August 1989

United States Army Armor School

MULTI-SALVO GRENADE LAUNCHER ABBREVIATED ANALYSIS

STUDY REPORT

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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS None
2a. SECURITY CLASSIFICATION AUTHORITY N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT Unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) N/A	5. MONITORING ORGANIZATION REPORT NUMBER(S) N/A
6a. NAME OF PERFORMING ORGANIZATION Directorate of Combat Developments 6b. OFFICE SYMBOL *(If applicable)* ATSB-CDC	7a. NAME OF MONITORING ORGANIZATION USAARMS
6c. ADDRESS *(City, State, and ZIP Code)* Fort Knox, KY 40121-5215	7b. ADDRESS *(City, State, and ZIP Code)* Fort Knox, KY 40121-5215
8a. NAME OF FUNDING/SPONSORING ORGANIZATION USAARMS 8b. OFFICE SYMBOL *(If applicable)*	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N/A
8c. ADDRESS *(City, State, and ZIP Code)* Fort Knox, KY 40121-5215	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO.: N/A PROJECT NO.: TASK NO.: WORK UNIT ACCESSION NO.:

11. TITLE *(Include Security Classification)*

MULTI-SALVO GRENADE LAUNCHER ABBREVIATED ANALYSIS (U)

12. PERSONAL AUTHOR(S)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15. PAGE COUNT
Final	FROM 1 Jun 89 TO 1 Sep 89	89/08/31	41

16. SUPPLEMENTARY NOTATION

N/A

17. COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUB-GROUP	Countermeasures, Vehicle Smoke, Launchers, VIDS, MSGL, Grenades, Obscuration

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

Report evaluates the multi-salvo grenade launcher assembly being developed to interface with the Vehicle Integrated Defense System (VIDS) and the M257 smoke grenade launcher, currently on the M2/M3 Bradley vehicles, to determine if the new launcher development is required.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
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MULTI-SALVO SMOKE GRENADE LAUNCHER
ABBREVIATED ANALYSIS

1. MISSION NEED/THREAT.

a. Current combat vehicles across the Army are equipped with different smoke grenade launchers that were developed as part of each specific vehicle program. These different launchers all provide the same basic smoke screen capability for the various vehicles on which they are mounted. The need exists to standardize the grenade launchers that will be mounted on all future Army combat vehicles. This will reduce the cost of the launchers and provide for interchangeability from one vehicle to the next. Also, the current launchers do not provide operator selected screening to the front, sides, or overhead. These deficiencies were identified in the 1987 and 1989 Battlefield Deficiency Plan (BDP).

b. Threat weapon systems utilizing electro-optical, infrared, microwave or radio frequency guidance schemes coupled with target acquisition systems using comparable wavelength sensors greatly increase the lethality of the battlefield. These systems, deployed on a variety of platforms, ranging from manportable to airborne, increase the capability of the threat force to fight effectively under a wide range of battlefield and environmental conditions. Technological advances also offer the potential for threat forces to employ Directed Energy Weapons (DEW). DEW systems (laser, radio frequency, sonic wave, and particle beam) are expected to have a variety of applications to include anti-sensor and anti-vehicular.

c. The Multi-Salvo Grenade Launcher (MSGL) will launch obscurant grenades to provide the host vehicle with concealment from threat surveillance, target acquisition systems, and weapon guidance systems by placing an obscurant screen between the observation/weapon system and the vehicle. The MSGL will be capable of firing its munitions to the front, sides, or above the vehicle to provide it protection in all directions.

2. ALTERNATIVES.

a. A draft Trade-Off Analysis (TOA) identified and ranked several currently fielded US Army and Allied smoke grenade launchers, along with MSGL as possible candidates to meet the technical characteristics stated in the MSGL Required Operating ~~Characteristics~~ CAPABILITIES (ROC). The MSGL was ranked first, and the currently fielded M257 smoke grenade launcher was ranked second. The M257 was chosen as the base case and the MSGL as the alternative system for this Abbreviated Analysis (AA). Product improvement of the M257 was not included as an alternative because the program cost was estimated to be the same as MSGL, and have a later fielding schedule.

b. The M257 is shown in Figure 1. It consists of four discharger tubes and a mounting base with a wiring harness and a resistor. The M257 is currently mounted on the Bradley, and several other combat vehicles. The M257 is proposed for the M1A2 Abrams (four 4-tube launchers) in lieu of the heavier, costlier 6-tube, and less efficient launchers currently on the M1 and M60 series tanks.

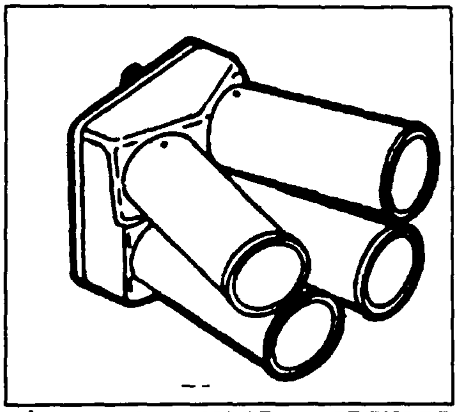

Figure 1 M257 GRENADE LAUNCHER

c. The alternative, MSGL, is shown in Figure 2. It consists of 4 discharger tubes (identical in function to the M257 tubes) and a mounting base which contains a wiring harness, resistor, and diode. The base is similar to the M257 base, but mounts the discharger tubes with mounting bolts that are accessible from the front of the launcher. The bolts on the M257 are accessible only from the back of the mounting bracket. This MSGL feature provides better maintainability than the M257, in that it can be repaired more quickly. Both the M257 and MSGL are repaired by replacement of individual tubes, and neither launcher assembly is discarded upon failure of tubes.

d. Although the wiring of the M257 and the MSGL differ, both launchers can be interfaced with an automatic vehicle firing and testing circuit. However, the wiring of the MSGL permits built-in firing circuit continuity testing, whereas the M257 does not. Also, the built-in test to determine if a launcher tube is loaded with a grenade will allow each of four tubes to be checked with MSGL, versus an aggregate of 4 tubes with M257. BIT with the M257 launcher would indicate that the launcher was loaded with grenades if any of the four tubes contained a grenade. BIT with MSGL would indicate that the loader was loaded only if all four launcher tubes were loaded. This feature would become important if an automatic firing circuit were to be required to switch from an empty launcher to a loaded one with a high degree of confidence that the firing would produce a full 8 grenade salvo of smoke.

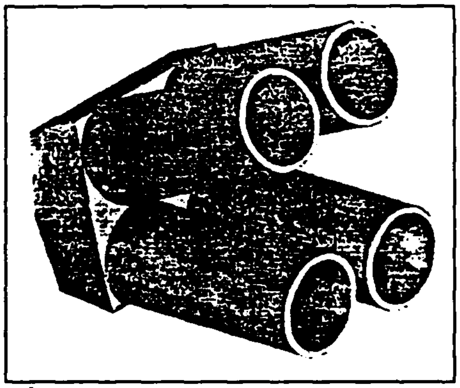

Figure 2 MSGL GRENADE LAUNCHER

e. The interface of the launchers to the vehicles will be a connection of the wiring harnesses of either the MSGL or M257 to the host vehicle electrical/electronic system. For the HFM/Block III tank, this connection will be made to the vehicle electronics (Vetronics) data/power bus for power and for processing of the launcher firing function by digital signals within the vehicle self defense system logic. Both launchers equally provide a means of connection to the vehicle. Neither launcher circuit provides any additional processing of digital signals to Vetronics.

f. A salvo of smoke is defined as the firing of a number of grenades to produce a sufficient cloud of smoke for a desired amount of coverage. This has been determined to be 120 degrees around the vehicle. Current grenades provide 15 degrees of smoke each. Therefore, it takes 8 grenades launched 15 degrees apart to produce a cloud of smoke that provides 120 degrees of coverage. MSGL and the M257 launchers both provide a 120 degree smoke cloud.

g. The four tubes on one MSGL launcher are arranged into two sets of parallel tubes. The parallel sets of two tubes each are 15 degrees apart. Firing two tubes (one from each parallel set) from a launcher provides 30 degrees of coverage around the vehicle. Hence, the smoke of two grenades from four separate MSGL launchers provides a total of 120 degrees coverage, and two salvos of 120 degree coverage without reloading.

h. All of the four tubes of the M257 launcher are angled 15 degrees apart, which provides 60 degrees of contiguous smoke coverage around the vehicle per launcher. Therefore, two 4-tube M257 launchers fired simultaneously will produce 120 degrees of coverage. Four 4-tube M257 launchers will produce two salvos of 120 degree coverage without reloading.

i. The smaller angles of the tubes of the MSGL reduces the vehicle surface mounting space required, measured perpendicular to the mounting surface. This smaller space would provide flexibility in location of launchers on any given vehicle. Some flexibility is lost, however, because a single salvo from MSGL launchers would still require the mounting of 4 launchers (16 tubes) at one location on the vehicle, whereas the M257 would only require two launchers (8 tubes).

j. Neither the requirement for overhead smoke nor the technical description of an overhead smoke system have been developed. It is therefore impossible to assess the worth of the ability of a launcher to produce overhead smoke. However, it is postulated by CRDEC engineers that because of tube orientation, the MSGL will provide more contiguous overhead smoke coverage than the M257. Testing has not been performed to compare the ability of the launchers to provide overhead coverage. However, since the MSGL Trade Off Analysis listed the MSGL as "excellent" and the M257 as "good" in the capability to produce overhead smoke, for study purposes, it is assumed that both have some capability.

3. ESSENTIAL ELEMENTS OF ANALYSIS (EEA).

a. What vehicle application requirements are associated with the performance and physical characteristics of the base case and the MSGL?

b. What are the applicable Life Cycle Costs (LCC) associated with each performance and physical characteristic of the base case and the MSGL?

c. What is the range of production quantities of the base case and the MSGL?

d. How does production quantity affect the unit production cost of the base case and the MSGL over the range of possible production quantities?

4. ANALYSIS OF SYSTEM CHARACTERISTICS, PERFORMANCE AND EFFECTIVENESS.

a. The purpose of this analysis is to discriminate among the two alternatives where actual differences exist using measures of system characteristics, performance, and effectiveness (CPE). These measures have been derived from engineering estimates of performance, and system descriptions.

b. In this section the systems will be ranked based upon a quantitative comparison of the physical characteristics of the systems. This comparison is shown in Table 1.

Table 1. Quantitative Comparison

CPE Parameter	Base case Measure	Base case Rank	MSGL Measure	MSGL Rank
Weight (lb)	12	2	11	1
Reliability (MSBF)	49	SAME	49	SAME
Maintainability(MTTR)	1.5	2	1.2	1
Maintenance Manhours Per Year (1000 MH) Army Wide	15.3	2	12.2	1
Single Tube Replaced	YES	SAME	YES	SAME
Mounting Space(sq in)	85	2	58	1

MSBF - Mean Salvo Between Failure
MTTR - Mean Time To Repair (Clock Hours)
Maintenance Manhours Per Year were calculated based on the following:

Maintenance MH Per Year = Failures/Year X MH/Failure; and

Failures/Yr = No. Launchers X Salvos/Yr/Launcher / MSBF

MH/Failure = MTTR X No. of Mechanics per Clock Hour

where: No. Launchers = 100,000 (assumed)

Salvos/Launcher/Yr = 5 (Peacetime estimate by Concepts Br., DCD, USAARMS)

MSBF = 49 Salvos/failure (RAM Rationale)

No. of Mechanics per Clock Hour = 1 (one man/task)

c. The performance characteristics of the launch tube and the mounting base will be compared in this section. This comparison is shown in Table 2.

Table 2. Launch Tube & Base Comparison

Characteristic	M257	MSGL	HFM ROC	MSGL ROC
Multi salvo	YES	YES	YES	YES
120 DEGREES	YES	YES	YES	YES
240 DEGREES	YES	YES	NO	YES
360 DEGREES	YES	YES	NO	YES
OVERHEAD	YES	YES	NO	YES

d. A comparison of the abilities of the two discharger assemblies to meet the various coverages of smoke could only be made subjectively for the following reasons. First, the host vehicle turret designs have not been finalized. Therefore the total amount of space available for mounting the launchers is not known. Second, the components and technology that will be used in the design of a combat vehicle self defense/countermeasure system have not been defined to the resolution required to determine the number and location of smoke grenade launchers. Smoke grenades are one type of countermeasure technology being considered for the self defense systems. One program proposed is the Vehicle Integrated Defense System (VIDS). VIDS is being developed by TACOM and is scheduled for proof of principle demonstration in 2Q91 as part of the Component Advanced Technology Test Bed (CATT-B). Smoke grenades will compete with vehicle exhaust produced smoke and other active and passive countermeasure technologies for space, funds, and the weight allowance allocated for the entire vehicle defense system. Once the turret designs are known, and the best mix of smoke and/or other countermeasures have been determined the comparison of the two launchers can be better quantified.

e. The comparison shown in Table 2 is based on an estimate of the feasibility of mounting 2 assemblies (1 salvo/8 tubes) of either the MSGL or the M257 on the front, and/or sides of a vehicle similar to the M1A1. For smaller vehicles, such as the Bradley, or the "turretless" Block III tank it becomes more difficult to mount the same amount of launchers around the vehicle or to provide multiple salvos at one location than on a larger turreted vehicle.

f. Regardless of the number and location of the grenade launchers finally chosen for the VIDS/self defense system, the total space claimed on the vehicle by the MSGL would be less than the space claimed by the M257. This is because the MSGL has a smaller mounting base and less tube spread than the M257. As the space to mount launchers becomes smaller, or the number of launchers increases, this attribute becomes more important.

g. The current requirement for the Heavy Force Modernization ROC is for "multiple" salvos of grenade launched smoke, 120 degrees forward of the vehicle. This requirement could be satisfied by two salvos (4 launchers/16 tubes) of either the MSGL or the M257. If the vehicle requirement is later established for greater than 120 degrees of smoke or for an overhead canopy of smoke additional launchers would be required on the vehicle. The smaller mounting space required by the MSGL would facilitate the mounting of additional launchers. Again, depending on the design of the turret (host vehicle) it may be just as easy to mount additional M257 launchers.

h. The performance characteristics of the circuit for each of the launchers will be compared in this section. This is shown in Table 3.

Table 3. Launcher Circuit Comparison

Characteristic	M257	MSGL	HFM ROC	MSGL ROC
BIT (continuity)	NO	YES	NO	YES
BIT (grenade in tube)	4 tubes	each tube	NO	YES
Automatic Firing	YES	YES	NO	NO
VIDS/VETRONICS INTERFACE	YES	YES	YES	YES

5. COST.

a. Introduction. This section presents the detailed results of the Multi-Salvo Grenade Launcher (MSGL) cost analysis to support the MSGL Abbreviated Analysis (AA).

(1) Alternatives.

(a) The Base Case is a M257 Grenade Launcher Discharger 4 tubes) (NSN 1040-01-095-0091). Figure 3 is a schematic drawing of components of the M257 Grenade Launcher Discharger. It is a hardwire configuration with three subassemblies:

1 Base housing with standard connecting bolt holes to connecting variant vehicle.

2 Four discharger tubes attached to base housing.

3 Electrical wire harness and connectors within base housing. Required to fire all four tubes simultaneously.

(b) Alternative 1 is a Multi-salvo Grenade Launcher (MSGL) Discharger (4 tubes). It is a hardwire configuration with three subassemblies:

1 Base housing with standard connecting bolt holes to connecting variant vehicle (slight physical modification to facilitate reduced mounting footprint of turret for host vehicles).

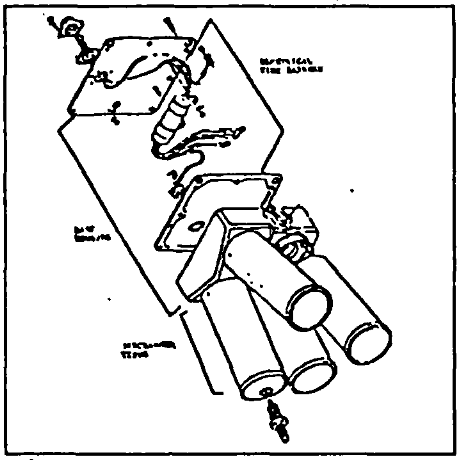

Figure 3 M257 GRENADE DISCHARGER

2 Four discharger tubes attached base housing (identical to M257 design for costing).

3 Electrical wire harness and connectors within base housing (additional wires included in harness to facilitate increased BIT (continuity) capability and ability to fire individual discharger tube).

(c) Both the Base Case and Alternative 1 will fire the standard M76 and L8 smoke grenades, as well as the developmental XM81 millimeter screening grenade.

(2) Ground Rules.

(a) All costs prior to FY90 are considered sunk and therefore will not be reflected within LCC Development Costs.

(b) All costs are presented in current and FY90 constant dollars.

(c) The operational life of each study alternative is 20 years (identical to appropriate vehicle operational life).

(3) Assumptions.

(a) Production and deployment schedules are identical for Base Case and Alternative 1.

(b) M257 quantities produced before FY94 will be considered sunk for this cost analysis. Listed below are production quantities of M257 produced since FY 86 (per AMSMC-CAR-S)

	86	87	88	89	90	91	TOTAL
M257 LAUNCHERS	243	600	288	0	0	398	1529
M257 DISCHARGERS	486	1200	576	0	0	796	3058

(c) Quantity requirements for M257 and MSGL from FY94 and later will be identical for the Base Case and Alternative 1. Annex 1 reflects an estimated requirement of 150,000 dischargers for twenty host vehicles within the Army's inventory. The main variables in determining the production requirements are the number of vehicles and number of dischargers per vehicle. These two variables are estimates. Consequently, for this study, it was estimated that dischargers will fall in a range from a minimum of 10,000 to a maximum of 100,000 units to meet proposed production requirements.

(d) Bradley Fighting Vehicle (BFV) is presently equipped with the M257 and is an adequate representation to formulate a standard vehicle MSGL (vs M257) incremental integration cost.

b. Methodology. The Life Cycle Cost Estimates (LCCE) and Sensitivity Analysis (SA) focussed on comparisons of Development, Production, Military Construction, Fielding and Sustainment costs of the Base Case and Alternative 1. Cost impact of the reliability, availability, and maintainability (RAM) rationale is incorporated into this cost analysis. In-depth Logistic Impact Analysis (LIA) and Training Analysis (TA) were not conducted in conjunction with this cost analysis.

(1) LCCE for the Base Case and Alternative 1 were obtained from AMSMC-CAA(A) and AMSMC-CAR-S, and validated at level III. LCCE for each case was provided in "C" matrix format per DCA-P-92(R) and projected at the minimum (10,000) and maximum (100,000) level. AMSMC-CAR-S inputted their data at the 50,000 and 500,000 level. Per AMSMC-CAR-S cost analyst, all LCCE elements can be reduced linearly, less development costs. Chief of Cost, TRAC has reviewed and approved all LCCE for use in this study.

(2) U.S. Army Armor School (USAARMS) has conducted a cursory review pertaining to host vehicle standard integration cost impact associated with MSGL.

(3) TRAC-WSMR has reviewed and provided final certification for this cost analysis.

c. Life Cycle Cost. LCC provided in Table 4 is a summary level presentation of the Life Cycle Cost Estimate (LCCE) for the Base Case and Alternative 1. For a detailed presentation of the LCCE data refer to Annexes 2 through 4. The greatest incremental LCCE cost difference is $9.2 million associated with the non-sunk Development costs. Production, Fielding, Military Construction, and Sustainment cost elements are the remaining LCCE cost differentials. All of these cost categories will be discussed in detail in the following paragraphs.

Table 4. Summary of Submitted Life Cycle Costs

(FY 90 CONSTANT DOLLARS IN MILLIONS)

	M257 BASE CASE		MSGL ALT. 1		INCREMENTAL MSGL VS M257	
PRODUCTION QTY	10,000	100,000	10,000	100,000	10,000	100,000
DEVELOPMENT	0.0	0.0	9.2	9.2	+ 9.2	+ 9.2
PRODUCTION	1.34	12.81	1.67	12.56	+ 0.33	(0.25)
MILITARY CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0
FIELDING	0.04	0.4	0.05	0.45	+ 0.01	+ 0.05
SUSTAINMENT	.55	5.5	0.02	0.15	(0.53)	(5.35)
TOTAL LCC	1.93	18.71	10.94	22.36	+ 9.01	+ 3.65

(1) Development Costs. The major cost differences between the Base Case and Alternative 1 occurs within the Development LCCE. Alternative 1 development costs represent over 80% of the total LCCE incremental cost. Table 5 reflects the total $14.5 million Development costs and incremental non-sunk $9.2 million developmental costs requirements for the MSGL program.

Table 5. MSGL Time-Phased Development Costs.

(FY 90 CONSTANT DOLLARS IN MILLIONS)

SUNK	FY 91	FY 92	FY 93	FY 94	TOTAL
5.269	3.626	3.491	2.092	0.0	14.478

(a) The $9.2 million non-sunk development costs represents the Full Scale Development(FSD) Phase of MSGL for a varied number of type host vehicles. A total of 1332 MSGL dischargers are expected to be fabricated during FSD to accommodate test requirements. Unit cost of prototype is $200.

(b) It should be noted that the development funds reflected above are for a semi-smart (digital) MSGL as stated in the present MSGL Baseline Cost Estimate (BCE). During the proof of principle phase it was decided that the most cost effective method was to provide a hardwire circuit design MSGL and utilize the smart digital capability (1553 bus) within the host vehicle. However, PM-Smoke has verbally indicated the non-sunk development funds reflected will be required for either a hardwire or digital MSGL.

(2) Production Costs. Table 6 reflects the Production LCCE. Recurring (manufacturing) cost is the most significant Production incremental cost. LCCE recurring costs for the Base Case reflect a constant Average Unit Cost (AUC) compared to a variable AUC within Alternative 1. As stated above, the present MSGL BCE and submitted recurring Production LCCE (shown in annex 3) reflects a higher cost semi-smart (digital) MSGL that is not a viable option. Consequently, the validated XM6 MSGL discharger with a variable manufacturing cost, as shown in Annex 4, is utilized as the recurring production cost for Alternative 1. The remaining submitted Production LCCE elements (engineering support, training devices and other elements) for all cases have not been altered and are not significant cost drivers for detailed analysis. However, as stated previously in the study, the present M257 procurement level since FY86 has been at a very reduced level and in order to ramp up for the 100,000 procurement level engineering support, training devices and other elements for the M257 should be identical to the MSGL LCCE level.

Table 6. Submitted LCCE Production Costs

(FY 90 CONSTANT DOLLARS IN MILLIONS)

	M257 BASE CASE		MSGL ALT. 1		INCREMENTAL MSGL VS M257	
PRODUCTION QTY	10,000	100,000	10,000	100,000	10,000	100,000
NON-RECURRING	0.0	0.0	0.0	0.0	0.0	0.0
RECURRING	1.27	12.74	1.59	11.91	+ 0.32	(0.83)
RECURRING ENG.	0.07	0.07	0.03	0.25	(0.04)	+0.18
TRAINING DEVICES	0.0	0.0	0.0	0.02	0.0	+ 0.02
OTHER	0.0	0.0	0.05	0.5	+ 0.05	+ 0.5
TOTAL LCC	1.34	12.81	1.67	12.68	+ 0.33	(0.13)

(a) Sensitivity Analysis of Recurring Production Costs. The cost/quantity relationship (Economies of Scale) of the M257 and MSGL discharger is explored in detail. Below is a detailed breakdown of elements that make-up the MSGL manufacturing cost at both the 10,000 and 100,000 production levels provided by CRDEC. This elemental breakdown clearly demonstrates the lower unit cost/increase quantity relationship associated with decreased unit cost of materials, better utilization of management, and decreased unit cost of labor through dilution of fix costs (overhead).

XM6 MSGL Design to Unit Production Unit Cost(DTUPC) - Data from Annex 4

	10,000			100,000		
	$	$/unit	%	$	$/unit	
1. MFG. LABOR	523483	52.35	33	3696623	36.97	31
2. PARTS MATERIAL	640752	64.08	~~42~~ 40	5348280	53.48	45
3. ENGR. and SUPPORT	84531	8.45	5	291505	2.92	3
4. G & A (std %)	212290	21.23	~~13~~ 14	1587189	15.87	13
5. PROFIT (std %)	131495	13.15	8	983124	9.83	8
TOTAL	159255~~2~~1	159.26	100	11906721	119.07	100

(b) Variable M257 Production. Conversely, due to time constraints the M257 discharger DTUPC submitted for the 10,000 and 100,000 manufacturing cost reflected a constant $127. This constant DTUPC has been reflected in all LCCE production cost data for the M257. However, the reduced lower DTUPC cost/increased quantity logic should apply to the higher production level of the M257 case. Figure 4 is a graphical representation of both the M257 and MSGL unit production costs. For the MSGL variable production levels a variable $159/$119 DTUPC is reflected in the cost data. For the M257 variable production levels a constant $127 DTUPC is reflected in the original cost data. The solid black bar depicts a M257 variable $127/$95 DTUPC which is in relationship to the MSGL variable DTUPC ($159/$119). Consequently, for comparison

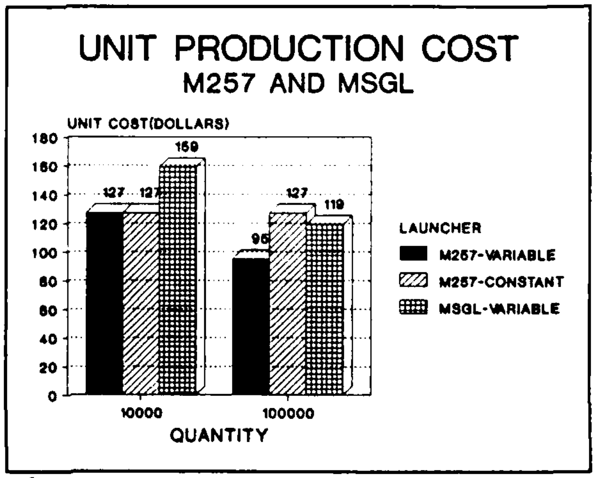

Figure 4 UNIT COST

purposes, the variable M257 DTUPC is a more representative unit production cost than the constant DTUPC and will be used in this cost analysis.

(3) Military Construction. No military construction is required to support the MSGL improvements.

(4) Fielding. Referring back to Table 4 the fielding LCC of the MSGL alternative appears greater than Base Case. This is mainly attributable to the advanced and normal fielding of initial spares to fill the pipeline of a new commodity. Below is Table 7 which is a breakdown of the fielding LCCE elements:

Table 7 Submitted LCCE Fielding Costs
(FY 90 Constant Dollars in Million)

	M257 BASE CASE		MSGL ALT. 1	
PRODUCTION QTY	10,000	100,000	10,000	100,000
INITIAL REPAIR PARTS	0.0	0.0	.04	0.4
FIRST DESTINATION TRANSPORTATION COSTS	.04	0.4	.01	0.1
TOTAL	.04	.4	.05	0.5

(a) Sensitivity Analysis of Initial Repair Parts. AMSSMC-CAR-S assumed there will be no requirement for initial spares for the MSGL discharger since only five component parts (out of a total of 27 component parts) are within the logistic system and those five are common to other weapon systems. In contrast, AMSMC-CAA reflected a maximum of $400,000 for initial repair parts to facilitate the higher volume ramp up requirements for the MSGL (Army's projected standard discharger for approximately twenty different host vehicles). As stated earlier, the present acquisition requirements experienced for the M257 have been procured in small lot sizes (for a minimum number of host vehicles) minimizing the need for a formal ramp up. However, for both M257 and MSGL high volume levels, it is subjectively concluded that projected ramp up requirements will necessitate an advance and normal fielding of repair parts. Consequently, a maximum of $400,000 of initial repair parts is required for both the M257 and MSGL high volume cases.

(b) Sensitivity Analysis of First Destination Transportation Costs (FDTC). The incremental increase is associated with the M257 and the details that support this increase are reflected in Annex 5. In summary, the M257 is produced in New York State and FDTC ($3.83/ discharger) is based on shipments from producer to Letterkenny Army Depot. Conversely, the present MSGL LCC FDTC is one-fourth of the M257. Per TRADOC/FORSCOM Cost Planning Factors, transportation cost is based on cost per ton mile. As stated earlier, the weight of M257 and MSGL only differ by one pound. Thus, the number of miles transported is the main variable for any cost difference between the M257 and MSGL. Present vendor selection process has not taken place for MSGL to identify with assurance transportation distance. Consequently, at this stage, it would be more prudent to utilize the higher and more defined M257 FDTC for all cases, reflecting equal costs for both systems.

(5) Sustainment. Referring back to Table 4 the sustainment cost in all cases relates only to the OMA funds associated with the replenishment of repair parts managed by AMCCOM. The LCCE supports the concept reflected in the technical manual which indicates that the components are very durable and maintenance free. For both the Base Case and MSGL Alternative the discharger design is simple and sustainment effort is reduced to replacing expendable parts, as required, to operate and maintain the discharger. There is no ASL/PLL for either system and all repairs are completed at the unit/organization level. There are no depot repairs. The minimum engineering changes associated with MSGL minimizes any sustainment cost differences. The significant difference reflected in the LCCE submitted is mainly associated with the number of years sustainment was reflected between the Base Case and Alternative 1. The projected LCC for the Base Case was based on 20 year life/20 years of replenishment (see annex 2). Alternative 1 was based on 15 year life/8 years of replenishment (per Cost Analyst at AMSMC-CAA). Replenishment costs for Alternative 1 are also based on a semi-smart MSGL.

(a) Sensitivity Analysis of Replenishment Repair Parts (RRP). AMSMC-CAR-S provided in-depth data describing the method utilized to develop M257 RRP costs. The RRP costs were estimated by multiplying the number of active M257 dischargers by the failure factor for a particular part and then multiplying the contract price of the part inflated to FY 90 constant dollars. The fielded M257 dischargers rate of 94% was arrived at by an activity rate of 95% (AMSMC-CAR assumption) minus 1% maintenance float (failure factor of discharger is 1%). On the next page is a summation of data reflected in Annex 6 which provides a roll-up of the inputted LCC RRP.

1 Percentage of total repair parts and LCCE repair parts cost for active fielded units (94%):

			BASE CASE M257	
			10,000	100,000
Gasket	=	2.7 %		
Tube	=	5.3 %		
Elect contact	=	6.2 %		
Resistor	=	6.1 %		
Cap plug	=	79.7 %	$ 455,274	$ 4,552,743
Total		100 %	$ 555,461	$ 5,555,461
Less cap plug		20.3 %	$ 111,092	$ 1,110,920

2 According to the smoke grenade technical manual (reference 12) the cap plug is not a component of the M257 discharger but a component of the M257 Launcher (which consists of two dischargers plus eight cap plugs) and thus should not have been reflected in the AMSMC-CAR-S LCC RRP analysis. For all cases the cap plug will require removal before arming the discharger and thereby will not reflect any cost differential in usage or RRP consumption. Removing the cap plug cost impact of the RRP analysis reduces the RRP by 79.7% ($111,092/$1,110,920 respectively) as illustrated above. As mentioned above, Alternative 1 submitted RRP was based on 15 year life/8 years of RRP. Below is a simple representation depicting Alternative 1 on a equal basis with the Base Case (20 year life/20 years of RRP).

	Alternative 1 MSGL	
	10,000	100,000
Submitted LCCE 15 yr.life/8 yr. RRP	$20,000	$150,000
20 yr.life/20 yr.RRP	$37,500	$375,000

3 A cursory review will reflect that the M257 RRP is an estimated 8.75% of the LCCE recurring production cost. The MSGL RRP is an estimated 2% to 3% of the LCC recurring production cost. The $37,500/$375,000 case indicates reduced failure factors for components of the MSGL discharger. However, the submitted RRP LCCE is based on a semi-smart MSGL with significant lower failure factors. But, the revised MSGL reflects minimum component changes to justify a 6% to 7% reduction in RRP costs. Subsequently, RRP differences for the M257 and MSGL should be based on no changes in recurring cost and the failure factors should be constant for all cases. Utilizing the Base Case 20 year standard percentage of recurring production (8.75%) for all cases is more appropriate than indicating a significant reduction for the MSGL cases.

(b) RAM Impact on Sustainment Costs. Elements of the RAM analysis are still being developed. However, MTTR, the main emerging cost impact from the RAM analysis has been incorporated within this study.

(c) Maintainability (MTTR). MTTR is the only RAM improvement that has been quantified reflecting a 3000 direct manhour/year savings (60,000 manhours for twenty years) throughout the Army at the 100,000 procurement level for Alternative 1. This manhour savings is at unit/organization level and distributed over numerous units within the Army, minimizing any impact on reductions to personnel staffing. However, it does indicate a potential cost avoidance in decreasing unit operating resource support requirements and will have a positive impact within the force. Based on TRADOC/FORSCOM Cost Planning Factors (E7 cost is approximately $25.00/direct hour) the MTTR manhours improvement represents, in monies, an equivalent cost impact of $75,000/year ($1.5 million for twenty years).

d. Sensitivity Analysis (SA) Impact to Life Cycle Costs (LCC). Purpose of the SA is to quantify and refine the submitted LCCE in accordance with the study plan and standardize cost data between alternatives. The SA diverges from the submitted LCC in the following ways.

(1) Production Cost - Recurring. A variable M257 AUC of $95 vs constant $127 was utilized for the M257 Base Case higher production level (100,000) case. The resultant reduced the submitted Production LCCE from $12.81 million to $9.64 million.

(2) Production Cost - Recurring Eng., Training Devices, and Other Production Costs. Increase M257 10,000 and 100,000 production level cases to reflect identical ramp up cost requirements of MSGL 10,000 and 100,000 Cases. The resultant will increase both M257 cases by $.07/.58 million respectively.

(3) Fielding - Initial Repair Parts. For ramp up purpose reflect identical costs for all cases. The resultant will increase the M257 cases by $.04/$.4 million respectively.

(4) Fielding - First Destination Transportation Costs. Reflect identical costs for all cases. The resultant will increase the MSGL cases by $.03/$.3 million respectively.

(5) Sustainment - Replenishment Repair Parts. Utilize the M257 adjusted replenishment standard (less cap plugs) of 8.75% of recurring production for all cases. The resultant will

decrease the M257 cases by $.44/$3.37 million respectively and increase the MSGL cases by $.11/$.85 million respectively.

Table 8 presents a summary of the SA impact for the Base Case and Alternative 1.

Table 8. Summary of Sensitivity Analysis Impact to LCC

(FY 90 CONSTANT DOLLARS IN MILLIONS)

	M257 BASE CASE		MSGL ALT. 1		INCREMENTAL MSGL VS M257	
PRODUCTION QTY	10,000	100,000	10,000	100,000	10,000	100,000
DEVELOPMENT	0.0	0.0	9.2	9.2	+ 9.2	+ 9.2
PRODUCTION	1.35	10.27	1.67	12.68	+ 0.32	+ 2.41
MILITARY CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0
FIELDING	0.08	0.8	0.08	0.8	0.0	0.0
SUSTAINMENT	.11	0.83	0.13	1.0	+ 0.02	+ 0.17
TOTAL LCC	1.54	11.90	11.08	23.68	+ 9.54	+11.78

e. Integration Cost Impact. Presently the M257 is deployed on the Bradley Fighting Vehicle (BFV). Thus, the BFV is utilized to reflect the possible integration cost differences of M257 vs MSGL.

(1) The BFV technical manual indicates that one M257 launcher (two dischargers/eight tubes) is controlled by the Weapons Control Box (see annex 7) which also controls three other weapon systems (TOW, Coax, and 25mm Chain Gun). Within the operation mode all eight discharger tubes are fired simultaneously. Per CRDEC the MSGL can be adapted to the present BFV and will operate identically to the M257. For future BFV systems the Weapons Control Box will be replaced by a more sophisticated VIDS controller (HFM) system tied to the BFV 1553 BUS. The M257-VIDS configuration will be able to fire each discharger (four tubes) individually. The VIDS/MSGL configuration will have increased capability to fire each discharger tube individually and/or simultaneously. MSGL circuit design will permit individual tube testing and grenade readiness check.

(2) The technical manual defines six possible maintenance fault symptom tests by 45T MOS to perform within the weapons control box/M257 configuration. For future HFM variants the VIDS/MSGL or M257 configuration will most likely reduce 45T MOS manhours in performing these checks. However, it appears the manhours saved will be directly associated with the VIDS capabilities rather than the dischargers. Estimated recurring production cost per unit (below) indicate all future HFM systems integration value is being incorporated into the VIDS. Neither the MSGL nor M257 added cost is significant when compared to the VIDS controller cost.

Present BFV		Future BFV	
Four M257	$508	Four M257	$508
Wpns Cntrl. Box	$1030	VIDS	$50,000
or		or	
Four MSGL	$636	Four MSGL	$636
Wpns.Cntrl.Box	$1030	VIDS	$50,000

f. Cost Summary.

(1) MSGL largest incremental cost is $9.2 million non-sunk Development costs (approximately 80% of LCC) that represent required Full Scale Development Phase.

(2) MSGL Recurring production costs are incrementally higher for both low volume buy (10,000) and high volume buy (100,000). DTUPC:

M257		MSGL	
10,000	100,000	10,000	100,000
$127	$95	$159	$119

(3) At 100,000 production level, MSGL (vs M257) maintainability (MTTR) reflects a potential cost avoidance in decreasing Army's unit operating support resource requirements by 3000 direct manhours per year (60,000 manhours for twenty years). Equivalent cost impact of $75,000 per year ($1.5 million for twenty years) (not included in LCC).

(4) Based on BFV, vehicle Integration cost impact difference between the M257 and MSGL is minimum.

6. GROWTH POTENTIAL COMPARISON. The above comparison of the characteristics of the M257 and MSGL to the current HFM requirements was based on current knowledge of the vehicle and vehicle defense system characteristics. It is possible that these requirements with respect to vehicle smoke will change as the HFM program matures and the self defense systems and vehicle configurations are further defined. The additional characteristics provided by MSGL will accommodate potential growth in sophistication of the vehicle self-defense systems better than the M257.

7. SUMMARY.

a. System Comparison.

(1) Quantitative Comparison. The only difference in the alternatives (M257 and MSGL) is in weight, maintainability, and mounting space per launcher. The difference in weight is one pound per launcher. This is an insignificant amount when compared to the total vehicle weight. The difference in footprint size per launcher is equivalent to 9.2 by 9.2 inches for the M257 and 7.62 by 7.62 inches for the MSGL. This may be significant depending upon the vehicle design and number of launchers desired to be mounted on each vehicle.

(2) Launch Tube and Base Comparison. Of the launch tube and base characteristics in Table 2, there is no quantifiable benefit associated with MSGL. There is a postulated, but unproven benefit of providing overhead smoke with MSGL versus M257. However, there is no current requirement for overhead smoke in the HFM ROC.

(3) Launcher Circuit Comparison. The launcher circuit of the MSGL provides better BIT capability than the M257. In general, better BIT is a benefit for maintenance. This would not warrant redesign of the launchers. There is no HFM vehicle, or HFM vehicle self defense system requirement established by which the benefit of the improved BIT can be estimated. Should the smoke grenade launchers of HFM, M1 Block III, or M2/3 Block III eventually be required to contain BIT of individual tube and be fired by individual tube, only the MSGL would meet requirements.

b. Discussion.

(1) The MSGL provides an improvement in the following:

(a) Maintainability (MTTR).

(b) Mounting space per launcher.

(c) Improved BIT.

(2) Of the above, maintainability is the only characteristic for which a benefit can be determined. By itself, the improvement in maintainability does not justify the incremental LCC of MSGL over the M257. However, the potential cost avoidance due to maintainability of MSGL is substantial when compared to the incremental LCC of MSGL.

(3) The performance benefits ascribed to the MSGL are minimal based on this analysis. Where performance differentials can be measured (BIT and mounting space), there are currently no host vehicle or vehicle self-defense requirements documentation to support such an enhancement. Based on this analysis the MSGL does not provide any benefit over the M257 which would warrant the expenditure of 9 to 12 million dollars at this time.

8. CONCLUSION.

a. The MSGL will provide a marginal increase in performance over the M257. At a cost of an additional 9 to 12 million dollars the MSGL will provide an improvement in maintainability, mounting space, and improved BIT. On the other hand, MSGL may be necessary to accommodate growth in the sophistication of HFM vehicle smoke systems.

b. The M257 meets all current HFM vehicle requirements. There is a risk that the M257 will not meet all future HFM design requirements, because smoke grenade launcher technical characteristics are being defined much earlier than the HFM vehicle technical characteristics.

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ANNEXES

Annex 1 - Estimated Production Quantities Requirements

Annex 2 - Base Case Submitted LCCE

Annex 3 - Alternate I Submitted LCCE

Annex 4 - Alternate I Revised Recurring Production Costs

Annex 5 - First Destination Transportation Data

Annex 6 - Replenishment of Repair Parts Data

Annex 7 - BFV Integration Data

ANNEX 1 M257 or MSGL DISCHARGERS ESTIMATED PRODUCTION REQUIREMENTS

(FY 94 - FY06)

1. HFM PACKAGE I (FOUR DISHARGERS/VEHICLE) (DATA FROM HFM COEA)

	# VEHICLES	# DISCHARGERS
BLOCK III/HFM TANK	3349	13396
CMV	249	996
FIFV	1893	7572
AFAS	888	0
LOS-AT	1404	5616
FARV-A	888	3352
SUB-TOTAL		30932

2. REMAINDING HFM VARIANTS (FOUR DISCHARGERS/VEHICLE)
(DATA TAKEN FROM AFV TOA (CFP)

	# VEHICLES	# DISCHARGERS
FRV	2000	8000
CGV	612	2448
SAPPER	2134	8536
FSCLOS	934	3736
LOSAD	729	2916
RV	1964	7856
MARS	1967	7868
AA	1484	5936
DEW-V	179	716
FARV-A * ROUGH ESTIMATE	* 2500	10000
FARV-F	* 2500	10000
SUB-TOTAL		68012

3. ADDITIONAL VARIANTS (12 DISCHARGERS/VEHICLE)

	# VEHICLES	# DISCHARGERS
ARMORED SECURITY VEHICLE	3325	39900
NBC RECON VEHICLE	650	7800
LARGE AREA SMOKE SCREEN VEHICLE	508	6096
		53796
GRAND TOTAL		152740

M257 SMOKE GRENADE DISCHARGER - SUMMARY SHEET
FY90 CONSTANT ($000) DOLLARS QUANTITY = 10,000

COST ELMT	DESCRIPTION	FUND	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00-11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	TOTAL
2.0	PRODUCTION																			
2.021	RECURRING PRODUCTION	PAA	159.2	159.2	159.2	159.2	159.2	159.2	159.2	159.2										1273.6
2.022	RECURRING ENGINEERING	PAA	17.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0										60.0
2.024	QUALITY CONTROL	PAA	3.2	1.0	0.9	0.9	0.9	0.9	0.9	0.9										9.6
4.0	FIELDING																			
4.031	FIRST DESTINATION TRANS	OMA	4.8	4.8	4.8	4.0	4.8	4.8	4.8	4.8										38.4
5.0	SUSTAINMENT																			
5.011	REPLENISHMENT REPAIR PARTS	OMA		3.5	6.9	10.4	13.9	17.3	20.8	24.3	27.7	332.7	24.3	20.8	17.3	13.9	10.4	6.9	3.5	554.6
	TOTAL COST		184.4	175.3	177.8	181.3	184.8	188.2	191.7	195.2	27.7	332.7	24.3	20.8	17.3	13.9	10.4	6.9	3.5	1936.2

M257 SMOKE GRENADE DISCHARGER - SUMMARY SHEET
FY90 CONSTANT ($000) DOLLARS QUANTITY = 100,000

ELMT	DESCRIPTION	FUND	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00-11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	TOTAL
2.0	PRODUCTION																			
2.021	RECURRING PRODUCTION	PAA	1592.0	1592.0	1592.0	1592.0	1592.0	1592.0	1592.0	1592.0										12736.0
2.022	RECURRING ENGINEERING	PAA	17.2	6.8	6.0	6.0	6.0	6.0	6.0	6.0										60.0
2.024	QUALITY CONTROL	PAA	3.2	1.0	0.9	0.9	0.9	0.9	0.9	0.9										9.6
4.0	FIELDING																			
4.031	FIRST DESTINATION TRANS	OMA	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0										384.0
5.0	SUSTAINMENT																			
5.011	REPLENISHMENT REPAIR PARTS	OMA		35.0	69.0	104.0	139.0	173.0	208.0	243.0	277.0	3327.0	243.0	208.0	173.0	139.0	104.0	69.0	35.0	5546.0
	TOTAL COST		1660.4	1682.8	1715.9	1750.9	1785.9	1819.9	1854.9	1889.9	277.0	3327.0	243.0	208.0	173.0	139.0	104.0	69.0	35.0	18735.6

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AUTOVON: 793-2996 DATE: 7/13/89
VALIDATOR C. Belden APPROVED BY G. Bates
VOID AFTER: 7/13/90
* - - AMCCOM Rock Island IL - - *

ANNEX 2
Base Case Submitted LCCE

BASE YEAR FY90
CONSTANT $
(000 $)
INFLATION REFERENCE:
AMCRM-ER
22 DEC 88

XM6 DISCHARGER, SMOKE GRENADE (ALSO KNOWN AS MULTISALVO SMOKE GRENADE LAUNCHER-(MSGL))

PRODUCTION SCHEDULES

FY94	FY95	FY96	FY97	FY98	TOTAL
10K	10K	10K	15K	10K	50K

CELL	COST ELEMENT	SUNK COSTS FY90 & PRIOR	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	TC	TOTAL
1.0	DEVELOPMENT:		1613	872	81							
1.01	DEV. ENGR	5269	[illegible]	[illegible]	[illegible]							9,209
	OTHER		[illegible]	[illegible]	[illegible]							4,540
			156	159	325							
2.0	PRODUCTION											
2.01	NON-RECURRING	X	X	X	X	X	X	X	X	X	X	X
2.02	RECURRING					2873	2832	2816	2813	2811	43	14188
2.03	ECOs					17		33	22	22		94
2.04	DATA					6						6
2.05	SYS TEST & EVAL					10	2	4	4	3	1	24
2.06	TRAINING EQUIP.					2						2
2.07	INITIAL SPARES	X	X	X	X	X	X	X	X	X	X	X
	OTHER					2	1	18	15	13		49
3.0	MILITARY CONST.											
4.0	FIELDING											
4.04	INIT REP PARTS					40	41	41	41	35		198
	OTHER		2	2	5	11	9	5	5	6		45
5.0	SUSTAINMENT											
5.011	REPAIR PARTS					12	7	8	8	9	31	75
5.041	DEPOT CIV LABR											
5.042	DEPOT MTCE MATL											
5.072	TRAINING SVCS											
5.08	MILITARY PERSONL											
	OTHER											
	TOTAL LCC											16547

DEVELOPMENT COST CHANGES PER AMSMC-CAA (A) COST ANALYST PER PHONE.

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VOID AFTER: 10 Nov 90
★ - - - - CECDC: AMSMC-CAA(A) - - ★
* SOURCE DOCUMENT: BCE 12 JAN 89 CONTR. No 8A0426

OTHER DATA:
1. APPROVED DEVELOPMENT PROGRAMMED MONIES BY YEAR
2. QUANTITY OF PROTOTYPES
3. APPROVED PROCUREMENT MONIES APPROVED
4. LEARNING CURVE

ENCL 3

BASE YEAR FY90
CONSTANT $
(000 $)
INFLATION REFERENCE:
AMCRM-ER
22 DEC 88

XM6 DISCHARGER, SMOKE GRENADE (ALSO KNOWN AS MULTISALVO SMOKE GRENADE LAUNCHER-(MSGL))

PRODUCTION SCHEDULES: FY94 100K; FY95 100K; FY96 100K; FY97 100K; FY98 100K; TOTAL 500K

CELL	COST ELEMENT	SUNK COSTS FY90 & PRIOR	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	TC	TOTAL
1.0	DEVELOPMENT:											
1.01	DEV. ENGR.	5269	1613 / 3620 / ~~3670~~ [illegible] / 156	87 / 2201 / ~~2340~~ [illegible] / 159	81 / 4640 / ~~2020~~ [illegible] / 125							7020 / 9120 / ~~5840~~ / 4640
	OTHER											
2.0	PRODUCTION											
2.01	NON-RECURRING	X	X	X	X	X	X	X	X	X	X	X
2.02	RECURRING					28730	28320	28160	28130	28110	430	141880
2.03	ECOS					170		330	220	220		940
2.04	DATA					60						60
2.05	SYS TEST & EVAL					100	20	40	40	30	10	240
2.06	TRAINING EQUIP.					20						20
2.07	INITIAL SPARES	X	X	X	X	X	X	X	X	X	X	X
	OTHER					20	10	180	150	130		490
3.0	MILITARY CONST.											
4.0	FIELDING											
4.04	INIT REP PARTS					400	410	410	410	350		1980
	OTHER		20	20	50	110	90	50	50	60		450
5.0	SUSTAINMENT					120	70	80	80	90	310	750
5.011	REPAIR PARTS											
5.041	DEPOT CIV LABR											
5.042	DEPOT MTCE MATL											
5.072	TRAINING SVCS											
5.08	MILITARY PERSONNEL											
	OTHER											
	TOTAL LCC											165470

DEVELOPMENT COST CHANGES PER AMSMC-CAA (A) COST ANALYST PER PHONE

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APG, MD
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* SOURCE DOCUMENT: BCE 12 JAN 89 CONTR. No. 8A0426

OTHER DATA:
1. APPROVED DEVELOPMENT PROGRAMMED MONIES BY YEAR
2. QUANTITY OF PROTOTYPES
3. APPROVED PROCUREMENT MONIES APPROVED
4. LEARNING CURVE

ENCL 4

ANNEX 4 - Alternate I Revised Recurring Production Data

XMS Discharger Manufacturing Cost Estimate 23 June 1989

QUANTITY	10,000	100,000
UNIT COST	$159.26	$119.07

	%	$ per 10000	OH	Total	Unit	%
Engr & Spt	117	38954.71	45577.00	84531.71	8.45	5
Mfg	200	174494.5	348989.00	523483.50	52.35	33
Parts	5	610240	30512.00	640752.00	64.08	40

				1248767.21		
G&A	17			212290.43		13

				1461057.64		
Profit	9			131495.19		8

TOTAL				1592552.82		-$159.26 each

	%	$ per 100000	OH	Total	Unit	%
Engr & Spt	117	134334	157171	291505	2.92	2.4
Mfg	200	1232208	2464415	3696623	36.97	31
Parts	5	5093600	254680	5348280	53.48	45

				9336408		
G&A	17			1587189		13

				10923597		
Profit	9			983124		8

TOTAL				11906721		$119.07 each

Projected manufacture of 10,000 or 100,000 dischargers.

Discharger is the 'Hardwired' model developed by the AAI Corp. during FY89

Manufacturing time estimates and material costs were taken from:
Contract Report, AAI Corp., Contract DAAA15-85-D-0021 (Task 11), Sequence No. A047, Data Item: DI-A-5345/T, subj: Design To Cost Report For The Multi-Salvo Grenade Launcher

Contractor cost data was obtained from:
DF, AMCCOM, AMSMC-CAA (A), 27 Mar 89, subj: FY89 Average Contractor Rates

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VALIDATOR [illegible] APPROVED BY: [illegible]
VOID AFTER: 23 JUN 90
★ - - - - CECDC: AMSMC-CAA(A) - -

LABOR and PARTS (1)

		Hrs/2,000	Hrs/4,000 Cap (4 each)	Hrs/40,000 *	Hrs/400,000 *
	Qty.	500	1000	10 k	100 k
PARTS					
Cost $ total		2000	4000	32000	260000
per unit		4	4	3.2	2.6
LABOR	Rate $/hr				
MANUFACTURING					
Elec Fab	8.50				
Elec Tst&Tool	12.65				
Assembly	8.50				
Pack & Ship	8.50				
Prod Ctrl	12.65				
Elec Prod	8.50				
Prod Mgr	12.65				
Inspection	12.65				
QA Engr	19.30				
Recv. Insp	12.65				
	Cost $	0.00	0.00	0.00 0	0.00 0
ENGINEERING					
Sr System, E	19.30				
System, E	12.15				
Sr System	19.30				
System	12.15				
Proj Mgt	20.65				
Proj Admin	11.05				
LABOR	Cost $	0.00	0.00	0.00 0	0.00 0

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LABOR and PARTS (2)

		Hrs/2,000	Hrs/4,000 Tube (4 each)	Hrs/40,000 10K	Hrs/400,000 ≈100K
PARTS					
Cost $ total		12000	20000	160000	1400000
per unit		24	20	16	14.00
LABOR	**Rate $/hr**				
MANUFACTURING					
Elec Fab	8.50				
Elec Tst&Tool	12.65				
Assembly	8.50				
Pack & Ship	8.50				
Prod Ctrl	12.65				
Elec Prod	8.50				
Prod Mgr	12.65				
Inspection	12.65				
QA Engr	10.30				
Recv. Insp	12.65				
	Cost $	0.00	0.00	0.00 0	0.00 0
ENGINEERING					
Sr System, E	10.30				
System, E	12.15				
Sr System	10.30				
System	12.15				
Proj Mgt	29.65				
Proj Admin	11.05				
LABOR					
	Cost $	0.00	0.00	0.00 0	0.00 0

LABOR and PARTS (3)

	Rate $/hr	Hrs/500		Hrs/1,000 Base (1 each)		Hrs/10,000 *		Hrs/100,000 *	
		500				10K		~100K	
PARTS									
Cost $ total		33175 ±		36910		401940		3317600	
per unit		66.35 plus		36.91		40.194		33.176	
Matl $ total		533		1060		10300		76000	
per unit		1.066		1.06		1.03		0.76	
LABOR									
MANUFACTURING									
Elec Fab	8.50	793	6740.5	1481	12588.5	6000	51000	35000	297500
		1.586		1.481		0.6		0.35	
Elec Tst&Tool	12.65	231	2922.15	462	5844.3	3500	44275	20000	253000
		0.462		0.462		0.35		0.2	
Assembly	8.50	420	3570	840	7140	6000	51000	50000	425000
		0.84		0.84		0.6		0.5	
Pack & Ship	8.50	12	102	24	204	200	1700	1000	8500
		0.024		0.024		0.02		0.01	
Prod Ctrl	12.65	50	632.5	96	1214.4	300	3795	2000	25300
		0.1		0.096		0.03		0.02	
Elec Prod	8.50	36	306	64	544	200	1700	10000	85000
		0.072		0.064		0.02		0.1	
Prod Mgr	12.65	130	1644.5	224	2833.6	400	5060	400	5060
		0.26		0.224		0.04		0.004	
Inspection	12.65	75	948.75	143	1808.95	80	1012	950	12017.5
		0.15		0.143		0.008		0.0095	
QA Engr	19.30	4	77.2	7	135.1	20	386	100	1930
		0.008		0.007		0.002		0.001	
Recv. Insp	12.65	0	0	0	0	0	0	0	0
		0		0		0		0	
	Cost $		16944		32313		159928		1113308
							15.9928		11.13307
ENGINEERING									
Sr System, E	19.30	350	6755	400	7720	400	7720	400	7720
		0.7		0.4		0.04		0.004	
System, E	12.15	690	8383.5	800	9720	800	9720	8500	103275
		1.38		0.8		0.08		0.085	
Sr System	19.30	390	7527	475	9167.5	400	7720	400	7720
		0.78		0.475		0.04		0.004	
System	12.15	775	9416.25	950	11542.5	950	11542.5	1000	12150
		1.55		0.95		0.095		0.01	
Proj Mgt	29.65	40	1186	40	1186	40	1186	40	1186
		0.08		0.04		0.004		0.0004	
Proj Admin	11.95	30	358.5	40	478	50	597.5	100	1195
		0.06		0.04		0.005		0.001	
	Cost $		33626		39814		38486		133246
							3.8486		1.33246

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LABOR and PARTS (4)

		Hrs/500		Hrs/1,000 Discharger		Hrs/10,000		Hrs/100,000	
PARTS		50				10K		100K	
Matl $ total		540		1080		8000		40000	
per unit		1.08		1.08		0.8		0.4	
LABOR	Rate $/hr								
MANUFACTURING									
Elec Fab	8.50								
Elec Tst&Tool	12.65								
Assembly	8.50	65	552.5	130	1105	1200	10200	11000	93500
		0.13		0.13		0.12		0.11	
Pack & Ship	8.50	20	170	40	340	350	2975	1500	12750
		0.04		0.04		0.035		0.015	
Prod Ctrl	12.65								
Elec Prod	8.50								
Prod Mgr	12.65								
Inspection	12.65	6	75.9	12	151.8	110	1391.5	1000	12650
		0.012		0.012		0.011		0.01	
QA Engr	19.30								
Recv. Insp	12.65								
	Cost $		798		1597		14567		118900
							1.45665		1.189
ENGINEERING									
Sr System, E	19.30								
System, E	12.15								
Sr System	19.30	2	38.6	4	77.2	10	193	10	193.00
		0.004		0.004		0.001		0.0001	
System	12.15	6	72.9	12	145.8	20	243	70	850.50
		0.012		0.012		0.002		0.0007	
Proj Mgt	29.65	0.7	20.755	0.7	20.755	0.7	20.755	0.7	20.76
		0.0014		0.0007		0.00007		0.000007	
Proj Admin	11.95	0.4	4.78	0.6	7.17	1	11.95	2	23.90
		0.0008		0.0006		0.0001		0.00002	
	Cost $		137.04		250.93		468.71		1088.18
							0.046870		0.010881

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PARTS COST

	per discharger	'500'		'1,000'		'10,000' *		'100,000' *	
Cap	4	1.00	4.00	1.00	4.00	0.800	3.20	0.650	2.60
Tube	4	6.00	24.00	5.00	20.00	4.000	16.00	3.500	14.00
ECA	4	5.00	20.00	4.00	16.00	3.500	14.00	3.000	12.00
Base	1	15.00	15.00	12.00	12.00	8.000	8.00	6.000	6.00
Insul. Side	4	0.17	0.68	0.15	0.60	0.100	0.40	0.080	0.32
Insul. End	4	0.07	0.28	0.05	0.20	0.050	0.20	0.040	0.16
Screw	12	0.05	0.60	0.03	0.36	0.030	0.36	0.028	0.34
Washer	12	0.05	0.60	0.03	0.36	0.030	0.36	0.028	0.34
Screw	4	0.01	0.04	0.01	0.02	0.008	0.03	0.008	0.03
Washer	4	0.01	0.04	0.01	0.02	0.008	0.03	0.008	0.03
Potting	1	2.00	2.00	2.00	2.00	2.000	2.00	1.900	1.90
Gasket	1	3.75	3.75	3.60	3.60	1.350	1.35	0.850	0.85
TOTAL-Base Parts			42.99		35.16		26.75		21.97
Connector	1	4.05	4.05	4.10	4.10	3.250	3.25	3.000	3.00
Resistor	4	0.53	2.12	0.51	2.04	0.350	1.40	0.250	1.00
Diode	4	3.20	12.80	3.10	12.40	1.800	7.20	1.500	6.00
Jackpost	2	0.22	0.44	0.20	0.40	0.100	0.20	0.090	0.18
Gasket	1	0.89	0.89	0.85	0.85	0.450	0.45	0.200	0.20
Terminal, Flat	4	0.32	1.28	0.28	1.12	0.080	0.32	0.075	0.30
Terminal Lug	4	0.10	0.40	0.10	0.40	0.100	0.40	0.090	0.36
Wire, 20 AWG	1	0.04	0.04	0.04	0.04	0.040	0.04	0.025	0.03
Wire, 20 AWG	1	0.04	0.04	0.04	0.04	0.040	0.04	0.025	0.03
Solder			0.00		0.00	0.000	0.00	0.000	0.00
Turret	8	0.05	0.40	0.05	0.36	0.020	0.16	0.015	0.12
TOTAL-Base Elect.			23.36		21.75		13.48		11.21
TOTAL for BASE			66.35		56.91		40.19		33.17
TOTAL for Discharger			94.35		80.91		59.39		49.77

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ANNEX 5 - First Destination Transportation Data

COST DATA RATIONALE

WORK ELEMENT: First Destination Trans. **COST ELEMENT/CELL:**4.031

ITEM: M257 Discharger **DATE:** July 1989

COST DATA EXPRESSION:

4.031 (by FY) = (# of Dischargers/# of Dischargers per drum)
* (shipping cost from New York to Letterkenny)

INCLUDES:

EXCLUDES:

FINAL COST MODEL EXPRESSION:

FY90 CONSTANT ($000) DOLLARS

	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98
QTY/150	8.33	8.33	8.33	8.33	8.33	8.33	8.33	8.33
X $574	$574	$574	$574	$574	$574	$574	$574	$574
First Dest Transport	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8

SOURCE:

1. Transportation Costs from AMSMC-TMR, Fonecon 11 July 1989. Each drum contains 150 dischargers: 1250 / 150 = 8.33 drums/yr. Shipping cost per drum = $554 x 1.036 = $573.94 = $574 (rounded) OSD/OMB Inflation Guidance, dated 22 Dec 88: OMA FY89-FY90=1.036.

2. Current Producer is in New York State and Launchers are currently shipped to Letterkenny AD. Source: AMSMC-PDA-D.

VARIABLE/FACTOR RATIONALE

ITEM: Replenishment Repair Parts

VARIABLE: N/A
COST ELEMENT/CELL: 5.011
DATE: July 1989

CURRENT VALUE BEING USED:

See attached detail sheet

DESCRIPTION OF HOW VALUE DERIVED:

1. Failure factors were taken from the Y95 report from the NSN-MDR file. These factors represent failures per 100 end items. Since the end item in this case is the M257 launcher, the failure factors were adjusted to reflect the fact that 1 launcher consists of 2 dischargers. (SOURCE: AMSMC-MMN-C)

2. Unit contract prices were also taken from the Y95 report from the NSN-MDR (Master Data Record) file.

3. The failure factor for the discharger is 2/100 launchers or 2/200 dischargers. This is a failure factor of .01 or 1%. This 1% was used to determine the maintenance float for the discharger.

4. An activity rate of 95% was assumed.(SOURCE: AMSMC-CAR assumption).

5. The activity rate and the maintenance float was used to determine the fielded quantities: 95% - 1% = 94% of production is fielded.

6. Only five repair parts are managed by AMCCOM:

NSN	NOMENCLATURE	FF/LAUNCHER	FF/DISCHARGER	FY 88 UNIT COST
5330-01-096-4551	Gasket	1/100=.01	1/200 = .005	$1.50
1010-01-246-9930	Tube	1/100=.01	1/200 = .005	$39.74**
5999-01-096-2017	Contact	3/100=.03	3/200 = .015	$11.38
5905-01-094-9838	Resistor	1/100=.01	1/200 = .005	$33.89
5340-01-095-0297	Cap-Plug	494/100=4.94	494/200=2.47	$0.91
1040-01-095-0091	Discharger	2/100=.02	2/200 = .01	$118.18

** This price is the AMDF price for the item which this NSN will replace. Because present stock levels are adequate for the anticipated requirements the replacement part has never been purchased.

7. The unit prices were adjusted to FY90 constant dollars by multiplying by the appropriate inflation factor, except in the case of the tube. It was estimated that the AMDF price for ASF items is about 30% higher than the contract price. Hence the tube price was divided by 1.3 and then inflated to FY90. The AMDF price is assumed to be in FY89 constant dollars.

ITEM	FY88 COST	FY89-AMDF COST	INFL TO FY90	FY90 COST
Gasket	$1.50		1.0774	$1.62
Tube		$39.74/1.3=$30.57	1.0360	$31.67
Contact	$11.38		1.0774	$12.26
Resistor	$33.89		1.0774	$36.51
Cap-Plug	$0.91		1.0774	$0.98

8. See attached detail sheet for roll-up of repair parts costs.

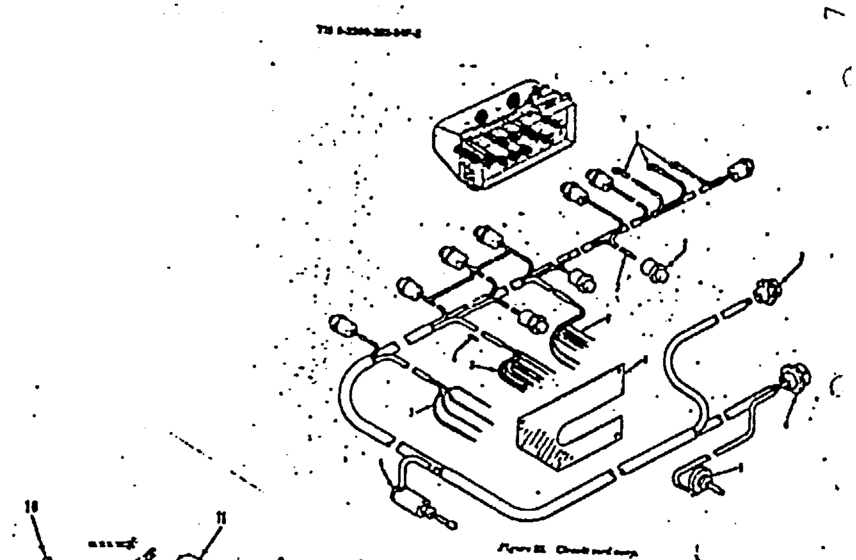
M257 DISCHARGER - REPLENISHMENT REPAIR PARTS DETAIL
COST ELEMENT 5.011 FY90 CONSTANT DOLLARS

	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00-11
DISCHARGER PRODUCT'N	1250	1250	1250	1250	1250	1250	1250	1250		
x .94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94		
ACTIVE QUANTITY	1175	1175	1175	1175	1175	1175	1175	1175		
1% FOR MAIN FLOAT										
95% ACTIVITY RATE										
M257 DISCHARGER FIELDED QUANTITIES		1175	2350	3525	4700	5875	7050	8225	9400	9400
REPLENISHMENT REPAIR PARTS										FY00-11 (12 years
GASKET X .005		5.8750	11.7500	17.6250	23.5000	29.3750	35.2500	41.1250	47.0000	47.0000
X UNIT CST		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
X INFL FAC		1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774
GASKET COST		9.5	19.0	28.5	38.0	47.5	57.0	66.5	76.0	911.5
TUBE X .005		5.8750	11.7500	17.6250	23.5000	29.3750	35.2500	41.1250	47.0000	47.0000
X UNIT CST		31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67	31.67
TUBE COST		186.1	372.1	558.2	744.2	930.3	1116.4	1302.4	1488.5	17861.9
ELECT CONT X .015		17.6250	35.2500	52.8750	70.5000	88.1250	105.7500	123.3750	141.0000	141.0000
X UNIT CST		11.38	11.38	11.38	11.38	11.38	11.38	11.38	11.38	11.38
X INFL FAC		1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774
ELECTRICAL CONT COST		216.1	432.2	648.3	864.4	1080.5	1296.6	1512.7	1728.8	20745.3
RESISTR NETWK X .005		5.8750	11.7500	17.6250	23.5000	29.3750	35.2500	41.1250	47.0000	47.0000
X UNIT CST		33.89	33.89	33.89	33.89	33.89	33.89	33.89	33.89	33.89
X INFL FAC		1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774
RESISTOR NETWRK COST		214.5	429.0	643.5	858.1	1072.6	1287.1	1501.6	1716.1	20593.4
CAP-PLUG X 2.47		2902.25	5804.50	8706.75	11609.00	14511.25	17413.50	20315.75	23218.00	23218.00
X UNIT CST		0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
X INFL FAC		1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774
CAP PLUG COST		2845.5	5690.9	8536.4	11381.9	14227.3	17072.8	19918.3	22763.7	273164.6
TOTAL REPAIR PARTS		3471.6	6943.3	10414.9	13886.5	17358.2	20829.8	24301.4	27773.1	333276.6

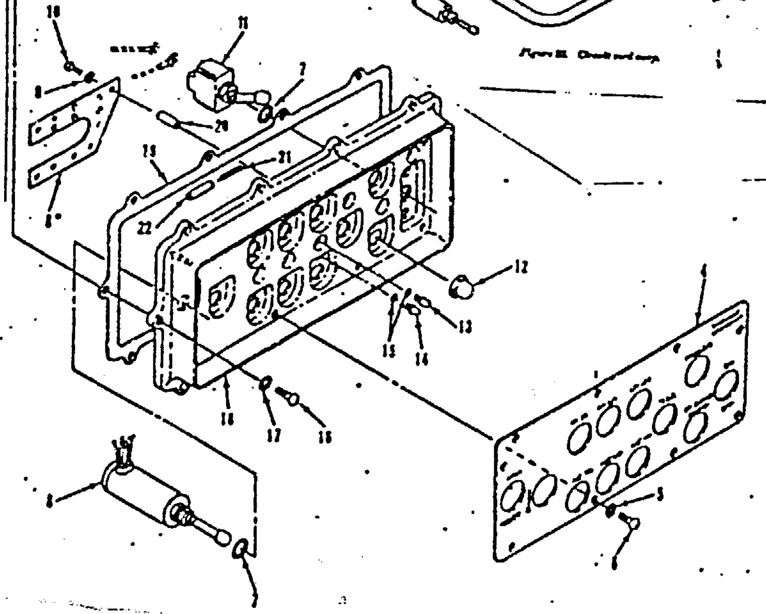
M257 DISCHARGER - REPLENISHMENT REPAIR PARTS DETAIL
COST ELEMENT 5.011-FY90 CONSTANT DOLLARS

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	TOTAL
DISCHARGER PRODUCT'N x .94								
ACTIVE QUANTITY								
1% FOR MAIN FLOAT 95% ACTIVITY RATE								
M257 DISCHARGER FIELDED QUANTITIES	8225	7050	5875	4700	3525	2350	1175	
REPLENISHMENT REPAIR PARTS GASKET X .005	41.1250	35.2500	29.3750	23.5000	17.6250	11.7500	5.8750	
X UNIT CST	1.50	1.50	1.50	1.50	1.50	1.50	1.50	
X INFL FAC	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	
GASKET COST	66.5	57.0	47.5	38.0	28.5	19.0	9.5	1519.1
TUBE X .005	41.1250	35.2500	29.3750	23.5000	17.6250	11.7500	5.8750	
X UNIT CST	31.67	31.67	31.67	31.67	31.67	31.67	31.67	
TUBE COST	1302.4	1116.4	930.3	744.2	558.2	372.1	186.1	29769.8
ELECT CONT X .015	123.3750	105.7500	88.1250	70.5000	52.8750	35.2500	17.6250	
X UNIT CST	11.38	11.38	11.38	11.38	11.38	11.38	11.38	
X INFL FAC	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	
ELECTRICAL CONT COST	1512.7	1296.6	1080.5	864.4	648.3	432.2	216.1	34575.5
RESISTR NETWK X .005	41.1250	35.2500	29.3750	23.5000	17.6250	11.7500	5.8750	
X UNIT CST	33.89	33.89	33.89	33.89	33.89	33.89	33.89	
X INFL FAC	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	
RESISTOR NETWRK COST	1501.6	1287.1	1072.6	858.1	643.5	429.0	214.5	34322.3
CAP-PLUG X 2.47	20315.75	17413.50	14511.25	11609.00	8706.75	5804.50	2902.25	
X UNIT CST	0.91	0.91	0.91	0.91	0.91	0.91	0.91	
X INFL FAC	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	1.0774	
CAP PLUG COST	19918.3	17072.8	14227.3	11381.9	8536.4	5690.9	2845.5	455274.3
TOTAL REPAIR PARTS	24301.4	20829.8	17358.2	13886.5	10414.9	6943.3	3471.6	555461.1

ANNEX 6 - Replenishment of Repair Parts Data



(1) ILLUS (A) FIG NO	(1) ILLUS (B) ITEM NO	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) FSCM	(5) PART NUMBER	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP 81AEB CONTROL BOX, WEAPON 12295616 (2A4)		
22	1	PAFZZ	5340-01-120-7332	19207	12257562	MOUNT,RESILIENT	EA	2
22	2	PADZZ	5355-00-815-4688	96906	MS91528-2K2B	KNOB	EA	1
22	3	XAFZZ		19207	12251572	BOX	EA	1
22	4	PAOZZ	1005-01-112-1831	19207	12252873	PANEL,WEAPON CONTRO	EA	1
22	5	PAOZZ	5310-00-785-3397	96906	MS27183-41	WASHER,FLAT	EA	5
22	6	PAOZZ	5305-00-984-6192	96906	MS35206-244	SCREW,MACHINE	EA	5
22	7	PAFZZ	5330-00-806-1783	96906	MS25136-3	PACKING WITH RETAIN	EA	2
22	8	XAFFF		19207	12292897	CIRCUIT CD ASSY (SEE GROUP 81AEBA)	EA	1
22	9	PAFZZ	5970-01-100-8797	81349	M38527/8-89P	WASHER,FLAT	EA	4
22	10	PAFZZ	5305-00-984-4992	96906	MS35206-232	SCREW,MACHINE	EA	4
22	11	PAFZZ	5930-00-865-9788	96906	MS24659-226	SWITCH,TOGGLE S11	EA	1
22	12	PAFZZ	5930-00-167-7627	81349	MS4723/07-05	BOOT,DUST AND MOIST	EA	10
22	13	PAFZZ	6210-01-118-8687	19207	12295758	LIGHT,INDICATOR DS1-DS8,DS9-DS14	EA	12
22	14	PAFZZ	6210-00-978-2548	81349	LHC82-YYT2	LIGHT,INDICATOR DS15-DS34	EA	20
22	15	PAFZZ	5330-00-579-3158	96906	MS28775-008	PACKING,PREFORMED	EA	32
22	16	PAFZZ	5305-00-984-6193	96906	MS35206-247	SCREW,MACHINE	EA	10
22	17	PAFZZ	5310-00-559-0070	96906	MS35333-38	WASHER,LOCK	EA	10
22	18	XAFZZ		19207	12292012	PANEL,WPN CONTROL	EA	1
22	19	PAFZZ	5330-01-098-7257	19207	12276823	GASKET	EA	1
22	20	PAFZZ	5365-00-302-8053	80205	NAS43DD1-32	SPACER,SLEEVE	EA	4
22	21	MFFZZ		81349	M81044/12-22-9	WIRE,ELECTRICAL MAKE FROM 8145001449231	FT	V
22	22	PAFZZ	5940-00-485-8348	80205	NAS1745-1	SPLICE,CONDUCTOR E1-E17,E18-34	EA	V



*PART OF ITEM NUMBER

Figure 22. Control box, weapon.

GRENADE LAUNCHER SYSTEM FAULT SYMPTOM INDEX

FAULT SYMPTOM
GRENADE LAUNCHER SYSTEM HAS SOMETHING WRONG
GRENADES DO NOT FIRE WHEN GRENADE TRIGGER BUTTON IS PRESSED
GRENADES FIRE BEFORE GRENADE TRIGGER BUTTON IS PRESSED
GRENADE LAUNCHER OR TRIGGER INDICATOR LAMP DOES NOT COME ON
GRENADE LAUNCHER OR TRIGGER INDICATOR LIGHT DOES NOT GO OFF
ONE OR MORE GRENADES CONSISTENTLY DO NOT FIRE WHEN GRENADE TRIGGER BUTTON IS PRESSED
GRENADE LAUNCHER SYSTEM INTERCONNECTION TABLE

GRENADES FIRE BEFORE GRENADE TRIGGER BUTTON IS PRESSED

INITIAL SETUP

Tools:

Turret mechanic's tool kit (Item 31, App F)
Multimeter (Item 15, App F)
Probe assembly (part of STE-M1/FVS) (Item 30, App F)

Personnel Required:

ITV/IFV/CFV Trt Mech 45T10
Helper (H)

References:

TM 9-2350-252-10-1
TM 9-2350-252-10-2

Equipment Conditions:

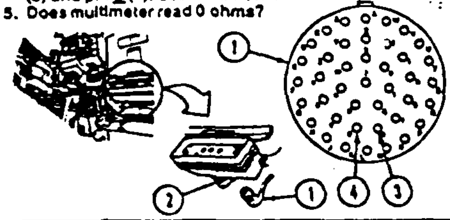
Engine stopped (TM 9-2350-252-10-1)
Turret shut down (TM 9-2350-252-10-2)
Weapons unloaded and safe (TM 9-2350-252-10-2)

1. (H) Move MASTER POWER switch to ON.
2. Move TURRET POWER switch to ON.
3. Is grenade trigger indicator light off?

NO (B) GO TO PAGE 3-116

YES ↓

1. Move TURRET POWER switch to OFF.
2. (H) Move MASTER POWER switch to OFF.
3. Remove plug 2W4P2 (1) from jack 2A4J2 (2).
4. Measure resistance between plug 2W4P2 (1), pin e (3) and pin d (4). Use multimeter.
5. Does multimeter read 0 ohms?



NO →

1. Replace weapon control box (page 5-110).
2. Verify no faults found.

YES ↓

(A)

GRENADES DO NOT FIRE WHEN GRENADE TRIGGER BUTTON IS PRESSED

INITIAL SETUP

Tools:

Turret mechanic's tool kit (Item 31, App F)

Personnel Required:

ITV/IFV/CFV Trt Mech 45T10
Helper (H)

References:

TM 9-2350-252-10-1

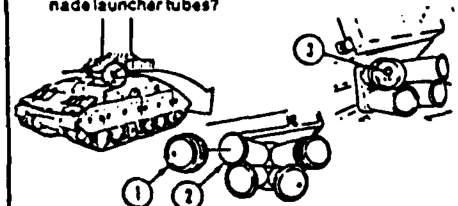
References (cont):

TM 9-2350-252-10-2

Equipment Conditions:

Engine stopped (TM 9-2350-252-10-1)
Turret shut down (TM 9-2350-252-10-2)
Weapons unloaded and safe (TM 9-2350-252-10-2)

1. (H) Remove rubber caps (1) from grenade launcher tubes (2).
2. (H) Move MASTER POWER switch to ON.
3. Move TURRET POWER switch to ON.
4. (H) Load grenade simulator into grenade launcher (TM 9-2350-252-10-2).
5. Move GRENADE LAUNCHER switch to ON.
6. Press and release grenade trigger button.
7. (H) Verify that grenade simulator indicator light (3) comes on when trigger button is pressed.
8. Repeat steps 4 thru 7 for all grenade launcher tubes.
9. Move GRENADE LAUNCHER switch to OFF.
10. Shut down turret.
11. (H) Move MASTER POWER switch to OFF.
12. (H) Unload grenade simulator from grenade launcher.
13. (H) Install rubber caps on grenade launcher tubes.
14. Did grenade simulator light remain off for all grenade launcher tubes?



NO →

1. Go to: ONE OR MORE GRENADES CONSISTENTLY DO NOT FIRE WHEN GRENADE TRIGGER BUTTON IS PRESSED (page 3-131).

YES ↓

1. Replace weapon control box (page 5-110).
2. Verify no faults found.

TM 9-2350-252-20-2-1

GRENADE LAUNCHER OR TRIGGER INDICATOR LAMP DOES NOT COME ON

INITIAL SETUP

Tools:
- Turret mechanic's tool kit (Item 31, App F)
- Multimeter (Item 18, App F)
- Probe assembly (part of STE-M1/FVS) (Item 30, App F)

Personnel Required:
- ITV/IFV/CFV Trt Mech 45T10
- Helper (H)

References:
- TM 9-2350-252-10-1
- TM 9-2350-252-10-2

Equipment Conditions:
- Engine stopped (TM 9-2350-252-10-1)
- Turret shut down (TM 9-2350-252-10-2)
- Weapons unloaded and safe (TM 9-2350-252-10-2)

1. (H) Move MASTER POWER switch to ON.
2. Move TURRET POWER switch to ON.
3. Move GRENADE LAUNCHER switch to ON.
4. Does grenade launcher indicator light come on?

NO (B) GO TO PAGE 3-120

YES ↓

1. Move FAN/LAMP TEST switch to LAMP TEST position.
2. Did grenade launcher trigger indicator light come on?

NO →
1. Move TURRET POWER switch to OFF.
2. (H) Move MASTER POWER switch to OFF.
3. Replace weapon control box (page 3-110).
4. Verify no faults found.

YES ↓ (A)

GO TO NEXT PAGE

TM 9-2350-252-20-2-1

GRENADE LAUNCHER OR TRIGGER INDICATOR LIGHT DOES NOT GO OFF

INITIAL SETUP

Tools:
- Turret mechanic's tool kit (Item 31, App F)
- Multimeter (Item 18, App F)
- Probe assembly (part of STE-M1/FVS) (Item 30, App F)

Personnel Required:
- ITV/IFV/CFV Trt Mech 45T10
- Helper (H)

References:
- TM 9-2350-252-10-1
- TM 9-2350-252-10-2

Equipment Conditions:
- Engine stopped (TM 9-2350-252-10-1)
- Turret shut down (TM 9-2350-252-10-2)
- Weapons unloaded and safe (TM 9-2350-252-10-2)

1. (H) Move MASTER POWER switch to ON.
2. Move TURRET POWER switch to ON.
3. Does grenade launcher indicator light come on?

NO (B) GO TO PAGE 3-

YES ↓

1. Press and release grenade launcher trigger switch.
2. Does grenade launcher trigger indicator light come on?

NO (C) GO TO PAGE 3-

YES ↓ (A)

TM 9-2350-252-20-2-1

ONE OR MORE GRENADES CONSISTENTLY DO NOT FIRE WHEN GRENADE TRIGGER BUTTON IS PRESSED

INITIAL SETUP

Tools:
- Turret mechanic's tool kit (Item 31, App F)

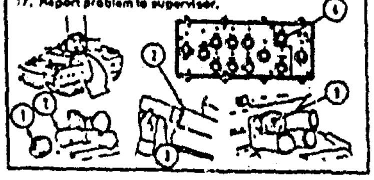
Personnel Required:
- ITV/IFV/CFV Trt Mech 45T10
- Helper (H)

References:
- TM 9-2350-252-10-1

References (cont):
- TM 9-2350-252-10-2

Equipment Conditions:
- Engine stopped (TM 9-2350-252-10-1)
- Turret shut down (TM 9-2350-252-10-2)
- Weapons unloaded and safe (TM 9-2350-252-10-2)

1. (H) Remove rubber caps (1) from grenade launcher tubes (2).
2. (H) Load grenade simulator (3) in grenade launcher tube (2).
3. (H) Move MASTER POWER switch to ON.
4. Move TURRET POWER switch to ON.
5. Move GRENADE LAUNCHER switch to ON.
6. Press grenade launcher trigger (4).
7. (H) Check whether light (5) on grenade simulator (3) comes on.
8. (H) Move grenade simulator (3) to next grenade launcher tube (2).
9. Repeat steps 6 thru 8 above until all grenade launcher tubes (2) have been checked.
10. (H) Verify that light on grenade simulator comes on for each grenade tube fired.
11. Move GRENADE LAUNCHER switch to OFF.
12. Shut down turret (TM 9-2350-252-10-2).
13. (H) Move MASTER POWER switch to OFF.
14. (H) Remove grenade simulator from grenade launcher tube.
15. (H) Install rubber caps on grenade launcher tubes.
16. If grenade simulator light did not come on for all grenade launcher tubes, write up DA Form 2404 on faulty grenade launcher.
17. Report problem to supervisor.



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