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Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Southwest Asia Corps/Division Scenario 7.0 (SWA CDS 7.0) Army of Excellence (AOE) Heavy Division Design Technical Report.

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The Training and Doctrine Command (TRADOC) Analysis Center at Fort Leavenworth Study and Analysis Center (TRAC-FLVN SAC) tasked the TRADOC Analysis Center at Fort Lee (TRAC-LEE) Vector-in-Commander (VIC) team to conduct an analysis of the Combat Service Support (CSS) portrayed in Southwest Asia Corps/Division Scenario 7.0 (SWA CDS 7.0). TRAC-LEE used VIC analysis to provide quantitative analysis of the effectiveness of the CSS during that scenario.

The dynamic gaming with the VIC model is based on the SWA CDS 7.0 scenario with a total duration of 48 hours incremented in four-hour time periods (TP) and one-hour reorder cycle time between CSS units. The modeled force cocsists ofthree armor brigades with corps support, one Marine Expeditionary Force (MEF) landing brigade, one Marine regimental landing team, and allied (Kuwaiti and Saudi) forces.

The analysis focuses first on those key maneuver resources necessary for a unit to perform its designated mission. The specific resources addressed are weapon system availability and the timely availability of supplies. Secondly, various aspects of the CSS system are examined to isolate bottlenecks or shortages, which limit the provision of needed services. And conversely, excesses or under-utilized CSS resources are identified for this scenario. The analysis entails three major areas: maintenance, medical, and supply support.

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GIST

STUDY TITLE: Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Southwest Asia Corps/Division Scenario 7.0 (SWA CDS 7.0) – CSS Analysis of VIC Dynamic Gaming Army of Excellence (AOE) Heavy Division Design.

PURPOSE: The purpose of this analysis was to produce quantitative analysis of the Army of Excellence Heavy Division Design's combat service support (CSS) structure which was dynamically gamed in the Soutwest Asia scenario with the VIC model. The focus of the analysis was on the maintenance and supply operations and how the CSS units functioned for the given scenario.

MAIN ASSUMPTIONS: The principal assumptions of this study include: (a) all repair parts were available upon request, (b) Echelons-Above-Division (EAD) were fully resourced, and (c) CSS enablers and other technological equipment are present.

PRINCIPAL FINDINGS: The CSS structure in the AOE Heavy Division could support the division during the 48-hour battle in the SWA CDS 7.0 scenario with a couple of exceptions. The M88 recovery operations for six recovery teams could not handle the workload produced during this scenario because the initial quantity of M88s given to these maneuver units. The armament mechanics maintenance man-hour (MMH) organic to the three forward support battalions (FSBs) were stressed during this scenario. These mechanics were over-utilized during the time of intense combat. Several artillery units expended all of their ammunition resources at some time during the scenario and could not be resupplied in a timely manner due to either a shortage of trucks or nonavailability of stocks for replenishment..

IMPACT: This report suggests that the CSS structure in the AOE Heavy Division is sufficient to sustain the division in a scenario such as the one portrayed in SWA CDS 7.0.

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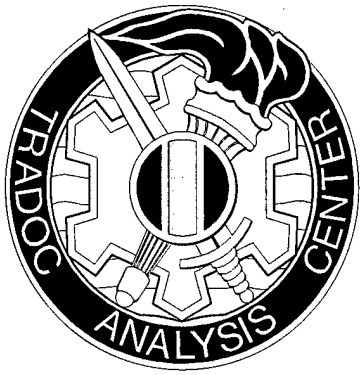
Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Southwest Asia Corps/Division Scenario 7.0 (SWA CDS 7.0)

CSS Analysis of VIC Dynamic Gaming Army of Excellence (AOE) Heavy Division Design.

Technical Report



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Vector-in-Commander (VIC) Analysis in
Support of Southwest Asia Corps/Division Scenario 7.0 (SWA CDS 7.0)

Army of Excellence (AOE) Heavy Division Design (SWA CDS 7.0)
15Apr98 VIC Analysis Data

1. General.

a. Major Charles Davis and Captain Philip Buford of the Training and Doctrine Command (TRADOC) Analysis Center at Fort Leavenworth Study and Analysis Center (TRAC-FLVN SAC) tasked the TRADOC Analysis Center at Fort Lee (TRAC-LEE) VIC team to conduct an analysis of the CSS portrayed in SWA CDS 7.0. TRAC-LEE used VIC analysis to provide quantitative analysis of the effectiveness of the CSS during that scenario.

b. The dynamic gaming with the VIC model is based on the SWA CDS 7.0 scenario with a total duration of 48 hours incremented in four-hour time periods (TP) and one-hour reorder cycle time between CSS units. The modeled force consists of three armor brigades with corps support, one Marine Expeditionary Force (MEF) landing brigade, one regimental landing team, and allied (Kuwaiti and Saudi) forces. Specific descriptions and details for both the scenario and modeled force are provided in the main scenario report.

c. The analysis focuses first on those key maneuver unit resources necessary for a unit to perform its designated mission. The specific resources addressed are weapon system availability and the timely availability of supplies. Secondly, various aspects of the CSS system are examined to isolate bottlenecks or shortages, which limit the provision of needed services. And conversely, excesses or under-utilized CSS resources are identified for this scenario.

d. The analysis entails three major areas: maintenance, medical, and supply support.

e. VIC unit name designators are used in this report for brevity. Appendix A shows the cross-reference between actual unit names and VIC unit names.

2. Model Description.

a. The VIC model is a two-sided, deterministic simulation of integrated land and air combat. The level of resolution is the maneuver battalion. As a deterministic model, VIC is driven by expected values; weapon systems, transporters, inventories/stockage levels, and utilization can be fractional values. VIC is event-stepped for maneuver elements and both time-stepped and event-stepped for calculation of CSS effects. The combat and combat support (C,CS) functions in VIC produce a workload for the CSS system. Two key modules within VIC are used to represent the CSS system: Return to Duty (RD - maintenance and medical) and Logistics (LO - supply).

b. The RD module operates on equipment and noncrew personnel, both of which are referred to as systems, as well as crews for key combat vehicles.

(1) Workloads. The attrition modules generate combat damage and casualty workloads in the form of combat-damaged systems. These quantities are adjusted to factor out catastrophic damage/killed in action (KIA) and abandonments (equipment only) before becoming a workload on the maintenance and medical system. Reliability failures to equipment and disease and non-battle injury (DNBI) to personnel are also generated, resulting in their removal from units and their introduction as workload upon the RD system.

(2) Processes. The RD module contains representations of the recovery, evacuation, and repair functions for weapon systems and recovery, evacuation, and treatment of personnel.

(a) Recovery is constrained by the availability of operational recovery vehicles. Recovery operations are represented as a delay time, which includes round trip travel, hook-up, and drop-off. The recovery time varies from vehicle to vehicle and the primary location of that vehicle.

(b) Evacuation is constrained by the availability of operational evacuation vehicles and dynamic evacuation times that are a function of distance and time on the main supply route (MSR) network.

(c) Repair is constrained by the available strength and type of assigned mechanics or medical personnel. Repair throughput is impacted by the 'time to repair.' A maintenance unit's maintenance man-hours (MMH) are degraded by 50 percent when that unit has to relocate on the battlefield.

(3) Products. The final product of the RD module is the return of crewed systems to owning units. Intermediate products of the various RD processes include recovered systems, evacuated systems, and repaired systems.

(4) Combat impacts on RD processes. Impacts include attrition of RD assets, productivity degradation due to unit movement, changes in evacuation distances due to unit movements, and changes in evacuation speeds due to congestion of MSR links.

c. The LO module provides the support structure to facilitate the resupply of ammunition and fuel to maneuver units and the restocking of these supplies at supply units.

(1) Workloads. The attrition modules dynamically generate the workload for ammunition as units engage in conflict. As units move and change posture they create a workload for fuel. A workload for other supplies is generated by a daily utilization rate, depending upon unit types. When maneuver units deplete their basic loads to specified reorder levels, a utilization of resupply is levied on the CSS system.

(2) Processes. The LO module contains representation of the resupply and move functions. Resupply to maneuver units is constrained by the availability of resupply vehicles, availability of supplies at supply units, load times, and travel time between the unit and its supplier. The availability of supplies at supply points is constrained by transportation, availability of load facilities, and load/unload

times. The move function is constrained by the availability of CSS trucks, congestion of the MSRs, and travel times between supply units.

(3) Products. The final product for the resupply and distribution system is the replenishment of expended ammunition, fuel, and other supplies to maneuver units. Intermediate products include the restocking of resupply units and the movements of supplies along the MSRs from higher echelon supply units.

(4) Combat impacts on LO process. Attrition and movement of supply units as a result of combat effects degrade the ability of these units to perform their resupply function. Resources which can be destroyed at the supply units include resupply vehicles, stocks, and materiel-handling equipment (MHE). The relocation of supply units results in degradation of their receipt/issue capability during the move. In addition, attrition of resupply vehicles, both at the maneuver unit and along the MSRs, degrades the ability of the CSS system to deliver supplies.

3. Assumptions.

a. When damaged weapon systems reach a maintenance facility, the correct tools, parts, and equipment are present at the facility. There is a delay of two hours for the necessary replacement part for the first damaged weapon system arriving at the maintenance facility. If the number of mechanics necessary to work on the damaged weapon system is available, they will begin working on the damaged weapon system immediately (i.e., prep time and time spent for damage assessment are not played in the model).

b. Resupply of all stockage items is available from echelons above corps (EAC).

c. All injured personnel will be recovered to the treatment facilities without constraint of availability of medical recovery vehicles.

4. Sufficiency Criteria.

a. Equipment. Maintain 80 percent availability of systems that have not been destroyed or abandoned. Rationale: Army Regulation (AR) 220-1, Unit Readiness Reporting, defines an equipment availability status of 80-90 percent as category C2 which is fully combat ready with minor risk.

b. Personnel.

(1) Have no weapon systems in awaiting-reissue queue due to nonavailability of crews. Rationale: The availability of weapon systems crews affects the availability criterion for combat systems.

(2) Maintain 80 percent personnel strength level for all modeled personnel. Rationale: AR 200-1 defines a personnel strength level of 80-90 percent as category C2 that is combat ready with minor risk.

c. Supply. Have no zero balance of any supply-class subitem (e.g., 155mm; 120mm; Petroleum (Bulk)). Rationale: The lack of a specific type could adversely affect tactical options.

5. Maintenance Analysis.

a. The six weapon system categories covered in this analysis are shown in table M-1. The Fixed Wing category was not represented in the CSS system. In addition, medical treatment of personnel and weapon system crews is presented as a separate category.

Table M-1: Key Weapon Systems by Category

Category	Weapon System
TANK	M1A1 M1A2
AFV	IFV/TOW BSFV LAV AAV
ADA	AVENGER
MLRS	MLRS HIMARS
CANNON	155HIP
HELICOPTERS	AH64D OH58D AH-1

b. The primary maintenance performance measure at the maneuver unit level is availability of unit weapon systems. Availability of unit weapon systems is determined by the current strength of weapon systems at a maneuver unit versus the initial strength less the number of catastrophically killed weapon systems at the same maneuver unit. The number of weapon systems available is a function of many dependent and interdependent factors. These factors can be partitioned into two groups: (1) those factors which render weapon systems inoperable: combat damage and reliability and (2) factors that contribute to the return of repaired systems to combat. When more weapon systems are returned to combat, a larger population is available for combat and reliability failure, which in turn workloads the Return-to-Combat (RTC) support system.

(1) Factors, which cause weapon systems to become inoperable, are combat damage and reliability failures. Combat damage is a function of the interaction of opposing forces resulting in catastrophic kills and repairable battle damage. The percentage of catastrophic kills versus the percentage of repairables varies by weapon system due to threat weapons and survivability characteristics. Table M-2 shows the percent repairable for each system once combat damaged. The percentages are not measures of overall survivability but are conditional results based on a weapon system first being combat damaged. Overall survivability also involves the likelihood of a weapon system being acquired and then being hit by the enemy. The percentages in table M-2 are, therefore, predicated on the occurrence of these two events. Table M-3 lists the percentage of organization (AVUM), direct support (AVIM), and general support repair for the weapon systems listed in table M-2.

Table M-2: Percent Repairable by Weapon System

Weapon System	Percent Reparable	Weapon System	Percent Reparable
M1A1	93	MLRS	61
M1A2	93	HIMARS	61
IFV/TOW	83	155HIP	49
BSFV	83	AH64D	41
LAV	60	OH58D	41
AAV	60	AH-1	18
AVENGER	69		

Table M-3: Percent Repairable by Support Echelon

Weapon System	% ORG Repair	% DS Repair	% GS Repair
M1A1	84	9	0
M1A2	84	9	0
IFV/TOW	34	47	2
BSFV	38	43	2
LAV	40	20	0
AAV	40	20	0
AVENGER	57	10	2
MLRS	19	14	28
HIMARS	72	2	17
155HIP	43	6	0
AH64D	23	18	--
OH58D	23	18	--
AH-1	9	9	--

(2) Permanent losses of operational systems can occur in several ways. The most frequent is usually due to catastrophic combat damage. In addition, both types of candidate repairables (combat and reliability) are subject to weapon system abandonment at the maneuver unit or maintenance unit level. Maneuver and maintenance unit abandonment of weapon systems occurs due to immediate war-fight conditions, thus becoming permanent losses like catastrophic kills. Weapon systems can be traveling on an MSR when the scenario ends; thus these weapon systems are not considered part of a combat unit's arsenal.

Another key factor, which affects availability, is the nonavailability of an owning unit. This occurs when a maintenance unit has repaired systems but does not have a maneuver unit in its area of influence with authorization to accept the system. In some cases, such weapons are never reissued during the scenario. Crewed weapon systems' RTC may be delayed because the appropriate number of crewmembers is not available to operate the weapon system. All six of these factors {catastrophic damage (k-kills), abandonments (maintenance unit and maneuver unit), currently being reissued, unit non-availability, and weapon systems waiting crews} are independent of the CSS system performance. Table M-4 shows the number of systems for each of these categories at the end of the scenario.

Table M-4: Weapon System Losses

Weapon	# Weapons Waiting Units	# Weapons Waiting Crews	# Weapons Being Reissued	Maintenance Unit Abandonments	Maneuver Unit Abandonments	K-Kills	Total
M1A1	77	30	6	44	35	25	217
M1A2	19	0	0	0	1	6	26
IFV/TOW	42	45	9	10	50	39	195
BSFV	0	0	0	0	0	0	0
LAV	0	4	12	0	0	8	24
AAV	6	0	0	0	0	2	8
AVENGER	27	0	0	0	0	11	38
MLRS	0	3	0	0	0	8	11
155HIP	0	4	0	0	0	23	27
AH64D	0	0	3	0	0	7	10
0H58D	0	0	0	0	0	0	0
AH-1	0	0	0	0	0	0	0
Total	171	86	30	54	86	129	

(3) Reliability failures are based on mean hours between failures (MHBF) for the major subsystems of each weapon. The major subsystems for this study are Automotive, Armament, Helicopter, and Medical. Of course, the subsystems that fail or are damaged vary by weapon systems (e.g., the M1A2 is composed of both subsystems, automotive and armament, while only automotive is represented for the heavy equipment transporter (HET)). A different mechanic type services each subsystem. In addition, the MHBF can vary by subsystem for each weapon. Helicopters, for this analysis, are serviced by a single type master mechanic although both automotive and armament failures occur for helicopters. In addition, a single medical type treats all wounded/DNBI personnel. The availability and performance of trucks used for resupply is addressed in the supply section of the report.

(4) Factors which influence the RTC of weapon systems are recovery, evacuation, and repair (to include medical treatment of personnel and crews) resources. Each of the CSS resources which performs these services is subject to both combat damage and reliability failure, which determine their availability for weapon system processing and treatment of personnel. Recovery and evacuation are performed on a designated priority basis, while repair and treatment are based on a more complex priority system. Further complicating the impact of repair on weapon system RTC are the repair characteristics of individual weapon systems. These characteristics vary by level of repair (i.e., organization (ORG), direct support (DS), and general support (GS)), and mean time to repair for each type repair (combat, reliability). These characteristics represent a very complex interrelated system, which determines the number of operational weapon systems.

c. Analysis. The maintenance analysis is divided into two sections (Support Services Sufficiency and Key Weapon Availability):

(1) Support Services Sufficiency.

(a) Recovery - Weapons.

1 With six exceptions, recovery operations serviced the recovery workload in a timely manner. "Timely manner" is defined as

servicing the recovery workload within two TPs for a given maintenance unit. To meet this criterion the recovery workload at the end of one TP must be serviced in the next time period. The reason for this explanation of "timely manner" is to account for the maximum time of 96 minutes it takes for a recovery vehicle to assist in the recovery of a damaged weapon system or vehicle. If a vehicle requires an assisted recovery during the last half of the current TP, that vehicle would not reach the designated maintenance area until the next TP. The two recovery vehicles modeled are the improved recovery vehicle (M88) and a generic recovery vehicle (HMTWRECKER) which represent all other recovery vehicles, which are not M88s. Table M-5 provides an overview of both recovery vehicles' status for the scenario where:

Initial Strength (Initial Str) is the assigned density at the start of the scenario.

Average Strength (AVG) is the expected number operational throughout the scenario.

Lowest Strength (LOW) is the smallest number operational within any TP.

Highest Strength (HIGH) is the largest number operational within any TP.

Table M-5: M88 and HMTWRECKER Availabilities

M88					HMTWRECKER				
Unit ID	Initial Str	AVG	LOW	HIGH	Unit ID	Initial Str	AVG	LOW	HIGH
B00000	10	10	10	10	B000AH	6	6	6	6
B000AH	3	3	3	3	B01CSA	103	102	101	103
B01CSA	49	47	46	49	B201AH	6	6	6	6
B20002	15	15	14	15	B20DSA	33	33	33	33
B200MX	1	1	1	1	B210AR	6	3	0	6
B201AH	3	3	3	3	B210EN	6	6	6	6
B20DSA	15	14	14	15	B211AR	6	6	6	6
B210AR	2	1	0	2	B212AR	6	6	6	6
B210EN	1	1	1	1	B213MX	6	6	6	6
B211AR	2	2	2	2	B21BSA	40	22	0	40
B212AR	2	2	2	2	B220AR	6	6	5	6
B213MX	1	1	1	1	B220EN	6	6	6	6
B21BSA	17	9	1	17	B221AR	6	6	6	6
B220AR	2	2	2	2	B222AR	6	6	6	6
B220EN	1	1	1	1	B223MX	6	6	6	6
B221AR	2	2	2	2	B224MX	6	6	6	6
B222AR	2	2	2	2	B22BSA	31	21	0	31
B223MX	1	1	1	1	B230AR	6	6	6	6
B224MX	1	1	1	1	B230EN	6	6	6	6
B22BSA	14	9	0	14	B231AR	6	6	6	6
B230AR	2	2	2	2	B232AR	6	6	6	6
B230EN	1	1	1	1	B233MX	6	6	6	6
B231AR	2	2	2	2	B23BSA	28	21	0	28
B232AR	2	2	2	2	B50SSA	15	15	15	15
B233MX	1	1	1	1	B511EN	6	6	6	6
B23BSA	9	7	0	9	B511MX	6	6	6	6
B50000	1	1	1	1	B513IN	3	3	3	3
B50SSA	8	8	7	8	B514AR	6	6	6	6
B510MX	6	6	5	6					
B511EN	1	1	1	1					
B511MX	3	3	3	3					
B513IN	1	1	1	1					
B514AR	3	3	3	3					

2 Table M-6 lists the recovery workload for all maintenance units by recovery vehicle type.

Table M-6: M88 and HMTWRECKER Recovery Workloads

Maintenance	Recovered by			Maintenance	Recovered by		
Unit	HMTWRECKER	M88	TOTAL	Unit	HMTWRECKER	M88	TOTAL
B00000	0	7	7	B223MX	0	17	17
B000AH	1	1	2	B224MX	2	16	18
B01CSA	451	6	457	B22BSA	3	6	9
B20002	0	47	47	B230AR	13	2	15
B200MX	0	31	31	B230EN	0	23	23
B201AH	1	1	2	B231AR	0	18	18
B20DSA	24	2	26	B232AR	4	34	38
B210AR	22	6	28	B233MX	0	8	8
B210EN	1	25	26	B23BSA	53	10	63
B211AR	4	17	21	B50000	0	2	2
B212AR	2	5	7	B50SSA	1	1	2
B213MX	3	25	28	B510MX	0	10	10
B21BSA	73	23	96	B511EN	3	28	31
B220AR	4	3	7	B511MX	3	8	11
B220EN	1	24	25	B513IN	0	0	0
B221AR	0	5	5	B514AR	4	17	21
B222AR	0	12	12				

3 Recovery operations for the engineer battalions by M88s located in the 1st and 2nd maneuver brigades listed in table M-7. The recovery operations for four maneuver battalions are located in table M-8.

a M88 recovery operations for the engineer battalion in the 1st battalion were not handled in a timely manner. The end of TP 7 did not recover the number of vehicles that needed to be recovered by this battalion's single M88 at the end of TP 6. Three CEVs, two BCMDVEHs, and one M113 were the vehicles waiting for recovery at the end of TP 6 and these systems were not evacuated for another eight hours. The M88 in the 2nd battalion's engineer battalion had difficulties with the workload produced during the latter part of the scenario (TPs 9-11). The number of vehicles that needed to be recovered at the end of TP 9 was ten (five M113s, three BCMDVEHs, 1 CEV, and 1 AVLB). The end of the next TP recovered only one M113 and the AVLB. This shortfall continued for the remainder of the scenario.

Table M-7: M88 Recoveries by Two Engineer Battalions

TP	1	2	3	4	5	6	7	8	9	10	11	12
	B210EN											
# REC.	1	2	2	2	2	3	3	3	3	3	2	1
WAITING REC.	0	0	1	1	1	7	7	5	3	1	0	0
	B220EN											
# REC.	1	2	2	2	2	2	2	2	2	3	3	3
WAITING REC.	0	0	0	0	0	0	0	0	10	8	7	5

b Forward M88 recovery operations for the 3rd mechanized infantry of the 1st brigade (unit **B213MX**) were encumbered during the 8th and 9th TPs. At the end of TP 8, eight vehicles (which included five M1A1s and two IFV/TOWs) required recovery by an M88. From this point on, M1A1s and IFV/TOWs were always waiting to be recovered. At

the end of the scenario, four M1A1s and one IFV/TOW were still waiting to be recovered by an M88. The 3rd mechanized infantry of the 2nd brigade (unit **B223MX**) had problems with its recovery operations in the latter half of the scenario. At the end of TP 9, eight IFV/TOWs, three M113s, and two BCMDVEHs were still waiting to be recovered to the maintenance area. These systems were being recovered from TP to TP but were never entirely recovered even by the end of the scenario. The 4th mechanized infantry of the 2nd brigade (unit **B224MX**) had similar recovery problems compared to the 3rd battalion. The end of the 9th TP saw a recovery backload of fourteen weapon systems with only three being recovered by the next TP. Among these eleven non-recovered systems were eight IFV/TOWs, two M113s, and one BCMDVEH. The 2nd armor battalion of the 3rd brigade (unit **B232AR**) had M88 recovery problems late in the scenario. Combat damaged weapon systems that needed recovery from the battlefield numbered 23 at the end of TP 7. With two M88s forward in this battalion, six weapon systems a TP was the rate of recovery for the rest of the scenario. This workload was eventually recovered but not in a timely manner (e.g., 13 M1A2s, three IFV/TOWs, and two M113s were waiting to be recovered at the end of TP 8).

Table M-8: M88 Recoveries by Four Maneuver Battalions

TP	1	2	3	4	5	6	7	8	9	10	11	12
	B213MX											
# REC.	3	3	1	1	2	3	3	3	3	3	Dead Unit	
WAITING REC.	3	1	0	0	6	3	4	8	5	5		
	B223MX											
# REC.	0	1	1	1	1	1	1	2	3	3	3	3
WAITING REC.	0	0	0	0	0	0	0	8	13	10	7	4
	B224MX											
# REC.	0	1	1	1	1	1	1	1	3	3	3	3
WAITING REC.	0	0	0	0	0	0	0	0	14	11	8	5
	B232AR											
# REC.	1	1	1	1	1	1	3	6	6	6	6	3
WAITING REC.	0	0	0	0	0	0	23	18	12	7	2	0

4 Conclusion:

> The M88 recovery operations in the six above-mentioned units were hampered by the lack of recovery vehicles. An additional two or more M88s strategically located near these units would have alleviated these recovery problems.

(b) Recovery - Personnel.

The recovery of injured personnel is implied; therefore, injured personnel do not require a recovery vehicle for transport from the battlefield to a medical facility. This phenomenon negates the possibility of a backlog of injured personnel needing recovery. Hence, recovery assets will never impede personnel RTD.

(c) Evacuation - Weapons.

1 HETs and a generic evacuation vehicle perform evacuation support in the scenario. The purpose of the generic evacuation vehicle

is to represent the backhaul capability of other transporters. The analysis focuses on the HETs because they are considered potential constraints on evacuation. All but four of the key weapon systems utilize HETs for evacuation. The exceptions are AH64D, OH58D, UH-1, and the AVENGER. Only the performance of HETs is addressed. Weapon system evacuations are performed in a "timely manner" if damaged weapon systems are evacuated to the designated area (corps or division) within two TPs of the sustained damage.

2 Evacuation in this scenario is supported at the division area (unit B200MX) and at the corps forward area (unit B00000) with 15 and 60 HETs assigned, respectively. Evacuations occur for two reasons:

- designation of maintenance support at higher support levels.

- maintenance overflow (maintenance overflow occurs when the number of hours needed to repair awaiting weapon systems exceeds a maintenance man hour threshold set for a maintenance unit).

3 Across the scenario, 84 percent of the corps area's HETs and 84 percent of the division area's HETs were available at any given TP.

4 There were 307 vehicle and weapon system evacuations to the corps area, which required a HET (refer to table M-9). These vehicles and weapon systems included 155 M113s, 48 M1A1s, 15 IFV/TOWs, and 2 MLRS. As shown in table M-9, not all of these systems were evacuated to the corps area in a timely manner. At the end of TP 2, 114 systems required a HET for transport. It took an additional ten hours to evacuated these vehicles to the corps area. The 26 vehicles and weapon systems that were evacuated to the DSA were done so in a timely manner. During this portion of the scenario, the number of weapon systems damaged was immense due to the combat intensity. These 114 systems were evacuated gradually as the scenario progressed.

Table M-9: HET Evacuations to the Corps Area

TP	1	2	3	4	5	6	7	8	9	10	11	12
# EVAC.	9	40	42	55	40	67	30	10	6	4	3	3
WAITING EVAC.	50	114	90	59	36	39	16	9	6	5	4	4

5 Conclusion:

> Time-distance factors and the magnitude of the workload produced by the scenario hampered the corps from evacuating the necessary vehicles and weapon systems to the CSA. As shown in table M-9, the backlog of vehicles requiring evacuation was depleted before the scenario ended but not in a timely manner.

(d) Evacuation - Personnel.

1 Injured personnel evacuation is performed in the scenario by ambulance. Injured personnel have to be evacuated to a higher echelon for treatment when they have sustained either combat damage or DNBI of

a severe nature. Personnel evacuations are performed in a "timely manner" if the injured personnel are evacuated before their wounds become fatal from receiving no treatment.

2 Ground evacuation is supported at the corps area by unit B00000 and at the division area by unit B200MX.

3 The corps has 64 ambulances and the division has 48 ambulances for personnel evacuations. Damage to these ambulances is negligible during the course of the scenario. An ambulance can transport four injured personnel in one trip.

4 There were 1488 injured personnel evacuated to the Corps Storage Area (CSA) during the scenario. Another 3966 injured persons were waiting for an ambulance at the end of the scenario. The reason for this was the Army's CSA was being used by the Green forces for treatment for their injured personnel. The CSA's ambulances could not handle this additional workload. The 50 personnel evacuations to the DSA were completed in a timely manner.

5 Conclusion:

> The injured person workload produced by this scenario could not be handled by the CSA. Lack of HNS ambulances were the main factor for this shortfall.

(e) Repair - Ground Based Weapons.

1 Sufficient repair support is determined by the availability of required mechanic types at the supporting maintenance facility. Table M-10 shows, for assigned mechanics, the maximum MMH percentage utilized for each of the 36 maintenance facilities across the scenario. When this percentage is 100 sufficient mechanics were not available to service the workload at some point during the scenario.

2 There is one exception to the above described 100 percent indicator - maintenance backlog overflow. Resource status is reported only at the end of a TP thus making it possible that 100 percent utilization occurred within the TP but shows less at the end of the TP due to completion of repairs. So the condition can exist where the ending TP utilization is less than 100 percent but within TP conditions existed that caused maintenance backlog overflow.

3 In general, for those facilities with less than 100 percent utilization at the end of a TP, sufficient maintenance resources were always available. There were only minor exceptions when very small fractional workloads were evacuated due to backlog status and the MMH utilization was not 100 percent. Any under-utilized resources are not necessarily "excesses" but are indicators of the magnitude of the workload for this scenario. Force structure implications are not addressed in this report.

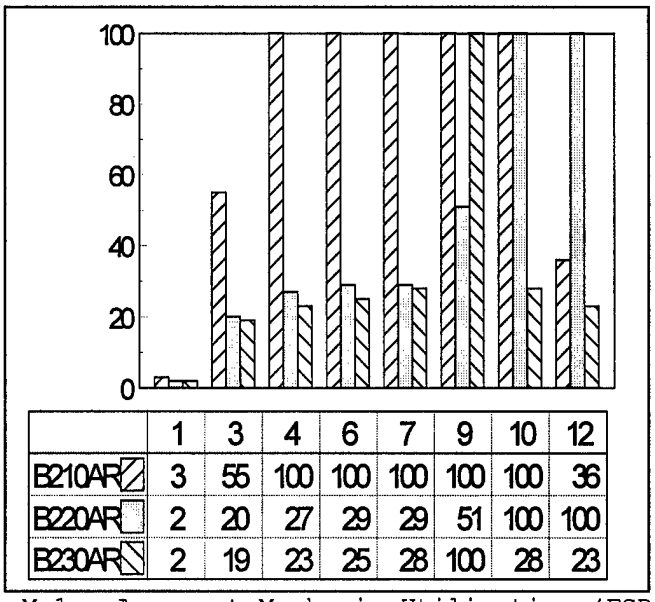
4 Figures M-1 through M-3 show the MMH utilization by mechanic type for those maintenance units with 100 percent utilization.

Table M-10: Utilization and Initial Strength by Maintenance Unit

Unit Name	Armament		Automotive		Helicopter		Medical	
	Util. %	Str.	Util. %	Str.	Util. %	Str.	Util. %	Str.
B00000	47	96	7	144	62	53	65	138
B000AH	0	1	18	6	27	21	32	7
B01CSA	0	3	100	10			95	6
B20002	82	11	100	24			100	6
B200MX	65	32	73	48	12	53	100	46
B201AH	0	1	19	6	25	21	32	7
B20DSA	0	2	53	10			95	6
B210AR	100	23	95	106			100	48
B210EN	75	5	61	24			100	6
B211AR	41	21	44	45			70	11
B212AR	29	21	27	45			76	11
B213MX	37	22	31	60			76	11
B21BSA	0	1	100	1			100	3
B220AR	100	23	57	106			100	48
B220EN	100	5	56	24			73	6
B221AR	29	21	9	45			47	11
B222AR	35	21	21	45			68	11
B223MX	26	22	16	60			96	11
B224MX	35	22	14	60			76	11
B22BSA	0	1	100	1			100	3
B230AR	100	23	46	106			100	48
B230EN	9	5	55	24			51	6
B231AR	47	21	38	45			48	11
B232AR	100	21	68	45			71	11
B233MX	22	22	6	60			53	11
B23BSA	0	1	100	1			100	3
B50000	98	32	45	48	4	53	100	46
B500AH	0	1	0	6	14	21	32	7
B501CH	0	1	0	6	32	44	68	7
B50SSA	0	3	21	10			95	6
B510MX	100	23	37	106			100	48
B511EN	100	5	100	24			100	6
B511MX	21	22	28	60			45	11
B512MX	15	22	22	60			49	11
B513IN	10	1	16	1			75	6
B514AR	35	21	24	60			54	11

a In the US Army units, the armament mechanics in the three Forward Support Battalions (FSBs) and two battalions (one maneuver (B232AR), one engineer (B220EN)) were 100 percent utilized for at least one TP during the scenario.

- The armament mechanics utilization in the 1st, 2nd, and 3rd brigades' FSBs are illustrated in figure M-1.



	1	3	4	6	7	9	10	12
B210AR	3	55	100	100	100	100	100	36
B220AR	2	20	27	29	29	51	100	100
B230AR	2	19	23	25	28	100	28	23

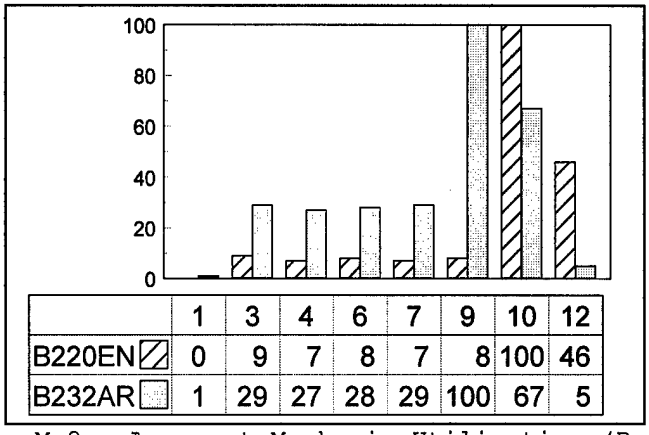
Figure M-1: Armament Mechanic Utilization (FSBs)

- The armament mechanics in the 1st brigade's FSB were fully utilized from TP 4 to TP 10. Starting at TP 4, the following vehicles were waiting for armament mechanics to become available: eleven M1A1s, seven 120MTRs, six M113s, five IFV/TOWs, and one HMMWV/MK19. TP 6 saw the largest backlog of unserviceable vehicles and weapon systems. Twelve M1A1s, eleven IFV/TOWs, eight 120MTRs, seven M113s, and two HMMWV/MK19s sought armament repair during this TP but had to wait for service. Maintenance overflow occurred at this FSB with four CEVs, two M113, and one AVENGER having to be evacuated to the CSA for maintenance.

- TP 10 and 12 saw maximum utilization of the armament mechanics in the 2nd brigade's FSB. Minimal maintenance overflow occurred with one IFV/TOW and one M113 being evacuated to the CSA for repair. At the end of TP 10, thirteen M113s, eleven IFV/TOWs, ten 120MTRs, and three M1A1s had to wait for armament repair. The delay in armament repair was a product of the massive workload produced by combat surges late in the scenario.

- The armament mechanics in the 3rd brigade's FSB were fully utilized in TP 9 only. Only one 120MTR was waiting for armament repair at the end of TP 9. This would indicate that the number of armament mechanics at this FSB was adequate to handle the workload produced during this scenario.

- The armament mechanic utilization in 2nd brigade's engineer battalion and the 2nd armor battalion of the 3rd brigade in figure M-2.



	1	3	4	6	7	9	10	12
B220EN	0	9	7	8	7	8	100	46
B232AR	1	29	27	28	29	100	67	5

Figure M-2: Armament Mechanic Utilization (Battalions)

- The armament mechanics in the 2nd brigade's engineer battalion were fully utilized only in TP 10 while the mechanics in the 2nd armor battalion of the 3rd brigade were maximized in TP 9. At the end of TP 9, three M113s were waiting for armament service by the mechanics in the engineer battalion. This event and the 46 percent utilization of the armament mechanics in TP 12 would indicate that the number of mechanics at this maintenance facility was adequate enough to service the workload produced by the scenario. A similar event occurred for the armament mechanics in the 2nd armor battalion of the 3rd brigade maintenance team at TP 9 and 10.

b In the US Army units, the only maintenance unit that had automotive mechanic over-utilization problems was the org level maintenance facility supporting the division artillery units (unit B20002). The automotive mechanic utilization in this unit is graphical represented in figure M-3.

- The automotive mechanics in this maintenance facility used all MMH available from TP 6 on. At the end of TP 6, seven 155HIPs, two MLRS, two FAASVs, and two M88s were waiting for automotive mechanics to become available at this maintenance facility. The largest buildup of unserviced systems took place at the end of TP 9 (23 systems total). At this juncture, eleven 155HIPs, one MLRS, three FAASVs, and two M88s were still waiting for automotive repair. Maintenance overflow occurred with four 155HIPs, two FAASVs, and one M88 having to be evacuated to the CSA for repair.

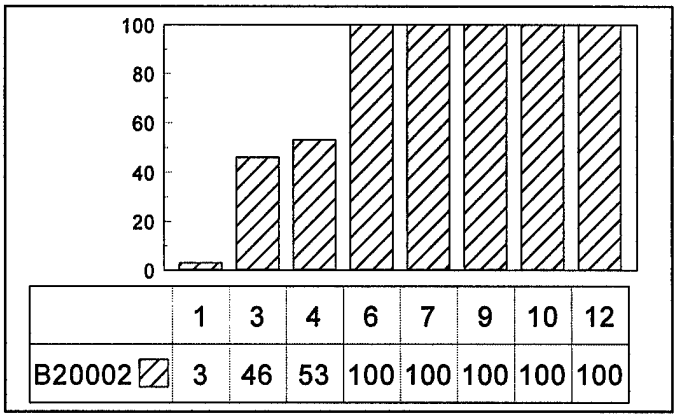


Figure M-3: Automotive Mechanic Utilization (DIVARTY)

5 Conclusion:

> The armament mechanics in the FSBs could not handle the maintenance workload produced during this scenario. These mechanics were over-utilized during the time of intense combat. The org level automotive mechanics supporting the division artillery also had a maintenance shortfall. This was a result of the quantity of combat damaged systems needing repair by these mechanics.

(f) Repair - helicopters.

Note: The AH64D, OH58D, and the AH-1 are the systems represented by the helicopter weapon system category.

1 Sufficient helicopter repair support is determined by the availability of required helicopter mechanics at the supporting maintenance facility. The number of helicopter mechanics assigned to the helicopter battalions, the corps area, and division area can be found in table M-10. Note from these tables that none of the helicopter maintenance facilities had their mechanics 100 percent utilized during any TP of the scenario.

2 Recovery - The AH64D, OH58D, and AH-1 do not require assisted recovery. If one of these helicopters receives non-catastrophic damage, that helicopter is assumed to self-recover. Recovery assets will never impede helicopter RTC.

3 Evacuation - The AH64D, OH58D, and AH-1 do not require a HET for evacuation. Instead, a generic evacuation vehicle is used to evacuate AH64Ds and RAH66Ds. The availability of HETs does not hamper the process of helicopter evacuation.

4 Conclusion:

None of the three CSS assets (recovery, evacuation, and repair) restricted helicopter RTC during the scenario.

(g) Medical treatment.

1 Personnel can be in one of the following three categories: combat ready, in the medical treatment process, or KIA. When injured personnel arrive at a medical facility, they receive treatment immediately, have to wait for the next available medic, or have to be evacuated to a higher echelon because of the severity of the wound. After treatment, injured personnel are returned to their respective unit. At TP 12, the theater's Blue troop force was at 71 percent, its lowest availability during any TP of the scenario. The KIA column is the accumulative blue troop losses over the scenario. (Note: The "Combat Ready" column summed with the "Being Treated" column will not always equal the initial strength (TP 0) because of the number of troops that are combat ready but were stationed at a unit which has since been destroyed, reference tables M-12 through M-15).

Table M-11: Theater Personnel Profile

TP	Combat Ready	Being Treated	Waiting for Unit	KIA	% AVAIL
0	36,307	0	0	0	100
1	35,114	291	812	90	97
2	35,206	466	545	90	97
3	35,551	437	220	99	98
4	34,630	512	1,036	129	98
5	33,577	1,235	1,073	422	96
6	33,198	1,417	1,116	576	97
7	31,058	2,585	1,374	1,290	94
8	27,368	4,694	2,575	1,670	86
9	23,323	6,770	3,437	2,777	78
10	22,716	6,788	3,760	3,043	78
11	19,586	8,368	4,525	3,828	73
12	19,097	8,834	4,206	4,170	71

2 During the course of the scenario, the majority of personnel that are not combat ready are being treated or awaiting treatment at the MEF SSA area (during TP 12 there were 2,851 troops waiting for treatment in the area).

3 Conclusion:

The corps had a substantial number of injured personnel evacuated to its medical teams during the scenario. The treatment time for these individuals was the reason for the large number of injured personnel still being treated at the end of the scenario. Medical teams organic to echelons lower than division did not constrain personnel RTC.

(2) Key Weapon Availability.

(a) Up to this point the analysis has addressed individual CSS support services (recovery, evacuation, repair, medical treatment) and their impact on RTC. With the exceptions noted, for the most part each of these support services was sufficient for the available workloads.

(b) The following section of the report, in effect, examines the cumulative effects of CSS services by looking at the availability of key weapons. Tables M-12 through M-24 provide unit level overviews for each key weapon system.

1 Each table (M-12 through M-24) contains the following information:

-Initial Strength (Str) - weapon system density at the start of the scenario.

-End Strength (Str) - weapon system density at the end of the scenario.

-Permanent Losses (K-kills) - catastrophic kills and abandonments.

-End % availability - weapon system availability at the end of the scenario. This availability calculation excludes permanent losses in conformance with the earlier described sufficiency criteria. Permanent losses are excluded because their occurrence is independent of how well (or poorly) CSS performs.

-Average availability (Avg) - the average number of weapon systems available based on the number available per TP for the entire scenario.

-Lowest availability (Low) - the smallest number of weapon systems available based on the number available per TP for the entire scenario.

-Highest availability (High) - the largest number of weapon systems available based on the number available per TP for the entire scenario.

2 Two phenomena appearing in the following tables warrant discussion:

a A "dead unit" is indicated when the "end strength" and "availability" are zero. A "dead unit" occurs when significant unit resources are decimated and that unit can no longer effectively function. Its surviving resources, damaged and undamaged, are distributed to repair or other units requiring weapons, respectively. The row in each table for dead units is shaded.

b One would expect the "end strength" to always be smaller than initial strength if there were permanent losses. This is not always the case because of the need-based reissue of repaired (and crewed) weapons. Depending on the current available strength of a weapon, reissues are distributed proportionally higher to those units with the

greatest need (lowest current strength) and not to the unit which originally "owned" the weapon.

(c) Results:

- The ending availability of the M1A1s in unit B222AR was below the 80 percent mark at the end of the scenario (reference table M-12). This unit had six M1A1s in the process of being reissued at the conclusion of TP 12. When these M1A1s are returned to their owning unit, the availability will be above 95 percent.

- The ending availability of the IFV/TOWs at the following units was below the 80 percent mark: B222AR (57 percent), B231AR (72 percent), and B232AR (71 percent). At the end of the scenario, 45 IFV/TOWs were operational but crews were not available to man these systems. Given this situation, there were enough IFV/TOWs waiting for crews that would push these three units' ending availability well above the 80 percent mark.

3 The US Army had nine units destroyed during the scenario while the MEF had seven units destroyed. Appendix D lists the combat ineffective ("dead") units for the BLUE and GREEN forces.

Reference (b).1). of Section (2), Key Weapon Availability -- end % availability is the weapon system's availability at the end of the scenario. This availability calculation excludes permanent losses in conformance with the earlier described sufficiency criteria. Permanent losses are excluded because their occurrence is independent of how well (or poorly) CSS performs. Note: Because of rounded off values, the ending percent availability may be off by a percentage point or two.

Table M-12: M1A1 Status (US ARMY and MEF)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B211AR	44	0	12	Dead	30	8	40
B212AR	44	0	3	Dead	28	4	41
B213MX	28	0	9	Dead	18	0	26
B221AR	44	0	13	Dead	41	40	42
B222AR	30	21	2	76	26	21	29
B231AR	44	37	2	89	39	31	42
B232AR	44	33	5	86	30	7	42
B233MX	28	26	0	94	26	26	27
B511MX	14	0	4	5	9	0	13
B514AR	44	11	10	31	31	11	42
Total Permanent Losses			60				

Table M-13: M1A2 Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B201DC	9	0	2	Dead	8	6	9
B202DC	9	0	2	Dead	5	3	9
B203DC	9	0	3	Dead	9	8	9
Total Permanent Losses			7				

Table M-14: IFV/TOW Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B200DC	2	0	1	0	1	0	2
B201DC	13	0	2	Dead	11	9	13
B202DC	13	0	4	Dead	7	3	13
B203DC	13	0	6	Dead	11	7	13
B211AR	14	0	5	Dead	9	0	12
B212AR	14	0	4	Dead	9	1	13
B213MX	30	0	14	Dead	11	0	27
B221AR	14	0	4	Dead	13	13	14
B222AR	28	13	5	57	23	13	27
B223MX	44	0	17	0	25	0	43
B224MX	44	0	17	0	28	0	43
B231AR	14	6	5	72	9	1	14
B232AR	14	7	5	71	8	0	14
B233MX	30	29	0	96	29	29	29
Total Permanent Losses			89				

Table M-15: BSFV Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B211S1	4	4	0	100	4	4	4
B212S1	4	4	0	100	4	4	4
B221S1	4	4	0	100	4	4	4
B222S1	4	4	0	100	4	4	4
B231S1	4	4	0	100	4	4	4
B232S1	4	4	0	100	4	4	4
Total Permanent Losses			0				

Table M-16: LAV/TOW Status (MEF)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B511RE	7	0	3	Dead	7	7	7
B512RE	7	0	3	Dead	7	5	7
B513RE	7	0	2	Dead	7	6	7
Total Permanent Losses			8				

Table M-17: AAV/50CAL Status (MEF)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B511MX	35	31	1	90	33	31	35
B512MX	45	40	1	90	43	40	44
B514AR	10	9	0	90	9	9	10
Total Permanent Losses			2				

Table M-18: AVENGER Status (US ARMY and MEF)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B213P1	6	0	1	Dead	4	2	6
B223P1	6	0	3	Dead	6	6	6
B233P1	6	6	0	99	6	6	6
B510P1	6	6	0	100	6	6	6
B511MX	4	0	1	0	2	0	4
B512MX	4	0	1	0	2	0	4
B513IN	4	0	1	0	3	0	4
B514AR	4	0	1	0	2	0	4
B521IN	4	0	2	Dead	3	0	4
B522IN	4	0	0	Dead	4	4	4
B523IN	4	0	1	Dead	3	0	4
Total Permanent Losses			11				

Table M-19: MLRS Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B000M2	9	0	5	0	4	0	9
B200M2	9	4	3	75	3	0	4
Total Permanent Losses			8				

Table M-20: HIMARS Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B001M2	3	3	0	99	3	3	3
Total Permanent Losses			0				

Table M-21: 155HIP Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B201A2	6	0	8	0	3	0	5
B202A2	6	0	3	0	2	0	6
B203A2	6	0	3	1	2	0	6
B204A2	6	0	3	0	4	0	6
B205A2	6	0	3	0	4	0	6
B206A2	6	0	3	0	4	0	6
B207A2	6	6	0	99	6	6	6
B208A2	6	6	0	99	6	6	6
B209A2	6	6	0	99	6	6	6
Total Permanent Losses			23				

Table M-22: OH58D Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B200SH	16	3	0	18	8	3	16
Total Permanent Losses			0				

Table M-23: AH64D Status (US ARMY)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B000AH	24	16	5	84	16	12	21
B201AH	24	19	2	87	19	16	21
Total Permanent Losses			7				

Table M-24: AH-1 Status (MEF)

Unit ID	Initial Str	End Str	K-Kills	End % Avail	AVG	LOW	HIGH
B500AH	14	13	0	94	13	13	14
Total Permanent Losses			0				

(3) CSS Workloads. The following CSS workloads are provided to show the type and magnitude of workload serviced by each unit.

(a) Recovery and evacuation vehicle workload. The second and third columns in table M-25 indicate the number of vehicles that required assisted recovery from their owning unit. The fourth through seventh columns show the number of vehicles that required evacuation 'in' and 'out' of a higher echelon maintenance unit; also indicated is whether or not the vehicle required a HET for evacuation.

Table M-25: Recovery and Evacuation Workload

	Total # of assisted recoveries		# EVAC'D IN		# EVAC'D OUT	
Maint Unit	HMTWRECKER	M88	TOTAL	w/ HET	TOTAL	w/ HET
B00000	0	7	62	6	0	0
B000AH	1	1	0	0	14	0
B01CSA	451	6	0	0	0	0
B20002	0	47	0	0	11	8
B200MX	0	31	47	25	0	0
B201AH	1	1	0	0	13	0
B20DSA	24	2	0	0	0	0
B210AR	102	66	0	0	19	14
B210EN	1	25	0	0	20	15
B211AR	4	17	0	0	14	10
B212AR	2	5	0	0	4	4
B213MX	3	25	0	0	15	14
B21BSA	73	23	0	0	10	5
B220AR	27	84	0	0	4	4
B220EN	1	24	0	0	17	13
B221AR	0	5	0	0	4	4
B222AR	0	12	0	0	9	9
B223MX	0	17	0	0	23	22
B224MX	2	16	0	0	24	22
B22BSA	3	6	0	0	18	4
B230AR	37	53	0	0	0	0
B230EN	0	23	0	0	11	6
B231AR	0	18	0	0	12	12
B232AR	4	34	0	0	23	19
B233MX	0	8	0	0	5	5
B23BSA	53	10	0	0	23	9
B50000	0	2	10	2	0	0
B500AH	0	0	0	0	0	0
B501CH	0	0	0	0	3	0
B50SSA	1	1	0	0	0	0
B510MX	0	10	104	32	8	2
B511EN	3	28	0	0	37	25
B511MX	3	8	0	0	19	2
B512MX	0	0	0	0	20	1
B513IN	0	0	0	0	16	0
B514AR	4	17	0	0	10	4

(b) Medical team workload. Table M-26 shows the number of personnel that arrived at a medical facility during the scenario due to combat and non-combat (DNBI) actions. The 'MMH EXPENDED' displays the number of treatment man hours expended by all medical teams.

Table M-26: Medical Unit Workload

MEDICAL UNIT	CBT MEDICAL RECOVERED	DNBI MEDICAL RECOVERED	MMH EXPENDED	MEDICAL UNIT	CBT MEDICAL RECOVERED	DNBI MEDICAL RECOVERED	MMH EXPENDED
B00000	170	135	827	B224MX	485	43	90
B000AH	0	26	41	B22BSA	519	35	40
B01CSA	0	25	82	B230AR	1	22	615
B20002	531	180	122	B230EN	0	28	44
B200MX	534	211	824	B231AR	26	55	75
B201AH	0	26	41	B232AR	160	48	75
B20DSA	0	25	81	B233MX	0	60	83
B210AR	131	16	743	B23BSA	262	43	44
B210EN	327	16	41	B50000	2,771	242	850
B211AR	477	19	24	B500AH	0	26	41
B212AR	48	13	14	B501CH	18	33	79
B213MX	157	42	71	B50SSA	0	25	82
B21BSA	522	26	29	B510MX	458	73	684
B220AR	101	19	610	B511EN	283	22	44
B220EN	192	16	34	B511MX	63	45	71
B221AR	0	37	44	B512MX	31	45	72
B222AR	60	57	83	B513IN	2	24	38
B223MX	485	42	89	B514AR	288	43	73

(c) Maintenance team workload. Table M-27 shows the number of vehicles (both ground and air) that were recovered to a maintenance facility during the scenario. The last four columns display the number of maintenance man hours expended on ground and air vehicles and the estimated number of maintenance man hours required at TP 12 to repair all vehicles at the maintenance facilities.

Table M-27: Maintenance Unit Workload

	# VEHICLES RECOVERED		GROUND VEHICLES		HELICOPTERS	
MAINT UNIT	CBT DAMAGE	RAM DAMAGE	MMH EXPENDED	MMH NEEDED	MMH EXPENDED	MMH NEEDED
B00000	30	70	244	91	365	1
B000AH	16	32	13	8	60	0
B01CSA	0	456	168	622		
B20002	54	17	413	239		
B200MX	47	20	551	207	66	1
B201AH	6	37	13	9	57	0
B20DSA	0	26	60	31		
B210AR	43	3	855	173		
B210EN	23	18	145	60		
B211AR	40	8	55	0		
B212AR	40	6	22	0		
B213MX	53	13	168	0		
B21BSA	141	9	8	10		
B220AR	9	4	538	426		
B220EN	23	19	158	50		
B221AR	0	19	69	0		
B222AR	9	22	112	11		
B223MX	40	11	89	7		
B224MX	40	11	87	7		
B22BSA	51	10	10	12		
B230AR	15	4	472	200		
B230EN	0	26	144	47		
B231AR	21	26	167	12		
B232AR	63	20	243	19		
B233MX	0	25	102	10		
B23BSA	95	9	12	5		
B50000	69	15	192	15	34	5
B500AH	0	8	0	0	41	3
B501CH	0	21	0	0	198	42
B50SSA	0	6	23	17		
B510MX	25	25	487	298		
B511EN	35	19	137	34		
B511MX	46	12	120	5		
B512MX	39	7	54	1		
B513IN	24	2	1	0		
B514AR	34	16	174	5		

(4) Observations.

1) The M88 recovery operations for six recovery teams could not handle the workload produced during this scenario because of the initial quantity of M88s given to these units.
2) The armament mechanics' MMH organic to the three FSBs were stressed during this scenario. These mechanics were over-utilized during the time of intense combat.

6. Supply Analysis.

a. This analysis assesses the CSS system's capability to support combat and combat support units for the defined scenario. The CSS units must fill requests for replenishment stockages in a "timely fashion"; failure to do so can be attributed to lack of transporters, lack of stockages, long order-to-delivery times, or a combination of all three.

b. Analysis. This analysis is structured into two parts: supply class IIIB and supply class V.

(1) Supply Class IIIB.

(a) Utilization. For the scenario, the usage of class IIIB (petroleum) was found by summing the utilization (quantities "used" plus quantities "destroyed") of all maneuver units during each TP. Calculated in gallons (gals), the utilization of class IIIB for the length of the scenario is presented in table L-1, table L-2, and table L-3 for the Corps, Division, and MEF (respectively).

The utilization of supplies generates a requirement for stocks of supply types as well as transportation assets to deliver the replenishments to maneuver unit stockages. Each order levies upon the CSS system a requirement for existing stocks and transportation assets. The authorized amount declines with time due to the attrition of weapon systems. Each weapon system has an authorized amount of specific supply types, and the authorized stockage is reduced as systems are destroyed. Tables L-1, L-2, and L-3 identify the stockage levels and activities for class IIIB: 1) amounts used; 2) amounts destroyed; and 3) amounts utilized (the requirement). Reference Appendix B for definitions of "amount used" and "amount destroyed".

Table L-1: Utilization of Class IIIB, Gals (Corps Units)

TP	Amount Used	Amount Destroyed	Utilization
0	0	0	0
1	194	0	194
2	3,429	25	3,454
3	2,350	1,119	3,469
4	173	2	175
5	169	0	169
6	172	0	172
7	167	0	167
8	166	0	166
9	148	219	367
10	145	0	145
11	143	0	143
12	142	0	142
Total	7,398	1,365	8,763

Table L-2: Utilization of Class IIIB, Gals (Division Units)

TP	Amount Used	Amount Destroyed	Utilization
0	0	0	0
1	13,734	305	14,039
2	5,100	0	5,100
3	2,331	1,537	3,868
4	1,826	241	2,067
5	1,848	727	2,575
6	1,663	174	1,837
7	1,984	2,027	4,011
8	1,395	1,005	2,400
9	1,263	0	1,263
10	1,197	768	1,965
11	3,321	167	3,488
12	1,448	22	1470
Total	37,110	6,973	44,083

Table L-3: Utilization of Class IIIB, Gals (MEF Units)

TP	Amount Used	Amount Destroyed	Utilization
0	0	0	0
1	1,495	0	1,495
2	627	0	627
3	1,717	0	1,717
4	753	0	753
5	787	0	787
6	1,152	0	1,152
7	1,102	1,172	2,274
8	977	175	1,152
9	742	2,494	3,236
10	2,888	0	2,888
11	1,495	300	1,795
12	3,329	0	3,329
Total	17,064	4,141	21,205

(b) Discussion. The resupply options for maneuver units are: 1) resupply is unnecessary (Balance-on-Hand >=75% of Authorized); 2) standard resupply (Balance-on-Hand >=50% & <75% of Authorized); or 3) emergency resupply (Balance-on-Hand <50% of Authorized); reference Appendix B for definitions of "standard" and "emergency" resupply. Table L-4 indicates during which TP(s) any maneuver unit(s) may have a Balance-on-Hand (BOH) so low as to warrant the use of either standard or emergency resupply.

Table L-4: Resupply Options, Class IIIB

Resupply	**TP**												
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Unnecessary	69	69	63	63	66	67	66	63	57	55	54	51	51
Standard	0	0	4	6	1	0	0	0	1	0	1	1	1
Emergency	0	0	2	0	0	0	0	0	0	0	0	1	1
All Units	69	69	69	69	67	67	66	63	58	55	55	53	53
COMBAT INEFFECTIVE (DEAD) UNITS ARE NOT INCLUDED.													

For more detail on individual maneuver units requiring resupply see table L-5. These Corps, Division, and MEF units wait an average of 1.58 TPs (approximately 6 hours, 20 minutes) with a median of 1 TP (four hours), before their BOH returns to a level no longer requiring resupply of class IIIB.

Table L-5: Percentage of Balance On-Hand for Maneuver Units Requiring Resupply, Class IIIB

	TP													
Unit	0	1	2	3	4	5	6	7	8	9	10	11	12	#TPs
B000AH				62										1
B200MX												70		1
B200SH			41	61										2
B201A2				70										1
B201AH			47											1
B202A2				68										1
B203A2			67	57										2
B211AR			60											1
B212AR			52											1
B213MX			66											1
B50000											67	23	43	3
B501CH				71	67				71				74	4
TOTAL	0	0	6	6	1	0	0	0	1	0	1	2	2	

For example, at the end of TP 11, B200MX had a class IIIB BOH of 70 percent. This was the only TP in which B200MX could have asked for resupply. During TP 11, B200MX was one of two units that requested resupply.

(c) Problems. Table L-5 shows the BOH percentage for individual maneuver units requiring resupply, however, there were no problems filling maneuver unit orders for class IIIB.

(d) Observations.

> (1) Emergency replenishment of supply class IIIB was required by only three of the 69 maneuver units in any TP.
>
> (2) There were no problems filling maneuver unit order requests for supply class IIIB.

(2) Supply Class V.

(a) Utilization. For the scenario, the utilization of class V (ammunition) was found by summing the utilization (quantities "used" plus quantities "destroyed") of all maneuver units during each of the 4-hour TPs. Calculated in short tons (stons), the utilization of class V for the length of the scenario is presented in table L-6, L-7, and L-8 for the Corps, Division, and MEF (respectively).

Table L-6: Utilization of Class V, STONS (Corps Units)

TP	*USED STONS*	*DESTROYED STONS*	*UTILIZATION*
0	0	0	0
1	70	0	70
2	9	0	9
3	32	1	33
4	0	5	5
5	0	0	0
6	0	0	0
7	65	0	65
8	38	0	38
9	18	325	343
10	0	0	0
11	0	0	0
12	0	0	0
TOTAL	232	331	563

Table L-7: Utilization of Class V, STONS (Division Units)

TP	*USED STONS*	*DESTROYED STONS*	*UTILIZATION*
0	0	0	0
1	25	695	720
2	5	0	5
3	39	8	47
4	32	4	36
5	6	15	21
6	7	0	7
7	65	9	74
8	72	11	83
9	42	0	42
10	40	7	47
11	6	0	6
12	1	0	1
TOTAL	340	749	1089

Table L-8: Utilization of Class V, STONS (MEF Units)

TP	*USED STONS*	*DESTROYED STONS*	*UTILIZATION*
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	16	2	18
8	18	1	19
9	13	9	22
10	9	0	9
11	4	0	4
12	4	0	4
TOTAL	64	12	76

- Tables L-6, L-7, and L-8 depict the utilization of Class V in stons for an aggregate of the key munition types during each TP in the scenario. Tables L-9, L-10, and L-11 give a better depiction of the class V utilization for the Corps, Division, and MEF maneuver units by sub-munition type for each TP in the scenario. The 23rd Division MLRS Battery (in TP 1) and the 21st Corps HIMARS Battery (in TP 9) have noticeable losses of ATACMS munitions due to engagement in combat.

- A list of all Corps, Division, and MEF assets listing VIC unit name designators and their actual unit names is contained in Appendix A.

- Table L-9 identifies the utilization of class V by sub-munition type for the 21st Corps MLRS Battery (B000M2), the 21st Corps HIMARS Battery (B001M2), and the 21st Corps Apache Attack Helicopter Battalion (B000AH) at the end of each TP in the scenario. B000AH2 through B000AH6 are aviation sorties generated from the munition assets of maneuver unit B000AH.

Table L-9: Utilization of Class V by Munition Type and Unit per TP (Corps)

TP	*UNIT NAME*	*MUNITION TYPE*	*USED STONS*	*DESTROYED STONS*	*UTILIZATION*
0	-	-	0	0	0
1	B000M2	ATACMS_II/B	70	0	70
2	B000AH2	LONGBOW	1	0	1
2	B000AH3	LONGBOW	1	0	1
2	B000AH4	LONGBOW	3	0	3
2	B000AH5	LONGBOW	2	0	2
2	B000AH6	LONGBOW	2	0	2
3	B000AH2	LONGBOW	2	0	2
3	B000AH3	LONGBOW	5	0	5
3	B000AH4	LONGBOW	4	0	4
3	B000AH6	LONGBOW	6	0	6
3	B000AH6	B30MM	0	1	1
3	B000M2	ATACMS_IA	15	0	15
4	B000M2	ATACMS_I	0	1	1
4	B000M2	ATACMS_IA	0	1	1
4	B000M2	ATACMS_II/B	0	1	1
4	B000M2	ATACMS_II/BP3I	0	1	1
4	B000M2	ATACMS_IIA/BP3I	0	1	1
5	-	-	0	0	0
6	-	-	0	0	0
7	B000M2	ER-MLRS	31	0	31
7	B001M2	ER-MLRS	12	0	12
7	B001M2	ER-MLRS/G	22	0	22
8	B000M2	ER-MLRS/G	7	0	7
8	B000M2	M26	19	0	19
8	B001M2	ER-MLRS	5	0	5
8	B001M2	ER-MLRS/G	7	0	7
9	B001M2	ATACMS_I	0	40	40
9	B001M2	ATACMS_IA	0	40	40
9	B001M2	ATACMS_II/B	0	81	81
9	B001M2	ATACMS_II/BP3I	0	81	81
9	B001M2	ATACMS_IIA/BP3I	0	81	81
9	B000M2	ER-MLRS/G	8	0	8
9	B000M2	M26	10	2	12
10	-	-	0	0	0
11	-	-	0	0	0
12	-	-	0	0	0
		TOTAL	232	331	563

- Table L-10 identifies the utilization of class V by sub-munition type for the 23rd Division maneuver units at the end of each TP in the scenario. As previously stated, the 23rd Division MLRS Battery utilization of the ATACMS munition type was most noticeable in TP 1.

Table L-10: Utilization of Class V by Munition Type and Unit per TP (Division)

TP	UNIT NAME	MUNITION TYPE	USED STONS	DESTROYED STONS	UTILIZATION
0	-	-	0	0	0
1	B200M2	ATACMS_I	0	87	87
1	B200M2	ATACMS_IA	0	87	87
1	B200M2	ATACMS_II/B	20	157	177
1	B200M2	ATACMS_II/BP3I	0	174	174
1	B200M2	ATACMS_IIA/BP3I	0	174	174
1	B200M2	ER-MLRS	0	9	9
1	B200M2	ER-MLRS/G	0	4	4
1	B200M2	M26	0	4	4
1	B201AH2	LONGBOW	5	0	5
2	B201AH2	LONGBOW	1	0	1
2	B201AH3	LONGBOW	3	0	3
2	B202A2	XM982	1	0	1
3	B200M2	ATACMS_IA	10	0	10
3	B202A2	M483A1	10	0	10
3	B202A2	XM898	13	0	13
3	B203A2	XM898	6	0	6
3	B212AR	120MM	0	2	2
3	B212AR	25MM	0	5	5
3	B212AR	50CAL	0	1	1
4	B200M2	ATACMS_IA	10	0	10
4	B201A2	M483A1	4	0	4
4	B202A2	M483A1	6	0	6
4	B202A2	XM898	0	2	2
4	B203A2	M483A1	4	0	4
4	B203A2	XM898	0	2	2
4	B207A2	XM982	1	0	1
4	B211AR	M933	6	0	6
4	B211AR	25MM	1	0	1
5	B201A2	M483A1	3	2	5
5	B201A2	M864	3	0	3
5	B201A2	M107/CB	0	2	2
5	B201A2	M549A1	0	1	1
5	B201A2	M692/M731	0	1	1
5	B201A2	XM898	0	3	3
5	B201A2	XM982	0	1	1
5	B203A2	M107/CB	0	1	1
5	B203A2	M483A1	0	2	2
5	B203A2	XM898	0	2	2
6	B201A2	M864	2	0	2
6	B203DC	TOWII	1	0	1
6	B207A2	M864	1	0	1
6	B208A2	M864	3	0	3
7	B200M2	ER-MLRS	28	0	28
7	B201A2	XM982	1	0	1
7	B203DC	TOWII	1	0	1
7	B204A2	M864	4	0	4
7	B205A2	M549A1	7	0	7
7	B205A2	M864	4	0	4
7	B206A2	M549A1	7	0	7
7	B206A2	M864	8	0	8
7	B208A2	M864	1	0	1
7	B232AR	120MM	0	4	4
7	B232AR	25MM	0	3	3
7	B232AR	50CAL	0	1	1
7	B232AR	TOWII	0	1	1

TP	UNIT NAME	MUNITION TYPE	USED STONS	DESTROYED STONS	UTILIZATION
7	B232AR	M933	4	0	4
8	B201A2	M483A1	2	0	2
8	B204A2	M483A1	8	0	8
8	B204A2	M864	1	0	1
8	B205A2	M483A1	4	0	4
8	B205A2	M864	1	0	1
8	B205A2	XM898	4	0	4
8	B206A2	M483A1	17	0	17
8	B206A2	XM898	11	0	11
8	B208A2	M864	5	0	5
8	B223MX	25MM	1	9	10
8	B223MX	M933	11	0	11
8	B223MX	TOWII	0	1	1
8	B224MX	M933	7	0	7
8	B231AR	120MM	0	1	1
9	B200M2	M26	40	0	40
9	B201A2	M864	1	0	1
9	B208A2	M864	1	0	1
10	B200M2	M26	35	0	35
10	B201A2	M864	1	0	1
10	B208A2	M864	4	0	4
10	B222AR	120MM	0	1	1
10	B222AR	25MM	0	5	5
10	B222AR	TOWII	0	1	1
11	B200M2	ER-MLRS	2	0	2
11	B201A2	M864	1	0	1
11	B208A2	M864	3	0	3
12	B201A2	M864	1	0	1
		TOTAL	340	750	1090

- Table L-11 identifies the utilization of class V for the MEF maneuver units by sub-munition type at the end of each TP. Although the MEF was part of the modeled force in this scenario; it receives logistics from the MEF Service Support Group and did not impact the Army CSS system.

Table L-11: Utilization of Class V by Munition Type and Unit per TP (MEF)

TP	UNIT NAME	MUNITION TYPE	USED STONS	DESTROYED STONS	UTILIZATION
0	-	-	0	0	0
1	-	-	0	0	0
2	-	-	0	0	0
3	-	-	0	0	0
4	-	-	0	0	0
5	-	-	0	0	0
6	-	-	0	0	0
7	B511EN	BWAMM	0	2	2
7	B513IN	TOWII	1	0	1
7	B51AT2	M549A1	2	0	2
7	B51AT2	M864	2	0	2
7	B51BT2	M549A1	2	0	2
7	B51BT2	M864	2	0	2
7	B51CT2	M549A1	2	0	2
7	B51CT2	M864	2	0	2
7	B521IN	TOWII	1	0	1
7	B522IN	TOWII	1	0	1
7	B523IN	TOWII	1	0	1
8	B511MX	120MM	1	0	1
8	B511MX	50CAL	2	0	2
8	B512MX	50CAL	2	0	2
8	B512MX	JAVELIN	1	0	1
8	B514AR	120MM	1	0	1
8	B51AT2	M483A1	6	0	6
8	B51AT2	M549A1	2	0	2
8	B51BT2	M483A1	3	0	3
8	B51BT2	XM982	0	1	1
9	B500AH	TOWII	4	0	4
9	B511MX	120MM	0	3	3
9	B511MX	M720	1	0	1
9	B512MX	TOWWII	2	0	2
9	B514AR	120MM	2	6	8
9	B51BT2	M107/CB	4	0	4
10	B500AH	B20MM	3	0	3
10	B500AH	TOWII	1	0	1
10	B51AT2	M483A1	3	0	3
10	B51BT2	M483A1	2	0	2
11	B51AT2	M483A1	3	0	3
11	B51BT2	M483A1	1	0	1
12	B51AT2	M483A1	4	0	4
		TOTAL	64	12	76

(b) Discussion.

(1) This analysis focuses on 19 munition types {155MM, ATACMS, MLRS, Hellfire, Longbow, 2.75RKT, Patriot, Stinger, 120MM, 60MM, 25MM, 40MM, B30MM, 7.62MM, 5.56MM, 50Cal, Javelin, LAW, and TOWII} using five indices {Amount Authorized, Amount On-Hand, Amount Used, Amount Destroyed, and Ratio of Amount On-Hand to Amount Authorized}. A list of all supply analysis definitions is contained in Appendix B.

(2) The 19 aforementioned munition types were grouped into seven functional categories {Field Artillery, Aviation, Air Defense Artillery, Armor & Mechanized Infantry, Anti-Armor, Anti-Tank, and Infantry}. Each of the functional categories was divided into

subcategories displayed in tables L-12, L-13, and L-14 for Corps, Division, and MEF maneuver units (respectively):

Table L-12: Key Functional Categories (Corps Units)

Category	*Member Munition Type*
Field Artillery	ATACMS - {ATACMS_I,ATACMS_IA,ATACMS_II/B, ATACMS_II/BP3I,ATACMS_IIA/BP3I} MLRS - {ER-MLRS,ER-MLRS/G,M26,M26IM,XRM26IM, XM85,XM85/G,TGW/MLRS,XRBAT/MLRS}
Aviation	HELLFIRE,LONGBOW,2.75RKT,B30MM
Air Defense Artillery (ADA)	STINGER
Anti-Tank	LAW
Infantry	5.56MM,7.62MM,50CAL

Table L-13: Key Functional Categories (Division Units)

Category	*Member Munition Type*
Field Artillery	155MM - {M107(CB),M116B1,M483A1,M549A1,M692/M731, M712,M718/M741,M864,XM898,XM982} ATACMS - {ATACMS_I,ATACMS_IA,ATACMS_II/B, ATACMS_II/BP3I,ATACMS_IIA/BP3I} MLRS - {ER-MLRS,ER-MLRS/G,M26}
Aviation	HELLFIRE,LONGBOW,2.75RKT,B30MM
Air Defense Artillery (ADA)	STINGER
Armor & Mechanized Infantry	120MM - {120MM,M929,M933}
Anti-Armor	25MM
Anti-Tank	JAVELIN,LAW,TOWII
Infantry	5.56MM,7.62MM,40MM,50CAL

Table L-14: Key Functional Categories (MEF Units)

Category	*Member Munition Type*
Field Artillery	155MM - {M107(CB),M116B1,M121A1,M483A1,M549A1, M692/M731,M712,M718/M741,M864,XM898,XM982}
Aviation	B20MM
Air Defense Artillery (ADA)	STINGER
Armor & Mechanized Infantry	120MM - {120MM,PGMM,M929,M933} 81MM - {M821,M889,MERLIN/M252} 60MM - {M302A1,M720}
Infantry	5.56MM,7.62MM,40MM,50CAL
Anti-Tank	JAVELIN,LAW,TOWII

(3) Tables L-15, L-16, and L-17 display the key munition types with the applicable aforementioned indices for each key munition at the end of the scenario. Tables L-15, L-16, and L-17 represent an aggregation by munition type for all units in the modeled force for the Corps, Division, and MEF (respectively).

- The first column, key munition type, lists each of the munition types included for analysis in this report.
- The second and third columns, amount authorized and BOH respectively, indicate quantities at initial state (TP 0) of the scenario.
- The fourth column, percentage of BOH of amount authorized, indicates that at initial state (TP 0) of the scenario, the quantity of munitions available for mission support was at least 100 percent and sufficient to meet requirements. **(Except the Balance-on-Hand percentage of munition type ATACMS for the Corps and the Division maneuver units will trigger a "standard resupply replenishment" request.)**

- The total amount used of a key munition type (column five) can exceed the End State BOH because during a particular TP a unit can receive and expend resupply .
- Munitions destroyed due to combat activity (column six) did not cause any significant inventory imbalances resulting in availability shortfalls.
- The seventh and eighth columns, amount authorized and BOH respectively, indicate quantities at end state (TP 12) of the scenario.
- The ninth column, percentage of Balance-on-Hand of amount authorized, indicates that at end state (TP 12) of the scenario, the quantity of munitions available for mission support was more than sufficient to meet requirements. **(Except the Balance-on-Hand percentage of munition type MLRS for the Division and B20MM for the MEF was so low at End State (TP 12); it will trigger an "emergency supply replenishment" request.)**
- **Note that the Ratio of Amount-on-Hand to Amount Authorized was higher for munition types Hellfire, B30MM and 50CAL than for the other munition types within the Corps (see table L-15).** For both the Hellfire and 50CAL, the BOH at end state was equal to the BOH at initial state minus the total amount used and destroyed throughout the scenario. Although, the 21st Corps Attack Helicopter Battalion had a Balance-on-Hand, which, was four times the Amount Authorized for both the Hellfire and Longbow munition types at initial state (TP 0); the CSS system was able to support the Corps maneuver units at all times.

Table L-15: Key Munition Status (Corps Units)

	Initial State			Utilization		End State		
Key Munition Type	Amt Authorized {Rounds} @ TP 0	BOH @ TP 0 {Rounds}	Percentage BOH of Authorized	Total Amount Used {Rounds}	Total Amount Destroyed {Rounds}	Amt Authorized {Rounds} @ TP 12	BOH @ TP 12 {Rounds}	Percentage BOH of Authorized
ATACMS	2,400	1,260	52.5%	141	225	589	1,001	170%
MLRS	1,782	1,782	100%	362	14	1,356	1,646	121%
HELLFIRE	192	768	400%	39	0	114	729	639%
LONGBOW	192	768	400%	606	9	114	153	134%
2.75RKT	1,128	1,128	100%	402	0	667	726	109%
B30MM	28,800	28,800	100%	2,181	2,611	17,028	60,358	354%
STINGER	480	480	100%	0	0	284	480	169%
5.56MM	269,010	269,010	100%	1,473	7,580	242,057	259,957	107%
7.62MM	35,200	35,200	100%	11,606	91	33,444	31,654	95%
50CAL	2,940	2,940	100%	179	410	433	2,351	543%
LAW	55	55	100%	3	1	45	51	113%

- For the **21st Corps Attack Helicopter Battalion** the amount authorized for **munition type B30MM** increased to **47,670 rounds** and the balance-on-hand decreased to 28,153 rounds during TP 2 (hour 7); the amount used was 354 rounds and the amount destroyed was 293 rounds. During this TP five sorties were generated with an amount authorized of 0 rounds and a balance-on-hand of 16,832 rounds. This caused the balance-on-hand amount to decrease to **11,321 rounds** and a **resupply request** was generated for **36,349 rounds**. Within

the same TP (hour 8) an additional 727 rounds were used and 28 rounds were destroyed decreasing the balance-on-hand to 27,398 rounds. During TP 3 (@ hour 11) the amount destroyed was 79 rounds. Also during TP 3 (@ hour 12) the amount destroyed was 1,495 rounds and the amount used was 690 rounds decreasing the balance on-hand to 25,133 rounds. (13,318 rounds for the 21st Corps Helicopter Battalion; 11,815 rounds for the 3 sorties). As previously stated, a resupply request was generated for **36,349 rounds** during TP 2 (hour 7); these rounds were **received by truck during TP 4** (hour 13) increasing the BOH to **61,483 rounds**. An additional 409 rounds were used and 716 rounds were destroyed during TP 4 (hour 13) decreasing the balance-on-hand to **60,358 rounds**. The amount authorized continued to decrease due to attrition and the balance-on-hand remained at 60,358 rounds at end state (TP 12). No additional B30MM rounds were either used or destroyed throughout the remainder of the scenario.

- ***As illustrated with the munition type B30MM for the 21st Corps Attack Helicopter Battalion, it is possible for the BOH at end state to exceed the amount authorized. In addition, the BOH @ end state does not always equal the BOH @ initial state minus the total amount used and destroyed throughout the scenario.***

Table L-16: Key Munition Status (Division Units)

	Initial State			Utilization		End State		
Key Munition Type	Amt Authorized {Rounds} @ TP 0	BOH @ TP 0 {Rounds}	Percentage BOH of Authorized	Total Amount Used {Rounds}	Total Amount Destroyed {Rounds}	Amt Authorized {Rounds} @ TP 12	BOH @ TP 12 {Rounds}	Percentage BOH of Authorized
155MM	15,930	15,930	100%	10,232	1,622	8,803	11,360	129%
ATACMS	1,800	900	50%	81	171	835	697	83%
MLRS	378	378	100%	443	11	175	44	25%
HELLFIRE	224	864	385.7%	64	0	174	824	474%
LONGBOW	192	768	400%	412	9	114	153	134%
2.75RKT	1,128	1,128	100%	0	0	813	1,128	139%
B30MM	28,800	28,800	100%	4,056	680	20,759	53,984	260%
STINGER	848	848	100%	0	13	621	790	127%
120MM	18,336	18,336	100%	3,342	941	6,245	8,070	129%
JAVELIN	390	390	100%	18	4	280	293	105%
LAW	155	155	100%	11	6	93	142	153%
25MM	258,300	258,300	100%	6,913	95,140	51,061	101,394	199%
40MM	34,320	34,320	100%	3	624	25,621	29,158	114%
5.56MM	2,788,590	2,788,590	100%	186,038	194,807	1,247,192	2,116,654	170%
7.62MM	400,400	400,400	100%	69,268	4,659	245,129	320,712	131%
50CAL	652,560	652,560	100%	12,153	55,152	300,654	441,736	147%
TOWII	2,009	2,009	100%	155	276	386	999	259%

- For the Division MLRS Battery the amount destroyed of munition type MLRS was 11 rounds during TP 1 (hour 1) decreasing the BOH to 368 rounds. During TP 9 the amount used was 159 rounds, during TP 10 the amount used was 242 rounds, and during TP 11 the amount used was 42 rounds. During TP 10 (hour 40) an emergency resupply request was generated for 64 rounds; during TP 11 (hour 41 through 44)

another emergency resupply request was generated for 86 rounds. During TP 12 (hour 45 through 48) an additional emergency resupply request was generated for 86 rounds. No MLRS rounds were received by truck or air during any TP.

- **The Balance-on-Hand percentages of amount Authorized for munition types Hellfire and B30MM were high for the Division Aviation units.**
- For the Apache Battalion in the 23rd Division, during TP 1 (hour 4), the amount authorized of munition type B30MM increased to **44,640 rounds** and the balance-on-hand decreased to 28,546 rounds (**14,720 rounds** for the 23rd Division Apache Battalion; 13,826 rounds for the sorties). During TP 1 (hour 4) four sorties were generated with an amount authorized of zero and balance-on-hand of 13,826; the amount used and the amount destroyed were 2,385 and 680 respectively. A resupply request was generated for **29,920 rounds** during TP 1 (hour 4) and received by truck during TP 2 (hour 6) increasing the BOH to 55,655 rounds. During TP 2 (hour 8) the amount used of munition type B30MM was 1,003 rounds, decreasing the BOH to 54,652 rounds. During TP 3 (hour 9) the amount used of munition type B30MM was 668 rounds, decreasing the BOH to **53,984 rounds**. The amount authorized continued to decrease due to attrition and the BOH remained at 53,984 rounds at end state (TP 12).
- For the Air Cavalry Troop in the 23rd Division, the BOH for munition type Hellfire decreased to 844 rounds during TP 3 (hour 12). During TP 2 through 5 (hour 5 through 18) six sorties were generated; the total amount used was 64 rounds, decreasing the BOH to 800 rounds. A standard resupply request was generated for 24 rounds during TP 5 (hour 18, 19, and 20) and received by truck during TP 6 (hour 21) increasing the BOH to 824 rounds.
- **The Balance-on-Hand percentage of amount Authorized for munition type TOWII for Division maneuver units was greater than 100 percent at end state because seven units were rendered combat ineffective throughout the scenario.** During TP 4 (hour 14) the Alpha Cavalry Troop was rendered combat ineffective. Also during TP 4 (hour 16) the 2nd Battalion 1st Brigade Armor Task Force was rendered combat ineffective. During TP 6 (hour 22) the 1st Battalion 1st Brigade Armor Task Force was rendered combat ineffective. During TP 7 (hour 25) the Bravo Cavalry Troop was rendered combat ineffective. During TP 9 (hour 35) both the Charlie Cavalry Troop and the 1st Battalion 2nd Brigade Armor Task Force were rendered combat ineffective. And during TP 11 (hour 43) the 3rd Battalion 1st Brigade Mechanized Infantry Task Force was rendered combat ineffective.

Table L-17: Key Munition Status (MEF Units)

	Initial State			Utilization		End State		
Key Munition Type	Amt Authorized {Rounds} @ TP 0	BOH @ TP 0 {Rounds}	Percentage BOH of Authorized	Total Amount Used {Rounds}	Total Amount Destroyed {Rounds}	Amt Authorized {Rounds} @ TP 12	BOH @ TP 12 {Rounds}	Percentage BOH of Authorized
155MM	1,320	1,320	100%	2,379	114	734	548	75%
120MM	2,320	2,320	100%	517	263	528	1,540	292%
60MM	5,700	5,700	100%	504	78	1,346	2,078	154%
B20MM	10,500	10,500	100%	16,500	0	9,525	3,815	40%
STINGER	272	272	100%	0	30	49	129	263%
5.56MM	1,642,650	1,642,650	100%	34,576	145,059	393,064	919,709	234%
7.62MM	236,400	236,400	100%	37,213	3,813	131,746	120,818	92%
50CAL	176,940	176,940	100%	79,480	11,015	96,325	95,426	99%
40MM	90,720	90,720	100%	4,570	1,937	78,293	80,488	103%
JAVELIN	414	414	100%	57	12	128	140	109%
LAW	100	100	100%	0	8	26	92	354%
TOWII	814	1,080	133%	600	19	115	259	225%

- **The Balance-on-Hand percentage of munition type 120MM, STINGER, LAW and TOWII were high for the MEF units.**
- However, for both the 120MM and LAW, the BOH at end state was equal to the BOH at initial state minus the total amount used and destroyed throughout the scenario.
- For the munition type Stinger no rounds were used or on order during any TP. During TP 7 (hour 28) the amount destroyed was 16 rounds, decreasing the BOH to 256 rounds. During TP 8 (hour 29) the 3-1 Infantry Battalion (32 rounds), the 1-2 Infantry Battalion (27 rounds), and the 2-2 Infantry Battalion (27 rounds) became combat ineffective; the amount destroyed was 4 rounds, which, decreased the BOH to 166 rounds. During TP 8 (hour 30) the 3-2 Infantry Battalion (26 rounds) became combat ineffective and the amount destroyed was 3 rounds, which, decreased the BOH to 137 rounds. During TP 8 (hour 32) the amount destroyed was 7 rounds, which decreased the BOH to 130 rounds. During TP 9 (hour 36) one additional round was destroyed, which, decreased the BOH to 129 rounds.
- During TP 7 (hour 25 and 26) for the munition type TOWII; the amount destroyed was 5 rounds, decreasing the BOH to 1,075 rounds. Also during TP 7 (hour 27) the Alpha Recon Troop (B511RE) was rendered combat ineffective, decreasing the BOH to 963 rounds. In addition, during TP 7 (hour 28): the Bravo Recon Troop (B512RE) was rendered combat ineffective, the amount used was 93 rounds, and the amount destroyed was 7 rounds, which, decreased the BOH to 756 rounds. An emergency resupply request was generated for 31 rounds during TP 7 (hour 28). During TP 8 (hour 29 through 32): the Charlie Recon Troop (B513RE) and all four Infantry Battalions (B513IN, B521IN, B522IN, & B523IN) were rendered combat ineffective, the amount used was 220 rounds, and the amount destroyed was 4 rounds, which, decreased the BOH to 392 rounds. Another emergency resupply request was generated for 356 rounds during TP 8 (hour 29 through 32) and 41 rounds were received by truck during TP 8 (hour 32)

increasing the BOH to 433 rounds. During TP 9 (hour 33 through 36) the amount used was 119 rounds and the amount destroyed was 4 rounds decreasing the BOH to 310 rounds. A standard resupply request was generated for 37 rounds and 95 rounds were received by truck during TP 9 increasing the BOH to 405 rounds. During TP 10 (hour 37 through 40) the amount used was 145 rounds decreasing the BOH to 260 rounds; a standard resupply request for 21 rounds was generated and 21 rounds were received by truck increasing the BOH to 281 rounds. During TP 11 (hour 41) the amount used was 5 rounds decreasing the BOH to 276 rounds, and during TP 12 (hour 46) the amount used was 17 rounds decreasing the BOH to 259 rounds.

- For the MEF Attack Helicopter Battalion the amount used was 7,099 rounds during TP 10 (hour 40) for munition type B20MM decreasing the BOH to 3,401 rounds. The amount authorized during TP 10 decreased to 9,475 rounds and an emergency resupply request was generated for 5,270 rounds. During TP 11 (hour 41) the amount used was 3,401 decreasing the BOH to zero, which, generated another emergency resupply request for 5,270 rounds, which, was received by truck during TP 11 (hour 42). During TP 12 (hour 45) additional 730 rounds were received by truck increasing the BOH to 6,000 rounds. However, during TP 12 (hour 46) the amount used was 6,000 rounds decreasing the BOH to zero and an emergency resupply request was generated for 6,000 rounds. At TP 12 (hour 48) 3,815 rounds were received by truck increasing the BOH to 3,815 rounds with 2,185 rounds still on order.

(4) Tables L-18, L-19, and L-20 provide an overall summary of the resupply options, which help assess the sufficiency of munition availability for the Corps, Division, and MEF maneuver units. These resupply options are shown by munition type; the individual indicators represent the presence (Yes) or absence (No) of that resupply option for a key munition type in the force at the end of a specific TP.

Table L-18: Balance-on-Hand Status (Corps Units)

Key Munition Type	*No Resupply BOH(>=75%)*	*Standard Resupply BOH(50%-74%)*	*Emergency Resupply BOH(1%-49%)*	*BOH(=0)*
ATACMS	Yes	Yes	Yes	No
MLRS	Yes	Yes	Yes	No
HELLFIRE	Yes	No	No	No
LONGBOW	Yes	No	No	No
2.75RKT	Yes	No	No	No
B30MM	Yes	Yes	Yes	No
STINGER	Yes	No	No	No
LAW	Yes	No	No	No
5.56MM	Yes	No	No	No
7.62MM	Yes	Yes	Yes	No
50CAL	Yes	No	No	No

Table L-19: Balance-on-Hand Status (Division Units)

Key Munition Type	*No Resupply BOH(>=75%)*	*Standard Resupply BOH(50%-74%)*	*Emergency Resupply BOH(1%-49%)*	*BOH(=0)*
155MM	Yes	Yes	Yes	Yes
ATACMS	Yes	Yes	Yes	No
MLRS	Yes	Yes	Yes	No
HELLFIRE	Yes	Yes	No	No
LONGBOW	Yes	No	No	No
2.75RKT	Yes	No	No	No
B30MM	Yes	Yes	Yes	No
STINGER	Yes	Yes	Yes	No
120MM	Yes	Yes	Yes	No
25MM	Yes	Yes	Yes	Yes
JAVELIN	Yes	Yes	No	No
LAW	Yes	No	Yes	Yes
TOWII	Yes	Yes	No	No
5.56MM	Yes	No	Yes	No
7.62MM	Yes	Yes	Yes	Yes
40MM	Yes	No	No	No
50CAL	Yes	Yes	No	No

Table L-20: Balance-on-Hand Status (MEF Units)

Key Munition Type	*No Resupply BOH(>=75%)*	*Standard Resupply BOH(50%-74%)*	*Emergency Resupply BOH(1%-49%)*	*BOH(=0)*
155MM	Yes	Yes	Yes	Yes
B20MM	Yes	Yes	Yes	No
STINGER	Yes	No	No	No
120MM	Yes	No	No	No
60MM	Yes	No	No	No
40MM	Yes	No	No	No
7.62MM	Yes	No	Yes	No
5.56MM	Yes	No	No	No
50CAL	Yes	Yes	Yes	Yes
JAVELIN	Yes	Yes	Yes	No
LAW	Yes	No	No	No
TOWII	Yes	Yes	Yes	Yes

- Balance-on-Hand (>=75%) of Authorized: Initially all units start in this range since the Balance-on-Hand is equal to the Amount Authorized. BOHs, which remain in this range, maintain a sufficient quantity of authorized munitions and at no time throughout the scenario require supply replenishment.
- Balance-on-Hand (50%-74%) of Authorized: This column indicates whether or not the BOH by munition type at any unit fell to the indicated percentage range of the authorized amount. BOH in this range triggers "standard supply replenishment" requests.
- Balance-on-Hand (1%-49%) of Authorized: This column indicates whether or not the BOH by munition type at any unit fell to the indicated percentage range of the authorized amount. BOH in this range triggers "emergency and standard supply replenishment" requests.
- Zero Balance-on-Hand: This column indicates whether or not the BOH by munition type at any unit fell to zero.
- None of the munition types experience a zero Balance-on-Hand for the Corps maneuver units. Four of the munition

types (155MM, 25MM, LAW, and 7.62MM) experience a zero Balance-on-Hand for the Division maneuver units. Three of the munition types (155MM, 50CAL, and TOWII) experience a zero Balance-on-Hand for the MEF maneuver units. Tables L-21 through L-27 depict specific units, time periods, and sub-munition types, which experience a zero Balance-on-Hand.

Table L-21: 155MM Zero Balance (Division Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B201A2: FA HIP Bty	0	TP 4,9,10,11,12	M483A1
	0	TP 3,4,5,11,12	M864
B202A2: FA HIP Bty	0	TP 4	M483A1
	0	TP 3 & 4	M864
B203A2: FA HIP Bty	0	TP 4	M483A1
	0	TP 3 & 4	M864
B204A2: FA HIP Bty	0	TP 7 & 8	M864
B205A2: FA HIP Bty	0	TP 7	M864
B206A2: FA HIP Bty	0	TP 7 & 8	M864
B207A2: FA HIP Bty	0	TP 6 - 12	M864
B208A2: FA HIP Bty	0	TP 7 - 12	M864
B209A2: FA HIP Bty	0	TP 7 - 12	M549A1
	0	TP 5 - 12	M864

Table L-22: 25MM Zero Balance (Division Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B200DC: Div Cav Sqdn	0	TP 12	25MM

Table L-23: LAW Zero Balance (Division Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B203A2: FA HIP Bty	0	TP 5	LAW

Table L-24: 7.62MM Zero Balance (Division Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B203A2: FA HIP Bty	0	TP 7 & 8	7.62MM
B206A2: FA HIP Bty	0	TP 12	7.62MM

Table L-25: 155MM Zero Balance (MEF Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B51AT2: Arty Bty	0	TP 10	M107/CB
	0	TP 8,9,10,11,12	M483A1
	0	TP 7,8,11	M549A1
	0	TP 7,8,9	M864
B51BT2: Arty Bty	0	TP 8,9,10,11,12	M483A1
	0	TP 7	M549A1
	0	TP 7,9,10,11,12	M864
B51CT2: Arty Bty	0	TP 12	M107/CB
	0	TP 8,9,11,12	M483A1
	0	TP 7	M549A1
	0	TP 7 & 8	M864

Table L-26: 50CAL Zero Balance (MEF Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B511MX: 1st Bn Task Force	0	TP 9,10,11,12	50CAL

Table L-27: TOWII Zero Balance (MEF Units)

Unit Name	*BOH(=0)*	*Time Period(TP)*	*Sub-munition*
B514AR: 4th Armor Bn	0	TP 8	TOWII
B522IN: 2nd Infantry Bn	0	TP 7	TOWII

(c) Problems. Of the 4796.66 stons ordered, via standard resupply (for Corps, Division, and MEF maneuver units); 540.06 stons were shipped (11.3 percent). Problems in unfilled orders are due to either unavailable trucks or supplies (Tables L-28, L-29, and L-30).

Table L-28: Problems Filling Maneuver Unit Orders, Class V (Corps Units)

TP	*REQUESTING UNIT*	*SUPPLY UNIT*	*SUPPLY TYPE*	*AMOUNT REQUESTED (Rounds)*	*AMOUNT SHIPPED (Rounds)*	*AMOUNT SHORTED (%)*	*TRUCKS AVAIL*	*AVAIL STOCKS (Rounds)*
1	B000M2	B00M2F	ATACMS I	180	14	92.2%	0	60
2	B001M2	B00M2F	ATACMS II/	30	0	100.0%	0	50
5	B001M2	B00M2F	ATACMS I	58	48	17.8%	0	60
7	B000M2	B00M2F	ER-MLRS/G	10	0	96.1%	6	0
7	B000M2	B00M2F	ER-MLRS/G	33	0	100.0%	6	0
7	B000M2	B00M2F	ATACMS II/	145	35	75.8%	0	76
8	B001M2	B00M2F	ER-MLRS/G	87	2	97.2%	0	169
8	B000M2	B00M2F	ER-MLRS	52	0	100.0%	6	0
8	B000M2	B00M2F	ER-MLRS/G	19	0	100.0%	6	0
8	B001M2	B00M2F	ER-MLRS/G	165	72	56.3%	0	169
9	B001M2	B00M2F	ER-MLRS	125	14	89.0%	0	211
11	B001M2	B00M2F	ER-MLRS	103	24	76.8%	0	211
11	B001M2	B00M2F	ER-MLRS/G	138	57	59.1%	0	176
	TOTAL			1,145	266	76.8%		

Table L-29 Problems Filling Maneuver Unit Orders, Class V (Division Units)

TP	REQUESTING UNIT	SUPPLY UNIT	SUPPLY TYPE	AMOUNT REQUESTED (Rounds)	AMOUNT SHIPPED (Rounds)	AMOUNT SHORTED (%)	TRUCKS AVAIL	AVAIL STOCKS (Rounds)
1	B220EN	B22BSA	BWAMM	21,241	720	96.6%	0	6,625
1	B220EN	B22BSA	5.56MM	57,540	31,685	44.9%	0	161,217
1	B230EN	B23BSA	BWAMM	21,265	720	96.6%	0	6,644
1	B210EN	B21BSA	BWAMM	21,231	720	96.6%	0	6,665
1	B210EN	B21BSA	5.56MM	57,540	32,352	43.8%	0	161,884
1	B200M2	B20M2F	ATACMS I	180	14	92.2%	0	145
1	B200M2	B23BSA	ATACMS I	180	2	98.9%	0	145
1	B200M2	B23BSA	ATACMS I	163	0	100.0%	0	145
4	B202A2	B21A2F	M864	39	2	94.2%	4	0
4	B202A2	B21BSA	M864	39	0	100.0%	4	0
4	B202A2	B21A2F	M864	39	11	70.7%	4	0
4	B201A2	B21BSA	M483A1	286	194	32.2%	4	0
4	B202A2	B21A2F	XM898	219	28	87.3%	0	235
5	B200M2	B20M2F	ATACMS II/	42	15	64.5%	0	100
5	B202A2	B21A2F	XM898	151	28	81.4%	0	200
5	B202A2	B21A2F	M483A1	86	51	41.0%	0	69
5	B202A2	B21A2F	M483A1	220	167	24.2%	0	69
5	B201A2	B21A2F	M483A1	359	38	89.3%	0	35
5	B200M2	B20M2F	ER-MLRS/G	21	5	77.8%	4	0
7	B213MX	B21BSA	M933	136	14	90.0%	0	62
8	B213MX	B21BSA	M933	50	49	2.9%	0	48
8	B200M2	B20M2F	ATACMS II/	41	12	70.8%	0	115
8	B200M2	B20M2F	ER-MLRS	32	0	100.0%	4	0
8	B200M2	B23BSA	ER-MLRS	32	0	100.0%	4	0
8	B200M2	B20M2F	ER-MLRS	12	5	61.2%	4	0
8	B200M2	B23BSA	ER-MLRS	12	0	100.0%	4	0
8	B223MX	B22BSA	M933	136	38	72.1%	2	0
8	B206A2	B24A2F	XM898	274	28	89.8%	0	234
8	B206A2	B22BSA	XM898	274	28	89.8%	0	234
9	B204A2	B22BSA	M483A1	271	158	41.7%	0	378
10	B230EN	B23BSA	BWAMM	5,174	11	99.8%	0	6,654
10	B200M2	B20M2F	M26	59	0	100.0%	0	62
12	B230EN	B23BSA	BWAMM	5,155	2	100.0%	0	6,654
	TOTAL			192,499	67,097	65.1%		

Table L-30: Problems Filling Maneuver Unit Orders, Class V (MEF Units)

TP	REQUESTING UNIT	SUPPLY UNIT	SUPPLY TYPE	AMOUNT REQUESTED (Rounds)	AMOUNT SHIPPED (Rounds)	AMOUNT SHORTED (%)	TRUCKS AVAIL	AVAIL STOCKS (Rounds)
2	B512MX	B51SSD	50CAL	19,584	9,500	51.5%	0	42,180
2	B512MX	B50SSA	50CAL	19,584	6,000	69.4%	0	42,180
3	B500AH	B50SSA	B20MM	6,729	2,185	67.5%	0	10,500
	TOTAL			45,897	17,685	61.5%		

- In table L-31, supply type-maneuver unit combinations that have a zero BOH are presented. The table has been coded: **0** - *time and distance problems;* **1** - *unsupported materiel;* **2** - *insufficient replenishment stockages;* and **3** - *unavailable transporters.* Generally, once a unit experiences a zero BOH, the zero BOH continues to the end of the scenario.

- Zero BOH for Corps, Division, and MEF maneuver units are attributed to shortages of transporters, shortages of Class V supply replenishments, and large time-distances between maneuver

units and their supporting CSS unit (reference Table L-31). The reader is cautioned regarding the "0"; some maneuver units consume everything on-hand, and cannot be provided a supply type fast enough regardless of the speed of the CSS system.

Table L-31: Causes for Zero BOH

MANEUVER UNIT	*SUPPLY TYPE*	*TP*													
		0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*# TPs*
B200DC	25MM													0	1
B511MX	50CAL										0	0	0	0	4
B203A2	7.62MM								0	0					2
B206A2	7.62MM													0	1
B000M2	ER-MLRS									2					1
B200M2	ER-MLRS									0,2	0	0	0	0	5
B000M2	ER-MLRS/G								0,2	0,2	0	0	0,2		5
B200M2	ER-MLRS/G				0	0	0,2	0	0	0	0	0	0	0	10
B203A2	LAW						0								1
B51AT2	M107/CB											0			1
B51CT2	M107/CB													0	1
B201A2	M483A1					0,2					0	0	0	0	5
B202A2	M483A1					0									1
B203A2	M483A1					0									1
B51AT2	M483A1									0	0	0	0	0	5
B51BT2	M483A1									0	0	0	0	0	5
B51CT2	M483A1									0	0		0	0	4
B209A2	M549A1								0	0	0	0	0	0	6
B51AT2	M549A1								0	0			0		3
B51BT2	M549A1								0						1
B51CT2	M549A1								0						1
B201A2	M864				0	0	0						0	0	5
B202A2	M864				0	0,2									2
B203A2	M864				0	0									2
B204A2	M864								0	0					2
B205A2	M864								0						1
B206A2	M864								0	0					2
B207A2	M864							0	0	0	0	0	0	0	7
B208A2	M864								0	0	0	0	0	0	6
B209A2	M864						0	0	0	0	0	0	0	0	8
B51AT2	M864								0	0	0				3
B51BT2	M864								0		0	0	0	0	5
B51CT2	M864								0	0					2
B211AR	M933					0									1
B223MX	M933									2					1
B224MX	M933									0					1
B514AR	TOWII									0					1
B522IN	TOWII								0						1
Total		0	0	0	4	8	4	3	17	20	14	13	15	16	114

(d) Observations.

(1) Four of the munition types (155MM, 25MM, 7.62MM, and LAW) experience a zero Balance-on-Hand for the Division maneuver units. Three of the munition types (155MM, 50CAL, and TOWII) experience a zero Balance-on-Hand for the MEF maneuver units.

(2) Problems with supply Class V unfilled orders, via standard resupply for the Corps, the Division, and the MEF maneuver units are associated with a shortage of trucks or stocks for replenishment.

(3) The Balance-on-Hand percentages of both the munition types MLRS for the Division and B20MM for the MEF were so low at end state (TP 12), they triggered emergency supply replenishment requests. In addition, these were the only two instances where the total amount used exceeded the BOH at initial state (TP 0).

APPENDIX A

VIC Name to Unit Name Cross Reference	
VIC Name	Unit Name
B00000	21ST CORPS
B000AH	21ST CORPS ATK HEL BN (AH64)
B00AHF	21ST CORPS ATK HEL FLE
B01CSA	21ST CORPS SPT GROUP
B001M2	21ST CORPS HIMARS BTY
B000M2	21ST CORPS MLRS BTY
B00M2F	21ST CORPS MLRS FLE
B200MX	23RD DIVISION
B210AR	1/23RD
B211AR	1-1 AR TF
B212AR	2-1 AR TF
B213MX	3-1 MECH TF
B211S1	ADA AVENGER BTRY
B212S1	ADA AVENGER BTRY
B213P1	ADA AVENGER BTRY
B210EN	ENGINEER BN
B21BSA	FOWARD SPT BN
B21FLE	FOWARD SPT BN
B220AR	2/23RD
B221AR	1-2 AR TF
B222AR	2-2 AR TF
B223MX	3-2 MECH TF
B224MX	4-2 MECH TF
B221S1	ADA AVENGER BTRY
B222S1	ADA AVENGER BTRY
B223P1	ADA AVENGER BTRY
B220EN	ENGINEER BN
B22BSA	FOWARD SPT BN
B22FLE	FOWARD SPT BN
B230AR	3/23RD
B231AR	1-3 AR TF
B232AR	2-3 AR TF
B233MX	3-3 MECH TF
B231S1	ADA AVENGER BTRY
B232S1	ADA AVENGER BTRY
B233P1	ADA AVENGER BTRY
B230EN	ENGINEER BN
B23BSA	FOWARD SPT BN
B23FLE	FOWARD SPT BN
B20002	DIV ARTY BDE
B201A2	FA HIP BTY
B21A2F	FA FLE
B202A2	FA HIP BTY
B203A2	FA HIP BTY
B204A2	FA HIP BTY
B24A2F	FA FLE
B205A2	FA HIP BTY
B206A2	FA HIP BTY
B207A2	FA HIP BTY
B27A2F	FA FLE
B208A2	FA HIP BTY
B209A2	FA HIP BTY
B200M2	MLRS BTRY
B20M2F	DIV MLRS FLE
B201AH	AH64 BN

VIC Name to Unit Name Cross Reference	
VIC Name	Unit Name
B21AHF	AH64 FLE
B200DC	DIV CAV SQDN
B20DCF	CAV FLE
B201DC	CAV TRP
B202DC	CAV TRP
B203DC	CAV TRP
B200SH	AIR CAV TRP
B20SHF	AIR CAV FLE
B20DSA	MAIN SPT BN
B30000	1ST KUWAIT DIVISION
B30DSA	1st KUWAIT DIV/SPT BDE
B300AH	AH64 BN
B30001	ADA BDE
B31AH1	ADA MISSILE PLT
B31BH1	ADA MISSILE
B31CH1	ADA MISSILE
B31DH1	ADA MISSILE
B31EH1	ADA MISSILE
B31FH1	ADA MISSILE
B31GH1	ADA MISSILE
B31HH1	ADA MISSILE
B31IH1	ADA MISSILE
B32AH1	ADA MISSILE PLT
B32BH1	ADA MISSILE
B32CH1	ADA MISSILE
B32DH1	ADA MISSILE
B32EH1	ADA MISSILE
B32FH1	ADA MISSILE
B32GH1	ADA MISSILE
B32HH1	ADA MISSILE
B32IH1	ADA MISSILE
B33AH1	KUWAITI PATRIOT MISSILE BTY
B33BH1	ADA MISSILE
B33CH1	ADA MISSILE
B33DH1	ADA MISSILE
B33EH1	ADA MISSILE
B33FH1	ADA MISSILE
B33GH1	SAUDI PATRIOT MISSILE BTY
B33HH1	ADA MISSILE
B33IH1	ADA MISSILE
B33JH1	ADA MISSILE
B33KH1	ADA MISSILE
B33LH1	ADA MISSILE
B33MH1	ADA MISSILE
B33NH1	ADA MISSILE
B33OH1	ADA MISSILE
B33PH1	ADA MISSILE
B33QH1	US PATRIOT MISSILE BTY
B33RH1	ADA MISSILE
B33SH1	ADA MISSILE
B33TH1	ADA MISSILE
B33UH1	ADA MISSILE
B33VH1	ADA MISSILE
B33WH1	ADA MISSILE
B33XH1	ADA MISSILE
B33YH1	ADA MISSILE
B33ZH1	ADA MISSILE

VIC Name to Unit Name Cross Reference	
VIC Name	Unit Name
B34AH1	ADA MISSILE PLT
B34BH1	ADA MISSILE
B34CH1	ADA MISSILE
B34DH1	ADA MISSILE
B34EH1	ADA MISSILE
B34FH1	ADA MISSILE
B34GH1	ADA MISSILE
B34HH1	ADA MISSILE
B34IH1	ADA MISSILE
B35AH1	ADA MISSILE PLT
B35BH1	ADA MISSILE
B35CH1	ADA MISSILE
B35DH1	ADA MISSILE
B35EH1	ADA MISSILE
B35FH1	ADA MISSILE
B35GH1	ADA MISSILE
B35HH1	ADA MISSILE
B35IH1	ADA MISSILE
B36AH1	ADA MISSILE PLT
B36BH1	ADA MISSILE
B36CH1	ADA MISSILE
B36DH1	ADA MISSILE
B36EH1	ADA MISSILE
B36FH1	ADA MISSILE
B36GH1	ADA MISSILE
B36HH1	ADA MISSILE
B36IH1	ADA MISSILE
B30002	ARTY BDE
B30BSA	FORWARD SPT BN
B30AM2	300 MM BTY
B30BM2	300 MM BTY
B30CM2	300 MM BTY
B30AA2	155 MM SP BTY
B30BA2	155 MM SP
B30CA2	155 MM SP
B30DA2	155 MM SP
B30EA2	155 MM SP
B30FA2	155 MM SP
B30GA2	155 MM SP
B30HA2	155 MM SP
B30IA2	155 MM SP
B30JA2	155 MM SP
B30KA2	155 MM SP
B30LA2	155 MM SP
B30006	COMMANDO BN
B37000	NATIONAL GUARD BDE
B37BSA	FORWARD SPT BN
B371MX	NATIONAL GUARD MECH BN
B372IN	NATIONAL GUARD INF BN
B373IN	NATIONAL GUARD INF BN
B374IN	NATIONAL GUARD INF BN
B375SF	NATIONAL GUARD SF BN
B310AR	15TH ARMOR BDE
B311AR	ARMOR BN
B312AR	ARMOR BN
B313AR	ARMOR BN
B314MX	MECH BN

VIC Name to Unit Name Cross Reference	
VIC Name	Unit Name
B320AR	26TH ARMOR BDE
B321AR	ARMOR BN
B322AR	ARMOR BN
B323MX	MECH BN
B330AR	35TH ARMOR BDE
B331AR	ARMOR BN
B332AR	ARMOR BN
B333MX	MECH BN
B340MX	6TH MECH BDE
B341AR	ARMOR BN
B342MX	MECH BN
B343MX	MECH BN
B344MX	MECH BN
B350MX	RESERVE MECH BDE
B351MX	MECH BN
B352MX	MECH BN
B353MX	MECH BN
B354MX	MECH BN
B31BSA	LOG BN
B32BSA	LOG BN
B33BSA	LOG BN
B34BSA	LOG BN
B35BSA	LOG BN
B50000	MEF
B500AH	MEF ATK HELO
B50AHF	MEF ATK HELO FLE
B501CH	LIFT HELO BN
B51CHF	LIFT HELO FLE
B510MX	MEF LANDING BDE
B511MX	BN TASK FORCE
B512MX	BN TASK FORCE
B513IN	INF BN
B514AR	ARMOR BN
B51AT2	ARTY BTY
B51BT2	ARTY BTY
B51CT2	ARTY BTY
B510P1	ADA AVENGER BTRY
B511RE	RECON TRP
B512RE	RECON TRP
B513RE	RECON TRP
B511EN	ENGINEER BN
B51SSD	SERVICE SPT
B520MX	MEF RLT
B521IN	INF BN
B522IN	INF BN
B523IN	INF BN
B52SSD	SERVICE SPT
B50SSA	MEF SERVICE SPT
B60000	US NAVY ASSETS
B70000	SAUDI UNITS
B71BSA	FORWARD SPT BN
B710MX	PSB 20TH MECH BDE
B711A2	155 MM SP BN
B711M2	MRL ASTROS BN
B711RE	RECON CO
B711MX	MECH BN
B712MX	MECH BN

VIC Name to Unit Name Cross Reference	
VIC Name	Unit Name
B713MX	MECH BN
B714AR	ARMOR BN
B715MX	MECH BN (57TH KUWAITI)
B720AR	6TH ARMOR BDE
B721AH	AH64 BN
B722AH	AH64 BN
B721A2	155 MM SP BN
B721RE	RECON CO
B721AR	MECH BN
B722AR	MECH BN
B723AR	MECH BN
B724MX	ARMOR BN
B730MR	2ND SANG BDE
B731A2	155 MM SP BN
B731MR	5th MOTORIZED BN
B732MR	6th MOTORIZED BN
B733MR	7th MOTORIZED BN
B734MR	8 MOTORIZED BN

APPENDIX B

DEFINITIONS

Specific supply analysis definitions are listed below:

(1) Amount Authorized of this supply type: Amount of this supply type that this unit is authorized at the end of the TP, this number is calculated by multiplying the number of available systems that use this supply type by the amount authorized per system. This number can change from one TP to another due to weapon losses.

(2) Balance-on-Hand of this supply type: Amount of this supply type that this unit has on hand at the end of the TP.

(3) Amount Used during this TP: Amount of this supply type that this unit used during this TP.

(4) Amount Destroyed during this TP: Amount of this supply type that was destroyed due to attrition of systems (when a system is assumed destroyed in combat a percentage (50) of its on-board supplies are assumed destroyed).

(5) Ratio of Balance on-Hand to Amount Authorized: A percent value used to indicate overall assessment of a munition; when this percent value is low, a greater risk is indicated as to possibility of exhausting all supplies.

(6) Total Amount Authorized during this TP: The sum of each amount authorized of each supply type at the end of the TP. The stockages are redistributed, used, or destroyed as the scenario proceeds. As units are engaged and attrited, the amount-authorized is reconciled with the number of surviving weapon systems.

(7) Total Amount-on-Hand during this TP: The sum of the amount of each supply type that the units actually have in stock at the end of the TP. Utilization, attrition, and other activities that may reduce the stockage of a supply type reduce this amount.

(8) Total Amount Used during this TP: The sum of the amount of each supply type consumed as a result of movement and combat at the end of the TP.

(9) Total Amount Destroyed during this TP: The sum of the amount of each supply type destroyed due to attrition of systems at the end of the TP (when a system is damaged in combat, a percentage of its on-board supplies are destroyed).

(10) Total Amount-on-Order during this TP: The sum of the amounts of each supply type ordered by each unit during a period. As materiel is consumed, units initiate orders based on a re-order threshold to restock its supplies. If an order cannot be shipped for reasons of shortages of stocks or movers, a unit will re-order the replenishments during the next period.

(11) Timely Fashion: When a maneuver unit calls for replenishment of supplies, the support of the maneuver unit shall be said to be in a

"timely fashion," if the maneuver unit did not suffer for lack of supplies. For class IIIB, a unit suffers when it is forced to stop for lack of class IIIB. For class V, a unit suffers a negative consequence when it exhausts a class V supply type.

(12) Standard Resupply: Maneuver units will generate an order for a supply type when, per the resupply schedule, the on-hand plus on-order quantity is less than 75 percent of the authorized quantity. The magnitude of the order is the amount of each supply type to bring the on-hand plus on-order quantity up to the authorized quantity. Routinely, the order is for 25 percent of authorized. When the shipment arrives, the on-hand balance will increase, and the maneuver unit will issue an order when the on-hand quantity again falls below the 75 percent authorized. Exceptions to this resupply process occur when, for lack of trucks or stocks, an order cannot be filled or shipped. When the order (or portion of it) cannot be shipped in the period it was requested, the unfilled portion is discarded - there are no backorders or due-outs. The maneuver unit will reassess its needs during the next period. Standard resupply can be divided into two types: supply point distribution (SPD) and unit distribution (UD). A unit that uses SPD provides its own organic transporters to convey replenishments between the supply unit(s) and itself; a unit using UD requires the supply unit to provide both replenishments and transporters.

(13) Emergency Resupply: Maneuver units will generate an "emergency" order for a supply type when, per the resupply schedule, the on-hand plus on-order quantity is less than 50 percent of the authorized quantity. The magnitude of the order is the amount of each supply type to bring the on-hand quantity up to 50 percent of the authorized quantity. When the shipment arrives, the on-hand balance will increase. This is "emergency resupply." Emergency resupply is subject to a number of factors: (1) the availability of replenishment stockages; (2) the availability of helicopter support to provide airlift between the supporting CSS unit(s) and the requesting maneuver unit; and (3) the hostile environment surrounding the maneuver unit. If the scenario is short-lived or has intensive combat, the last factor can be the most limiting. Helicopters will not provide lift to maneuver units that are under assault. If any one of the factors prohibits emergency resupply, the "emergency" request for replenishments will be routed for "standard" resupply. When the order (or portion of same) cannot be shipped in the time period it was requested, the unfilled portion is discarded - there are no backorders or due-outs - the unit must wait for the next period per the resupply schedule to assess its stockage position and re-order.

APPENDIX C

TABLES

Table C-1: **ARMY** Units Rendered Combat Ineffective During the Scenario

Ineffective "Dead" Unit	Time	Major Weapon Systems
B201DC	14.0	M1A2, IFV/TOW
B212AR	15.8	M1A1, IFV/TOW, HMMWV/MK19
B211AR	21.6	M1A1, IFV/TOW, HMMWV/MK19
B202DC	24.4	M1A2, IFV/TOW
B223P1	33.2	AVENGER
B221AR	34.1	M1A1, IFV/TOW, HMMWV/MK19
B203DC	34.4	M1A2, IFV/TOW
B213MX	42.8	M1A1, IFV/TOW, HMMWV/MK19
B213P1	43.1	AVENGER

Table C-2: **MEF** Units Rendered Combat Ineffective During the Scenario

Ineffective "Dead" Unit	Time	Major Weapon Systems
B511RE	26.4	LAV/TOW
B512RE	28.0	LAV/TOW
B513RE	28.0	LAV/TOW
B522IN	28.2	HMMWV/TOW, AVENGER
B521IN	28.3	HMMWV/TOW, AVENGER
B513IN	28.9	HMMWV/TOW, AVENGER
B523IN	29.1	HMMWV/TOW, AVENGER

Table C-3: **Kuwaiti** Units Rendered Combat Ineffective During the Scenario

Ineffective "Dead" Unit	Time	Major Weapon Systems
B30JA2	6.0	KM1988
B344MX	6.8	HMMWV/TOW, HMMWV/MK19, KBMP3
B343MX	7.7	HMMWV/MK19
B30CA2	7.7	K155SP
B30LA2	7.8	KM1988
B33BH1	8.5	PATRIOT
B32BH1	9.8	IHAWK
B32AH1	9.9	IHAWK
B32CH1	10.4	IHAWK
B32EH1	10.5	IHAWK
B32FH1	10.5	IHAWK
B32DH1	10.5	IHAWK
B33CH1	11.7	PATRIOT
B33FH1	13.1	PATRIOT
B373IN	14.4	NONE
B35DH1	16.5	ASPIDE
B35EH1	16.5	ASPIDE
B35FH1	16.5	ASPIDE
B321AR	22.1	M1A2, HMMWV/MK19
B34AH1	22.5	ASPIDE
B34CH1	22.5	ASPIDE
B34BH1	22.6	ASPIDE
B35AH1	23.5	ASPIDE
B35BH1	23.5	ASPIDE
B35CH1	23.5	ASPIDE
B35GH1	28.0	ASPIDE
B35HH1	28.0	ASPIDE
B35IH1	28.0	ASPIDE

Table C-4: **Saudi** Units Rendered Combat Ineffective During the Scenario

Ineffective "Dead" Unit	Time	Major Weapon Systems
B711RE	4.2	M113/TOW, M60A3
B711MX	4.6	M113/TOW
B715MX	4.7	IFV/TOW
B712MX	4.8	M113/TOW
B713MX	4.9	M113/TOW
B714AR	4.9	M60A3
B711A2	5.6	155HIPD
B721RE	9.3	LAV/90MM, LAV/TOW
B732MR	19.2	LAV/90MM, LAV/TOW
B723AR	19.3	M1A2
B722AR	19.5	M1A2
B721AR	20.4	M1A2
B724MX	21.1	M113/TOW
B733MR	21.4	LAV/90MM, LAV/TOW
B734MR	22.5	LAV/90MM, LAV/TOW
B731A2	23.3	155HIPD
B731MR	23.5	LAV/90MM, LAV/TOW
B721A2	27.1	155HIPD

APPENDIX D

TABLES

Table D-1: Truckloads On-Road, CSS-to-Maneuver Units (Corps Units)

CLASS IIIB & V, TRUCKLOADS BY TP								
TP	ATACMS I	ATACMS II/B	B30MM	ER-MLRS	ER-MLRS/G	7.62MM	M26	TOTAL
1	1.75	---	---	---	---	---	---	1.75
2	---	---	1.50	---	---	---	---	1.5
3	---	---	1.50	---	---	---	---	1.5
4	---	---	1.50	---	---	---	---	1.5
5	5.99	---	---	---	---	---	---	5.99
6	5.99	---	---	---	---	---	---	5.99
7	5.99	4.37	---	0.89	0.70	---	---	11.95
8	---	4.37	---	0.89	2.24	---	---	7.5
9	---	---	---	1.18	1.55	---	1.57	4.3
10	---	---	---	---	---	0.01	3.77	3.78
11	---	---	---	0.50	1.19	0.02	1.36	3.07
12	---	---	---	0.50	1.19	0.01	---	1.7

Table D-2: Truckloads On-Road, CSS-to-Maneuver Units (Division Units)

CLASS IIIB & V, TRUCKLOADS BY TP													
TP	25MM	5.56MM	ATACMS_I	ATACMS_II/B	M483A1	M549A1	M864	M933	POL-B	POL-BACFT	XM898	XM982	TOTAL
1	---	0.3	2.0	---	---	---	0.28	---	10.08	---	---	---	12.66
2	---	---	2.0	---	---	---	0.97	---	13.88	0.96	---	---	17.81
3	---	---	0.25	---	0.5	0.52	1.66	0.07	18.22	0.96	---	---	22.18
4	---	---	---	---	3.86	1.02	1.59	0.18	4.34	0.96	0.11	---	12.06
5	---	---	---	1.88	4.08	1.21	2.11	0.51	---	0.96	0.22	---	10.97
6	---	---	---	1.88	1.5	0.48	1.49	0.38	---	---	0.11	---	5.84
7	---	---	---	1.88	0.22	1.42	2.73	0.74	---	---	---	0.31	7.3
8	---	---	---	3.38	1.64	1.28	4.68	0.86	---	---	0.22	---	12.06
9	---	---	---	1.5	3.46	---	3.35	0.17	---	---	0.22	---	8.7
10	0.04	---	---	1.5	---	---	1.97	0.09	---	---	---	---	3.6
11	0.11	---	---	1.5	---	---	1.8	0.22	---	---	---	---	3.63
12	0.15	---	---	---	---	0.17	1.23	0.09	---	---	---	---	1.64

Table D-3: Truckloads On-Road, CSS-to-Maneuver Units (Division Units)

CLASS IIIB & V, TRUCKLOADS BY TP													
TP	ER-MLRS	ER-MLRS/G	LAW	B30MM	HELLFIRE	JAVELIN	7.62MM	M107/CB	M26	BWAMM	STING	50CAL	TOTAL
1	---	---	---	1.24	---	---	0.15	---	---	7.71	---	---	9.1
2	---	---	---	1.24	---	---	---	---	---	---	0.22	---	1.46
3	---	0.1	---	---	---	---	---	---	---	---	---	---	0.1
4	---	0.1	---	---	---	---	---	0.67	---	---	0.2	---	0.97
5	---	0.22	---	---	0.33	---	---	0.67	---	---	0.2	0.02	1.44
6	---	0.12	---	---	0.33	---	0.01	---	---	---	---	0.02	.48
7	---	0.12	---	---	---	---	0.01	---	---	---	---	---	0.13
8	0.1	0.51	---	---	---	0.04	0.02	---	---	---	---	---	0.67
9	0.1	0.39	0.01	---	---	0.04	0.02	0.44	---	---	---	---	1.0
10	0.1	0.39	---	---	---	---	0.01	---	---	0.04	---	---	0.45
11	0.1	0.9	---	---	---	---	0.01	---	---	---	---	---	1.01
12	---	0.51	---	---	---	---	0.01	---	---	0.01	---	---	0.53

Table D-4: Truckloads On-Road, CSS-to-Maneuver Units (MEF Units)

CLASS IIIB & V, TRUCKLOADS BY TP											
TP	POL-B	M549A1	M864	M483A1	M107/CB	TOWII	JAVELIN	B20MM	7.62MM	50CAL	TOTAL
1	---	---	---	---	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---	---	---	---	---
3	10.39	---	---	---	---	---	---	---	---	---	10.39
4	10.39	---	---	---	---	---	---	---	---	---	10.39
5	10.39	---	---	---	---	---	---	---	---	---	10.39
6	---	---	---	---	---	---	---	---	---	---	---
7	---	0.09	0.06	---	---	0.18	---	---	---	---	0.33
8	8.89	0.29	0.12	1.91	0.81	0.98	0.1	---	---	0.16	13.26
9	8.89	0.15	0.06	1.45	---	0.87	0.16	---	---	0.16	11.74
10	---	0.04	---	1.25	0.21	0.31	0.06	0.14	---	---	2.01
11	3.41	0.07	---	1.06	0.46	0.18	---	0.26	---	---	5.44
12	10.99	0.07	---	0.91	0.47	0.18	---	0.18	0.08	---	12.88

APPENDIX E

ACRONYM LIST

AAV	Amphibious Assault Vehicle
ADA	Air Defense Artillery
AFV	Armored Fighting Vehicle
AO	Area of Operation
AOE	Army of Excellence
AR	Army Regulation
ATACMS	Army Tactical Missile System
AVLB	Armored Vehicle Launch Bridge
AVIM	Aviation Intermediate Maintenance
AVUM	Aviation Unit Maintenance
BCMDVEH	Command Vehicle
BSA	Brigade Support Area
BSFV	Bradley Stinger Fighting Vehicle
BOH	Balance-on-Hand
C	Combat
CDS	Corps/Division Scenario
CEV	Combat Engineer Vehicle
CS	Combat Support
CSA	Corps Storage Area
CSS	Combat Service Support
DNBI	Disease and Non-battle Injury
DS	Direct Support
DSA	Division Support Area
EAC	Echelons Above Corps
FSB	Forward Support Battalion
Gals	Gallons
GS	General Support
HET	Heavy Equipment Transporter
HIMARS	High Mobility Artillery Rocket System
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
IFV	Infantry Fighting Vehicle
LAV	Light Armored Vehicle
LO	Logistics
KIA	Killed in Action
MEF	Marine Expeditionary Force
MHBF	Mean Hours Between Failures

MHE	Materiel-Handling Equipment
MMH	Maintenance Man-hour
MLRS	Multi-Launch Rocket System
MSR	Main Supply Route
ORG/DS	Organization/Direct Support
POL	Petroleum, Oil, Lubricant
RTC	Return-to-Combat
RD	Return to Duty
SPD	Supply Point Distribution
Stons	Short Tons
SWA	Southwest Asia
TOW	Tube Launched, Optically Sighted, Wire Guided
TP	Time Period
TRAC-FLVN SAC	TRADOC Analysis Center at Fort Leavenworth Study and Analysis Center
TRAC-LEE	TRADOC Analysis Center at Fort Lee
TRADOC	Training and Doctrine Command
UD	Unit Distribution
VIC	Vector-in-Commander