placed in its intended location in the simulator.

30.3.2 Devices to Be Modeled.

30.3.2.1 Annunciators. Devices that provide visual or auditory indications to the crew that something requires additional/immediate attention. A red light and/or a beeper is an example of an annunciator.

30.3.2.2 Decision Aids. Decision Aids (DA) consist of: (1) a set of rules, implemented in hardware or software; (2) a graphical user interface (GUI) to present the choices to the user and receive user commands; (3) an information base that provides data for the rules to act on; and (4) a computer to control the GUI, update and maintain the information base and execute the rules.

30.3.2.3 Switches. Switches may be either software or hardware devices. They are used to change the state of a device.

30.3.2.4 Sensors. Sensors may be either hardware or software devices that are used to determine the state of a device or process.

30.3.2.5 Controls. Crew activated mechanical devices used to move devices or control dynamic processes.

30.3.2.6 GUI. Graphical User Interface. Computer-like display screen. May be illuminated icons or buttons, flat panel or CRT, or some other device that can display pictures.

30.3.2.7 GUI/Control. GUI with some sort of associated control or input device. Could be keyboard, mouse, joystick or touch screen.

30.3.2.8 GUI Screen. GUI/Text based menu screen. Allows the display and selection of items from menus or lists. Allows moving/dynamic displays.

30.3.2.9 Intercom. System that allows the crew to hear other crew members conversations/commands within the vehicle, or within close proximity to the vehicle.

30.3.2.10 Intercom/Mike. System that allows internal and external communications between crew members and other persons who are located far away from the vehicle.

30.3.3 Crew Tasks. With fewer crew members, less specialization will be allowed. Each crew member will be able to do some, if not all of the other crew member's task, depending on the current situation. The crew tasks must be passed back and forth, started and stopped in a coordinated manner. Decision aids and rapidly reconfigurable crew station displays and controls will make task shifting and task sharing easier.

30.3.3.1 Task Shifting. For instance, all self defense tasks are not assigned to the same person or crew position at all times. When the vehicle is moving, primary responsibility for self defense systems monitoring lies with the gunner, and all other crew members monitor the system to some degree. The CoS will monitor the system more than the driver. When the vehicle is stopped and is conducting fire missions, then the primary responsibility for self defense systems monitoring lies with the driver, and the other crew members then monitor the system, but the gunner would monitor the system less than the CoS. In the transition phases, when the driver is preparing to move, and the gunner is securing the gun for movement, the chief of section will have to momentarily assume primary responsibility for monitoring the self defense systems. Either the gunner or the chief of section will have primary responsibility for monitoring the self defense systems whenever the driver is performing maintenance outside the vehicle.

30.3.3.2 Task Matrices. The possible combat related situations are addressed in the matrices are:

(1) Resting or accomplishing maintenance.
(2) Transitioning from one state to another (Preparing to move).
(3) Tactical Movement (between areas of operations)
(4) Survivability Movement (between firing sites).
(5) Firing operations.
(6) Resupply operations.

30.3.4 Crew Responsibilities and Crew Station Requirements.

30.3.4.1 Driver. The driver is primarily responsible for driving the vehicle when the vehicle is moving. He monitors the self defense sensors and mans the self defense weapon(s) when the vehicle is stationary. He monitors system start-up and system initialization as it pertains to his duties and crew position. He is also responsible for monitoring the status of all of the automotive systems, and performing maintenance on those systems whenever required.

- **Driver Station.** Fidelity Required: High. The driver must feel like he is actually driving a vehicle and controlling any self defense systems. As a minimum, the simulator should provide visual, tactile, and auditory fidelity.

- **Physical Fidelity. High.** The driver should have access to and be able to operate all of the controls that he is responsible for. This includes defensive armament and sensor readouts. The driver is also responsible for PMCS and maintenance on the vehicle. He may require high fidelity external features on the simulator for combat battle damage assessment and repair tasks.

- **Decision Aid Fidelity. High.** Actual software decision aids can be used to drive the simulations.

- **Visual Fidelity. High.** The driver must think that he can see enough to drive the vehicle and avoid obstacles. Some of his vision capability will be provided by television cameras, and some by direct view through glass. The television views should be very high fidelity while some of the through glass capability could be of a lower quality.

30.3.4.2 Chief of Section (CoS). The CoS is responsible for the actions of the crew and the safe and efficient operation of the vehicle in the accomplishment of the mission. He reports arriving and departing specific locations. He navigates between locations and monitors the driver's performance while the vehicle is moving. He monitors the actions of the gunner when the vehicle is stationary and in a firing position. He monitors system start-up and system initialization as it pertains to his duties and crew position. He plans routes and selects positions. He establishes the defense plans. He assigns responsibilities and tasks, monitors their

accomplishment, and provides continuity when task responsibilities are passed from one crew station to another.

- **Chief of Section Station.** Fidelity Required: High. The CoS must feel like he is actually commanding a vehicle and controlling any of the self defense systems, resupply, planning, firing, etc. systems. As a minimum, the simulator should provide visual, tactile, and auditory fidelity.

- **Physical Fidelity.** High. The CoS should have access to and be able to operate all of the controls that he is responsible for. This includes defensive armament and sensor readouts.

- **Decision Aid Fidelity.** High. Actual software decision aids can be used to drive the simulations.

- **Visual Fidelity.** High. The CoS must think that he can see enough to drive the vehicle and avoid obstacles. He must be able to see enough to help direct the driver and ensure that the driver is safe. Some of his vision capability will be provided by television cameras, and some by direct view through glass. The television views should be very high fidelity while some of the through glass capability could be of a lower quality.

30.3.4.3 **The Gunner.** The gunner is responsible for monitoring and executing firing operations. When the vehicle is moving, he is responsible for monitoring and operating the self defense equipment. He monitors system start-up and system initialization, as it pertains to his duties and crew position. He is also responsible for monitoring the status of all of the armament systems, and performing maintenance on those systems whenever required.

- **Gunner Station. Fidelity Required:** High. The Gunner must feel like he is actually controlling the firing process. He must also be able to control the vehicle and any of the self defense systems, resupply, planning, firing, etc. systems. As a minimum, the simulator should provide visual, tactile, and auditory fidelity.

- **Physical Fidelity.** High. The Gunner should have access to and be able to operate all of the controls that he is responsible for. This includes defensive armament and sensor readouts. The Gunner should have access to a gun compartment, equipped with copperhead rounds and loading equipment, for accomplishing all of his primary combat tasks.

- **Decision Aid Fidelity.** High. Actual software decision aids can be used to drive the simulations.

- **Visual Fidelity.** High. The Gunner must think that he can see enough outside the vehicle to drive and avoid obstacles. He must be able to see enough to help direct the driver during positioning for resupply. He must be able to "see" the loading and firing mechanism working in the turret from his station. Some of his vision capability will be provided by television cameras, and some by direct view through glass. The television views should be very high fidelity while some of the through glass capability could be of a lower quality.

30.3.4.4 The Handler. In the FARV the Handler is responsible for monitoring and executing resupply operations. When the vehicle is moving, he is responsible for monitoring and operating the self defense equipment. He monitors system start-up and system initialization, as it pertains to his duties and crew position. He is also responsible for monitoring the status of all of the resupply conveyor and robotic systems, and performing maintenance on those systems whenever required.

- **Handler Station. Fidelity Required:** High. The Handler must feel like he is actually controlling the resupplying (FARV up-load) process. He must also be able to control the vehicle and any of the self defense systems, resupply, planning, firing, etc. systems. As a minimum, the simulator should provide *visual, tactile, and auditory fidelity.*

- **Physical Fidelity.** High. The Handler should have access to and be able to operate all of the controls that he is responsible for. This includes defensive armament and sensor readouts. The Handler should have access to a supply compartment (equipped with copperhead rounds) and materials transfer equipment for accomplishing all of his primary combat tasks.

- **Decision Aid Fidelity.** High. Actual software decision aids can be used to drive the simulations.

- **Visual Fidelity.** High. The Handler must think that he can see enough outside the vehicle to drive and avoid obstacles. He must be able to see enough to help direct the driver during positioning for resupply. He must be able to "see" the materials handling mechanism working in the ammunition compartment from his station. Some of his vision capability will be provided by television cameras, and some by direct view through glass. The television views should be very high fidelity while some of the through glass capability could be of a lower quality.

30.3.5 Component Fidelity. When individual hardware and software components of the FARV, FAS and FAAPS are called out, I have listed them in a

matrix and assigned fidelity values to them. The criteria used was based on the degree that the crew members interacted directly with the components.

30.3.5.1 Hardware Components. If the hardware component would not be directly viewed or touched by any crew member, it was assigned a low fidelity rating. If the component was likely to be viewed but not touched, then it was given a medium fidelity rating. If the component is likely to be both viewed and touched by the crew members, it was assigned a high fidelity rating.

30.3.5.2 Software Components. If a software component fed data directly to the crew stations then it was assigned a high fidelity rating. If the component feeds data to a device that is used by the crew, it is assigned a medium fidelity rating. If the device does not directly or indirectly feed data to the crew station, it is assigned a low fidelity rating.

30.3.5.3 Matrices. The data is summarized in the following tables.

AFAS		Primary Responsibility							
TASKS		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
PREPARE FOR OPERATIONS									
	SYSTEM INITIALIZATION								
	Selects Initialization Display	Up Crewman	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Selects Pre-operational Checks Aid [DA]	Up Crewman	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Monitors Pre-operation Checks [DA]	Up Crewman	N/A	N/A	N/A	N/A	GUI Screen	High	Sensors/Simulation
	Activates Master Power	N/A	Driver/CoS	N/A	N/A	N/A	Control	High	Switch
	Activates Starting Sequence	N/A	Driver/CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Monitors Engine Warning Indicators	N/A	Driver/Cos	N/A	N/A	N/A	GUI Screen	High	Sensors/Simulation
	Activates Power to Crew Stations	N/A	Driver/CoS	N/A	N/A	N/A	Control	High	Switch
	Monitors Self Tests	N/A	All	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Selects Crew Configuration Selection Displays [DA]	Up Crewman	All	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Selects Crew Configuration and Task Allocations [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Selects Crew Interfaces in order to assign positions [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Monitors Power up and Crew Ready Indication	N/A	All	N/A	N/A	N/A	GUI Screen	High	Sensors
	Receives Crew Ready Alert	N/A	CoS	N/A	N/A	N/A	Annunciator	High	Sensors and DA
	Determines Position Location and Orientation	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Sensors
	Verifies Position and Orientation	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Selects System Pre-operational Checks Aid [DA]	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Switch
	Selects System Default Mode Display [DA]	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Switch
	Observes System Modes	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Sensors
	Receives Operations Order	Up Crewman	CoS/Gunner	N/A	N/A	N/A	GUI Screen	High	Radio
	Enters Data from Operations Order	Up Crewman	CoS/Gunner	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Selects Operations Order Display	Up Crewman	CoS/Gunner	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Observes Operations Order	N/A	CoS/Gunner	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Informs Crew of Operations Order and Tasks	N/A	CoS/Gunner	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Receives OPORD Displays	N/A	CoS/All	N/A	N/A	N/A	GUI Screen	High	Radio and DA
	Receives Section Chief Guidance	N/A	CoS/Gunner	N/A	N/A	N/A	GUI Screen	High	Radio
	Determines Operational Mode Changes [DA]	N/A	CoS	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Selects Operational Mode [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Selects Status Display	Up Crewman	All	N/A	N/A	N/A	GUI Screen	High	Switch
	Monitors Status of System Readiness Report	Up Crewman	CoS	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Determines if Maintenance is Required [DA]	Up Crewman	All	N/A	N/A	N/A	GUI Screen	High	Sensors and DA
	PERFORM COMMUNICATIONS SETUP								
	Selects Communications Setup Display	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Determines Communications Configuration [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Establishes and Updates Communications Database	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Sets Radios	Up Crewman	CoS/All	N/A	N/A	N/A	Control	High	Radio
	Selects Message Setup Aid [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Sets Internal Message Procedures [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Establishes Internal Message Priority [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Monitors Digital Command Check	Up Crewman	CoS/All	N/A	N/A	N/A	Annunciator	High	Radio

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Enters Net	Up Crewman	CoS	N/A	N/A	N/A	Control	High	Radio
PERFORM INFORMATION MANAGEMENT								
Selects Information Management Display	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Data Required to Perform Mission [DA]	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors File Contents for Completeness	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Itemizes Incomplete or Missing Files	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Data Display for Review	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Identifies Obsolete Data [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Reviews Data Files	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Deletes Outdated Data	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Requests Current Data	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Radio
Monitors Updates	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
PERFORM PLANNING AND COORDINATE OPERATIONS								
Selects Operational Displays [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Reviews Mission	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Determines Activities to Support Mission [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Determines Resources Required for Each Activity [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Determines Mission/Task Priorities [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Determines Scheduling Requirements with Scheduling Aid [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Determines Restraints [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Plans Coordination of Activities [DA] 2.	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
CONDUCTS TERRAIN ANALYSIS								
Recieves METT-T Data	Up Crewman	All	CoS	CoS	CoS	GUI/Control	High	Radio
Selects Operational Overlay of Terrain Graphics	Up Crewman	All	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Observes Terrain Features	Up Crewman	All	CoS	CoS	CoS	GUI Screen	High	Sensors
Identifies Terain that will Support Operations	Up Crewman	All	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Monitors Digital Data Display	Up Crewman	All	CoS	CoS	CoS	GUI Screen	High	CPU and DA
RSOP								
PERFORM SECURITY SWEEP								
Activates Vehicle Display Screen	Up Crewman	CoS/Driver	Driver	N/A	Driver	GUI/Control	High	CPU and DA
Selects NAV System Route Display	Up Crewman	CoS/Driver	Driver	N/A	Driver	GUI/Control	High	CPU and DA
Selects Area Sweep Aid [DA]	Up Crewman	CoS/Driver	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	CPU and DA
Analyzes Digital Terrain Display	Up Crewman	CoS/Driver	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	CPU and DA
Selects/Indicates Sweep Route [DA]	Up Crewman	CoS/Driver	Driver	N/A	Driver	GUI/Control	High	CPU and DA
Determines Threat [DA]	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Selects Early Warning System Display [VIDS]	Up Crewman	All	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
Activates Early Warning System	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
Verifies Early Warning System Activation	Up Crewman	All	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	Sensors
Selects Sensor Display [VIDS]	Up Crewman	All	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
Activates Sensor Suite	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
Verifies Sensor(s) Activation	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	GUI Screen	High	CPU and DA

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Observes Display	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	GUI Screen	High	CPU and DA
Observes using Visual Surveillance Device	Up Crewman	CoS/Driver	Driver	Gunner/CoS	Driver	GUI Screen	High	Video/Sensor
Identifies Elements in Area [DA]	Up Crewman	CoS/Driver	Driver	Gunner/CoS	Driver	GUI Screen	High	Video/Sensor
Identifies Denial Elements [DA]	Up Crewman	CoS	Driver	Gunner/CoS	Driver	GUI Screen	High	Video/Sensor
MONITOR SENSOR ALARMS								
Selects Alarms and Alerts [DA]	Up Crewman	All	Driver/CoS	Gunner/CoS	Driver/CoS	Control	High	Switch
Monitors Early Warning System Display [VIDS]	Up Crewman	Driver/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Sensors
Monitors Sensor Suite Warning Display [VIDS]	Up Crewman	Driver/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Sensors
Monitors Audio Visual Display (HRTV)	Up Crewman	Driver/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Monitors Area Denial Proximity Warning [DA]	Up Crewman	All	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	CPU and DA
Selects Wide Field of View for Surveillance Device	Up Crewman	Driver/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
RESPOND TO SENSOR ALARM								
Monitors Warning Systems [VIDS]	Up Crewman	All	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensors
Verifies Attack [DA]	Driver/CoS	Driver/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensors
Monitors Activation of Countermeasures	Driver/CoS	Driver/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensors
Monitors Activation of Signature Suppression System	CoS/Driver	CoS/Driver	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	CPU and DA
Monitors Activation of Active RADAR Mode	CoS/Driver	CoS/Driver	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	CPU and DA
Monitors IFF Display [DA]	CoS/Driver	CoS/Driver	CoS/Driver	CoS/Gunner	Cos/Driver	GUI Screen	High	CPU and DA
Locates System Designated Target	N/A	Driver/CoS	Driver/CoS	CoS/Gunner	Driver/CoS	GUI Screen	High	Video/Sensor
Chooses Target Override (if desired)	N/A	Driver/CoS	Driver/CoS	CoS/Gunner	Driver/CoS	GUI Screen	High	Video/Sensor
Selects Alternate Target (if desired)	N/A	CoS/Driver	Driver/CoS	CoS/Gunner	Driver/CoS	Control	High	Video/Sensor
Selects Narrow Field of View for Surveillance Device	N/A	CoS/Driver	Driver/CoS	CoS/Gunner	Driver/CoS	Control	High	Video/Sensor
Monitors LASER Range Finder	N/A	CoS/Driver	Driver/CoS	CoS/Gunner	Driver/CoS	GUI Screen	High	Sensor
Identifies New Target (if desired)	N/A	Driver/CoS	Driver/CoS	CoS/Gunner	Driver/CoS	GUI/Control	High	Video/Sensor
Monitors/Selects Armament for Defense	N/A	CoS/Driver	Driver/CoS	CoS/Gunner	Driver/CoS	GUI Screen	High	CPU and DA
Reads Evasive Action Advisory System Display [DA]	N/A	CoS/Driver	Driver/CoS	CoS/Gunner	Driver/CoS	GUI Screen	High	CPU and DA
Determines Use of Tactical Mobility [DA]	N/A	CoS/Driver	Driver/CoS	CoS/Gunner	Driver/CoS	GUI Screen	High	CPU and DA
SELECTS POSITION								
Selects Site Selection Aid [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Observes Graphic Terrain Information	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Verifies NAV/POS Information [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Locates Other Elements in Area [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Selects Firing Position [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Locates FARV Position	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU, DA and Radio
PERFORMS SITE IMPROVEMENT								
Determines Site Improvement Requirements [DA]	Driver/Gunner	N/A	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Directs Site Improvement	CoS/Gunner	N/A	CoS	N/A	CoS	GUI Screen	High	CPU and DA
ESTABLISH SECURITY/DEFENSIVE PLAN								
Selects Integrated Defense Display [VIDS]	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Observes Integrated Defense Display [VIDS]	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Determines Sensor Requirements [DA]	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA

AFAS		Primary Responsibility							
TASKS		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Activates Sensor Suite	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
	Determines Countermeasure Requirements [DA]	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Countermeasures	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
	Determines Signature Suppression System Requirements [DA]	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Signature Suppression System	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
	Determines Early Warning System Requirements [DA]	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Early Warning System	CoS/Driver	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
	ESTABLISH COMMUNICATIONS								
	Selects Message Setup Aid [DA]	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
	Enters Subscriber Table Information	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	CPU and DA
	Enters Authentication Table	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	CPU and DA
	Selects Communications Configuration [DA]	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
	Communicates with External Stations	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	Radio
	Receives Automatic FARV Location Update	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	Radio
	Verifies Automatic Communications with POC/BOC	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	Radio
	Communicates with Crew	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Intercom/Radio
	Verifies Subsystem Warning and Alert Configuration [DA]	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
	Monitors/Transmits Situation Report	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	Radio
	Monitors CCE Warnings [DA]	CoS/Gunner	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Tactical Movement									
	PREPARE FOR MOVEMENT								
	Monitors Movement Criteria Warnings [DA]	Up Crewman	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	CPU and DA
	Receives Movement Order	Up Crewman	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Radio
	Activates Vehicle Power-up Sequence	Driver/CoS	Driver/CoS	Driver/CoS	N/A	Driver/CoS	Control	High	Switch
	Monitors Afterstart Checks	All	All	All	N/A	All	GUI Screen	High	CPU and DA
	Inspects for Loose Equipment	All	All	All	N/A	All	GUI/Control	High	Video/Sensor
	Activates Movement Sequence	Driver	Driver	Driver	N/A	Driver	Control	High	Switch
	Monitors Ammunition Security Locks Status	Gunner	Gunner	Gunner	N/A	Gunner	GUI/Control	High	Video/Sensor
	Monitors Remote Travel Lock Position Status	Gunner	Gunner	Gunner	N/A	Gunner	GUI/Control	High	Video/Sensor
	Monitors Secondary Armament Status	Up-crewman	Gunner	Driver	Gunner	Driver	GUI/Control	High	Video/Sensor
	Monitors Doors and Hatches Closure Status	All/CoS	All/CoS	All/CoS	N/A	All/CoS	GUI/Control	High	Video/Sensor
	Activates NAV System Route Display [DA]	Up-crewman	CoS/Driver	CoS/Driver	CoS/Driver	CoS/Driver	GUI/Control	High	CPU and DA
	Determines Threat [DA]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
	Selects Early Warning System Display [VIDS]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
	Activates Early Warning Systems	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	Control	High	Switch
	Verifies Early Warning Systems Activation	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensor
	Selects Sensor Display [VIDS]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
	Activates Sensor Suite	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	Control	High	Switch
	Verifies Sensor(s) Activation	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensor
	Observes Display	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
	Monitors for System Checks Warnings [DA]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
MONITOR SENSOR ALARM								
Selects Alarm Mode and Alert Aid [DA]	Up-crewman	CoS	CoS	CoS	CoS	GUI/Control	High	Switch
Monitors Early Warning System Display [VIDS]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Sensor Suite Warning Display [VIDS]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Audio Visual Display	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Monitors Area Denial Proximity Warning [DA]	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Selects Wide Field of View for Surveillance Device	Up-crewman	Gunner/CoS	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
RESPOND TO SENSOR ALARM								
Monitors Warning Systems [VIDS]	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Verifies Attack [DA]	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	DA and Video/Sensor
Monitors Activation of Countermeasures	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Activation of Signature Suppression System	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Activation of Active RADAR Mode	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensor
Monitors IFF Display [DA]	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensor
Locates System Designated Target	N/A	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Chooses Target Override (if desired)	N/A	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Selects Alternate Target (if desired)	N/A	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Selects Narrow Field of View for Surveillance Device	N/A	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Monitors LASER Range Finder	N/A	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	Sensors/Simulation
Identifies New Target	N/A	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Reads Evasive Action Advisory System Display [DA]	Up-crewman	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Determines Use of Tactical Mobility [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
MONITOR ROUTE INDICATOR								
Monitors Driver Route Indicator	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	Video and Sensor
Monitors Graphic Terrain Indicator	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	Video and Sensor
Monitors Visual Displays	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	Video and Sensor
Monitors Obstacles Warnings [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Video/Sensor
DRIVE								
Communicates Movement Order to Crew	N/A	N/A	N/A	CoS	N/A	Intercom/Mike	High	Intercom/Radio
Activates Driver Route Indicator	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Switch
Selects Driver Display	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Switch
Activates Vision Devices/FLIR	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Video/Sensor
Observes Terrain using Vision Devices	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	Video/Sensor
Moves Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Communicates Movement	N/A	N/A	N/A	Driver/CoS	N/A	Intercom/Mike	Medium	Radio/Simulation
Adjusts Speed	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Steers Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Stops Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Monitors Integrated Defense System [VIDS]	N/A	N/A	N/A	Gunner/CoS	N/A	GUI Screen	High	DA and Sensors
Monitors Vehicle Warning Messages	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	DA and Sensors
NAVIGATE ROUTE								

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Selects Tactical Move Route Planning Aid [DA]	N/A	N/A	N/A	CoS	N/A	Control	High	Switch
Locates Current Position [DA]	N/A	N/A	N/A	CoS	N/A	GUI Screen	High	DA and Sensors
Identifies Destination	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
Indicates/Selects Route [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
Verifies Route and Location	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Monitors Graphic Terrain Display	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Monitors Move Variation Alert [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	Radio/DA
Determines Movement Plan Changes [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
Monitors Movement Safety Procedures [DA]	N/A	N/A	N/A	All	N/A	GUI/Control	High	CPU and DA
Enters/Receives MAPS Update Data	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	Radio/CPU and DA
CONDUCT COMMUNICATIONS								
Selects Message Handling Configuration [DA]	N/A	N/A	N/A	CoS/Gunner	N/A	Control	High	Switch
Monitors Radio	N/A	N/A	N/A	CoS/Gunner	N/A	Annunciator	High	Radio/Simulation
Monitors Digital Display	N/A	N/A	N/A	CoS/Gunner	N/A	GUI Screen	High	Radio/Simulation
Transmits External Communications	N/A	N/A	N/A	CoS/Gunner	N/A	Intercom/Mike	Medium	Radio/Simulation
Enters New External Nets	N/A	N/A	N/A	CoS/Gunner	N/A	Intercom/Mike	Medium	Radio/Simulation
Transmits Position Reports [DA]	N/A	N/A	N/A	CoS/Gunner	N/A	Intercom/Mike	Medium	Radio/Simulation
NEGOTIATE OBSTACLES								
Selects Obstacle Identification Aid [DA]	N/A	N/A	N/A	CoS/Driver	N/A	Control	High	Switch
Identifies Obstacles [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Determines Obstacle Restrictions [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Selects Route to Breech or By-pass Obstacle [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Directs Crossing or Detour	N/A	N/A	N/A	CoS/Driver	N/A	Intercom/Mike	Medium	Intercom/Radio
OCCUPY POSITION								
Selects Site Selection Aid [DA]	N/A	N/A	CoS	N/A	CoS	Control	High	Switch
Observes Terrain Analysis using Graphic Display	N/A	N/A	CoS	N/A	CoS	GUI Screen	High	Sensors/Simulation
Locates Firing Position [DA]	N/A	N/A	CoS	N/A	CoS	GUI/Control	High	Video/Sensor
Verifies Position with Emplacement Aid [DA]	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Positions Vehicle on Azimuth of Fire	N/A	N/A	Driver/CoS	N/A	Driver/CoS	GUI/Control	High	Video/Sensor
Pushes Emplace Button	N/A	N/A	CoS	N/A	CoS	Control	High	Switch
Monitors Remote Travel Lock Release	N/A	N/A	Gunner	N/A	Gunner	GUI Screen	Medium	Video/Sensor
Verifies Azimuth of Fire[DA]	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	Sensors/Simulation
Activates Backup Azimuth Reference System (if required)	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	Control	High	Switch
Identifies Distant Aiming Point [DA]	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Determines Site and Range to Crest with Laser [DA]	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	Video/Sensor
Determines/Verifies Target Priority	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	CPU and DA
Monitors System Checks	N/A	N/A	All	N/A	All	GUI Screen	High	CPU and DA
Monitors Fire Control Checks	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	CPU and DA
Enters/Receives Fire Control System Update	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
Monitors/Transmits System Status Report	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation
Monitors/Receives Safety Data from POC	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation

AFAS TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Determines Criteria for Survivability Move [DA]	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
Survivability Move									
	PREPARE FOR MOVEMENT								
	Monitors Movement Criteria Warnings [DA]	N/A	N/A	Gunner/CoS	N/A	Driver/CoS	GUI/Control	High	CPU and DA
	Determines Type of Move (Hasty, etc.) [DA]	N/A	N/A	CoS	N/A	CoS	GUI/Control	High	CPU and DA
	Receives/Gives Movement Order	N/A	N/A	CoS	N/A	CoS	Intercom/Mike	Medium	Radio/Simulation
	Activates Vehicle Power-up Sequence (if required)	N/A	N/A	Driver/CoS	N/A	Driver/CoS	Control	High	Switch
	Monitors After-start Checks	N/A	N/A	All	N/A	All	GUI Screen	High	DA and Sensors
	Inspects for Loose Equipment	N/A	N/A	All	N/A	All	GUI Screen	High	Video/Sensor
	Activates Movement Sequence	N/A	N/A	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Monitors Ammunition Security Locks Status	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	Video/Sensor
	Monitors Remote Travel Lock Position Status	N/A	N/A	Gunner/Cos	N/A	Gunner/Cos	GUI Screen	High	Video/Sensor
	Monitors Secondary Armament Status	N/A	N/A	Gunner/Cos	N/A	Gunner/Cos	GUI Screen	High	Video/Sensor
	Monitors Doors and Hatches Closure Status	N/A	N/A	All	N/A	All	GUI Screen	High	Video/Sensor
	Activates NAV System Route Display [DA]	N/A	N/A	CoS/Gunner	N/A	CoS/Driver	Control	High	Switch
	Observes Display	N/A	N/A	CoS/Gunner	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors for System Checks Warnings	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	MONITOR SENSOR ALARM								
	Selects Alarms and Alerts [DA]	N/A	All	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Monitors Early Warning System Display [VIDS]	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Sensor Suite Warning Display [VIDS]	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Audio Visual Display (HRTV)	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
	Monitors Area Denial Proximity Warning [DA]	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Selects Wide Field of View for Surveillance Device	N/A	Gunner	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	RESPOND TO SENSOR ALARM								
	Monitors Warning Systems [VIDS]	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Verifies Attack [DA]	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Activation of Countermeasures	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Activation of Signature Suppression System	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Activation of Active RADAR Mode	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors IFF Display [DA]	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Locates System Designated Target	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
	Chooses Target Override (if desired)	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Selects Alternate Target (if desired)	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
	Selects Narrow Field of View for Surveillance Device	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Monitors LASER Range Finder	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Identifies New Target (if desired)	N/A	CoS	CoS/Driver	N/A	CoS	GUI Screen	High	Video/Sensor
	Monitors/Selects Armament for Defense	N/A	Gunner/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Reads Evasive Action Advisory System Display [DA]	N/A	All	CoS/Driver	N/A	All	GUI Screen	High	DA and Sensors
	Determines Use of Tactical Mobility [DA]	N/A	CoS	CoS/Driver	N/A	CoS	GUI Screen	High	DA and Sensors
	MONITOR ROUTE INDICATOR								

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Monitors Driver Route Indicator	N/A	CoS/Driver	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
Monitors Graphic Terrain Indicator	N/A	CoS	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
Monitors Visual Displays	N/A	CoS	N/A	CoS/Driver	N/A	GUI Screen	High	Video/Sensor
Monitors Obstacles Warnings	N/A	CoS	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
DRIVE								
Communicates Movement Order to Crew	N/A	N/A	N/A	CoS	N/A	Intercom/Mike	High	Intercom/Radio
Activates Driver Route Indicator	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Switch
Selects Driver Display	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Switch
Activates Vision Devices/FLIR	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Video/Sensor
Observes Terrain using Vision Devices	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	Video/Sensor
Moves Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Communicates Movement	N/A	N/A	N/A	Driver/CoS	N/A	Intercom/Mike	Medium	Radio/Simulation
Adjusts Speed	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Steers Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Stops Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
Monitors Integrated Defense System [VIDS]	N/A	N/A	N/A	Gunner/CoS	N/A	GUI Screen	High	DA and Sensors
Monitors Vehicle Warning Messages	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	DA and Sensors
NAVIGATE ROUTE								
Selects Survival Move Route Selection Aid [DA]	N/A	N/A	N/A	CoS	N/A	Control	High	Switch
Locates Current Position [DA]	N/A	N/A	N/A	CoS	N/A	GUI Screen	High	DA and Sensors
Identifies Destination	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
Indicates/Selects Route [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
Verifies Route and Location	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Monitors Graphic Terrain Display	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Monitors Move Variation Alert [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	Radio/DA
Determines Movement Plan Changes [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
Monitors Movement Safety Procedures [DA]	N/A	N/A	N/A	All	N/A	GUI/Control	High	CPU and DA
Enters/Receives MAPS Update Data	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	Radio/CPU and DA
CONDUCT COMMUNICATIONS								
Selects Message Handling Configuration [DA]	N/A	N/A	N/A	CoS/Gunner	N/A	Control	High	Switch
Monitors Radio	N/A	N/A	N/A	CoS/Gunner	N/A	Annunciator	High	Radio/Simulation
Monitors Digital Display	N/A	N/A	N/A	CoS/Gunner	N/A	GUI Screen	High	Radio/Simulation
Transmits External Communications	N/A	N/A	N/A	CoS/Gunner	N/A	Intercom/Mike	Medium	Radio/Simulation
Enters New External Nets	N/A	N/A	N/A	CoS/Gunner	N/A	Intercom/Mike	Medium	Radio/Simulation
Transmits Position Reports [DA]	N/A	N/A	N/A	CoS/Gunner	N/A	Intercom/Mike	Medium	Radio/Simulation
NEGOTIATE OBSTACLES								
Selects Obstacle Identification Aid [DA]	N/A	N/A	N/A	CoS/Driver	N/A	Control	High	Switch
Identifies Obstacles [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Determines Obstacle Restrictions [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Selects Route to Breech or By-pass Obstacle [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
Directs Crossing or Detour	N/A	N/A	N/A	CoS/Driver	N/A	Intercom/Mike	Medium	Intercom/Radio

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
OCCUPY POSITION								
Selects Site Selection Aid [DA]						Control	High	Switch
Observes Terrain Analysis using Graphic Display	N/A	N/A	CoS	N/A	CoS	GUI Screen	High	Sensors/Simulation
Locates Firing Position [DA]	N/A	N/A	CoS	N/A	CoS	GUI/Control	High	Video/Sensor
Verifies Position with Emplacement Aid [DA]	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Positions Vehicle on Azimuth of Fire	N/A	N/A	Driver/CoS	N/A	Driver/CoS	GUI/Control	High	Video/Sensor
Pushes Emplace Button	N/A	N/A	CoS	N/A	CoS	Control	High	Switch
Monitors Remote Travel Lock Release	N/A	N/A	Gunner	N/A	Gunner	GUI Screen	Medium	Video/Sensor
Verifies Azimuth of Fire [DA]	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	Sensors/Simulation
Activates Backup Azimuth Reference System (if required)	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	Control	High	Switch
Identifies Distant Aiming Point [DA]	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Determines Site and Range to Crest with Laser [DA]	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	Video/Sensor
Determines/Verifies Target Priority	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	CPU and DA
Monitors System Checks	N/A	N/A	All	N/A	All	GUI Screen	High	CPU and DA
Monitors Fire Control Checks	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	CPU and DA
Enters/Receives Fire Control System Update	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
Monitors/Transmits System Status Report	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation
Monitors/Transmits Safety Data from POC	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation
Determines Criteria for Survivability Move [DA]	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
HASTY OCCUPATION OF POSITION								
Selects Site Selection Aid [DA]	N/A	N/A	CoS	N/A	CoS	Control	High	Switch
Locates Firing Position [DA]	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
Positions Vehicle on Azimuth of Fire	N/A	N/A	Driver/CoS	N/A	Driver/CoS	GUI Screen	High	Video/Sensor
Pushes Emplace Button	N/A	N/A	CoS	N/A	CoS	Control	High	Switch
Monitors Remote Travel Lock Release	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	Video/Sensor
Verifies Azimuth of Fire [DA	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
Monitors System Checks	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
Monitors Fire Control Checks	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
DELIVER INDIRECT FIRE								
MONITOR COMMAND FIRE NET								
Determines Message Handling Configuration [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Monitors Radio	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Intercom/Mike	Medium	Radio/Simulation
Monitors Digital Display	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	CPU and DA
Receives Fire Mission/Corrections	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Annunciator	High	Radio/Simulation
EXECUTE FIRE ORDERS								
Receives Fire Mission	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Annunciator	High	Radio/Simulation
Observes Fire Mission Display	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	CPU and DA
Observes Fire Mission Priority	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	CPU and DA
Determines to Accept/Reject Fire Mission [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	CPU and DA
Informs Crew of Fire Mission	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Intercom/Mike	Medium	Radio/Simulation
Observes Fire Mission Data	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	CPU and DA

AFAS TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Enters Data into the Fire Control System (if required)	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	Radio, CPU and DA
	EXECUTE LIMITED TACTICAL FIRE DIRECTION								
	Determines Capability to Support [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	CPU and DA
	Selects Fire Planning Aid [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Control	High	Switch
	Determines/Monitors Round Selection [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
	Determines/Monitors Fuze Selection [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
	Determines/Monitors Number of Rounds to Fire [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
	Selects Howitzers to Fire	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	FIRE MAIN ARMAMENT								
	Monitors Prefire Checks	N/A	Gunner/CoS	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	Video/Sensor
	Verifies System Ready to Fire [DA]	N/A	Gunner/CoS	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Activates Firing Sequence	N/A	N/A	N/A	N/A	Gunner/CoS	Control	High	Switch
	Pushes Cease Fire Interrupt (if required)	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Monitors Afterfire Checks	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Verifies Ammunition Update	N/A	N/A	N/A	Gunner/CoS	Gunner/CoS	GUI/Control	High	CPU and DA
	MONITOR SAFE FIRE CONDITIONS								
	Monitors/Verifies Fire Control System Data Input	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Verifies Quadrant and Deflection [DA]	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Monitors Site to Crest Warning	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Monitors Friendly Forces Location Warnings	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Monitors No Fire Control Measures Warnings	N/A	N/A	Gunner/CoS	N/A	Gunner/CoS	GUI Screen	High	CPU and DA
	Monitors Tube Thermal Warning System	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Monitors Unobstructed Bore Sensor Warning	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	MONITOR SAFE FIRE CONDITIONS (Continued)								
	Monitors propellant Sensor Warnings	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Monitors Rates of Fire	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Pushes Cease Fire Interrupt (if required)	N/A	N/A	N/A	N/A	Gunner/CoS	Control	High	Switch
	PERFORM MISFIRE PROCEDURES								
	Monitors for Misfire Warning	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Verifies Misfire [DA]	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Determines Cause of Misfire [DA]	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Determine Corrective Action [DA]	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Directs Corrective Action	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	OBTAIN AND REPORT BATTLE DAMAGE ASSESSMENT								
	Monitors Projectile Tracking System Display	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
	Monitors Fire Control Net	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
	Determines BDA from Target Acquisition Source	N/A	N/A	N/A	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation
	Determines to Terminate/Continue Mission	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	CPU and DA
	Verifies Mission Adjustment	N/A	N/A	N/A	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation
	Monitors Corrections	N/A	N/A	N/A	N/A	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation
	Monitors/Transmits BDA Report	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	Intercom/Mike	Medium	Radio/Simulation

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
MONITOR AUTOLOADER OPERATIONS								
Monitors Selection of Projectile	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	Video/Sensor
Monitors Selection of Liquid Propellant Charge	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	Video/Sensor
Monitors Fuze/Time Interrogation Sensor Warning	N/A	N/A	N/A	N/A	Gunner/CoS	GUI/Control	High	Video/Sensor
Monitors Autoloader "Event" Sensor Warnings	N/A	N/A	N/A	N/A	Gunner/CoS	GUI Screen	High	DA and Sensors
Selects Autoloader Override (if required)	N/A	N/A	N/A	N/A	Gunner/CoS	Control	High	Switch
PLAN FOR REARM								
Monitors Inventory Alarm [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Estimates Ammunition Requirements [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Estimates Fuel Requirements [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Determines Rearming Point Location [DA]	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Receives Automatic FARV Location Update	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Intercom/Mike	Medium	Radio/Simulation
Communicates with FARV	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Intercom/Mike	Medium	Radio/Simulation
PLAN FOR MOVEMENT								
Selects Route Planning Aid [DA]	N/A	CoS	CoS	CoS	CoS	Control	High	Switch
Observes Terrain Analysis using Graphic Display	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	Video/Sensor
Observes for Battlefield Management Information	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Determines Survival Move Criteria [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Locates Positions [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Indicates/Selects Route [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Rearming Points [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Identifies Hiding Positions [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
UPDATE MET/MUZZLE VELOCITY DATA								
Receives MET Data	Up-crewman	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	Radio, CPU and DA
Monitors Input of MET Data into the Fire Control System	Up-crewman	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Verifies Muzzle Velocity Update Data	Up-crewman	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
Monitors Input of MV Data into the Fire Control System	Up-crewman	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	CPU and DA
INITIALIZE FIRE DIRECTION COMPUTER								
Activates Fire Control System	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	Gunner/CoS	Control	High	Switch
Monitors System Checks	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	CPU and DA
Receives Operational Data	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
Selects Mode	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	CPU and DA
Verifies/Observes Operation Date	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	CPU and DA
OPERATE AND VERIFY POS/NAV SYSTEM								
Locates Current Position [DA]	N/A	N/A	N/A	N/A	CoS/Gunner	GUI Screen	High	DA and Sensors
Verifies Current Position	N/A	N/A	N/A	N/A	CoS/Gunner	GUI Screen	High	Video/Sensor
Aligns Graphics	N/A	N/A	N/A	N/A	CoS/Gunner	Control	High	Switch
Receives GPS Automatic Update	N/A	N/A	N/A	N/A	CoS/Gunner	GUI Screen	High	Sensor
Verifies GPS Automatic Update	N/A	N/A	N/A	N/A	CoS/Gunner	GUI Screen	High	DA and Sensors
OPERATE MANUAL LOADING OF CPHD								
Selects CPHD Projectile	N/A	N/A	N/A	N/A	Gunner	None - Manual	Medium	Projectile

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Moves CPHD to Transfer Device	N/A	N/A	N/A	N/A	Gunner	None - Manual	Medium	Projectile
Sets Fuse Setting	N/A	N/A	N/A	N/A	Gunner	None - Manual	Medium	Fuze
Sets Weapons/Frequency Switch Setting	N/A	N/A	N/A	N/A	Gunner	None - Manual	Medium	Projectile
Moves CPHD to Intake Conveyor	N/A	N/A	N/A	N/A	Gunner	None - Manual	Medium	Conveyor Tray
Activates Loading Sequence	N/A	N/A	N/A	N/A	Gunner	None - Manual	High	Controls
Monitors Loading Sequence	N/A	N/A	N/A	N/A	CoS	GUI Screen	Medium	Video/Sensor
UPDATE/VERIFY FIRE SUPPORT COORDINATION MEASURES								
Communicates with FOC/Fire Support Element	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Intercom/Mike	Medium	Radio/Simulation
Enters/Receives Battlefield Management Update Data	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	Radio/Simulation
Enters/Receives Fire Control System Update Data	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	Radio/Simulation
Verifies System Data Update	N/A	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	DA and Sensors
DELIVER DIRECT FIRE with PRIMARY ARMAMENT								
MONITOR SENSOR ALARM								
Selects Alarms and Alerts [DA]	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
Monitors Early Warning System Display [VIDS]	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Monitors Sensor Suite Warning Display [VIDS]	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Monitors Audio Visual Display	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Selects Wide Field of View for Surveillance Device	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
RESPOND TO SENSOR ALARM								
Monitors Warning Systems [VIDS]	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Verifies Attack [DA]	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors Activation of Countermeasures	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Monitors Activation of Signature Suppression System	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Monitors Activation of Active RADAR Mode	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
PRIORITIZE/IFF/ENGAGE TARGETS						GUI Screen	High	DA and Sensors
Activates IFF System	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
Identifies Targets using IFF System [DA]	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Selects Narrow Field of View for Surveillance Device	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Locates System Designated Targets	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors LASER Range Finder	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Scans Commander's Panoramic Sight	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors Engagement Criteria Warnings [DA]	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Chooses Target Override	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Control	High	Switch
Selects Alternate Target	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Control	High	Switch
Selects Narrow Field of View for Surveillance Device	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Control	High	Switch
Identifies New Target	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	GUI/Control	High	Video/Sensor
Informs Crew	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Intercom/Mike	Medium	Radio/Simulation
Tracks Target with Direct Fire Sight	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Activates Automatic Firing Sequence	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	Control	High	Switch
Monitors/Activates Loading Sequence	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Monitors Autoloader	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Monitors Automatic Target Tracking	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Monitors Maneuvering Target Predictor	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Pushes Fire Button (if manual)	CoS/Gunner	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	Control	High	Switch
ASSESS DAMAGE								
Observes with Visual Devices	N/A	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Monitors Automatic Target Screening	N/A	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	CPU and DA
Determines Target Damage	N/A	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Determines Target Threat	N/A	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Video/Sensor
Determines Priority to Refire	N/A	CoS/Gunner	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	DA and Sensors
TRANSMIT SITREP								
Enters SITREP	N/A	CoS	CoS	N/A	CoS	Intercom/Mike	Medium	Radio/Simulation
Transmits SITREP	N/A	CoS	CoS	N/A	CoS	Control/Mike	Medium	Radio/Simulation
Receives Acknowledge of SITREP	N/A	CoS	CoS	N/A	CoS	Intercom/Mike	Medium	Radio/Simulation
REARM PRIMARY ARMAMENT								
Selects Projectile	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Robotics/Simulation
Selects Charge	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Robotics/Simulation
Sets Automatic Fuze Setter	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	Robotics/Simulation
Activates Loading Sequence for Main Armament	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	Control	High	Switch
Activates Loading Sequence for Secondary Armament	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	Control	High	Switch
Monitors Inventory Alarm (DA)	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	DA and Sensors
MONITOR AUTOLOADER OPERATIONS								
Monitors Selection of Projectile	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	Video/Sensor
Monitors Selection of Liquid Propellant Charge	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	Video/Sensor
Monitors Fuze/Time Interrogation Sensor Warning	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	Video/Sensor
Monitors Autoloader "Event" Sensor Warnings	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI Screen	High	Video/Sensor
Selects Autoloader Override (if required)	N/A	N/A	CoS/Gunner	N/A	CoS/Gunner	GUI/Control	High	CPU and DA
DELIVER DIRECT FIRE with SECONDARY ARMAMENT								
MONITOR SENSOR ALARM								
Selects Alarms and Alerts (DA)	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
Monitors Early Warning System Display (VIDS)	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors Sensor Suite Warning Display (VIDS)	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Monitors Audio Visual Display	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Selects Wide Field of View for Surveillance Device	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
RESPOND TO SENSOR ALARM								
Monitors Warning Systems (VIDS)	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Verifies Attack (DA)	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors Activation of Countermeasures	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Monitors Activation of Signature Suppression System	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors Activation of Active RADAR Mode	Up Crewman	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
PRIORITIZE/IFF/ENGAGE TARGETS								
Activates IFF System	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Identifies Targets using IFF System [DA]	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Selects Narrow Field of View for Surveillance Device	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
Locates System Designated Targets	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	Video/Sensor
Monitors LASER Range Finder	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	CPU and DA
Scans Commander's Panoramic Sight	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Video/Sensor
Monitors Engagement Criteria Warnings [DA]	Up Crewman/CoS	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	DA and Sensors
Chooses Target Override	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Control	High	Switch
Selects Alternate Target	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Control	High	Switch
Selects Narrow Field of View for Surveillance Device	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Control	High	Switch
Identifies New Target	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	GUI/Control	High	Video/Sensor
Informs Crew	Up Crewman/CoS	CoS/Gunner	CoS	CoS/Gunner	CoS	Intercom/Mike	Medium	Radio/Simulation
Tracks Target with Direct Fire Sight	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	Video/Sensor
Activates Automatic Firing Sequence	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Control	High	Switch
Monitors/Activates Loading Sequence	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI/Control	High	Video/Sensor
Monitors Autoloader	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	Video/Sensor
Monitors Automatic Target Tracking	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	Video/Sensor
Monitors Maneuvering Target Predictor	Up Crewman/CoS	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	GUI Screen	High	Video/Sensor
Pushes Fire Button (if manual)	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	Control	High	Switch
ASSESS DAMAGE								
Observes with Visual Devices	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Driver	GUI/Control	High	Video/Sensor
Monitors Automatic Target Screening	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Driver	GUI Screen	High	
Determines Target Damage	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Driver	GUI/Control	High	Video/Sensor
Determines Target Threat	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Driver	GUI/Control	High	CPU and DA
Determines Priority to Refire	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Gunner	CoS/Driver	GUI/Control	High	CPU and DA
TRANSMIT SITREP								
Enters SITREP	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Transmits SITREP	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	Radio/Simulation
Receives Acknowledge of SITREP	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	Radio/Simulation
REARM PRIMARY/SECONDARY ARMAMENT								
Activates Loading Sequence for Secondary Armament	N/A	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Gunner	Control	High	Switch
Monitors Inventory Alarm [DA]	N/A	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI/Control	High	CPU and DA
MONITOR AUTOLOADER OPERATIONS								
Monitors Selection of Projectile	N/A	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Monitors Autoloader "Event" Sensor Warnings	N/A	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	GUI Screen	High	Video/Sensor
Selects Autoloader Override (if required)	N/A	CoS/Gunner	CoS/Driver	CoS/Gunner	CoS/Driver	Control	High	Switch
CONDUCT FIRING IN AN NBC ENVIRONMENT								
PREPARE FOR OPERATIONS IN AN NBC ENVIRONMENT								
Determines MOPP Level Uniform Requirements [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Identifies Difficult Mission Essential MOPP 4 tasks [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans MOPP 4 Rest Schedules [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Identifies Criteria for Automatic Masking [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Selects NBC Alarms and Sensors [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors Chemical Agent Alarms [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Sensor
APPLY SPECIAL HANDLING PROCEDURES AS REQUIRED								
Identifies Special Handling Procedures [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Performs Special Handling Procedures	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	DA, CPU and Robotics
Activates Loading Sequence						Control	High	Switch
Monitors Special Handling Procedures	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Sensor
OPERATE COMMUNICATIONS SYSTEMS								
OPERATE SINCGARS								
Determines Communications Configuration [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Message Setup Configuration [DA	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors Voice and Digital Communications	Up Crewman/CoS	CoS	CoS	CoS	CoS	Intercom/GUI	Medium	Radio/Simulation
Transmits and Receives Voice Transmissions	Up Crewman/CoS	CoS	CoS	CoS	CoS	Intercom/GUI	Medium	Radio/Simulation
Transmits and Receives Digital Transmissions	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	Medium	Radio/Simulation
Selects Linked Observer Mode	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Directs Target Handling Procedures	Up Crewman/CoS	CoS	CoS	CoS	CoS	Intercom/Mike	Medium	Radio/Simulation
OPERATE COMSEC EQUIPMENT								
Monitors COMSEC System	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Installs COMSEC Keys	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
OPERATE INTERCOM								
Selects Headset/Loudspeaker Mode	Up Crewman/CoS	All	All	All	All	Control	High	Switch
Installs Headset to External Intercom Jack	Up Crewman/CoS	All	All	All	All	Control	High	Switch
Activates FARV/AFAS-C Hookup Intercom	Up Crewman/CoS	N/A	CoS/Gunner	N/A	CoS/Driver	Control	High	Switch
Transmits Message	Up Crewman/CoS	N/A	CoS/Gunner	N/A	CoS/Driver	GUI/Control	Medium	Radio/Simulation
MAINTAIN CEOI								
Receives CEOI Update from NCS	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	Medium	Radio/Simulation
Identifies CEOI Procedures	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
RECOGNIZE ECM/EMPLOY ECCM								
Determines ECM Interference [DA]	Up Crewman/CoS	All	All	All	All	GUI/Control	High	CPU and DA
Continues Operations	Up Crewman/CoS	All	All	All	All	GUI/Control	High	CPU and DA
Selects ECCM Menu	Up Crewman/CoS	All	All	All	All	Control	High	Switch
Selects Radio Jamming Mode	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Directs Anti-Jamming Procedures [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Alternate Frequency Scan	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Transmits ECM Report	Up Crewman/CoS	All	All	All	All	GUI/Control	Medium	Radio/Simulation
COLLECT AND DISTRIBUTE INTELLIGENCE								
SENSE AND GATHER INFORMATION								
Selects Intelligence Gathering Aid [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors Integrated Defense System [VIDS]	Up Crewman/CoS	All	All	All	All	GUI/Control	High	CPU and DA
Observes High Resolution TV	Up Crewman/CoS	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Monitors FLIR Display	Up Crewman/CoS	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Observes with 360 Degree Vision Device	Up Crewman/CoS	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Observes with Night Vision Devices	Up Crewman/CoS	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Inspects Signs of Enemy Activity	Up Crewman/CoS	CoS/Gunner	Driver/CoS	Gunner/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Receives External Intelligence Information	Up Crewman/CoS	All	All	All	All	GUI/Control	Medium	Radio
PROCESS INFORMATION								
Selects Receives and Processes Intelligence Aid [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors External Intelligence Information [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Enters Local Intelligence Information	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
ANALYZE INFORMATION								
Monitors Intelligence Updates	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
Observes Battlefield Information Display	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
REPORT INFORMATION								
Directs Target Hand-off	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
Transmits Intelligence Reports	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
Transmits SPOT Report	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
Transmits Crater Analysis Report	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
UNIT DEFENSE PLANNING								
DEVELOP DIRECT FIRE PLAN								
Selects Direct Fire Planning Display [DA]	CoS/Driver	CoS/Gunner	CoS	CoS	CoS	Control	High	Switch
Determines Threat [DA]	CoS/Driver	Cos/Gunner	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Digital Map Display	CoS/Driver	Cos/Gunner	CoS	CoS	CoS	Control	High	Switch
Determines Likely Enemy Avenues of Approach [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Fields of Fire [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Direct Fire Positions [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Range Card Data [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Decision Points for Coordination [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Early Warning Requirements [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP INDIRECT FIRE PLAN								
Selects Unit Defense Indirect Fire Planning Display	CoS/Gunner	N/A	CoS	CoS	CoS	Control	High	Switch
Selects Preplanning Defensive Indirect Fire Aid [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	Control	High	Switch
Plans Execution of Final Protective Fires [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for "On Call" Missions [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for Execution of CPHD [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for SEAD [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Stand-off Range Fires for Ground Targets [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Indirect Cover Fire for Evacuation [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Alternate Howitzer Positions [DA]	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Verifies Coordination of Fire Control Measures	CoS/Gunner	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP POSITION FORTIFICATION/CONCEALMENT PLAN								
Plans use of Existing Terrain [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Fortification Assets [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA

AFAS TASKS	Primary Responsibility					Interface Device	Fidelity	Enabling Device
	Resting	Startup	Resupplying	Moving	Firing			
Selects Equipment to be Fortified [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Indirect Fire Positions to be Fortified [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Direct Fire Positions to be Fortified [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Concealment Requirements [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Position Consistent with Requirements [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Internal Position Movement Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans External Position Movement Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP POSITION EVACUATION PLAN								
Selects Evacuation Route Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Selects Evacuation Display	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Evacuation Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Evacuation Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Escape Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Hide Positions [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP POSITION SUPPRESSION PLAN								
Selects Minimize Signature Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Selects Suppression System Display	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines Threat [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Reviews/Receives Unit Suppression Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Acoustic Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Radar Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Visual Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Infrared Suppression Suite [DA	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Magnetic Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Optical Augmentation Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP FIRST AID PLAN								
Plans Crewman Evacuation [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Medical Assistance Locations	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP SANITATION PLAN								
Plans Re supply of Field Sanitation Items [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Unit Water Supply Tests [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Location of Latrines and Urinals [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans use of Shower Points [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for Sanitation and Discard of Refuse [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
PERFORM CONOPS PLANNING								
Selects Task Scheduling Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Plans Sleep Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Crew Rotation Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for Cold Section Operations [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Maintenance Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
UNIT DEFENSE OPERATIONS								

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
OPERATE VEHICLE INTEGRATED DEFENSE SYSTEM								
Activates Sensor Suite	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines Countermeasures Requirement [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Mode for Countermeasures	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Activates Early Warning System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors for Warnings	All	All	All	All	All	GUI/Control	High	CPU and DA
CONSTRUCT FORTIFICATION/CREW SERVED WEAPONS POSITIONS								
Fortifies Howitzer Indirect Firing Positions	N/A	N/A	N/A	N/A	N/A	Manual Task	None	
Fortifies Howitzer Direct Firing Positions	N/A	N/A	N/A	N/A	N/A	Manual Task	None	
Fortifies Crew Served Weapon Positions	N/A	N/A	N/A	N/A	N/A	Manual Task	None	
Fortifies Designated Equipment	N/A	N/A	N/A	N/A	N/A	Manual Task	None	
Fortifies Designated Alternate and Supplemental Positions	N/A	N/A	N/A	N/A	N/A	Manual Task	None	
EMPLOY SIGNATURE SYSTEM								
Determines Signature Minimization Requirements [DA]	CoS	CoS	CoS	CoS	Driver/CoS	GUI/Control	High	CPU and DA
Activates Acoustic Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Radar Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Visual Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Infrared Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Magnetic Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Optical Augmentation Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
ESTABLISH LOCAL DEFENSE								
Activates Visual Area Defense Monitor	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
Determines Primary Area of Responsibility [DA]	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Communicates Crew Responsibility assignment [DA]	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Early Warning System	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Visual Area Defense Monitor	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
OPERATE IFF SYSTEMS								
Activates IFF System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors IFF Display	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Mode	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Identifies Target Friend or Foe	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Video/Sensor
Informs Gunner/Secondary Armament Operator	CoS/Driver	CoS/Driver	CoS/Driver	CoS/Driver	CoS/Driver	Intercom/Mike	Medium	Radio/Simulation
OPERATE ARMAMENT SYSTEMS								
Scans with Visual Sight	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Monitors Commander's Module Fire Control System	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
Selects Armament to Fire	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
Determines Range to Target with Laser	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
Determines Main Gun Designation	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
Verifies Alignment with Visual Display	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
Tracks Target with Direct Fire Sight	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
Activates Main Armament Loading Sequence	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	Control	High	Switch

AFAS TASKS	Primary Responsibility					Interface Device	Fidelity	Enabling Device
	Resting	Startup	Resupplying	Moving	Firing			
Monitors Autoloader	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
Pushes Fire Button	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
Determines Secondary Armament Designation	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	CPU and DA
Verifies Alignment with Visual Display	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Tracks Target with Secondary Armament Sight	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Presses Fire Button on Joystick	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
Monitors/Activates Reload Sequence	Up Crewman/CoS	CoS/Gunner	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
EMPLOY NBC SELF DEFENSE SYSTEM (SENSORS)								
Selects Threat Evaluation Aid [DA]	All	All	All	All	All	Control	High	Switch
Selects NBC Detection and Warning System Display	All	All	All	All	All	Control	High	Switch
Receives NBC Decision Aid Information [DA]	All	All	All	All	All	GUI/Control	High	Radio/Simulation
Activates Individual/Collective Protection System	All	All	All	All	All	Control	High	Switch
Selects NBC Sensor [DA]	All	All	All	All	All	Control	High	Switch
Activates NBC Detection and Warning System	All	All	All	All	All	Control	High	Switch
APPLY FIRST AID								
Selects First Aid Kit	All	All	All	All	All	Manual Task	High	
Applies First Aid	All	All	All	All	All	Manual Task	Low	
Determines Medical Personnel Requirements [DA]	All	All	All	All	All	GUI/Control	High	CPU and DA
Determines Evacuation Requirements [DA]	All	All	All	All	All	GUI/Control	High	CPU and DA
Moves Casualty in order to evacuate	All	All	All	All	All	Manual Task	Low	
NBC DEFENSIVE OPERATIONS								
SENSE/MONITOR FOR NBC THREAT								
Determines Threat [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors Automatic Chemical Agent Alarm [DA	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
Monitors Radic Meter Alarm [DA]	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
Monitors Biological Agent Detector Alarm [DA]	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
Monitors Radio for NBC Alert	All	All	All	All	All	GUI/Control	High	CPU, DA and Radio
ID/REPORT NBC ATTACK/AGENTS								
Verifies Alarm Warning [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Sensor
Determines Initial Identification from Detector	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Radio
Activates Sample Transfer System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Activates Sampling Device	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors/Transmits NBC Report	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Radio
OPERATE ONBOARD NBC PROTECTION SYSTEM								
Activates Emergency Containment Controls	All	All	All	All	All	Control	High	Switch
Activates NBC Over pressure (Main) System	All	All	All	All	All	Control	High	Switch
Monitors NBC Backup System	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
Activates MOPP Conditions [DA]	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
Dons Ventilated Facepieces	All	All	All	All	All	Manual Task	Medium	
Monitors FARV Access Port Indicator	All	All	All	All	All	GUI/Control	High	Video/Sensor
DECONTAMINATE SYSTEM AS REQUIRED								

AFAS		Primary Responsibility							
TASKS		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Selects Decontamination Decision Aid Display [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Determines Contamination Status [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Sensor
	Activates Automatic Decontamination System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Monitors Automatic Chemical Agent Alarm	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Dons Protective Gear	All	All	All	All	All	Manual Task	High	
	Directs Manual Decontamination [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Sensor
	PERFORM CONOPS PLANNING								
	Selects Task Scheduling Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Plans Sleep Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Plans Crew Rotation Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Plans for Cold Section Operations [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Plans Maintenance Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
AUTOMOTIVE MAINTENANCE									
	OPERATE ELECTRONIC TECHNICAL MANUALS.								
	Selects Automatic Logbook Display [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Switch
	Selects Preventive Maintenance Aid [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Electronic Manuals
	Selects PMCS Checklists [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Switch
	Identifies Scheduled Maintenance Requirements [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU and DA
	Determines Status of Maintenance Subsystems [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU, DA and Sensor
	Selects Unscheduled Maintenance Aid [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Switch
	Identifies Corrective Maintenance Procedures [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU and DA
	Enters Maintenance Record Updates [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU and DA
	CONDUCT PMCS AND MAINTENANCE.								
	Directs PMCS on Turret Assembly [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Inspects Turret Subassemblies	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Crew Stations [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Crew Stations [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Crew Stations [BITE]	Driver/CoS	All	All	All	All	GUI/Control	High	Electronic Manuals
	Directs PMCS on Stowage Racks and Boxes [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Suspension Assembly [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Adjusts Suspension [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Track Assembly [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces Track Blocks [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Removes/Replaces Sprocket [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Power pack [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Power pack [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals

AFAS TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Power pack [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Final Drives [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Fuel System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Fuel System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fuel System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Cooling System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Cooling System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Cooling System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Air Induction System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Air Induction System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Air Induction System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Exhaust System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Exhaust System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Exhaust System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Auxiliary Systems [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Auxiliary Systems [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Auxiliary Systems [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Hydraulic Power System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Hydraulic Power System[BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Hydraulic Power System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Potable Water Unit	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Embedded Training Device [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Embedded Training Device [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Embedded Training Device [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Survivability System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Survivability System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals

AFAS TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Portable Handheld Extinguishers	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on Crew Compartment Extinguishing System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Crew Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Manual Task	Medium	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Crew Compartment Extinguishing System [BITE]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Directs PMCS on Weapon Compartment Extinguishing System [DA	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Weapons Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Weapons Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Engine Compartment Extinguishing System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Engine Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Engine Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Fire Suppression Alarm System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Fire Suppression Alarm System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fire Suppression Alarm System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
PERFORM PMCS AND MAINTENANCE ON CCE EQUIPMENT.									
	Directs PMCS on Intercommunication System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Intercommunication System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces Intercommunication System LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Intercommunication System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on SINCGARS Radio [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots SINCGARS [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests SINCGARS [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Electrical System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Electrical System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Electrical System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Navigation Equipment [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Navigation Equipment [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Navigation Equipment [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Mission Critical Computer [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Troubleshoots Mission Critical Computer [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Mission Critical Computer [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
ARMAMENT MAINTENANCE								
OPERATE ELECTRONIC TECHNICAL MANUALS								
Selects Automatic Logbook Display [DA]	Gunner	N/A	N/A	N/A	N/A	Control	High	Switch
Selects Preventative Maintenance Aid [DA]	Gunner	N/A	N/A	N/A	N/A	Control	High	Switch
Selects PMCS Checklists [DA]	Gunner	N/A	N/A	N/A	N/A	Control	High	Switch
Identifies Scheduled Maintenance Requirements [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	DA and Elec. Manuals
Determines Status of Armament Subsystems [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	DA and Elec. Manuals
Selects Unscheduled Maintenance Aid [DA]	Gunner	N/A	N/A	N/A	N/A	Control	High	Switch
Identifies Corrective Maintenance Procedures [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	DA and Elec. Manuals
Enters Maintenance Record Updates [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	DA and Elec. Manuals
CONDUCT PMCS AND MAINTENANCE								
Directs PMCS on Gun Tube Assembly [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects Components [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	DA and Elec. Manuals
Directs PMCS on Cannon Cooling Assembly [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots Cannon Cooling Assembly [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	DA and Elec. Manuals
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects Components [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Cannon Cooling Assembly [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on Breech/Combustor Assembly [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects Components [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Directs PMCS on Cannon Assembly Sensors [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots Cannon Assembly Sensors [BITE]	Gunner/CoS		Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Cannon Assembly Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on Recoil/Counterrecoil Assembly [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoot Subassemblies [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Recoil/Counterrecoil Assembly [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on Gun Mount Cooling Assembly [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects Subassemblies [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Directs PMCS on Gun Mount Sensors [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots Gun Mount Sensors [BITE]	Gunner/CoS		Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals

AFAS TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Tests Gun Mount Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Travel Lock Assembly [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Travel Lock Assembly [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Subassemblies [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Travel Lock Assembly [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Projectile Storage and Handling System [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Projectile Storage and Handling System [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Projectile Storage and Handling System [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Autoloader Sensors [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Autoloader Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Autoloader Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Propellant Storage and Handling System [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Propellant Storage and Handling System [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Propellant Storage and Handling System [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Propellant Sensors [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Propellant Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Propellant Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Fire Control System [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Fire Control System [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fire Control System [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Fire Control Sights [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Night Vision Viewer [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs Self-Test	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on Secondary Armament [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Secondary Armament [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Secondary Armament [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Smoke Grenade Launcher [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Smoke Grenade Launcher	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals

AFAS TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Smoke Grenade Launcher [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Range Finder [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs Self-Test	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on Fire Control Sensors [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoot Fire Control Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fire Control Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Gun Pointing System [DA]	Gunner	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Troubleshoots Fire Control Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects LRUs [DA]	Gunner	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fire Control Sensors [BITE]	Gunner/CoS	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	Electronic Manuals
NBC MAINTENANCE]									
	OPERATE ELECTRONIC TECHNICAL MANUALS								
	Selects Automatic Logbook Display [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
	Selects Preventative Maintenance Aid [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
	Selects PMCS Checklists [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
	Identifies Scheduled Maintenance Requirements [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Determines Status of NBC Subsystems [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Selects Unscheduled Maintenance Aid [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
	Identifies corrective Maintenance Procedures [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Enters Maintenance Record Updates [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	CONDUCT PMCS AND MAINTENANCE								
	Directs PMCS on MOPP Equipment	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on NBC Sensors [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots NBC Sensors [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests NBC Sensors [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on NBC Overpressure System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Troubleshoots NBC Overpressure System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects LRUs	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests NBC Overpressure System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on NBC Self Defense System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs Self-Tests	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on NBC Backup System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots NBC Backup System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests NBC Backup System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on Decontamination System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots Decontamination System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Decontamination System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
CONDUCT RESUPPLY OPERATIONS								
MONITOR/REPORT LEVELS OF ONBOARD CLASS I, III, V STOCKS								
Selects Automatic Inventory System [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors Stock Levels [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors Automatic Requests Monitors Inventory Warnings [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Estimates POL Usage [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Enters Changes to Requests	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors/Transmits Logistical Reports	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
PLAN/COORDINATE RESUPPLY OPERATIONS								
Selects Resupply Coordination Aid [DA]	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Receives Automatic FARV Location Update	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Selects Resupply Route Planning Aid [DA]	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Identifies/Selects Route of Movement [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Resupply Point [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Resupply Point Time Window [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors Automatic Supply Request [DA]	CoS	N/A	CoS	CoS	CoS	GUI Screen	Medium	Video/Sensor
Requests Immediate Resupply	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	Radio/Simulation
TRANSFER CLASS I, III, V STOCKS								
Positions Vehicle	N/A	N/A	CoS	CoS	CoS	GUI/Control	Medium	Video/Sensor
Selects Resupply Ready Mode	N/A	N/A	CoS	CoS	CoS	Control	High	Switch
Positions FARV in order to mate with AFAS	N/A	N/A	CoS	CoS	CoS	GUI/Control	Medium	Video/Sensor
Monitors Transfer Interface Warnings	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Automatic Transfer Sensors	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
LOCATE/NAVIGATE TO RESUPPLY POINT								
Selects Graphic Terrain Display	N/A	N/A	CoS	CoS	CoS	Control	High	Switch
Locates Current Position [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Identifies Resupply Point [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Describes/Selects Route [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Graphic Display	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Movement Variation Alert [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Directs Movement to Resupply Point	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DOWNLOAD CLASS III, V STOCKS								
Positions Vehicles	N/A	N/A	Driver	N/A	N/A	GUI/Control	Medium	Video/Sensor
Moves Stocks for repositioning if Required	N/A	N/A	Gunner	N/A	N/A	GUI/Control	High	DA, CPU and Robotics

AFAS TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Activates Automated Handling System in AFAS	N/A	N/A	Gunner	N/A	N/A	Control	High	Switch
Moves Stocks in order to download	N/A	N/A	Gunner	N/A	N/A	GUI/Control	High	DA, CPU and Robotics
Monitors Automatic Inventory Control System [DA]	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Enters Updates into Inventory Control System	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
CONDUCT RECOVERY OPERATIONS								
COORDINATE FOR HET/MBT EVACUATION/RECOVERY								
Informs Command Element	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI Screen	High	Radio, CPU and DA
Communicates with Maintenance Element	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI Screen	High	Radio, CPU and DA
Determines Recovery Point [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Determines Evacuation Method [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Determines Vehicle Configuration [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Positions Vehicle	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	Medium	Video/Sensor
CONDUCT SELF-RECOVERY								
Selects Maintenance Recovery Guide [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
Selects Troubleshooting Sequence [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
Determines Problem [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	DA and Elec. Manuals
Adjusts and Repair Cause of Problem (Temporary) [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	DA and Elec. Manuals
Directs Movement to Maintenance Area	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
CONDUCT AFAS/FARV-A RECOVERY								
Determines Recovery Point [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Activates Load Transfer	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
Moves Load for Transfer	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Manual Task	Low	
Installs Towing Equipment	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Manual Task	Low	
Positions Vehicle	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	Medium	Video/Sensor
Directs Movement to Maintenance Area	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
COMM/POS NAV DEGRADED/UNUSUAL OPERATIONS								
OPERATE AFAS IN PAIRS (1 AFAS FIRE CONTROL)								
Selects Degraded Operations Aid [DA]	N/A	N/A	CoS	CoS	CoS	Control	High	Switch
Directs Paired Howitzer Concept	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Installs Wire (if Appropriate)	N/A	N/A	Driver	N/A	Driver	Manual Task	Low	
Directs Data Base Exchange	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Transmits Fire Mission	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Determines Fire Command Corrections for Second Howitzer	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI/Control	High	CPU and DA
Transmits Fire Commands to Second Howitzer	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
Determines Corrections	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	DA and Sensors
OPERATE AFAS IN PAIRS (1 AFAS W/COMMO DEAD ON VOICE)								
Determines Digital Message Configuration [DA]	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Directs Paired Howitzer Concept	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Installs Wire (if Possible)	N/A	N/A	Driver	N/A	Driver	Manual Task	Low	
Receives Fire Mission	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
Transmits Digital to Other Howitzer	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	Radio, CPU and DA

AFAS TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Transmits Fire Mission	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
Verifies Acknowledgment	N/A	N/A	Gunner/CoS	Gunner/CoS	Gunner/CoS	GUI Screen	High	Radio, CPU and DA
MAP READING WITH DEGRADED NAV SYSTEM								
Selects Basic Route Planner Aid [DA]	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Selects NAV System in Degraded Mode Display	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Determines Usable Features of NAV System [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Activates Backup Azimuth System	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Locates Current Position	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Verifies Position [DA]	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Display	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Route [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
MAP READING WITH INOPERATIVE NAV SYSTEM								
Locates Current Position	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Activates Backup Azimuth System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Orients Map	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Verifies Map Location with Visual References	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Video/Sensor
Determines Route	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEGRADED OPERATIONS								
OPERATE WITH OVER PRESSURE SYSTEM INOPERATIVE								
Selects NBC Warning Display [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines MOPP Uniform Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors NBC Detection and Warning System	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Entry/Exit/Sealing System Warnings	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Dons Ventilated Face pieces	CoS	CoS	CoS	CoS	CoS	Manual Task	Medium	
Dons Protective Gear	CoS	CoS	CoS	CoS	CoS	Manual Task	Medium	
OPERATE W/NBC SENSOR SYSTEM INOPERATIVE								
Selects NBC Warning Display [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines Sensor Degradation [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Communicates with Adjacent Howitzers for Alerts	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Communicates with POC for Alerts	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Communicates with FARV for Alerts	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Determines MOPP Uniform Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Masking Procedures and Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
OPERATE WITH SINGLE CREWMAN								
Selects Single Crewman Operations Display [DA]	All	All	All	All	All	Control	High	Switch
Directs Functions to Selected Crew Station [DA]	All	All	All	All	All	GUI/Control	High	CPU and DA
Determine Priority Warnings [DA]	All	All	All	All	All	GUI Screen	High	DA and Sensors
Selects Mission Function	All	All	All	All	All	Control	High	Switch
Activates Mission Function	All	All	All	All	All	Control	High	Switch
Monitors for Mission Warnings	All	All	All	All	All	GUI Screen	High	DA and Sensors
Monitors for Priority Warnings	All	All	All	All	All	GUI Screen	High	DA and Sensors

AFAS		Primary Responsibility							
TASKS		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
I									

FARV TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
PREPARE FOR OPERATIONS								
SYSTEM INITIALIZATION								
Selects Initialization Display	Up Crewman	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Selects Pre-operational Checks Aid [DA]	Up Crewman	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Monitors Pre-operation Checks [DA]	Up Crewman	N/A	N/A	N/A	N/A	GUI Screen	High	Sensors
Activates Master Power	N/A	Driver/CoS	N/A	N/A	N/A	Control	High	Switch
Activates Starting Sequence	N/A	Driver/CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Monitors Engine Warning Indicators	N/A	Driver/Cos	N/A	N/A	N/A	GUI Screen	High	Sensors
Activates Power to Crew Stations	N/A	Driver/CoS	N/A	N/A	N/A	Control	High	Switch
Monitors Self Tests	N/A	All	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Selects Crew Configuration Selection Displays [DA]	Up Crewman	All	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Selects Crew Configuration and Task Allocations [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Selects Crew Interfaces in order to assign positions [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Monitors Power up and Crew Ready Indication	N/A	All	N/A	N/A	N/A	GUI Screen	High	Sensors
Receives Crew Ready Alert	N/A	CoS	N/A	N/A	N/A	Annunciator	High	Sensors and DA
Determines Position Location and Orientation	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Sensors
Verifies Position and Orientation	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Selects System Pre-operational Checks Aid [DA]	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Switch
Selects System Default Mode Display [DA]	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Switch
Observes System Modes	Up Crewman	CoS/All	N/A	N/A	N/A	GUI Screen	High	Sensors
Receives Operations Order	Up Crewman	CoS/Handler	N/A	N/A	N/A	GUI Screen	High	Radio
Enters Data from Operations Order	Up Crewman	CoS/Handler	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Selects Operations Order Display	Up Crewman	CoS/Handler	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Observes Operations Order	N/A	CoS/Handler	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Informs Crew of Operations Order and Tasks	N/A	CoS/Handler	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Receives OPORD Displays	N/A	CoS/All	N/A	N/A	N/A	GUI Screen	High	Radio and DA
Receives Section Chief Guidance	N/A	CoS/Handler	N/A	N/A	N/A	GUI Screen	High	Radio
Determines Operational Mode Changes [DA]	N/A	CoS	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Selects Operational Mode [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Selects Status Display	Up Crewman	All	N/A	N/A	N/A	GUI Screen	High	Switch
Monitors Status of System Readiness Report	Up Crewman	CoS	N/A	N/A	N/A	GUI Screen	High	CPU and DA
Determines if Maintenance is Required [DA]	Up Crewman	All	N/A	N/A	N/A	GUI Screen	High	Sensors and DA
PERFORM COMMUNICATIONS SETUP								
Selects Communications Setup Display	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Determines Communications Configuration [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Establishes and Updates Communications Database	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Sets Radios	Up Crewman	CoS/All	N/A	N/A	N/A	Control	High	Radio
Selects Message Setup Aid [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Sets Internal Message Procedures [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Establishes Internal Message Priority [DA]	Up Crewman	CoS	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Monitors Digital Command Check	Up Crewman	CoS/All	N/A	N/A	N/A	Annunciator	High	Radio
Enters Net	Up Crewman	CoS	N/A	N/A	N/A	Control	High	Radio
PERFORM INFORMATION MANAGEMENT								
Selects Information Management Display	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Data Required to Perform Mission [DA]	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA

FARV TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Monitors File Contents for Completeness	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Itemizes Incomplete or Missing Files	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Selects Data Display for Review	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Identifies Obsolete Data [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Reviews Data Files	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Deletes Outdated Data	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Requests Current Data	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Radio
	Monitors Updates	Up Crewman	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	PERFORM PLANNING AND COORDINATE OPERATIONS								
	Selects Operational Displays [DA]	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Reviews Mission	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Determines Activities to Support Mission [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Determines Resources Required for Each Activity [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Determines Mission/Task Priorities [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Determines Scheduling Requirements with Scheduling Aid [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Determines Restraints [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Plans Coordination of Activities [DA]	N/A	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	CONDUCTS TERRAIN ANALYSIS								
	Recieves METT-T Data	Up Crewman	All	CoS	CoS	CoS	GUI/Control	High	Radio
	Selects Operational Overlay of Terrain Graphics	Up Crewman	All	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Observes Terrain Features	Up Crewman	All	CoS	CoS	CoS	GUI Screen	High	Sensors
	Identifies Terain that will Support Operations	Up Crewman	All	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Monitors Digital Data Display	Up Crewman	All	CoS	CoS	CoS	GUI Screen	High	CPU and DA
RSOP									
	PERFORM SECURITY SWEEP								
	Activates Vehicle Display Screen	Up Crewman	CoS/Driver	Driver	N/A	Driver	GUI/Control	High	CPU and DA
	Selects NAV System Route Display	Up Crewman	CoS/Driver	Driver	N/A	Driver	GUI/Control	High	CPU and DA
	Selects Area Sweep Aid [DA]	Up Crewman	CoS/Driver	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	CPU and DA
	Analyzes Digital Terrain Display	Up Crewman	CoS/Driver	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	CPU and DA
	Selects/Indicates Sweep Route [DA]	Up Crewman	CoS/Driver	Driver	N/A	Driver	GUI/Control	High	CPU and DA
	Determines Threat [DA]	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
	Selects Early Warning System Display [VIDS]	Up Crewman	All	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
	Activates Early Warning System	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
	Verifies Early Warning System Activation	Up Crewman	All	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	Sensors
	Selects Sensor Display [VIDS]	Up Crewman	All	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
	Activates Sensor Suite	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
	Verifies Sensor(s) Activation	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	GUI Screen	High	CPU and DA
	Observes Display	Up Crewman	CoS/Driver	CoS/Driver	N/A	Driver/CoS	GUI Screen	High	CPU and DA
	Observes using Visual Surveillance Device	Up Crewman	CoS/Driver	Driver	Handler/CoS	Driver	GUI Screen	High	Video/Sensor
	Identifies Elements in Area [DA]	Up Crewman	CoS/Driver	Driver	Handler/CoS	Driver	GUI Screen	High	Video/Sensor
	Identifies Danial Elements [DA]	Up Crewman	CoS	Driver	Handler/CoS	Driver	GUI Screen	High	Video/Sensor
	MONITOR SENSOR ALARMS SUITE								
	Selects Alarms and Alerts [DA]	Up Crewman	All	Driver/CoS	Handler/CoS	Driver/CoS	Control	High	Switch
	Monitors Early Warning System Display [VIDS]	Up Crewman	Driver/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Sensors
	Monitors Sensor Suite Warning Display [VIDS]	Up Crewman	Driver/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Sensors

FARV TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Monitors Audio Visual Display (HRTV)	Up Crewman	Driver/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	Monitors Area Denial Proximity Warning [DA]	Up Crewman	All	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	CPU and DA
	Selects Wide Field of View for Surveillance Device	Up Crewman	Driver/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	RESPOND TO SENSOR ALARM								
	Monitors Warning Systems [VIDS]	Up Crewman	All	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Sensors
	Verifies Attack [DA]	Driver/CoS	Driver/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Sensors
	Monitors Activation of Countermeasures	Driver/CoS	Driver/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Sensors
	Monitors Activation of Signature Suppression System	CoS/Driver	CoS/Driver	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	CPU and DA
	Locates System Designated Target	N/A	Driver/CoS	Driver/CoS	CoS/Handler	Driver/CoS	GUI Screen	High	Video/Sensor
	Chooses Target Override (if desired)	N/A	Driver/CoS	Driver/CoS	CoS/Handler	Driver/CoS	GUI Screen	High	Video/Sensor
	Selects Alternate Target (if desired)	N/A	CoS/Driver	Driver/CoS	CoS/Handler	Driver/CoS	Control	High	Video/Sensor
	Identifies New Target (if desired)	N/A	Driver/CoS	Driver/CoS	CoS/Handler	Driver/CoS	GUI/Control	High	Video/Sensor
	Monitors/Selects Armament for Defense	N/A	CoS/Driver	Driver/CoS	CoS/Handler	Driver/CoS	GUI Screen	High	CPU and DA
	Reads Evasive Action Advisory System Display [DA]	N/A	CoS/Driver	Driver/CoS	CoS/Handler	Driver/CoS	GUI Screen	High	CPU and DA
	Determines Use of Tactical Mobility [DA]	N/A	CoS/Driver	Driver/CoS	CoS/Handler	Driver/CoS	GUI Screen	High	CPU and DA
	SELECTS POSITION								
	Selects Site Selection Aid [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Observes Graphic Terrain Information	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Verifies NAV/POS Information [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Communicates with Other Elements in Area	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Selects Hide/Overwatch Position [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Locates AFAS Position	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU, DA and Radio
	PERFORMS SITE IMPROVEMENT								
	Determines Site Improvement Requirements [DA]	Driver/Handler	N/A	N/A	N/A	N/A	GUI Screen	High	CPU and DA
	Directs Site Improvement	CoS/Handler	N/A	CoS	N/A	CoS	GUI Screen	High	CPU and DA
	ESTABLISH SECURITY/DEFENSIVE PLAN								
	Selects Integrated Defense Display [VIDS]	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Observes Integrated Defense Display [VIDS]	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Determines Sensor Requirements [DA]	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Sensor Suite	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	Control	High	Switch
	Determines Countermeasure Requirements [DA]	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Countermeasures	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	Control	High	Switch
	Determines Signature Suppression System Requirements [DA]	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Signature Suppression System	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	Control	High	Switch
	Determines Early Warning System Requirements [DA]	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Activates Early Warning System	CoS/Driver	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	Control	High	Switch
	ESTABLISH COMMUNICATIONS								
	Selects Message Setup Aid [DA]	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Enters Subscriber Table Information	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI/Control	High	CPU and DA
	Enters Authentication Table	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI/Control	High	CPU and DA
	Selects Communications Configuration [DA]	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
	Communicates with External Stations	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI/Control	High	Radio
	Receives Automatic AFAS Location Update	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI/Control	High	Radio
	Verifies Automatic Communications with POC/BOC	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI/Control	High	Radio
	Communicates with Crew	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	Control	High	Intercom/Radio

FARV TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Verifies Subsystem Warning and Alert Configuration [DA]	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
Monitors/Transmits Situation Report	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI/Control	High	Radio
Monitors CCE Warnings [DA]	CoS/Handler	CoS/Handler	CoS/Driver	CoS/Handler	CoS/Driver	GUI Screen	High	CPU and DA
Tactical Movement								
PREPARE FOR MOVEMENT								
Monitors Movement Criteria Warnings [DA]	Up Crewman	CoS/Handler	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	CPU and DA
Receives Movement Order	Up Crewman	CoS/Handler	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Radio
Activates Vehicle Power-up Sequence	Driver/CoS	Driver/CoS	Driver/CoS	N/A	Driver/CoS	Control	High	Switch
Monitors Afterstart Checks	All	All	All	N/A	All	GUI Screen	High	CPU and DA
Inspects for Loose Equipment	All	All	All	N/A	All	GUI/Control	High	Video/Sensor
Activates Movement Sequence	Driver	Driver	Driver	N/A	Driver	Control	High	Switch
Monitors Ammunition Security Locks Status	Handler	Handler	Handler	N/A	Handler	GUI/Control	High	Video/Sensor
Monitors Secondary Armament Status	Up-crewman	Handler	Driver	Handler	Driver	GUI/Control	High	Video/Sensor
Monitors Doors and Hatches Closure Status	All/CoS	All/CoS	All/CoS	N/A	All/CoS	GUI/Control	High	Video/Sensor
Activates NAV System Route Display [DA]	Up-crewman	CoS/Driver	CoS/Driver	CoS/Driver	CoS/Driver	GUI/Control	High	CPU and DA
Determines Threat [DA]	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Selects Early Warning System Display [VIDS]	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Activates Early Warning Systems	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	Control	High	Switch
Verifies Early Warning Systems Activation	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Sensor
Selects Sensor Display [VIDS]	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Activates Sensor Suite	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	Control	High	Switch
Verifies Sensor(s) Activation	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Sensor
Observes Display	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors for System Checks Warnings [DA]	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
MONITOR SENSOR ALARM								
Selects Alarm Mode and Alert Aid [DA]	Up-crewman	CoS	CoS	CoS	CoS	GUI/Control	High	Switch
Monitors Early Warning System Display [VIDS]	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Sensor Suite Warning Display [VIDS]	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Audio Visual Display	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Monitors Area Denial Proximity Warning [DA]	Up-crewman	Handler/CoS	Driver/CoS	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Selects Wide Field of View for Surveillance Device	Up-crewman	Handler/CoS	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
RESPOND TO SENSOR ALARM								
Monitors Warning Systems [VIDS]	Up-crewman	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Verifies Attack [DA]	Up-crewman	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	DA and Video/Sensor
Monitors Activation of Countermeasures	Up-crewman	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Activation of Signature Suppression System	Up-crewman	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Locates System Designated Target	N/A	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Chooses Target Override (if desired)	N/A	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Selects Alternate Target (if desired)	N/A	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	Video/Sensor
Identifies New Target	N/A	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
Reads Evasive Action Advisory System Display [DA]	Up-crewman	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Determines Use of Tactical Mobility [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
MONITOR ROUTE INDICATOR								
Monitors Driver Route Indicator	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	Video and Sensor
Monitors Graphic Terrain Indicator	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	Video and Sensor

FARV TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Monitors Visual Displays	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	Video and Sensor
	Monitors Obstacles Warnings [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Video/Sensor
DRIVE									
	Communicates Movement Order to Crew	N/A	N/A	N/A	CoS	N/A	Control	High	Intercom/Radio
	Activates Driver Route Indicator	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Switch
	Selects Driver Display	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Switch
	Activates Vision Devices/FLIR	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Video/Sensor
	Observes Terrain using Vision Devices	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	Video/Sensor
	Moves Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Communicates Movement	N/A	N/A	N/A	Driver/CoS	N/A	Control	High	Intercom/Radio
	Adjusts Speed	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Steers Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Stops Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Monitors Integrated Defense System [VIDS]	N/A	N/A	N/A	Handler/CoS	N/A	GUI Screen	High	DA and Sensors
	Monitors Vehicle Warning Messages	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	DA and Sensors
NAVIGATE ROUTE									
	Selects Tactical Move Route Planning Aid [DA]	N/A	N/A	N/A	CoS	N/A	Control	High	Switch
	Locates Current Position [DA]	N/A	N/A	N/A	CoS	N/A	GUI Screen	High	DA and Sensors
	Identifies Destination	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
	Indicates/Selects Route [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
	Verifies Route and Location	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Monitors Graphic Terrain Display	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Monitors Move Variation Alert [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	Radio/DA
	Determines Movement Plan Changes [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
	Monitors Movement Safety Procedures [DA]	N/A	N/A	N/A	All	N/A	GUI/Control	High	CPU and DA
	Enters/Receives MAPS Update Data	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	Radio/CPU and DA
CONDUCT COMMUNICATIONS									
	Selects Message Handling Configuration [DA]	N/A	N/A	N/A	CoS/Handler	N/A	Control	High	Switch
	Monitors Radio	N/A	N/A	N/A	CoS/Handler	N/A	Annunciator	High	Radio/Simulation
	Monitors Digital Display	N/A	N/A	N/A	CoS/Handler	N/A	GUI Screen	High	Radio/Simulation
	Transmits External Communications	N/A	N/A	N/A	CoS/Handler	N/A	Intercom/Mike	Medium	Radio/Simulation
	Enters New External Nets	N/A	N/A	N/A	CoS/Handler	N/A	Intercom/Mike	Medium	Radio/Simulation
	Transmits Position Reports [DA]	N/A	N/A	N/A	CoS/Handler	N/A	Intercom/Mike	Medium	Radio/Simulation
NEGOTIATE OBSTACLES									
	Selects Obstacle Identification Aid [DA]	N/A	N/A	N/A	CoS/Driver	N/A	Control	High	Switch
	Identifies Obstacles [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Determines Obstacle Restrictions [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Selects Route to Breech or By-pass Obstacle [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Directs Crossing or Detour	N/A	N/A	N/A	CoS/Driver	N/A	Intercom/Mike	Medium	Intercom/Radio
OCCUPY POSITION									
	Selects Site Selection Aid [DA]	N/A	N/A	CoS	N/A	CoS	Control	High	Switch
	Observes Terrain Analysis using Graphic Display	N/A	N/A	CoS	N/A	CoS	GUI Screen	High	Sensors/Simulation
	Locates Firing Position [DA]	N/A	N/A	CoS	N/A	CoS	GUI/Control	High	Video/Sensor
	Verifies Position with Emplacement Aid [DA]	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
	Monitors System Checks	N/A	N/A	All	N/A	All	GUI Screen	High	CPU and DA

FARV TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Monitors/Transmits System Status Report	N/A	N/A	Handler/CoS	N/A	Handler/CoS	Intercom/Mike	Medium	Radio/Simulation
	Monitors/Receives Safety Data from POC	N/A	N/A	Handler/CoS	N/A	Handler/CoS	Intercom/Mike	Medium	Radio/Simulation
	Determines Criteria for Survivability Move [DA]	N/A	N/A	Handler/CoS	N/A	Handler/CoS	GUI/Control	High	CPU and DA
Survivability Move									
PREPARE FOR MOVEMENT									
	Monitors Movement Criteria Warnings [DA]	All	All	Handler/CoS	N/A	Driver/CoS	GUI/Control	High	CPU and DA
	Determines Type of Move (Hasty, etc.) [DA]	CoS	N/A	CoS	N/A	CoS	GUI/Control	High	CPU and DA
	Receives/Gives Movement Order	CoS	N/A	CoS	N/A	CoS	Intercom/Mike	Medium	Radio/Simulation
	Activates Vehicle Power-up Sequence (if required)	CoS/Driver	N/A	Driver/CoS	N/A	Driver/CoS	Control	High	Switch
	Monitors After-start Checks	All	N/A	All	N/A	All	GUI Screen	High	DA and Sensors
	Inspects for Loose Equipment	All	N/A	All	N/A	All	GUI Screen	High	Video/Sensor
	Activates Movement Sequence	CoS/Driver	N/A	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Monitors Ammunition Security Locks Status	Handler/CoS	N/A	Handler/CoS	N/A	Handler/CoS	GUI Screen	High	Video/Sensor
	Monitors Armament Status	N/A	N/A	Handler/Cos	N/A	Handler/Cos	GUI Screen	High	Video/Sensor
	Monitors Doors and Hatches Closure Status	N/A	N/A	All	N/A	All	GUI Screen	High	Video/Sensor
	Activates NAV System Route Display [DA]	N/A	N/A	CoS/Handler	N/A	CoS/Driver	Control	High	Switch
	Observes Display	N/A	N/A	CoS/Handler	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors for System Checks Warnings	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
MONITOR SENSOR ALARM									
	Selects Alarms and Alerts [DA]	N/A	All	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Monitors Early Warning System Display [VIDS]	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Sensor Suite Warning Display [VIDS]	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Audio Visual Display (HRTV)	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
	Monitors Area Denial Proximity Warning [DA]	N/A	All	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
RESPOND TO SENSOR ALARM									
	Monitors Warning Systems [VIDS]	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Verifies Attack [DA]	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Activation of Countermeasures	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Monitors Activation of Signature Suppression System	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	DA and Sensors
	Locates System Designated Target	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
	Chooses Target Override (if desired)	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
	Selects Alternate Target (if desired)	N/A	Handler/CoS	CoS/Driver	N/A	CoS/Driver	GUI Screen	High	Video/Sensor
	Identifies New Target (if desired)	N/A	CoS	CoS/Driver	N/A	CoS	GUI Screen	High	Video/Sensor
	Reads Evasive Action Advisory System Display [DA]	N/A	All	CoS/Driver	N/A	All	GUI Screen	High	DA and Sensors
	Determines Use of Tactical Mobility [DA]	N/A	CoS	CoS/Driver	N/A	CoS	GUI Screen	High	DA and Sensors
MONITOR ROUTE INDICATOR									
	Monitors Driver Route Indicator	N/A	CoS/Driver	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
	Monitors Graphic Terrain Indicator	N/A	CoS	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
	Monitors Visual Displays	N/A	CoS	N/A	CoS/Driver	N/A	GUI Screen	High	Video/Sensor
	Monitors Obstacles Warnings	N/A	CoS	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
DRIVE									
	Communicates Movement Order to Crew	CoS	CoS	CoS	CoS	CoS	Intercom/Mike	High	Intercom/Radio
	Activates Driver Route Indicator	Driver/CoS	Driver/CoS	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
	Selects Driver Display	Driver/CoS	Driver/CoS	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
	Activates Vision Devices/FLIR	Driver/CoS	Driver/CoS	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Video/Sensor

FARV TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Observes Terrain using Vision Devices	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	Video/Sensor
	Moves Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Communicates Movement	N/A	N/A	N/A	Driver/CoS	N/A	Intercom/Mike	Medium	Radio/Simulation
	Adjusts Speed	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Steers Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Stops Vehicle	N/A	N/A	N/A	Driver	N/A	Control	High	Simulator/Model
	Monitors Integrated Defense System [VIDS]	N/A	N/A	N/A	Handler/CoS	N/A	GUI Screen	High	DA and Sensors
	Monitors Vehicle Warning Messages	N/A	N/A	N/A	Driver/CoS	N/A	GUI Screen	High	DA and Sensors
NAVIGATE ROUTE									
	Selects Survival Move Route Selection Aid [DA]	N/A	N/A	N/A	CoS	N/A	Control	High	Switch
	Locates Current Position [DA]	N/A	N/A	N/A	CoS	N/A	GUI Screen	High	DA and Sensors
	Identifies Destination	N/A	N/A	N/A	CoS/Driver	N/A	GUI Screen	High	DA and Sensors
	Indicates/Selects Route [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
	Verifies Route and Location	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Monitors Graphic Terrain Display	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Monitors Move Variation Alert [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	Radio/DA
	Determines Movement Plan Changes [DA]	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	CPU and DA
	Monitors Movement Safety Procedures [DA]	N/A	N/A	N/A	All	N/A	GUI/Control	High	CPU and DA
	Enters/Receives MAPS Update Data	N/A	N/A	N/A	CoS	N/A	GUI/Control	High	Radio/CPU and DA
CONDUCT COMMUNICATIONS									
	Selects Message Handling Configuration [DA]	N/A	N/A	N/A	CoS/Handler	N/A	Control	High	Switch
	Monitors Radio	N/A	N/A	N/A	CoS/Handler	N/A	Annunciator	High	Radio/Simulation
	Monitors Digital Display	N/A	N/A	N/A	CoS/Handler	N/A	GUI Screen	High	Radio/Simulation
	Transmits External Communications	N/A	N/A	N/A	CoS/Handler	N/A	Intercom/Mike	Medium	Radio/Simulation
	Enters New External Nets	N/A	N/A	N/A	CoS/Handler	N/A	Intercom/Mike	Medium	Radio/Simulation
	Transmits Position Reports [DA]	N/A	N/A	N/A	CoS/Handler	N/A	Intercom/Mike	Medium	Radio/Simulation
NEGOTIATE OBSTACLES									
	Selects Obstacle Identification Aid [DA]	N/A	N/A	N/A	CoS/Driver	N/A	Control	High	Switch
	Identifies Obstacles [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Determines Obstacle Restrictions [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Selects Route to Breach or By-pass Obstacle [DA]	N/A	N/A	N/A	CoS/Driver	N/A	GUI/Control	High	CPU and DA
	Directs Crossing or Detour	N/A	N/A	N/A	CoS/Driver	N/A	Intercom/Mike	Medium	Intercom/Radio
OCCUPY POSITION									
	Selects Site Selection Aid [DA]						Control	High	Switch
	Observes Terrain Analysis using Graphic Display	N/A	N/A	CoS	N/A	CoS	GUI Screen	High	Sensors/Simulation
	Locates Position [DA]	N/A	N/A	CoS	N/A	CoS	GUI/Control	High	Video/Sensor
	Verifies Position with Emplacement Aid [DA]	N/A	N/A	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
	Positions Vehicle	N/A	N/A	Driver/CoS	N/A	Driver/CoS	GUI/Control	High	Video/Sensor
	Monitors System Checks	N/A	N/A	All	N/A	All	GUI Screen	High	CPU and DA
	Monitors/Transmits System Status Report	N/A	N/A	Handler/CoS	N/A	Handler/CoS	Intercom/Mike	Medium	Radio/Simulation
	Determines Criteria for Survivability Move [DA]	N/A	N/A	Handler/CoS	N/A	Handler/CoS	GUI/Control	High	CPU and DA
OPERATE COMMUNICATIONS SYSTEMS									
OPERATE SINCGARS									
	Determines Communications Configuration [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Determines Message Setup Configuration [DA	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA

FARV TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Monitors Voice and Digital Communications	Up Crewman/CoS	CoS	CoS	CoS	CoS	Intercom/GUI	Medium	Radio/Simulation
	Transmits and Receives Voice Transmissions	Up Crewman/CoS	CoS	CoS	CoS	CoS	Intercom/GUI	Medium	Radio/Simulation
	Transmits and Receives Digital Transmissions	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	Medium	Radio/Simulation
	OPERATE COMSEC EQUIPMENT								
	Monitors COMSEC System	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Installs COMSEC Keys	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	OPERATE INTERCOM								
	Selects Headset/Loudspeaker Mode	Up Crewman/CoS	All	All	All	All	Control	High	Switch
	Installs Headset to External Intercom Jack	Up Crewman/CoS	All	All	All	All	Control	High	Switch
	Activates FARV/AFAS-C Hookup Intercom	Up Crewman/CoS	N/A	CoS/Handler	N/A	CoS/Driver	Control	High	Switch
	Transmits Message	Up Crewman/CoS	N/A	CoS/Handler	N/A	CoS/Driver	GUI/Control	Medium	Radio/Simulation
	MAINTAIN CEOI								
	Receives CEOI Update from NCS	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	Medium	Radio/Simulation
	Identifies CEOI Procedures	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	RECOGNIZE ECM/EMPLOY ECCM								
	Determines ECM Interference [DA]	Up Crewman/CoS	All	All	All	All	GUI/Control	High	CPU and DA
	Continues Operations	Up Crewman/CoS	All	All	All	All	GUI/Control	High	CPU and DA
	Selects ECCM Menu	Up Crewman/CoS	All	All	All	All	Control	High	Switch
	Selects Radio Jamming Mode	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Directs Anti-Jamming Procedures [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Selects Alternate Frequency Scan	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Transmits ECM Report	Up Crewman/CoS	All	All	All	All	GUI/Control	Medium	Radio/Simulation
COLLECT AND DISTRIBUTE INTELLIGENCE									
	SENSE AND GATHER INFORMATION								
	Selects Intelligence Gathering Aid [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Monitors Integrated Defense System [VIDS]	Up Crewman/CoS	All	All	All	All	GUI/Control	High	CPU and DA
	Observes High Resolution TV	Up Crewman/CoS	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	Monitors FLIR Display	Up Crewman/CoS	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	Observes with 360 Degree Vision Device	Up Crewman/CoS	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	Observes with Night Vision Devices	Up Crewman/CoS	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	Inspects Signs of Enemy Activity	Up Crewman/CoS	CoS/Handler	Driver/CoS	Handler/CoS	Driver/CoS	GUI Screen	High	Video/Sensor
	Receives External Intelligence Information	Up Crewman/CoS	All	All	All	All	GUI/Control	Medium	Radio
	PROCESS INFORMATION								
	Selects Receives and Processes Intelligence Aid [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Monitors External Intelligence Information [DA]	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Enters Local Intelligence Information	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	ANALYZE INFORMATION								
	Monitors Intelligence Updates	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	Observes Battlefield Information Display	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI Screen	High	CPU and DA
	REPORT INFORMATION								
	Directs Target Hand-off	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
	Transmits Intelligence Reports	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
	Transmits SPOT Report	Up Crewman/CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
	Transmits Crater Analysis Report	N/A	CoS	CoS	CoS	CoS	GUI/Control	High	Radio, CPU and DA
UNIT DEFENSE PLANNING									

FARV TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
DEVELOP DEFENSIVE FIRE PLAN								
Selects Defensive Fire Planning Display [DA]	CoS/Driver	CoS/Handler	CoS	CoS	CoS	Control	High	Switch
Determines Threat [DA]	CoS/Driver	CoS/Handler	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Digital Map Display	CoS/Driver	CoS/Handler	CoS	CoS	CoS	Control	High	Switch
Determines Likely Enemy Avenues of Approach [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Fields of Fire [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Direct Fire Positions [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Range Card Data [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Decision Points for Coordination [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Early Warning Requirements [DA]	CoS/Driver	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP POSITION FORTIFICATION/CONCEALMENT PLAN								
Plans use of Existing Terrain [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Fortification Assets [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Equipment to be Fortified [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Concealment Requirements [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Position Consistent with Requirements [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Internal Position Movement Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans External Position Movement Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP POSITION EVACUATION PLAN								
Selects Evacuation Route Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Selects Evacuation Display	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Evacuation Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Evacuation Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Escape Routes [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Hide Positions [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP POSITION SUPPRESSION PLAN								
Selects Minimize Signature Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Selects Suppression System Display	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines Threat [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Reviews/Receives Unit Suppression Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Acoustic Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Radar Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Visual Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Infrared Suppression Suite [DA	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Magnetic Suppression Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for use of Optical Augmentation Suite [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP FIRST AID PLAN								
Plans Crewman Evacuation [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Medical Assistance Locations	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEVELOP SANITATION PLAN								
Plans Re supply of Field Sanitation Items [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Unit Water Supply Tests [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Location of Latrines and Urinals [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans use of Shower Points [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for Sanitation and Discard of Refuse [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA

FARV TASKS	Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
PERFORM CONOPS PLANNING								
Selects Task Scheduling Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Plans Sleep Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Crew Rotation Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans for Cold Section Operations [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Plans Maintenance Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
UNIT DEFENSE OPERATIONS								
OPERATE VEHICLE INTEGRATED DEFENSE SYSTEM								
Activates Sensor Suite	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines Countermeasures Requirement [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Selects Mode for Countermeasures	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Activates Early Warning System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Monitors for Warnings	All	All	All	All	All	GUI/Control	High	CPU and DA
EMPLOY SIGNATURE SYSTEM								
Determines Signature Minimization Requirements [DA]	CoS	CoS	CoS	CoS	Driver/CoS	GUI/Control	High	CPU and DA
Activates Acoustic Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Radar Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Visual Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Infrared Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Magnetic Suppression Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
Activates Optical Augmentation Suite	CoS	CoS	CoS	CoS	Driver/CoS	Control	High	Switch
ESTABLISH LOCAL DEFENSE								
Activates Visual Area Defense Monitor	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	Control	High	Switch
Determines Primary Area of Responsibility [DA]	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Communicates Crew Responsibility assignment [DA]	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Early Warning System	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
Monitors Visual Area Defense Monitor	CoS/Driver	CoS	CoS/Driver	N/A	Driver/CoS	GUI/Control	High	CPU and DA
OPERATE ARMAMENT SYSTEMS								
Scans with Visual Sight	Up Crewman/CoS	CoS/Handler	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Activates Pop-up Turret	Up Crewman/CoS	CoS/Handler	CoS/Driver	N/A	CoS/Driver	Manual Task	Medium	Video
Verifies Alignment with Visual Display	Up Crewman/CoS	CoS/Handler	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Tracks Target with Direct Fire Sight	Up Crewman/CoS	CoS/Handler	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
Presses Fire Button on Joystick	Up Crewman/CoS	CoS/Handler	CoS/Driver	N/A	CoS/Driver	Control	High	Switch
Monitors/Activates Reload Sequence	Up Crewman/CoS	CoS/Handler	CoS/Driver	N/A	CoS/Driver	GUI/Control	High	Video/Sensor
EMPLOY NBC SELF DEFENSE SYSTEM (SENSORS)								
Selects Threat Evaluation Aid [DA]	All	All	All	All	All	Control	High	Switch
Selects NBC Detection and Warning System Display	All	All	All	All	All	Control	High	Switch
Receives NBC Decision Aid Information [DA]	All	All	All	All	All	GUI/Control	High	Radio/Simulation
Activates Individual/Collective Protection System	All	All	All	All	All	Control	High	Switch
Selects NBC Sensor [DA]	All	All	All	All	All	Control	High	Switch
Activates NBC Detection and Warning System	All	All	All	All	All	Control	High	Switch
APPLY FIRST AID								
Selects First Aid Kit	All	All	All	All	All	Manual Task	High	
Applies First Aid	All	All	All	All	All	Manual Task	Low	
Determines Medical Personnel Requirements [DA]	All	All	All	All	All	GUI/Control	High	CPU and DA

FARV TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Determines Evacuation Requirements [DA]	All	All	All	All	All	GUI/Control	High	CPU and DA
	Moves Casualty in order to evacuate	All	All	All	All	All	Manual Task	Low	
NBC DEFENSIVE OPERATIONS									
SENSE/MONITOR FOR NBC THREAT									
	Determines Threat [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Monitors Automatic Chemical Agent Alarm [DA	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Monitors Radic Meter Alarm [DA]	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Monitors Biological Agent Detector Alarm [DA]	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Monitors Radio for NBC Alert	All	All	All	All	All	GUI/Control	High	CPU, DA and Radio
ID/REPORT NBC ATTACK/AGENTS									
	Verifies Alarm Warning [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Sensor
	Determines Initial Identification from Detector	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Radio
	Activates Sample Transfer System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Activates Sampling Device	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Monitors/Transmits NBC Report	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Radio
OPERATE ONBOARD NBC PROTECTION SYSTEM									
	Activates Emergency Containment Controls	All	All	All	All	All	Control	High	Switch
	Activates NBC Over pressure (Main) System	All	All	All	All	All	Control	High	Switch
	Monitors NBC Backup System	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Activates MOPP Conditions [DA]	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Dons Ventilated Facepieces	All	All	All	All	All	Manual Task	Medium	
	Monitors FARV Access Port Indicator	All	All	All	All	All	GUI/Control	High	Video/Sensor
DECONTAMINATE SYSTEM AS REQUIRED									
	Selects Decontamination Decision Aid Display [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Determines Contamination Status [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Sensor
	Activates Automatic Decontamination System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Monitors Automatic Chemical Agent Alarm	All	All	All	All	All	GUI/Control	High	CPU, DA and Sensor
	Dons Protective Gear	All	All	All	All	All	Manual Task	High	
	Directs Manual Decontamination [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU, DA and Sensor
PERFORM CONOPS PLANNING									
	Selects Task Scheduling Aid [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
	Plans Sleep Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Plans Crew Rotation Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Plans for Cold Section Operations [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Plans Maintenance Schedule [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
AUTOMOTIVE MAINTENANCE									
OPERATE ELECTRONIC TECHNICAL MANUALS									
	Selects Automatic Logbook Display [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Switch
	Selects Preventive Maintenance Aid [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Electronic Manuals
	Selects PMCS Checklists [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Switch
	Identifies Scheduled Maintenance Requirements [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU and DA
	Determines Status of Maintenance Subsystems [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU, DA and Sensor
	Selects Unscheduled Maintenance Aid [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	Control	High	Switch
	Identifies Corrective Maintenance Procedures [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU and DA
	Enters Maintenance Record Updates [DA]	Driver/CoS	N/A	Driver/CoS	N/A	N/A	GUI/Control	High	CPU and DA

FARV TASKS		Primary Responsibility Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
CONDUCT PMCS AND MAINTENANCE.									
	Directs PMCS on Pop-up Turret Assembly [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Inspects Turret Subassemblies	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Crew Stations [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Crew Stations [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Crew Stations [BITE]	Driver/CoS	All	All	All	All	GUI/Control	High	Electronic Manuals
	Directs PMCS on Stowage Racks and Boxes [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Suspension Assembly [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Adjusts Suspension [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Track Assembly [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces Track Blocks [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Removes/Replaces Sprocket [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Power pack [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Power pack [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Power pack [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Final Drives [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Fuel System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Fuel System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fuel System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Cooling System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Cooling System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Cooling System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Air Induction System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Air Induction System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Air Induction System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Exhaust System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Exhaust System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Exhaust System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Auxiliary Systems [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Auxiliary Systems [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals

FARV TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Auxiliary Systems [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Hydraulic Power System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Hydraulic Power System[BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Hydraulic Power System [BITE]	Driver/CoS		Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Potable Water Unit	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Embedded Training Device [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Embedded Training Device [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Embedded Training Device [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Survivability System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Survivability System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Directs PMCS on Portable Handheld Extinguishers	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on Crew Compartment Extinguishing System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Crew Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Manual Task	Medium	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Crew Compartment Extinguishing System [BITE]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Directs PMCS on Weapon Compartment Extinguishing System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Weapons Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Weapons Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Engine Compartment Extinguishing System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Engine Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Engine Compartment Extinguishing System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Fire Suppression Alarm System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Fire Suppression Alarm System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspect LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Fire Suppression Alarm System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
PERFORM PMCS AND MAINTENANCE ON CCE EQUIPMENT.									
	Directs PMCS on Intercommunication System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Intercommunication System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces Intercommunication System LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Intercommunication System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on SINCGARS Radio [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots SINCGARS [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals

FARV TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Adjusts Components [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests SINCGARS [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Electrical System [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Electrical System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Electrical System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Navigation Equipment [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Navigation Equipment [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Navigation Equipment [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Mission Computer [DA]	Driver	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Mission Critical Computer [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Driver	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Mission Critical Computer [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
ARMAMENT MAINTENANCE									
	OPERATE ELECTRONIC TECHNICAL MANUALS								
	Selects Automatic Logbook Display [DA]	Handler	N/A	N/A	N/A	N/A	Control	High	Switch
	Selects Preventative Maintenance Aid [DA]	Handler	N/A	N/A	N/A	N/A	Control	High	Switch
	Selects PMCS Checklists [DA]	Handler	N/A	N/A	N/A	N/A	Control	High	Switch
	Identifies Scheduled Maintenance Requirements [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Determines Status of Armament Subsystems [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Selects Unscheduled Maintenance Aid [DA]	Handler	N/A	N/A	N/A	N/A	Control	High	Switch
	Identifies Corrective Maintenance Procedures [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Enters Maintenance Record Updates [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	CONDUCT PMCS AND MAINTENANCE								
	Directs PMCS on Projectile Storage and Handling System [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Projectile Storage and Handling System [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Projectile Storage and Handling System [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Propellant Storage and Handling System [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Propellant Storage and Handling System [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Inspects Components [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Propellant Storage and Handling System [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Night Vision Viewer [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs Self-Test	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Directs PMCS on Armament System [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Armament System [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Adjusts Components [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
	Tests Secondary Armament [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
	Directs PMCS on Smoke Grenade Launcher [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
	Troubleshoots Smoke Grenade Launcher	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
	Removes/Replaces LRUs [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals

FARV TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Inspects Components [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Smoke Grenade Launcher [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on Sighting Devices [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Directs Self-Test	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Directs PMCS on Sighting Devices Sensors [DA]	Handler	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoot Sighting Devices Sensors [BITE]	Handler/CoS	N/A	Handler/CoS	Handler/CoS	Handler/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs [DA]	Handler	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
NBC MAINTENANCE]								
OPERATE ELECTRONIC TECHNICAL MANUALS								
Selects Automatic Logbook Display [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
Selects Preventative Maintenance Aid [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
Selects PMCS Checklists [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
Identifies Scheduled Maintenance Requirements [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Determines Status of NBC Subsystems [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Selects Unscheduled Maintenance Aid [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Control	High	Switch
Identifies corrective Maintenance Procedures [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Enters Maintenance Record Updates [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
CONDUCT PMCS AND MAINTENANCE								
Directs PMCS on MOPP Equipment	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Directs PMCS on NBC Sensors [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots NBC Sensors [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests NBC Sensors [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on NBC Overpressure System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	Electronic Manuals
Troubleshoots NBC Overpressure System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests NBC Overpressure System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on NBC Self Defense System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Directs Self-Tests	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Directs PMCS on NBC Backup System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots NBC Backup System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests NBC Backup System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Directs PMCS on Decontamination System [DA]	Driver/CoS	N/A	N/A	N/A	N/A	GUI/Control	High	CPU and DA
Troubleshoots Decontamination System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
Removes/Replaces LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Inspects LRUs [DA]	Driver/CoS	N/A	N/A	N/A	N/A	Manual Task	Medium	Electronic Manuals
Tests Decontamination System [BITE]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	Electronic Manuals
CONDUCT RESUPPLY OPERATIONS								
MONITOR/REPORT LEVELS OF ONBOARD CLASS I, III, V STOCKS								
Selects Automatic Inventory System [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Monitors Stock Levels [A]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA

FARV TASKS		Primary Responsibility							
		Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
	Receives Automatic Requests [DA]	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
	Monitors Inventory Warnings	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Estimates POL Usage [A]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Enters Changes to Requests	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Monitors/Transmits Logistical Reports	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
PLAN/COORDINATE RESUPPLY OPERATIONS									
	Selects Resupply Coordination Aid [A]	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
	Receives Automatic AFAS Location Update	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
	Selects Resupply Route Planning Aid [DA]	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
	Identifies/Selects Route of Movement [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Vreifies Resupply Point [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Receives Resupply Point Time Window [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	Radio/Simulation
	Monitors Automatic Supply Request [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	Radio/Simulation
TRANSFER CLASS I, III, V STOCKS									
	Positions Vehicle	N/A	N/A	CoS	CoS	CoS	GUI/Control	Medium	Video/Sensor
	Selects Resupply Ready Mode	N/A	N/A	CoS	CoS	CoS	Control	High	Switch
	Positions Boom to mate with AFAS	N/A	N/A	CoS	CoS	CoS	GUI/Control	Medium	Video/Sensor
	Monitors Transfer Interface Warnings	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Monitors Automatic Transfer Sensors	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Monitors Automatic Inventory Control System	N/A	N/A	CoS	CoS	CoS			
LOCATE/NAVIGATE TO RESUPPLY POINT									
	Selects Graphic Terrain Display	N/A	N/A	CoS	CoS	CoS	Control	High	Switch
	Locates Current Position [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Identifies Resupply Point [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Describes/Selects Route [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Monitors Graphic Display (2023.3)	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Monitors Movement Variation Alert [DA]	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
	Directs Movement to Resupply Point	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DOWNLOAD CLASS III, V STOCKS									
	Positions Vehicles	N/A	N/A	Driver	N/A	N/A	GUI/Control	Medium	Video/Sensor
	Moves Stocks for repositioning if Required	N/A	N/A	Handler	N/A	N/A	GUI/Control	High	DA, CPU and Robotics
	Activates Automated Handling System	N/A	N/A	Handler	N/A	N/A	Control	High	Switch
	Moves Stocks in order to download	N/A	N/A	Handler	N/A	N/A	GUI/Control	High	DA, CPU and Robotics
	Monitors Automatic Inventory Control System [DA]	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
	Enters Updates into Inventory Control System	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
UPLOAD CLASS III, V STOCKS									
	Positions Vehicles	N/A	N/A	Driver	N/A	N/A	GUI/Control	Medium	Video/Sensor
	Moves Stocks for repositioning if Required	N/A	N/A	Handler	N/A	N/A	GUI/Control	Medium	Video/Sensor
	Activates Automated Handling System	N/A	N/A	Handler	N/A	N/A	Control	High	Switch
	Moves Stocks in order to download	N/A	N/A	Handler	N/A	N/A	GUI/Control	Medium	Video/Sensor
	Monitors Automatic Inventory Control System [DA]	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	DA, CPU and Robotics
	Enters Updates into Inventory Control System	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
UPLOAD CLASS III, V STOCKS (MANUAL)									
	Positions Vehicles	N/A	N/A	Driver	N/A	N/A	GUI/Control	Medium	Video/Sensor
	Moves Stocks for repositioning if Required	N/A	N/A	Handler	N/A	N/A	GUI/Control	High	DA, CPU and Robotics

FARV TASKS	Primary Responsibility							
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Activates Lifting Crane	N/A	N/A	Handler	N/A	N/A	Control	High	Switch
Directs Manual Upload	N/A	N/A	Handler	N/A	N/A	GUI/Control	High	DA, CPU and Robotics
Monitors Automatic Inventory Control System [DA]	N/A	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Enters Updates into Inventory Control System	N/A	N/A	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
CONDUCT RECOVERY OPERATIONS								
COORDINATE FOR HET/M88 EVACUATION/RECOVERY								
Informs Command Element	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI Screen	High	Radio, CPU and DA
Communicates with Maintenance Element	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI Screen	High	Radio, CPU and DA
Determines Recovery Point [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Determines Evacuation Method [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Determines Vehicle Configuration [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Positions Vehicle	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	Medium	Video/Sensor
CONDUCT SELF-RECOVERY								
Selects Maintenance Recovery Guide [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
Selects Troubleshooting Sequence [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
Determines Problem [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	DA and Elec. Manuals
Adjusts and Repair Cause of Problem (Temporary) [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	DA and Elec. Manuals
Directs Movement to Maintenance Area	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
CONDUCT AFAS/FARV-A RECOVERY								
Determines Recovery Point [DA]	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
Activates Load Transfer	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Control	High	Switch
Moves Load for Transfer	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Manual Task	Low	
Installs Towing Equipment	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	Manual Task	Low	
Positions Vehicle	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	Medium	Video/Sensor
Directs Movement to Maintenance Area	Driver/CoS	N/A	Driver/CoS	Driver/CoS	Driver/CoS	GUI/Control	High	CPU and DA
COMM/POS NAV DEGRADED/UNUSUAL OPERATIONS								
MAP READING WITH DEGRADED NAV SYSTEM								
Selects Basic Route Planner Aid [DA]	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Selects NAV System in Degraded Mode Display	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Determines Usable Features of NAV System [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Activates Backup Azimuth System	CoS	N/A	CoS	CoS	CoS	Control	High	Switch
Locates Current Position	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Verifies Position [DA]	CoS	N/A	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Display	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Route [DA]	CoS	N/A	CoS	CoS	CoS	GUI/Control	High	CPU and DA
MAP READING WITH INOPERATIVE NAV SYSTEM								
Locates Current Position	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Activates Backup Azimuth System	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Orients Map	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Verifies Map Location with Visual References	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	Video/Sensor
Determines Route	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
DEGRADED OPERATIONS								
OPERATE WITH OVER PRESSURE SYSTEM INOPERATIVE								
Selects NBC Warning Display [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines MOPP Uniform Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors

FARV TASKS	Primary Responsibility								
	Resting	Startup	Resupplying	Moving	Firing	Interface Device	Fidelity	Enabling Device
Monitors NBC Detection and Warning System	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Monitors Entry/Exit/Sealing System Warnings	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Dons Ventilated Face pieces	CoS	CoS	CoS	CoS	CoS	Manual Task	Medium	
Dons Protective Gear	CoS	CoS	CoS	CoS	CoS	Manual Task	Medium	
OPERATE W/NBC SENSOR SYSTEM INOPERATIVE								
Selects NBC Warning Display [DA]	CoS	CoS	CoS	CoS	CoS	Control	High	Switch
Determines Sensor Degradation [DA]	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	DA and Sensors
Communicates with Adjacent Howitzers for Alerts	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Communicates with POC for Alerts	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Communicates with FARV for Alerts	CoS	CoS	CoS	CoS	CoS	GUI Screen	High	Radio, CPU and DA
Determines MOPP Uniform Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
Determines Masking Procedures and Criteria [DA]	CoS	CoS	CoS	CoS	CoS	GUI/Control	High	CPU and DA
OPERATE WITH SINGLE CREWMAN								
Selects Single Crewman Operations Display [DA]	All	All	All	All	All	Control	High	Switch
Directs Functions to Selected Crew Station [DA]	All	All	All	All	All	GUI/Control	High	CPU and DA
Determine Priority Warnings [DA]	All	All	All	All	All	GUI Screen	High	DA and Sensors
Selects Mission Function	All	All	All	All	All	Control	High	Switch
Activates Mission Function	All	All	All	All	All	Control	High	Switch
Monitors for Mission Warnings	All	All	All	All	All	GUI Screen	High	DA and Sensors
Monitors for Priority Warnings	All	All	All	All	All	GUI Screen	High	DA and Sensors

AFAS Subsystems.	Suggested Fidelity Level For Simulator
1. Primary Armament.	
155mm Gun.	Low
Gun Mount.	Low
Cannon Assembly	Medium
Regenerative Liquid Propellant Gun (RLPG).	Low
LP Mount.	Low
Ignition System.	Low
Propellant Storage. and Handling System (PSHS).	Low
Provide LP to the Gun.	Low
Provide Lubricant to the Gun.	Low
Load/Download Fluids.	Low
Store Fluids.	Low
Meter Fluids.	Low
Damper Oil Reservoirs.	Low
Hydraulic/Electric Power Unit.	Low
Cabling	Low
Hoses.	Low
Piping.	Low
Gun Positioning System.	Low
Damper Oil Reservoirs.	Low
Hydraulic/Electric Power Unit.	Low
Cabling	Low
Hoses.	Low
Piping.	Low
Sensors.	High
Muzzle Reference Sensor (MRS)	High
Azimuth.	High
Elevation.	High
Muzzle Velocity Management and Prediction.	High
Projectile Tracking System	High
Gun Control System.	High
Decision Aids.	High
Power Supplies.	Low
Communications Device. (RS 422)	Low
Controller (Computer)	Low
Control Hardware.	Low
Pneumatic Power Supplies.	Low
Hydraulic Power Supplies.	Low
Breech Controller.	Low
Hardware and Software.	High
Breech Actuators.	High
Ballistic Computer and Fire Control.	High
Environmental Sensors.	High

AFAS Subsystems.	Suggested Fidelity Level For Simulator
Compensation Algorithms.	High
Projectile Tracking System.	High
Ammunition Handling System.	Medium
Ammunition Loading System.	Medium
Inventory Control System.	High
Ammunition Type.	High
Ammunition Lot Number.	High
Ammunition Fuze Information.	High
Ammunition Weight.	High
Ammunition Storage System.	Medium/Low
Ammunition Racks.	Medium/Low
Transfer/Lift Mechanism.	Medium/Low
Hydraulic and Electrical Controls.	Medium/Low
Ammunition Selection System.	Medium/Low
Ammunition Loading System.	High
Transfer/Lift Mechanism.	Medium/Low
Fuze Setting Mechanism.	Medium/Low
Upload.	Medium/Low
Storage.	Medium/Low
Handling/Selection.	Medium/Low
Transfer.	Medium/Low
Setting.	Medium/Low
Identification.	Medium/Low
Verification.	Medium/Low
Down Load.	Medium/Low
Ramming Mechanism.	High
Verify Projectile/Fuze Combination	High
Hydraulic and Electrical Controls.	High
Extracting Mechanism.	High
Peripheral Equipment.	Medium/Low
Liquid Propellant Handling System.	Low
Loading mechanism.	Low
Measuring mechanism.	Low
Handling System.	Low
2. Defensive Armament.	
Weapons.	High
Weapon Mounts.	High
Peripherals.	High
3. Command, Control and Communications.	
Fire Control System	High
Position, Navigation and Azimuth System.	High

AFAS Subsystems.	Suggested Fidelity Level For Simulator
Enhanced Position Location and Reporting System (EPLARS).	High
Global Positioning System (GPS) and Position (POS/NAV)	High
Communications System.	High
Internal Commo Systems.	High
Crew Station Intercom Systems.	High
Very High Speed Bus.	High
External Port Interface.	High
LAN Interface for:	High
Digital Audio.	High
Digital Video.	High
Other Data.	High
Data Storage.	High
Digital Maps.	High
Mission Queue (Up to 30 Missions.)	High
Message Formats.	High
Electronic Manuals and Checklists.	High
PMCS	High
Operator Manuals.	High
Maintainer Manuals.	High
Diagnostics.	High
Prognostics.	High
Automated Log Books.	High
Tactical Data.	High
Logistical Data.	High
Etc.	High
Electrical Cooling Equipment.	Low
External Commo Systems.	High
Two CINGARS radios.	High
Army Tactical Command and Control System (ATCCS)	High
Advanced Field Artillery Data System (AFATDS).	High
??TACFIRE.??	High
Intercom Connection to FARV when docked.	High
Decision Aids.	High
Navigation.	High
Prognostics/Diagnostics.	High
Degraded Mode Operations	High
Diagnosing/Performing/Deferring and Repair (BDAR).	High
Fire Mission Planning and Management.	High
Moving Target Prediction and Aiming.	High
Fire Support Coordination Measures Checking	High
Management of Ammunition Inventory.	High
Managing Survivability (Resupply and Support).	High
Sensing Safety Status.	High

AFAS Subsystems.	Suggested Fidelity Level For Simulator
Override Automatic Functions if Unsafe Condition Exists.	High
Tracking and Sensing Threat and Risk Status.	High
Embedded Training.	High
CATT Compatible.	High
FARV Compatible.	High
Machine-Crew Interface.	High
Interactive Display Units (IDUI)	High
Power Module	High
General Purpose Processor.	High
Bus Interface Modules.	High
Graphics Display Interface Module.	High
General Purpose Interface Module.	High
Remote Vehicle Control and Monitoring System.	High
Fire Control.	High
Systems Operation.	High
Automated Reporting.	High
Occupation Report.	High
Position.	High
Altitude.	High
Azimuth of Fire.	High
Mask Data.	High
Non Mission Capable Report.	High
Biological Agent Reporting.	High
4. Mobility.	
Chassis/Hull	Low
Turret.	Medium
Propulsion System.	Low
Engine.	Low
Transmission or equivalent device.	Low
Final Drive System or equivalent device..	Low
Auxiliary Automotive System.	Low
Track and Suspension System	Low
The fuel system.	Low
5. Survivability.	
Armor.	Low
Secondary Armament.	High
Sensors.	High
Thermal.	High
Optical.	High
Long Range (acoustic, seismic, radar, etc.)	High
Identification Friend or Foe (IFF).	High

AFAS Subsystems.	Suggested Fidelity Level For Simulator
Vehicle Integrated Defense System (VIDS).	High
Acoustic Sensors.	High
Laser/Missile Warning System or Sensors.	High
NBC Detection Equipment.	High
Counter-Mine Equipment.	High
Automatic Fire Extinguishing System.	High
Nuclear Biological and Chemical (NBC) system.	High
Auxiliary Power System	Medium
Battery	Low
Aux. Powered Generator.	Medium
Power Generation and Management System.	High
Main Power System	High
Auxiliary Power Systems	High
Battery Powerpacks.	High
External Port Power Connections.	High
Power Bus Controllers.	High
Electrical Loads.	High
Maintenance Support.	High
Prognostics.	High
Diagnostics.	High
Electronic Repair Manuals.	High
Degraded Operational Modes.	High
Auxillary Maintenance, Transport, and Recovery Equipment.	Low
Cranes.	Low
Hoists.	Low
Pintels.	Low
Lifting Eyes.	Low
Tools.	Low
Gauges.	Low
Welding Apparatus.	Low
Ramps.	Low
Other Devices.	Low
Battle Damage Assessment and Repair Equipment (BDAR).	Medium

FARV	Suggested Level of Fidelity For Simulator
1. Primary Resupply Subsystem.	
Automated Ammunition Upload System.	Medium
Automated Ammunition Download System.	Medium
Manual Up-load Sustem	Low
Manual Down-load Sustem	Low
Automated Ammunition Storage and Handling System.	Medium
Refuel and Defuel System.	Medium
Automated Upload for Class I, water, Class III and Class IX.	Medium
2. Defensive Armament.	
Weapons.	High
Weapon Mounts.	High
Peripherals.	High
3. Command, Control and Communications.	
Fire Control System	High
Position, Navigation and Azimuth System.	High
Communications System.	High
Army Tactical Command and Control System (ATCCS)	High
Army Advanced Field Artillery Data System.	High
TACFIRE.	High
Decision Aids.	High
Mission Management.	High
Inventory Management.	High
Information Processing.	High
Hardware Control.	High
Self Defense.	High
Risk Assessment.	High
Operational Support Reporting.	High
Embedded Training.	High
CATT Compatible.	High
AFAS Compatible.	High
4. Mobility.	
Chassis/Hull.	Low
Propulsion System.	Low
Diesel Engine.	Low
Advanced Integrated Propulsion System (AIPS)	Low
Electric Drives.	Low
Weight-Efficient Tracks.	Low
Drive-by-wire.	Medium
Auxiliary Automotive System.	Low

FARV	Suggested Level of Fidelity For Simulator
Track and Suspension System	Low
The fuel system.	Low
5. Survivability.	
Armor.	Low
Secondary Armament.	High
Sensors.	High
Thermal.	High
Optical.	High
Long Range (acoustic, seismic, radar, etc.)	High
Identification Friend or Foe (IFF).	High
Vehicle Integrated Defense System (VIDS).	High
Acoustic Sensors (or equivalent).	High
Laser/Missile Warning System.	High
Automatic Fire Extinguisher.	High
Nuclear Biological and Chemical (NBC) system.	High
Auxiliary Power System.	Medium
Battery	Low
Aux. Powered Generator.	Medium
Maintenance Support Systems.	High
Electronic Repair Manuals.	High
Degraded Operational Modes.	High
Auxiliary Maintenance, Transport, and Recovery Equipment. .	Low
Cranes.	Low
Hoists.	Low
Pintels.	Low
Lifting Eyes.	Low
Tools.	Low
Gauges.	Low
Welding Apparatus.	Low
Ramps.	Low
Other Devices.	Low
Battle Damage Assessment and Repair (BDAR).	Medium

APPENDIX D

SOLDIER MACHINE INTERFACE DESIGN CRITERIA

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APPENDIX D

40. SOLDIER MACHINE INTERFACE DESIGN CRITERIA.

40.1 Human Engineering Design Approach. This human engineering design approach is robust in that it addresses the objective AFAS/FARV requirements in space claim, capacity, and functionality. This approach is traceable to the results of analyses and MIL-STD-1472D criteria. It is a systems approach to AFAS/FARV soldier machine interface design into which decision aid technology, embedded training, and additional functionality can be integrated in a manner consistent with the rest of the interface.

To instill user confidence in this level of automation, automating safety and accuracy checks, rechecks, and interlocks is necessary. The interface should be designed so that potentially dangerous or incorrect options are not presented to the user. Automatic and manual overrides that may result in a dangerous condition should be explained to the user and require dual control action to execute.

Human engineering design, layout, and arrangement of each item of crew station equipment having an user interface should be designed to MIL-STD-1472D guidelines as supplemented by MIL-HDBK-759B. Human engineering task analysis (per MIL-H-46855B guidelines) optimizes the design according to system mission, functions, and target audience description. Design Criteria, and a resulting design approach is addressed in the Crew Station Description.

40.2 AFAS/FARV Simulator Crew Station Display/Control Design Criteria and Task Analysis. The following listing of tasks performed by or through the user interface screen displays for the AFAS/FARV Simulator is only representative of the type of screens that should be required for operation of the simulation system. In order to determine the exact numbers and requirements for screens an in-depth Functional Analysis should be performed.

RESTING

AFAS/FARV Driver:

- Selects Vehicle Power-up Display
- Selects Movement Display
- Select Preventative Maintenance Display
- Select PMCS Checklists
- Select Unscheduled Maintenance Display
- Select Electronic Technical Manuals
- Select Automatic Log Book

AFAS Gunner/FARV Ammo Handler:

- Selects Weapons System Status Display
- Select Preventative Maintenance Display
- Select PMCS Checklists
- Select Unscheduled Maintenance Display
- Select Electronic Technical Manuals
- Select Automatic Log Book

AFAS Chief of Section/FARV Vehicle Commander:

- Select Direct Fire Planning Display
- Select Digital Map Display
- Select Indirect Fire Planning Display
- Select Evacuation Display
- Select Suppression System Display
- Select Task Scheduling Display
- Select Inventory Management Display
- Select Resupply Display

AFAS/FARV Up Crewman

- Initialization Screen
- Pre-Operational Checks/Starting Procedures Screen
- Crew Position Selection Screen
- Position/Orientation Display Screen
- System Default Mode Screen
- Select Operational Display Screen
- Select Status Display
- Initialize Communication Procedures Screen
- Set Radios
- Select Message Setup
- Select Information Management Display Screen
- Select Data Display Screen
- Select Operational Overlay of Terrain Graphics
- Activate Vehicle Display Screen
- Select NAV System Route Display
- Select Area Sweep Aid
- Select Early Warning System Display
- Select Sensor Display
- Select Alarms and Alerts Display
- Select ECCM Display
- Select Intelligence Display
- Select NBC Detection and Warning System Display

STARTUP

AFAS/FARV Driver:

- Initialization Screen
- Crew Position Selection Screen
- Pre-Operational Checks/Starting Procedures Screen
- Maintenance System Checks Screen
- System Default Mode Screen
- Position/Orientation Display Screen
- Select Sensor Display Screen
- Select Wide Field View for Surveillance Device Screen
- Select Self Defense Weapons Screen
- Select Security Display
- Select Alarms and Alerts Display

AFAS Gunner/FARV Ammo Handler:

- Initialization Screen
- Crew Position Selection Screen
- Weapon System Pre-Operational Checks Screen
- Review Mission Queue Screen
- Review Ammo/LP Inventory Screen
- Select Alarms and Alerts Display
- Activate Self Defense Posture Screen
- Select Early Warning System Display
- Select Sensor Display

AFAS Chief of Section/FARV Vehicle Commander:

- Initialization Screen
- Crew Position Selection Screen
- Pre-Operational Checks/Starting Procedures Screen
- System Default Mode Screen
- Position/Orientation Display Screen
- Select Communication Setup Screen
- Set Radios
- Select Information Management Display Screen
- Select Data Display Screen
- Select Operational Display Screen
- Review Mission Queue Screen
- Review Ammo/Fuel/LP Inventory Screen
- Select Security Display
- Monitor Early Warning System Display Screen
- Monitor Sensor Suite Warning Display Screen

- Select Alarms and Alerts Display
- Selects Site Selection Display
- Activate Self Defense Posture Screen

RESUPPLY

AFAS/FARV Driver:

- Select Vehicle Security Display
- Select Early Warning System Display
- Select Sensor Display
- Select Alarms and Alerts Display
- Select Integrated Defense Display
- Select Preventative Maintenance Display

AFAS Gunner/FARV Ammo Handler:

- Select Resupply Module Screen

AFAS Chief of Section/FARV Vehicle Commander:

- Select Information Management Display
- Select Data Display
- Select Digital Map Display
- Select Operational Display
- Select Early Warning System Display
- Select Sensor Display
- Select Alarms and Alerts Display
- Select Site Selection Display
- Select Integrated Defense Display
- Select Route Planning Display
- Select Intelligence Gathering Display
- Select Unit Defense Indirect Fire Planning Display (Except FARV)
- Select Suppression System Display
- Select Task Scheduling Display
- Select Preventative Maintenance Display

MOVING

AFAS/FARV Driver:

- Selects Drivers Display

AFAS Gunner/FARV Ammo Handler:

- Select Integrated Defense Display
- Select Early Warning System Display
- Select Sensor Display
- Selects Message Handling Display

AFAS Chief of Section/FARV Vehicle Commander:

- Select Information Management Display
- Select Data Display
- Select Digital Map Display
- Select Operational Display
- Select Site Selection Display
- Select Integrated Defense Display
- Select Early Warning System Display
- Select Sensor Display
- Selects Message Handling Display
- Select Route Planning Display
- Select Intelligence Gathering Display
- Select Unit Defense Indirect Fire Planning Display (Except FARV)
- Select Suppression System Display
- Select Task Scheduling Display

FIRING

AFAS/FARV Driver:

- Select Vehicle Security Display
- Select Early Warning System Display
- Select Sensor Display
- Select Alarms and Alerts Display
- Select Integrated Defense Display

AFAS Gunner/FARV Ammo Handler:

- Select Weapons Systems Display

AFAS Chief of Section/FARV Vehicle Commander:

- Select Information Management Display
- Select Data Display
- Select Digital Map Display
- Select Operational Display
- Select Early Warning System Display

- Select Sensor Display
- Select Alarms and Alerts Display
- Select Site Selection Display
- Select Integrated Defense Display
- Select Route Planning Display
- Select Intelligence Gathering Display
- Select Direct Fire Planning Display (Except FARV)
- Select Unit Defense Indirect Fire Planning Display (Except FARV)
- Select Suppression System Display
- Select Task Scheduling Display

40.3 Crew Station Description.

40.3.1 Console. The crew station console should consist of a high-resolution, dual capability (data and NTSC video) color Cathode Ray Tube (CRT) as the primary display. This CRT should be equipped with a touch-sensitive overlay used for user control inputs and menu selections.

40.3.2 CRT. The CRT should be flanked by panels of fixed-function pushbuttons, some of them with Built-In indicators. The pushbuttons and indicators should designed so that the computer can activate the indicators to maintain consistency with the actual state/mode of the system. For objective AFAS safety reasons, the CHECK FIRING and the objective FARV, the EMERGENCY UN-DOCK push-button is an exception to this approach.

40.3.3 Left Panel. The left panel should contain pushbuttons supporting the general operation of the interface (e.g., POWER, EXECUTE, MAIN MENU, etc.). This panel of pushbuttons should allow the user to turn the crew station on or off, navigate through the menu structure, and execute computer processing of decisions made on the CRT display.

40.3.4 Right Panel. The right panel should contain pushbuttons for controlling the states and modes of the system. This panel should allow the user to command the system and to configure hardware and software for discrete operational modes or override conditions (e.g., emplaced to shoot, ready to move, ready to rearm, check firing, and direct fire). The user controls the execution of fire missions and gives the system authority to fire from this panel. The user can also select a joystick mode to identify the specific configuration of subsystems to be manipulated under control of the joystick.

40.3.5 Joystick. The joystick should support multiple functions based on the mode the user selects. The user can control direction of vehicle travel, direct movement of the main gun, panoramic camera. secondary armament, laser, or cursor using the joystick. Other than control of the cursor, joystick control of subsystems would be simulated.

40.3.6 Keyboard. The detachable Keyboard provides a keyboard entry capability for drafting free text messages. It is to be used only when the use of the joystick and cursor are inappropriate.

40.3.7 Data Input Device. The data input device is a magnetic medium that provides a means to enter large amount of data as an option to digital message exchange.

40.4 Anticipated Equipment List.

40.4.1 Workstation. The workstation/console design for all crew positions should be identical. Any deviation from this standard is noted.

40.4.1.1 Touch-sensitive interactive display screen provides an interface that displays information and provides controls specific to the task at hand.

40.4.1.2 Fixed-function pushbuttons provide controls and displays that are always available to the user, independent of the interactive control/display interface status.

40.4.1.3 Multi-function joystick provides a control suitable for tasks requiring aiming of a pointer or camera.

40.4.1.4 Crewmember headset provides an interface for crew-to-crew communications and simulated radio communications.

40.4.1.5 Detachable keyboard provides a keyboard data entry capability for drafting free text messages.

40.4.1.6 Data input device provides a means to enter large amounts of data as an option to digital message exchange.

40.4.1.7 Auxiliary control panel provides an interface to simulate master power and engine operation. (AFAS/FARV Driver position)

40.5 Level of Fidelity Configuration Requirements. Results of the initial AFAS task analysis has established baseline crew station design requirements that impact system configuration as well as crew station integration and layout. The following paragraphs summarize the human factors design influence on the AFAS/FARV simulator.

40.5.1 Crew Compartment. The crew should be consolidated in one compartment to provide improved performance through greater control by the chief of section/vehicle commander, crew psychology, crew sustainment, and cross training. Crew station arrangement for the AFAS/FARV must be responsive to the following design requirements and performance objectives. Each requirement is

rated HIGH, MEDIUM, or LOW as defined by the top level analysis completed for Task 2.

40.5.1.1 Any crewmember should be capable of leaving his/her seat/workstation to exit the simulator, without displacing other crewmembers from their workstations. The access to the crew compartment from outside the simulator must be designed for easy passage of the 5th percentile female through the 95th percentile Arctic-clothed male. This fidelity requirement is considered HIGH.

40.5.1.2 A hatch must be available to allow the crew to enter the AFAS/FARV weapons compartment without leaving the simulator. This fidelity requirement is considered LOW.

40.5.1.3 The crew should have unrestricted access to at least two separate means of egress. This fidelity requirement is considered HIGH.

40.5.1.4 The crew should be capable of leaving their seats and stretching for short periods without leaving the crew compartment. The crew should have adequate space for putting on and removing clothing without leaving the crew compartment. This fidelity requirement is considered HIGH.

40.5.1.5 The crew compartment should address the stowage of the crew's personal gear. This fidelity requirement is considered LOW.

40.5.1.6 The crew station arrangement should address design for accessibility of components for maintenance. This fidelity requirement is considered LOW.

40.5.1.7 Crew station arrangement should facilitate each crewman's access to commonly used equipment, facilities, and stowage compartments. This fidelity requirement is considered LOW.

40.5.1.8 Crew member crew stations and seats should be designed to allow reclining seating. All seats should have headrests to protect the crew from whiplash injuries. The seats should be configured with 3 point passenger restraints. This fidelity requirement is considered HIGH.

40.5.1.9 The crew must be able to sit erect to conduct continuous operations at a fire control console/mission operation. This fidelity requirement is considered HIGH.

40.5.1.10 Crew stations should be designed to allow static elbow clearance for 95th percentile Arctic-clothed male. This fidelity requirement is considered HIGH.

40.5.1.11 The primary displays and external vision features should be presented to the user in the optimal vertical visual field. Because the display screen is also a control panel, the display must be located in the optimal position for control actuation. This fidelity requirement is considered HIGH.

40.5.1.12 The chief of section and driver need 360° visibility optimized for terrain analysis, navigation. This fidelity requirement is considered MEDIUM.

40.5.1.13 The chief of section should be able to observe the activities of each individual crewmember from his/her workstation. This fidelity requirement is considered HIGH.

40.6 The Information Input Types. Data should be presented in the logical sequence in which it naturally occurs (i.e., chronologically or alphabetically). Data of significant importance requiring immediate response or used more frequently should be presented at the top of the display.

Each unique display screen format and every field and column should be labeled with a meaningful title as to the purpose or contents of the display/field/column. The top of each display should also be reserved for status messages and instructional prompts relevant to the interface.

Groups of data should each contain a descriptive title, phrase, word, or similar label to designate its contents. Labels should be located above or to the left of the data they describe. Labels should de displayed to be easily recognizable to the user in all upper case letters.

Interfaces with more than one display page should be labeled to identify the currently displayed page. The content of displays should all be laid out is a consistent, standardized manner. Information should be displayed in plain concise text. Use of abbreviations and acronyms should only be used as a last resort.

40.6.1 Visual.

40.6.1.1 Dedicated Simple Indicator--an indicator that is on or off and is always visible in either condition.

40.6.1.2 Text--written communications.

40.6.1.3 Graphic--Icons, bar graphs, gauges, etc.

40.6.1.4 Video Camera--a view from a video camera.

40.6.1.5 Windows/Periscopes--direct view through passive vision devices.

40.6.2 Audible.

40.6.2.1 Tone/Alarm--a simple tone with a meaning gained through training and experience.

40.6.2.2 Synthesized Voice--a stored voice message played back to the user.

40.6.2.3 Voice--crew-to-crew or voice radio communications.

40.6.2.4 Tactile--Information via sense of touch/feel

40.7 The User Response Control Types.

40.7.1 Momentary. This control type provides an on/off function, but does not lock in either position. (Unless the control type is held in the actuated position, it returns to normal.) This control type can be used for alternating action, where the function pushbuttons on or off each time the control is actuated, or momentary action, where the function is on only as long as the control is held in one position.

40.7.2 Discrete. This control type provides selection between any number of exclusive conditions where the control locks into the selected condition and that condition remains in effect until the control is changed to another condition by the user.

40.7.3 Proportional. This control type allows directional and proportional commands to be given to a controlled function.

40.8 AFAS/FARV Crew Station Control Selection. Table 1 in MIL-HDBK-759B, Human Factors Engineering Design for Army Material, a supplement to MIL-STD-1472D, was used to select control types for crew station console. Table 14 provides the results of application of this type control selection criteria.

40.9 I/O.

40.9.1 Data Display Format. Data input and output displays should use the same formats when appropriate. The data entry formats used by the system should match the formats of the source documents. Required data should be computer controlled. Only data required by the user's needs should be presented.

40.9.2 Display Coding. Flash coding should be used to prompt the user to push the push-button or select the touch screen option that is flashing. The flash rate should be between three and five flashes per second. Standard symbols, in accordance with FM 101-5-1, Operational Terms and Symbols, should be used for display of tactical information on the digitized map display. Other symbols and icons should be analogous of the object they represent. Color coding should be used

to indicate operational conditions, warnings, and hazards. Colors should be used in accordance with table II in MIL-STD-1472D. Brightness inversion or "reverse video" should be used to indicate selection of a touch screen option.

40.9.3 Tabular data. Tabular data should be arranged in increasing order from left to right and top to bottom. All subclassification should be titled. Data in lists should be arranged in a recognizable order (e.g., chronological or alphabetical). Tabular data that extends beyond one page should be scrollable line by line. Arabic numbers should be used to number tabular data when necessary. Entry of numerical data by the user should be right or left justified by the system as appropriate. The units of measure for data should be included as part of the column label.

40.9.4 Graphic Displays. The graphic interfaces (e.g., the digitized map) should use a distinctive cursor (e.g., a crosshair) whose intersection can mark a position with precision. Designating a point should require two control actuation's: (1) positioning the cursor and (2) designating the position. An easy and convenient means should be used for saving and retrieving graphic displays. The user should be able to designate file names of his/her choice for the stored data. Where graphic data must be plotted in predefined formats, a template display should be provided for that format to aid data entry. When an user's attention must be directed to a portion of a graphic display showing critical or abnormal data, that feature should be highlighted with some distinctive means of data coding. The capability to precisely read graphic data in actual numeric values should be provided. Pictorial symbols (e.g., icons) should look like the object they represent. Bar graphs should be used to compare a single measure across a set of several entities. Adjacent bars should be spaced closely enough so that a direct visual comparison can be made without eye movement.

40.9.5 Menu Selection. Menu selection style interactive controls should be used to reduce the training burden and to negate the need for memorization of commands. Touch screen technology should be used for menu selection. Each menu should have a title and be logically segmented to allow several sequential selections among a few alternatives. The system should only present menu selections for actions that are currently available. The menus should be presented in consistent format throughout the system and should always be accessible. The user should be able to return to the previous menu level or to the top level menu using a single control actuation.

40.9.6 Form Filling. The system should use form filling interactive control when some flexibility of data to be entered is needed (e.g., entry of grid coordinates). The format and content of displayed forms should be perceptually related to that of paper forms if paper forms are used to guide data entry. Fields should be separated by spaces, lines, or other delineating cues. Required fields should be distinguished from optional fields. The system should prompt entry at the first logical data field and should automatically prompt entry at the next field after a valid entry has been

made at the first. The system should require the user to input any required entries omitted by the user. The user should be allowed to re-enter, change, or cancel any data item before taking a final enter action.

40.9.7 Graphic Interaction. Graphic aids should be used as a supplement to other types of interactive control. Where icons are used to represent control actions, verbal labels should be used to ensure that their intended meaning should be understood.

40.9.8 Feedback. The system should provide an indication to the user when processing necessitates a delay in user interaction with the system. The system should provide an indication to the user when a process is completed or aborted or when user input is required. The system should display the current states and modes of the system. When the user selects an object or inputs data, the system should indicate acknowledgment by highlighting the object. When the system rejects an user input, the system should provide an indication of the rejection and instructions for taking corrective action.

40.9.9 Prompts. Prompts should be displayed in a standard area of the screen. Prompts should be explicit and in language easily understood by the user. User acceptance of data should be accomplished using a single confirming action.

40.9.10 Defaults. *Default data values* should be used to reduce user workload. Default values should be displayed automatically upon initiation of a data entry transaction. The user should be able to change the value for that transaction without changing the default value defined in the system. The system should allow the user to accept the default data as a group without accepting each item individually.

40.9.11 Error Management. The system should provide an easy means to correct erroneous entries. The system should allow correction of data without requiring the user to re-enter correctly entered data. The system should detect incorrectly entered data after keying, but prior to entry into the system for processing (e.g., incorrect number of digits in grid coordinate). Erroneous data entry should be minimized by only presenting valid options for selection by the user. The system should require confirmation for entry of critical data. Error messages should be appropriate to the target audience, specific to the error at hand, and explicit in a way to recover from the error.

40.9.12 System Response Time. The system should respond to user commands/inputs in accordance with table XXIX in MIL-STD-1472D.

40.9.13 Message Transmission. The user should be able to transmit data using the same procedures used for general entry, display, and other processing of data. These procedures should be consistent among transactions and other information handling tasks. The system should use standard and predictable

message formats and provide the user with stored forms to aid In message preparation. The system should not require the user to enter data into message formats that the system is aware of for other purposes. The system should automatically address messages based on a default by message type or by user selection of the destination.

40.10 Input/Output Configuration Requirements.

40.10.1 Visual Configuration Requirements.

40.10.1.1 Data Display Format. Data input and output displays should use the same formats when appropriate. The data entry formats used by the system should match the formats of the source documents. Required data should be computer controlled. Only data required by the user's needs should be presented.

40.10.1.2 User Controls and Displays. Each user display should contain interface-specific guidance on legal entries and instruction for use of the interface and task completion. Each user display should designate the operational states and modes that are displayed in day or night conditions. The system should respond to contradictory or conflicting control actuation's based on an established priority and the availability of data/subsystems.

40.10.1.2.1 Automatic Emergency Override Displays. Generally, the computer should not override an user's display screen without the user acknowledging a high-priority alert. Upon actuation of a specialized push-button, the system should automatically change mode to that activity. The user's display screen should inform him of the mode change and automatically present an interface to support appropriate tasks.

4.10.1.2.2 Operational Mode Change Displays. Initial operation mode display screens should give the user the opportunity to conduct a deliberate or hasty transition. Deliberate transition allows the user the option to complete the task in progress before beginning to transition between modes. Hasty mode change allows subsystems to be properly stowed, but automatically bypasses resolution of conflicts in favor of transitioning to the next mode. The mode transition screens should walk the user through the resolution of current tasks that conflict with the need to reconfigure subsystems for a mode change. Upon satisfactory resolution, the user should be prompted, in a computer controlled sequence, to authorize the movement and stowage of equipment into configuration for the desired operational mode.

40.10.1.2.3 Computer-Initiated User Tasks. The automation of subsystem monitoring and information handling results in a need for the computer top prompt users to perform different tasks of various priorities. In general, the approach to achieve this should be for the computer to display an alert to the user that a certain activity needs to be advised. The prompt should include some

indication of the priority of the activity or, in some cases, the probable consequences of delaying the activity. This prompt should be brief and presented in such a way as to not interfere with the task in progress. The user should normally be given the option to complete what he/she is doing or pause his/her current activity. In the case of the chief of section, the user may have the option to delegate the task to one of the subordinate crewmembers. This interface should be achieved using the touch-screen.

40.10.1.2.4 Log-On/Log-Off Procedures. User identification must occur prior to selection of operational states and modes. Log-on prompts should be automatically displayed upon application of power to the crew station. Orderly shutdown of the system prior to removal of power should occur to prevent loss of data or damage to hardware.

40.10.1.2.5 Data Entry. The system should provide feedback to the user of the acceptance or rejection on data entry. When a delay in processing occurs, the system should provide the user with an indication of the delay and the reason for the delay. Entering data into the system for processing requires an explicit action. The system should not allow execution of data that is not complete or not a legal value. The method of entering data should remain consistent throughout the interface. Areas prescribed for data entry should be clearly defined on the display visually.

40.10.1.2.6 Cursors. The system should provide control of cursors thro ɔh the use of a joystick. The cursors should each be visually unique to the tasks they support (e.g., map and site-to-crest) and not obscure other information on the display. When necessary for fine positioning accuracy, the cursor should appear as a crosshair. When appropriate to the interface, the cursor should remain centered in the display screen and the display image should be made to scroll beneath it. The joystick should have a unique push-button to desi-nate cursor location. Cursor movement using the joystick should be proportional to the displacement of the joystick.

40.10.1.2.7 Keyboard. Use of a keyboard should be avoided where selection of prompted options is practical.

40.10.1.2.8 Fixed-Function Keys. Fixed-function keys should be used for all time-critical, error critical, and frequently used control inputs. The functions and placement of the fixed function keys should be consistent among the three crew stations. The functions controlled by the fixed function keys should always be available for actuation by any crewmember unless preempted by a crewmember with high priority of control actuation. Fixed function keys with related functions should be grouped together physically and placed in a distinctive location on the control panel and labeled at all times as to their function. These keys should be limited to one function each. Actuation of a fixed-function key should result in immediate feedback to the crewmember.

40.10.1.2.9 Joystick. A Joystick should be used to enter data requiring more precision than is possible using the touch-sensitive display screen. The joystick should also be used to control subsystems such as the external camera and laser. Fixed function keys should be provided to control the mode of the joystick.

40.10.1.2.10 Touch Screen. A touch screen should be used at each crew station to provide direct visual reference access and optimum direct control access. The touch screen display should have sufficient luminance transmission to be daylight readable, night vision device compatible. The touch screen should provide a positive indication of touch screen actuation. Dimensions and separation of responsive areas of the touch screen should be in accordance with figure 14 in MIL-STD-1472D. The force required for actuation of the touch screen selections should be in accordance with table X in MIL-STD-1472D.

40.10.2 Audio Configuration Requirements.

40.10.2.1 Audio Displays. The audio signals used should be supplementary to the visual signals and should be used to direct the user's attention to the appropriate visual display. Some audio alerts should be one time for use in altering the user to an errant entry, while others should be intermittent for use in prompting an user response or warning the user of a hazard. Intermittent signals should be automatically terminated when no longer applicable or by user action. Audio signals should be used when:

- The information to be processed is short and simple and requires an immediate or time-based response.
- User inattention is anticipated.
- The criticality of transmission response makes supplementary or redundant transmission desirable.
- It is desirable to warn, alert, or cue the user to subsequent additional response.
- Custom or usage has created anticipation of an audio display.

40.11 Screen Design Approach. Screen design refers to how information is arranged and presented on a display screen. It is difficult to develop standard guidelines for screen design for command and control systems, primarily because of the differences in tasks being performed by the users. Screen design requirements can vary extensively, depending on the function being performed by the system. Some systems are actually information management systems that rely heavily on databases and do not require immediate user response to information displayed on their screens. On the other hand, real-time tactical display and control systems require the user to make immediate decisions and to input commands based on the

information presented on the display screen. Each system has different screen design requirements based on its primary function. The designer needs to understand the primary function of the system being developed to provide an effective screen design. An example of the complexity is shown in Figure 40.1. Example Screen Design.

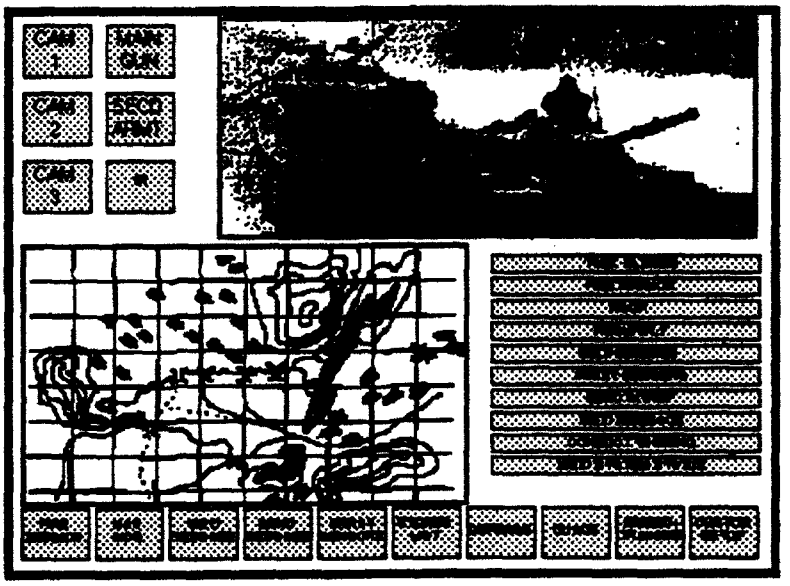

Figure 40.1. Example Screen Design

Certain common, general principles of human factors engineering (HFE) design should be incorporated into the screen design, regardless of the system function.

The user's performance is improved by the following screen features: an orderly, clutter-free appearance; information present in expected locations plain, simple language; a simple way to move through the system; a clear indication of interrelationships. Displays should be formatted to group data items on the basis of some logical principle, considering trade-off's derived from task analysis.

Screen design should minimize pointer and eye movement requirements within the overall design. The goal to minimize eye and pointer movement must be considered within general task considerations, with logical trade-off's taken into account.

40.11.1 Organization. Organization of information should be guided by Gestalt principles of perception, such as rules of proximity and similarity. These are discussed in greater detail in the introduction.

40.11.2 Formats. Display formats should be designed to provide optimum transfer of information to the user by the use of information coding, density, grouping, and enumerating.

40.11.3 Presentation. Information should be presented simply and in a well-organized manner for high information transfer.

40.12 Maps and Situation Displays. Graphical presentation of data is a critical feature of many emerging command and control applications. This section suggests possible means for presenting data in graphical formats. The applications discussed here include tactical graphics (overlays, symbology, and terrain representation) and pictographic representations (digitized maps, pictures, etc.).

40.12.1 Maps. Maps refer to projected representations of geographic data, usually on flat surface displays. Maps include both natural and man-made features and text and/or graphics and colors used to describe or code those features. Situation displays provide a means of relating changing conditions or events to geographic features represented on maps

40.12.1.1 Curvature. Be consistent in projecting the earth's curvature on flat surface maps when displaying large geographic areas.

40.12.1.2 Map Label Position. Position map labels consistently (e.g., beneath or within the feature). Where possible, label all significant features without cluttering the display.

40.12.1.3 Map Orientation. Use a consistent map orientation when more than one map should be displayed (e.g., north consistent for all maps).

40.12.1.4 Designating Map Areas. Consider using color, shading, texture patterns, or highlighting to define map areas of special interest. Shades (tones) of a single color are preferable to multiple colors when observers must make relative comparisons between or among areas. When using shades of color or texture patterns, the gradation of shades from dark to light should correspond to variation in the variable that is represented.

40.12.1.5 Situation Display Presentation. Provide a means of presenting situation displays as overlays on related map backgrounds.

40.12.1.6 Automated Tools. Provide automated tools for complex map analyses. The specific tools should be based upon the user's needs. For example, avenue of approach, line-of-sight, and trafficability are needed by some but not all users. The user requirements should be determined and appropriate tools provided.

40.12.1.7 Coverage Area and Resolution. As a minimum, maps must cover the areas of responsibility of the user at each organizational level and provide all essential details required to conduct operations. Map displays should be large enough to permit the simultaneous presentation and visual integration of information required by the user. Small electronic displays may be panned and

zoomed to increase map coverage. However, at present, such displays have significant visual limitations when compared to traditional, large-format, paper maps.

40.12.1.8 Map Feature Representation. All critical map features must be represented .

40.12.1.9 Reduction of Clutter. Provide a means for reducing clutter while preserving essential information.

40.12.1.10 Area of View on Maps. Maneuver commanders at each echelon should be able to view their own areas of operation, activities one echelon above and two echelons below, and activities of friendly adjacent (flanking) units. The activities of adjacent and deep enemy units that oppose displayed friendly forces should also be displayed.

40.12.1.11 Accuracy of Location. Connecting Symbols to Location. Symbols should be accurately placed on the map or connected to the desired location using arrows, lines, or other pointing devices.

40.12.1.12 Automatic Registration. Provide an automated means of registering graphic data with background map information at all display scales.

40.12.2 Standard Military Symbols. Use standard military symbols in accordance with doctrine when preparing maps and overlays. For example, use the current edition of FM 101-5-1. Operational Terms and Symbols.

40.12.2.1 Symbol Color Coding. Use standard military map color codes and provide a user-prompted key defining the color codes which are used.

40.12.2.2 Overlap of Symbols. Map symbols should not be allowed to overlap, particularly if this would obscure their identity. Where overlap is unavoidable, provide a means for moving background symbols to the foreground or otherwise revealing masked symbols.

40.12.2.3 Symbol Labeling. Essential labels (for example, unit identification) should be displayed with the symbol; otherwise, provide a means by which the user can display information related to selected symbols.

40.12.3 Terrain Representation. Digital terrain data available for some versions of electronic map (e-map) allow alternative methods of portraying terrain features. In addition to traditional topographic contour intervals, digital terrain data can present map backgrounds depicting road networks, drainage, vegetation, and soil type. Shading, coloring, or other visual cues can also be used to accentuate terrain features.

40.12.4 Location of Displayed Section. Where location information is frequently used, a constantly visible display of coordinates associated with the cursor should be displayed in user-selectable coordinate units that can also be conveniently changed. The continuous display of location should be augmented with the capability to fix (point on the map) a location to facilitate moving overlay displays.

40.12.5 Availability of Symbol/Map Feature Coordinates. Provide to the user a means of obtaining the exact map coordinates for a selected symbol or map feature by means of querying the symbol or feature. The recommended method of querying an item is to use a pointing device, such as a mouse or trackball cursor.

40.12.6 Larger Map Inset. When the entire map is not displayed, provide an inset that shows where the displayed portion is within the larger map.

40.12.7 Distance Determination. Provide an automated means for readily determining the distance between points.

40.12.8 Bearing Determination. Provide a means for readily determining the bearing between points.

40.13 Display Size. Because of the limited screen size of many displays, a method is needed to scan and change the scales of the maps. In addition, changes in the tactical situation require updates to various map overlays. The following guidelines should be considered when implementing dynamically changing maps.

40.13.1 Use of Panning. Permit the user to change the displayed area by moving a window over the map in any direction. Panning operations may be continuous (preferable) or discrete but should meet the user's requirements.

40.13.2 Position Indicator for Panning. During panning operations, provide an indicator of position in the overall display.

40.13.3 Return to Start Point. During panning operations, provide a means for rapidly returning to the starting point.

40.13.4 Use of Zooming. Provide a means for moving away from or toward the displayed area (zooming) to obtain a larger view or greater detail.

40.13.5 Variable Level of Detail. When zooming, symbols should be collapsed into fewer summary symbols to declutter.

40.13.6 Levels of Detail. Consider modifying the level of detail (number of symbols and features depicted) to match the degree of zooming used (i.e., more detail for close-up views and less for large-area perspectives).

40.13.7 Method of Zooming. Of the two methods of zooming (i.e., continuous and discrete), continuous is preferable. Whichever method is used must be satisfactory to the user.

40.13.8 Return to Default. Provide a means for quickly returning to the normal display size when zooming.

40.13.9 Expanded Sector Position Indication. It is recommended that an inset or window be provided that shows the maximum available map coverage. An example of map coverage would be a graphic square on the inset map that indicates the position of the map currently displayed. In the most useful form, this inset would be interactive and used to set parameters for calling up a screen map display.

40.14 Automatic Updating. Automatic updating, editing, and distributing map data are among the primary advantages offered by electronic displays. The following guidelines address considerations in implementing these capabilities.

40.14.1 Selecting Information for Update. As appropriate, allow the user to select categories of information that should be automatically updated.

40.14.2 Stable Reference Elements. Provide stable reference elements (e.g., terrain features, boundaries, etc.) when displays are automatically updated.

40.14.3 Identification of Updates. Provide a means for readily identifying updates or changes. Critical changes must be easily recognized and distinguishable from other changes to the display. For example, highlight the update until the user acknowledges it.

40.15 Display Sequencing. Display sequencing refers to two practices: 1) selectively presenting and removing displayed data, such as a series of overlays with different information. This can act as an aid for decluttering a display. 2) illustrating temporal changes in the information of historical data or simulation of future events.

40.15.1 Sequencing. Display sequencing may be used to reduce clutter (e.g., presenting map overlays in succession), to reproduce temporal changes in the display database (e.g., changes in the tactical situation), and to aid in visualizing simulated changes in the battlefield situation.

40.15.2 Rate of Sequencing Control. Where possible, allow the user to control the rate of sequencing.

40.15.3 Sequencing Pause or Suspend. Provide a capability to pause or suspend sequencing operations and provide an indicator of the status of sequencing operations.

40.15.4 Forward and Reverse Sequencing. As appropriate, allow the user to present sequenced displays in forward or reverse order.

40.15.5 Return to a Specific Display in a Sequence. Provide a means for the user to return quickly to a selected display within a sequence of displays.

40.15.6 Use of Animation in Sequencing. Consider using animation as an aid to the pictorial display for complex objects.

40.16 Grid Overlay. Provide a user-selectable grid overlay that is keyed to the coordinate system of the map. It should be easy for the user to turn the grid on and off. Coordinate keying of the overlays must be clearly specified and easily operated by the user.

40.17 Dynamic Map Legend. The map display should have an associated window giving relevant information in a continuous display. The information should include map scale, cursor location, graphic of map coverage, and status (i.e.,. working, computing, available, etc.).

40.17.1 Standard Symbol Library. Provide a library of standard symbols and a means of transferring and manipulating symbols.

40.17.2 Labeling Symbols. Provide an easy means of labeling symbols. Consider automated means of aiding the user in labeling and enforcing labeling conventions.

40.17.3 Building Symbols and Overlays. Provide automated tools to assist the user in constructing new symbols and graphics overlays.

40.17.4 Addition and Deletion. The user should be able to add or delete symbols, labels, or other features without destroying background information.

40.18 Area Expansion for Data Placement. Allow the user to expand an area of the display as required for accurate placement of critical data.

40.19 Graphic Element Designation. Provide a means for designating graphic elements for editing. Highlight selected items to provide a visual cue of forthcoming subsequent actions.

40.19.1 Repositioning Elements. Allow the user to reposition selected elements on the display.

40.19.2 Remove/Restore Elements. Allow the user to remove and restore selected elements.

40.20 Selection from Existing Options. Allow the user to select from displays of available options when making changes to display attributes, such as color, symbols, line types, textures, etc. Selection should be made by pointing rather than by naming the options .

40.21 Attribute Identification. Provide an easy means for the user to identify attributes currently selected.

40.21.1 Attribute Change. The user should be able to change the attributes of selected graphic elements.

40.22 Storage of Graphic Display. Provide an easy means for naming, storing, and retrieving graphics displays and elements. Also, provide a means for reviewing and selecting from stored graphics files .

40.23 Map as a Base Screen. When an application is map intensive, it is recommended that the map be used as the background or base screen, which should be the maximum display size possible to promote readability.

40.23.1 Map Readability. It is beneficial to ensure the readability of map features since the map is the focus of the user. The screen design should avoid displays that cover the map when possible, and windows should not obscure the map.

40.23.2 Map Cursors. Map cursors should use a crosshair design that has high contrast with the background. It is recommended that cursor size subtend 20 minutes of visual angle so the average user can easily locate it on the map.

40.23.3 Graphic Overlays. The preselection or filtering of graphic overlays is a recommended feature. The decluttering graphic displays (especially maps) should be assisted.

40.23.4 Filters. Labels and titles used for filters should be carefully reviewed to ensure items are understandable. The filters should be extended to map features, such as roads, cities, vegetation, topography, and political data. The intensity of the map should be controllable to allow fadeout of the map without losing all the map features.

40.23.5 Labeling of Graphic Overlays. It is understood that graphic overlays should overlap map features, but text information should not be obscured. The text should be offset with arrows to preserve map legibility .

40.23.6 Color Use with Graphic Overlays. Using color to identify symbols is encouraged. but redundant coding that does not use color should also be used. This caution is especially true for friend-enemy or danger-safe designations. Dots, dashes, shapes, and video effects are recommended. Care must be taken to avoid visual

color illusions caused by color blending (i.e., adjacent red and blue lines are seen as one purple line).

APPENDIX E

BEHAVIORAL REPRESENTATION OF SAFOR ENTITIES

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APPENDIX E

AFAS, FARV and LRP SAFOR Behavior

50. BEHAVIORAL REPRESENTATION OF SAFOR ENTITIES

50.1 Introduction

This appendix describes behavioral representations required for SAFOR entities corresponding to the AFAS vehicle, the FARV vehicle, the Logistics Resupply Point (LRP), and certain other battlefield elements expected to be involved in exercises that evaluate design revisions and operational employment alternatives.

Although the information provided in this appendix is sufficiently generic to support creation of SAFOR entities by alternative methods, the descriptions are structured to facilitate use of the ModSAF technology for implementation. Behavioral descriptions for tasked units / subordinate units are hierarchically decomposed in terms of the MISSIONS, MISSION PHASES, and TASKS they may be assigned during a simulation exercise. An account of the basic physical model for each unit / sub-ordinate unit is also supplied (where applicable).

50.2 AFAS SAFOR

The tasked subordinate unit described in this subsection is an AFAS vehicle.

The physical model for this unit is a 55 ton tracked vehicle equipped with a 155mm cannon, a variety of secondary armament, and a suite of passive sensors for self defense.

The following behavioral specifications presume that the AFAS vehicle is operating in its role as a subordinate unit responsible to a platoon leader.

50.2.1 Missions (AFAS)

mission name: Move
description: AFAS will conduct two types of Moves on the battlefield: Tactical Move and Survivability Move. In either type of Move, Platoon Operations Center (POC) will receive and transmit to the AFAS movement guidance for the section, specifying such things as section timing guidance, tactical movement routes, start points, release points, refuel points, traffic control points, check points, rest points, refuel points, area of operations and other information pertinent to the conduct of the type move planned.
component phases: Tactical Move, Survivability Move

mission name: Communications
description: AFAS will communicate with external elements using a combination of voice, digital and, as an alternative, wire communications. In order to establish and maintain communications, AFAS must consider electronic line of sight (LOS) in the selection of positions and move to accommodate LOS when necessary.
component phases: Digital Communications, Voice Communications, Wire Communications

mission name: Survive
description: To survive, the AFAS must be prepared to meet the threat presented by enemy ground forces, counterfire, aircraft and nuclear, biological and chemical (NBC) assets. AFAS must determine the best of several options in dealing with any of these threats. These threats may be singular or multiple. AFAS will determine its most appropriate defensive posture, develop a defensive plan based on the threat information provided by its C3 elements, and react to threats identified by its on-board sensor suite. (Decision aids will assist the crew in planning and conducting survivability operations by providing recommendations for responses to counteract identified threats.) To survive, AFAS must create a self-defense plan and monitor / control its own signatures and activities based on the projected threat while monitoring / reacting to threat activity, ultimately choosing to remain in position and fight the threat, run from the threat or hide.
component phases: Develop Self-defense Plan, Monitor / Control AFAS Signatures and Activities, Monitor / React to Threat

mission name: Deliver Fires
description: The delivery of fires is the primary mission of the AFAS; all other missions are subordinate to and performed in support of this mission. To perform this mission, AFAS must establish and maintain a firing capability, determine firing data, coordinate / control firing data, conduct fire missions, control ammunition and manage / submit reports. AFAS must be capable of performing these functions for itself and one additional AFAS. The additional AFAS may be performing in a senior or subordinate role during paired howitzer operations or in a degraded mode of operation due to a subsystem failure. In order to perform its mission, AFAS relies on a digital link with C2 elements as a source of the data required. Commander's guidance, battlefield geometry, fire support coordination measures and meteorological updates are the primary external information that affects virtually every aspect of the delivery of fires. The AFAS will have the capability to link directly with an observer to engage specific targets as directed by C2 elements. AFAS can perform its mission while consolidated in a centralized mode of operation (where all howitzers are centrally located), while paired with another AFAS (in either a senior or subordinate role), while moving independently within the platoon's position area (in a decentralized mode of operation), or in a combination of these operational modes that best suites the tactical situation as determined by the commander.
component phases: Establish / Maintain Firing Capability, Attack Targets

50.2.2 Mission Phases (AFAS)

mission phase name: Tactical Move
description: Move that is controlled by higher levels of command and control, such as battalion TOC; normal distances are 2 to 14 km.
component tasks: Plan Route, Follow Route

mission phase name: Survivability Move
description: Move within the assigned platoon position area which is controlled either by the POC or the howitzer; this move is normally less than 2 km.
component tasks: Plan Route, Follow Route

mission phase name: Digital Communications
description: Digital communications will represent the bulk of the communications with external sources. This method is considered to represent less likelihood of detection than voice and will be used to transmit and receive all information relative to AFAS databases. Additionally, a plain text message format will be included for the transfer of unformatted messages.
component tasks: Use Correct Radio Procedures

mission phase name: Develop Self-defense Plan
description: AFAS will determine the best plan for defense of its current and future positions and routes. The plan will be made based on the information available to the AFAS from its C3 elements. This information includes expected enemy capabilities in air power, ground forces and equipment types, counterfire threat and NBC capability. Each of these plans will consider the terrain in which the AFAS is operating, based on a digital mapping system integral to the howitzer which displays battlefield geometry and boundaries and friendly / enemy unit information. The terrain analysis will provide tactical options based on the physical terrain features.
component tasks: Develop Position Defense Plan, Develop Route Defense Plan

mission phase name: Monitor / Control AFAS Signatures and Activities
description: AFAS will determine the type of threat (air, ground, counterfire, NBC or a combination of these) that is most likely to be encountered, based on intelligence information provided by its C3 element. From this the AFAS will determine the type of signatures or activities most likely to cause the AFAS to be identified as a target by the enemy. For example, if the enemy has air superiority, the necessity to move less frequently is implied, thereby necessitating a reduction in movement activity and use of active sensors. The result would indicate the use of less frequent survivability moves using terrain that provided the most overhead concealment and sensors that were passive (versus active emitters).
component tasks: Develop Sensor Plan, Develop Movement Plan

mission phase name: Monitor / React to Threat
description: In the event that a threat presents itself to the system, AFAS must plan for and initiate an appropriate response. An appropriate response is based on the idea that a system has three options when confronted: run, hide, or fight. The plans developed in the previous two mission phases will have narrowed the options available and, in most cases, reaction to a threat will be no more than carrying out a previously- developed plan. However, each threat must be prioritized and dealt with as the situation dictates, thereby affecting the validity of any plan unless the circumstances are static.
component tasks: Determine Rationale to Run, Determine Rationale to Hide, Determine Rationale to Fight

mission phase name: Establish / Maintain Firing Capability
description: To establish a firing capability, AFAS must have (1) the ability to communicate, (2) necessary information within the ballistic computer databases, and (3) ammunition available. To maintain that capability, AFAS must maintain communications, update databases, control ammunition and manage / submit reports while ensuring the maintenance and sustaining actions are monitored and performed.
component tasks: Establish Communications, Initialize / Update Ballistic Computer Data, Control Ammunition, Manage / Submit Records and Reports, Maintain and Sustain

mission phase name: Attack Targets
description: The ability to attack targets is the execution phase (and the key phase) of the AFAS' Deliver Fires mission. During this mission phase, AFAS will coordinate and control fire missions, receiving, reviewing, accepting, rejecting and prioritizing them upon receipt. Once the mission is accepted, a priority is assigned, based on the other missions awaiting action. Firing data are then computed for the mission and the mission is either placed in the queue or fired, depending upon the prioritization process. The final task is initialization of the firing process by the crew.
component tasks: Determine Firing Data, Coordinate / Control Fire Missions, Conduct Fire Missions

50.2.3 Tasks (AFAS)

task name: Plan Route
description: When executing a Tactical Move, AFAS will determine the best route from its current location to the start point (SP), and will plan its route from the release point (RP) to its first firing position (FP) within the new position area (PA). When executing a Survivability Move, AFAS will plan routes from its current position to the next planned position.

task name: Follow Route
description: When executing a Tactical Move, AFAS will follow the route provided either in convoy or incrementally, as designated by the POC, from the SP to the RP. When executing a Survivability Move, AFAS will follow planned route to next position.

task name: Develop Position Defense Plan
description: Position defense plans establish the intended method of defense prior to or upon occupation of a position, based on what is known of the enemy. The AFAS must take into account the intelligence information provided by C3 elements. This information includes air defense status based on the enemy air capabilities, enemy unit locations along with type of unit, and how the unit is equipped. NBC defensive posture is also provided. Based on this information, AFAS will determine an overall defense plan by combining the strategy applied in its sensor, weapon and movement plan, taking into account commander's guidance.

task name: Develop Route Defense Plan
description: Route defense plans are developed identically to the position defense plans with the exception that the location for the plan is continually changing. Some elements of the plan, such as the sensors, are affected by movement. This will limit the availability of certain data that can be used in position defense. For example, the AFAS will not be able to use a motion detection device while it is moving and acoustic sensors may not be able to filter out the noise of its own passage.

task name: Develop Weapons Plan
description: Weapons plans are developed to maximize the benefits of the available weapons systems, based on the threat. Weapons plans will be developed based on available intelligence and linked to sensor input during the course of surveillance by the sensor suite when the AFAS is stationary in a position. Weapons plans for armament when the AFAS is enroute between positions will be based on the most likely threat. The secondary armament will be the primary means of defense against aircraft, light armor and dismounted infantry. If the ability exists to engage the threat using indirect fire with the main armament, this would be preferable to allowing the enemy within striking distance of its weaponry but would not be initiated until there is little doubt that the enemy will (or has) detected the AFAS.

task name: Develop Sensor Plan
description: The sensor plan will provide the AFAS with the ability to monitor its external environment. The plan is developed to provide AFAS with a warning that a threat is approaching prior to the threat having the ability to strike. The plan will take into account the enemy capabilities and equipment when selecting the most appropriate options for sensor deployment. Terrain will play a major part in determining which sensor is most capable of monitoring which sector within the avenues of approach available to the enemy. For example, a sensor which requires line of sight to detect the enemy would not be used in a sector that had limited line of sight.

task name: Develop Movement Plan
description: The movement plan establishes a sequence of positions within the position area for the AFAS to use in the accomplishment of its mission. These movement plans expand on the position and route selection in that tactical considerations are applied based on the threat. For example, if the enemy counterfire capability is high, the AFAS would most likely move after each fire mission to another position outside the counterfire footprint.

task name: Determine Rationale to Run
description: Commander's guidance is the primary input to this task. It is not usually left up to the individual crews to determine if the mission is best supported by evasion. The primary mission of the AFAS is to provide fire support to the ground gaining arms. As such, if movement interrupts the accomplishment of the mission, in most cases the AFAS will report the threat and call for support in the event it is incapable of providing its own.

task name: Determine Rationale to Hide
description: The rationale to hide is based on the mission. If AFAS is not firing missions at the time the threat is detected, the best approach may very well be to simply remain in place and not draw attention to itself or move to a position that provides concealment. Again, the key to this strategy is the effect of the decision to hide on mission accomplishment and the commander's guidance provided.

task name: Determine Rationale to Fight
description: The rationale to fight is linked to the requirements for the AFAS to survive in order to continue its mission. AFAS is not, by design, a frontal assault type weapon. There is considerable improvement in the AFAS in terms of lethality in direct fire engagements using both the main and secondary armament. This function, however, is best left to armor and infantry. The decision to fight will normally be made after the ability to run and / or hide have been attempted and failed. Once AFAS has committed to fight, it must engage targets with its available firepower and countermeasures until the threat is destroyed or neutralized to the point that the indirect fire mission can be resumed.

task name: Establish Communications
description: AFAS requires the ability to communicate with C2 elements to engage the enemy with indirect fire. Communications with the platoon operations center (POC) provides the AFAS with digital information updates on commander's guidance / attack criteria, battlefield geometry, fire support coordination measures, and meteorological updates, as well as plain text digital message and voice communications. Observer information transmitted is essential in computing firing data and determining the method of engagement to neutralize or destroy the target. AFAS requires the ability to communicate directly with the observer for missions so directed by the POC. This requirement dictates the need to communicate out to a range of 25 km.

task name: Initialize / Update Ballistic Computer Data
description: Initialization of the ballistic computer is performed when turning the system on or as directed by C2 elements. C2 elements may use initialization as a means of standardizing databases prior to an engagement or to accomplish a specific tactical goal. Most, but not all, data elements are provided with a default in the absence of specified information. The operator may be required to input it manually or to verify critical data elements.

task name: Control Ammunition
description: The ability to control ammunition is directly linked to the decision making process required for the acceptance or rejection of fire missions. AFAS must know what ammunition is on hand at any given moment, compare that ammunition to those missions already in the fire mission queue and determine if the remaining ammunition is sufficient to support incoming missions. AFAS must request resupply upon reaching critical stockage levels derived from commander's guidance.

task name: Manage / Submit Records and Reports
description: Managing and submitting reports is critical to the availability of the AFAS. C2 elements will rely upon--and base their operational and tactical decisions upon--the information available to them from AFAS' reports. Information such as location, operational status of subsystems, ammunition stock levels, fuel levels and crew status will impact these decisions significantly. Timeliness of fire support will be affected by the efficiency with which the AFAS can perform this task.

task name: Maintain and Sustain
description: AFAS must maintain its operational status in order to sustain the ability to deliver fires. The system will, through diagnostics and prognostics, evaluate internal systems for operational status and rely on embedded publications and preventive maintenance aides to assist in replacement or repair decisions. Sustainment aides will assist the crew in making decisions regarding all classes of supply available to the AFAS and managing critical stockage levels. Resupply decisions will be based on these stockage levels. AFAS will report changes in operational status to its C2 element. Requests for resupply will be sent to the POC for processing. The POC will process the requests, based on the tactical situation and availability of requested items. POC will base ammunition resupply on the amount of ammunition available both at the LRP and on board the FARV.

task name: Determine Firing Data
description: AFAS will determine firing data for itself and one additional AFAS. The POC will provide the AFAS with target and observer information as required. AFAS will compute firing data that accounts for internal, external and terminal ballistics to include round-to-round muzzle velocity corrections. Data will be derived which will fulfill the observers' request as modified by commander's guidance, attack criteria and the joint munitions effects manual (JMEM). A database will be maintained of all missions fired, along with the respective firing data and such perishable information as the meteorological update information corresponding to the period for which the missions were fired.

task name: Coordinate / Control Fire Missions
description: AFAS will process fire missions upon receipt, deciding whether to accept or reject the mission and, if accepted, prioritize the mission. These decisions will be based on commander's guidance and the AFAS' current status. For example, if AFAS receives a fire mission which requires a time on target that conflicts with a mission currently in its queue, AFAS will reject the mission. The POC will receive the rejected mission along with the reason for rejection and forward the mission to another AFAS. In most instances, the POC will not send missions that conflict if all information regarding the AFAS' status is current. The POC may decide to resolve the conflict by eliminating the mission already in the queue. AFAS will be required to control and provide data to an additional AFAS that is assigned, either in a subordinate role or when the other AFAS is performing its mission with inoperative subsystems. The senior/subordinate relationship requires one howitzer, normally the senior section chief's, to receive the fire missions for itself and one additional howitzer. AFAS will control all aspects of fire mission coordination and control for both howitzers. When supporting a degraded howitzer, AFAS will provide the degraded howitzer with firing data and have the howitzer fire the number of rounds for its missions the degraded system can support. For example, an AFAS has an electrical malfunction that disables the computer system. A fully functional AFAS is directed by the POC to collocate with the degraded system and provide firing data to the system. The functional AFAS will provide the degraded howitzer with firing data and commands as well as managing its ammunition stockage.

task name: Conduct Fire Missions
description: AFAS will conduct fire missions as directed by its C2 elements and / or as computed by its on-board ballistic computer. Each mission will be conducted in accordance with the observer's request as modified by commander's guidance, attack criteria and the joint munitions effects manual (JMEM).

50.3 FARV SAFOR

The tasked subordinate unit described in this subsection is a FARV vehicle.

The physical model for this unit is a 55 ton tracked vehicle equipped with automated loading mechanisms, a variety of secondary armament, and a suite of passive sensors for self defense.

The following behavioral specifications presume that the FARV vehicle is operating in its role as a subordinate unit responsible to a platoon leader.

50.3.1 Missions (FARV)

mission name: Move
description: FARV will move extensively on the battlefield in the support of AFAS with all classes of supply. FARV will perform three types of movement: resupply, survivability and tactical. Resupply moves will require FARV to move from hide positions to the AFAS location or to the battery logistical resupply point (LRP) to resupply its stockage levels in support of AFAS' requirements. FARV will receive movement orders from the POC or, in a one-on-one relationship with AFAS, the AFAS to which it has been assigned. FARV will perform survivability moves as the situation and threat dictate. FARV will perform tactical moves between platoon position areas under POC control. Much like the AFAS, FARV will simply plan the route from its current location to the start point for the tactical move.
component phases: Resupply Move, Tactical Move, Survivability Move

mission name: Communicate
description: FARV will communicate with external elements using voice, digital and inter-vehicular communications. FARV must consider electronic line of sight and move to accommodate it when necessary.
component phases: Digital Communications, Voice Communications, Inter-Vehicular Communications

mission name: Survive
description: The survive mission for FARV is the same as that for AFAS, with two key exceptions. First, FARV does not possess the lethality afforded AFAS by its main gun. The emphasis placed on passive defense in the AFAS mission description still applies but is greater as a result. FARV has a significantly smaller signature when in the hide position than AFAS due to decreased amounts of radio traffic and lack of the main gun signature. Second, FARV will move more frequently than AFAS, especially during peak and surge operations, increasing its signature as well as its likelihood for detection.
component phases: Develop Self-defense Plan, Monitor / Control FARV Signatures and Activities, Monitor / React to Threat

mission name: Sustain
description: FARV has one primary purpose: provide AFAS with all classes of supply and provide limited recovery assistance to AFAS and other FARVs. FARV will perform this function by responding to resupply / recovery requests from the POC or the AFAS.
component phases: FARV Resupply, AFAS Resupply, Recovery

50.3.2 Mission Phases (FARV)

mission phase name: Resupply Move
description: FARV will conduct resupply moves to two specific entities on the battlefield: the AFAS, of which there are four within the platoon, and the battery LRP. AFAS locations change frequently and the number and locations of AFASs the FARV supports will change according to the tactical situation. For example, the FARV may begin the day supporting only one AFAS and, based on the optempo, receive orders from the POC requiring FARV to support a pair of AFAS. The LRP location also changes, but less frequently and normally in conjunction with a tactical move to a different position area. FARV will, upon receipt of a resupply order from AFAS or an order from the POC to go to the LRP, plan a route from its current location to the destination. When resupplying AFAS, time of arrival should coincide with AFAS arrival so as to limit the amount of activity and time in the area, thereby reducing the likelihood of detection. Normally, the AFAS will use this resupply location to conduct fire missions following FARVs departure. From the resupply, FARV will move to a hide position pending receipt of its next resupply request.
component tasks: none

mission phase name: Tactical Move
description: Move that is controlled by higher levels of command and control, such as battalion TOC; normal distances are 2 to 14 km. FARV will perform tactical moves as directed by the POC in the same manner as the AFAS.
component tasks: Plan Route, Follow Route

mission phase name: Survivability Move
description: Move within the assigned platoon position area which is controlled either by the POC or the howitzer; this move is normally less than 2 km. FARV will make survivability moves much the same as the AFAS and for mostly the same reasons. Survivability moves will normally be conducted from one hide position to another, based on having an increased likelihood of detection. For example, if FARV has frequent radio transmissions while in one hide position, the self- defense system will alert the crew to the increased likelihood of being acquired and recommend a move. FARV will then request authorization from its control element (an AFAS or the POC) and select a route to another hide position.
component tasks: Plan Route, Follow Route

mission phase name: Digital Communications
description: Digital communications will represent the bulk of the communications with external sources. This method is considered to represent less likelihood of detection than voice and will be used to transmit and receive all information relative to AFAS / FARV databases. A plain text message format will be included for the transfer of unformatted messages.
component tasks: Use Correct Radio Procedures

mission phase name: Inter-Vehicular Communications
description: Inter-vehicular communications is the physical link for transferring digital database information and providing voice communications through the vehicle intercom systems between AFAS and FARV during resupply operations. FARV establishes the link when the vehicles are within docking range and disconnects the system upon completion. AFAS will control docking operations and data transfer through this link.
component tasks: none

mission phase name: Develop Self-defense Plan
description: FARV will determine the best plan for defense of its current and future positions and routes. The plan will be made based on the information available to the FARV from its C3 elements. This information includes expected enemy capabilities in air power, ground forces and equipment types, counterfire threat and NBC capability. Each of these plans will consider the terrain in which the FARV is operating, based on a digital mapping system integral to the howitzer which displays battlefield geometry and boundaries and friendly / enemy unit information. The terrain analysis will provide tactical options based on the physical terrain features.
component tasks: Develop Position Defense Plan, Develop Route Defense Plan

mission phase name: Monitor / Control FARV Signatures and Activities
description: FARV will determine the type of threat (air, ground, counterfire, NBC or a combination of these) that is most likely to be encountered, based on intelligence information provided by its C3 element. From this the FARV will determine the type of signatures or activities most likely to cause the FARV to be identified as a target by the enemy. For example, if the enemy has air superiority, the necessity to move less frequently is implied, thereby necessitating a reduction in movement activity and use of active sensors. The result would indicate the use of less frequent survivability moves using terrain that provided the most overhead concealment and sensors that were passive (versus active emitters).
component tasks: Develop Sensor Plan, Develop Movement Plan

mission phase name: Monitor / React to Threat
description: In the event that a threat presents itself to the system, FARV must plan for and initiate an appropriate response. An appropriate response is based on the idea that a system has three options when confronted: run, hide, or fight. The plans developed in the previous two mission phases will have narrowed the options available and, in most cases, reaction to a threat will be no more than carrying out a previously- developed plan. However, each threat must be prioritized and dealt with as the situation dictates, thereby affecting the validity of any plan unless the circumstances are static.
component tasks: Determine Rationale to Run, Determine Rationale to Hide, Determine Rationale to Fight

mission phase name: FARV Resupply
description: FARV stockage levels are reported to the POC or (in instances where the FARV is dedicated to a single howitzer or pair of howitzers) to the AFAS. Critical stockage levels are established by commander's guidance to the FARV. When FARV approaches the critical level in any required stockage item, it will send a request to the POC for resupply. Resupply of the FARV will normally be controlled to prevent more than one FARV being at the LRP at any given time. This reduces the risk of detection or the level of collateral damage possible in the event the LRP is attacked. FARV will proceed to the LRP as directed by the POC and procure the quantities of munitions and other classes of supply as directed by the POC. Upon completion of the upload, FARV will move to either a hide position or directly to an AFAS.
component tasks: FARV Upload, FARV Download

mission phase name: AFAS Resupply
description: The POC or (in instances when FARV is under AFAS control) the supported AFAS, will contact FARV for resupply. FARV will rendezvous with the AFAS at the location and time designated in the request. This move will normally be conducted within the platoon position area. FARV will establish the inter-vehicular communications link when within docking range of AFAS. From that point on, all docking and resupply operations fall under the control of the receiving vehicle. For example, if FARV is to provide AFAS with 60 rounds of DPICM and receive 3 rounds of RAP from the AFAS, FARV would control receipt of the 3 rounds in order to control the rate of transfer. AFAS would control docking operations and transfer of the 60 rounds of DPICM. Fuel and ammunition transfer, with the exception of the cannon launched guided projectile (CLGP) and small arms, is automated. All other classes of supply can require manual hookups and crew egress to effect the resupply. Transfer of class I (food and potable water) is expected to be performed manually. AFAS crew members will not be required to dismount for any reason during transfer of supplies.
component tasks: none

mission phase name: Recovery
description: FARV will have the ability to recover (tow) an inoperative AFAS or FARV to the LRP, or assist and AFAS or FARV if the vehicle is stuck. Recovery operations may include providing auxiliary electrical power to operate on-board automated systems.
component tasks: none

50.3.3 Tasks (FARV)

task name: Plan Route
description: When executing a Tactical Move, FARV will determine the best route from its current location to the start point (SP), and will plan its route from the release point (RP) to its first firing position (FP) within the new position area (PA). When executing a Survivability Move, FARV will plan routes from its current position to the next planned position.

task name: Follow Route
description: When executing a Tactical Move, FARV will follow the route provided either in convoy or incrementally, as designated by the POC, from the SP to the RP. When executing a Survivability Move, FARV will follow planned route to next position.

task name: Develop Position Defense Plan
description: Position defense plans establish the intended method of defense prior to or upon occupation of a position, based on what is known of the enemy. The FARV must take into account the intelligence information provided by C3 elements. This information includes air defense status based on the enemy air capabilities, enemy unit locations along with type of unit, and how the unit is equipped. NBC defensive posture is also provided. Based on this information, FARV will determine an overall defense plan by combining the strategy applied in its sensor, weapon and movement plan, taking into account commander's guidance.

task name: Develop Route Defense Plan
description: Route defense plans are developed identically to the position defense plans with the exception that the location for the plan is continually changing. Some elements of the plan, such as the sensors, are affected by movement. This will limit the availability of certain data that can be used in position defense. For example, the FARV will not be able to use a motion detection device while it is moving and acoustic sensors may not be able to filter out the noise of its own passage.

task name: Develop Weapons Plan
description: Weapons plans are developed to maximize the benefits of the available weapons systems, based on the threat. Weapons plans will be developed based on available intelligence and linked to sensor input during the course of surveillance by the sensor suite.

task name: Develop Sensor Plan
description: The sensor plan will provide the FARV with the ability to monitor its external environment. The plan is developed to provide FARV with a warning that a threat is approaching prior to the threat having the ability to strike. The plan will take into account the enemy capabilities and equipment when selecting the most appropriate options for sensor deployment. Terrain will play a major part in determining which sensor is most capable of monitoring which sector within the avenues of approach available to the enemy. For example, a sensor which requires line of sight to detect the enemy would not be used in a sector that had limited line of sight.

task name: Develop Movement Plan
description: The movement plan establishes a sequence of positions within the position area for the FARV to use in the accomplishment of its mission. These movement plans expand on the position and route selection in that tactical considerations are applied based on the threat.

task name: Determine Rationale to Run
description: Commander's guidance is the primary input to this task. FARV will normally run or hide from the threat.

task name: Determine Rationale to Hide
description: The rationale to hide is based on the mission. If there is no immediate demand for resupply, the best approach may very well be to remain in place and not draw attention to the FARV, or move to a position that provides concealment. Again, the key to this strategy is the effect of the decision to hide on mission accomplishment and the commander's guidance provided.

task name: Determine Rationale to Fight
description: The rationale to fight is linked to the requirements for the FARV to survive in order to continue its mission. There is considerable improvement in the FARV in terms of lethality. The decision to fight will normally be made after the ability to run and/or hide have been attempted and failed. Once FARV has committed to fight, it must engage targets with its available firepower and countermeasures until the threat is destroyed or neutralized to the point that the mission can be resumed.

task name: FARV Upload
description: Upon arrival at the LRP, FARV will upload the quantities of all classes of supply designated by the POC. The FARV crew will be required to manually unpackage and inspect the ammunition, fuze the projectiles with the appropriate fuze, weigh and bar-code the fuzed projectile and load the fuzed projectile, presumably through the docking attachment of the FARV. The FARV autoloader will receive the fuzed projectile and place it in a vacant storage slot. FARV will record the data on the bar-code label, storing the location of the fuzed projectile for use when selecting projectiles for resupply. Liquid propellant (LP) will be pumped into the FARV storage tanks from the containers on the PLS flatrack. FARV will carry sufficient LP to provide top charge for 75% of its projectile carrying capacity. FARV will receive fuel, while being simultaneously rearmed, from any Standard Army Refueling System (SARS) container or vehicle. Manual upload of 130 rounds by the crew and complete refuel process must be performed in less than 65 minutes. FARV will have the capability to receive ammunition from an AFAS or another FARV at a rate of 130 complete rounds within 20 minutes after docking.

task name: FARV Download
description: FARV will have the ability to completely and automatically download 130 complete rounds (excluding copperhead) and fuel to another FARV in 20 minutes after docking. FARV will be capable of downloading 130 complete rounds (LP to containers without contaminating the LP) to the ground within 30 minutes. FARV must allow the crew to manually unload 130 complete rounds in 90 minutes.

50.4 LRP (Logistics Resupply Point) SAFOR

In a virtual simulation, each LRP will be visually represented as a small gathering of distinct SAFOR entities, most of which are already implemented in ModSAF. For example, the following ModSAF entities could typically be included in the representation of an LRP: HMMWV, HEMTT (M977), HEMTT (M978), and US DI. New SAFOR entities may be needed to represent the palletized loading system (PLS) truck, and the PLS flatracks that it brings to the LRP and deposits on the ground.

The behavior of entities in the LRP "scene" will be very similar to the behavior they would display at an analogous resupply point for armor units. For example, it should be possible to represent arrival and departure of trucks as a function of supply inventories at the LRP and/or orders from higher echelons. Similarly, it should be possible to task this collection of SAFOR entities with movement to another location.

As a supplement to the foregoing descriptions, the following information from a U.S. Army Field Artillery School document (Preliminary Operational Concept for Advanced Field Artillery System (AFAS) and Future Armored Resupply Vehicle (FARV), 27 June, 1994, pp. 46-47) may be useful:

". . . The AFAS battery will generally manage the LRP. The LRP itself is a point on the ground chosen to permit easy access by the FARVs and rapid turn- around for the PLS and HEMTTs, which have more limited cross-country mobility. Not only does the LRP support ammunition and fuel resupply, but it also is the point of exchange for all classes of resupply actions and maintenance supporting the batteries. There will be a HEMMT tanker located at each LRP to refuel the FARVs. The location of the LRP may change rapidly depending on the tactical situation. For example, when the force is conducting an offensive operation with long moves, the LRP will frequently shift forward to reduce the travel distance between the FARV and the AFAS. In a rapidly changing situation the PLS vehicles may retain the flatracks and not drop them on the ground, this will allow the LRP to keep pace with the force. In defensive operations, the LRP may move less frequently, only moving in response to security or survivability demands. . . . Once in the LRP, the PLS normally drops its CCL [Combat Configured Load] flatrack, though it may retain the flatrack on the vehicle depending on the tactical situation. Empty flatracks will be backhauled by a PLS that has dropped its CCL at the LRP."

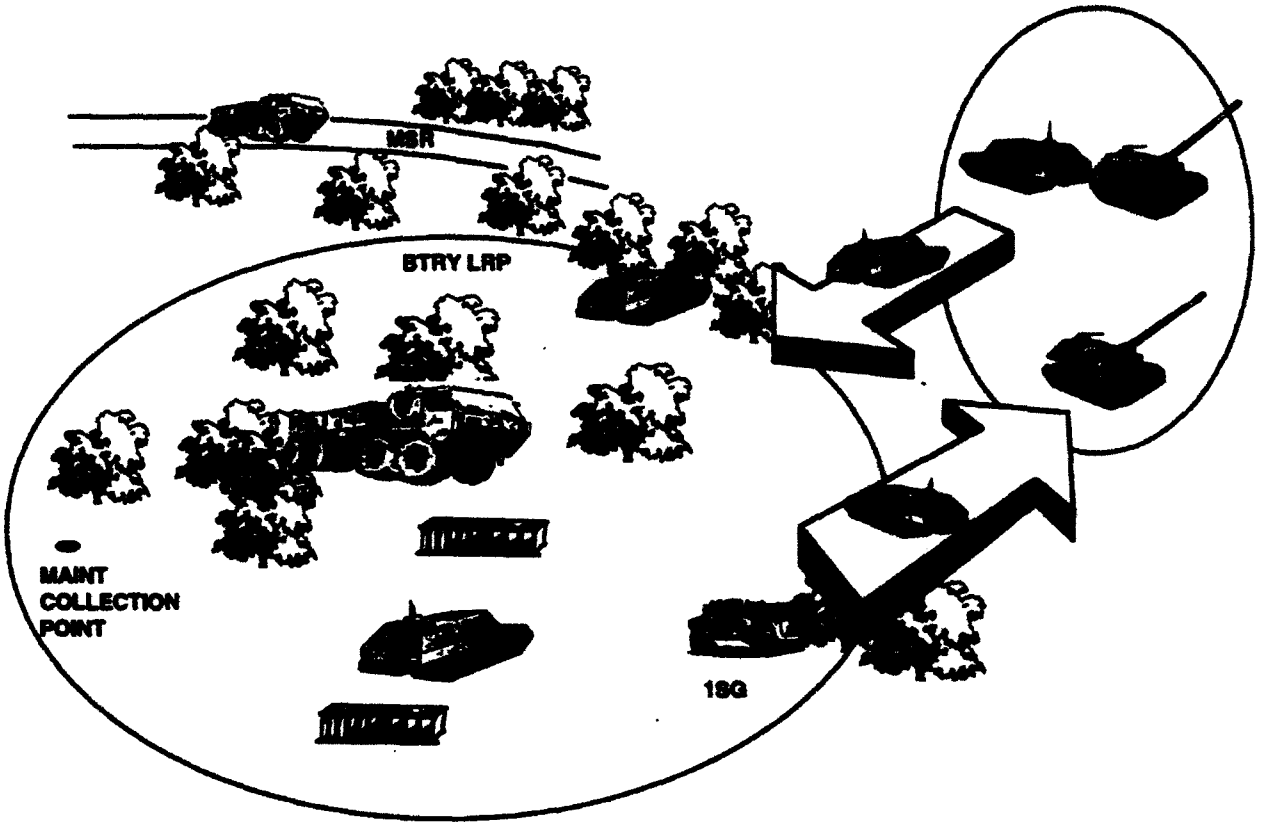

Figure 50.4 Logistic Resupply Point (LRP) Layout

50.5 Other SAFOR

It is anticipated that a number of additional SAFOR entities will be involved in DIS exercises for AFAS/FARV in ways that will require no significant changes to either the physical models or behavioral repertoire of existing ModSAF entities.

For example, exercises concerned with the self defense capabilities of AFAS and FARV SAFOR may require characteristic behaviors by enemy entities such as Mi-28 Havoc, SU-25, T72, or BMP1. Again, characteristic recovery behavior by the M88A1 entity may be required for disabled AFAS or FARV SAFOR. Finally, AFAS/FARV exercises may reasonably be expected to involve characteristic behavior of U.S. entities such as M1A1, M2, M3, US DI, OH-58D, and AH-64.

An existing ModSAF tracked vehicle, the M577, may be used for visual representation of an AFAS/FARV POC. The missions for this unit would be those previously defined for the AFAS and FARV vehicles, although the individual vehicles would operate (as described above) in the role of subordinate units to the POC.

APPENDIX F

AFAS/FARV ROM ESTIMATES

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APPENDIX F

COSTING DATA

60. **AFAS/FARV ROM ESTIMATES.** This section provides the detail to support the rough order of magnitude (ROM) estimates for an Advanced Field Artillery System/Future Armored Resupply Vehicle (AFAS/FARV) Simulation System (SS) Cell. The proposed architecture, functionality, hardware, software and support tasking are derived from requirements stated in the system specifications, operational requirements documents (ORDs), and the tasks of the AFAS/FARV Feasibility Analysis Study.

The AFAS/FARV Simulation System provides a Distributed Interactive Simulation (DIS) compatible simulation cell with reconfigurable crew station simulators and table top simulators along with the support subsystems needed to allow them to function in a stand-alone DIS compatible environment. The cell provides the functionality required to support a full complement of positions which may be needed to support a full up operational exercise. The cell will be integrated with the connectivity provided by the site to provide connectivity to site resources and DIS resources over long-haul networks.

60.1 **Program Management.** Program Management provides for the overall direction, coordination and control to successfully meet the requirements of the AFAS/FARV Delivery Order. Program management prepares for and conducts program management reviews, design reviews, preliminary design reviews, critical design reviews, and test readiness reviews. In addition, program management establishes and coordinates program controls including cost/schedule performance management, finance, contracts, and subcontracts management.

In order to meet the AFAS/FARV objectives, the program has been conceived in a phased approach. Each phase represents a milestone for hardware/software development fidelity, providing incremental functionality to the customer so that experiments can be supported during the full life cycle of the program. Although the direct implementation of the full requirements/objectives is the most cost efficient, a phased approach supports the development and demonstration of AFAS/FARV providing appropriate points for review of the direction and requirements of the simulation program with respect to the vehicle development. Adjustment and redirection of tasking can be introduced while minimizing the additional cost to the overall program. However, the phased approach does incur additional costs for additional integration efforts and some hardware.

We have divided the program in to four phases. Figure 60.1-1 illustrates the phased approach, while Table 60.1-1 summarizes the component description of each phase.

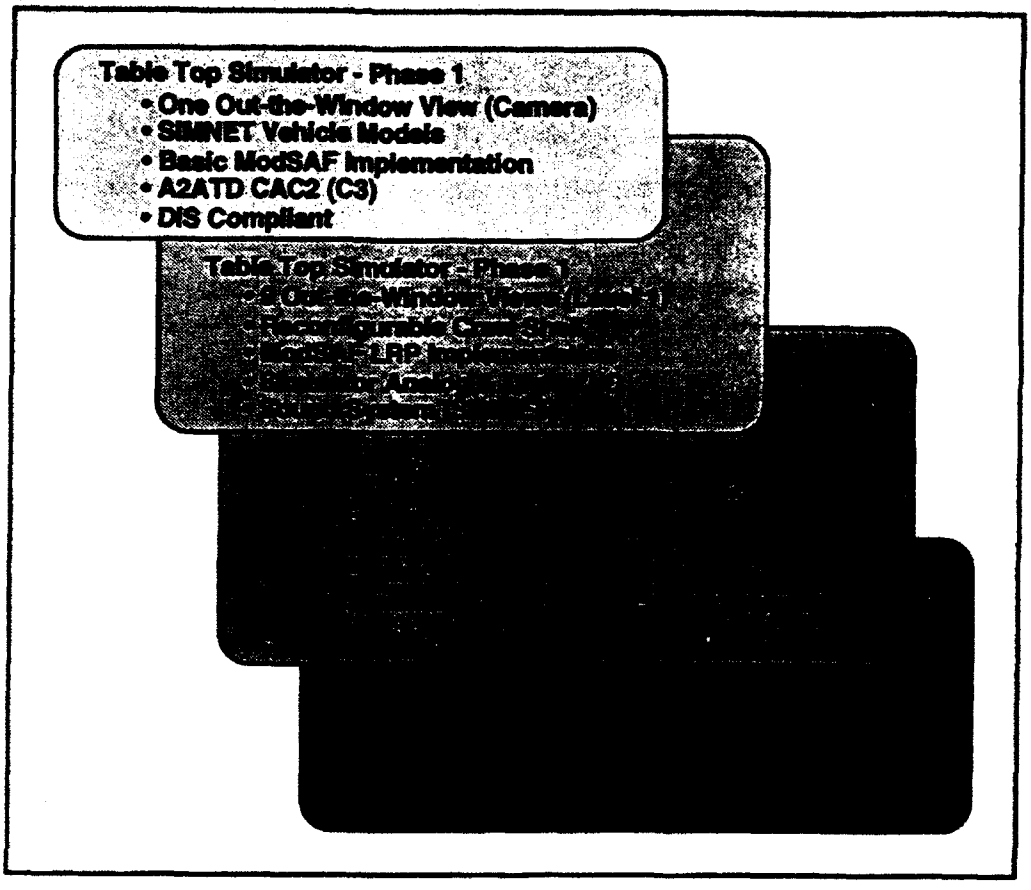

Figure 60.1-1 AFAS/FARV Phased Approach

Table 60.1-1 AFAS/FARV Phase Description Summary

PHASE	Concept	Component Description
Phase 1	Phase 1 is a very basic Table Top Simulator that would physically have two monitors, a SINCGARS radio face plate, touch screens and a mouse for user interface. The simulator would be capable of moving, shooting, resuppling, digital communication, and interaction with other simulated vehicles. A very basic ModSAF will be implemented according to the AFAS/FARV specifications.	• The simulation host will be on a ONYX desk side computer. This computer will use old M1 SIMNET SW models for the vehicle dynamics and ballistics. • The ONYX will produce one OTW view. • The A2ATD CAC2 model will be used for the command and control. • The A2ATD SINCGARS model will be used for the radio and intercom communications. • A CAU will be used to meet the DIS compliant requirements. • ModSAF will be enhanced to have an AFAS and a FARV with the basic capabilities and performance characteristics.
Phase 2	The phase 2 is a low fidelity Crew Station Simulator, which will be a reconfigurable simulator with a 9 OTW viewing capability generated from a GT111. The simulator will have basic hard switches and a joy stick. A sound system will be included with no new sounds from the SIMNET version. ModSAF performance capabilities will be enhanced as required.	The approach is to build off of the previously built Table Top Simulator. • The ONYX will no longer be needed to produce imagery for the one view port. The GT111 will do all of the visuals with an interface to the ONYX. • The ONYX will be equipped with an analog and digital board to handle the joy stick and miscellaneous hard switches. • The existing SIMNET sound systems will be purchased and integrated with the ONYX. The existing sound libraries will be utilized. • ModSAF will be enhanced to meet the increased requirements of the customer. This could be enhancing the LRP from a vehicle to a full-up vehicle depot with DI interacting.

Phase 3	The phase 3 Crew Station Simulator will be the same crew station as Phase 2 but, the imagery will be enhanced to a Level II CIG. Environmental effects will be included. The vehicle dynamics will be modified to model an actual AFAS/ FARV Vehicle. The ballistic model will be changed to act like a Copperhead and other indirect fire munitions. The fidelity of the simulator will be increased to model or help define the growing cycle of the prototype vehicles.	The approach is to build off of the previously built phase 2 Crew Station Simulator. • The GT111 will be replaced with a Level II Image Generator. All environmental effects will be represented. • The SIMNET M1 vehicle dynamics will be replaced with a specification model of the AFAS/FARV. • The SIMNET M1 ballistics model will be replaced with a model of the Copperhead for laser guide projectiles and for indirect fire munitions. • More hard switches and knobs will be added to the face plates. The crew shell will be enhanced to more closely replicate the AFAS/FARV conceptual designs.
Phase 4	The phase 4 Crew Station simulator will be a validated simulation to either the AFAS/FARV specifications or the actual vehicles.	The approach is to build off of the previously built phase 3 Crew Station Simulator. • Validate the vehicle dynamics model. This will be a test-fix-test process. • Validate the vehicle ballistics model. This will be a test-fix-test process.

Phase 1 represents a Table Top Simulator with limited fidelity. Phase 1 is based on existing software components from Simulation Network (SIMNET) software, Anti-Armor Advanced Technology Demonstration (A2ATD) DO, and other programs/sources integrated as a complete cell that is DIS compliant. Phase 1 provides the base platform to communicate with the outside world, i.e., the DIS environment. Stand alone components can be interfaced or ported using established and mutual interface definitions. The simulator will recognize all DIS Protocol Data Units (PDUs) through the use of a Cell Adapter Unit (CAU) and make this information available to the cell components. New software development is minimized. Characteristics and performance is modified through parameters and tables for a low fidelity simulation of an AFAS/FARV. The primary effort is in integration of the hardware and existing components. The out-the-window view is limited to one view on a large monitor that will also contain other command and control information. The table top simulator represents a single crew station position. The table top simulators will be able to play with the integrated Modular Semi-Automated Forces (ModSAF).

As an option to Phase 1, additional graphics boards and monitors can be added to represent additional crew station positions. Display priority software for control of display output and crew command/control input would have to be developed for crew coordination. The out-the-window view would remain a single view-point replicated on each out-the-window monitor.

Phase 2 develops low fidelity reconfigurable crew station simulators. Crew stations are fabricated that are modular and reconfigurable for each crew position. The crew station

position can be utilized as a stand-alone or co-located in a side-by-side arrangement for crew interaction and crew cab replication. Some software development is accomplished to integrate the multi-channel out-the-window computer image generator. Additional hardware is purchased, including a GT111 computer image generator (CIG) and a computing system. Individual points of view are made available for out-the-window display and sensor. It is assumed that the table top simulators from Phase 1 remain intact with upgraded software during Phase 2. We recommend that the GT111 be government furnished equipment (GFE) as a cost savings measure.

Phase 3 increases the functionality and fidelity of the crew station simulators developed in Phase 2. New software development is accomplished to better replicate the system fidelity and vehicle performance and provide a more robust development environment. Weapon systems fidelity is enhanced, utilizing higher fidelity ballistic models and data. A full suite of the DIS support subsystems is integrated. The Level 1 CIG is replaced with a Level II CIG supporting great entity resolution and additional environmental / battlefield effects, such as fog, haze, rain, smoke, time-of-day, illumination, etc.

Phase 4 provides the additional effort to accomplish validation and verification (V&V) of the simulator for obtaining accreditation. This effort requires documentation development, structured component testing and acceptance, and report generation to support the V&V. Additional software development is accomplished to provide a higher level of fidelity for the command and control, weapons systems, and vehicle performance, and to support the V&V tasks.

For purposes of preparing ROM estimates, a conceptual architecture and work breakdown structure were developed. Components of the AFAS/FARV Simulation System Cell are illustrated in Figure 60.1-2.

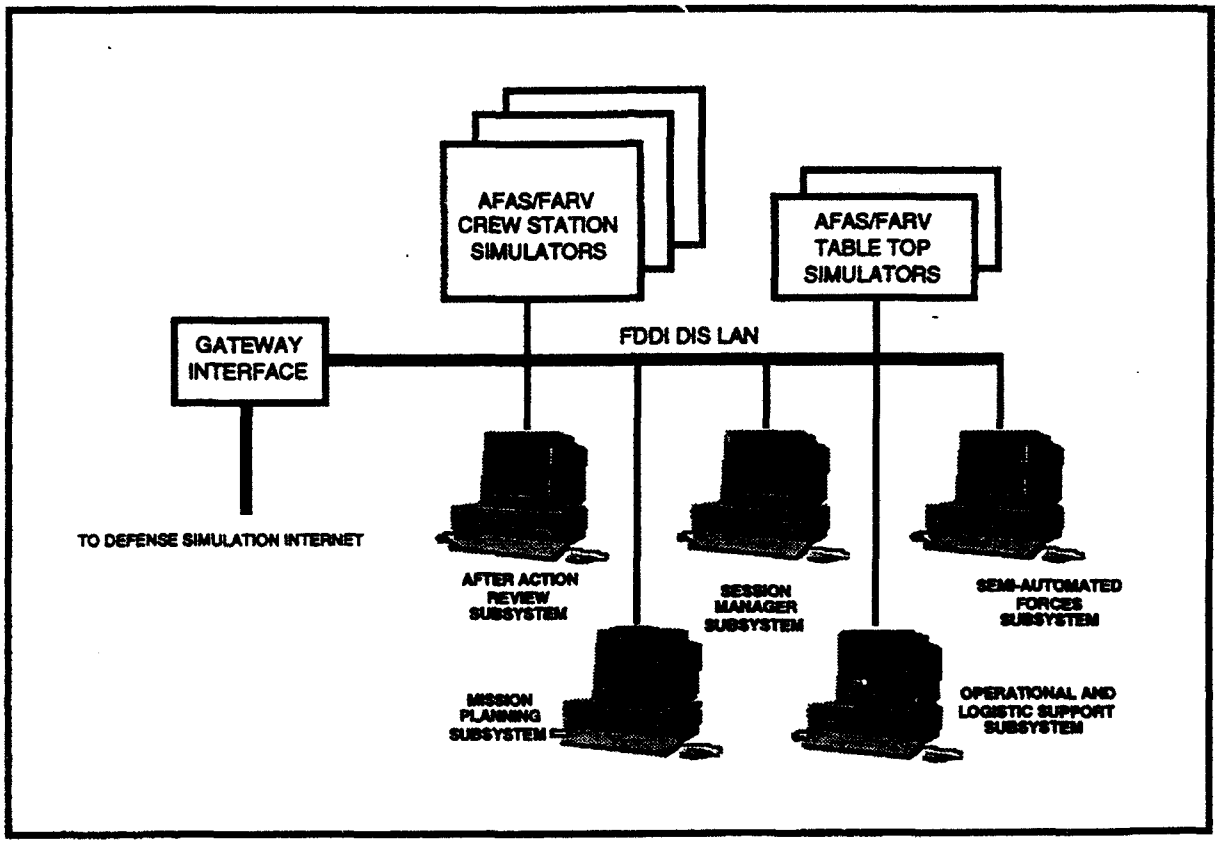

Figure 60.1-2 AFAS/FARV Simulation System Cell

From the simulation system cell, the AFAS/FARV Work Breakdown Structure (WBS) is defined. Figure 60.1.3 shows the top level structure, computer software configuration items (CSCIs), hardware configuration items (HWCIs) , and supporting tasks for estimating purposes.

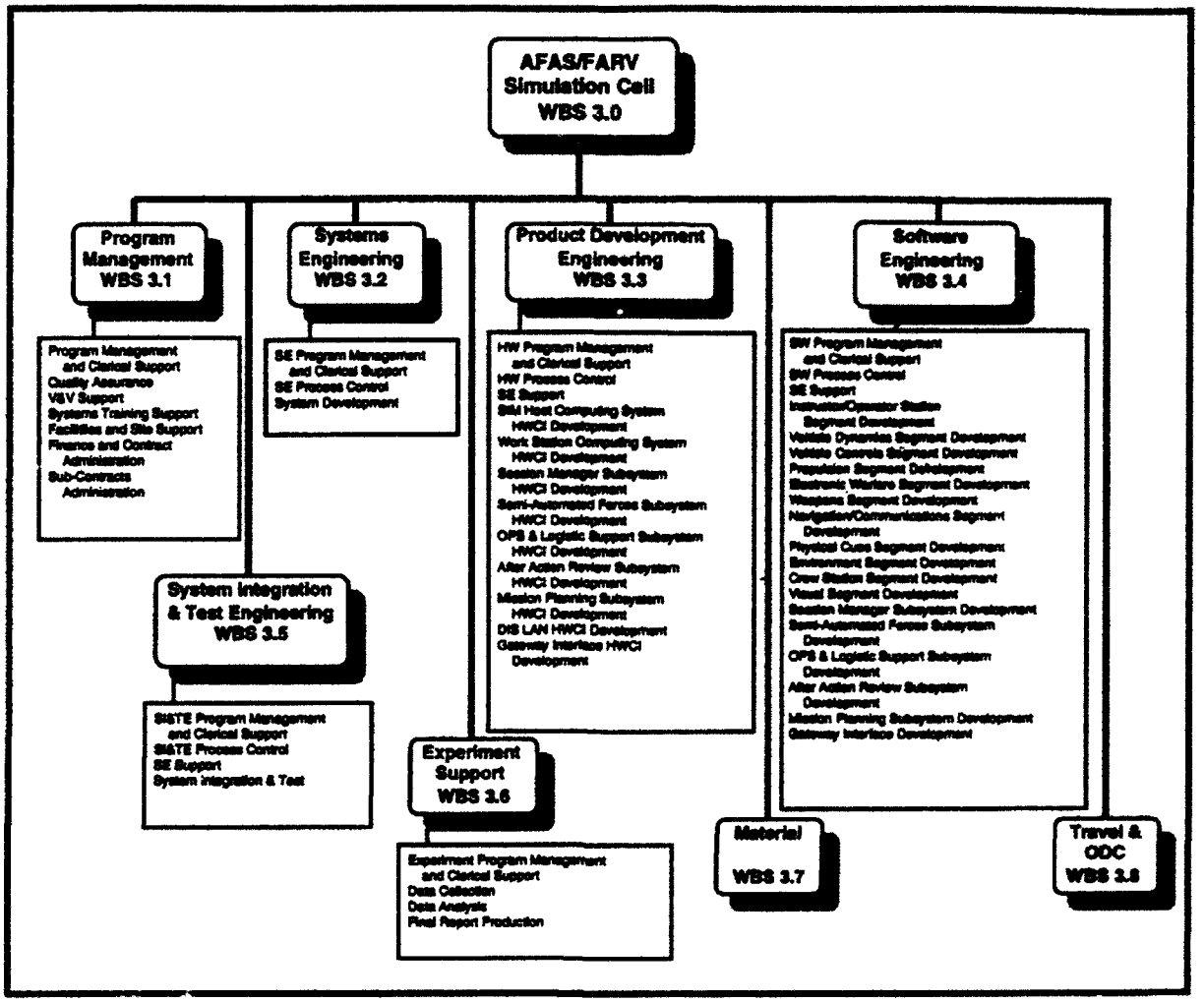

Figure 60.1-3 AFAS/FARV Work Breakdown Structure

Table 60.1 gives greater detail to the AFAS/FARV WBS. The elements of the WBS are used to structure the tasking, facilitate completeness and comprehension, and define estimatable tasks.

The elements of the WBS are based on experience of other Advanced Distributed Simulation Technology (ADST) DOs and simulation programs with similar functional requirements for experiment support and development. This architecture utilizes design concepts previously developed and leverages off of other DOs focused on developing infra-structure for DIS compatible simulation on local and distributed resources.

TABLE 60.1-2 Work Breakdown Structure Elements

PARAGRAPH	WBS ELEMENT
3 .1	PROGRAM MANAGEMENT
3 .1 .01	Program Management and Clerical Support
3 .1 .02	Quality Assurance Support
3 .1 .03	V&V Support
3 .1 .04	System Training Support
3 .1 .05	Facilities and Site Support
3 .1 .06	Finance and Contract Administration
3 .1 .07	Sub-contracts Administration
3 .2	SYSTEMS ENGINEERING
3 .2 .01	SE Program Management and Clerical Support
.01	Program management and clerical support
.02	Early Systems Engineering Planning
3 .2 .02	Systems Engineering Process Control
.01	Tools/Vendor Support
.02	Metrics Assembly & Administration
.03	Training Assembly & Course Administration
3 .2 .03	System Development
.01	Program Planning
.02	System Requirements Analysis
.03	System Design
.04	Configuration Item Requirements Analysis
.05	Preliminary Design
.06	Detailed Design
.07	System Development
.08	System Integration
.09	System Acceptance Testing
.10	System Installation
3 .3	PRODUCT DEVELOPMENT ENGINEERING
3 .3 .01	Hardware Program management and clerical support
.01	Program management and clerical support
.02	Early HW Engineering Planning
3 .3 .02	Hardware Process Control
.01	HW Configuration Management
.02	Tools/Vendor Support
.03	Training Assembly & Course Administration
3 .3 .03	Systems Engineering Support
.01	HW (PRE) Support to System Analysis & Design
.02	HW (POST) Support to System Analysis & Design

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .3 .04	SIM Host Computing System HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .3 .05	Work Station Computing System HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .3 .06	Session Manager Subsystem HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .3 .07	Semi-Automated Forces Subsystem HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .3 .08	Ops & Logistic Support Subsystem HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .3 .09	After Action Review Subsystem HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .3 .10	Mission Planning Subsystem HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .3 .11	DIS LAN HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .3 .12	Gateway Interface HWCI Development
.01	Technical Management
.02	HW Requirements Analysis
.03	HW Preliminary Design
.04	HW Detailed Design
.05	HW Assembly and Test
.06	HW Support to S/S Integration & Test
.07	HW Support to S/S Installation & Test
.08	Hardware Subcontract Management
.09	Hardware Product Training
3 .4 .01	SOFTWARE ENGINEERING
3 .4 .01	Software Program management and clerical support
.01	Program management and clerical support
.02	Early SW Engineering Planning
3 .4 .02	Software Process Control
.01	SW Configuration Management
.02	Tools/Vendor Support
.03	System/DB Administration
.04	Metrics Assembly & Administration
.05	Training Assembly & Course Administration
3 .4 .03	Systems Engineering Support
.01	SW (PRE) Support to System Analysis & Design
.02	SW (POST) Support to System Analysis & Design
3 .4 .04	Instructor/Operator Station Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .05	Vehicle Dynamics Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .4 .06	Vehicle Controls Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .07	Propulsion Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .08	Electronic Warfare Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .09	Weapons Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .4 .10	Navigation/Communication Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .11	Physical Cues Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .12	Environment Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .13	Crew Station Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .4 .14	Visual Segment Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .15	Session Manager Subsystem Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .16	Semi-Automated Forces Subsystem Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .17	Operational & Logistic Support Subsys. Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .4 .18	After Action Review Subsystem Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .19	Mission Planning Subsystem Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .4 .20	Gateway Interface Development
.01	Technical Management
.02	SW Requirements Analysis
.03	Preliminary Design
.04	Detailed Design
.05	Code & CSU Test
.06	CSC Integration & Test
.07	CSCI Test
.08	Software Subcontract Management
.09	Software Product Training
3 .5	SYSTEM INTEGRATION & TEST ENGINEERING
3 .5 .01	SI&TE Program management and clerical support
.01	Program management and clerical support
.02	Early SI&T Engineering Planning
3 .5 .02	SI&TE Process Control
.01	Tools/Vendor Support
.02	Metrics Assembly & Administration
3 .5 .03	Systems Engineering Support
.01	SI&TE (PRE) Support to Sys Analysis & Design
.02	SI&TE (POST) Support to Sys Analysis & Design

TABLE 60.1-2 Work Breakdown Structure Elements [Continued]

PARAGRAPH	WBS ELEMENT
3 .5 .04	System Integration & Test
.01	SI&T Preliminary Design
.02	SI&T Detailed Design
.03	HWCI & CSCI Integration into the System
.04	First Article Testing
.05	On-Site Installation and Test
3 .6	EXPERIMENT SUPPORT
3 .6 .01	Experiment Program and Clerical Support
3 .6 .02	Data Collection
3 .6 .03	Data Analysis
3 .6 .04	Final Report Production
3 .7	MATERIAL
3 .8	TRAVEL & OTHER DIRECT COSTS
3 .8 .01	ODC
3 .8 .02	Travel

60.2 **Systems Engineering.** System Engineering provides the multi-disciplined technical focus for the AFAS/FARV project which ensures implementation of a complete technical solution within the boundaries established by the AFAS/FARV Delivery Order.

System Engineering is active throughout the entire AFAS/FARV development cycle providing a consistent system-level focus for the design and development effort. System Engineering is charged primarily with:

- Ensuring system level requirements are captured, documented, and controlled, and that traceability is maintained to design components and test procedures.
- Establishing the system level design and providing a system view oversight for design of system components.
- Overseeing development and providing system level resolution of problems as they arise.
- Controlling AFAS/FARV internal interfaces and participating with external agencies in the control of external interfaces.
- Integrating developed and acquired components into the AFAS/FARV system.
- Integrating AFAS/FARV with external DIS systems.
- Ensuring testing is comprehensive and complete at the system level.

System Engineering provides the concurrent engineering framework necessary to coordinate and support simultaneous engineering efforts within the AFAS/FARV team with those external to the AFAS/FARV team. System Engineering will be responsible for the requirements baseline including obtaining data from the valid sources, including

manufacturers, and establishing the formal design criteria baseline for this effort. System Engineering will be responsible for leading design activities and overseeing implementation to effect a phased development program. This phased development effort is built upon a "spiral" development process which significantly reduces implementation and integration risk.

The spiral development process model was originally conceived as an approach to software engineering which reconciled the formality of a linear development process model with the real-world observation that for any significant development effort, the process tends to be cyclical with early design work contributing to the refinement of requirements for later design activities. Loral Team members have successfully used this process model. It is used as the *de facto* process model on selected contractual efforts where an incremental approach has been appropriate in order to resolve uncertainties in the early part of a program.

The spiral model allows the developers to focus on problem solving and risk avoidance rather than the large scale production of documents or the production-line generation of code that often results from a linear development model. The basic version of the Spiral Development Model, illustrated in Figure 60.2, shows that the spiral cycles are represented on polar coordinates. Each of the quadrants represents a different range of activities, and a cycle is a traversal of all four quadrants, represented by a 360 degree rotation in the graph that denotes that some aspect of the product has matured by a specified amount. The angular component, w, represents progress to date; it is not uniform over time. Some parts of a cycle may require months to complete, others may require days or hours. Cycles themselves will take varying times to complete, depending on their objectives. The radial component, r, indicates cumulative project cost, increasing over the time of the cycles

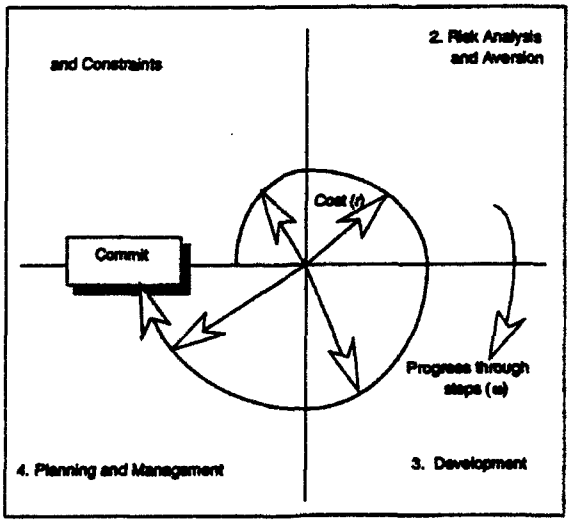

Figure 60.2 The Basic Cycle of the Spiral Process Model

Throughout the program, the Systems Engineering team has responsibility for and the support of the following tasks:

- Requirements Management
- Requirements Baseline
- Requirements Traceability
- System Specification
- Interface Management
- Interface Standards
- Interface Control
- Design Oversight
- Task and Skills Analysis
- Selective Fidelity Analysis
- Model Verification and Validation
- Safety Analysis

The ROM estimates for System Engineering is summarized in the summary tables presented in Paragraphs 60.9.

60.3 **Product Development Engineering.** Product Development Engineering provides the multi-disciplined technical focus for the hardware issues. The Product Development Engineering team has responsibility for hardware specification, procurement and integration. The team will work closely with the Systems Engineering team, coordinating the hardware tasks. Using commercial-off-the-shelf (COTS) components lessens the integration risk and effort.

For estimating purposes, the AFAS/FARV Crew Station Simulator Architecture illustrated in Figure 60.3 is used as a basis for estimate, which corresponds to the Phase 4 developmental approach. The cost summary of the material is presented in the tables of paragraph 60.7.

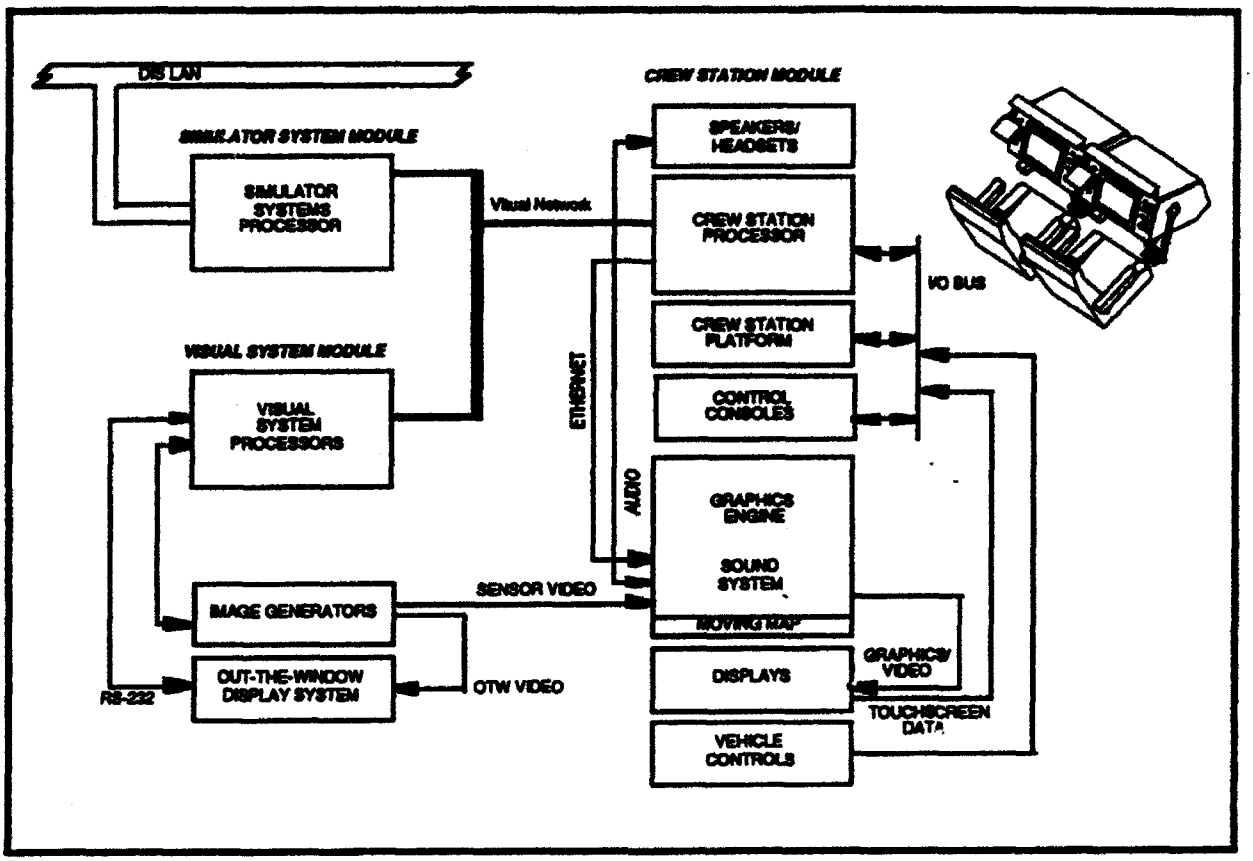

Figure 60.3 AFAS/FARV Crew Station Simulator Architecture

The ROM estimates for Product Development Engineering is summarized in the summary tables presented in Paragraphs 60.9.

60.3.1 Phase 1 Hardware Design Approach. Phase 1 represents a Table Top Simulator with limited fidelity. Phase 1 is based on existing COTS components and essentially providing a gateway to communicate with the outside world, i.e., the DIS environment. The approach behind the building of the Table Top Simulator is to provide a stepping stone for the customer on his way to the expensive V&Ved simulation world. The primary hardware effort is in integration of the COTS components. The out-the-window view is limited to one view on a large monitor that will also contain other command and control information. The table top simulator represents a single crew station position. Multiple Table Top Simulators could be built and placed in a side-by-side configuration, providing the customer with an entire AFAS or FARV simulator. Additional graphics boards and monitors would be added to represent additional crew station positions. Display priority software for control of display output and crew command/control input would be developed for crew coordination. The out-the-window view would remain a single view-point replicated on each out-the-window monitor. The table top simulators can play with Modular Semi-Automated Forces (ModSAF) or any other DIS compatible, networked simulator

or simulation. A minimal suite of DIS support subsystems can be integrated to provide control, data collection, and review. Phase 1 has two basic options. Option 1 will contain the host computing system for driving the simulation; controlling the vehicle dynamics and ballistics; providing the out-the-window view; and controlling the user inputs and outputs. The hardware involved is the computing system; primary monitor for command and controls screens, secondary monitor for user input and output; Single Channel Ground and Airborne Radiop Systems (SINCGARS) faceplate interface; and the keyboard/mouse.

The primary monitor will be used as the user interface to the Combined Arms Command and Control (CAC2). Other command and control system could be integrated into this phase very easily if they are developed to interface with the DIS Protocol. It will also provide the out-the window view for the operator of that vehicle position. The monitor provided for the Table Top Simulator will be the same type of monitor used for the following phases. This monitor could essentially be taken out of the Table Top Simulator and placed into the crew station simulator in the phase 2 design approach.

The secondary monitor will be used as the user interface to the vehicle and mission control buttons. This monitor should be developed with a touch screen to simulate more of what the operator would actually be doing. For example, the master power switch would be on this screen and the operator could turn it 'on' by touching it on the screen. The option is to use a mouse to control the buttons on this screen. This is not as feasible as the touch screen approach because the operator would only be using a mouse instead of being more interactive with the simulation.

The SINCGARS face plates will be the user interface to the controls on the simulated SINCGARS Radio. The simulated SINCGARS Radio will have the functionality required to executed the require tasking in the simulated world. There will be two face plates simulating two radios. These simulated radios will be connected to the simulator via the simulation network. The radios will be communicating in the DIS Protocol.

The AFAS/FARV is a drive-by-wiring vehicle, which would be simulated phase 1 by the mouse. The operator would control vehicle movement by the moving the mouse forward for the throttle and reverse for braking and reverse direction. Left and right movement would control the turning direction. The Phase 1 (option 1) simulator representation is shown in figure 60.3.1-1.

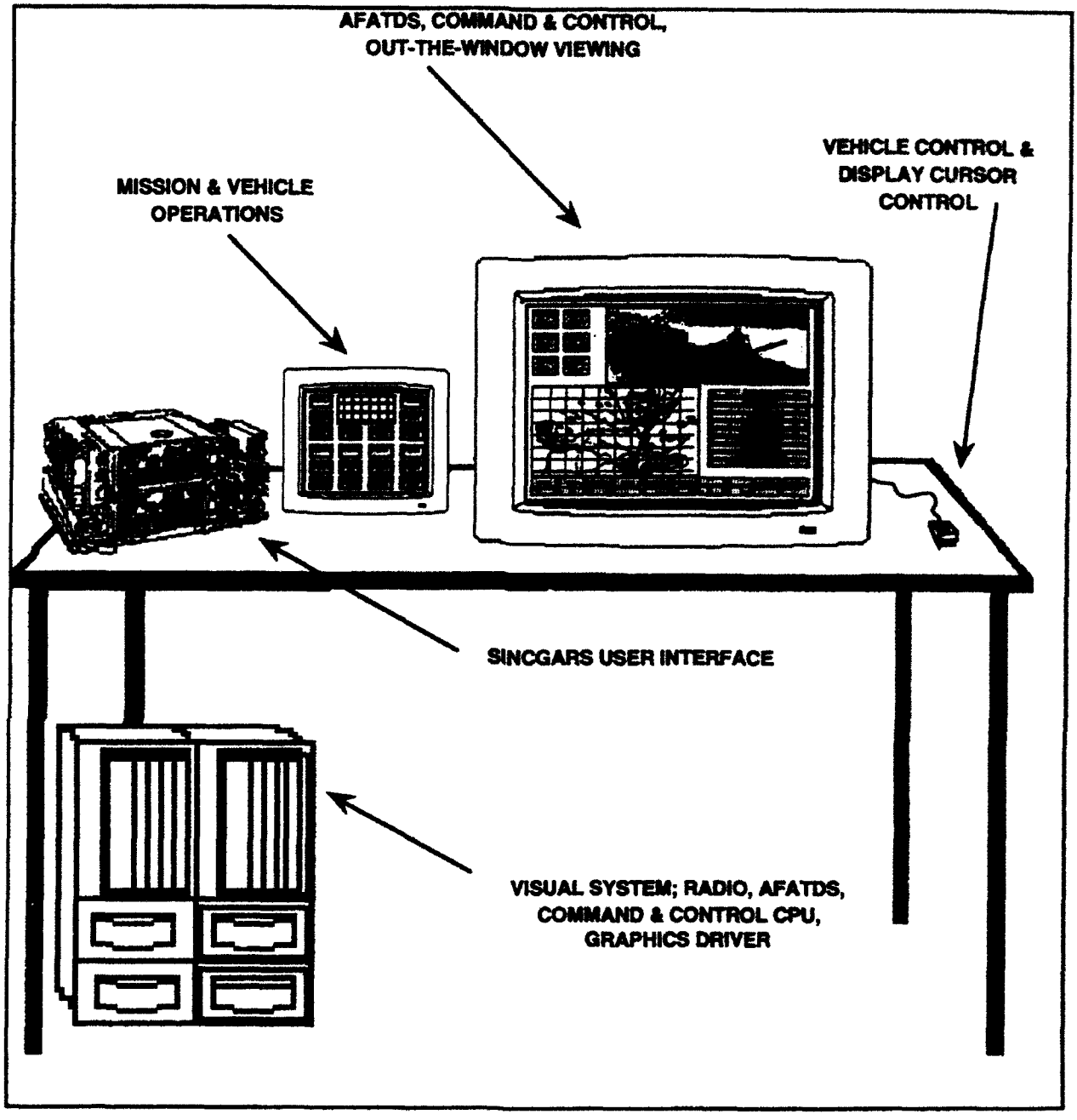

Figure 60.3.1-1 Phase 1 Table Top Simulator (Option 1)

Option 2 will contain the host computing system for driving the simulation; controlling the vehicle dynamics and ballistics; providing the out-the-window view; and controlling the user inputs and outputs. The hardware involved is the computing system; primary monitor for command and controls screens, switch panel for user input and output; SINCGARS face plate interface; and the joystick.

The primary monitor and SINCGARS face plates would have the same functionality as the previous option.

The switch panel is an integrated mixture of switches from the left and right sides of the large crew monitor in the vehicle. In the vehicle the left panel of switches would control the mission specific functions and the right panel would control the vehicle specific functions. These two switch panels would be mounted together for easy of usage on the table.

The joystick will provide the user with the capability to drive the vehicle. The same joystick would be mounted in the simulator with the same functionality as the Table Top Simulator. The various buttons and controls on the joystick would all be active. The thumb transducer knob would control the cursor on the screen. The Phase 1 (option 2) simulator representation is shown in figure 60.3.1-2.

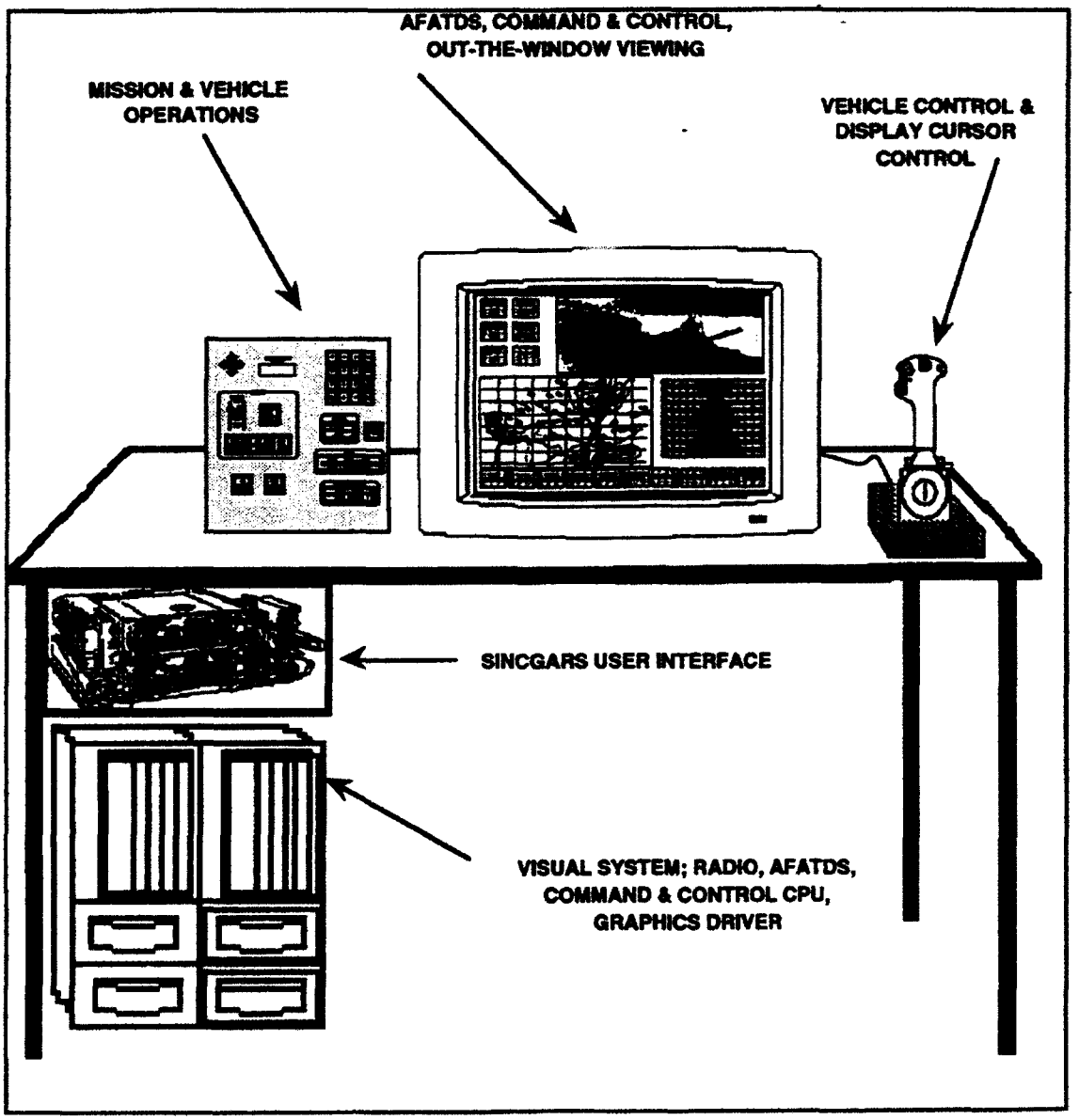

Figure 60.3.1-2 Phase 1 Table Top Simulator (Option 2)

This Table Top Simulator can also be used in the following phases of this program. The goal is to use existing software and only develop new software if it can be used in some follow-on simulator. The hardware used in the Table Top Simulator can also be used for follow-on phases. However, this is not recommended in this situation if the phased approach is selected. The hardware purchased in this phase could be used as a simulator or a development platform in following phases. Once the development of the phase 1 is completed, the following phases will require a development platform, therefore it would make most sense for the customer to leave phase 1 equipment in tact and purchase new hardware for phase 2.

This phase is also unique because the hardware could be integrated into an existing simulator crew shell (i.e. M1 or M2 SIMNET Crew Shell) and modified to act as an AFAS/FARV on the virtual environment. This is shown in figure 60.3.1-3

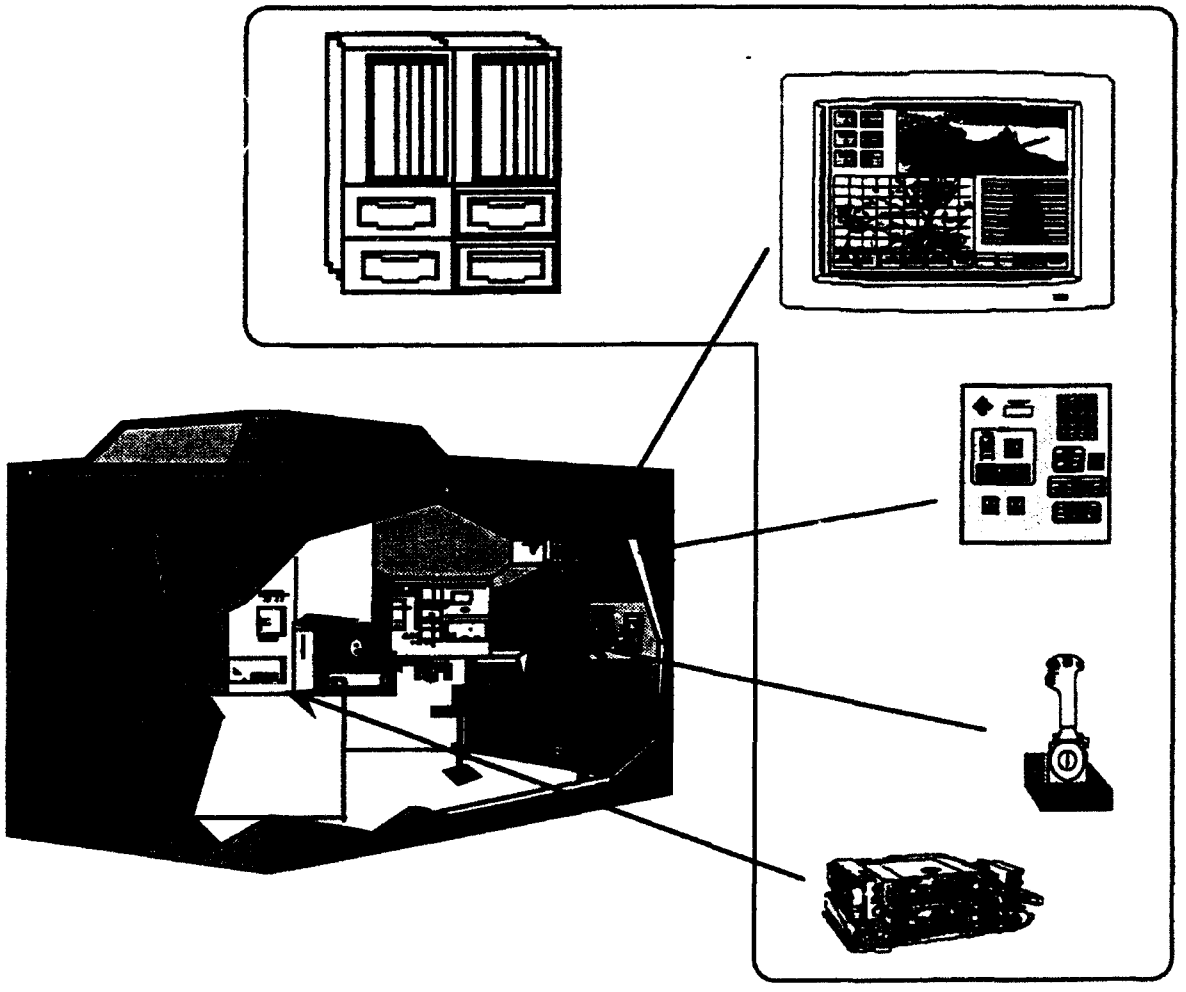

Figure 60.3.1-3 Table Top Hardware Integrated into Existing Simulators

This option is essentially the same as all of the others in phase 1, except that a GFE crew shell would be used instead of a table. The software that controls the displays and user interface would all be the same. The hardware interface would be designed using the

backdoor methodology. The backdoor methodology is designing the system so that it can operate as a standalone or use the simulation network (ethernet or Fiber Optic Data Distribution Interface (FDDI)) to attach to the simulator. This would allow the Table Top hardware to be installed into the crew shell and the connection to occur directly onto the simulation network without any software modifications to the interface of the existing simulator.

60.3.2 Phase 2 Hardware Design Approach. Phase 2 develops low fidelity reconfigurable crew station simulators. Crew stations are fabricated that are modular and reconfigurable for each crew position. The crew station position can be utilized as a stand-alone module or co-located in a side-by-side arrangement for crew interaction and crew cab replication. The phase 2 design using modules will allow the customer to experiment with the three or four man crew configuration. The only major software development is accomplished to integrate the multi-channel out-the-window computer image generator. Other software may include some modifications to the digital or analog input/output signals. Additional hardware is purchased, including a GT111 computer image generator (CIG) and a computing system. This CIG will support the three or four man crew configuration. Individual points of view are made available for out-the-window display and sensor. It is assumed that the table top simulators from Phase 1 remain intact with upgraded software during Phase 2. We recommend that the GT111 be government furnished equipment (GFE) as a cost savings measure.

The components of the crew station will be mounted in a fashion that will allow easy removal and relocation. This aspect is required when designing a reconfigurable simulator to allow the basic crew shell to be modified along with the of the life cycle design of the actual vehicle.

The out-the-window views will be supplied through monitors mounted on the outside of the simulator. The monitors selected must be a multisync monitor to allow for the variation of CIGs. This multisync monitor will allow the customer to upgrade the CIG from phase 2 to phase 3 and not have difficulties with the pictures not syncing on the monitors. The operator's monitors will be on a sliding rack that is mounted to the ceiling of the crew shell. The ceiling of the each module will be outfitted for the out-the-hatch view. If the module is configured so that it does not need the out-the-hatch view, there will be a hard cover that fastens to the roof from the outside.

The chairs will be on a sliding rack for purposes of entry and exit, in addition to the potential of wanting the chief of section to sit in a different location. The chairs will be designed to allow the position to be locked in the front (for the gunner or driver) or in the back (for the chief of section). Any of the crew locations will be reconfigurable to allow Soldier Machine Interface (SMI) experiments to take place on the internal positioning of the crew. The joysticks will be mounted under the operator's display area and extend with an elbow pad for the operator. Each of the joysticks will be mounted for usage with the right hand but, could be reconfigured for the left hand. The top view basic design is shown in figure 60.3.2-1.

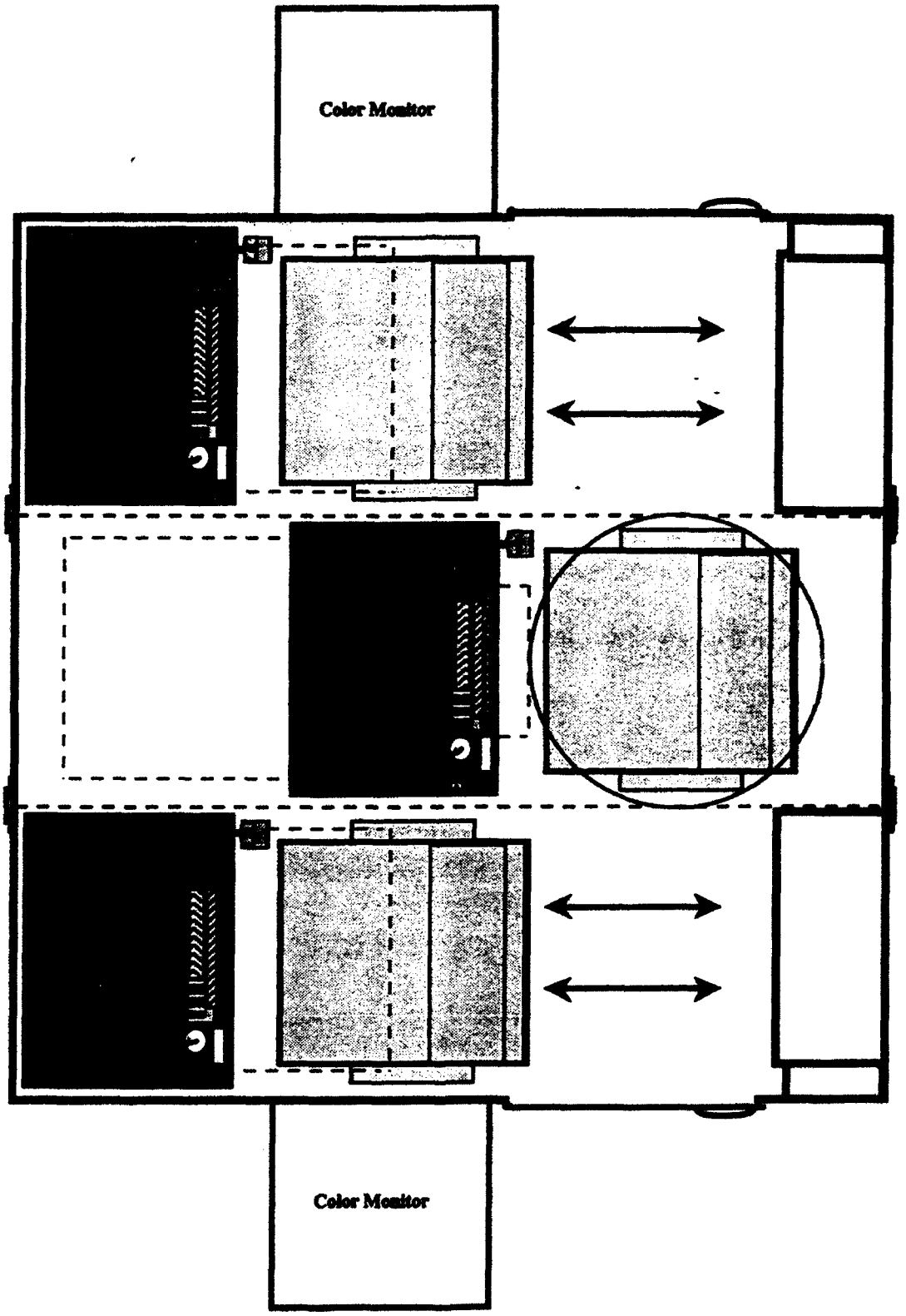

Figure 60.3.2-1 AFAS/FARV Phase 2 Crew Station Simulator - Top View

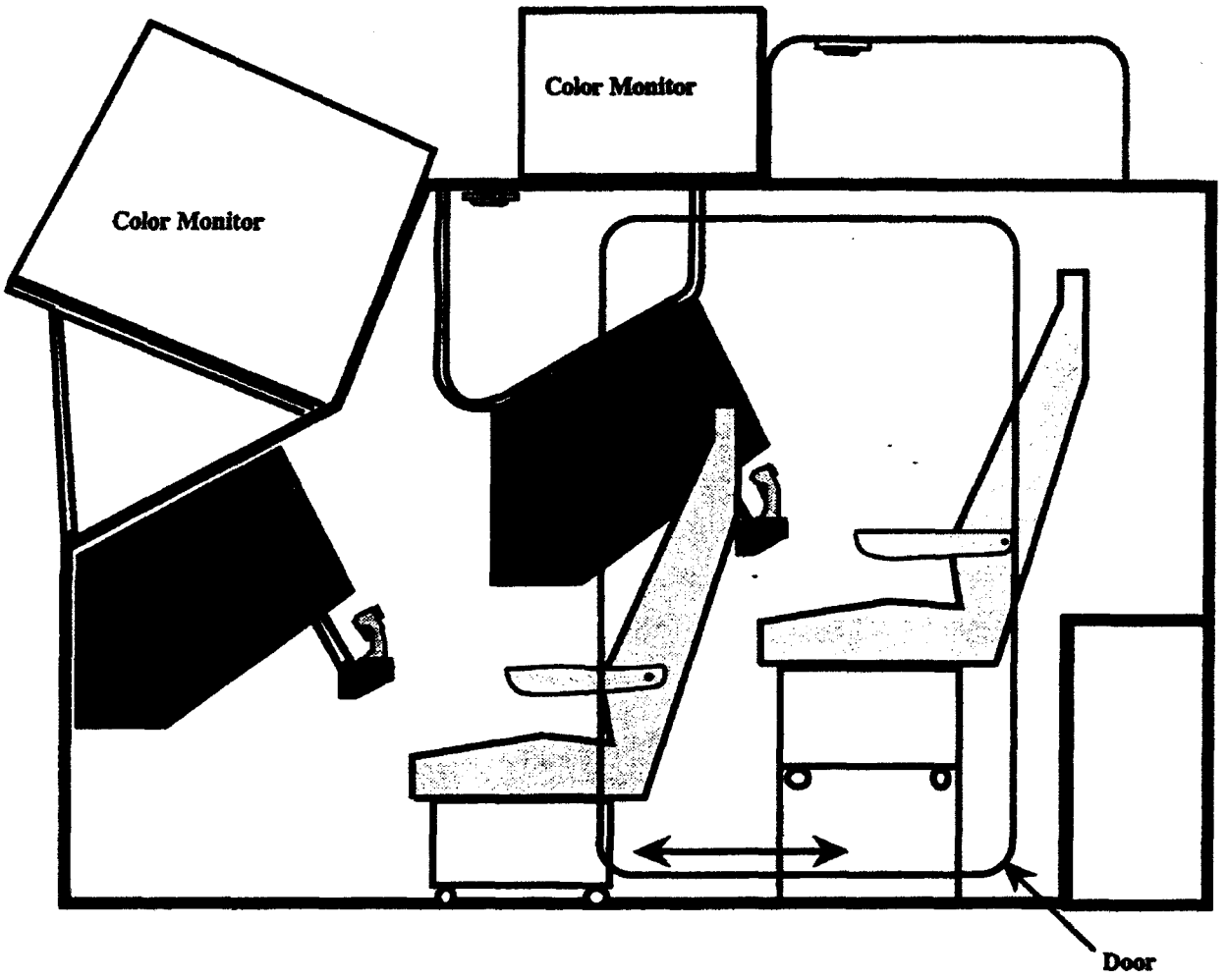

Figure 60.3.2-2 AFAS/FARV Phase 2 Crew Station Simulator - Side View

60.3.3 Phase 3 Hardware Design Approach. Phase 3 increases the functionality and fidelity of the crew station simulators developed in Phase 2. The Level 1 CIG is replaced with a Level II CIG supporting environmental effects, smoother texturing, and higher fidelity vehicle models. In addition to the CIG upgrade, vehicle specific software is upgraded/developed to model the AFAS and FARV. For example ballistic models and vehicle dynamics will replicate actual munition characteristics and vehicle mobility attributes. Ammunition transfer operations that were based on SIMNET conventions will be realistically modeled in accordance with system specifications. The other changes include the some interface boards and keyboards for inputting information by the operator. It has also been discussed about adding a disc drive for external data that may come from the field. This type of data could be the operation orders for each day in the field. As the vehicle develops through the first 2 phases there could be some changes or modification required to the switches, knobs, or dials.

60.3.4 Phase 4 Hardware Design Approach. Phase 4 provides the additional effort to accomplish validation and verification (V&V) of the simulator for obtaining accreditation. It is anticipated that some new hardware will be required to better

replicate the actual vehicle as it grows through it's development cycle. It is ROM costed with some digital and analog (input/output) I/O boards and some miscellaneous switches and buttons.

60.4 Software Engineering. Software Engineering estimates are based on a proposed implementation of the standard Loral Software Development Process Model. This models is implemented utilizing the following constraints and objectives:

1) Developed software is built upon and is compatible with the existing Mod Sim design approach for manned simulators, including extensions to definitions of the sub-segment components.

2) Developed software functions are designed for reuse in accordance with recognized guidelines.

3) The Software Development Process is tailored to the specific needs of the program.

4) The software design represents a hierarchical approach, with the definition of objects and the mapping of the objects to the configuration item (CI) hierarchy, especially computer software configuration items (CSCIs), computer software components (CSCs), and computer software units (CSUs), as defined in DoD-STD-2167A.

5) CSCs are functionally tested in accordance with a series of "builds", in a "build-a-little", "test-a-little" approach that maps directly to a standard spiral model approach.

6) The software development process emphasizes an "Open Approach" that minimizes the development or use of proprietary software, except for commercial-off-the-shelf (COTS) components.

For purposes of this ROM, it is assumed that most of the development is done in-house. Databases are government furnished information (GFI). The predominant language of the existing code will be the development language. From our initial survey, the predominant language is a form of "C". We also assume that a relatively full suite of documentation is required to support experiment planning and preparation.

For purposes of this ROM, we have assumed that Phase 4 will be completed. Additional effort incurred due to the phased approach for integration and delay of certain software development, testing and documentation are presented in the cost summary tables of paragraph 60.9. Direct implementation of Phase 4 is the most cost efficient approach.

60.4.1 Software Estimation Process. The estimates for a ROM cost of the AFAS/FARV software development and support are made using the Loral Western

Development Laboratories (WDL) Software Estimation Process. This process was developed and is maintained by the Loral-WDL Division Software Technology Department. The process is described in the Loral-WDL Software Estimation Process Handbook.

The Loral-WDL Engineering Process Handbook defines the processes necessary for a structured approach to engineering. One of these processes is the Development of Software Size, Cost, and Schedule Estimates. The Loral-WDL Software Estimation Process Handbook defines a formal, repeatable procedure for generating and reviewing software size, cost, and schedule estimates. This handbook captures our experiences and is the basis for ongoing process improvement. The process is based on learning from mistakes and institutionalizing our successes.

Before software sizing and costing can begin, the nature, extent and scope of the software project must be determined. The customer's requirements documents will provide most of this information, e.g., Request for Proposal, Statement of Work, Operations Concept, etc. The key areas to investigate include (1) required functions to be performed by software, (2) specific deliverables, (3) extent of "user friendly", "self-diagnosing", or "fault-tolerant", or other requirements that would impact the development effort, and (4) number and types of customer involvement, including in-progress review, technical interchange meetings, major reviews, etc.

Once this is done, the system/software engineering team must allocate functions to hardware, software and user operations. After the team has allocated functions, and the functions allocated to software are understood, the estimation input activities are started. A software architecture is identified, and functions are allocated to the components of the architecture, including CSCIs, CSCs, and CSUs. A complete list of all deliverables to be costed is created and documented. A WBS is agreed upon, consistent with MIL-HDBK-WBS.SW and MIL-STD-881B. The Loral-WDL standard software WBS is consistent with the standard. Every attempt is made to map the CSCI structure onto the WBS structure.

With these inputs, software engineering can start the estimation process. The classification and sizing of code is a function of several different conditions. What is expected and/or acceptable to the customer. Is Ada required? What code is available for code type and size comparisons, and possible reuse? What code is government furnished? What software development methodology is to be used?

The code is classified as new code, modified code, and display code. Code sizing is estimated on display count and lines of code (LOC). Cost factors are analyzed and applied to the process. Historical data is analyzed for productivity rates, site requirements, and labor mix.

From this data, detailed costs and schedules are generated. A spreadsheet has been developed for the process using macros to generate this information. The process can rapidly respond to changes in date through the established links to input spreadsheets

of data and factors. The resulting information is reviewed by the engineering team and management. The process outputs software decomposition and LOC summary, software cost, schedule and resource summary, basis of estimates, and data for System Evaluation and Estimation of Resources (SEER) model runs and risk analysis.

The process creates a consistent quality approach to generating ROMs. It can be tailored for the specific program, and amended as new data or design decisions become available.

60.4.2 Objectives. The AFAS/FARV software shall be designed using a modular open architecture. The software shall be reconfigurable, reusable, DIS compliant, interoperable and "V&V-able". Common software objects and common DIS infra-structure components will be used to the maximum extent possible, along with common hardware components. The software design shall strive for high reuse of existing models, especially validated models and data. COTS development tools will be used. Table driven models shall be used to increase the flexibility and robustness of the software for experimentation. On-line parametric modification shall be available to the instructor/operator. This capability enhances the real-time response for software model modification during run-time.

60.4.3 Software Architecture. The software architecture for the AFAS/FARV Simulation System Cell centers around the FDDI local area network (LAN). All components are interfaced to the LAN and communicate using protocol packets. The LAN is also connected to the Defense Simulation Internet (DSI) via a gateway. The components attached to the LAN are basically of two types: 1) the crew station simulators and table top simulators, and 2) the DIS subsystems.

60.4.4 Crew Station Simulators. The crew station simulators and table top simulators software architecture's are based on the Mod Sim architecture developed by a tri-services program to reduce simulator development schedules and cost. The architecture promotes systematic reuse of software and hardware. The architecture defines a modular, reusable simulator architecture using a well-defined standardized communication interface. The interface provides the coordination between the loosely coupled segments, while standardization eliminated the need for proprietary interfaces and their associated costs. The architecture does not dictate hardware.

The Mod Sim architecture defines twelve segments. The radar segment is not used in the AFAS/FARV architecture. The names of the segments have been changed to reflect the nature of the AFAS/FARV as a ground vehicle. Segments can be allocated to a single processor or computing system, or grouped. A group of segments is referred to as a module. One segment does all communication with the outside world, the environment segment. This segment connects to the outside world via a FDDI LAN accepting protocol packets, including DIS Protocol Distribution Units (PDUs).

The central feature of the Modular Simulator (Mod Sim) System architecture is the virtual network. The virtual network is a mechanism for communication between segments using a message passing protocol. Each of the segments is connected to a virtual network by a network interface unit. The interface units send and receive messages providing the communication between segments required to execute the simulation. The Mod Sim virtual network has been carefully defined to be independent of specific hardware implementation. This concept provides the ability to scale the concept to both high end and low end applications and is adaptable to advances in hardware technology. The virtual network can be a physical connection, a back-plane, or shared memory.

The table top simulators shall use the same software components as the crew station simulators. The build files determine the software functionality available to the table top simulators. The table top simulators are assumed to provide a limited suite of functionality to the user, i.e., no full out-the-window presentation, limited sensors, etc.

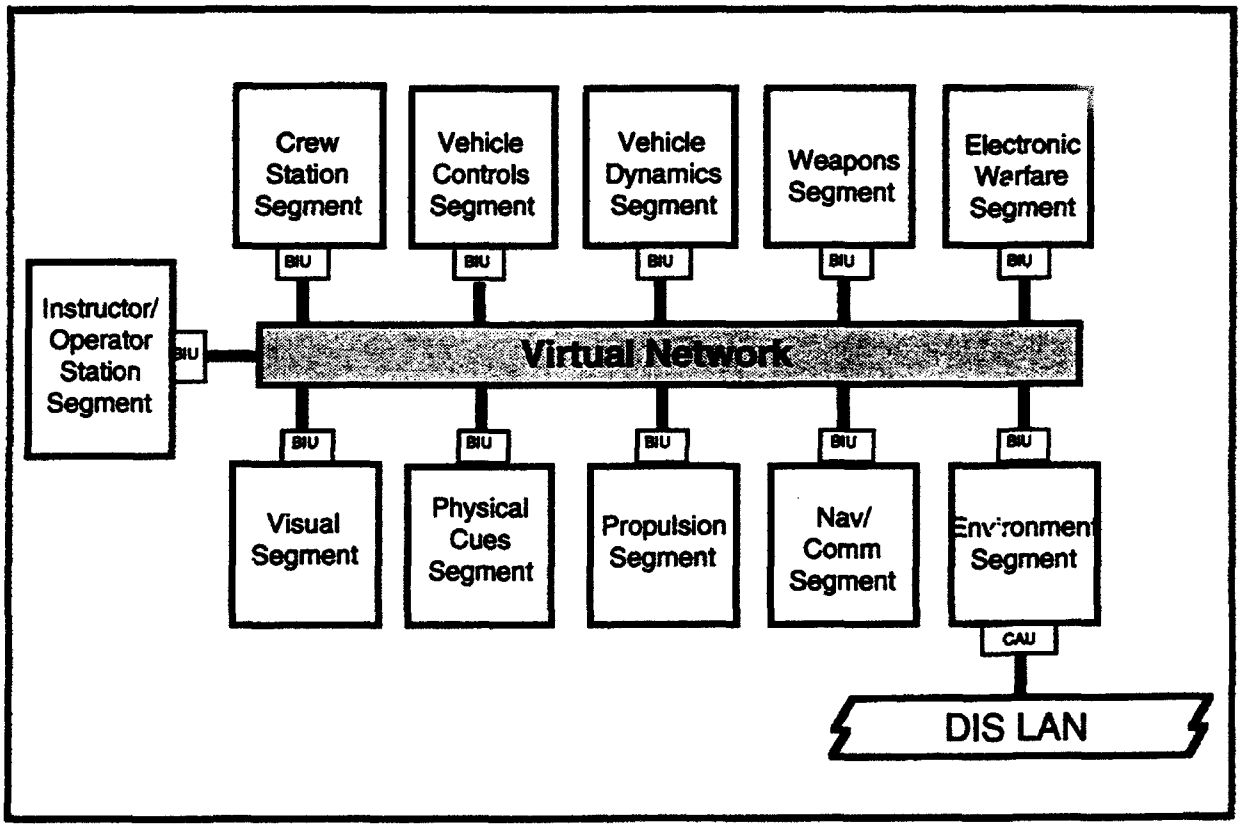

Figure 60.4.4-1 AFAS/FARV Crew Station Simulator Software Segments

AFAS/FARV segments have been grouped into three modules: 1) the Simulation Systems Module (SSM), 2) the Crew Station Module (CSM), and 3) the Visual System Module (VSM). These modules and respective segments were grouped based on the functionality of the software, computational size, physical hardware allocation, and

relationship of message packets. Figures 60.4.2 and 60.4.3 illustrate the segment allocation to the modules.

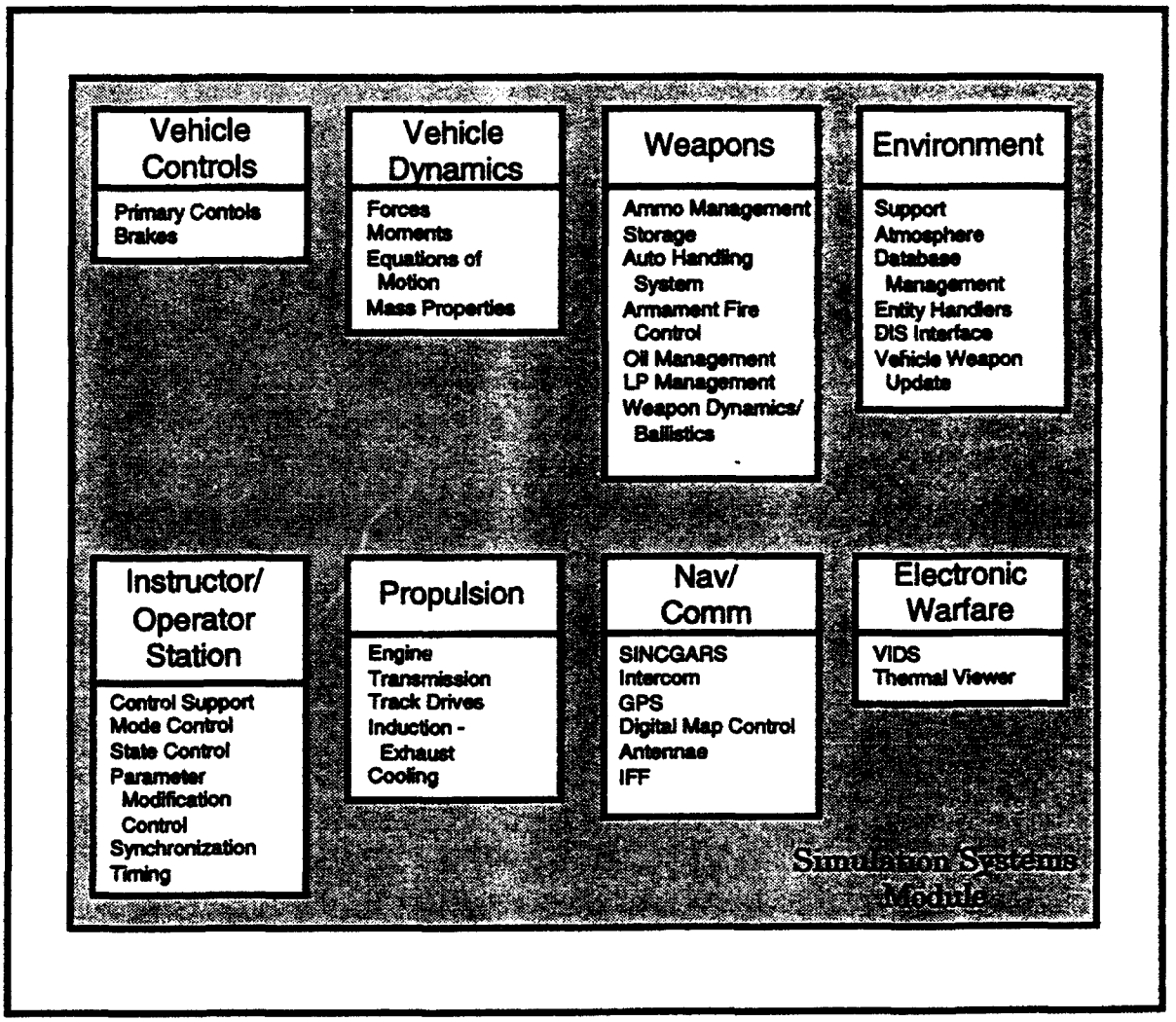

Figure 60.4.4-2 AFAS/FARV Simulation Systems Module

Software components are replaceable at the segment and subsegment level. The interface definition must be maintained. This allows functional model replacement with higher or lower complexity without disrupting the integrity of the remaining segments and subsegments.

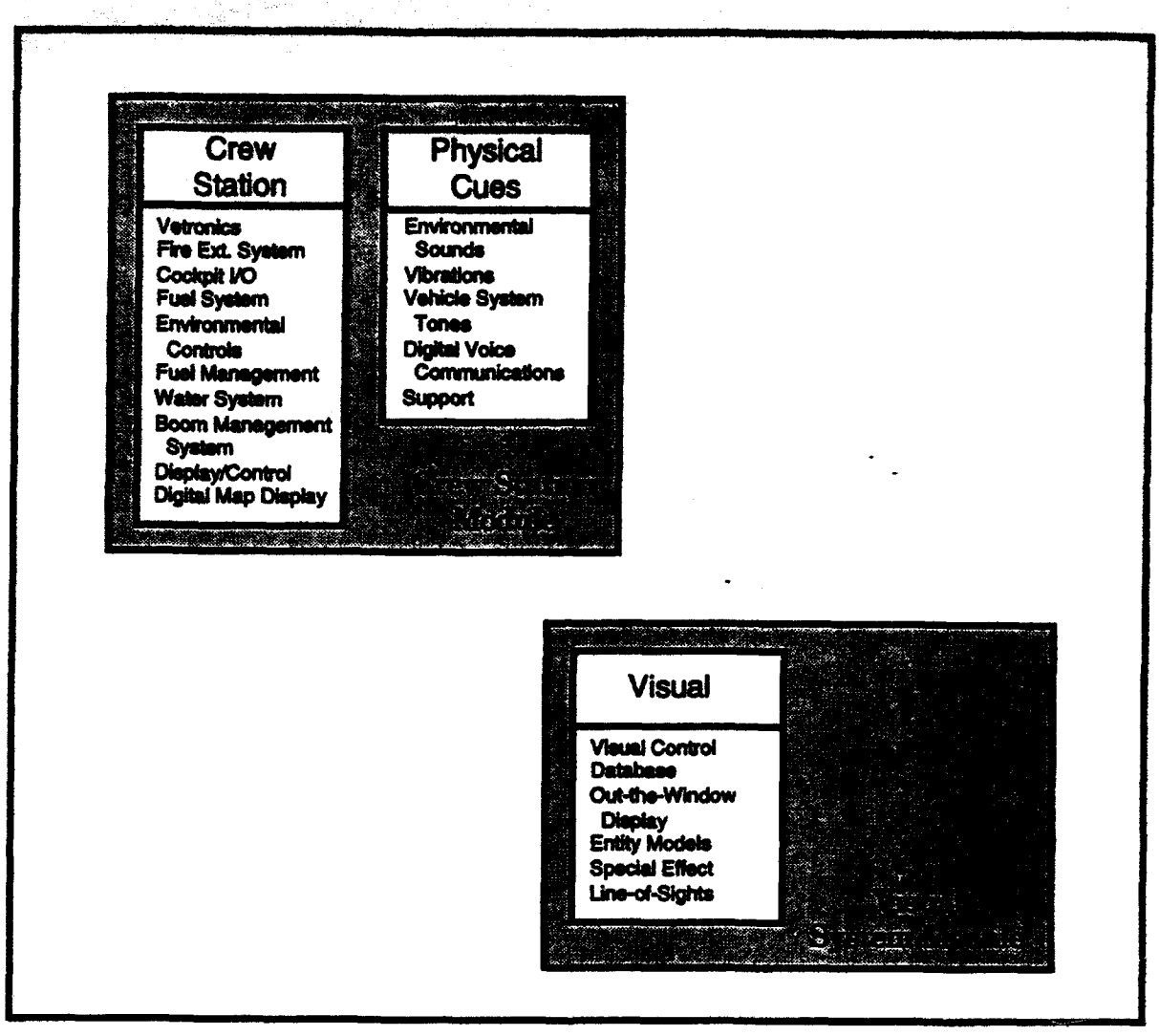

Figure 60.4.4-3 AFAS/FARV Crew Station Module and Visual System Module

Each segment is treated as a software CSCI. The eleven segments of the AFAS/FARV are described in the following paragraphs.

60.4.4.1 Instructor/Operator Station Segment. The Instructor/Operator Station (IOS) provides the interface between the instructor or operator and the simulation. It includes the central control of the simulator. Sub-segment functions include mode control, state control, parameter modification control, synchronization, and timing.

For software estimation purposes, the IOS segment is referred to as CSCI #1. Lines-of-code (LOC) estimates for CSCI #1 are summarized in Table 60.4.4.1. The estimates are based on previous development from the Advanced Rotary Wing Aircraft (ARWA) DO and from implementations at the Aviation Test Bed (AVTB), Fort Rucker, AL, and the Mounted Warfare Test Bed (MWTB), Fort Knox, KY.

Table 60.4.4.1 Software LOC for CSCIs #1 through #4

UNITS	SOURCE Count (LOC/Displays)	CSCI #1	CSCI #2	CSCI #3	CSCI #4
New LOC	• New Application Code • Non-Delivered Code	6,727	279	70	335
Modified LOC	• Added Code	0	0	0	0
	• Changed Code	0	817	817	817
	• Deleted Code	0	0	0	0
	• Unmodified Code	0	783	783	783
	• Ported Code	0	279	0	0
	• COTS Integration Code				
Displays	• GUI (Displays)	3	1	0	1
	• 4GL (Displays)				
	• Prototype GUI (Displays)				

60.4.4.2 Vehicle Dynamics Segment. The Vehicle Dynamics includes the simulation of the vehicle including equations of motion and generation of the vehicles state vector. Sub-segment functions include vehicle forces, moments, equations of motion, and mass properties.

For software estimation purposes, the Vehicle Dynamics Segment is referred to as CSCI #2. Lines-of-code estimates for CSCI #2 are summarized in Table 60.4.4.1. The estimates are based on previous development from Simulation Network (SIMNET) models and from model implementations at the AVTB and MWTB.

60.4.4.3 Vehicle Controls Segment. The Vehicle Controls includes the simulation of the controls such as the steering yoke and brakes, and the associated components. Sub-segment functions include primary controls and brake system.

For software estimation purposes, the Vehicle Controls Segment is referred to as CSCI #3. Lines-of-code estimates for CSCI #3 are summarized in Table 60.4.4.1. The estimates are based on previous development from the SIMNET models and from implementations at the AVTB and MWTB.

60.4.4.4 Propulsion Segment. The Propulsion includes the simulation of the engine, powertrain, and associated subsystems. Sub-segment functions include engine and power generation, power train transmission, track drives, induction-exhaust system, and cooling systems.

For software estimation purposes, the Propulsion Segment is referred to as CSCI #4. Lines-of-code estimates for CSCI #4 are summarized in Table 60.4.4.1. The estimates are based on previous development experience and from implementations at the AVTB and MWTB.

60.4.4.5 Electronic Warfare Segment. The Electronic Warfare includes the simulation of the vehicle sensors and survivability systems. Sub-segment functions include Vehicle Integrated Defense System (VIDS), thermal sensor, and optics.

For software estimation purposes, the Electronic Warfare Segment is referred to as CSCI #5. Lines-of-code estimates for CSCI #5 are summarized in Table 60.4.4.5. The estimates are based on previous development from the ARWA DO, the VIDS DO, and from implementations at the AVTB and MWTB.

Table 60.4.4.5 Software LOC for CSCIs #5 through #8

UNITS	SOURCE Count (LOC/Displays)	CSCI #5	CSCI #6	CSCI #7	CSCI #8
New LOC	• New Application Code • Non-Delivered Code	0	170	955	270
Modified LOC	• Added Code	3,000	388	6,247	0
	• Changed Code	3,717	817	2,033	817
	• Deleted Code	5,000	0	1,500	0
	• Unmodified Code	717	783	35,567	783
	• Ported Code	2,967	450	36,730	0
	• COTS Integration Code				
Displays	• GUI (Displays)	18	2	33	0
	• 4GL (Displays)				
	• Prototype GUI (Displays)				

60.4.4.6 Weapons Segment. The Weapons includes the simulation of the vehicle weapon systems and weapons. Sub-segment functions include ammo management, storage, auto handling system, armament fire control, oil management, liquid propellant (LP) management, and weapon dynamics and ballistics.

For software estimation purposes, the Weapons Segment is referred to as CSCI #6. Lines-of-code estimates for CSCI #6 are summarized in Table 60.4.4.5. The estimates are based on previous development from the ARWA DO and from implementations at the AVTB and MWTB.

60.4.4.7 Navigation/Communication Segment.

The Navigation/Communication includes the simulation of the vehicle navigation and communication systems such as radios and positioning, including the message handling. Sub-segment functions include Advanced Field Artillery Tactical Data System (AFATDS), Single Channel Ground and Airborne Radio Systems (SINCGARS), Intercom, global positioning system (GPS), digital map control, antennae, and Identification, Friend or Foe (IFF) System.

For software estimation purposes, the Navigation/Communication Segment is referred to as CSCI #7. Lines-of-code estimates for CSCI #7 are summarized in Table 60.4.4.5.

The estimates are based on previous development from the ARWA DO, A^2 ATD DO, and from implementations at the AVTB and MWTB.

60.4.4.8 Physical Cues Segment. The Physical Cues includes the simulation of the motion and environmental sound cueing. Sub-segment functions include environmental sounds vibrations, vehicle system tones and warnings, and digital voice communications.

For software estimation purposes, the Physical Cues Segment is referred to as CSCI #8. Lines-of-code estimates for CSCI #8 are summarized in Table 60.4.4.5. The estimates are based on previous development from the ARWA DO and from implementations at the AVTB and MWTB.

60.4.4.9 Environment Segment. The Environment provides simulation of the natural environment, an interface to the FDDI LAN and tactical network environment. Sub-segment functions include atmosphere model, database management, entity handlers, DIS interface, and vehicle weapon update, and players database management.

For software estimation purposes, the Environment Segment is referred to as CSCI #9. Lines-of-code estimates for CSCI #9 are summarized in Table 60.4.4.9. The estimates are based on previous development from the ARWA DO and from implementations at the AVTB and MWTB.

Table 60.4.4.9 Software LOC for CSCIs #9 through #11 and Total LOC

UNITS	SOURCE Count (LOC/Displays)	CSCI #9	CSCI #10	CSCI #11	TOTALS
New LOC	• New Application Code	42,167	290	5,000	56,263
	• Non-Delivered Code				0
Modified LOC	• Added Code	640	102	10,000	20,376
	• Changed Code	817	817	5,817	17,283
	• Deleted Code	0	0	25,000	31,500
	• Unmodified Code	783	983	35,783	77,750
	• Ported Code	1,220	60	0	41,706
	• COTS Integration Code				0
Displays	• GUI (Displays)	0	3	0	61
	• 4GL (Displays)				0
	• Prototype GUI (Displays)				0

60.4.4.10 Crew Station Segment. The Crew Station includes the physical crew positions(s), physical representation and instrumentation along with simulation of standard vehicle systems such as electrical power, fuel, and hydraulics. Sub-segment functions include Vetronics, fire extinguishing system, cockpit input/output (I/O), fuel system, environmental controls, fuel management, water system, boom management system, display control, and digital map display.

For software estimation purposes, the Crew Station Segment is referred to as CSCI #60. Lines-of-code estimates for CSCI #10 are summarized in Table 60.4.4.9. The estimates are based on previous development from the ARWA DO and from implementations at the AVTB and MWTB.

60.4.4.11 Visual Segment. The Visual includes the generation and display of out the window images, sensors, and optics. The database is assumed to be Government Furnished Information (GFI). Sub-segment functions include database, out-the-window display, entity models, special effects, and line-of-sight (LOS).

For software estimation purposes, the Visual Segment is referred to as CSCI #11. Lines-of-code estimates for CSCI #11 are summarized in Table 60.4.4.9. The estimates are based on previous development from the ARWA DO and from implementations at the AVTB and MWTB.

60.4.5 DIS Subsystem Components. The Distributed Interactive Simulation (DIS) initiative focuses on implementation of a far ranging standards based environment for interactive simulation. When fully implemented, DIS compatible simulation assets are utilized in small to large simulation sessions involving geographically dispersed and dissimilar simulators capable of inter-operating on a "level playing fields". Multiple sessions, involving players in diverse locations may be in progress simultaneously.

The ADST Battlefield Distributed Simulation - Developmental (BDS-D) DO is responsible for the development and maintenance of the DIS Subsystem components. These components are assumed to be functional when required by the schedule and to meet the requirements of the AFAS/FARV experiments. ROM estimates are not given for these items except for modifications to the Modular Semi-Automated Forces (ModSAF) for AFAS/FARV functionality. Other modifications to subsystems, such as data logging requirements, on-line parameter modification, etc., are assumed to be minor in nature and usually accomplished with new tabular data. This type of modification has to be estimated on a base by base criteria depending on the data collection requirement.

Each DIS Subsystem component is treated as a CSCI.

60.4.5.1 Session Manager Subsystem. A Session Manager Subsystem performs BDS-D session management functions including allocation and initialization of simulation entities. The Session Manager is a BDS-D Architecture DO effort and is implemented on a COTS workstation.

60.4.5.2 Semi-Automated Forces Subsystem. ModSAF development is currently being conducted via two separate, but tightly intertwined, Delivery Orders -- ModSAF Upgrades and ModSAF System Development. The objectives of both ModSAF Delivery Orders are to replace the previously fielded SAF systems used for research and

development; to ensure all requirements for Computer Generated Forces (CGF) at the BDS-D sites in support of Simulation Training and Instrumentation Command (STRICOM) projects are completed; and to provide the infrastructure to support Advanced Research Projects Agency research initiatives in the future.

ModSAF is an open architecture, modular software system that encourages users to extend and modify the system to support their applications. ModSAF is object-based, dividing the world into distinct objects whose activities are simulated individually. The architecture supports composing these objects from layers of sub-objects. Generic interfaces are defined to allow components in the same family to be interchanged. All the simulated entities are data-driven so that parameters of components, as well as the components comprising the entity, can be modified at runtime.

Behaviors are controlled by group tasks that execute concurrently and translate the entity's mission and sensor inputs into commands for the entity's physical actuators that generate movement, shooting, and communication.

The software architecture implements both behavioral tasks and physical systems as modules with strictly defined public interfaces. This architecture provides users with exceptional flexibility.

The ModSAF architecture divides its functions into three components: the ModSAF data logger or SAF-logger, which records the time evolution of the virtual battlefield; the ModSAF command workstation or SAF station; and the ModSAF simulator or SAF sim. The SAF station allows a user to monitor and control ModSAF forces, to set up exercises, and to plan missions. The SAF station does no simulation; it simply places requests for entities to be simulated and orders to be executed. The SAF sim accepts these requests and simulates the entities carrying out their orders. This division of labor is opportunistic, since it allows the use of different sources to generate entity missions. Different workstations, Artificial Intelligence (AI) programs, and even other SAF sims can generate orders for the SAF sim to execute.

ModSAF is hosted on a COTS workstations. ModSAF is able to operate with both the SIMNET and DIS protocol data sets, in order to meet the current training needs of the U.S. Army, and the requirements for DIS exercises now and in the future.

Modifications for the ModSAF are estimated in the following tables and a summary is presented in the tables of paragraph 60.9. ModSAF is implemented in Phase 1 with icons and basic behaviors. Each additional phase adds optional behaviors. We have not defined the optional behaviors. The estimates are based on historical data and experience in adding new models and behaviors.

ModSAF is assumed to be "V&V"-ed under the A2ATD DO. The AFAS and FARV entities would "V&V"-ed during Phase 4 under this DO.

Table 60.4.5.2-1 presents the cost summary for initially implementing AFAS and FARV models to the ModSAF entities. Icons and basic behaviors are added along with the appropriate documentation. The integration of the ModSAF subsystem is accomplished in Phase 1.

Table 60.4.5.2-1 Phase 1 ModSAF Cost Summary

Phase One		
Item #	**Tasking**	***ROM Cost***
1	AFAS Model and Documentation	$9,113
2	FARV Model and Documentation	$9,113
3	LRP use HEMTT Model	$0
4	AFAS Icon	$1,036
5	FARV Icon	$1,036
	AFAS Old Behaviors	
6	Move	$2,071
7	Communicate	$2,071
8	Survive	$2,071
9	Digital Communication	$2,071
10	Inter-Vehicular Communication	$2,071
11	Attack Targets	$2,071
12	Plan Routes	$2,071
13	Follow Routes	$2,071
14	Determine Rationale to Run	$2,071
15	Conduct Fire Mission	$2,071
	FARV Old Behaviors	
16	Move	$2,071
17	Communicate	$2,071
18	Survive	$2,071
19	Tactical Move	$2,071
20	Digital Communication	$2,071
21	Inter-Vehicular Communication	$2,071
22	Resupply	$2,071
23	Recovery	$2,071
24	Plan Route	$2,071
25	Follow Route	$2,071
26	Determine Rationale to Run	$2,071
Phase One: Total ROM Costing		$63,793

Table 60.4.5.2-2 presents the cost summary for adding six additional behaviors each to the AFAS and FARV ModSAF entities in Phase 2. The delta cost from Phase 1 is included in the table with the accumulative costs through Phase 2.

Table 60.4.5.2-2 Phase 2 ModSAF Cost Summary

Phase Two		
Item #	**Tasking**	**ROM Cost**
1	LRP Design and Dev. w/Basic Behaviors	$31,615
	AFAS Behaviors	
2	Behavior #1	$4,142
3	Behavior #2	$4,142
4	Behavior #3	$5,058
5	Behavior #4	$5,058
6	Behavior #5	$5,058
7	Behavior #6	$5,058
	FARV Behaviors	
8	Behavior #1	$4,142
9	Behavior #2	$4,142
10	Behavior #3	$5,058
11	Behavior #4	$5,058
12	Behavior #5	$5,058
13	Behavior #6	$5,058
	Phase Two: Delta ROM Costing	$88,652
	Phase Two: Total ROM Costing	$152,445

Table 60.4.5.2-3 presents the cost summary for adding six additional behaviors each to the AFAS and FARV ModSAF entities in Phase 3. The delta cost from Phase 2 is included in the table with the accumulative costs through Phase 3.

Table 60.4.5.2-3 Phase 3 ModSAF Cost Summary

Phase Three		
Item #	Tasking	ROM Cost
	AFAS Behaviors	
1	Behavior #7	$4,142
2	Behavior #8	$4,142
3	Behavior #9	$4,142
4	Behavior #10	$5,058
5	Behavior #11	$5,058
6	Behavior #12	$5,058
	FARV Behaviors	
1	Behavior #7	$4,142
2	Behavior #8	$4,142
3	Behavior #9	$4,142
4	Behavior #10	$5,058
5	Behavior #11	$5,058
6	Behavior #12	$5,058
	Phase Three: Delta ROM Costing	$55,205
	Phase Three: Total ROM Costing	$207,650

Table 60.4.5.2-4 presents the cost summary for adding six additional behaviors for the AFAS simulation and two additional behaviors for the FARV simulation. The delta cost from Phase 3 is included in the table with the accumulative costs through Phase 4.

Table 60.4.5.2-4 Phase 4 ModSAF Cost Summary

Phase Four		
Item #	Tasking	ROM Cost
	AFAS Behaviors	
1	Behavior #13	$4,142
2	Behavior #14	$4,142
3	Behavior #15	$5,058
4	Behavior #16	$5,058
5	Behavior #17	$5,058
6	Behavior #18	$5,058
	FARV Behaviors	
7	Behavior #13	$4,142
8	Behavior #14	$5,058
	Phase Four: Delta ROM Costing	$37,719
	Phase Four: Total ROM Costing	$245,369

60.4.5.3 Operational and Logistic Support Subsystem. An Operational and Logistics Support Subsystem is a windowed COTS workstation environment allowing any or all tactical and logistical positions to be filled from a single workstation, or distributed across multiple workstations. This subsystem allows human inter-action during the exercise representing comm/net decisions for these functions.

60.4.5.4 After Action Review Subsystem. The After Action Review Subsystem provides the ability to capture and store PDUs during an exercise and play them back utilizing a commercial workstation and a mixture of COTS, developmental and non-developmental software. This workstation provides a large capacity disk storage capability for data logging and PDU playback. A single channel computer image generator (CIG) out-the-window view is provided for viewing the simulated battlefield and environment. A graphic user interface provides user friendly controls.

60.4.5.5 Mission Planning Subsystem. The Mission Planning Subsystem is an implementation of a preplanning workstation for crew mission planning activities, and exercise planning and development. The subsystem is hosted on COTS hardware.

60.4.5.6 Gateway Interface. The Gateway Interface provides an FDDI local area network (LAN) and Cell Adapter Unit (CAU). The network provides connection between the AFAS/FARV simulation system elements and the CAU to other DIS cells and resources. The CAU performs protocol translation as required to ensure inter-

operability. The FDDI network is readily available as COTS products, and the CAU is implemented on a COTS workstation with a software package developed by the BDS-D Architecture DO.

60.4.6 Software Development ROM Estimate Summary.

Table 60.4.6 summarizes the Software Development ROM Estimate.

Table 60.4.6 Software Development ROM Estimate

SW LOE Hrs	SOFTWARE LABOR (SDR-FQT)	
	• Total LOE & Product Development Hrs	92,278
	- Admin & Clerical	3,723
	- CM	5,897
	- Software QA	2,865
	- Metrics	2,158
	- Tools, ADP, Process Eng	3,184
Product Develop Hrs	- Technical Management	6,562
	- S/W Req. Analysis	4,832
	- Preliminary Design	13,079
	- Detailed Design	16,247
	- Code & CSU Testing	14,262
	- CSC Int & Test	11,049
	- CSCI Test	8,421
K$	ODC	$68
	• TDY/Travel	$58
	• Misc	$10
K$	CAPITAL (not additive)	$1,184
	• SW Dev. Environment Hardware/Install	$650
	• S/W Licenses and Installation	$534
	• Facilities	$0
	• Maintenance	$0
K$	TOTAL COST FOR SOFTWARE	$5,904
	LABOR (SDR thru FQT)	$4,807
	ODC (SDR thru FQT)	$68
	Software Support Labor	$1,030
K$	CAPITAL	$1,184
Mths	SCHEDULE (SDR thru CSCI FQT)	18
EqH	Peak Software Staff	71
Type	Predominant Code Type	New C
Support Hrs	• Support Hours	19,767
	- Software Subcontractor Management	6,645
	- Pre SDR Support	1,208
	- System Integration Support	11,909
EqH	• Software Maintenance Staff	5

60.5 **Systems Integration & Test Engineering.** The AFAS/FARV SS integration and test program minimizes the time spent at the site by completing integration in the Loral Orlando Software Development Facility (SDF).

For estimating purposes, Loral proposes an incremental and progressive approach to system integration and test which builds up the full AFAS/FARV SS by successive additions of capabilities, this eliminating risks inherent in a single big-bang approach to system integration. The crew station simulators and support subsystems are brought into the integration activity according to a plan developed to effectively and efficiently resolve integration issues as each component is added to the system. The test program takes advantage of functional and performance testing carried out at the subsystem level to allow system testing to concentrate on system level requirements. At the end of system integration, the acceptance test procedures will be executed against the completely integrated AFAS/FARV SS to verify the system is ready for site installation and the final execution of the system acceptance test.

System Integration of the AFAS/FARV Simulation System takes place in an orderly incremental fashion providing increased functionality with each integration step. Implementation of the AFAS/FARV Simulation System involves bringing together a number of components in a comprehensive DIS compatible environment. Some of the components exist now or will exist in the near future as a result of other development efforts outside of the AFAS/FARV DO. Other components are being designed and developed on the AFAS/FARV project. In order to minimize cost and schedule risk associated with integrating all of these components an incremental approach to integration is established where a base is established and then other architectural components are added incrementally in a phased approach. Each additional architectural component brings with it added functionality, so that when the last component has been added, the system is complete.

Incremental integration of AFAS/FARV subsystems will be thought through to provide a plan which progressively builds up system capability. The plan would take into consideration the functionality each subsystem adds to the overall AFAS/FARV SS. The integration activity will staged in Orlando, and centered on adding increasingly more capabilities to the AFAS/FARV simulator on the integration floor.

If a phased approach is implemented, the following phases will have to be implemented at the hosting site location. The efforts involved in the phased approach are greater than the direct approach due to the additional integration required at the sites. The integration is minimal with the direct approach. The increased cost due to the additional integration is reflected in the summary cost presented in paragraphs 60.9.

Loral would coordinate facility upgrade needs with site personnel, and would actively participate in the site activation program. When System Integration is complete in Orlando, the Acceptance Test procedures would be dry run on the system to verify that the system is ready to ship, and a ship readiness review would be conducted with

STRICOM. Upon receiving permission to ship the system, the AFAS/FARV SS will be torn down, packed and shipped to the site. Upon arrival at the site, the system would be unpacked, reassembled, and checked out. A brief site integration activity would be conducted to verify readiness. Once this has been completed the entire Acceptance Test would be dry ran to verify that the system is ready for formal acceptance testing.

60.6 **Experiment Support.** The experiments are broken down into 4 phases corresponding to the simulation development phases listed previously. There are 20 experiment categories listed for each phase of experiments. These categories are the recommended testing areas that can be achieved using the DIS architecture in the virtual simulation. The second column shown in each of the tables is a ranking of whether or not that experiment category could be tested in that simulation development phase. The column will have a "Y", "N", or a "P". The "Y" is signifying 'yes', that simulation can be used to fully test the entire capabilities of that experiment category. The "N" is signifying that simulation can not be used to test the capabilities of that experiment category and you must wait until the next development phase is achieved. The "P" is signifying that simulation could partially test the capabilities of that experiment category. In the third column, there will be comments explaining each of the responses (Y, N, or P) in column two. The results in column two could change depending on the actual development level reached in each phase. For instance, phase 2 could include some of phase 3 capabilities. This will depend on the customer's priorities, goals, and timelines. Therefore, the responses in column two are derived from the proposed development cycle and have the potential of changing at a later date. It should also be known that the design and development of the simulator strongly depends on the experiments that the customer would like to accomplish.

60.6.1 **Experiment ROM Costing.** The methodology used to determine the cost of each experiment depends on three criteria. This method considers DIS PDUs, video and audio data. Each of these categories are run through some developed algorithms that will calculate the number of hours required to bring each of these categories of data to an analysis stage. The analysis stage is the point where all three of these categories are equivalent (i.e. comparing apples to apples). At this point, the total number of hours is multiplied by a factor to determine how much time is required to develop the final report. The experiment ROM cost estimate is one estimate that will vary more then any other. There are many factors involved in developing the cost estimate and any one variable has a major impact in the cost. For example, considering the video reduction, it's estimated that every one hour of video tape will take four hours to reduce this data. But, if the information that you're interested in is the initial detection of a threat, this might only take the first 5 minutes of the video tape to find. The cost estimates that are summarized in section 6.9 are broken into phased and direct approaches. The phased approach will be less then the direct approach because the set-up time for the Measures of Performances (MOPs) might have been completed in the previous phase. The direct approach assumes that the set-up for data reduction has not taken place.

60.6.1.1 **DIS PDU Data Collection.** The collection of DIS PDUs is accomplished through the use of a Data Logger. This logger will collect every PDU on

the network and store them on some media (i.e. magnetic tape, hard disc, etc.). Once the Data Logger has stored this information, it can replay the entire exercise including all events that took place during the live exercise. This stored data file is then run through a data reduction routine which will separate the PDUs and reformat them into correlated tables. These tables are then analyzed to answer the MOPs and Measures of Effectiveness (MOEs) that were developed by the customer. The table output is at the analysis stage that needs to be correlated with the other two categories.

60.6.1.2 Video Data Collection. The collection of video data is accomplished through the use of video cassette recorders (VCRs), video converters, video multiplexers, and video encoder / decoders. The VCR will ultimately contain all of the video data. The types of video data that could be collected are video from the Chief of Section's view; the sensor view; any out-the-window view; AFATDS map view; camera view of the crew; or camera view of joysticks. The view is determined once the desired data to be collected (i.e. SMI) is determined. The video data reduction is a long process that requires every video tape to be reviewed and metrics collected from each. The metrics collected are put into table format and then prepared for the analysis stage.

60.6.1.3 Audio Data Collection. The collection of audio data is accomplished through the use of VCR's and audio mixers. The VCR will ultimately contain all of the audio data. This data can potentially be stored on the same tape as the video depending on the quantity of audio channels desired to be analyzed. The types of audio data that could be collected are communications from the Chief of Section to the outside world (radio communication) or the Chief of Section to others inside the vehicle (intercom). The intercom data would contain all member inside the vehicle. The audio data reduction is a long process that requires every VCR tape to be reviewed and metrics collected from each. The metrics collected are put into table format and then prepared for the analysis stage.

60.6.2 Phase 1 Experiments. As previously discussed, phase 1 is a very basic Table Top Simulator that could have two monitors, a SINCGARS radio face plate, touch screens and a mouse for user interface depending on the option selected in phase 1. The simulator would be capable of moving, shooting, resuppling, digital communication, and interaction with other simulated vehicles. This phase would integrate software developed under the existing SIMNET simulation devices. The phase 1 simulation would be able to transfer fuel and ammunition with the same characteristics as simulation in the existing SIMNET simulators. This is accomplished by getting within 100 feet of the resupply vehicle and the transfer begins once the simulators have been placed in their proper modes. The vehicle dynamics of the AFAS and FARV simulators will be modeled after the M1 SIMNET simulators. The ballistics of the artillery will be modeled after the existing artillery models in the SIMNET simulation. All of the parameters could be modified to closely resemble the parameters of the AFAS and FARV.

A very basic ModSAF will be implemented according to the AFAS/FARV specifications. The basic existing behaviors will be implemented into ModSAF. These

include movement, shooting, communicating and resuppling. Other new behaviors are proposed to be added in the follow-on phases. Table 60.6.1 lists the experiment categories and whether the experiment can be executed or not.

Phase 1 ROM experiment cost is $58,905. These costs are summarized in section 60.9

Table 60.6.2-1 Phase 1 Experiment Evaluation

PDUs		Video		Audio	
# of MOEs	0	# of Views	0	# of channels	2
# of MOPs	35	# of Runs	20	# of Runs	20
Subtotal	35	Subtotal	0	Subtotal	40
PDU Set-up Time	63	Video Factor	4	Audio Factor	2
Reduction Time	40	Reduction Time	0	Reduction Time	80
Analysis Time	140	Analysis Time	0	Analysis Time	20
Subtotal Analysis Time	243	**Subtotal Analysis Time**	0	**Subtotal Analysis Time**	100

Table 60.6.2-2 Phase 1 Experiments

Experimentation Categories	Phase 1	Comments
Command, Control, and Communications	P	The C3 will be implemented into the simulation with the capabilities of the CAC2 being developed for the A2ATD Project. These capabilities include; overlays, contact rpt., spot rpt., call for fire, sit rpt., adjust fire, position and ID rpts. Further capabilities will be included in phase 3, which will include the full operational AFATDS. This may be included in phase 1 if there is a DIS compatible software package currently developed.
AFAS primary armament	P	The primary armament can be tested with the flyouts of the old SIMNET simulation and the parameters modified after the AFAS. The ballistic algorithms will not be fully accurate because they will be modeled after the M109s from the SIMNET simulations.
Secondary armament	N	The secondary armaments will not be implemented in phase 1.
Decision aids: RSOP, SD, FMP, SUST, MM, ET	Y	The decision aids should be able to be tested, pending the delivery of decision aids that are DIS compatible. These test should be run throughout all of the phases to understand how the fidelity helps or hurts the operator when using the decision aids.
Sensor assets to support SD, i.e., FLIR, video, other	P	There will be one out-the-window view that can be tested. This will only be a video type view. Phase 2 will add IR capabilities.

Countermeasure suite	P	The capabilities developed under the ADST Vehicle Integrated Defense System (VIDS) could be implemented onto phase 1. This is very limited until the level 2 CIG gets integrated
Firing position parameters	P	The parameters to be measured are ranges, firing from various slopes, number of rounds fired, and location of detonation. These can be tested but, the results should not be considered valid until a V,V&Aed model is inputted.
Ammunition capacity	Y	The capacity of ammunition that the AFAS and FARV can hold could be tested in phase 1. This test should also be repeated in phase 4 for a V,V&Aed solution.
Docking operations	P	Docking in this phase will be very minimal. It would have to take place considering a closed or degraded operation because there will only be one out-the-window view. The models and the resolution will be a low fidelity until phase 3 is achieved.
Ammunition transfer operations	P	There will be the capability to transfer fuel and ammunition. This transfer will match the capabilities of the SIMNET simulations. The timing parameters could be modified to resemble the AFAS, FARV and LRP but, the data collected should not be considered valid until V,V& A has been achieved in phase 4.
LRP operations	P	In phase 1, there will be a Heavy Expandable Mobile Tactical Truck (HEMTT) that will provide all ammunition and fuel resupply. Therefore, the entire LRP will not be simulated but, some testing can take place.
Degraded operations	P	The simulator will contain degraded visuals due to only one out-the-window; communication and uploading/downloading can also be degraded. Various other systems could be degraded to help consider options to evaluate in the degraded mode. The testing will be very limited and is recommend that in depth testing wait until phase 3.
Crew size	N	It would be very difficult to obtain accurate MOPs or MOEs with Table Top Simulators when considering crew size. Phase 2 is a minimum and phase 3 is recommended.
Crew MOPP levels	P	It could be completed with a Table Top Simulators by comparing the time it takes to operate in level 1 compared to level 4. It is recommended that this test begin in phase 2 when a simulator crew shell is built.

Table 60.6.2-3 Phase 1 Experiments [Continued]

Experimentation Categories	Phase 1	Comments
Crew position intra/intervisibility	N	It would be very difficult to obtain accurate MOPs or MOEs with Table Top Simulators when considering crew position intra/intervisibility. Phase 2 is a minimum and phase 3 is recommended.
Crew environment	N	It would be very difficult to obtain accurate MOPs or MOEs with Table Top Simulators when considering crew environment. Phase 2 is a minimum and phase 3 is recommended.
System safety	P	The only portion of system safety that could be tested is the audio tone that come from the radio. Further testing is needed in phase 2.
Vehicle mobility	P	Some of the soldier machine interface functions could be tested on the joystick for driving the simulator. Different types of joysticks for driving the simulator could be tested. The vehicle performance characteristics could not be tested in this phase.
Auxiliary power	P	Very basic test could be run on the length of time the operator needs power before a critical point is reached. These test can be varied many ways but, the data should not be considered valid until V,V&A has been achieved.
Interoperability	P	The simulator will be able to interoperate with other simulators and simulations but, these interoperabilities are from the SIMNET Simulations. It is recommended that the test that are critical wait until phase 3.

60.6.3 Phase 2 Experiments. Phase 2 simulation will take the development efforts accomplished in phase 1 and integrate a GT111 CIG. This CIG will provide up to 9 out-the-window channels. Individual points of view are made available for out-the-window display and sensor. Phase 2 simulation also includes the development of a low fidelity reconfigurable crew station simulator. The crew stations are fabricated with a modular and reconfigurable design for each crew position. The crew station position can be utilized as a stand-alone or co-located in a side-by-side arrangement for crew interaction and crew cab replication. The simulation will stay very much the same as phase 1 except for the additional out-the-window views and the crew shell to house the operators.

ModSAF will be enhance with a fully operational LRP. This includes the variety of vehicles that would normally reside at an LRP. The AFAS and FARV will be upgraded with new behaviors each.

Phase 2 direct approach ROM experiment cost is $137,224. Phase 2 phased approach ROM experiment cost is $131,869. These costs are summarized in section 60.9

Table 60.6.3-1 Phase 2 Experiment Evaluation

PDUs		Video		Audio	
# of MOEs	0	# of Views	4	# of channels	2
# of MOPs	68	# of Runs	20	# of Runs	20
Subtotal	68	Subtotal	80	Subtotal	40
PDU Set-up Time	59.4	Video Factor	4	Audio Factor	2
Reduction Time	40	Reduction Time	320	Reduction Time	80
Analysis Time	272	Analysis Time	80	Analysis Time	20
Subtotal Analysis Time	371.4	**Subtotal Analysis Time**	400	**Subtotal Analysis Time**	100

Table 60.6.3-2 Phase 2 Experiments

Experimentation Categories	Phase 2	Comments
Command, Control, and Communications	P	No real change from phase 1. The C3 will be implemented into the simulation with the capabilities of the CAC2 being developed for the A2ATD Project. These capabilities include; overlays, contact rpt., spot rpt., call for fire, sit rpt., adjust fire, position and ID rpts. Further capabilities will be included in phase 3, which will include the full operational AFATDS. This may be included in phase 2 if there is a DIS compatible software package currently developed.
AFAS primary armament	P	The primary armament can be tested with the flyouts of the old SIMNET simulation and the parameters modified after the AFAS. The direct fire can be tested in this phase. The ballistic algorithms will still not be fully accurate because they will be modeled after the M109s from the SIMNET simulations.
Secondary armament	N	The secondary armaments will not be implemented in phase 2.
Decision aids: RSOP, SD, FMP, SUST, MM, ET	Y	Same test as phase 1. These test should be run throughout all of the phases to understand how the fidelity/type of the simulator helps or hurts the operator when using the decision aids.
Sensor assets to support SD, i.e , FLIR, video, other	P	There will be an IR sensor view integrated in this phase. This will allow more testing then phase 1. The total view in this phase include 5 out-the-windows, 3 Television (TV) views, and 1 sensor view.
Countermeasure suite	P	The same test as phase 1. Need a level 2 CIG for further testing.
Firing position parameters	P	The same test as phase 1.

Ammunition capacity	Y	This test should be repeated in both phase 3 and 4 for a V,V&Aed solution.
Docking operations	P	More testing could take place due to the additional out-the-window views. The models and the resolution will still be a low fidelity until phase 3 is achieved.
Ammunition transfer operations	P	Same as phase 1. Further testing should wait until V,V&A has been achieved in phase 4.
LRP operations	P	In phase 2, there will be a fully operational LRP implemented into ModSAF but the AFAS and FARV will still be using the transfer models of the SIMNET simulation. Testing should continued in the follow-on phases.

Table 60.6.3-2 Phase 2 Experiments [Continued]

Experimentation Categories	Phase 2	Comments
Degraded operations	P	Very similar to phase 1. The simulator will contain degraded visuals due to only one out-the-window; communication and uploading / downloading can also be degraded. Various other systems could be degraded to help consider options to evaluate in the degraded mode. The testing will be limited and is recommend that in depth testing wait until phase 3.
Crew size	Y	Crew size could be tested very well in this phase. The crew modules will be fabricated to allow different crew configurations.
Crew MOPP levels	Y	Crew MOPP level could be tested very well in phase 2. The crew shell will be fabricated with reconfiguration in mind and the component can be moved around to measure the impact to the operators with various levels of MOPP.
Crew position intra/intervisibility	Y	Crew position intra/intervisibility could be tested very well in phase 2. The crew modules will be fabricated to allow different crew configurations to measure the impact to the Chief of Section's view with various positioning and different crew locations.
Crew environment	Y	Phase 2 would support testing on the crew environment. This involves the measurement of crew tasking and load during various operations. These could be accomplished with the crew shell developed in phase 2.
System safety	Y	The audio portion of this was began in phase 1, phase 2 could expand on this with the addition of lights and gauges built into the simulator crew shell.
Vehicle mobility	P	Very similar to phase 1. The only major difference is the driver will now have a full out-the-window view. The vehicle performance characteristics could not be tested in this phase.
Auxiliary power	P	Same as phase 1. These test can be varied many ways but, the data should not be considered valid until V,V&A has been achieved.
Interoperability	P	Same as phase 1. It is recommended that the test that are critical wait until phase 3.

60.6.4 Phase 3 Experiments. Phase 3 increases the functionality and fidelity of the crew station simulators developed in Phase 2. New software development is accomplished to better replicate the system fidelity and vehicle performance and provide a more robust development environment. Weapon systems fidelity is enhanced, utilizing higher fidelity ballistic models and data. A full suite of the DIS support subsystems is integrated. The Level 1 CIG is replaced with a Level II CIG supporting additional environmental effects.

ModSAF will be upgrade with additional new behaviors over phase 2.

Phase 3 direct approach ROM experiment cost is $200,345. Phase 3 phased approach ROM experiment cost is $189,941. These costs are summarized in section 60.9

Table 60.6.4-1 Phase 3 Experiment Evaluation

PDUs		Video		Audio	
# of MOEs	0	# of Views	4	# of channels	2
# of MOPs	115	# of Runs	20	# of Runs	20
Subtotal	115	Subtotal	80	Subtotal	40
PDU Set-up Time	84.6	Video Factor	4	Audio Factor	2
Reduction Time	40	Reduction Time	320	Reduction Time	80
Analysis Time	460	Analysis Time	80	Analysis Time	20
Subtotal Analysis Time	584.6	**Subtotal Analysis Time**	400	**Subtotal Analysis Time**	100

Table 60.6.4-2 Phase 3 Experiments

Experimentation Categories	Phase 3	Comments
Command, Control, and Communications	Y	AFATDS will be fully functional.
AFAS primary armament	Y	The primary armament will now use the ballistic algorithms that the AFAS has defined. The actual flyouts and all ammunition types will be implemented. These test should also be repeated in phase 4 for a V,V&Aed solution.
Secondary armament	Y	The secondary armaments will now be implemented and can be run through any variety of tests. These test should also be repeated in phase 4 for a V,V&Aed solution.
Decision aids: RSOP, SD, FMP, SUST, MM, ET	Y	Any new decisions aids can be tested. We anticipate that new decision aids will be implemented in every phase. These test should be run throughout all of the phases to understand how the fidelity/type of the simulator helps or hurts the operator when using the decision aids.

Sensor assets to support SD, i.e., FLIR, video, other	Y	There will be a new IR sensor view and out-the-window views integrated in this phase. This will allow more testing then phase 1 or 2. All of the environmental effects (i.e. fog, haze, rain, day, night, etc.) will be included. The smoke models for a degraded battle field will be included.
Countermeasure suite	Y	All countermeasures will implemented in this phase. The environmental and smoke models are includes by the integration of the level 2 CIG, this will allow any countermeasure testing to occur.
Firing position parameters	Y	The vehicle dynamics and model will be upgrade as the new CIG is integrated. This show enhance the testing of the firing position parameters.
Ammunition capacity	Y	Continue testing from phase 1 & 2. These test should also be repeated in phase 4 for a V,V&Aëd solution.
Docking operations	Y	All testing could take place due to the additional out-the-window views and the high resolution CIG. The models and the resolution will now be a higher fidelity allowing better resolution in the docking operations.

Table 60.6.4-2 Phase 3 Experiments [Continued]

Experimentation Categories	Phase 3	Comments
Ammunition transfer operations	Y	The transfer models will now be modeled after the AFAS and FARV specifications allowing more accurate testing to be completed. These test should also be repeated in phase 4 for a V,V&Aed solution.
LRP operations	Y	In phase 2, there will be a fully operational LRP implemented into ModSAF. Phase 3 will include the transfer models from the AFAS and FARV specifications allowing more accurate testing to be completed. That will provide capabilities to resupply ammunition and fuel. The uploading and downloading timings could be varied to run a wide variety of test. Testing should continue in phase 4 with V,V&Aed models.
Degraded operations	Y	All of the models included in phase 3 for the AFAS and FARV will be derived from the AFAS and FARV specifications, therefore the testing of degraded operation will be more accurate. These test could demonstrate how the operators would choose to function while some of their systems have failed. Testing should continue in phase 4 with V,V&Aed models.
Crew size	Y	Continue testing from phase 2. The crew modules will be fabricated to allow different crew configurations.
Crew MOPP levels	Y	Continue the same testing as phase 2.
Crew position intra/intervisibility	Y	Continue the same testing as phase 2.
Crew environment	Y	Continue the same testing as phase 2.
System safety	Y	Continue the same testing as phase 2.
Vehicle mobility	Y	The vehicle performance characteristics could be tested in this phase. All of the AFAS/FARV vehicle dynamics will be correctly modeled after the AFAS and FARV specification.
Auxiliary power	Y	All of the models included in phase 3 for the AFAS and FARV will be derived from the AFAS and FARV specifications, therefore the testing of different auxiliary power sources could be achieved.
Interoperability	Y	All of the models included in phase 3 for the AFAS and FARV will be derived from the AFAS and FARV specifications and with the level 2 CIG, the interoperability testing could be achieved more accurately.

60.6.5 Phase 4 Experiments. Phase 4 provides the additional effort to accomplish validation and verification (V&V) of the simulator for obtaining accreditation. This effort requires documentation development, structured component testing and acceptance, and report generation to support the V&V. Additional software development is accomplished to provide a higher level of fidelity for the command and control, weapons systems, and vehicle performance, and to support the V&V tasks.

Phase 4 direct approach ROM experiment cost is $200,345. Phase 4 phased approach ROM experiment cost is $200,345. These costs are summarized in section 60.9

Table 60.6.5-1 Phase 4 Experiment Evaluation

PDUs		Video		Audio	
# of MOEs	0	# of Views	4	# of channels	2
# of MOPs	115	# of Runs	20	# of Runs	20
Subtotal	115	Subtotal	80	Subtotal	40
PDU Set-up Time	207	Video Factor	4	Audio Factor	2
Reduction Time	40	Reduction Time	320	Reduction Time	80
Analysis Time	460	Analysis Time	80	Analysis Time	20
Subtotal Analysis Time	707	**Subtotal Analysis Time**	400	**Subtotal Analysis Time**	100

Table 60.6.5-2 Phase 4 Experiments

Experimentation Categories	Phase 4	Comments
Command, Control, and Communications	Y	All vehicle performance models, algorithms and ballistic solutions will be V,V&Aed. Therefore, the test results are fully valid.
AFAS primary armament	Y	"
Secondary armament	Y	"
Decision aids: RSOP, SD, FMP, SUST, MM, ET	Y	"
Sensor assets to support SD, i.e., FLIR, video, other	Y	"
Countermeasure suite	Y	"
Firing position parameters	Y	"
Ammunition capacity	Y	"
Docking operations	Y	"
Ammunition transfer operations	Y	"
LRP operations	Y	"
Degraded operations	Y	"
Crew size	Y	"
Crew MOPP levels	Y	"
Crew position intra/intervisibility	Y	"
Crew environment	Y	"
System safety	Y	"
Vehicle mobility	Y	"
Auxiliary power	Y	"
Interoperability	Y	"

60.7 **Material.** The hardware equipment and material is detailed in the following tables. The hardware and material is arranged by development phase. The hardware and material requirements are dependent upon the purchase and integration of all hardware and material of the current and previous development phases. The only exception is the Level I CIG purchased in Phase 2. If development begins with Phase 3, the GT111 is not purchased. If development is started at Phase 2 or lower, the Level I CIG is purchased, and then shelved when development moves into Phase 3. It is recommended that the Level I CIG for Phase 2 be government furnished equipment (GFE). GFE GT111s should be available from the A^2ATD DO following the upgrade of the M1A2 devices at the MWTB to Level II CIGs.

It is assumed that the hardware and materials for the Table Top Simulators in Phase 1 are not used for the Crew Station Simulators. Dedicated equipment and hardware for the Crew Station Simulators is purchased starting in Phase 2.

Table 60.7-1 summarizes the material for Phase 1 development of the table top simulator.

Table 60.7-1 Phase 1 Material Summary for the Table Top Simulator

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
ONYX	Computer/IG	CPU & Visuals	SGI	$210 K		
	2nd Monitor	User Interface	SGI	$2 K		
	Development SW	Development Environment	SGI	$40 K		
	Graphics Board	Second Monitor	SGI	$2 K		
	Audio Board	Intercom & Radio	A2ATD Purchase	$2 K		
	2-Touch Screen & Board	Drive the Touch Screen	A2ATD Purchase	$8 K		
	FDDI Board	Network Interface	A2ATD Purchase	$7 K	$271 K	
SINCGARS	Face Plate	User Interface	A2ATD Purchase	$5 K		
	Digital I/O Board	Controlling Switches	A2ATD Purchase	$2 K		
	Head Set & Misc. HW	User Interface	Engineering Est.	$1 K	$8 K	$278 K
OPTIONS						
COMPONENT	**SUB COMPONENT**	**TASKING**	**SOURCE**	**ROM COST**	**SUB TOTAL**	**TOTAL COST**
Joy Stick	Joy Stick	Driving Simulator	Measurement Sys.	$10 K		
	Mount	Holding Joy Stick	Engineering Est.	$1 K	$11 K	
ONYX	Digital I/O Board	Controlling Switches	Engineering Est.	$2 K		
	Analog Input Board	Reading Joy Stick Outputs	Engineering Est.	$2 K	$4 K	
Switch Panel	Key Pad	Numerical Inputs	Engineering Est.	$1 K		
	Push Buttons	Digital Inputs	Engineering Est.	$1 K		
	Panel / Mount	Holding Switches	Engineering Est.	$1 K	$2 K	$17 K
					For Three Crew Stations	**$50 K**

Table 60.7-1 Phase 1 Material Summary for the Table Top Simulator [Continued]

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
3 Crew Stations	Large High Res. Monitor	Graphics Display	SGI	$4 K		
	Large High Res. Monitor	Graphics Display	SGI	$4 K		
	2 - Graphics Boards	Communications w/Monitor	SGI	$6 K		
					For Three Crew Stations	$14 K
				TOTAL ROM MATERIAL COST FOR PHASE 1		$342 K

Table 60.7-2 summarizes the material for Phase 2 development of the crew station simulator.

Table 60.7-2 Phase 2 Material Summary for the Crew Station Simulator

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
ONYX	Computer	CPU	SGI	$210 K		
	Development SW	Development Environment	SGI	$40 K		
	Graphics Board	Second Monitor	SGI	$2 K		
	Graphics Board	Third Monitor	SGI	$2 K		
	Touch Screen Board	Drive the Touch Screen	A2ATD Purchase	$2 K		
	Touch Screen Board	Drive the Touch Screen	A2ATD Purchase	$2 K		
	Touch Screen Board	Drive the Touch Screen	A2ATD Purchase	$2 K		
	Audio Board	Intercom & Radio	A2ATD Purchase	$2 K		
	Digital I/O Board	Controlling Switches	Engineering Est.	$2 K		
	Digital I/O Board	Controlling Switches	Engineering Est.	$2 K		
	Analog Input Board	Reading Joy Stick Outputs	Engineering Est.	$2 K		
	Ether Net Board	Communications w/IG	Engineering Est.	$2 K		
	FDDI Board	Network Interface	A2ATD Purchase	$7 K	$277 K	
GT111 CIG	Image Generator	Create Visuals	LADS-Bellevue	$250 K		
	SW and Licenses	Operational	LADS-Bellevue	$50 K	$300 K	
Crew Station	3 - Crew Shells	Frame of Individual Units	Engineering Est.	$200 K		
	3 - Chairs	Crew Seating	Engineering Est.	$1 K		
	5-Multisync Color Monitor	OTW Viewing	Sony	$15 K		

Table 60.7-2 Phase 2 Material Summary for the Crew Station Simulator [Continued]

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
	1-Multisync Color Monitor	CoS OTW Viewing	Sony	$2 K		
	3 - Power Supplies	Driving Misc. I/O	Engineering Est.	$1 K		
	Cabling and Mounting HW	Dressing and Cleanup	Engineering Est.	$1 K		
	3 - 19" Color Monitors	Crew Operators	SGI	$9 K		
	3 - 19" Touch Screens	Crew User Interface	A2ATD Purchase	$6 K	$235 K	
SINCGARS	Face Plate	User Interface	A2ATD Purchase	$5 K		
	Digital I/O Board	Controlling Switches	A2ATD Purchase	$2 K		
	Head Set & Misc. HW	User Interface	Engineering Est.	$1 K	$8 K	
Sound System	Computer	CPU	Perceptronics	$14 K		
	Amplifiers	Sound Boosting	Engineering Est.	$2 K		

Table 60.7-2 Phase 2 Material Summary for the Crew Station Simulator [Continued]

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
	Speakers	Outputting Sound	Engineering Est.	$2 K	$18 K	
User Inputs	3 - Joy Sticks	Driving Simulator	Measurement Sys.	$30 K		
	3 - Key Pads	Numerical Inputs	Engineering Est.	$2 K		
	3 - Sets of Push Buttons	Digital Inputs	Engineering Est.	$2 K		
	3 - Left Panel / Mount	Holding Switches	Engineering Est.	$2 K		
	3 - Right Panel / Mount	Holding Switches	Engineering Est.	$2 K		
	3 - Head Set & Misc. HW	User Interface	Engineering Est.	$2 K	$40 K	
			TOTAL ROM MATERIAL COST FOR PHASE 2			**$876 K**

Table 60.7-3 summarizes the material for Phase 3 for the enhancement of the crew station simulators. This includes an upgrade to a Level II CIG.

Table 60.7-3 Phase 3 Material Summary for the Crew Station Simulator Upgrade

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
ONYX	I/F Board	Interface to Key Board	SGI	$2 K		
	I/F Board	Interface to Key Board	SGI	$2 K		
	Digital I/O Board	Controlling Switches	Engineering Est.	$2 K	$6 K	
ONYX CIG	Image Generator	Create Visuals	LADS-Bellevue	$644 K		
	SW and Licenses	Operational	LADS-Bellevue	$100 K	$744 K	
Crew Station	Key Board	Key Board Input	SGI	$2 K		
	Key Board	Key Board Input	SGI	$2 K		
	Disc Drive	Crew Data Inputs	SGI	$4 K		
	Misc. Switches	User Interface	Engineering Est.	$1 K	$9 K	
			ROM MATERIAL COST FOR UPGRADE TO PHASE 3			$759 K

Table 60.7-4 summarizes the material for Phase 4 enhancements.

Table 60.7-4 Phase 4 Material Summary for the VV&A Crew Station Simulator Enhancement

COMPONENT	SUB COMPONENT	TASKING	SOURCE	ROM COST	SUB TOTAL	TOTAL COST
ONYX	Digital I/O Board	Controlling Switches	Engineering Est.	$2 K		
	Analog Input Board	Reading Joy Stick Outputs	Engineering Est.	$2 K	$4 K	
Switch Panel	Key Pad	Numerical Inputs	Engineering Est.	$1 K		
	Push Buttons	Digital Inputs	Engineering Est.	$1 K		
	Panel / Mount	Holding Switches	Engineering Est.	$1 K	$2 K	$6 K
			TOTAL ROM MATERIAL COST FOR PHASE 1			$6 K

60.8 Travel & Other Direct Costs. Travel costs are estimated on the basis of approximately $1500 for each trip per person. This figure includes an estimated $1000 for airfare and $500 for room, meals, and transportation for two and one half days. Based on 24 months of total program, we estimate one trip a month for program management, 18 trips for technical meetings, 8 day trips each for Progress Design Review (PDR) and Critical Design Review (CDR), and 18 trips for integration, data collection, and acceptance.

Other direct costs (ODC) includes reproduction, postage, shipping, and miscellaneous costs not included under labor, materials, or travel.

The travel and other direct costs are summarized in the tables in paragraph 60.9.

60.9 Program Cost Summary. The following paragraphs summarize the estimated ROM costs for the AFAS/FARV program. Each table presents a summary for a specific phase along with a delta cost and total costs. The direct cost is an accumulative cost and includes a savings over the phased cost because some additional effort such as integration and material are not required. The phased cost reflects an incremental phased program with delayed software development tasks, additional integration tasks and hardware that is replaced in later phases.

A labor summary is presented in paragraph 60.9.4. The labor summary assumes a direct approach to Phase 4.

60.9.1 Phase 1 Summary. Table 60.9.1 summarizes the program cost for Phase 1 implementation of the table top simulators. Also included are options for expanding the number of crew stations available while retaining a single view point.

Table 60.9.1 Phase 1 - Table Top Simulator Cost Summary

Item	Description	Cost	Options	Comment
1	Labor	$450,000	$455,000	PM, SW Dvlpmt, HW Dvlpmt, Sys. Eng., Exp. Support
2	Materials (* See Note)	$278,000	$341,500	One View Image Generator, User I/O Monitor, SINCGARS
3	ModSAF Development	$63,793	$63,793	Supply AFAS/FARV Models and Basic Behaviors
4	Experiments	$58,905	$58,905	Test Ops/Dev, Data Analysis & Final Rpt.
5	Travel	$15,000	$15,000	This travel covers all areas of the AFAS/FARV development
6	Other Direct Cost	$1,000	$1,000	ODC are the Misc. items that occur during the length of the project
	Subtotal Experiment ost:	*$866,698*	$935,19[illegible]	* This cost is for the purchase of the required material for the upgraded version of the Table Top Simulator. It includes the ONYX computer, joy stick, hard switches, and the SINCGARS Radio.
	G&A:	$4,767	$5,144	
	Fee (10%):	$87,146	$94,034	
	Total Program ROM Cost:	$958,611	$1,034,376	

60.9.2 Phase 2 Summary. Table 60.9.2 summarizes the program cost for Phase 2 implementation of the crew station simulators.

Table 60.9.2 Phase 2 - Crew Station Simulator Cost Summary

Item	Description	Direct Cost	Delta Cost	Phased Cost	Comment
1	Labor	$1,600,000	N/A	$1,760,000	PM, SW Dvlpmt, HW Dvlpmt, Sys. Eng., Exp. Support
2	Materials (* See Note)	$876,400	N/A	$1,154,400	Build Crew Stations and Incorporate GT111 Image Generator
3	ModSAF Development	$152,445	$88,652	$152,445	Add LRP Models and Behaviors & more Behaviors for AFAS/FARV
4	Experiments	$137,224	N/A	$131,869	Test-Ops/Dev, Data Analysis & Final Rpt.
5	Travel	$55,000	$40,000	$55,000	This travel covers all areas of the AFAS/FARV development
6	Other Direct Cost	$6,000	$5,000	$6,000	ODC are the Misc. items that occur during the length of the project
	Subtotal Experiment Cost:	$2,827,069	N/A	$3,259,714	* This cost is for the purchase of the required material for the development of a Reconfigurable Crew Station Simulator. It includes the ONYX computer, a GT111G, 3 stations, hard switches, and the SINCGARS Radio. This cost assumes that no other hardware is available or previously purchased.
	G&A:	$15,549	N/A	$17,928	
	Fee (10%):	$284,262	N/A	$327,764	
	Total Program ROM Cost:	$3,126,879	N/A	$3,605,406	

60.9.3 Phase 3 Summary. Table 60.9.3 summarizes the program cost for Phase 3 implementation with upgrades of fidelity and integration of a Level II CIG.

Table 60.9.3 Phase 3 - Enhanced IG Crew Station Simulator Cost Summary

Item	Description	Direct Cost	Delta Cost	Phased Cost	Comment
1	Labor	$5,000,000	N/A	$6,160,000	PM, SW Dvlpmt, HW Dvlpmt, Sys. Eng., Exp. Support
2	Materials	$1,335,400	$759,000	$1,913,400	Enhanced Internal Components, Level II IG
3	ModSAF Development	$207,650	$55,205	$207,650	Add more Behaviors for AFAS/FARV
4	Experiments	$200,345	N/A	$189,941	Test Ops/Dev, Data Analysis & Final Rpt.
5	Travel	$85,000	$30,000	$85,000	This travel covers all areas of the AFAS/FARV development
6	Other Direct Cost	$11,000	$5,000	$11,000	ODC are the Misc. items that occur during the length of the project
	Subtotal Experiment Cost:	$6,839,395	N/A	$8,566,991	
	G&A:	$37,617	N/A	$47,118	
	Fee (10%):	$687,701	N/A	$861,411	
	Total Program ROM Cost:	$7,564,712	N/A	$9,475,520	

60.9.4 Phase 4 Summary. Table 60.9.4-1 summarizes the program cost for Phase 4 implementation with additional upgrades for fidelity and a V&V effort.

Table 60.9.4-1 Phase 4 - VV&A: Crew Station Simulator Cost Summary

Item	Description	Direct Cost	Delta Cost	Phased Cost	Comment
1	Labor	$7,030,375	N/A	$8,692,000	PM, SW Dvlpmt, HW Dvlpmt, Sys. Eng., Exp. Support
2	Materials	$1,341,400	$6,000	$1,919,400	Misc. HW Components for Upgrades
3	ModSAF Development	$245,369	$37,719	$245,369	Add more Behaviors for AFAS/FARV
4	Experiments	$200,345	N/A	$200,345	Test Ops/Dev, Data Analysis & Final Rpt.
5	Travel	$115,000	$30,000	$115,000	This travel covers all areas of the AFAS/FARV development
6	Other Direct Cost	$16,000	$5,000	$16,000	ODC are the Misc. items that occur during the length of the project
	Subtotal Experiment Cost:	$8,948,488	N/A	$11,188,114	
	G&A:	$49,217	N/A	$61,535	
	Fee (10%):	$899,771	N/A	$1,124,965	
	Total Program ROM Cost:	$9,897,476	N/A	$12,374,613	

Table 60.9.4-2 presents an assumed period of performance for a Phase 4 direct approach.

Table 60.9.4-2 AFAS/FARV Assumed Period of Performance

Task	Schedule: For ROM Purposes	Period of Perf.
3.1	Program Management	mon 1 - mon 24
3.2	Systems Engineering	mon 1 - mon 18
3.3	Product Development	mon 2 - mon 12
3.4	Software Engineering	mon 2 - mon 15
3.5	Systems Integration & Test Engineering	mon 11 - mon 18
3.6	Experiment Support	mon 17 - mon 24

Table 60.9.4-3 presents the labor summary for a Phase 4 direct approach in more detail for each WBS element.

Table 60.9.4-3 Labor Summary for a Phase 4 Direct Approach

3.1	Program Management	ROM Cost
	DO Manager	$280,593
	Quality Assurance	$0
	System Training	$16,570
	Facilities and Site Support	$0
	Administrative Support	$9,058
	Clerical	$4,959
	Subtotal:	$311,180

3.2	Systems Engineering	ROM Cost
	Lead Engineer	$281,257
	V&V Plan Development	$49,709
	V,V&A Specialist	$70,314
	Systems Development	$66,898
	Administrative Support	$12,961
	Clerical	$8,563
	Subtotal:	$401,280

3.3	Product Development	ROM Cost
	Crew Station Design	$46,890
	I/O Interface Design	$8,285
	Hardware Procurement	$9,394
	Systems Engineering Support	$29,970
	Crew Station Development	$0
	Administrative Support	$4,017
	Clerical	$2,654
	Subtotal:	$101,210

3.4	Software Engineering	ROM Cost
	Figures taken from SW Spread Sheets	5900000
	Subtotal:	$5,900,000

Table 60.9.4-3 Labor Summary for a Phase 4 Direct Approach [Continued]

3.5	Systems Integration & Test Engineering	ROM Cost
	HW/Systems Integration	$28,543
	SW/Systems Integration	$28,543
	Command & Control System Integration	$14,272
	Indirect Fire Control System Integration	$14,272
	Administrative Support	$3,336
	Clerical	$2,204
	Subtotal:	$91,169

3.6	Experiment Support	ROM Cost
	Technician Support	$18,175
	Field Technician Support	$22,450
	SAFOR Operators	$15,994
	Battle Master	$15,994
	Research Assistant	$7,483
	Data Analysis Engineer	$8,753
	Administrative Support	$4,726
	Clerical	$3,122
	Subtotal:	$96,698

Table 60.9.4-4 summarizes the total labor cost for a Phase 4 direct approach.

Table 60.9.4-4 Labor Summary

	Rqmt No.	Requirement Description	ROM Cost
ROM Tasks	3.1	Program Management	$311,180
	3.2	Systems Engineering	$401,280
	3.3	Product Development	$101,210
	3.4	Software Engineering	$5,900,000
	3.5	Systems Integration & Test Engineering	$91,169
	3.6	Experiment Support	$96,698
PMO LABOR		Contracts	$49,709
		Subcontracts	$22,299
		ROM/SOW/Proposal Preparation	$16,570
		Finance	$40,260
		Subtotal (Labor Cost):	$7,030,375

60.10 Assumptions. Throughout the development of this AFAS/FARV ROM, certain assumptions were made with regard to requirements, performance, schedule, and available models and hardware from other sources. We have repeated the assumptions here for reference and convenience of the reader.

The following assumptions were made during the development of this AFAS/FARV ROM.

1) The table top simulators and the crew station simulators each use dedicated hardware, i.e., a new computing system is acquired in Phase 2 for the crew station simulator.

2) Site facilities, including the DSI network connection, is GFE. No estimates are made for physical site preparation.

3) Software development is done in-house.

4) The predominant software language will be "C".

5) Visual databases, validated weapons models and data, MWTB software, AVTB software, SIMNET software, ARWA software, A^2ATD software, VIDS software, and IVIS software are GFI.

6) A relatively full suite of documentation is required to support experiment planning and preparation.

7) A full program through Phase 4 will be completed without delays between phases.

8) DIS standard for PDU definition will be Version 2.03 as a minimum. Requirements proposed in Draft 4 are considered.

9) COTS hardware and software will be used to the maximum extent possible.

10) V&V is required.

11) ModSAF is assumed to be "V&V"-ed under the A2ATD DO, less the AFAS/FARV entities.

12) The DIS support subsystems are developed and are available as GFI and GFE. The level of functionality are sufficient as provided, or can be modified with minimal effort for control and data. The ModSAF subsystem will be modified to include the AFAS/FARV icons and behaviors.

13) The DIS support subsystems are not costed in this FAS and are assumed that the hardware will be purchased through another contract, unless the ROM estimates are requested to reflect the additional hardware required.

14) No schedule has been assumed except as that which falls out of the estimation. The resulting nominal program schedule appears to be approximately 24 months through the completion of Phase 4.

15) Integration and testing is completed in the Loral SDF prior to shipment and final test on site.

16) The site is assumed to be at Ft. Sill, Okalhoma.

17) The simulation system is DIS compliant. All PDUs are accepted and may be filtered. PDU information and content may be passed to independently developed segments. The simulation system provides the DIS environment connectivity for the cell.