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Armored Family of Vehicles (AFV)
Phase I Report (U)

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Book 7
Volume XI

Prepared By:
ARMORED FAMILY OF VEHICLES TASK FORCE (AFVTF)
MG ROBERT J. SUNELL, DIRECTOR

AUGUST 31, 1987

89 6 14 034

UNCL

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION [redacted]	1b. RESTRICTIVE MARKINGS [redacted]
2a. SECURITY CLASSIFICATION AUTHORITY [redacted] 19 Nov 86, CONT #DAAE07-87-C-R004, [redacted]	3. DISTRIBUTION/AVAILABILITY OF REPORT UNLIMITED
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE [redacted]	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Armored Family of Vehicles Task Force	6b. OFFICE SYMBOL (If applicable) DAMO-AFV
6c. ADDRESS (City, State, and ZIP Code) Fort Eustis, VA 23604-5597	7a. NAME OF MONITORING ORGANIZATION 7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)
8c. ADDRESS (City, State, and ZIP Code)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

DTIC
ELECTE
JUN 20 1989
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D CG

11. TITLE (Include Security Classification)
Armored Family of Vehicles (AFV) Phase I Report (U)
Book 7 Vol. XI

12. PERSONAL AUTHOR(S)
See item #19

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM Jun 86 TO Aug 87	1987 Aug 31	11 vols. 6780 pgs

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	
15	01,03,04		(KEYWORDS: MANPRINT; Light Forces; Computer Resource Management (KR))
19	03		

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

This Armored Family of Vehicles Final Report covers the efforts of a Department of the Army Special Task Force from the period June 1986 through August 1987.

The objectives of the Armored Family of Vehicles (AFV) program were to develop and field a force capable of defeating the threat to [SIC] the 90's, while at the same time significantly reducing system and force operations and support costs. Reduction in costs will be achieved through modularity, component commonality and multiple systems capabilities combined so as to achieve required effectiveness with more survivable, cost effective systems. Support structure savings in both active and Reserve Components and the training support base driven by systems/force savings will be specifically considered. Both peacetime and wartime structure and systems savings will be addressed. Other goals include increased deployability, ease of training, modular design for future improvement, fewer crew members, reduced battlefield signature; and increased battlefield supportability. (con't)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL MAJ Randy Tatum	22b. TELEPHONE (Include Area Code) 804-878-1465
	22c. OFFICE SYMBOL DAMO-AFV

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted.
All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

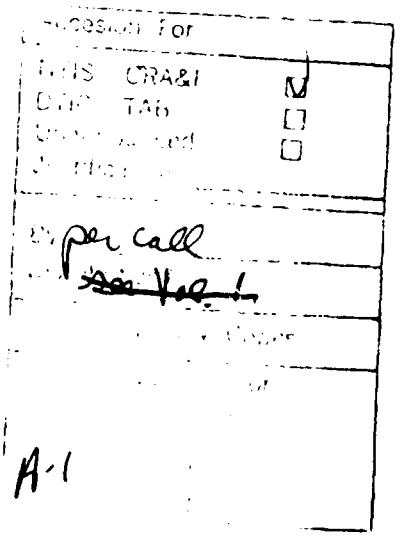
BLOCK 19 con't. Personnel savings must be identified in terms of numbers of people as well as dollars. This effort is a detailed, eleven book (sixteen volume) report of the AFV Study.

Authors:

MG Sunell, Robert J.
COL Logan, James A.
COL Inman, Stephen E.
LTC Greene, Lee F.
LTC Gibson, Joseph W.
LTC Hallissey, Stephen C.
LTC Bryant, John T., III
LTC Robinson, Michael I.
LTC Aadland, Anders B.
MAJ Rozman, Thomas R.
MAJ Duvall, Richard G.
MAJ Winter, Ronald E.
MAJ King, Harold E.
MAJ Gregg, Robert B.
MAJ Tatum, Randy D.
MAJ Fil, Joseph F., Jr.
MAJ Buckstad, Robert D.
CPT Smith, Carleton M.
Mr. Nette, Robert
Ms. Conwell, Debra L.
Mrs. Mosley, Alice H.
Mr. Coffman, Richard L.
Mr. Stryker, Harm
Mr. Augustine, Ed
Mr. Bahnsen, John C., Jr.
Mr. Bisno, Chester J.
Mr. Brown, Sam A.
Mr. Cargile, Jim
Mr. Denby, Otis E.
Mr. Gilmore, Joseph R.
Mr. Graves, Richard T.
Mr. Harrington, Robert H.
Mr. Heisner, Ralph P., Jr.
Mr. Hurford, Ellwood C.
Mr. Kersey, Ian G.
Mr. Phalin, Frederick T.
Mr. Williamson, Earl W., Jr.

(U) AFV PHASE I REPORT ORGANIZATION

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2	III	REQUIREMENTS DOC	S
	IV	THREAT	S
3	V	LOGISTICS DOC	U
	VI	SMMP	U
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	VIII	RSIP	U
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VOLUME XI

ARMORED FAMILY OF VEHICLES

TASK FORCE

PHASE I REPORT

VOLUME XI

TRAINING STRATEGY

31 AUGUST 1987

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(U) FOREWORD

(This Page Is Unclassified)

This volume contains the concept, strategy and guidance to develop the training subsystem for the Armored Family of Vehicles.

Specific requirements and products are described which initiate the training development process and a training management umbrella that extends from materiel development through sustainment of the force in the field.

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CHAPTER 1

(U) TRAINING OVERVIEW
(This Chapter Is Unclassified)

1-1 PURPOSE. This Volume and its Appendices contain the concept, strategy, and guidance for developing, validating and fielding the AFV training subsystem concurrently and in concert with AFV hardware/software acquisition. The action documents in each appendix contain specific guidance for industry and government combat and materiel developers.

1-2 REFERENCE.

a. This Volume was prepared IAW:

(1) Memorandum, DAMO-AFV-C, Subject: TF Final Products/Scheduled Updates, 18 April 1987.

(2) Preliminary Outline of the Armored Family of Vehicles Task Force Major Products, 30 September 1986.

b. The Appendices were prepared in accordance with the provisions of AR 70-1, Systems Acquisition Policy and Procedures; AR 71-9. Force Development, Materiel Requirements, AR 700-127, Logistics, Integrated Logistic support. AR 602-2, MANPRINT in the Materiel Acquisition Process; TRADOC Reg 351-9, Individual and Collective Training Plan for Developing Systems; AFC/TRADOC PAM 70-2, Materiel Acquisition Handbook and DA Circular 350-84-4, Standards in Weapons Training.

1-3 OVERVIEW.

a. As the AFV concept is articulated, it is essential to clearly define the training requirements and initiatives required to develop, field and sustain the AFV throughout system life cycle.

b. Because the AFV will be developed and fielded as a force, two distinct training echelons must be considered.

(1) The first and most complex is training development in terms of the family concept. Three essential points are associated with this issue:

(a) Ensuring maximum commonality of devices, simulations, training materials and facilities -- so they can be used for multiple subsystems and missions. Examples are conduct of fire trainers, driver trainers, and maintenance trainers. This is essentially capturing and directing the synergism and economies associated with AFV system development.

(b) Applying leap ahead (breakthrough) training technology discovered during development of one system to other systems of the AFV. This requirement suggests a training clearing house capable of cross-pollinating training information throughout the training community. Because many subsystems will be under simultaneous development, it is essential that opportunities are not missed and a mechanism established for intra-family training development. Accomplishment of this requirement is dependent upon establishing an effective, working, horizontal communication network among the training, combat, and materiel development communities.

(c) Ensuring that force level training packages are fielded to coincide with the AFV fielding concept. This is an essential aspect of the AFV training development program. It will provide the capability for leader, combined arms, unit and individual training required for effective AFV force deployment, train-up and sustainment.

(2) The second echelon, subordinate and contributory to the AFV force concept, is the proponent responsibility to develop the most effective and efficient training program for individual AFV systems. Four points are associated with this issue.

(a) Ensuring appropriate funds and facilities are programmed for training development and procurement.

(b) Ensuring the training development program maintains pace and synchronization with its AFV system combat and materiel development.

(c) Ensuring the training development program is in consonance with and supportive of the AFV family training concept.

(d) Providing feedback to the training community regarding progress and breakthroughs.

1-4 GOALS. The goals of the AFV Training Development program are:

a. Having an integrated training system in place to support AFV fielding.

b. Providing the capability to train realistically based on combat critical tasks, conditions and standards. Concurrently, providing a training feedback system linked with readiness to provide training management information for attaining and maintaining individual and unit proficiency.

c. Ensuring the training system logistics are embedded in the program. Specifically, the MCA and OMA programs must be programmed to include total DEH involvement.

d. Reducing high operation and sustainment costs throughout equipment life cycle.

e. Eliminating force structure and personnel requirements that are reduced or streamlined through AFV design and development. Specifics and particulars will appear and accrue as the benefits and economies of commonality, modularity, and multiple mission capabilities of the AFV concept permeate the training, combat and materiel development process.

f. Reducing expensive corrective program improvements. Much of this can be accomplished through the system design influence of MANPRINT, ILS, and LSA/LSAR initiatives. The issue is to eliminate problems before they happen.

g. Properly fitting equipment and its use to the soldier, commander and mission.

h. Improving and sustaining readiness.

Chapter 2

(U) CONCEPT AND STRATEGY

(This Chapter Is Unclassified)

2-1 OPPORTUNITIES. To promote the greatest impact and synergism, it is essential to develop and exploit opportunities and identify high cost drivers where training can have the greatest positive effect. These possibilities exist primarily in the areas of personnel, ammunition, and spares.

a. Personnel. The largest cost driver in the current armored vehicle fleet is personnel. It accounts for over 40 percent of operation and sustainment costs. AFV efforts that have distinct personnel (training) implications are:

(1) Crew reduction resulting from advanced technology.

(2) Extensive training commonality among subsystems to include devices, simulations and programs that can be used by multiple AFV subsystems.

(3) Simplified training based upon target audience capability and designed to fit the equipment to the man and his mission.

(4) Embedded training capability to train combat critical operational capabilities at home station.

(5) Reduced numbers of MOS, particularly in maintenance and support resulting from AFV commonality, modularity, and multiple system applications.

(6) Reduced support structure resulting from AFV commonality, modularity, and multiple system applications, and attendant MOS and training base consolidations.

(7) Improved cross training capabilities of all MOS in a unit.

(8) Improved RAM.

(9) Built-in test and test equipment.

(10) Battlefield cannibalization.

b. Unit Training Ammunition. The next highest O&S driver is unit training ammunition. It accounts for about 18% of the cost. AFV initiatives that will have a direct impact on ammunition are:

(1) An embedded training capability in each AFV system to provide commanders the ability to substitute simulation for

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live fire and maneuver in their cantonment areas and train to and maintain combat standards.

(2) Development of a device based training strategy IAW DA Circular 350-85-4, Standards in Weapons Training. This will provide the essential methodology, direction, and guidance regarding weapon systems training programs that effectively and efficiently integrate simulation and full service ammunition as a function of training readiness conditions.

c. Replenishment Spares.

(1) Another 18% of O&S costs is in replenishment spares. Improved maintenance and support concepts will result from better RAM and the AFV family synergy of commonality, modularity and multiple system capability. Battlefield cannibalization will also provide cost effective benefits.

(2) Excellent opportunities exist to develop training concepts and programs which enhance and complement maintenance and support initiatives. These are categorized in terms of consolidated or reduced:

(a) Training programs/courses;

(b) Facilities, devices, simulation and training equipments;

(c) Literature, institutional and MOS requirements.

2-2 CONCURRENT DEVELOPMENT. Essential to the AFV training development program is:

a. Concurrent development, testing, and validation of the training subsystem with supported materiel. This is to be accomplished in accordance with ILS/LSA/LSAR, MANPRINT, and individual and collective training plan initiatives and requirements.

b. Having the training subsystem in-place when the AFV is fielded. This assumes:

(1) Trained soldiers are available to man equipment on issue.

(2) Necessary simulation and training devices and maintenance and support literature are fielded.

(3) Facilitation available: Hard stands, power, shelters/buildings, ranges.

(4) The maintenance, repair and replacement structure is in place with initial parts stockage.

(5) Manpower for ancillary staff requirements validated and resourced so receiving units are not required to divert critical soldier assets.

2-3 AFV TRAINING CONCEPT. The AFV training concept is based upon the following requirements:

a. A fully integrated and organic training program for an Armored Family of Vehicles and for each system of the family for the life cycle of the equipment. This requirement applies to the unit and institution, Active and Reserve Component forces.

b. The optimized use of the devices and simulators for both development and training. Device and simulator development must consider the issues of commonality, multiple mission capability and multi-proponent capability.

c. An embedded training capability in each AFV system that can be used to train combat critical tasks to standard at the unit. The capability to net devices and simulators to provide individual unit and combined arms capability is required. An embedded training capability will be the cornerstone of unit training.

d. A family of stand-alone, multi-station simulations and devices to accomplish the preponderance of institutional training and reduce the need for operational equipment, training, ammunition, and range requirements.

e. Mutually supportive individual and collective training products for:

(1) New equipment training,

(2) Sustainment training, and

(3) Displaced equipment training.

f. Integration of training equipments, facilities, and personnel requirements to ensure each is identified, designed, validated and provided in synchronization with equipment life cycle. This is an across-the-army program requiring concurrent involvement and active participation by major commands. Involved is the programming and designation of appropriate OPA, OMA, and MCA funds, and the physical establishment of training subsystem hardware in locations required by the commander.

2-4 AFV TRAINING STRATEGY. The AFV training concept will be realized by execution of the following requirements:

a. In accordance with approved doctrine and threat estimates and using MANPRINT, ILS/LSA/LSAR and Individual and

Collective Training regulations and initiatives, development of tasks, conditions and standards based on:

(1) The soldiers we will have,

(2) The equipment to be manned,

(3) The enemy to be engaged, and

(4) US Army combat doctrine.

b. Development of collective and individual training and testing materials and mechanisms for training and sustaining soldiers, units, and leaders to combat standards. This requirement includes a feedback system to provide commanders the capability to adjust training programs.

c. Development of a family of training devices and simulations which provide the capability for effective, efficient, and realistic training to combat standards. This requirement includes the capability to qualify soldiers and units on selected combat critical tasks. This program should result in reduced:

(1) Institutional training personnel, facilities, and structure.

(2) Training ammunition requirements for unit and institution.

(3) Mission equipment required for training in the unit and institution.

d. Development of an Army training program linked directly to AR 220-1, Readiness.

2-5 IMPLEMENTATION. The training development products described in the chapters that follow are designed to set the AFV training strategy in motion. Each is based upon the Army level goals, concept, and strategy contained in Chapters 1 and 2.

CHAPTER 3

(U) INDIVIDUAL AND COLLECTIVE TRAINING

(This Chapter Is Unclassified)

a. The AFV Umbrella Individual and Collective Training Plan (ICTP) provides the TRADOC Headquarters, Integrating Centers and proponent schools the essential guidance and direction to systematically plan, develop, manage, and integrate the training subsystem for the AFV.

b. The initial ICTP prepared by the AFV Task Force is at Appendix A. The purpose of this ICTP was to provide the TRADOC the individual and collective training concept and strategy as developed within the Task Force to use in development of the TRADOC approved ICTP and its annexes. Also at Appendix A is the TRADOC approved ICTP to include the draft AFV Cost and Training Effectiveness Analysis (CTEA) and the Training Device Requirement (TDR) documents from proponent schools.

c. Each ICTP was prepared IAW TRADOC Regulation 351-9 and other regulations dealing with The Systems Approach to Training, Integrated Logistics Support and MANPRINT. The ICTP reflects the actions and requirements to implement the AFV training subsystem as it pertains to the AFV as a force and the individual systems of the AFV the comprise the force.

CHAPTER 4

(U) TRANSITION TRAINING
(This Chapter Is Unclassified)

4-1 Transition of the AFV into the Army will be accomplished in brigade size force packages. The goal is to transition one division a year.

4-2 The detailed concept, strategy and plan for the transition is at Appendix B. The salient features of the program are:

a. A Central Training Facility (CTF) located in CONUS with the capability to train a brigade size force each quarter.

b. A training simulation center, as a part of the CTF which will be used for train-up and certification -- before operation of combat equipment.

CHAPTER 5

(U) SUSTAINMENT TRAINING
(This Chapter Is Unclassified)

5-1 More than one half of the AFV life cycle costs are for sustainment. A large portion of the sustainment requirement is for training and training support. An essential requirement of the AFV is to develop a cost and training effective training subsystem -- and reduce O&S costs across the force.

5-2 At Appendix C is a detailed concept and strategy for sustainment training. It provides the Combat and Materiel Developer the basis for developing and executing a unit training strategy based on embedded capabilities in individual AFV systems and standalone, multi-station generic simulators for the institution.

CHAPTER 6

(U) RESERVE COMPONENT TRAINING
(This Chapter Is Unclassified)

6-1 The current fleet of armored vehicles in the Active force and round out units which will be replaced by the AFV will be transitioned into the Reserve Components (RC). The rate of equipment flow into the RC will be essentially a brigade size quantity each quarter.

6.2 Appendix D contains a detailed concept and strategy for Displaced Equipment Training (DET). The essential features of the program are:

a. Transition accomplished essentially within the personnel, facility and time currently available to the RC supported by selected contractor teams.

b. Reserve component leadership is directly responsible for the transition effort and are represented in the Program Execution Office (PEO).

CHAPTER 7

(U) REQUIREMENT DOCUMENTS
(This Chapter Is Unclassified)

7-1 In large measure, the success of the AFV training subsystem is directly proportional to how clearly and precisely training requirements are stated and articulated to contractor and government combat and materiel developers.

7-2 Appendix E contains paragraph 8C, Training Assessment and Appendix 5, Training Devices for the AFV umbrella Required Operational Capability. The significant features of the documents are:

a. Concurrent development, testing, validation and fielding of an organic training subsystem with operational equipment.

b. An embedded training capability included in each AFV system.

c. All training subsystems based on a device training strategy.

CHAPTER 8

(U) TRAINING EFFECTIVENESS
(This Chapter Is Unclassified)

8-1 Development of the training subsystems to support the fielding/implementation of AFV requires an integrated and standard program. Estimated resource and support requirements must be identified to support AFV decision fielding milestones in direct support of the Cost Operational Effectiveness Analysis (COEA). The process to insure the AFV training subsystem is both effective and supportable is accomplished through execution of a Cost and Training Effectiveness Analysis (CTEA).

8-2 Appendix F contains the AFV CTEA. The CTEA is a multi-year effort that began in April 1987 and will continue through September 1992. The objectives of the analysis are to:

a. Enhance battlefield effectiveness through standardization of soldier-training subsystem interfaces for AFV.

b. Establish a baseline to insure effective initiation of CTEA for individual mission modules.

c. Determine elements of a training management program to ensure standardization of development, analysis and data collection relative to AFV training.

d. Determine need to fine tune contractor provided support packages.

e. Determine specific elements of the AFV training subsystems.

f. Determine potential training issues related to AFV fielding.

g. Reduce simultaneous and costly excursions.

APPENDIX A

(U) UMBRELLA INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP)

FOR THE

ARMORED FAMILY OF VEHICLES

SEPTEMBER 1987

(This Appendix Is Unclassified)

GENERAL

1. This Appendix is in two parts:

a. Part I is the initial ICTP developed by the AFV Task Force. The purpose of the ICTP was to provide the TRADOC community with the training concepts and strategies considered essential to develop an effective and efficient AFV training subsystem.

b. Part II is the approved ICTP as developed by the TRADOC. Included as an annex is the Training Device Requirements documentation from proponent schools. These documents will serve as the basis for further definition and specific requirement assignment as the AFV proceeds into Phase II.

(U) ARMORED FAMILY OF VEHICLES

TASK FORCE

PHASE I REPORT

PART I
(U) UMBRELLA INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP) FOR ARMORED FAMILY OF VEHICLES (AFV)

PART I

(U) UMBRELLA INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP)

FOR

ARMORED FAMILY OF VEHICLES (AFV)

AS PREPARED BY THE

ARMORED FAMILY OF VEHICLES TASK FORCE

JULY 1987

(This Part Is Unclassified)

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ARMORED FAMILY OF VEHICLES (AFV) UMBRELLA

INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP)

1. REFERENCES. This ICTP has been prepared in accordance with the training management policies and requirements prescribed in the references at Appendix A.

2. GENERAL.

a. Purpose. This umbrella ICTP is the AFV Capstone strategy document for training. It provides the training concept and a systematic approach for the TRADOC and proponent schools to plan, develop, manage and integrate the training subsystem(s) for the Armored Family of Vehicles (AFV). This ICTP contains annexes from each proponent school that describe the training requirements for individual AFV systems in detail.

b. Scope. Armywide training requirements to include institution, unit, extension, and Reserve Component (RC) training are described. Specific requirements for new equipment, institutional, and nonresident training are also described.

c. Revisions. This ICTP is a living document. It will be reviewed and updated when required, but as a minimum, annually.

3. SYSTEM ACQUISITION DATA.

a. Army Modernization Information Memorandum (AMIM) number-TBD.

b. New Equipment Training Plan (NETP) number - TBD.

c. Description of equipment (See Appendix B).

d. First Unit Equipped Date - FY95.

4. ASSUMPTIONS.

a. Funding will be made available for AFV training development.

b. The AFV will consist of common chassis capable of receiving different modules and mission systems.

c. The AFV will reduce long term system and force O&S costs. Major savings will be realized in training ammunition, OPTEMPO and spare part requirements.

d. AFV fielding may initially increase the training and support requirements of the training base. This is a result of

the requirement to continue training for the current system and the ramp up to train AFV. (Long term impact of AFV will reduce training support costs as current system equipment is phased out of the force).

e. AFV commonality, modularity and multiple mission capabilities will result in:

(1) New tasks and skills that will be common across the force.

(2) Simplified individual and collective training requirements.

(3) Some institutional course consolidation and restructure.

(4) Some MOS restructure and in some cases MOS consolidation.

(5) A broad base for device and simulation commonality especially with regard to drivers, maintainers and crews.

f. AFV training will be predicated upon a device based training strategy. An embedded training capability is the preferred alternative for accomplishing the strategy. An effective embedded training program will lower unit training costs.

g. Stand-alone or bolt-on simulations and devices will only be considered for unit training when an embedded capability is not technically or economically feasible.

h. Training simulations and devices will replace the predominance of operational equipment in the institution. Institutional training ammunition will be reduced, by at least 20%, as a result of an effective simulation program.

i. All MANPRINT domains will be addressed and applied to training subsystem as appropriate.

j. Integrated Logistic Support (ILS) requirements will be thoroughly integrated into training subsystems.

k. Divisional AFV will be fielded in brigade-slice sets. Non-divisional AFV will be fielded in brigade sized sets.

l. Instructors and key personnel will be identified and stabilized in the training base (institutions and central training facility) until the AFV training base requirements are established and operational.

5. TRAINING CONCEPT.

a. Beginning in 1995, the Army will begin modernization by fielding the Armored Family of Vehicles. A brigade slice or brigade size piece will be organized, trained and deployed each quarter until fielding is complete. The training program to support this modernization effort is based upon the following concepts:

(1) A fully integrated and interactive training program for the armored family of vehicles and for each system within the family

(2) A fully developed training subsystem organic to and concurrently developed and validated with the family and each system of the family. Each subsystem will be in place at fielding. Included will be individual and collective products and equipment for the unit and institution, active and Reserve Components. This is required to support:

(a) Initial and professional development training.

(b) New equipment training.

(c) Sustainment training.

(d) Displaced equipment training.

(3) A device based training strategy that takes advantage of the synergism and economies associated with AFV commonality, modularity and multiple mission capabilities. This strategy will contribute significantly to O&S cost reductions particularly in regard to training ammunition, OPTEMPO and spare parts.

(a) Unit Training. An embedded training capability is the preferred approach to unit training. The capability should replicate the system it supports in terms of operation, gunnery and operator maintenance. Embedded simulations, within, e.g. the tank, should have the capability to be netted with other tank embedded simulations. This will allow collective training. Ideally, embedded tank systems should have the capability to net with the embedded training simulations in Infantry fighting vehicles and supporting field artillery for combined arms training. A coherent and integrated embedded training program is the cornerstone for effective and economical unit training. Stand-alone or bolt on devices should be considered as last resort for unit training.

(b) Institutional Training. Low cost, stand-alone devices and simulators is the preferred approach for institutional training. The approach drastically reduces operational equipment requirements -- particularly for operator, maintainer, gunnery and driver training. Also, AFV commonality,

modularity and multiple mission capabilities promises a greatly expanded multi-proponent simulator and device sharing capability.

b. To insure the training concepts become reality, the following actions are required:

(1) Combined Arms Center (CATA lead). Increase the horizontal coordination and integration capability within the TRADOC and between TRADOC and MACOM. This is required because of:

(a) Compressed AFV development and fielding.

(b) The enormity and complexity of equipment infusion is apparent from the diversity of the equipment which crosses all proponent and MACOM boundaries.

(c) Extensive operational and training equipment commonality which will also cross most proponent boundaries.

(d) The requirement for continuous force level (combined arms) training.

(2) TRADOC (DCST lead). Establish a centralized training facility capable of equipping, training and deploying brigade size forces on a quarterly basis.

(3) TRADOC (DCST lead). Adjust the institutional training base to complement AFV equipment and personnel initiatives and to support the Central Training Facility personnel requirements. Include greater centralization of courses, and the equipment required to support courses. Specific targets are: maintainers, drivers, and crews. The essence of the initiative is to align the institutions in such a way as to accrue the same types of efficiencies and economies as the AFV. The purpose of the initiative is to facilitate initial and sustainment training in the field and institution for the life of the AFV. The training resources required to field and sustain the AFV will be identified and validated throughout equipment life cycle.

(4) TRADOC (DCST lead). Ensure facilities and the capability to transfer "current" equipment to the Reserve Components and accomplished essential training is in place.

6. DETAILS. The AFV Training concept and program will be implemented as follows:

a. Task and objective schedule (Appendix C.)

b. New Equipment Training (NET). The AFV will be transitioned into the Army in unit sets beginning in 1995. This will be done at the rate of one brigade each quarter until fielding is complete. The scope, complexity and enormity of

this requirement dramatically changes traditional NET procedures. Specific AFV requirements are:

(1) TRADOC and AMC. Develop an AFV UMBRELLA NET PLAN that ensures all AFV training subsystems required for each brigade package are in place. The essential requirement is integration of individual system NET plans into a coherent program that assembles in a collective and coordinated fashion for a brigade -- the training requirements contained in the individual system DA FORM 5316-R, New Equipment Training Plan (NETP). This scope, level and perspective of training coordination and management is essential to program success.

(2) Proponents. Develop individual system NETP that support the brigade fielding concept.

(3) TRADOC/MACOM. Establish or designate a Central Training Facility capable of training an AFV brigade each quarter. The responsibility of the center would include doctrinal and tactical training.

(4) TRADOC (DCST lead). Ensure the institutional training base is organized and positioned to provide initial entry and professional development training, and supports the Central Training Facility requirements and unit sustainment requirements.

(5) TRADOC/AMC/MACOM. Establish coordination facility between TRADOC, AMC and MACOM to ensure the orderly movement of units and materiel.

(6) TRADOC/AMC/MACOM. Determine the level and essential quantity/percentage of contractor support required for new and displaced equipment movement, processing and training. This is essential to reducing military requirements for overhead activities.

c. Institutional courses of Instruction (new/and or revised).

As indicated in the NET discussion, institutional requirements must be addressed in terms of training to support:

(1) Individual system requirements (AFV and current)

(2) The Central Training Facility, a brigade level requirement

(3) AFV fielded unit sustainment

(4) Current system fielded unit sustainment

Organization and coordination of the institutional effort, considering how the AFV will be transitioned into the

Army, must be addressed at the force level. It is recognized that the bulk of new institutional training requirements are identified in system NETP. However, the overriding AFV consideration is that the institutional training effort be organized to insure supportability of the brigade a quarter AFV transition concept beginning in 1996.

The exact nature and scope of course changes will be determined by output from the ILS/LSA/LSAR process, MANPRINT initiatives, front end analysis, Early User Test and Experimentation Tests, Initial Operational Test and Evaluation and Cost Training Effectiveness Analysis.

Examples of specific institutional training issues and initiatives to be analyzed are:

(1) Centralized driver training. This is a direct result of the AFV common chassis program. It would include maximum dependence on driver simulators with operational equipment being used to validate proficiency.

(2) Centralized and/or consolidated maintenance training, also relying heavily on devices and simulators to reduce operational vehicle requirements.

(3) Generic Conduct of Fire Trainers, that with simple adaptation/conversion, can be used for multiple weapon systems.

Specific proponent systems are listed at Appendix D.

d. Identification of tasks and/or duty positions to be included in unit training. Operator and maintainer tasks will initially be identified by the contractor in a front-end analysis. These tasks will be developed, validated by TRADOC, and included in Training Plan (TP) and Training Support Package (TSP). Proponent schools will specify additional training requirements IAW appropriate Military Standards. Unit training tasks and/or duty positions will be further refined through the use of nonresident training material. Collective training tasks will be developed IAW SAT and distributed by proponent schools through the use of ARTEP/AMTP. Doctrinal and Tactical Training tasks will be developed by the proponent.

e. Requirement for instructor and support personnel. Initial operator and maintenance personnel training, i.e., Instructor and Key Personnel Training (IKPT), for the testing and deployment of AFV will be provided by contractor utilizing contractor developed training courses. Military and Civilian manpower requirements and cost projections are TBD.

f. Facilities requirements (new or add-on). Transitioning to the AFV will effect facilities in the following areas:

(1) Central Training Facility. Depending on the location selected, new facility requirements could be either modest or extensive. If a major operational post is selected, new facilitation requirements should be minimal. If an isolated location is selected, that will require a ground-up approach - billets, motor parks, ranges etc., the cost of establishing the central training facility will in fact be extensive and most likely prohibitive.

(2) Institutions (Proponent schools). The essential institutional facilitation requirement apply to:

(a) Providing the capability to install and operate training devices and simulations.

(b) Developing new and sophisticated learning centers.

(c) Modifying ranges to accommodate AFV capabilities.

(d) Modifying existing motor park/maintenance facilities to accommodate AFV.

(e) Developing centralized driver and maintenance training capabilities at the force training level and expanding and contracting current facilities to respond the consolidation or adjustment of MOS densities.

(3) Range facilities. As AFV weapon capabilities, mobility and maneuver requirements are more clearly identified, revised requirements for existing and new ranges will become apparent. However, initial planning can begin in light of planned AFV capabilities that include:

(a) New direct fire crew served weapons.

(b) Longer range combat support weapons.

(c) Greater use of laser capabilities and other DEW.

(d) Greater speed and maneuverability.

To ensure early planning and problem recognition is under way, this ICTP will be coordinated with TRADOC DCSENG. Facilities must be documented and submitted for programming by 2QFY88.

g. Training equipment requirements and proposed distribution plan. TRADOC must receive the AFV in sufficient quantities to establish the institutional base before FUE. The AFV quantities and organization locations will be IAW the AFV Force Basis of Issue Plan (BOIP). Unique subsystem requirements will be addressed as appendices to the force plan. The training

base must be internally coordinated to provide replacements to the force to support the brigade fielding strategy.

h. New funding requirements. Specific requirements continue to require definition. However, general requirements as pertain to the Central Training Facility, simulation requirements in terms of centralized driver and maintenance facilities can be considered for early planning purposes at this time.

i. Ammunition. Specific ammunition requirements for specific AFV weapon systems cannot be identified now. However, guidance concerning O&S costs indicates expected reductions. Accordingly, early planning must account for this factor. In consonance with DA PAM 350-XX, Standards in Weapons Training, develop training programs with a much greater reliance on an embedded training capability, and a lower reliance on live fire and OPTEMPO to attain and maintain combat readiness. Early definition of simulation requirements in light of expected ammunition levels will provide an in depth understanding of specific simulation capabilities directly applicable to ROC/RFP development.

j. Training aids and instructional media requirements. The training materials required to support the Central Training Facility, resident and extension training will be prepared and validated by the appropriate proponent and available for IKPT.

k. Training Literature Requirements. A front end analysis of AFV doctrinal and tactical implications will provide the basis for development of How-to-Fight manuals and supplementary Training Circulars. The contractors developing the AFV systems will identify and describe operator and maintainer tasks. These tasks will be validated by the proponent and appropriate conditions and standards applied. These documents are all part of the Army Training Literature program and must be available at fielding. The essential target is availability of required literature at the Central Training Facility in 1995, for training the first AFV brigade.

l. Training Device and Simulation Requirements. Appendix E contains a detailed description of how to implement a device based training strategy for the AFV. The essential issues are:

(1) An embedded training capability in the operational equipment is the preferred method for unit training. Embedded training should:

(a) Enable training on combat critical tasks.

(b) Provide the capability to shoot, move and communicate in the motor park on 110 power without having to start up the vehicle.

(c) Reduce the requirement for training ammunition and OPTEMPO.

(d) Be compatible (nettable) with other embedded simulations to provide unit and combined arms training.

(e) Stand-alone or bolt-on devices should only be prescribed for unit training when the embedded capability is not technically or economically feasible.

(2) Institutional training will be characterized by a preponderance of stand-alone devices and simulations that will reduce the requirements for operational equipment and training ammunition. Common Simulations e.g., drivers, maintainers, crew operations that can be used by multiple proponents is essential.

m. Other support requirements. Additional support requirements are addressed in Appendix D.

n. Doctrinal, maintenance training or other publication/media. Training and technical literature will be prepared, distributed, evaluated, and updated as an integral part of the AFV development and fielding program.

APPENDIX A

REFERENCES

a. AR 71-5, Introduction of New or Modified Systems/Equipment.

b. AR 350-1, Army Training.

c. AR 350-35, Army Modernization Training.

d. AR 570-2, Organization and Equipment Authorization Tables - Personnel.

e. AR 700-18, Provisioning of U.S. Army Equipment.

f. AR 700-127, Integrated Logistics Support.

g. AR 1000-1, Basic Policies for Systems Acquisition.

h. DA Form 11-25, Life Cycle System Management Model for Army Systems.

i. DA Form 570-558, Staffing guide for U.S. Army Service Schools.

j. TRADOC Regulation 70-1, Research and Development, New Equipment Training Requirements and Procedures.

k. TRADOC Regulation 350-7, A Systems Approach to Training.

l. TRADOC Regulation 351-3, TRADOC schools Curriculum Administration and Training Policy.

m. TRADOC Regulation 351-9, Individual and Collective Training Plan for Developing Systems Policy and Procedures.

n. TRADOC Regulation 351-11, Soldier's Manuals, Trainer's Guide, a Job Book Policy and Procedures.

o. TRADOC REGULATION 700-1, Integrated Logistics Support.

p. TRADOC Circular 350-3, Individual and Collective Training Plan for Developing Systems Policy and Procedures.

q. Charter, Armored Family of Vehicles.

r. Operational and Organizational (O&O) Plan for AFV.

s. System MANPRINT Management Plan for AFV.

t. AFV Integrated Logistics Support Plan.

APPENDIX B

DESCRIPTION OF EQUIPMENT

1. The AFV will replace the currently fielded and projected fleet of armored vehicles throughout active Army and Reserve Component (RC) roundout units. The AFV fielding will be accomplished in unit sets issued approximately one set per quarter completing a Division issue per year.

2. The AFV is a system of vehicles that when manned with trained soldiers and supported by other equipment creates a total close combat-heavy force package. The AFV will be characterized by incorporation of modularity, component commonality (with a desired goal of total commonality, power pack, fire control, suspension items, etc.), common battlefield signature, common vehicle electronics (vetronics) architecture, and multiple system capabilities. The AFV provides follow-on/replacement vehicles for various systems now managed or under conceptual evaluation by proponent centers. Even with the fielding of the AFV family, a high/low (new/old) mix of equipment and technology is expected through the year 2000. To optimize commonality through the fleet, the AFV will be developed considering the following technologies:

a. Advanced survivability technologies that reduce the size/weight of individual systems through the use of innovative materials and electronic devices.

b. Modular vetronics, propulsion, fire control, position navigation, maintenance, and Battlefield Management System (BMS) components such as controls and displays.

c. Tunable armor and suspension systems, capable of being tailored to various mission requirements.

d. Advanced NBC survivability systems.

e. State-of-the-art diagnostic and prognostic testing devices which incorporate an automated call capability for supply/resupply to the appropriate maintenance and supply organizations and will also support common training programs.

f. Robotics and artificial intelligence.

g. Human factors engineering and soldier-machine interface advances.

h. Embedded training which will be the primary training option for operators, crews, and maintenance personnel in the unit. Embedded training is defined as the training which

results from features designed and built into a specific item of equipment which provides training in its use.

i. Advanced logistical considerations to include:

(1) A programmable simulation for training degraded operational modes in trouble shooting and fault isolation.

(2) Development of nonstandard or transportation/storage training requirements for movement and storage of sensitive/classified and end item/weapon system components, ammunition, TPS's, etc.

(3) Technical Data.

(a) The AFV will be supported by DA publications. Technical data will be developed using the computer aided logistic support (CALS) system and the militarized electronic information distribution system (MEIDS) for technical documentation.

(b) Preliminary draft equipment publications (PDEP) will be made available for evaluation during EUT&E. They will then be updated to support the logistic demonstration (LD). Draft equipment publications (DEP), further updated as a result of the LD, will be available to support IOT&E and FOT&E and will be fully evaluated during those tests. A formal publications verification will be accomplished by the government using soldier personnel.

(c) As LSA data is expanded and refined, the operations, maintenance, supply, and design requirements developed will serve as the data base for accurate technical publications. This data will help eliminate inaccuracy and duplication in all areas and greatly assist in configuration management. New publications will be developed from the LSAR data base to ensure compatibility between repair parts lists, support equipment and tools lists, task allocation, skills, and operating and maintenance instructions. An evaluation of the maintenance philosophy will be a prime driver in the selection and preparation of publications.

(d) Draft equipment publications will be updated to incorporate changes which occur during LD, EUT&E, IOT&E, and FOT&E. Updates and finalized publication dates will be scheduled to ensure timely availability before first unit equipped (FUE).

APPENDIX C

TASK, OBJECTIVE, AND MILESTONE SCHEDULE

TASK/OBJECTIVE	QTR/FY
1. SMMP	2/87
2. O&O Plan	3/87
3. Training Constraints	TBD
4. Training Concepts	1/87-2/87
5. Training Issues and Criteria	1/87-4/87
6. ICTP	1/87-4/87
7. Draft ROC (TD Input)	2/87-4/87
8 ROC Approved	3/89
9. CTEA	3/87-3/88
10. ILSP Input	2/87-1/89
11. NETP	1/88-3/88
12. TTSP	1/88-3/88
13. ICTP Update	1/88-1/89
14. Review BOIP/QQPRI	3/88-4/88
15. Asst AMC with RFP/SOW	3/88-4/88
16. Contractor Training Program	1/89-1/90
17. Training Device Prototypes	1/89-1/90
18. Update TTSP	1/90-3/91
19. CAD/ITP	1/91-4/91
20. IKPT	1/91-2/91
21. Test Player Training	3/91-1/92
22. ICTP & NETP Update	3/91-4/92
23. POI	I/93-CONTINUOUS
24. Resident Training Program	I/93-CONTINUOUS

UNCLASSIFIED

APPENDIX C

TASK, OBJECTIVE, AND MILESTONE SCHEDULE

TASK/OBJECTIVE		QTR/FY
25.	Training Devices	I/93-CONTINUOUS
26.	Unit Training Support Packages	1/93-1/94
27.	Resident Training	3/94-CONTINUOUS
28.	IKPT	4/94-1/95
29.	FUE	I/95
30.	New Equipment Training	I/95-CONTINUOUS
31.	Post Fielding Evaluation	I/95-TBD

UNCLASSIFIED

APPENDIX D

AFV PROPONENT DESIGNATIONS BY ANNEX

A	Future Armored Combat System (FACS)	USAARMS
B	Light Future Armored Combat System (LT FACS)	USSAARMS
C	Future Reconnaissance Vehicle (FRV)	USSAARMS
D	Future Armored Resupply Vehicle (FARV)	USSAARMS
E	Command and Control Vehicle (C&C)	USAARMS
F	Future Infantry Fighting Vehicle (IFV)	USAIS
G	Directed Energy Weapons Vehicle (DEW-V)	USAIS
H	Kinetic Energy Missile Vehicle (KEM-V/LOS-AT)	USAIS
I	Mortar Weapon System Vehicle (MWS-V)	USAIS
J	General Purpose Carrier (GPC)	USAIS
K	Advanced Field Artillery System - Cannon (AFAS-C)	USAFAS
L	Fire Support Combat Observation Lasing System (FSCOLS)	USAFAS
M	Elevated Target Acquisition System (ETAS)	USAFAS
N	Rocket and Missile System (RAMS)	USAFAS
O	Line of Sight Forward - Heavy (LOS-F-H)	USAADS
P	Non-Line of Sight Vehicle (NLOS)	USAADS
Q	Sapper Vehicle (SV)	USAEC
R	Combat Mobility Vehicle (CMV)	USAEC
S	Mine Dispensing Vehicle (MDV)	USAEC
T	Combat Excavator (CEX)	USAEC
U	Combat Earthmover (CEM)	USAEC
V	Combat Gap Crosser (CGC)	USAEC
W	Maintenance Assistance and Repair System (MARS)	USAORDC
X	Recovery Vehicle (RV)	USAORDC
Y	Intelligence and Electronic Warfare Vehicle (IEW)	USAICS

APPENDIX D (CONTINUED)

Z	Nuclear, Biological, and Chemical Reconnaissance System (NBC)	USACMLS
AA	Combat Smoke Vehicle (SMOKE)	USACMLS
BB	Armored Security Vehicle (Security)	USAMPS
CC	Armored Ambulance (Ambulance)	USAAHS/USAIS
DD	Armored Bn Aid Station (ABAS)	USAAHS/USAARMS

APPENDIX E

Training Device Strategy

1. The AFV training will be developed using a device based training strategy. The training strategy will be developed by using four training categories:

a. Category A - Individual/Operator. (Example - Maintenance/Driver Trainer).

Training Objective: To attain and sustain individual, maintenance, and system orientation skills.

b. Category B - Crew. (Example - Gunnery Trainer/COFT).

Training Objective: To sustain combat ready crews/teams.

c. Category C - Functional. (Example - Tactical/Maneuver Trainers - SIMNET/TWGSS/PGS/MILES).

Training Objective: To train or sustain commanders, staffs, and crews/teams within each functional area to be utilized in their operational role.

d. Category D - Force Level (Combined Arms Command and Battle Staff). (Example - ARTBASS).

Training Objective: To train or sustain combat ready commanders and battle staffs.

2. Integrated Logistic Support (ILS) and MANPRINT, along with resource constraints and macro/micro training strategy, are the catalysts for factoring the need for and type of training devices that are required. The training devices developed may include stand-alone devices, appended devices and embedded devices. Embedded training capability is the preferred alternative, and to the extent possible, will be incorporated in the development and follow-on Product Improvement Programs of all variants of the AFV consistent with AFV system constraints. The requirement to train in the future will be severely impacted by peacetime constraints on individual and collective training caused by time, space, and resource shortfalls. In addition, the enhanced characteristics of the AFV may surpass the current resource capability to train the system's maximum potential; therefore, the use of devices and simulations exploiting emerging technology must offset AFV system O&S, OPTEMPO, and ammunition cost.

3. To identify and develop a hierarchy of training devices and simulations that will train and sustain the force, a common training device strategy media selection model that is both horizontally and vertically integrated and identifies training

device requirements and cost trade-offs within the entire AFV family of devices is required. The following model will be used to ensure that the above is accomplished:

I. Develop Macro/Micro Training Strategy.

A. MACRO:

	Inst.	Ind.	Crew	Plt	Co/Tm	BnTF
Now (1986-87)						
Near Term (1988-1992)						
Future (1993+)						

MICRO:

	Inst.	Ind.	Crew	Plt	Co/Tm	BnTF
Now (1986-87)						
Near Term (1988-1992)						
Future (1993+)						

B. Develop matrix depicting predecessor (M113-M2/3, M60-M1/M1A1), baseline (M2A1-M1A1 Blk I, II), and future (AFV) training requirements using the same format above.

II. List constraints of the AFV: Understand that the AFV as stated in the base document will, through the use of devices and simulators, reduce the cost of training. This reduction in training cost equates to a reduction in ammunition expended (100 rd to 80 rd?), OPTEMPO (750 MI to 500 MI?), and O&S cost. This reduction in future training cost, through the use of devices and simulators, is a direct result of the OMS/MP and BLTM.

O&O/ROC
OMS/MP
Essential Characteristics
Ammunition
O&S Cost
OPTEMPO

III. Develop BLTM for the AFV system with consideration of AR 350-1, Standards in Training Requirements (STRAC) and AR 220-1

	Predecessor	Baseline	Future
	Battalion events		
	CPX		
	MAPEX		
	TEWT		
	CFX		
	FTX		
	MCX		
	FCX		
	LOGX		
	Company events		
	TEWT		
Event/Req.	CFX		
	FTX		
	FCS		
	Platoon events		
	TEWT		
	FTX		
	Tactical tables		
	Basic		
	Intermediate		
	Advanced		
	CALFEX		

IV. MANPRINT:

A. Training Domain:

MOS/Skill Level
Events:
Individual
Crew
NET
CPX
CFX
etc.

B. Training Device Media Selection:

	Stand-alone	Appended	Embedded
Individual			
Crew			
Functional			
Forces			

3. Milestones: TBD.

(U) ARMORED FAMILY OF VEHICLES

TASK FORCE

PHASE I REPORT

PART II
(U) UMBRELLA INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP) FOR ARMORED FAMILY OF VEHICLES (AFV)

PART II

(U) UMBRELLA INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP)

FOR

ARMORED FAMILY OF VEHICLES (AFV)

(This Part Is Unclassified)

UNITED STATES ARMY COMBINED ARMS CENTER
FORT LEAVENWORTH, KS 66027-7000

UNITED STATES ARMY LOGISTICS CENTER
FORT LEE, VA 23801-6000

2 SEPTEMBER 1987

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ARMORED FAMILY OF VEHICLES (AFV) UMBRELLA

INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP)

1. REFERENCES. This ICTP has been prepared in accordance with the training management policies and requirements prescribed in the following references:

a. AR 71-5, Introduction of New or Modified Systems/Equipment.

b. AR 350-1, Army Training.

c. AR 350-35, Army Modernization.

d. AR 570-2, Organization and Equipment Authorization Tables - Personnel.

e. AR 700-18, Provisioning of U.S. Army Equipment

f. AR 700-127, Integrated Logistics Support.

g. AR 1000-1, Basic Policies for Systems Acquisition.

h. DA Form 11-25, Life Cycle System Management Model for Army Systems.

i. DA Form 570-558, Staffing guide for U.S. Army Service Schools.

j. TRADOC Regulation 70-1, Research and Development, New Equipment Training Requirements and Procedures.

k. TRADOC Regulation 350-7, A systems Approach to Training.

l. TRADOC Regulation 351-1, Training Requirements Analysis System (TRAS).

m. TRADOC Regulation 351-3, TRADOC Schools Curriculum Administration and Training Policy.

n. TRADOC Regulation 351-9, Individual and collective Training Plan for Developing Systems Policy and Procedures.

o. TRADOC Regulation 351-011, Soldier's Manuals, Trainer's Guide, and Job Book Policy and Procedures.

p. TRADOC Regulation 700-1, Integrated Logistics Report.

q. TRADOC Circular 350-3, Individual and Collective Training Plan for Developing Systems Policy and Procedures.

r. Charter, Armored Family of Vehicles.

s. Operational and Orginational (O&O) , Plan for AFV.

t. System MANPRINT Management Plan for AFV.

u. Integrated Logistics Support Management Plan for AFV.

2. GENERAL.

a. Purpose. This umbrella ICTP is the strategy document that provides the training concept approach to planning, managing, and integrating the training subsystem of the developing Armored Family of Vehicles (AFV). This baseline ICTP will be the capstone document with supporting proponent annexes for each AFV variant.

b. Scope. This ICTP addresses the Armywide training program to include institution, unit, extension, and Reserve component (RC) training. The plan outlines the specific requirements for new equipment, institutional, and nonresident training.

c. Revisions. This ICTP is a living document and will be reviewed and updated on an as required basis or as a minimum annually.

3. SYSTEMS ACQUISITION DATA.

a. Army Modernization Information Memorandum (AMIM) number - TBD.

b. New Equipment Training Plan (NETP) number - TBD.

c. Description of Equipment (See appendix A).

d. First Unit Equipped Date - FY 95.

4. ASSUMPTIONS.

a. The deployed AFV will be capable of defeating the turn of the century threat.

b. The AFV will deploy a number of variants which will maximize the benefits of commonality. This will result in:

(1) New tasks and skills that will be common across the force.

(2) Simplified individual and collective training requirements.

(3) Some institutional course consolidation and restructure.

(4) Some MOS restructure and in some cases MOS consolidation.

(5) A broad base for device and simulation commonality especially in regards to drivers, maintainers and crews.

c. Impact on the MOS structure will be minimized.

d. Funding will be made available for AFV training development actions and deployment.

e. The AFV fielding will reduce long term system and force O&S costs. Major savings will be realized in training ammunition, OPTEMPO and spare parts requirements.

f. The AFV will initially increase the training and support requirements of the training base. The long term impact of the AFV will reduce training support costs.

g. The AFV will use embedded training and/or have a device based training strategy.

h. All domains of MANPRINT will be addressed.

i. Integrated Logistics Support (ILS) will be thoroughly incorporated.

j. Divisional AFV will be fielded in brigade-slice sets. Nondivisional AFV will be fielded in brigade-sized sets. Projected fielding is four brigade-sized sets per year.

k. Instructors and key personnel will be identified and stabilized in the training base until the training base is established.

5. TRAINING CONCEPT.

a. The AFV training will be developed IAW the Systems Approach to Training (SAT) and executed within the Materiel Acquisition Development Process as regulated by the Army Life Cycle System Management Model (LCSMM). The concept will optimize the use of embedded training to the extent technology permits. Embedded training is defined as that training which results from features designed and built into specific end time equipment to provide training in the use of that end item equipment. Individual and collective training will be thoroughly designed and developed to assure a total training system is maintained for both operators and maintainers. All resource requirements necessary to field this system will be identified, validated, and made available throughout the equipment lifecycle. This concept visualizes a family of armored vehicles that equips the force with its training system in place. The family will be designed with embedded training systems to support unit sustainment training and/or device bases

subsystems to support institutional training. These will emcompass all training categories (individual/operator, crew, functional, and force level).

b. Beginning 1995, and in each quarter thereafter, the AFV will be fielded in brigade equivalent packages until fielding is complete. Institutional training will be in place to support the fielding. Training in the institution will be based upon the maximum use of training device technology. The concept will include force level combined arms and individual variant training programs for both individual and collective requirements. To accomplish the training mission, we will develop the following strategy refinements.

(1) Significantly increase the horizontal coordination and integration capability within the TRADOC and between TRADOC and MACOMs. This is required because of the compressed development and fielding of the AFV, the enormity of equipment infusion and diffusion crossing all proponent boundaries, and the requirement for continuous force level training.

(2) A New Equipment Training (NET) strategy based on one of the following fielding strategies;

(a) Centralized brigade level training facility.

(b) Two regional brigade training centers, one in Europe and one in CONUS.

(c) A traveling transition unit resembling a more extensive combined M-1, MLRS, M2/3 fielding effort.

(3) Reserve Component training for roundout battalions to be issued the AFV. Training will be developed IAW the Systems Approach to Training (SAT) and executed in such a manner as to facilitate initial and sustainment training in the field and training base of the life of the AFV. The training resources required to field and sustain the AFV will be identified and validated throughout equipment life cycle.

(4) Facilities and/or capabilities to transfer displaced equipment to the Reserve components and accomplish essential training.

(5) The consolidation of training facilities for operators and maintainers to reduce the overall training overhead.

(6) Update Doctrine and Tactics Training to reflect the new doctrine emerging from the Concept Based Requirements System (CBRS).

6. DETAILS: The AFV training concept will be implemented by the following:

a. Task and Objective Schedule. See Milestone Schedule at Appendix B.

b. New Equipment Training (NET) Requirements. The NET will be conducted IAW AR 350-35, and will, as a minimum, address NET responsibilities, displaced equipment training, doctrine and tactics training and sustainment training. The AFV systems will be issued in brigade (plus) sets. The NET will be conducted for an entire brigade sized element quarterly. Type of instruction facility, estimated spaces, time frame, TDY, and travel costs and New Equipment Training Team (NETT) requirements are TBD and will be based on the final fielding strategy.

c. Institutional Courses of Instruction (new and/or revised). The AFV institutional training will be based on results of Cost and Training Effectiveness Analysis (CTEA), Early User Test and Experimentation Test (EUT&ET) during Proof of Principle, and Initial Operational Test and Evaluation (IOT&E) during Development Production Prove-Out. Device-based training will be relied upon to reduce costs and limit training base requirements for operational equipment. Appropriate existing officer, NCO, and enlisted courses will be modified to incorporate necessary instruction on doctrinal, tactical and logistics issues. New courses will be implemented if required. Proponent institutional requirements are listed in Appendix J.

d. Identification of tasks and/or duty position to be included in unit training. Operator and maintainer tasks will initially be identified by the contractor in a front-end analysis. These tasks will be developed, validated by TRADOC, and included in Training Plan (TP) and Training Support Package (TSP). Proponent schools will specify additional training requirements for their variants IAW appropriate Military Standards. Unit training tasks and/or duty positions will be further refined through the use of nonresident training material. Collective training tasks will be developed IAW SAT and distributed by proponent schools through the use of ARTEP/AMTP. Inputs to doctrinal and tactical training tasks will be identified by the proponent and developed into revised FM capable of exporting new tactics to the field.

e. Requirements for Instructor and Support Personnel. Initial operator and maintenance personnel training, i.e., instructor and Key Personnel Training (IKPT), for the testing and deployment of AFV will be contractor conducted utilizing contractor developed training courses. IKPT trained personnel will instruct test players during testing. Military and civilian manpower requirements and cost projections are TBD.

f. Facilities Requirements (new or add-on). The AFV will impact facilities and ranges. Modifications to existing facilities and construction of new facilities to support the training strategy and equipment will be completed prior to fielding. Copies of this ICTP will be forwarded and coordinated

with TRADOC DCSENG. See individual variant annexes for specific requirements. Facilities requirements must be documented and submitted for programming NLT 2QFY88.

g. Training Equipment Requirements and Proposed Distribution Plan. Training equipment includes all devices, simulations and simulators (DSS) not embedded in the vehicle. TRADOC must receive the AFV and DSS in sufficient quantities to establish the institutional base prior to FUE. The AFV quantities and organization locations will be IAW the AFV Force Basis of Issue Plan (BOIP). Unique variant training requirement will be addressed as appendices to the force plan. The training base must be internally coordinated to provide replacements to the force to support the brigade fielding strategy.

h. New funding Requirements. TBD.

i. Ammunition. TBD.

j. Training Aids and Instructional Media Requirements. All training material required to support resident and extension training will be on hand prior to initiation of IKPT.

k. Training Literature Requirements. The results of Front-End-Analysis (FEA) will identify the need for initiation of Army Literature programs, i.e., FMs, TC, etc. Contractors will identify and provide operator and maintainer task description standards and conditions. These will be validated by TRADOC.

l. Training Device Requirements. The AFV will make maximum utilization of embedded training and/or device based training strategies in both institutional and unit training.

m. Other Support Requirements. Additional support requirements are addressed in Appendix J.

n. Doctrinal, Maintenance Training and other Publication/Media. Training and technical literature will be prepared, distributed, evaluated, and updated as an integral part of the AFV development and fielding program.

APPENDICES:

A Description of Equipment

B Task Objective and Milestone Schedule

C Training Devices Requirements (TDRs)

D Resourcing

E New Equipment Training Plan (NETP) (TBD)

F New Equipment Training Plan (NETP) (TBD)

G Range Requirements (TBD)

H Materiel Fielding Plan (TBD)

I Proponent School ICTP Annexes (TBD)

J Coordination (TBD)

APPENDIX A

DESCRIPTION OF EQUIPMENT

1. The AFV will eventually replace the entire fleet of currently fielded and projected armored vehicles throughout active Army, Reserve Components (RC), and the Army National Guard (ARNG). The AFV fielding will be accomplished in unit sets issued approximately one set per quarter completing a Division issue per year.

2. The AFV is a system of vehicles that when manned with trained soldiers and supported by other equipment creates a total close combat-heavy force package. The AFV will be characterized by incorporation of modularity, component commonality (with a desired goal of total commonality, power pack, fire control, suspension items, etc.), common battlefield signature, common vehicle to various systems now managed or under conceptual evaluation by proponent centers. Even with the fielding of the AFV family, a high/low (new/old) mix of equipment and technology is expected through the year 2000. In order to optimize commonality through the fleet, the AFV will be developed with consideration given to the following technological areas:

a. Advanced survivability technologies to reduce the size/weight of individual systems through the use of innovative materials and electronic devices.

b. Modular vetronics, propulsion, fire control, position navigation, maintenance, and Battlefield Management Systems (BMS) components such as controls and displays.

c. Tuneable armor and suspension systems, capable of being tailored to other mission requirements.

d. Advanced NBC survivability systems.

e. State-of-the-art diagnostic and prognostic testing devices which incorporate an automated call capability for supply/resupply to the appropriate maintenance and supply organization and will also support common training programs.

f. Robotics and artificial intelligence.

g. Human factor engineering and soldier-machine interface advances.

h. Embedded training will be considered as a primary sustainment training option for operators, crews, and maintenance personnel. Embedded training is defined as that training which results from features designed and built into a specific end item of equipment which provides training in its use. This concept can be especially useful to RC units.

APPENDIX B

TASK, OBJECTIVE, AND MILESTONE SCHEDULE

TASK/OBJECTIVE		QTR/FY
1.	SMMP	2/87
2.	O&O PLAN	3/87
3.	TRAINING CONSTRAINTS	3/87
4.	TRAINING CONCEPTS	1/87-2/87
5.	TRAINING ISSUES AND CRITERIA	1/87-4/87
6.	ICTP	1/87-4/87
7.	DRAFT ROC (TD INPUT)	2/87-3/87
8.	ROC APPROVED	3/88
9.	CTEA	3/87-3/88
10.	ILSP INPUT	2/87-1/89
11.	NETP	1/88-3/88
12.	TTSP	1/88-1/91
13.	ICTP UPDATE	1/88-1/89
14.	REVIEW BOIP/QQPRI	3/88-4/88
15.	ASST AMC WITH RFP/SOW	3/88-4/88
16.	CONTRACTOR TRAINING PROGRAM	1/89-1/90
17.	TRAINING DEVICE PROTOTYPES	1/89-1/90
18.	UPDATE TTSP (TO INCLUDE FM, TM AND DOCTRINAL TNG)	1/90-3/91
19.	CAD/ITP	1/91-1/92
20.	IKPT	1/91-2/91
21.	TEST PLAYER TRAINING	3/91-1/92
22.	ICTP & NETP UPDATE	3/91-1/92
23.	POI	1/93-3/94
24.	RESIDENT TRAINING PROGRAM	1/93-3/94

25.	TRAINING DEVICES	1/93-3/94
26.	UNIT TRAINING SUPPORT PACKAGES	1/93-1/95
27.	RESIDENT TRAINING	3/94-CONTINUOUS
28.	IKPT	1/92-2/92
29.	FUE	1/95
30.	NEW EQUIPMENT TRAINING	1/95-CONTINUOUS
31.	POST FIELDING EVALUATION	1/95-TBD

APPENDIX C

CAPSTONE TRAINING DEVICE REQUIREMENT

1. Title.

a. Device/Simulator/Simulation (DSS) requirements for the Armored Family of Vehicles (AFV).

b. Cards No. TBD.

2. Need. The development of training subsystems to support the fielding/implementation of AFV requires an integrated and standardized strategy. These training subsystems must have cross proponent applications with mission specific flexibility. Candidates for embedded training (ET), built into, appended, and stand-alone DSS requirements must be identified early and developed concurrent with, or prior to, AFV hardware fielding.

3. IOC. See Required Operational Capability (ROC) for date (clas).

4. Operational and Organizational Plan (O&O Plan).

a. Unit. The AFV DSS will be operated throughout the world under all climatic conditions by combat, combat support, and combat service support units. DSS will be the basis of the AFV Training strategy from the mid-1990's onward.

b. Institution. DSS will be used by schools and centers to train all AFV personnel. Weather conditions are generally not a factor since these DSS will be used in a classroom environment. DSS will be operated and maintained by Tables of Distribution and allowances (TDA) personnel and/or by contractor support.

5. Essential Characteristics: The AFV DSS strategy will provide the capability to train and sustain individual/ collective critical tasks in both the institution and the field. this strategy will be executed through a combination of embedded capabilities in individual AFV systems and/or appended or stand-alone DSS that replicate system capabilities. The following are AFV DSS requirements:

a. Will network/interface with other embedded systems enabling collective and combined arms training.

b. Will provide unit training capability for individual and collective critical tasks.

c. Institutional stand-alone DSS will be cost effective and accommodate not less than 80% of Advanced Individual Training (AIT) of initial entry (AFV) training.

d. Maintenance related DSS will provide training at all skill levels. Maintenance and diagnostic training beyond operator/crew responsibilities may be appended or stand-alone in both the unit and institution.

e. Common driver, gunnery, maintenance and diagnostic, communications, displays and controls, and combat skills and tactics (to include force on force) DSS will be adaptable to multiple proponent users.

f. Will provide compressed/centralized/standardized training, particularly in the institutions/centers.

g. Will provide a common approach to DSS application to ranges, targets and other training facilities.

h. Will eliminate the need for non-system or gap filler training equipment.

i. Will shift, for reporting purposes, training readiness dependency from the actual operation of equipment to DSS subsystems.

j. Tactical Engagement Simulation Training and Force on force should be integral to the wartime/combat capability. for example, detectors that sense simulated attack in peacetime force on force engagement could sense that the vehicle is being painted by enemy transmitters in combat. The change from operational to training mode should be done by simple switchology and/or software exchange.

k. The embedded training capability will be transparent to the crew and not interfere with operational/combat capabilities.

l. Gold plating the replication of every operational and maintenance capabilities will be avoided. Only those characteristics required to train and sustain critical tasks to standard will be provided.

m. Malfunction of embedded training capability will not detract from operational capability.

n. Embedded training must operate from both 110 and 240 volt AC, 50-60 Hz; as well as be compatible with vehicle on board power system(s), and must not require special environmental controls.

o. System design must incorporate the provision for future P3I if current technology is not sufficiently mature to embed training capabilities.

p. Utilize Built In Test/Built In Test Equipment (BIT/BITE) to the maximum possible extent.

q. Will support those requirements unique to the Reserve Component training situation (e.g. mobile DSS, etc.). This may include unique DSS and/or capability embedded into DSS for unique Reserve component applications.

r. Will support Combat Vehicle Identification training.

6. Technical Assessment. Minimize training equipment costs by developing families of advanced technology DSS which use a common technology capable of being adapted to provide training for a number of different tasks. Several simulation technologies provide this capability. They include but are not restricted to electromechanical/microprocessor type simulators, video disc/microprocessor simulators, computer generated imagery simulators, computerized tactical games, and interactive display/microprocessor simulators. The common element with such families of DSS is normally but not restricted to a data processing/computer subsystem. The variable elements are those hardware portions of the system (e.g., panel boards, video discs, controls/switches) peculiar to the task for which training is provided and the associated software. Risk and best technical approach will be determined during concept formulation by the materiel developer.

7. System Support Assessment.

a. Logistic support, to include maintenance and repair, for embedded DSS will be consistent with support requirements for the AFV, and will be provided by the same personnel, organizations, and systems which support the AFV.

b. Stand-alone and appended DSS will be contractor logistically supported.

c. DSS system support packages will be available for testing during Early User Test & Experimentation (EUT&E) and Initial Operational Test & Evaluation (IOT&E) and validated prior to IOC.

d. Configurement Management of DSS, both hardware/software, will be the responsibility of the Materiel Developer for the life of the system, to include concurrent changes to DSS hardware/software as changes to AFV variants occur.

8. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. Tactical organization force structures are not affected by DSS. No growth in MOS or Civil service specialties will be required by institutional DSS.

b. Personnel assessment. Required aptitudes and skills for DSS will be supported from within or under the projected AFV manpower footprint limitations.

c. Training assessment. The Materiel and Training Developers will conduct training assessments. Based on these investigations, training/training products in support of DSS will be developed.

d. Human Factors Engineering (HFE). Human Factors Engineering Analysis (HFEA) must be done and the results applied to each DSS design.

e. System Safety. DSS will be designed to preclude safety hazard to personnel.

f. Health Hazard Assessment (HHA). DSS will be designed to preclude health and environmental hazards.

9. Standardization and Interoperability.

a. The US Marine corps has expressed an interest in the AFV program to the extent of maintaining an information link with the US Army. Several Allied nations have expressed sufficient interest in this program to request an information link with the US Army. To date, briefings on the AFV program have been provided to liaison officers and visitors from Japan, Germany, United Kingdom, France and Israel. The AFV program should be a topic of discussion in the appropriate Panel of the NATO Army Armaments Group and the Quadripartite Working Group on Armor. Consideration should be given to placing the AFV on the Information List of the Quadripartite (ABCA) Standardization list.

b. The AFV must be capable of operating within the framework of NATO doctrine as described in ATP 35. All consumables used by the AFV fleet should be compatible with the NATO Allies. Communications and automation equipment should be compatible with the NATO standard.

10. Life-Cycle Cost Assessment. TBD by Materiel Developer.

11. Milestone Schedule. DSS milestones are contingent upon and concurrent by associated AFV variant milestones.

ANNEXES:

A Rationale (TBD)

B TDS (TBD)

C RAM Rationale (TBD)

D Operational Mode Summary/Mission Profile (TBD)

E Institutional Driver Trainer TDR

F Institutional Maintenance Trainer TDR

G Future Armored Combat System TDR

H Light Future Armored Combat System TDR

I Future Reconnaissance Vehicle TDR

J Future Armored Resupply Vehicle TDR

K Command and Control Vehicle TDR

L Future Infantry Fighting Vehicle TDR

M Directed Energy Weapons Vehicle TDR

N Kinetic Energy Missile Vehicle TDR

O Mortar Weapons System Vehicle TDR

P General Purpose Carrier TDR

Q Advanced Field Artillery System - Cannon TDR

R Fire support Combat Observation Lasing System TDR

S Elevated Target Acquisition System TDR

T Rocket and Missile System TDR

U Line of Sight Forward Heavy (LOS-AT) TDR

V Non-Line of Sight Vehicle TDR

W Sapper Vehicle TDR

X Combat Mobility Vehicle TDR

Y Mine Dispensing Vehicle TDR

Z Combat Excavator TDR

AA Combat Earth Mover TDR

BB Combat Gap Crosser TDR

CC Maintenance Assistance and Repair System TDR

DD Recovery Vehicle TDR

EE Intelligence and Electronic Warfare Vehicle TDR

FF Nuclear, Biological, and Chemical Warfare System

GG Combat Smoke Vehicle TDR

HH Armored Security Vehicle TDR

II Armored Ambulance TDR

JJ Armored Battalion Aid Station TDR

UNCLASSIFIED

ANNEX A

RATIONALE

(TBD)

UNCLASSIFIED

UNCLASSIFIED

ANNEX B

TRAINING DEVICE STATEMENT

(TBD)

UNCLASSIFIED

ANNEX C

RAM RATIONALE

(TBD)

ANNEX D

OPERATIONAL MODE SUMMARY/

MISSION PROFILE

(TBD)

ANNEX E

TRAINING DEVICE REQUIREMENT (TDR)

INSTITUTIONAL DRIVER TRAINER

TRAINING DEVICE REQUIREMENT (TDR)

1. Title:

a. ARMORED FAMILY OF VEHICLES (AFV) - DRIVER TRAINER (AFV-DT)

b. CARDS reference number: TBD

2. Need: There is a need to provide for initial familiarization, basic and advanced driver training for AFV drivers and for transition training of drivers not qualified or current on the AFV. The AFV-DT will permit the student to become familiar with the arrangement and operation of the AFV driving controls. Realistic visual and audio simulations will permit training in proper starting and stopping procedures, monitoring gauges and instruments, and familiarization with procedures employed while driving under varied terrain, weather and combat conditions. The AFV-DT will increase the effectiveness of AFV driver training by permitting observation of driver performance and reactions to artificially induced malfunctions and emergency conditions without requiring the use of actual vehicles for driver training.

3. IOC: See variant ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The AFV-DT will be used at institutions to provide initial and advanced driving training.

b. Some AFV-DTs may be required at major Army Training Areas and by other major AFV users, to include the Reserve Components.

5. Essential Characteristics:

a. The interior of the AFV-DT driver station will accurately represent the driver's compartment of the AFV variants. Instruments and controls will be identical to those of the variant in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The AFV-DT will provide visual, action and audio cues to the student giving the perception of driving the AFV variant. Visual stimuli will be provided by computer generated imagery (CGI) encompassing a variety of terrain features and driving conditions. A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (track, engine, weapons system, etc.) corresponding to the driving surface condition, speed of the engine, and operational conditions of the variant in use. Audio, motion and visual

feedback will be provided in response to student control movement required to start, stop, steer (including backing up), accelerate, decelerate and shift gears, as well as to simulate the onset of ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The AFV-DT must include the ability to monitor the student driver's actions while "driving" in order to detect improper operation practices and procedures. The controlling/monitoring system will have the capability to introduce engine, transmission, and track/suspension malfunctions into the system in order to teach the student driver the recognition of, and appropriate responses to such malfunctions. The driver trainer will permit the controller to freeze the action and controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as brake, steering and track failure.

d. The AFV-DT will allow both closed and open hatch operation.

e. The AFV-DT must include an intercommunication system which will allow two-way communications between the student and instructor/operator (I/O).

f. The AFV-DT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The AFV-DT must be capable of readily accepting modifications that conform to product improvements of the basic system.

h. The AFV-DT should allow student observers to view a student driver's movement over the terrain via a visual monitor and hear the instructor/student interchange.

i. The AFV-DT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 147A, Noise Limits for Army materiel, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represent the best estimate of the operational and technical requirement for this system based on currently available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/ technical capabilities or breech of thresholds, changes may be initiated to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) - TBD - Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hour scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator with in 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e., computer and controller/monitor stations) between the AFV-DT and other AFV training devices is a design goal to reduce costs but is not required.

6. Technical Assessment: The technology required to develop the AFV-DT exists and will be used extensively in the M1/M60 series driver trainers under development by the Army and commercial interests. The motion platform and computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O stations and drivers compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the AFV-DT is considered to be low to moderate.

7. System Support Assessment:

a. Operator and maintenance manuals will be delivered with each AFV-DT. In addition, interim repair parts will be purchased to be delivered with each AFV-DT.

b. The AFV-DT should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the AFV-DT for damage and will perform GO/NOGO Checks.

c. Type classification is not required. total contractor logistics support (CLS) is required.

d. No dedicated I/O personnel will be required. School or training center trainers may have I/O's permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial AFV-DT delivery.

8. MANPRINT Assessment:

a. Manpower/Force Structure Assessment: AFV-DT will not increase manpower of force structure requirements.

b. Personnel Assessment: The AFV-DT will be used to train AFV crewmembers as drivers. Instructor/operator personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The AFV variant proponent will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and approved by the AFV variant proponent prior to government acceptance.

(4) Training effectiveness and positive training transfer will be established in the IOT&E.

d. Human Factors Engineering (HFE): Information will come from the M1/M60A3 TDT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: AFV-DT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: AFV-DT will not increase the health hazard to crewmembers.

g. The System MANPRINT Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. Standardization and Interoperability:

a. As shown in para 6 above, the AFV-DT could use existing technology.

b. The US Marine Corps could use AFV-DT for training Marine variants.

10. Life Cycle Costs: TBD

11. Milestone schedule: AFV-DT milestones are contingent upon and concurrent with associated AFV variant milestones.

Appendix 1 - Rationale (TBD)

2 - TDS (TBD)

3 - RAM RATIONALE (TBD)

4 - Operational Mode Summary/Mission Profile (TBD)

Annex A - Life Cycle Cost Assessment (TBD)

B - TDNS (TBD)

C - Coordination (TBD)

ANNEX F

TRAINING DEVICE REQUIREMENT (TDR)

INSTITUTIONAL MAINTENANCE TRAINER

1. The Army Family of Vehicles Institutional Maintenance Trainers (AFV/AFV)

a. Stand-alone generic troubleshooting trainers to support AFV maintenance training.

b. CARDS reference number to be determined.

2. Need. The most challenging aspect of Army maintenance training for mechanics/repairers at all levels of maintenance has traditionally been fault diagnosis. complex new systems with built-in test equipment have not reduced this challenge, and it will continue for the AFV. It is assumed that each variant of the AFV will have an embedded maintenance training capability which will permit troubleshooting of faults indicated on the actual equipment. To provide comparable troubleshooting training capability in TRADOC schools and at decentralized training sites and to reduce the requirement for actual equipment in these institutions, stand-alone maintenance trainers are required which provide functional simulations of AFV systems and subsystems. The trainers identified in this document are based on the M1 Abrams tank model with the addition of the hydraulics trainers. (A separate suite of trainers may be needed for heavy, medium, and light vehicles). We anticipate a need for the following:

a. Turret Troubleshooting Trainer (Unit level)

Simulates Turret Systems test equipment. Trains maintenance personnel in system troubleshooting procedures required to isolate, test, and replace major turret components at unit level in accordance with technical manuals.

b. Turrent Troubleshooting Trainer (Intermediate)

Simulates turrent components and test equipment. Trains maintenance personnel to troubleshoot major turret components, and simulates repair, adjustment, and alignment procedures in accordance with technical manuals.

c. Engine Troubleshooting Trainer

Simulates engine and test equipment. Trains maintenance personnel in troubleshooting procedures required to isolate faults and repair or replace major components in accordance with technical manuals.

d. Transmission Troubleshooting Trainer

Simulates transmission and test equipment. Trains maintenance personnel in troubleshooting procedures required to isolate faults, repair or replace defective parts, and retest in accordance with technical manuals.

e. Hull Electrical System Troubleshooting Trainer

Simulates hull electrical system and test equipment. Trains maintenance personnel in troubleshooting procedures required to isolate faults, repair or replace defective parts, and retest in accordance with technical manuals.

f. Fire Control System Troubleshooting Trainer

Simulates fire control system components and test equipment. Trains maintenance personnel in troubleshooting procedures required to isolate faults in components of the fire control system, repair or replace defective parts and retest in accordance with technical manuals.

g. Hydraulic Systems Troubleshooting Trainer

Simulates vehicle hydraulic systems and test equipment. Trains maintenance personnel in operation, troubleshooting and maintenance of hydraulics systems in accordance with technical manuals.

3. Ready for training date. FY 95 1Q.

4. Operational/Organizational Plan

a. How the trainer will be used. The trainers will be used in institutional training environments as stand-alone equipment to supplement hands-on training on actual equipment. They will be used to develop basic knowledge and skills in maintenance and to provide practice in troubleshooting.

b. Geographical areas of use. within CONUS and 7th Army, Europe.

c. Weather and climatological factors. Trainers will be used indoors in classroom environments.

d. The type of units that will use and support the trainer, TRADOC schools, installation level schools, and Regional Maintenance Training Sites.

5. Essential Characteristics.

a. Compatibility with existing systems. Because the AFV/AFV will support an entirely new family of vehicles, compatibility with existing trainers is not essential. The trainers will be interoperable, that is, all trainers will have a common console. Trainers will be capable of networking to provide feedback to an instructor station. Instructor stations will be capable of monitoring student progress and inserting faults in 5 to 10 trainers.

b. Personnel Assessment. N/A.

c. Training Assessment. New Equipment training for instructors will be provided by the contractor when the trainers are delivered. Operators manuals will be provided by the contractor and approved by the USAOC&CS prior to government acceptance of the trainers.

d. Human Factors Engineering (HFE). The HFE analysis must consider the ease of use of the trainers and optimum training time.

e. System Safety: The trainers will incur no safety risk to users. Safety on actual equipment will be a major teaching point on all trainers.

APPENDIX

1. Rationale

2. TDS

3. RAM Rationale

4. OMS/MP

Annex A Life-Cycle Cost Assessment

Annex B TDNS

Annex C Coordination

Encl 1 BOIP/QQPRI

ANNEX G

TRAINING DEVICE REQUIREMENTS

FOR

FUTURE ARMORED COMBAT SYSTEM:

ENCLOSURES:

1. Gunnery Embedded Training System (TDR)
2. Institutional Gunnery Trainer (TDR)
3. Operator Maintenance Embedded (TDR) Training System (TDR)
4. Embedded Tactical Training (TDR)

TRAINING DEVICE REQUIREMENT (TDR)

FUTURE ARMORED COMBAT SYSTEM (FACS)
GUNNERY EMBEDDED TRAINING SYSTEM (GETS)

(FACS-GETS)

1. TITLE:

a. FUTURE ARMORED COMBAT SYSTEM GUNNERY EMBEDDED TRAINING SYSTEM (FACS-GETS)

b...CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System precision gunnery training must be given in the context of tactical training to give crews experience firing and using proper techniques and procedures against free moving, intelligently controlled targets. This experience must come through both simulated engagements in controlled situations and actual engagements against target presentations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crew proficiency. The FACS-GETS must support all current and proposed gunnery requirements for FACS, and the Armor Center goal of improving tank gunnery proficiency in institutional and unit training.

3. IOC: See ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FACS-GETS will be used to provide realistic computer generated imagery simulations of terrain and targets for individual and crew gunnery tasks.

b. FACS-GETS will provide a target engagement system that will include the ability to train in force-on-force operations.

c. FACS-GETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during gunnery and tactical training.

d. FACS-GETS will be the media used to incorporate individual and crew gunnery skills into the FACS tactical training system.

e. The three FACS-GETS subsystems will operate either independently or together.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics.

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) FACS-GETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank fire control system to perform or respond as normal.

(3) FACS-GETS must duplicate the functioning characteristics of the fire control system between the crew positions/stations.

(4) When used with FACS fire control system, both day, night and under conditions of limited visibility (smoke, fog, etc.), the GETS must function the same as the FACS weapon system.

(5) FACS-GETS much have a self-test ability to isolate any faults within the system.

(6) The FACS-GETS must interface with the FACS Weapons Effects Simulator System (FACS-WESS).

(7) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FACS.

(8) FACS-GETS must provide for firing from a stationary or moving tank at both stationary and moving targets using precision and degraded mode gunnery techniques at the gunner and tank commander stations.

b. Computer Generated Imagery (CGI) Characteristics.

(1) FACS-GETS CGI must provide a realistic view to both the gunner and tank commander of the same view from their individual perspectives.

(2) FACS-GETS must provide the capability to switch to different geographical location and threat presentations without any internal system modifications.

(3) The FACS-GETS must determine the miss distance or the relationship of where the projectile passed through a vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only

to the extent they would occur during firing actual ammunition.

(5) The FACS-GETS must provide a realistic hit/kill/miss signal.

(6) FACS-GETS shall include a crew evaluation subsystem to provide a hard copy record of target presentations, engagements, hits, kills, near misses, true target range, crew determined range, ammunition indexed ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

(7) FACS-GETS must simulate the probability of hit and probability of kill on all target presentations.

(8) FACS-GETS must simulate the round dispersion, probability of hit and probability of kill of all current and future main gun service ammunitions.

c. Target Engagement System (TES) Characteristics.

(1) The FACS-GETS must be operational out to the maximum effective range of the weapons system being emulated.

(2) The FACS-GETS must be accurate to within one meter at the maximum effective range.

(3) The FACS-GETS must provide a realistic target hit/kill/miss cue.

(4) The FACS-GETS must be eye safe.

(5) A controller gun is required to assess kills, adjust ammunition load mix, and check the operation of equipment.

d. Audio/Visual Recording System Characteristics.

(1) The FACS-GETS must record and playback appropriate gunners and tank commanders primary sight picture during all operations.

(2) The FACS-GETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The FACS-GETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The FACS-GETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FACS-GETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the FACS.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness check, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FACS.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded gunnery training in FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FACS crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on FACS.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for FACS-GETS concepts will be used on all variants of FACS.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	See ROC
CTEA	TBD

APPENDIX	1 - RATIONALE
	2 - CTEA
	3 - RAM RATIONAL
	4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE
ANNEX	A - LIFE CYCLE COST ASSESSMENT
	B - TDNS
	C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)

FUTURE ARMORED COMBAT SYSTEM (FACS)
INSTITUTIONAL GUNNERY TRAINER (IGT)
(FACS-IGT)

1. Title:

a. FUTURE ARMORED COMBAT SYSTEM - INSTITUTIONAL GUNNERY TRAINER (FACS - IGT)

b. CARDS reference number: TBD

2. Need: There is a need to provide for initial familiarization, basic and advanced gunnery training for FACS gunners and tank commanders and provide for transition training of crewmen not qualified or current on the FACS. The FACS-IGT will permit the student to become familiar with the arrangement and operation of the FACSfiring and sighting controls and procedures. Realistic visual and audio simulations will permit training in proper target acquisition and firing, while operating under varied terrain, weather and combat conditions. The FACS-IGT will increase the effectiveness of FACS gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: See ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The FACS-IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The FACS-IGT will be fielded in sufficient quantities to support institutional training of all FACS with machinegun and main gun. Some simulators may be required at other service schools and 7th ATC.

c. The FACS-IGT will be used under environmentally controlled conditions.

5. Essential Characteristics:

a. The interior of the FACS-IGT will accurately represent the gunner's/TC's compartment of the FACS. Instruments and controls will be identical to those of the FACS in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The FACS-IGT will provide visual, motion and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke

grenades and the main armament of the FACS. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility (see Annex 7). A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, motion and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The FACS-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate responses to such malfunctions. The FACS-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of range finder, turret power or ammunition malfunction.

d. The FACS-IGT can allow closed or open hatch operation..

e. The FACS-IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

f. The FACS-IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The FACS-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The FACS-IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The FACS-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A, Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and technical requirement for this system based on current

available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/technical capabilities or breech of thresholds,, the combat and materiel developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hour scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e. computer and I/O stations) between the FACS-IGT and other FACS stand alone training devices is a design goal to reduce costs but is not required.

l. The FACS-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

6. Technical Assessment: The technology required to develop the FACS-IGT exists and will be used extensively in the M1/M60 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the FACS-IGT is considered to be low to moderate.

7. System Support Assessment:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO Checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. No dedicated I/O personnel will be required. School or training center trainers may have I/O's permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial trainer delivery.

8. Manprint Assessment:

a. Manpower/Force Structure Assessment: FACS-IGT will not increase manpower or force structure requirements.

b. Personnel Assessment: The FACS-IGT will be used to train FACS crewmembers as gunners and tank commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAARMS will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAARMS prior to government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): information will come from the M1/M60A3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: FACS-IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment FACS-IGT will not increase the health hazard to crewmembers.

g. The FACS System MANPRINT Management Plan (SMMP) provides detailed information on FACS-IGT MANPRINT issues and concerns.

9. Standardization and Interoperability: As shown in para 6 above, the FACS-IGT could use preexisting technology.

10. Life Cycle Costs: TBD

11. Milestone schedule:

Event	Date
Draft TDR approval	TBD
MDR I (IPR)	TBD
TT/IOTE	TBD
MDR III (IPR)	TBD
IOC	See ROC
CTEA	TBD

Appendix 1 - Rationale
2 - CTEA
3 - RAM RATIONAL
4 - Operational Mode Summary/Mission Profile

Annex A - Life Cycle Cost Assessment
B - TDNS
C - Coordination

TRAINING DEVICE REQUIREMENT

FUTURE ARMORED COMBAT SYSTEM (FACS)
OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (OPMETS)

(FACS-OPMETS)

1. TITLE:

a. FUTURE ARMORED COMBAT SYSTEM OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (FACS-OPMETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System operator maintenance training must be given in the context of tactical training to give crews experience in using proper techniques and procedures in performing operator maintenance in all situations/conditions. This experience must come through both simulated situations in controlled environments and actual training during vehicle operations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crew proficiency The FACS-OPMETS must support all current and proposed maintenance requirements for FACS, and the Armor Center goal of improving tank maintenance quality in institutional and unit training.

3. IOC: See ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FACS-OPMETS will be used to provide realistic computer generated imagery simulations for individual and crew maintenance tasks.

b. FACS-OPMETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during maintenance and logistical training.

c. FACS-OPMETS will be the media used to incorporate individual and crew maintenance skills into the FACS training system.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics..

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) FACS-OPMETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank to perform or respond as normal.

(3) FACS-OPMETS must duplicate the operational characteristics of the turret and hull systems.

(4) FACS-OPMETS must have a self-test ability to isolate and identify faults within the vehicle systems.

(5) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FACS.

b. Computer Generated Imagery (CGI) Characteristics.

(1) FACS-OPMETS CGI must provide a realistic diagnostic and troubleshooting malfunction.

(2) FACS-OPMETS must provide the capability to switch to different internal systems.

(3) FACS-OPMETS shall include a individual/crew evaluation subsystem to provide a hard copy record of maintenance actions performed.

c. Audio/Visual Recording System Characteristics.

(1) The FACS-OPMETS must record and playback crew actions during all operations.

(2) The FACS-OPMETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The FACS-OPMETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The FACS-OPMETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FACS-OPMETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the FACS.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FACS.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded maintenance training in FACS will not increase manpower of force structure requirements.

b. personnel assessment: Embedded training will be used to train FACS crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on FACS.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for FACS-OPMETS concepts will be used on all variants of FACS.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	See ROC
CTEA	TBD

APPENDIX	1 - RATIONALE
	2 - CTEA
	3 - RAM RATIONAL
	4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE
ANNEX	A - LIFE CYCLE COST ASSESSMENT
	B - TDNS
	C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)
FOR EMBEDDED TACTICAL TRAINING (ETT)
IN THE
FUTURE ARMORED COMBAT SYSTEM (FACS)
(FACS-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE FUTURE ARMORED COMBAT SYSTEM (FACS-ETT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual, crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on board computer-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises.

3. IOC: See ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into FACS to enhance and maintain the skill proficiency necessary to employ the FACS.

c. Embedded tactical training capability will be used under all environmental and climatic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than FACS on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the FACS and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. Essential Characteristics:

a. The FACS interior will not be significantly altered solely to incorporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru FACS optics and aural stimuli thru FACS communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of FACS controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational FACS. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the FACS.

e. RAM: Must meet the stated RAM criteria of the FACS.

f. Maintaining will be done by FACS maintenance personnel.

6. TECHNICAL ASSESSMENT: Although computer generated technology has matured to meet trainer requirements, it has not been demonstrated as an embedded tactical training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedded tactical training in FACS variants is considered moderate to high risk.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FACS crewmembers. The tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded tactical training and actual tactical training.

(5) FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on each FACS variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers..

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for embedded training concepts will be used on other variants of the AFV family.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	See ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

ANNEX H

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

LIGHT FUTURE ARMORED COMBAT SYSTEM

ENCLOSURES:

1. Gunnery Embedded Training System (TDR)
2. Institutional Gunnery Trainer (TDR)
3. Weapons Effects Simulator System (TDR)
4. Operator Maintenance Embedded Training System (TDR)
5. Embedded Tactical Training (TDR)

TRAINING DEVICE REQUIREMENT (TDR)

LIGHT FUTURE ARMORED COMBAT SYSTEM (LT FACS)
GUNNERY EMBEDDED TRAINING SYSTEM (GETS)

(LT FACS-GETS)

1. TITLE:

a. LIGHT FUTURE ARMORED COMBAT SYSTEM GUNNERY EMBEDDED TRAINING SYSTEM (LT FACS-GETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System precision gunnery training must be given in the context of tactical training to give crews experience firing and using proper techniques and procedures against free moving, intelligently controlled targets. This experience must come through both simulated engagements in controlled situations and actual engagements against target presentations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crews. The LT FACS-GETS must support all current and proposed gunnery drills for LT FACS, and the Armor Center goal of improving tank gunnery proficiency in institutional and unit training.

3. IOC: See ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. LT FACS-GETS will be used to provide realistic computer generated imagery simulations of terrain and targets for individual and crew gunnery tasks.

b. LT FACS-GETS will provide a target engagement system that will include the ability to train in force-on-force operations.

c. LT FACS-GETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during gunnery and tactical training.

d. LT FACS-GETS will be the media used to incorporate individual and crew gunnery skills into the LT FACS tactical training system.

e. The three LT FACS-GETS subsystems will operate either independently or together.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics.

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) LT FACS-GETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank fire control system to perform or respond as normal.

(3) LT FACS-GETS must duplicate the functioning of the main gun fire control system between the crew members.

(4) When used with LT FACS fire control system, both day and under conditions of limited visibility, the GETS must function the same as the LT FACS weapon system.

(5) LT FACS-GETS must have a self-test ability to isolate faults within the system.

(6) The LT FACS-GETS must interface with the LT FACS Weapons Effects Simulator System (LT FACS-WESS).

(7) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for LT FACS.

b. Computer Generated Imagery (CGI) Characteristics.

(1) LT FACS-GETS CGI must provide a realistic view to both the gunner and tank commander of the same view from their individual perspectives.

(2) LT FACS-GETS must provide the capability to switch to different geographical location and threat presentations without any internal system modifications.

(3) The LT FACS-GETS must determine the miss distance or the relationship of where the projectile passed through a vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only to the extent that they would occur during firing actual ammunition.

(5) The LT FACS-GETS must provide a realistic hit/kill/miss signal.

(6) LT FACS-GETS shall include a crew evaluation subsystem to provide a hard copy record of target presentations, engagement, hits, kills, near misses, true target range, crew

determined range, ammunition indexed, ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

(7) LT FACS-GETS must simulate the probability of hit and probability of kill on all target presentations.

(8) LT FACS-GETS must simulate the probability of hit and probability of kill of all current and future main gun service ammunitions.

c. Target Engagement System (TES) Characteristics.

(1) The LT FACS-GETS must be operational out to the maximum effective range of the weapons system being emulated.

(2) The LT FACS-GETS must be accurate to within one meter at the maximum effective range.

(3) The LT FACS-GETS must provide a realistic hit/kill/miss signal.

(4) The LT FACS-GETS must be eye safe.

(5) A controller gun is required to assess kills, adjust ammunition load mix, and check the operation of equipment.

d. Audio/Visual Recording System Characteristics.

(1) The LT FACS-GETS must record and playback appropriate gunners and tank commanders primary sight picture during all operations.

(2) The LT FACS-GETS recording must include simulataneous audio recording of the crew intercom and radio transmissions.

(3) The LT FACS-GETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The LT FACS-GETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedded LT FACS-GETS is considered moderate to high risk.

b. The goal of the combat, training and material developers is to develop and field the training system concurrently with the LT FACS.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustments/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/ components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for LT FACS.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded gunnery training in LT FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train LT FACS crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications

will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) LT FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on LT FACS.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for LT FACS-GETS concepts will be used on all variants of AFV.

b. The US Marine Corps could use the training concepts on the Marine LT FACS.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)

LIGHT FUTURE ARMORED COMBAT SYSTEM (LT FACS)
INSTITUTIONAL GUNNERY TRAINER (IGT)
(LT FACS-IGT)

1. TITLE:

a. LIGHT FUTURE ARMORED COMBAT SYSTEM - INSTITUTIONAL GUNNERY TRAINER (LT FACS-IGT).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: There is a need to provide for initial familiarization, basic and advanced gunnery training for LT FACS gunners and tank commanders and provide for transition training of crewmen not qualified or current on the LT FACS. The LT FACS-IGT will permit the student to become familiar with the arrangement and operation of the LT FACS firing and sighting controls and procedures. Realistic visual and audio simulations will permit training in varied terrain, weather and combat conditions. The LT FACS-IGT will increase the effectiveness of LT FACS gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The LT FACS-IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The LT FACS-IGT will be fielded in sufficient quantities to support institutional training of all LT FACS with machinegun and main gun. Some simulators may be required at other service schools and 7th ATC.

c. The LT FACS-IGT will be used under environmentally controlled conditions.

5. ESSENTIAL CHARACTERISTICS:

a. The interior of the LT FACS-IGT will accurately represent the gunner's/TC's compartment of the LT FACS. Instruments and controls will be identical to those of the LT FACS in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The LT FACS-IGT will provide visual, motion and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke

grenades and the main armament of the LT FACS. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility (see Annex ?). A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, motion and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The LT FACS-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate responses to such malfunctions. The LT FACS-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of range finder, turret power or ammunition malfunction.

d. The LT FACS-IGT can allow closed or open hatch operation.

e. The LT FACS-IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

f. The LT FACS-IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The LT FACS-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The LT FACS-IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The LT FACS-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A. Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and technical requirement for this system based on current available knowledge. However, when information is gained from subsequent

studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/ technical capabilities or breech of thresholds, the combat and material developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hours scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e., computer and I/O stations) between the LT FACS-IGT and other LT FACS stand alone training devices is a design goal to reduce costs but is not required.

l. The LT FACS-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

6. TECHNICAL ASSESSMENT: The technology required to develop the LT FACS-IGT exists and will be used extensively in the M1/M60 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the LT FACS-IGT is considered to be low to moderate.

7. SYSTEM SUPPORT ASSESSMENT:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO Checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. No dedicated I/O personnel will be required. School or training center trainers may have I/O's permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial trainer deliver.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: LT FACS-IGT will not increase manpower or force structure requirements.

b. Personnel Assessment: The LT FACS-IGT will be used to train LT FACS crewmembers as gunners and tank commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAARMS will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAARMS prior to government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): information will come from the M1/M60A3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: LT FACS-IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: LT FACS-IGT will not increase the health hazard to crewmembers.

g. The LT FACS System MANPRINT Management Plan (SMMP) provides detailed information on LT FACS-IGT MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. As shown in para 6 above, the LT FACS-IGT could use preexisting technology.

b. The US Marine Corps should use LT FACS-IGT for training Marine variant of LT FACS.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I (IPR)	TBD
TT/IOTE	TBD
MDR III (IPR)	SEE ROC
CTEA	TBD

APPENDIX
1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX
A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)

LIGHT FUTURE ARMORED COMBAT SYSTEM (LT FACS)
WEAPONS EFFECTS SIMULATOR SYSTEM (WESS)

(LT FACS-WESS)

1. TITLE:

a. FUTURE ARMORED COMBAT SYSTEM WEAPONS EFFECTS SIMULATOR SYSTEM (LT FACS-WESS).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: The Future Armored Combat System requires a main gun simulator. LT FACS-WESS will provide an audio signature that accurately represents that of the main gun. The LT FACS-WESS will be used in conjunction with the FACS-GETS (Gunnery Embedded Training System) and FACS-SRS (Sight Recording System) to provide realistic training scenarios. The LT FACS-WESS will be in consonance with the Standards in Training Commission and the Armor Center goal of improving tank gunnery proficiency in institutional and unit training.

3. IOC: SEE ROC.

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. LT FACS-WESS will be used in the institution and by units equipped with FACS to provide vehicle oriented instruction to train and/or sustain gunnery and tactical skills and provide realism to training.

b. LT FACS-WESS will be used during the conduct of gunnery tables, tactical tables, force-on-force gunnery training and during conduct of field training exercises where gunnery training is integrated with tactical training.

5. ESSENTIAL CHARACTERISTICS:

a. The system must meet climatic design, basic as outlined in AR 70-38.

b. LT FACS-WESS will promote realism by providing the firing FACS with a means of simulating main gun firing.

c. LT FACS-WESS electronics and mounting hardware will be embedded into FACS.

d. LT FACS-WESS will have electrical interlock with the FACS-GETS system and will only activate concurrently with the FACS-GETS firing controls.

e. LT FACS-WESS must have a self-test ability to isolate faults within the system.

f. LT FACS-WESS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank fire control system to perform or respond as normal.

g. The firing device will have a capability to simulate the same number of rounds as the FACS basic load.

h. The firing device will fire the cartridge developed for MTG-WESS.

i. The firing device will be mounted onto the embedded mouting hardware by no more than two crewmembers, using no lifting devices and using only tools provided as FACS BII within 10 minutes.

j. Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FACS.

6. TECHNICAL ASSESSMENT:

a. Although hardware to meet these requirements is available, and computer and video technology has matured to meet trainer requirements, it has not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding LT FACS-WESS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to field the training system concurrently with the FACS.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FACS.

g. System reloading will be accomplished by FACS crewmembers.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded training in FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: When embedded training will be used to train FACS crewmembers, the tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on FACS.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for LT FACS-WESS concepts will be used on all variants of AFV requiring a weapons effects system.

b. The US Marine Corps could use the training concepts on the Marine FACS.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS

TRAINING DEVICE REQUIREMENT (TDR)

LIGHT FUTURE ARMORED COMBAT SYSTEM (LT FACS)
OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (OPMETS)

(LT FACS-OPMETS)

1. TITLE:

a. FUTURE ARMORED COMBAT SYSTEM OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (LT FACS-OPMETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System operator maintenance training must be given in the context of tactical trianing to give crews experience in using proper techniques and procedures in performing operator maintenance in all situations/conditions. This experience must come through both simulated situations in controlled environments and actual training during vehicle operations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crew proficiency. The LT FACS-OPMETS must support all current and proposed maintenance requirements for LT FACS, and the Armor Center goal of improving tank maintenance quality in institutional and unit training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. LT FACS-OPMETS will be used to provide realistic computer generated imagery simulations for individual and crew maintenance tasks.

b. LT FACS-OPMETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during maintenance and logistical training.

c. LT FACS-OPMETS will be the media used to incorporate individual and crew maintenance skills into the LT FACS training system.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics:

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) LT FACS-OPMETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank to perform or respond as normal.

(3) LT FACS-OPMETS must duplicate the operational characteristics of the turret and hull systems.

(4) LT FACS-OPMETS must have a self-test ability to isolate and identify faults within the vehicle systems.

(5) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for LT FACS.

b. Computer Generated Imagery (CGI) Characteristics.

(1) LT FACS-OPMETS CGI must provide a realistic diagnostic and troubleshooting malfunction.

(2) LT FACS-OPMETS must provide the capability to switch to different internal systems.

(3) LT FACS-OPMETS shall include an individual/crew evaluation subsystem to provide a hard copy record of maintenance actions performed.

c. Audio/Visual Recording System Characteristics.

(1) The LT FACS-OPMETS must record and playback crew actions during all operations.

(2) The LT FACS-OPMETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The LT FACS-OPMETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The LT FACS-OPMETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding LT FACS-OPMETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the LT FACS.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/ components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for LT FACS.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded maintenance training in LT FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train LT FACS crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) LT FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on LT FACS.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for LT FACS-OPMETS concepts will be used on all variants of LT FACS.

b. The US Marine Corps could use the training concepts on the Marine LT FACS.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
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ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT)
IN THE
LIGHT FUTURE ARMORED COMBAT SYSTEM (LT FACS)

(LT FACS-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE LIGHT FUTURE ARMORED COMBAT SYSTEM (LT FACS-ETT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into LT FACS to enhance and maintain the skill proficiency necessary to employ the LT FACS.

c. Embedded tactical training capability will be used under all environmental and climactic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than LT FACS on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the LT FACS and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The LT FACS interior will not be significantly altered solely to incoporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru LT FACS optics and aural stimuli thru LT FACS communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of LT FACS controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational LT FACS. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the LT FACS.

e. RAM: Must meet the stated RAM criteria of the LT FACS.

f. Maintaining will be done by LT FACS maintenance personnel.

6. TECHNICAL ASSESSMENT: Although computer generated technology has matured to meet trainer requirements, it has not been demonstrated as an embedded tactical training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedded tactical training in LT FACS variants is considered moderate to high risk.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in LT FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train LT FACS crewmembers. The tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded tactical training and actual tactical training.

(5) LT FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on each LT FACS variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for embedded training concepts will be used on other variants of the AFV family.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
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ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
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UNCLASSIFIED

ANNEX I

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

FUTURE RECONNAISANCE VEHICLE

ENCLOSURES:

1. Gunnery Embedded Training System (TDR)
2. Institutional Gunnery Trainer (TDR)
3. Weapons Effects Simulator System (TDR)
4. Operator Maintenance Embedded Training System (TDR)
5. Embedded Tactical Trainer (TDR)

UNCLASSIFIED

TRAINING DEVICE REQUIREMENT (TDR)

FUTURE RECONNAISSANCE VEHICLE (FRV)
GUNNERY EMBEDDED TRAINING SYSTEM (GETS)

(FRV-GETS)

1. TITLE:

a. FUTURE RECONNAISANCE VEHICLE GUNNERY EMBEDDED TRAINING SYSTEM (FRV-GETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: FUTURE RECONNAISSANCE System precision gunnery training must be given in the context of tactical training to give crews experience firing and using proper techniques and procedures against free moving, intelligently controlled targets. This experience must come through both simulated engagements in controlled situations and actual engagements against target presentations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crews. The FRV-GETS must support all current proposed gunnery drills for FRV, and the Armor Center goal of improving tank gunnery proficiency in institutional and unit training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FRV-GETS will be used to provide realistic computer generated imagery simulations of terrain and targets for individual and crew gunnery tasks.

b. FRV-GETS will provide a target engagement system that will include the ability to train in force-on-force operations.

c. FRV-GETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during gunnery and tactical training.

d. FRV-GETS will be the media used to incorporate individual and crew gunnery skills into the FRV tactical training system.

e. The three FRV-GETS subsystems will operate either independently or together.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics.

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) FRV-GETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank fire control system to perform or respond as normal.

(3) FRV-GETS must duplicate the functioning of the main gun fire control system between the crew members.

(4) When used with FRV fire control system, both day and under conditions of limited visibility, the GETS must function the same as the FRV weapon system.

(5) FRV-GETS must have a self-test ability to isolate faults within the system.

(6) The FRV-GETS must interface with the FRV Weapons Effects Simulator System (FRV-WESS).

(7) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FRV.

b. Computer Generated Imagery (CGI) Characteristics.

(1) FRV-GETS CGI must provide a realistic view to both the gunner and tank commander of the same view from their individual perspectives.

(2) FRV-GETS must provide the capability to switch to different geographical location and threat presentations without any internal system modifications.

(3) The FRV-GETS must determine the miss distance or the relationship of where the projectile passed through a vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only to the extent that they would occur during firing actual ammunition.

(5) The FRV-GETS must provide a realistic hit/kill/ miss signal.

(6) FRV-GETS shall include a crew evaluation subsystem to provide a hard copy record of target presentations, engagements, hits, kills, near misses, true target range, crew determined range, ammunition indexed, ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

(7) FRV-GETS must simulate the probability of hit and probability of kill on all target presentations.

(8) FRV-GETS must simulate the probability of hit and probability of kill of all current and future main gun service ammunitions.

c. Target Engagement System (TES) Characteristics.

(1) The FRV-GETS must be operational out to the maximum effective range of the weapons system being emulated.

(2) The FRV-GETS must be accurate to within one meter at the maximum effective range.

(3) The FRV-GETS must provide a realistic hig/kill/ miss signal.

(4) The FRV-GETS must be eye safe.

(5) A controller gun is required to assess kills, adjust ammunition load mix, and check the operation of equipment.

d. Audio/Visual Recording System Characteristics.

(1) The FRV-GETS must record and playback appropriate gunners and tank commanders primary sight picture during all operations.

(2) The FRV-GETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The FRV-GETS visual recording will include a superimposed digital clock proving real time to one-tenth of a second.

(4) The FRV-GETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FRV-GETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the FRV.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replace or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FRV.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded gunnery training in FRV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FRV crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manual and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FRV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on FRV.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for FRV-GETS concepts will be used on all variants of AFV.

b. The US Marine Corps could use the training concepts on the Marine FRV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

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TRAINING DEVICE REQUIREMENT (TDR)

FUTURE RECONNAISSANCE VEHICLE (FRV)
INSTITUTIONAL GUNNERY TRAINER (IGT)

(FRV-IGT)

1. TITLE:

a. FUTURE RECONNAISANCE VEHICLE - INSTITUTIONAL GUNNERY TRAINER (FRV-IGT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: There is a need to provide for initial familiarization, basic and advanced gunnery training for FRV gunners and tank commanders and provide for transition training of crewmen not qualified or current on the FRV. The FRV-IGT will permit the student to become familiar with the arrangement and operation of the FRV firing and sighting controls and procedures. Realistic visual and audio simulations will permit training in proper target acquisition and firing, while operating under varied terrain, weather and combat conditions. The FRV-IGT will increase the effectiveness of FRV gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The FRV-IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The FRV-IGT will be fielded in sufficient quantities to support institutional training of all FRV with machinegun and main gun. Some simulators may be required at other service schools and 7th ATC.

c. The FRV-IGT will be used under environmentally controlled conditions.

5. ESSENTIAL CHARACTERISTICS:

a. The interior of the FRV-IGT will accurately represent the gunner's/TC's compartment of the FRV. Instruments and controls will be identical to those of the FRV in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The FRV-IGT will provide visual, motion and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke grenades and the main armament of the FRV. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility (see Annex ?). A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, motion and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The FRV-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate responses to such malfunctions. The FRV-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of range finder, turret power or ammunition malfunction.

d. The FRV-IGT can allow closed or open hatch operation.

e. The FRV-IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

f. The FRV-IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The FRV-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The FRV-IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The FRV-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A. Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and

technical requirement for this system based on current available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/ technical capabilities or breech of thresholds, the combat and material developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hours scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e., computer and I/O stations) between the FRV-IGT and other FRV stand alone training devices is a design goal to reduce costs but is not required.

l. The FRV-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

6. TECHNICAL ASSESSMENT: The technology required to develop the FRV-IGT exists and will be used extensively in the M1/M60 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the FRV-IGT is considered to be low to moderate.

7. SYSTEM SUPPORT ASSESSMENT:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO Checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. No dedicated I/O personnel will be required. School or training center trainers may have I/O's permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial trainer deliver.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: FRV-IGT will not increase manpower or force structure requirements.

b. Personnel Assessment: The FRV-IGT will be used to train FRV crewmembers as gunners and tank commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAARMS will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAARMS prior to government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): information will come from the M1/M60A3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: FRV-IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: FRV-IGT will not increase the health hazard to crewmembers.

g. The FRV System MANPRINT Management Plan (SMMP) provides detailed information on FRV-IGT MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. As shown in para 6 above, the FRV-IGT could use preexisting technology.

b. The US Marine Corps should use FRV-IGT for training Marine variant of FRV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I (IPR)	TBD
TT/IOTE	TBD
MDR III (IPR)	SEE ROC
CTEA	TBD

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ANNEX A - LIFE CYCLE COST ASSESSMENT
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TRAINING DEVICE REQUIREMENT (TDR)

FUTURE RECONNAISSANCE VEHICLE (FRV)
WEAPONS EFFECTS SIMULATOR SYSTEM (WESS)

(FRV-WESS)

1. TITLE:

a. FUTURE RECONNAISANCE VEHICLE WEAPONS EFFECTS SIMULATOR SYSTEM (FRV-WESS).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: The Future Armored Combat System requires a main gun simulator. FRV-WESS will provide an audio signature that accurately represents that of the main gun. The FRV-WESS will be used in conjunction with the FACS-GETS (Gunnery Embedded Training System) and FACS-SRS (Sight Recording System) to provide realistic training scenarios. The FRV-WESS will be in consonance with the Standards in Training Commission and the Armor Center goal of improving tank gunnery proficiency in institutional and unit training.

3. IOC: SEE ROC.

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FRV-WESS will be used in the institution and by units equipped with FACS to provide vehicle oriented instruction to train and/or sustain gunnery and tactical skills and provide realism to training.

b. FRV-WESS will be used during the conduct of gunnery tables, tactical tables, force-on-force gunnery training and during conduct of field training exercises where gunnery training is integrated with tactical training.

5. ESSENTIAL CHARACTERISTICS:

a. The system must meet climatic design, basic as outlined in AR 70-38.

b. FRV-WESS will promote realism by providing the firing FACS with a means of simulating main gun firing.

c. FRV-WESS electronics and mounting hardware will be embedded into FACS.

d. FRV-WESS will have electrical interlock with the FACS-GETS system and will only activate concurrently with the FACS-GETS firing controls. XI-A-II-107

e. FRV-WESS must have a self-test ability to isolate faults within the system.

f. FRV-WESS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank fire control system to perform or respond as normal.

g. The firing device will have a capability to simulate the same number of rounds as the FACS basic load.

h. The firing device will fire the cartridge developed for MTG-WESS.

i. The firing device will be mounted onto the embedded mouting hardware by no more than two crewmembers, using no lifting devices and using only tools provided as FACS BII within 10 minutes.

j. Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FACS.

6. TECHNICAL ASSESSMENT:

a. Although hardware to meet these requirements is available, and computer and video technology has matured to meet trainer requirements, it has not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FRV-WESS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to field the training system concurrently with the FACS.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/ components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FACS.

g. System reloading will be accomplished by FACS crewmembers.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded training in FACS will not increase manpower of force structure requirements.

b. Personnel Assessment: When embedded training will be used to train FACS crewmembers, the tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FACS maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on FACS.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for FRV-WESS concepts will be used on all variants of AFV requiring a weapons effects system.

b. The US Marine Corps could use the training concepts on the Marine FACS.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

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TRAINING DEVICE REQUIREMENT (TDR)

FUTURE RECONNAISSANCE VEHICLE (FRV)
OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (OPMETS)

(FRV-OPMETS)

1. TITLE:

a. FUTURE RECONNAISANCE VEHICLE OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (FRV-OPMETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System operator maintenance training must be given in the context of tactical trianing to give crews experience in using proper techniques and procedures in performing operator maintenance in all situations/conditions. This experience must come through both simulated situations in controlled environments and actual training during vehicle operations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crew proficiency. The FRV-OPMETS must support all current and proposed maintenance requirements for FRV, and the Armor Center goal of improving tank maintenance quality in institutional and unit training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FRV-OPMETS will be used to provide realistic computer generated imagery simulations for individual and crew maintenance tasks.

b. FRV-OPMETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during maintenance and logistical training.

c. FRV-OPMETS will be the media used to incorporate individual and crew maintenance skills into the FRV training system.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics:

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) FRV-OPMETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank to perform or respond as normal.

(3) FRV-OPMETS must duplicate the operational characteristics of the turret and hull systems.

(4) FRV-OPMETS must have a self-test ability to isolate and identify faults within the vehicle systems.

(5) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FRV.

b. Computer Generated Imagery (CGI) Characteristics.

(1) FRV-OPMETS CGI must provide a realistic diagnostic and troubleshooting malfunction.

(2) FRV-OPMETS must provide the capability to switch to different internal systems.

(3) FRV-OPMETS shall include an individual/crew evaluation subsystem to provide a hard copy record of maintenance actions performed.

c. Audio/Visual Recording System Characteristics.

(1) The FRV-OPMETS must record and playback crew actions during all operations.

(2) The FRV-OPMETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The FRV-OPMETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The FRV-OPMETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FRV-OPMETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the FRV.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/ components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FRV.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded maintenance training in FRV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FRV crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FRV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on FRV.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for FRV-OPMETS concepts will be used on all variants of FRV.

b. The US Marine Corps could use the training concepts on the Marine FRV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

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TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT)
IN THE
FUTURE RECONNAISSANCE VEHICLE (FRV)

(FRV-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE FUTURE RECONNAISANCE VEHICLE (FRV-ETT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into FRV to enhance and maintain the skill proficiency necessary to employ the FRV.

c. Embedded tactical training capability will be used under all environmental and climactic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than FRV on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the FRV and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The FRV interior will not be significantly altered solely to incoporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru FRV optics and aural stimuli thru FRV communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of FRV controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational FRV. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the FRV.

e. RAM: Must meet the stated RAM criteria of the FRV.

f. Maintaining will be done by FRV maintenance personnel.

6. TECHNICAL ASSESSMENT: Although computer generated technology has matured to meet trainer requirements, it has not been demonstrated as an embedded tactical training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedded tactical training in FRV variants is considered moderate to high risk.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in FRV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FRV crewmembers. The tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded tactical training and actual tactical training.

(5) FRV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on each FRV variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for embedded training concepts will be used on other variants of the AFV family.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

ANNEX J

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

FUTURE ARMORED RESUPPLY VEHICLE

ENCLOSURES:

1. EMBEDDED TACTICAL TRAINING (TDR)
2. OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (TDR)

TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE FUTURE ARMORED RESUPPLY VEHICLE (FARV)

(FARV-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE FUTURE ARMORED RESUPPLY VEHICLE (FARV-ETT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into FARV to enhance and maintain the skill proficiency necessary to employ the FARV.

c. Embedded tactical training capability will be used under all environmental and climactic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than FARV on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the FARV and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The FARV interior will not be significantly altered solely to incoporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru FARV optics and aural stimuli thru FARV communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of FARV controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational FARV. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the FARV.

e. RAM: Must meet the stated RAM criteria of the FARV.

f. Maintaining will be done by FARV maintenance personnel.

6. TECHNICAL ASSESSMENT: Although computer generated technology has matured to meet trainer requirements, it has not been demonstrated as an embedded tactical training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedded tactical training in FARV variants is considered moderate to high risk.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in FARV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FARV crewmembers. The tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded tactical training and actual tactical training.

(5) FARV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on each FARV variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for embedded training concepts will be used on other variants of the AFV family.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)

FUTURE ARMORED RESUPPLY VEHICLE (FARV)
OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (OPMETS)

(FARV-OPMETS)

1. TITLE:

a. FUTURE ARMORED RESUPPLY VEHICLE OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (FARV-OPMETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System operator maintenance training must be given in the context of tactical trianing to give crews experience in using proper techniques and procedures in performing operator maintenance in all situations/conditions. This experience must come through both simulated situations in controlled environments and actual training during vehicle operations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crew proficiency. The FARV-OPMETS must support all current and proposed maintenance requirements for FARV, and the Armor Center goal of improving tank maintenance quality in institutional and unit training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FARV-OPMETS will be used to provide realistic computer generated imagery simulations for individual and crew maintenance tasks.

b. FARV-OPMETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during maintenance and logistical training.

c. FARV-OPMETS will be the media used to incorporate individual and crew maintenance skills into the FARV training system.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics:

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) FARV-OPMETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank to perform or respond as normal.

(3) FARV-OPMETS must duplicate the operational characteristics of the turret and hull systems.

(4) FARV-OPMETS must have a self-test ability to isolate and identify faults within the vehicle systems.

(5) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FARV.

b. Computer Generated Imagery (CGI) Characteristics.

(1) FARV-OPMETS CGI must provide a realistic diagnostic and troubleshooting malfunction.

(2) FARV-OPMETS must provide the capability to switch to different internal systems.

(3) FARV-OPMETS shall include an individual/crew evaluation subsystem to provide a hard copy record of maintenance actions performed.

c. Audio/Visual Recording System Characteristics.

(1) The FARV-OPMETS must record and playback crew actions during all operations.

(2) The FARV-OPMETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The FARV-OPMETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The FARV-OPMETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FARV-OPMETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the FARV.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/ components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FARV.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded maintenance training in FARV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FARV crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FARV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on FARV.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for FARV-OPMETS concepts will be used on all variants of FARV.

b. The US Marine Corps could use the training concepts on the Marine FARV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

UNCLASSIFIED

ANNEX K

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

FUTURE COMMAND AND CONTROL VEHIICLE

ENCLOSURES:

1. EMBEDDED TACTICAL TRAINING (TDR)
2. OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (TDR)

UNCLASSIFIED

TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE FUTURE COMMAND AND CONTROL VEHICLE (FCCV)

(FCCV-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE FUTURE COMMAND AND CONTROL VEHICLE (FCCV-ETT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into FCCV to enhance and maintain the skill proficiency necessary to employ the FCCV.

c. Embedded tactical training capability will be used under all environmental and climactic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than FCCV on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the FCCV and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The FCCV interior will not be significantly altered solely to incoporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru FCCV optics and aural stimuli thru FCCV communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of FCCV controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational FCCV. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the FCCV.

e. RAM: Must meet the stated RAM criteria of the FCCV.

f. Maintaining will be done by FCCV maintenance personnel.

6. TECHNICAL ASSESSMENT: Although computer generated technology has matured to meet trainer requirements, it has not been demonstrated as an embedded tactical training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedded tactical training in FCCV variants is considered moderate to high risk.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in FCCV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FCCV crewmembers. The tank commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a positive transfer of training between the embedded tactical training and actual tactical training.

(5) FCCV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): information will come from a separate HFE analysis conducted on each FCCV variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY: The technology employed for embedded training concepts will be used on other variants of the AFV family.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

TRAINING DEVICE REQUIREMENT (TDR)

FUTURE COMMAND AND CONTROL VEHICLE (FCCV)
OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (OPMETS)

(FCCV-OPMETS)

1. TITLE:

a. FUTURE COMMAND AND CONTROL VEHICLE OPERATOR MAINTENANCE EMBEDDED TRAINING SYSTEM (FCCV-OPMETS)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Armored Combat System operator maintenance training must be given in the context of tactical trianing to give crews experience in using proper techniques and procedures in performing operator maintenance in all situations/conditions. This experience must come through both simulated situations in controlled environments and actual training during vehicle operations. In addition there is a requirement to analyze errors and provide accurate evaluation of tank crew proficiency. The FCCV-OPMETS must support all current and proposed maintenance requirements for FCCV, and the Armor Center goal of improving tank maintenance quality in institutional and unit training.

3. IOC: SEE ROC

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. FCCV-OPMETS will be used to provide realistic computer generated imagery simulations for individual and crew maintenance tasks.

b. FCCV-OPMETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during maintenance and logistical training.

c. FCCV-OPMETS will be the media used to incorporate individual and crew maintenance skills into the FCCV training system.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics:

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) FCCV-OPMETS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank to perform or respond as normal.

(3) FCCV-OPMETS must duplicate the operational characteristics of the turret and hull systems.

(4) FCCV-OPMETS must have a self-test ability to isolate and identify faults within the vehicle systems.

(5) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for FCCV.

b. Computer Generated Imagery (CGI) Characteristics.

(1) FCCV-OPMETS CGI must provide a realistic diagnostic and troubleshooting malfunction.

(2) FCCV-OPMETS must provide the capability to switch to different internal systems.

(3) FCCV-OPMETS shall include an individual/crew evaluation subsystem to provide a hard copy record of maintenance actions performed.

c. Audio/Visual Recording System Characteristics.

(1) The FCCV-OPMETS must record and playback crew actions during all operations.

(2) The FCCV-OPMETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The FCCV-OPMETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The FCCV-OPMETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding FCCV-OPMETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the FCCV.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for FCCV.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded maintenance training in FCCV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train FCCV crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded training and actual vehicle performance.

(5) FCCV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on FCCV.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for FCCV-OPMETS concepts will be used on all variants of FCCV.

b. The US Marine Corps could use the training concepts on the Marine FCCV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

ANNEX L

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

INFANTRY FIGHTING VEHICLE

ENCLOSURES:

1. Embedded Tactical Training (TDR)
2. Institutional Gunnery Trainer (TDR)
3. Gunnery Embedded Training System (TDR)
4. Tactical Engagement System (TDR)

UNCLASSIFIED

TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE INFANTRY FIGHTING VEHICLE (IFV)

(IFV-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE INFANTRY FIGHTING VEHICLE (IFV-ETT).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises for After Action Reviews (AAR).

3. IOC: 3RD QTR FY87 (PROTOTYPE NLT 4TH QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into IFV to enhance and maintain the skill proficiency necessary to employ the IFV.

UNCLASSIFIED

c. Embedded tactical training capability will be used under all environmental and climactic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than IFV on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the IFV and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The IFV interior will not be significantly altered solely to incoporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru IFV optics and aural stimuli thru IFV communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of IFV controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational IFV. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the IFV.

e. RAM: Must meet the stated RAM criteria of the IFV.

f. The system must be capable of operating as part of a local area net (LAN).

g. Must provide an automated OPFOR capability.

h. Maintaining will be done by IFV maintenance personnel.

i. Must be capable of transitioning from training to operational mode within 30 seconds.

j. Training systems must operate off either internal or external power.

6. TECHNICAL ASSESSMENT: Although computer based technology has matured to meet trainer requirements, it has not been demonstrated as an Embedded Tactical Training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with Embedded Tactical Training in KEM-V variants is considered moderate to high.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Modification of existing trackparks/construction of new trackparks with power/networking hook-ups will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in IFV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded Tactical Training will be used to train IFV crewmembers. The vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAIS prior to Government acceptance.

(4) Training effectiveness and transfer will be established in the IOTE. There will be a transfer of training between the embedded tactical training and actual tactical training.

(5) IFV maintainers will have to be trained in the proper procedure for maintaining the embedded training components.

d. Human Factors Engineering (HFE): HFE information will come from a separate HFE analysis conducted on each Armored Family of Vehicles (AFV) variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for embedded training concepts will be used on other variants of the AFV family.

b. The US Marine Corps could use the training concepts on the Marine variant of the IFV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	3rd QTR FY 93
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

RATIONALE FOR ESSENTIAL TRAINING CHARACTERISTICS

TRAINING DEVICE REQUIREMENT (TDR) FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE INFANTRY FIGHTING VEHICLE (IFV-ETT)

1. PURPOSE: The purpose of the appendix is to set forth the rationale for selecting Essential Training Characteristics for Embedded Tactical Training in the Infantry Fighting Vehicle.

2. GENERAL: Embedded Tactical Training will be designed to provide a training capability built into the IFV such that individual and crew training may be conducted in either a stand-alone or networked configuration using the actual vehicle to operate in a simulated environment. That environment will be simulated through the use of on-board technologies and perceived by the crewmembers such that they will perform those tasks which they would normally perform in an actual situation. The following provides that rationale for selection of the Essential Training Characteristics.

a. The IFV interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

RATIONALE: Embedded Tactical Training will be a means of achieving technical and tactical proficiency, not and end unto itself. As such, it should be transparent to the user to the greatest extent possible. Specifically, the environment of the crew compartment in the IFV should be designed to accommodate the normal operation of the vehicle under its stated operational profile and not solely for the purpose of facilitating training.

b. Embedded Tactical Training capabilities will provide visual stimuli thru GPC optics and aural stimuli thru IFV communications systems. Stimuli presented will be responsive to operator or maintainer manipulation of the IFV controls, buttons, switches, dials, etc.

RATIONALE: Visual and aural stimulation will be the means by which the crewmembers of the IFV will be cued to perform required tasks. The extent to which that stimulation replicates an actual environment will directly impact on the quality of the training conducted. Correct actions by crewmembers should be rewarded by appropriate feedback, and likewise, incorrect actions should result in a realistic continuation or worsening of the situation.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an

operational IFV. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

RATIONALE: Crewmember response will be driven by cues which are the result of the simulation of an actual operating environment. Integration of the visual and aural cues into the existing sighting and communications equipment will provide the crewmember with the most realistic and effective cues.

d. Audio and visual feedback will be provided in response to individual maneuvers of the DEW-Y.

RATIONALE: Crewmember reaction to stimuli must result in realistic effects on the simulated environment. These effects must closely relicate the actual effects in degree and intensity of resulting feedback. For example, if the driver properly responds to a warning gauge, the gauge should react by displaying the correct reading in approximately the same time frame as would be expected under normal conditions.

e. RAM: Must meet the stated RAM criteria for the IFV.

RATIONALE: Because Embedded Tactical Training will be an integral part of the vehicle, RAM must be identical to that of the vehicle.

f. Maintaining will be done by IFV maintenance personnel.

RATIONALE: As an integral part of the IFV, the Embedded Tactical Trainer must be maintained in a variety of environments. The fact that embedded training can be conducted in a combat theater of operations will be one of its strongest attributes. As such, the embedded training hardware must be maintainable in that environment, without special personnel requirements.

TRAINING DEVICE REQUIREMENT (TDR)

INFANTRY FIGHTING VEHICLE (IFV)

INSTITUTIONAL GUNNERY TRAINER (IGT)

1. TITLE:

a. INFANTRY FIGHTING VEHICLE - INSTITUTIONAL GUNNERY TRAINER (IFV-IGT)

2. NEED: There is a need to provide for initial familiarization, basic and advanced gunnery training for IFV gunners and tank commanders and provide for transition training of crewmen not qualified or current on the IFV. The IFV-IGT will permit the student to become familiar with the arrangement and operation of the IFV firing and sighting controls and procedures. Realistic visual and audio simulations will permit training in proper target acquisition and firing, while operating under varied terrain, weather and combat conditions. The IFV-IGT will increase the effectiveness of IFV gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: 3RD QTR FY93 (PROTOTYPE NLT 4TH QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The IFV-IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The IFV-IGT will be fielded in sufficient quantities to support institutional training of all IFV with machinegun and main gun. Some simulators may be required at other service schools and 7th ATC.

c. The IFV-IGT will be used under environmentally controlled conditions.

5. ESSENTIAL CHARACTERISTICS:

a. The interior of the IFV IGT will accurately represent the gunner's/TC's compartment of the IFV. Instruments and controls will be identical to those of the IFV in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The IFV-IGT will provide visual motion and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke grenades and the main armament of the IFV. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility (see Annex ?). A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, motion and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The IFV-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate responses to such malfunctions. The IFV-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of range finder, turret power or ammunition malfunction.

d. The IFV-IGT can allow closed or open hatch operation.

e. The IFV-IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

f. The IFV-IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The IFV-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The IFV-IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The IFV-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A. Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and

technical requirement for this system based on current available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/ technical capabilities or breech of thresholds, the combat and material developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hours scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e., computer and I/O stations) between the IFV-IGT and other IFV stand alone training devices is a design goal to reduce costs but is not required.

l. The IFV-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

6. TECHNICAL ASSESSMENT: The technology required to develop the IFV-IGT exists and will be used extensively in the M1/M60 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the IFV-IGT is considered to be low to moderate.

7. SYSTEM SUPPORT ASSESSMENT:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO Checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. Dedicated I/O personnel will be required. School or training center trainers must have I/O's permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial trainer delivery.

f. MCA project will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: IFV-IGT will not increase manpower or force structure requirements.

b. Personnel Assessment: The IFV-IGT will be used to train IFV crewmembers as gunners and tank commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAIS will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAARMS prior to government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): information will come from the M1/M60A3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: IFV-IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: IFV-IGT will not increase the health hazard to crewmembers.

g. The IFV System MANPRINT Management Plan (SMMP) provides detailed information on IFV-IGT MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. As shown in para 6 above, the IFV-IGT could use preexisting technology.

b. The US Marine Corps should use IFV-IGT for training Marine variant of IFV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I (IPR)	TBD
TT/IOTE	TBD
MDR III (IPR)	SEE ROC
CTEA	TBD

SD03SS16

RATIONALE

TRAINING DEVICE REQUIREMENT (TDR)
FOR THE
INFANTRY FIGHTING VEHICLE (IFV)
INSTITUTIONAL GUNNERY TRAINER (IGT)

APPENDIX 1 - RATIONALE

5a. The interior of the IFV-IGT will accurately represent the gunner's/commander's compartment of the IFV instruments and controls will be identical to those of the IFV in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

This will help maintain transparent training as well as giving the instructor the capability to see what the crews are doing. The instructor then can help the crews at any point in the presentations.

5b. The IFV-IGT will provide visual, motion and audio cues to the students giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke grenades/ missiles and the main armament of the IFV. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility. The audio will include vehicle noise (track, engine and weapons firing corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

Training in different environments with different threat presentations is needed if crewmembers are expected to be able to fight all over the world. Induced stimuli, such as a motion platform audio, and visual feedback, will increase the crews capability to survive on the battlefield. Because these devices will help maintain transparent training.

5c. The IFV-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring systems will have the capability to introduce malfunctions into the system in order to teach the student gunner, commander and driver, the recognition of, and appropriate responses to such malfunctions. The IFV-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of turret power or ammunition malfunction.

Characteristics are the same as 5a.

5d. The IFV-IGT can allow closed or open hatch operation.

Training must be transparent in order to prevent negative training.

5e. The IFV-IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

Characteristics are the same as 5d.

5f. The IFV-IGT must be provided with a suitable maintenance support package to include operation, maintenance and trouble-shooting instructions.

The maintenance support package would be able to help maintain equipment better and help keep the equipment functioning longer.

5g. The IFV-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

It would be cost effective to change just a few parts as changes and improvements are made than to make a new system.

5h. The IFV-IGT should allow observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

By viewing another crew's performance the viewing crew can learn what mistakes are being made and learning is enhanced.

5i. The IFV-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A, Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

Crew safety must be maintained.

5j. RAM. See Appendix 3.

5k. Sharing of components (i.e., computer and I/O stations) between the IFV-IGT and other IFV stand-alone training devices is a design goal to reduce costs but is not required.

This characteristic would help maximize some of the components in the future to reduce overall cost.

5l. The IFV-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

Keeping track of how a crew member is doing will help instructors know where to start and what to train him on.

APPENDIX 2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

SD04SS16

TRAINING DEVICE REQUIREMENT (TDR)

INFANTRY FIGHTING VEHICLE (IFV)

GUNNERY EMBEDDED TRAINING SYSTEM (GETS)

1. TITLE:

a. INFANTRY FIGHTING VEHICLE GUNNERY EMBEDDED TRAINING SYSTEM (IFV-GETS).

b. CARDS REFERENCE NUMBER: TBD.

2. NEED: Future armored combat system precision gunnery training must be given to the context of tactical training to give crews experience firing and using proper techniques and procedures against free moving, intelligently controlled targets. This experience must come through both simulated engagements in controlled situations and actual engagements against target presentations. In addition there is a requirement to analyze errors and provide accurate evaluation of IFV crews. The IFV-GETS must support all current and proposed gunnery drills for IFV, and the Infantry Center goal of improving gunnery proficiency institutional and unit training.

3. IOC: 3RD QTR FY93.

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. IFV-GETS will be used to provide realistic computer generated imagery simulations of terrain and targets for individual and crew gunnery tasks.

b. IFV-GETS will provide a target engagement system that will include the ability to train in force-on-force operations.

c. IFV-GETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during gunnery and tactical training.

d. IFV-GETS will be the media used to incorporate individual and crew gunnery skills into the AFV tactical training system.

e. The three IFV-GETS subsystems will operate either independently or together.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics.

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) IFV-GETS will not interfere with the vehicle crew's ability to perform normal crew functions and the ability of the IFV fire control system to perform or respond as normal.

(3) IFV-GETS must duplicate the functioning of all weapons in the fire control system between the crew members.

(4) When used with IFV fire control system, both day and under conditions of limited visibility, the GETS must function the same as the IFV weapons system.

(5) IFV-GETS have a self-test ability to isolate faults within the system.

(6) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for IFV.

b. Computer Generated Imagery (CGI) Characteristics.

(1) IFV-GETS CGI must provide a realistic view to the driver, gunnery and IFV commander of the same view from their individual perspectives.

(2) IFV-GETS must provide the capability to switch to different geographical location and threat presentations without any internal system modifications.

(3) The IFV-GETS must determine the miss distance or the relationship of where the projectile passed through a vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only to the extent that they would occur during firing actual ammunition.

(5) The IFV-GETS must provide a realistic hit/kill/miss signal.

(6) IFV-GETS shall include a crew evaluation subsystem to provide a hard copy record of target presentations, engagements, hits, kills, near misses, true target range, crew determined range, ammunition indexed, ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

(7) IFV-GETS must simulate the probability of hit and probability of kill on all target presentations.

(8) IFV-GETS must simulate the probability of hit and probability of kill of all current and future main gun service ammunition.

(9) Simulation programs will progress from simple to complex scenarios. But crews may start at any point.

(10) IFV-GETS must have the capability to computer generate the gunnery IFV commander position.

(11) Feedback by gunners on scenarios should be stored.

(12) IFV-GETS must have the capability of possessing an IFF system.

(13) Drivers will be taking commands from the IFV commander. The drivers reactions should also be tied into the scenarios and recorded.

c. Audio/Visual Recording System Characteristics.

(1) The IFV-GETS must record and playback appropriate gunners and IFV commanders primary sight picture during all operations, to include live fire exercises.

(2) The IFV-GETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The IFV-GETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The IFV-GETS recording system will be compatible with existing technology.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding IFV-GETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the IFV.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/Operator will be required. Each vehicle commander will serve as an I/O as required.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for IFV.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded gunnery training in IFV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train IFV crewmembers, this may require the IFV commander to have some specialized training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals. These publications will be prepared and validated by the contractor and verified by USAIS prior to Government acceptance.

(4) Training effectiveness and transfer will be established in the IOT&E. There will be a transfer of training between the embedded training and actual vehicle performance.

(5) IFV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on IFV.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for IFV-GETS concepts will be used on all variants of Armored Family of Vehicles (AFV).

b. The US Marine Corps could use the training, concepts on the Marine IFV.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	3 QTR FY 93
CTEA	TBD

SD01SS16

RATIONALE

TRAINING DEVICE REQUIREMENT (TDR)

INFANTRY FIGHTING VEHICLE (IFV)

GUNNERY EMBEDDED TRAINING SYSTEM (GETS)

APPENDIX 1 - RATIONALE FOR ESSENTIAL CHARACTERISTICS:

5a.(1) The system must meet climatic design, basic as outlined in AR 70-38.

This vehicle will be used in all parts of the world. The basic climatic design must be used for maximum reliability. Temperatures are from minus (-) 32 degrees Fahrenheit to plus (+) 120 degrees Fahrenheit.

5a.(2) IFV GETS will not interfere with the vehicle crews ability to perform normal crew functions and the ability of the IFV fire control system to perform or respond as normal.

Training must be transparent in order to prevent negative training.

5a.(3) IFV-GETS must duplicate the functioning of all weapons in the fire control system between the crewmembers.

Maintain transparent training.

5a.(4) When used with IFV fire control system, day and night, under conditions of limited visibility, the GETS must function the same as the IFV weapon system.

Maintain transparent training day and night.

5a.(5) IFV-GETS must have a self-test ability to isolate faults within the system.

This will allow the operator to find problems before, during and after training. Identifying problems before training will prevent wasted training time if the equipment does not work. Testing equipment after training will insure reliability the next time the equipment is used.

5a.(6) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for IFV.

Because the MAV are the trainers' standards.

5b.(1) IFV-GETS CGI must provide a realistic view to both the gunner and IFP commander of the same view from their individual perspectives.

Crew coordination will be accomplished as well as transparent training.

5b.(2) IFV-GETS must provide the capability to switch to different geographical location and threat presentations without any internal system modifications.

Training in different environments with different threat presentations is needed if crew members are expected to be able to fight all over the world.

5b.(3) The IFV-GETS must determine the miss distance or the relationship of where the projectile passed through a vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

For positive training feedback the crew will need to know where they are hitting. Also, different ammunition will give a different aim point.

5b.(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only to the extent that they would occur during firing actual ammunition.

Positive feedback and transparent training will be enhanced.

5b.(5) The IFV-GETS must provide a realistic hit/kill/miss signal.

With the appropriate signal the crews will know if they need to continue firing or switch to another target. This would increase the crews ability to switch to another target rapidly.

5b.(6) IFV-GETS shall include a crew evaluation subsystem to provide a hard copy record of target presentations, engagements, hits, kills, near misses, true target range, crew determined range, ammunition indexed, ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

This would help find weak points in the crew and determine where additional training is needed.

5b.(7) IFV-GETS must simulate the probability of hit and probability of kill on all target presentations.

This would allow for a better critique.

5b.(8) IFV-GETS must simulate the probability of hit and probability of kill of all current and future service ammunitions.

Maintain transparent training.

5b.(9) Simulation programs will progress from simple to complex scenarios, but crews may start at any point.

This allows the crew to have positive training and be able to train new crews or crewmembers efficiently.

5b.(10) IFV-GETS must have the capability to computer generate the Gunner or IFV-Commanders position.

If one crew member is weak and needs extra training, he could do the training without his counter part.

5b.(11) Feedback from gunners scenarios should be stored.

This would allow for a better critique.

5b.(12) IFV-GETS must have the capability of possessing an IFF system.

With new weapon systems and their lethality at longer ranges, crews will need a better and faster way to identify enemy or friendly vehicles.

5b.(13) Drivers will be taking commands from the IFV-Commander. The drivers reaction should also be tied into the scenarios and recorded.

This will allow all three crew members to interact in the IFV-GETS system.

5c.(1) The IFV-GETS must record and playback appropriate gunners and IFV commanders primary sight picture during all operations.

Will allow for an outstanding critique.

5c.(2) The IFV-GETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

Will allow for an outstanding critique.

5c.(3) The IFV-GETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

Will allow for an outstanding critique.

5c.(4) The IFV-GETS recording system will be compatible with existing technology.

This would allow the system to be easily maintained.

APPENDIX	2	- CETA
	3	- RAM RATIONALE
	4	- OPERATIONAL MODE SUMMARY/MISSION PROFILE
ANNEX	A	- LIFE CYCLE COST ASSESSMENT
	B	- TDNS
	C	- COORDINATION

SD02SS16

TRAINING DEVICE REQUIREMENT (TDR)
INFANTRY FIGHTING VEHICLE (IFV)
TACTICAL ENGAGEMENT SYSTEM (TES)

1. TITLE:

a. INFANTRY FIGHTING VEHICLE TACTICAL ENGAGEMENT SYSTEM (IFV-TSS)

b. CARD REFERENCE NUMBER: TBD

2. NEED: The Infantry Fighting Vehicle requires a main gun simulator. IFV-TES will provide an audio signature that accurately represents that of the main gun. The IFV-TES will be used in conjunction with the IFV-GETS (Gunnery Embedded Training System) to provide realistic training scenarios. The IFV-TES will be in consonance with the Standards in Training Commission and the Infantry Center goal of improving IFV gunnery proficiency in institutional and unit training.

3. IOC: 3D QTR FY93

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. IFV-TES will be used in the institution and by units equipped with IFVs to provide vehicle oriented instruction to train and/or sustain gunnery and tactical skills and provide realism to training.

b. IFV-TES will be used during the conduct of gunnery tables, tactical tables, force-on-force gunnery training and during conduct of field training exercises where gunnery training is integrated with tactical training.

5. ESSENTIAL CHARACTERISTICS:

a. The system must meet climatic design, basic as outlined in AR 70-38.

b. IFV-TES will promote realism by providing the firing IFV with a means of simulating firing. All weapons systems.

c. IFV-TES electronics and mounting hardware will be embedded into IFV.

d. IFV-TES will have electrical interlock with the IFV-GETS system and will only activate concurrently with the IFV-GETS firing controls.

e. IFV-TES must have a self-test ability to isolate faults within the system.

f. IFV-TES will not interfere with the IFV crews ability to perform normal crew functions and the ability of the weapons fire control system to perform or respond as normal.

g. The firing device will have a capability to simulate the same number of rounds as the IFV basic load.

h. The firing device will be mounted onto the embedded mounting hardware by no more than two crew members, using no lifting devices and using only tools provided as IFV BII within 10 minutes.

i. Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for IFV.

j. The IFV-TES must be operational out to the maximum effective range of the weapon system being emulated.

k. The IFV-TES must be accurate to within one meter at the maximum effective range.

l. The IFV-TES must provide a realistic hit/kill/miss signal for crews, and opponents must also know what damage they have sustained.

m. The IFV-TES must be eye safe.

n. Checks such as adjusting ammunition lead mix, operation of equipment and assess kills will all be done automatically by the on-board computer.

6. TECHNICAL ASSESSMENT:

a. Although hardware to meet these requirements is available, and computer and video technology has matured to meet trainer requirements, it has not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding IFV-TES is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to field the training system concurrently with the IFV.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/Operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for IFV.

g. System reloading will be accomplished by IFV crew members.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded training in IFV will not increase manpower of force structure requirements.

b. Personnel Assessment: When embedded training will be used to train IFV crew members, the IFV commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAIS prior to Government acceptance.

(4) Training effectiveness and transfer will be established in the IOTE. There will be a transfer of training between the embedded training and actual vehicle performance.

(5) IFV maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on IFV.

e. System Safety: Embedded training technology will not increase the risk of injury to crew members.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crew members.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technical employed for IFV-TES concepts will be used on all variants of IFV requiring a weapons effects system.

b. The U.S. Marine Corps could use the training concepts on the Marine IFV.

10. LIFE CYCLE COSTS: TBD

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/IOTE	TBD
MDR III	TBD
IOC	3D QTR FY93
CTEA	TBD

RATIONALE 1

5a. The system must meet climatic design, basic as outlined in AR 70-38.

RATIONALE: This vehicle will be used in all parts of the world. The basic climatic design must be used for maximum reliability. Temperatures are from -32 to +120F.

5b. IFV-TES will promote realism by providing the firing IFV with a means of simulating firing all weapons systems separately.

RATIONALE: Training must be transparent in order to prevent negative training.

5c. IFV-TES electronics and mounting hardware will be embedded into IFV.

RATIONALE: This would save training time, and you could utilize the system at any location.

5d. IFV-TES will have electrical interlock with the IFV-GETS systems and will only activate concurrently with the IFV-GETS firing controls.

RATIONALE: You will get the added training value by play back recording for evaluation.

5e. IFV-TES must have a self-test ability to isolate faults within the system.

RATIONALE: This will allow the operator to find problems before, during and after training. Identifying problems before training will prevent wasted training time if the equipment does not work. Testing equipment after training will ensure reliability the next time the equipment is used.

5f. IFV-TES will not interfere with the IFV crews ability to perform normal crew functions and the ability of the weapons fire control system to perform or respond as normal.

RATIONALE: Training must be transparent in order to prevent negative training.

5g. The firing device will have a capability to simulate the same number of rounds as the IFV basic load.

RATIONALE: Training must be transparent in order to prevent negative training.

5h. The firing device will be mounted onto the embedded mounting hardware by no more than two crewmembers, using no lifting

devices and using only tools provided as IFV BIII within 10 minutes.

RATIONALE: The ease of mounting the device will cut down on training time.

5i. Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for IFV.

RATIONALE: Because the MAVs are the trainers standards.

5j. The IFV-TES must be operational out to the maximum effective range of the weapons system being emulated.

RATIONALE: Maintain transparent training.

5k. The IFV-TES must be accurate to within one meter at the maximum effective range.

RATIONALE: Maintain transparent training.

5l. The IFV-TES must provide a realistic hit/kill/miss signal for crews, and opponents must also know what damage they have sustained.

RATIONALE: Maintain transparent training. This will also force both opponents to think, and fight realistically.

5m. The IFV-TES must be eye safe.

RATIONALE: Safety.

5n. Checks such as adjusting ammunition load mix, operation of equipment and assess kills will all be done automatically on the computer.

RATIONALE: This will maintain a more realistic count.

APPENDIX	2	- CTEA
	3	- RAM
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ANNEX	A	- LIFE CYCLE COST ASSESSMENT
	B	- TDNS

UNCLASSIFIED

ANNEX M

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

DIRECTED ENERGEY WEAPONS

ENCLOSURES:

1. Embedded Tactical Training (TDR)
2. Institutional Gunnery Trainer (TDR)
3. Tactical Engagement Simulations (TDR)

UNCLASSIFIED

TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT)
IN THE
DIRECTED ENERGY WEAPON VEHICLE (DEW-V)

(DEW-V-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE DIRECTED ENERGY WEAPON VEHICLE (DEW-V-ETT).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises for After Action Reviews (AAR).

3. IOC: 3RD QTR FY87 (PROTOTYPE NLT 4TH QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into DEW-V to enhance and maintain the skill proficiency necessary to employ the DEW-V.

c. Embedded tactical training capability will be used under all environmental and climactic/weather conditions.

d. Embedded tactical training capability will not require an alternate power source other than DEW-V on-board source. However, an outside power source capability is desired.

e. Embedded tactical training capabilities will not adversely impact the operational requirements/capabilities of the DEW-V and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded tactical training capability will train individual tasks through force-level collective tasks.

g. Embedded tactical training capability will have the capability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The DEW-V interior will not be significantly altered solely to incoporate embedded training capabilities.

b. Embedded tactical training capabilities will provide visual stimuli thru DEW-V optics and aural stimuli thru DEW-V communication systems. Stimuli presented will be responsive to operator/maintainer manipulation of DEW-V controls, buttons, switches, dials, etc.

c. Embedded tactical training capabilities will provide visual and audio cues to the crew giving the perception of an operational DEW-V. Computer Generated Imagery (CGI) may be appended or as a part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate and tactically maneuver the DEW-V.

e. RAM: Must meet the stated RAM criteria of the DEW-V.

f. The system must be capable of operating as part of a local area net (LAN).

g. Must provide an automated OPFOR capability.

h. Maintaining will be done by DEW-V maintenance personnel.

i. Must be capable of transitioning from training to operational mode within 30 seconds.

j. Training systems must operate off either internal or external power.

6. TECHNICAL ASSESSMENT: Although computer based technology has matured to meet trainer requirements, it has not been demonstrated as an Embedded Tactical Training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with Embedded Tactical Training in KEM-V variants is considered moderate to high.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Modification of existing trackparks/construction of new trackparks with power/networking hook-ups will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded tactical training in DEW-V will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded Tactical Training will be used to train DEW-V crewmembers. The vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded tactical training procedures will be a part of the operators manuals, field manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAIS prior to Government acceptance.

(4) Training effectiveness and transfer will be established in the IOTE. There will be a transfer of training between the embedded tactical training and actual tactical training.

(5) DEW-V maintainers will have to be trained in the proper procedure for maintaining the embedded training components.

d. Human Factors Engineering (HFE): HFE information will come from a separate HFE analysis conducted on each Armored Family of Vehicles (AFV) variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for embedded training concepts will be used on other variants of the AFV family.

b. The US Marine Corps could use the training concepts on the Marine variant of the DEW-V.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	3rd QTR FY 93
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

RATIONALE FOR ESSENTIAL TRAINING CHARACTERISTICS

TRAINING DEVICE REQUIREMENT (TDR) FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE DIRECTED ENERGY WEAPON-VEHICLE (DEW-V-ETT)

1. **PURPOSE:** The purpose of the appendix is to set forth the rationale for selecting Essential Training Characteristics for Embedded Tactical Training in the Infantry Fighting Vehicle.

2. **GENERAL:** Embedded Tactical Training will be designed to provide a training capability built into the DEW-V such that individual and crew training may be conducted in either a stand-alone or networked configuration using the actual vehicle to operate in a simulated environment. That environment will be simulated through the use of on-board technologies and perceived by the crewmembers such that they will perform those tasks which they would normally perform in an actual situation. The following provides that rationale for selection of the Essential Training Characteristics.

a. The DEW-V interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

RATIONALE: Embedded Tactical Training will be a means of achieving technical and tactical proficiency, not and end unto itself. As such, it should be transparent to the user to the greatest extent possible. Specifically, the environment of the crew compartment in the DEW-V should be designed to accommodate the normal operation of the vehicle under its stated operational profile and not solely for the purpose of facilitating training.

b. Embedded Tactical Training capabilities will provide visual stimuli thru GPC optics and aural stimuli thru DEW-V communications systems. Stimuli presented will be responsive to operator or maintainer manipulation of the DEW-V controls, buttons, switches, dials, etc.

RATIONALE: Visual and aural stimulation will be the means by which the crewmembers of the DEW-V will be cued to perform required tasks. The extent to which that stimulation replicates an actual environment will directly impact on the quality of the training conducted. Correct actions by crewmembers should be rewarded by appropriate feedback, and likewise, incorrect actions should result in a realistic continuation or worsening of the situation.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an

operational DEW-V. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

RATIONALE: Crewmember response will be driven by cues which are the result of the simulation of an actual operating environment. Integration of the visual and aural cues into the existing sighting and communications equipment will provide the crewmember with the most realistic and effective cues.

d. Audio and visual feedback will be provided in response to individual maneuvers of the DEW-Y.

RATIONALE: Crewmember reaction to stimuli must result in realistic effects on the simulated environment. These effects must closely relicate the actual effects in degree and intensity of resulting feedback. For example, if the driver properly responds to a warning gauge, the gauge should react by displaying the correct reading in approximately the same time frame as would be expected under normal conditions.

e. RAM: Must meet the stated RAM criteria for the DEW-V.

RATIONALE: Because Embedded Tactical Training will be an integral part of the vehicle, RAM must be identical to that of the vehicle.

f. Maintaining will be done by DEW-V maintenance personnel.

RATIONALE: As an integral part of the DEW-V, the Embedded Tactical Trainer must be maintained in a variety of environments. The fact that embedded training can be conducted in a combat theater of operations will be one of its strongest attributes. As such, the embedded training hardware must be maintainable in that environment, without special personnel requirements.

TRAINING DEVICE REQUIREMENT (TDR)

DIRECTED ENERGY WEAPON VEHICLE (DEW-V)

INSTITUTIONAL GUNNERY TRAINER (IGT)

1. TITLE:

a. DIRECTED ENERGY WEAPON-VEHICLE - INSTITUTIONAL GUNNERY TRAINER (DEW-V, IGT)

2. NEED: There is a need to provide for initial familiarization, basic and advanced gunnery training for DEW-V gunners and tank commanders and provide for transition training of crewmen not qualified or current on the DEW-V. The DEW-V IGT will permit the student to become familiar with the arrangement and operation of the DEW-V firing and sighting controls and procedures. Realistic visual and audio simulations will permit training in proper target acquisition and firing, while operating under varied terrain, weather and combat conditions. The DEW-V IGT will increase the effectiveness of DEW-V gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: 3RD QTR FY93 (PROTOTYPE NLT 4TH QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The DEW-V IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The DEW-V IGT will be fielded in sufficient quantities to support institutional training of all DEW-V with machinegun and main gun. Some simulators may be required at other service schools and 7th ATC.

c. The DEW-V IGT will be used under environmentally controlled conditions.

5. ESSENTIAL CHARACTERISTICS:

a. The interior of the DEW-V IGT will accurately represent the gunner's/TC's compartment of the DEW-V. Instruments and controls will be identical to those of the DEW-V in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The DEW-V IGT will provide visual, motion and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke

grenades and the main armament of the DEW-V. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility (see Annex ?). A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, motion and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The DEW-V IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate responses to such malfunctions. The DEW-V IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations.

d. The DEW-V IGT can allow closed or open hatch operation.

e. The DEW-V IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

f. The DEW-V IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The DEW-V IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The DEW-V IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The DEW-V IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A. Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and technical requirement for this system based on current available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/

technical capabilities or breech of thresholds, the combat and material developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hours scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e., computer and I/O stations) between the DEW-V IGT and other DEW-V stand alone training devices is a design goal to reduce costs but is not required.

l. The DEW-V IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

6. TECHNICAL ASSESSMENT: The technology required to develop the DEW-V IGT exists and will be used extensively in the M1/M60 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the DEW-V IGT is considered to be low to moderate. Although the risk is low to moderate, you could not get this device within 7-8 years unless a Bradley chassis is chosen.

7. SYSTEM SUPPORT ASSESSMENT:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO Checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. Dedicated I/O personnel will be required. School or training center trainers must have I/O's permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial trainer delivery.

f. Permanent facilities are required in which these devices will be installed.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: DEW-V IGT will require dedicated instructors for the institution.

b. Personnel Assessment: The DEW-V IGT will be used to train DEW-V crewmembers as gunners and tank commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAIS will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAARMS prior to government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): information will come from the M1/M60A3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: DEW-V IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: DEW-V IGT will not increase the health hazard to crewmembers.

g. The DEW-V System MANPRINT Management Plan (SMMP) provides detailed information on DEW-V IGT MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. As shown in para 6 above, the DEW-V IGT could use preexisting technology.

b. The US Marine Corps should use DEW-V IGT for training Marine variant of DEW-V.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I (IPR)	TBD
TT/IOTE	TBD
MDR III (IPR)	SEE ROC
CTEA	TBD

APPENDIX 1 - RATIONALE
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ANNEX A - LIFE CYCLE COSTS ASSESSMENT
B - TDNS
C - COORDINATION

SD01BS17

RATIONALE

TRAINING DEVICE REQUIREMENT (TDR)

DIRECTED ENERGY WEAPON-VEHICLE (DEW-V)

INSTITUTIONAL GUNNERY TRAINER (IGT)

APPENDIX 1 - RATIONALE

a. The interior of the DEW-V IGT will accurately represent the gunner's/commander's compartment of the DEW-V instruments and controls will be identical to those of the DEW-V in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

If the interior of the DEW-V IGT does not match the interior of the DEW-V, then a negative training value will be introduced into the system. In that the crew will have learned two interiors - one of the DEW-V IGT and the DEW-V, itself. Thus, defeating the purpose of the trainer.

b. The DEW-V IGT will provide visual, motion and audio cues to the students giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke grenades/ missiles and the main armament of the DEW-V. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility. The audio will include vehicle noise (track, engine and weapons firing corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

If the DEW-V IGT can produce in the student the actual conditions of the DEW-V then there will be no training loss when the crew moves back and forth between the DEW-V and the DEW-V IGT. The more actual tactical conditions that the DEW-V IGT can produce for the crew the better they will understand the DEW-V and the more likely they are to perform well in combat and survive.

c. The DEW-V IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring systems will have the capability to introduce malfunctions into the system in order to teach the student gunner, commander and driver, the recognition of, and appropriate responses to such malfunctions. The DEW-V IGT will permit the controller to freeze the action and provide controls to allow correction of

the student. The controller/monitor will also have the capability to safely induce emergency situations.

If the I/O can not monitor everything that is going on in the DEW-V IGT then improper practices and procedures may be learned by the crew which could adversely effect them in tactical situations. The I/O also need to be able to include all situations that can happen with the actual DEW-V so if and when they happen to the crew in the DEW-V it will not be the first the crew has experienced it and they will know proper procedure in overcoming that problem. Along with this the I/O should be able to freeze the action so if the crew is doing something wrong it can be corrected then before bad or dangerous habits are learned.

d. The DEW-V IGT can allow closed or open hatch operation.

This options is needed because the crew will operate in tactical situations in both positions. The DEW-V IGT should allow all the options that the actual vehicle offers to the crew.

e. The DEW-V IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

If there is not two-way communications between the crewmember and the I/O, then effective training cannot take place, in that it will be heavily onesided, which can cause training lessons to be lost due to ineffective two-way exchanges of information between crew and I/O.

f. The DEW-V IGT must be provided with a suitable maintenance support package to include operation, maintenance and trouble-shooting instructions.

A well designed maintenance support package is ordinarily developed by the contractor. In theory the contractor/ engineer best knows the intricacies of his own system. To minimize down-time and meet RAM requirements the contractor must develop a user-friendly support package which can be used effectively by the target audience.

g. The DEW-V IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

If the DEW-V IGT cannot accept the same modifications and improvements as the DEW-V then its value as a training is nonexistent.

h. The DEW-V IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

Crews that are waiting to use the DEW-V IGT should see what the crew is doing so that they may learn from their mistakes and successes before they start themselves. Causing training to move faster by learning from previous crews and not repeating the same mistakes themselves.

i. The DEW-V IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A, Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

The DEW-V IGT should be no more hazardous to the crewmembers than the DEW-V itself.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and technical requirement for this system based on current available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/ technical capabilities or breech of thresholds, the combat and material developers may jointly initiate a change to the appropriate RAM requirement.

The requirement is based on current data, but since this is to be more of a revolutionary than an evolutionary, the RAM requirement are of a best guess nature.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

The more reliable the DEW-V IGT is the better training value the system becomes and productive it becomes to the crews being trained.

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hour scheduled training week.

The more operational hours that the DEW-V IGT is available to the crewmember, the higher the training value it becomes to the using unit. Allowing the using crewmember to become even more proficient in using the actual DEW-V.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

This failure is defined in this manner because it is felt that a malfunction that hinders or stops operation for over 15 minutes detracts from previous training received because

the crew then has time to forget the current lessons learned by the break in training and the lesson will have to be restarted.

k. Sharing of components (i.e., computer and I/O stations) between the DEW-V IGT and other DEW-V stand-alone training devices is a design goal to reduce costs but is not required.

The more components that can be shared between the DEW-V IGT and other DEW-V devices the less retraining on these is necessary, which allows more training time available to crewmembers as opposed to learning other devices.

l. The DEW-V IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

With the ability to transfer information between sources a data base for each crewmember is established which is transferable to all external and/or embedded sources. Thus letting the crew and crewmembers continue to proceed through the training matrix no matter what source or location is available to them.

SD02BS17

TRAINING DEVICE REQUIREMENT (TDR)
FOR
TACTICAL ENGAGEMENT SIMULATIONS (TES)
IN THE
DIRECTED ENERGY WEAPON-VEHICLE (DEW-V)

1. TITLE:

a. EMBEDDED TACTICAL ENGAGEMENT SIMULATIONS IN THE DIRECTED ENERGY WEAPON-VEHICLE (DEW-V).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contain an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987 signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual crew and unit sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity of the actual vehicle and or the crew compartment. This method, while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a resolution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics, and fire controls (switchology). Embedded tactical training may include, but should not be limited to, on-board computers-assisted instruction, laser disc technology for MILES force-on-force training, cassette tape and/or systems connected through a network umbilical cord. This type of training requires a provision for feedback to the user and also records all exercises.

3. IOC: 3RD QTR FY93

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded tactical training capability will be used by AC/RC units to provide sustainment training and will allow the DEW-V to interact on the force-on-force MILES battlefield.

b. Tactical training capabilities will be built into DEW-V to enhance and maintain the skill proficiency necessary to employ the DEW-V.

c. DEW-V will provide a target engagement system that will include the ability to train in force-on-force operations and individual and crew gunnery skills.

d. DEW-V will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during gunnery and tactical training.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics.

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) The DEW-V interior will not be significantly altered solely to incorporate embedded training capabilities.

(3) Embedded tactical training capabilities will utilize DEW-V optics. This embedded capability should not degrade the DEW-V's IFF capability.

(4) Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate the DEW-V.

(5) When used with DEW-V fire control system, both day, night and under conditions of limited visibility (smoke, fog, etc.), the Tactical Engagement Simulator must function the same as the DEW-V weapon system.

(6) DEW-V must have a self-test ability to isolate any faults within the system.

(7) The DEW-V must record and playback appropriate gunners and tank commanders primary sight picture during all gunnery operations.

(8) Targetry required on ranges or MPRCS during embedded DEW-V Precision Gunnery Training must have the capability to detect and process the DEW-V, TES engagement codes and provide for target damage assessment.

(9) In (TES) force-on-force training, all vehicles must be equpped with receptors that will process the laser codes emitted by the (DEW-V) TES to access catastrophic/mobility kills on the MILES battlefield.

6. TECHNICAL ASSESSMENT:

a. Although recording capability and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk

associated with embedding DEW-V is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the DEW-V.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded tactical training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of ault isolation at the module level and repair by removal and replacement or adjustment/alignment of faulty modules/ components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for DEW-V.

g. Multiple Purpose Range Complexes and ranges must be equipped with targets that have the capability to detect and process the DEW-V, TES engagement codes and provide target damage assessment.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded gunnery training in DEW-V will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train DEW-V crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals. These publications will be prepared and validated by the contractor and verified by USAIS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a positive transfer of training between the embedded tactical training and actual vehicle performance.

(5) DEW-V maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on DEW-V.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for DEW-V concepts will be used on all variants of the DEW-V family.

b. The US Marine Corps could use the training concepts on the Marine DEW-V.

10. LIFE CYCLE COSTS: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	(3 QTR FY 93)
CTEA	TBD

SD01BS15

RATIONALE

a.(1) The system must meet climatic design, basic as outlined in AR 70-38.

This characteristic is needed because the DEW-V will be required to operate in these climatic conditions.

a.(2) The DEW-V interior will not be significantly altered solely to incorporate embedded training capabilities.

This is done so that crew space does not become more cramped than it already is with fire control systems of the main weapon system.

a.(3) Embedded tactical, training capabilities will utilize DEW-V optics. This embedded capability should not degrade the DEW-Vs IFF capability.

This will be done so that the DEW-V crew in the training environment will operate just as if the DEW-V was under actual tactical conditions.

a.(4) Audio and visual feedback will be provided in response to individual/crew control movement and switch manipulation required to operate the DEW-V.

Rationale is same as for characteristic a.(3).

a.(5) When used with DEW-V fire control system, both day, night and under conditions of limited visibility (smoke, fog, etc.), the Tactical Engagement Simulator must function the same as the DEW-V weapon system.

This characteristic is required because the crew must be trained in the same environment and conditions that the crew will be required in combat.

a.(6) DEW-V must have a self-test ability to isolate any faults within the system.

Done to speed repair of system and to cut down time of the system which would degrade crew training on the DEW-V.

a.(7) The DEW-V must record and playback appropriate gunners and tank commanders primary sight picture during all gunnery operations.

This capability is needed so that after a training session is over it can be played back to the DEW-V crew as part of the crew debrief of the training session and the crew can see what the I/O is talking about.

a.(8) Targetry required on ranges or MPRCs during embedded DEW-V Precision Gunnery training must have the capability to detect and process the DEW-V, TES engagement codes and provide for target damage assessment.

Self explanatory.

a.(9) In (TES) force-on-force training, all vehicles must be equipped with receptors that will process the laser codes emitted by the (DEW-V) TES to access catastrophic/mobility kills on the MILES battlefield.

Self explanatory.

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ANNEX N

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

KINETIC ENERGY MISSILE VEHICLE

ENCLOSURES:

1. Embedded Tactical Training (TDR)
2. Institutional Gunnery Trainer (TDR)
3. Gunnery Embedded Training System (TDR)
4. Weapons Effect Simulator System (TDR)

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TRAINING DEVICE REQUIREMENT (TDR)
FOR EMBEDDED TACTICAL TRAINING (ETT)
IN THE
KINETIC ENERGY MISSILE VEHICLE (KEM-V)
(KEM-V-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE KINETIC ENERGY MISSILE VEHICLE (KEM-V-ETT).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contains an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1967, signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual, crew and collective sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity to the actual vehicle or the crew compartment. This method while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a solution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics and fire controls (switchology). Embedded Tactical Training may include, but should not be limited to, simulators, on-board computer assisted instruction, laser disc technology, cassette tape and systems connected through a Local Area Network (LAN) This type of training requires a provision for feedback to the user and also records all exercises for After Action Reviews (AAR).

3. IOC: 3rd QTR FY87 (Prototype NLT 4th QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded Tactical Training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into the KEM-V to enhance and maintain the skill proficiency necessary to employ the KEM-V.

c. Embedded Tactical Training capability will be used under all environmental and climatic or weather conditions.

d. Embedded Tactical Training capabilities will not require an alternate power source other than the KEM-V on-board source. However, an outside power capability is desired.

e. Embedded Tactical Training capabilities will not adversely impact the operational requirements or capabilities of the KEM-V and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded Tactical Training capability will train individual tasks thru force-level collective tasks.

g. Embedded Tactical Training capability will have the ability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The KEM-V interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

b. Embedded Tactical Training capabilities will provide visual stimuli thru KEM-V optics and aural stimuli thru KEM-V communication systems. Stimuli presented will be responsive to operator or maintainer manipulation of the KEM-V controls, buttons, switches, dials, etc.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an operational KEM-V. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual or crew control movement and switch manipulation required to operate and tactically maneuver the KEM-V.

e. RAM: Must meet the stated RAM criteria for the KEM-V.

f. The system must be capable of operating as part of a local area net (LAN).

g. Must provide an automated OPFOR capability.

h. Maintaining will be done by KEM-V maintenance personnel.

i. Must be capable of transitioning from training to operational mode within 30 seconds.

j. Training systems must operate off either internal or external power.

6. TECHNICAL ASSESSMENT: Although computer based technology has matured to meet trainer requirements, it has not been demonstrated as an Embedded Tactical Training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with Embedded Tactical Training in KEM-V variants is considered moderate to high.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/Operator (I/O) will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded Tactical Training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Modification of existing trackparks/construction of new trackparks with power/networking hook-ups will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded Tactical Training in the KEM-V will not increase manpower or force structure requirements.

b. Personnel Assessment: Embedded Tactical Training will be used to train KEM-V crewmembers. The vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded Tactical Training procedures will be a part of the operators manuals, field manuals and maintenance manuals. The publications will be prepared and validated by the contractor and verified by USAIS prior to government acceptance.

(4) Training effectiveness and transfer will be established in the ITOE. There will be a transfer of training between Embedded Tactical Training and actual tactical training.

(5) KEM-V maintainers will have to be trained in the proper procedure for maintaining the embedded training components.

d. Human Factors Engineering (HFE): HFE information will come from a separate HFE analysis conducted on each Armored Family of Vehicles (AFV) variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for embedded training concepts will be used on other variants of the AFV family.

b. The US Marine Corps could use the training concepts on the Marine variant of the KEM-V.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
Draft TDR Approval	TBD
MDR I	TBD
TT/ITOE	TBD
MDR II	TBD
IOC	3rd QTR FY93
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

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RATIONALE FOR ESSENTIAL TRAINING CHARACTERISTICS

TRAINING DEVICE REQUIREMENT (TDR) FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE KINETIC ENERGY MISSILE-VEHICLE (KEM-V-ETT)

1. PURPOSE: The purpose of the appendix is to set forth the rationale for selecting Essential Training Characteristics for Embedded Tactical Training in the Kinetic Energy Missile-Vehicle.

2. GENERAL: Embedded Tactical Training will be designed to provide a training capability built into the KEM-V such that individual and crew training may be conducted in either a stand-alone or networked configuration using the actual vehicle to operate in a simulated environment. That environment will be simulated through the use of on-board technologies and perceived by the crewmembers such that they will perform those tasks which they would normally perform in an actual situation. The following provides that rationale ;for selection of the Essential Training Characteristics.

a. The KEM-V interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

Rationale: Embedded Tactical Training will be a means of achieving technical and tactical proficiency, not an end unto itself. As such, it should be transparent to the user to the greatest extent possible. Specifically, the environment of the crew compartment in the KEM-V should be designed to accommodate the normal operation of the vehicle under its stated operational profile and not solely for the purpose of facilitating training.

b. Embedded Tactical Training capabilities will provide visual stimuli thru GPC optics and aural stimuli thru KEM-V communication systems. Stimuli presented will be responsive to operator or maintainer manipulation of the KEM-V controls,, buttons, switches, dials, etc.

Rationale: Visual and aural stimulation will be the means by which the crewmembers of the KEM-V will be cued to perform required tasks. The extent to which that stimulation replicates an actual environment will directly impact on the quality of the training conducted. "Correct actions by crewmembers should be rewarded by appropriate feedback, and likewise, incorrect actions should result in a realistic continuation or worsening of the situation.

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c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an operation KEM-V. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

Rationale: Crewmember response will be driven by cues which are the result of the simulation of an actual operating environment. Integration of the visual and aural cues into the existing sighting and communications equipment will provide the crewmember with the most realistic and effective cues. Crewmember reaction to stimuli must result in realistic effects on the simulated environment. These effects must closely relicate the actual effects in degree and intensity of resulting feedback. For example, if the driver properly responds to a warning gauge, the gauge should react by displaying the correct reading in approximately the same time frame as would be expected under normal conditions.

d. RAM: Must meet the stated RAM criteria for the KEM-V.

Rationale: Because Embedded Tactical Training will be an integral part of the vehicle, RAM must be identical to that of the vehicle.

e. Maintaining will be done by KEM-V maintenance personnel.

Rationale: As an integral part of the KEM-V, the Embedded Tactical Trainer must be maintained in a variety of environments. The fact that embedded training can be conducted in a combat theater of operations will be one of its strongest attributes. As such, the embedded training hardware must be maintainable in that environment, without special personnel requirements.

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TRAINING DEVICE REQUIREMENT (TDR)

KINETIC ENERGY MISSILE VEHICLE (KEM-V)

INSTITUTIONAL GUNNERY TRAINER (IGT)

(KEM-V-IGT)

1. TITLE:

a. FUTURE KINETIC ENERGY MISSILE VEHICLE - INSTITUTIONAL GUNNERY TRAINER (KEM-V-IGT)

b. CARDS REFERENCE NUMBER: TBD

2. NEED: There is a need to provide for initial familiarization, basic and advance gunnery training for KEM-V gunners and vehicle commanders and provide for transition training of crewmen not qualified or current on the KEM-V. The KEM-V-IGT will permit the student to become familiar with the arrangement and operation of the KEM-V firing and sighting controls and procedures. Realistic visual and audio simulations will permit training in proper target acquisition and firing, while operating under varied terrain, weather and combat conditions. The KEM-V-IGT will increase the effectiveness of KEM-V gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: 3d QTR FY93 (Prototype NLT 4th QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The KEM-V-IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The KEM-V-IGT will be fielded in sufficient quantities to support institutional training of all KEM-V with machinegun and main gun. Some simulators may be required at other service schools and 7th ATC.

c. The KEM-V-IGT will be used under environmentally controlled conditions.

5. ESSENTIAL CHARACTERISTICS:

a. The interior of the KEM-V-IGT will accurately represent the gunner's/TC compartment of the KEM-V. Instruments and controls will be identical to those of the KEM-V in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

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b. The KEM-V-VGT will provide visual, and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke grenades and the main armament of the KEM-V. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student action responses.

c. The KEM-V-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate response to such malfunctions. The KEM-V-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of range finder, turret power or ammunition malfunction.

d. The KEM-V-IGT can allow closed or open hatch operation.

e. The KEM-V-IGT must include a communication system which will reply two-way communications between the crewmembers and I/O.

f. The KEM-V-IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The KEM-V-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The KEM-V-IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The KEM-V-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A, Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

j. RAM. The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and technical requirement for this system based on current available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/technical capabilities or breech of thresholds, the combat and materiel developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on a 96 hour scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e. computer and I/O stations) between the KEM-V-IGT and other KEM-V stand alone training devices is a design goal to reduce costs but is not required.

l. The KEM-V-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

6. TECHNICAL ASSESSMENT: The technology required to develop the KEM-V-IGT exists and will be used extensively in the M2/M3 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the KEM-V-IGT is considered to be low to moderate.

7. SYSTEM SUPPORT ASSESSMENT:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. Dedicated I/O personnel will be required. School or training center trainers may have I/Os permanently assigned for efficiency, but no new MOS is required.

e. I/O training by the contractor will be required for initial trainer delivery.

f. Permanent facilities will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: KEM-V-IGT will not increase manpower or force structure requirements. A dedicated operator will be required.

b. Personnel Assessment The KEM-V-IGT will be used to train FRV crewmembers as gunners and tank commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAIS will provide training ;management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAIS prior to government acceptance.

(4) Training effectiveness and transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): Information will come from the M2/M3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: KEM-V-IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: KEM-V-IGT will not increase the health hazard to crewmembers..

g. The KEM-V-IGT System MANPRINT Management Plan (SMMP) provides detailed information on KEM-V-IGT MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. As shown in para 6 above, the KEM-V-IGT could use preexisting technology.

b. The U.S. Marine Corps could use KEM-V-IGT for training Marine variant of KEM-V.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
Draft TDR approval	TBD
MDR I (IPR)	TBD
TT/IOTE	TDB
MDR III (IPR)	TBD
IOC	3 QTR FY93
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

RATIONALE

General:

ESSENTIAL CHARACTERISTICS:

a. The interior of the KEM-V-IGT will accurately represent the gunner's/TC's compartment of the KEM-V. Instruments and controls will be identical to those of the KEM-V in both appearance and operation under all conditions, and KEM-V will be monitored on the instructor's master control console.

Rationale: The trainer must be an actual representative of the KEM-V for a positive training transfer. Monitoring on the instructors master console is required so the instructor is able to observe all that is done by the crew.

b. The KEM-V-IGT will provide visual, and audio cues to the student giving the illusion of acquiring targets and using the fire control systems to fire machineguns, smoke grenades and the main armament of the KEM-V. Visual and audio stimuli will provide a variety of terrain features and threat presentations and visibility. The audio will include vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions, speed of the engine and targets being fired on. Audio, and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

Rationale: The KEM-V-IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunner/TC the recognition of, and appropriate responses to such malfunctions. The KEM-V-IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of range finder, turret power or ammunition malfunction.

Rationale: For realistic training the I/O must have the capability to introduce realistic situations into the program as he believes necessary for effective training.

d. The KEM-V-IGT can allow closed or open hatch operation

Rationale: To replicate actual vehicle operations.

e. The KEM-V-IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

Rationale: Required to allow the I/O to pass information or situations to the crew and/or critique crew actions on the spot.

f. The KEM-V-IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

Rationale: To allow the I/O or CLS supporter to conduct maintenance and make immediate repair if required.

g. The KEM-V-IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

Rationale: Cost effectiveness.

h. The KEM-V-IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

Rationale: Student can benefit from watching other crews operate. They will be able to observe what is done correctly and benefit from errors of the other crews.

i. The KEM-V-IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A, Noise Limits for Army Material, 3 Mar 75. Toxic gases and other hazardous atmospheric contaminants will not be produced.

Rationale: Health and Safety requirements.

j. Sharing of components (i.e. computer and I/O stations) between the KEM-V and other KEM-V and other stand-alone training devices is a design goal to reduce cost, but is not required.

Rationale: Cost savings.

k. The KEM-V-IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

Rationale: To provide a total capability of maintaining progress records of crews being trained.

TRAINING DEVICE REQUIREMENT (TDR)

KINETIC ENERGY MISSILE VEHICLE (KEM-V)

GUNNERY EMBEDDED TRAINING SYSTEM (GETS)

DERIVATIVE VEHICLE OF:

(KEM-V-GETS)

1. TITLE:

a. KINETIC ENERGY MISSILE VEHICLE EMBEDDED GUNNERY TRAINING SYSTEM (KEM-V-GETS).

b. CARDS REFERENCE NUMBER: TBD

2. NEED: Future Kinetic Energy Missile precision gunnery training must be given in the context of tactical training to give crews experience firing and using proper techniques and procedures against free moving, intelligently controlled targets. This experience must come through both simulated engagements in controlled situations and actual engagements against target presentations. In addition there is a requirement to analyze errors and provide accurate evaluation of vehicle crews. The KEM-V-GETS must support all current and proposed gunnery skills for KEM-V.

3. IOC: 3d QTR FY93

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. KEM-V-GETS will be used to provide realistic computer generated imagery simulations of terrain and targets for individual and crew gunnery tasks.

b. KEM-V-GETS will provide a target engagement system that will include the ability to train in force-on-force operations.

c. KEM-V-GETS will provide a video and audio recording system to enhance vehicle oriented instruction through evaluation and critique of performance during gunnery and tactical training.

d. KEM-V-GETS will be the media used to incorporate individual and crew gunnery skills into the KEM-V tactical training system.

e. The KEM-V-GETS subsystems will operate either independently or together using internal or external power source.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics.

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) KEM-V-GETS will not interfere with the veh crew's ability to perform normal crew functions and the ability of the veh fire control system to perform or respond as normal.

(3) KEM-V-GETS must duplicate the functioning of the ;main gun fire control system between the crew members.

(4) When used with KEM-V fire control system, both day and under conditions of limited visibility, the GETS must function the same as the KEM-V weapon system. *To include IFF.*

(5) KEM-V-GETS must have a self-test ability to isolate faults within the system.

(6) The KEM-V-GETS must interface with the KEM-V Weapons Effects Simulator System (KEM-V-WESS).

(7) Reliability, Availability and maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for KEM-V.

(8) The system must be able to convert from Tactical to Training Mode in not more than 10 minutes and from Training to Tactical in not more than 30 seconds.

b. Computer Generated Imagery (CGI) Characteristics.

(1) KEM-V-GETS CGI must provide a realistic view to both the gunner, tank commander and driver of the same view fro their individual perspectives.

(2) KEM-V-GETS must provide the capability to switch different geographical location and threat presentations without any internal system modifications.

(3) The KEM-V-GETS must determine the miss distance or the relationship of where the projectile passed through a horizontal and vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only to the extent that they would occur during firing actual ammunition.

(5) The KEM-V-GETS must provide a realistic hit/kill/miss signal.

(6) KEM-V-GETS shall include a crew evaluation subsystem to provide a hard copy record of target presentations, engagements, hits, kills, near misses, true target range, crew determined range, ammunition indexed, ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

(7) KEM-V-GETS must simulate the probability of hit and probability of kill on all target presentations.

(8) KEM-V-GETS must simulate the probability of hit and probability of kill on all current and future main gun service ammunitions.

c. Audio/Visual Recording System Characteristics.

(1) The KEM-V-GETS must record and playback appropriate gunners and/or commanders primary sight picture during all operations.

(2) The KEM-V-GETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

(3) The KEM-V-GETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

(4) The KEM-V-GETS recording system will use commercial video tapes.

6. TECHNICAL ASSESSMENT:

a. Although video recording capability, computer generated imagery and laser technology have all matured to meet trainer requirements, they have not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding KEM-V-GETS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to develop and field the training system concurrently with the KEM-V.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness check, fault isolation using self-diagnostics, replacement of minor components, and adjustment/alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for KEM-V.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded gunnery training in FRV will not increase manpower of force structure requirements.

b. Personnel Assessment: Embedded training will be used to train KEM-V crewmembers, this may require the tank commander to have some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal changes and publish a revised manual when required.

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOT&E. There will be a transfer of training between the embedded training and actual vehicle performance.

(5) KEM-V maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on KEM-V.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for KEM-V-GETS concepts will be used on all variants of AFV.

b. The U.S. Marine Corps could use the training concepts on the Marine FRV.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	3 QTR FY93
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

RATIONALE

Systems Characteristics:

a. General Characteristics

(1) The systems must meet climatic design, basic as outline in AR 70-38.

Rationale: The system will be used in climates ranging from -32F to +120F.

(2) KEM-V-GETS will not interfere with the vehicle crew's ability to perform normal crew functions and the ability of the vehicle fire control system to perform or respond as normal.

Rationale: The principal role of the vehicle and weapons system is combat engagements. The training system must not interfere with this role.

(3) KEM-V-GETS must duplicate the functioning of the main gun fire control system between the crew members.

Rationale: Each member of the crew has to perform his specific role of the crew functions when training.

(4) When used with KEM-V fire control system, both day and under conditions of limited visibility, the GETS must function the same as the KEM-V weapon system to include IFF.

Rationale: For positive training the GETS must function the same as the actual system under all conditions.

(5) KEM-V-GETS must have a self-test ability to isolate faults within the system.

Rationale: This is needed to expedite repairs and/or adjustments to the system to reduce down time.

(6) The KEM-V-GETS must interface with the KEM-V Weapons Effects Simulator System (KEM-V-WESS).

Rationale: The KEM-V-GETS/KEM-V-WESS interface is essential to provide the appropriate aural and visual signature to simulate the weapons firing.

(7) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptance Values (MAV) for KEM-V.

Rationale: The system must operate as a total unit with the same operational requirements.

(8) It is probable that in a war zone there will be occasions when there will be a need for training, i.e., replacements etc. Along with this, it may be important to place the system back into a tactical mode with a sudden threat appearance.

Rationale: Self-explanatory.

b. Computer Generated Imagery (CGI) Characteristics.

(1) KEM-V-GETS CGI must provide a realistic view to both the gunner and vehicle commander of the same view from their individual perspectives.

Rationale: Vehicle must operate under the same conditions in training that it does in the combat role.

(2) KEM-V-GETS must provide the capability to switch to different geographical location and threat presentations without any internal system modifications.

Rationale: Saves training time and reduces down time on the device.

(3) The KEM-V-GETS must determine the miss distance or the relationship of where the projectile passed through a vertical plane relative to the optimum aim point at the target for each type of ammunition simulated.

Rationale: Direct feedback to allow for immediate correction of gunnery errors.

(4) Ammunition effects to include realistic tracer image and point of impact will be displayed in the crew optics only to the extent that they would occur during firing actual ammunition.

Rationale: Allows for positive training transfer.

(5) The KEM-V must provide a realistic hit/kill/miss signal.

Rationale: Same as b (4).

(6) FRV-GETS shall include a crew evaluation subsystem to provide a hard copy of target presentations, engagements, hits, kills, near misses, true target range, crew determined range ammunition indexed, ammunition fired, and engagement times to enable the trainer to reconstruct the target engagement sequence.

Rationale: Feedback to provide information to be used to measure crews effectiveness. Also information can be stored to measure improvement or areas of weakness to be trained.

(7) KEM-V-GETS must simulate the probability of hit and probability of kill on all target presentations.

Rationale: Same as b (4).

(8) KEM-V-GETS must simulate the probability of hit and probability of kill of all current and future main gun service ammunitions.

Rationale: Same as b (4).

c. Audio/Visual Recording System Characteristics:

(1) The KEM-V-GETS must record and playback appropriate gunners and tank commanders primary sight picture during all operations.

Rationale: Same as b (6).

(2) The KEM-V-GETS recording must include simultaneous audio recording of the crew intercom and radio transmissions.

Rationale: Same as b (6).

(3) The KEM-V-GETS visual recording will include a superimposed digital clock providing real time to one-tenth of a second.

Rationale: Same as b (6).

(4) The KEM-V-GETS recording system will use commercial video tapes.

Rationale: Same as b (6).

TRAINING DEVICE REQUIREMENT (TDR)

KINETIC ENERGY MISSILE VEHICLE (KEM-V)

WEAPONS EFFECT SIMULATOR SYSTEM (WESS)

(KEM-V-WESS)

1. TITLE:

a. KINETIC ENERGY MISSILE VEHICLE WEAPONS EFFECT SIMULATOR SYSTEM (KEM-V-WESS)

b. CARDS REFERENCE NUMBER: TBD

2.. NEED: The Future Kinetic Energy Vehicle requires a main gun simulator. KEM-V-WESS will provide an audio signature that accurately represents that of the main gun. The KEM-V-WESS will be used in conjunction with the KEM-V-GETS (Gunnery Embedded Training System) to provide realistic training scenarios. The KEM-V-WESS will be in consonance with the Standards in Training Commission and the Infantry Center goal of improving gunnery proficiency in institutional and unit training.

3. IOC: 3d QTR FY93.

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. KEM-V-WESS will be used in the institution and by units equipped with KEM-V to provide vehicle oriented instruction to train and/or sustain gunnery and tactical skills and provide realism to training.

b. KEM-V-WESS will be used during the conduct of gunnery tables, tactical tables, force-on-force gunnery training is integrated with tactical training.

5. ESSENTIAL CHARACTERISTICS:

a. General System Characteristics:

(1) The system must meet climatic design, basic as outlined in AR 70-38.

(2) KEM-V-WESS will promote realism by providing the firing KEM-V with a means of simulating main gun firing.

(3) KEM-V-WESS Electronics and mounting hardware will be embedded into the KEM-V-GETS.

(4) KEM-V-WESS will have electrical interlock with the KEM-V-GETS system and will only activate concurrently with the KEM-V-GETS firing controls.

(5) KEM-V-WESS must have a self-test ability to isolate faults within the system.

(6) KEM-V-WESS will not interfere with the tank crew's ability to perform normal crew functions and the ability of the tank fire control system to perform or respond as normal.

(7) The firing device will have a capability to simulate the same number of rounds as the KEM-V basic load.

(8) The firing device will fire the cartridge developed for KEM-V.

(9) The firing device will be mounted onto the embedded mounting hardware by no more than two crewmembers, using no lifting devices and using only tools provided as KEM-V BII within 10 minutes.

(10) Reliability, Availability and Maintainability (RAM) must be equal to the established Minimum Acceptable Values (MAV) for KEM-V.

b. Target Engagement System (TES) Characteristics:

(1) The KEM-V-WESS-TES must be operational out to the maximum effective range of the weapons system being emulated.

(2) The KEM-V-WESS-TES must be accurate within one meter at the maximum effective range.

(3) The KEM-V-WESS-TES must provide a realistic hit/kill/miss signal.

(4) The KEM-V-WESS-TES must be eye safe.

(5) A controller gun is required to assess kills, adjust ammunition load mix, and check the operation of equipment.

6. TECHNICAL ASSESSMENT:

a. Although hardware to meet requirements is available, and computer and video technology has matured to meet training requirements, it has not been demonstrated as an embedded training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with embedding KEM-V-WESS is considered moderate to high risk.

b. The goal of the combat, training, and material developers is to field the training system concurrently with the KEM-V.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/operator will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Operator maintenance will consist of visual inspections of subassemblies (i.e., computers and/or optics/fire control instruments), daily readiness checks, fault isolation using self-alignment not requiring special tools or test equipment.

e. Organizational maintenance will consist of fault isolation to the module level and repair by removal and replacement or adjustment/alignment of faulty modules/components.

f. Direct/General/Depot support will be accomplished in the same manner as the fire control system for KEM-V.

g. System reloading will be accomplished by KEM-V crewmembers.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded training in KEM-V will not increase manpower of force structure requirements.

b. Personnel Assessment: When embedded training will be used to train KEM-V crewmembers, the vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes and publish a revised manual .

(3) Embedded training procedures will be a part of the operators manuals and maintenance manuals. These publications will be prepared and validated by the contractor and verified by USAARMS prior to Government acceptance.

(4) Training effectiveness and positive transfer will be established in the IOTE. There will be a transfer of training between the embedded training and actual vehicle performance.

(5) KEM-V maintainers will have to be trained in the proper procedures for maintaining the embedded training components.

d. Human Factors Engineering (HFE): Information will come from a separate HFE analysis conducted on KEM-V.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for FRV-WESS concepts will be used on all variants of AFV requiring a weapons effects systems.

b. The U.S. Marine Corps could use the training concepts on the Marine KEM-V.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I	TBD
TT/ITOE	TBD
MDR III	TBD
IOC	3 QTR FY93
CTEA	TBD

APPENDIX 1 - RATIONALE
2 - CTEA
3 - RAM RATIONAL
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE
ANNEX A - LIFE CYCLE COST ASSESSMENT
B - TDNS

RATIONALE

Systems Characteristics:

a. The system must meet climatic design, basic as outlined in AR 70-38.

RATIONALE: System will be required to operate in temperatures from a minus (-) 32 degrees Fahrenheit to plus (+) 120 degrees Fahrenheit.

b. KEM-V-WESS will promote realism by providing the firing KEM-V with a means of simulating main gun firing.

RATIONALE: The system will give the same signature and effect (electronic or other technology) for Force-on-Force training.

c. KEM-V-WESS electronics and mounting hardware will be embedded into KEM-V.

RATIONALE: Availability and ease of handling.

d. KEM-V-WESS will have electrical interlock with the KEM-V-GETS system and will only activate concurrently with the KEM-V-GETS firing controls.

RATIONALE: By having an electrical interlock between the training device and the gunnery system the crew will get the benefit of the playback system to critique the exercise.

e. KEM-V-WESS must have a self-test ability to isolate faults within the system.

RATIONALE: Speed and ease of maintenance.

f. KEM-V-WESS will not interfere with the crew's ability to perform normal crew functions and the ability of the vehicle fire control system to perform or respond as normal.

RATIONALE: The primary role of the KEM-V is a combat mission. The WESS cannot in anyway interfere with that role.

g. The firing device will have a capability to simulate the same number of rounds as the KEM-V basic load.

RATIONALE: Tactical realism. This will also teach the vehicle commander to monitor his basic load during and after fire missions.

h. The firing device will be mounted onto the embedded mounting hardware by no more than two crewmembers, using no lifting devices and using only tolls provided as KEM-V-BII within 10 minutes.

RATIONALE: Ease of handling and will not increase the number of tools in the BII. Also, if the system needs to be mounted or dismounted in a remote area no special tools would be required.

i. Target Engagement System (TES) Characteristics:

(1) The KEM-V-WESS-TES must be operational out to the maximum effective range of the weapons system being emulated.

Rationale: Realism

(2) The KEM-V-WESS-TESS must be accurate to within one meter at the maximum effective range.

Rationale: To be an effective simulator, system must be as accurate as the system emulated.

(3) The KEM-V-WESS-TESS must provide a realistic hit/kill/miss signal.

Rationale: To provide positive training to do as well but not better or worse than the system being emulated.

(4) The KEM-V-WESS must be eye safe.

Rationale: Health protection for the soldiers during training.

(5) A controller gun is required to assess kills, adjust ammunition load mix, and check the operation of equipment.

Rationale: To provide a control factor during force-on-force operations.

UNCLASSIFIED

ANNEX O

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

MORTAR WEAPONS SYSTEM VEHICLE

ENCLOSURES:

1. Institutional Gunnery Trainer (TDR)
2. Embedded Tactical Training (TDR)
3. Embedded Tactical Engagement Simulation (TDR)
4. Embedded Tactical Simulation System (TDR)

UNCLASSIFIED

TRAINING DEVICE REQUIREMENT (TDR)

MORTAR WEAPON SYSTEM-VEHICLE (MWS-V)

INSTITUTIONAL GUNNERY TRAINER (IGT)

1. TITLE:

a. MORTAR WEAPON SYSTEM-VEHICLE, INSTITUTIONAL GUNNERY TRAINER (MWS-V,IGT)

2. NEED: There is a need to provide for initial familiarization, basic and advanced gunnery training for MWS-V crewmen (11C) and provide for transition training of crewmen not qualified or current on the MWS-V. The MWS-V, IGT will permit the student to become familiar with the arrangement and operation of the MWS-V firing, while operating under varied terrain, weather and combat conditions. The MWS-V, IGT will increase the effectiveness of MWS-V gunner/TC training by permitting the I/O to observe their performance and reactions to artificially induced scenarios and emergency conditions without requiring the use of actual vehicles for gunnery training.

3. IOC: 3d QTR FY93 (Prototype NLT 4th QTR FY91).

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The MWS-V,IGT will be used at Army Service Schools to provide initial and advanced gunnery training.

b. The MWS-V, IGT will be fielded in sufficient quantities to support institutional training of all MWS-V's with machinegun, smoke grenades and 120mm mortar (possibly turreted). Some simulators may be required at other service schools and 7th ATC.

c. The MWS-V, IGT will be used under environmentally controlled conditions.

5. ESSENTIAL CHARACTERISTICS:

a. The interior of the MWS-V, IGT will accurately represent the crew compartment of the MWS-V. Instruments and controls will be identical to those of the MWS-V in both appearance and operation under all conditions, and will be monitored on the instructor's master control console.

b. The MWS-V, IGT will provide visual, motion and audio cues to the student giving the illusion of acquiring targets (indirect, direct lay, and direct alignment methods) and using the fire control systems to fire machineguns, smoke grenades, main armament of the MWS-V. Visual and audio stimuli will

provide a variety of terrain features and threat presentations and visibility. A motion platform will impart necessary pitch, yaw and roll stimuli to the student. The audio will include vehicle noise (tract, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on. Audio, motion and visual feedback will be provided in response to student control movement required to acquire and engage targets, as well as to simulate the ongoing conditions and satisfactorily provide realistic stimuli for student emergency action responses.

c. The MWS-V. IGT must include the ability to monitor the student actions while engaging targets in order to detect improper practices and procedures. The controlling/monitoring system will have the capability to introduce malfunctions into the system in order to teach the student gunners the recognition of, and appropriate responses to such malfunctions. The MWS-V, IGT will permit the controller to freeze the action and provide controls to allow correction of the student. The controller/monitor will also have the capability to safely induce emergency situations such as loss of turret power, robot loader, or ammunition malfunction.

d. The MWS-V, IGT can allow closed or open hatch operation.

e. The MWS-V, IGT must include a communication system which will allow two-way communications between the crewmembers and I/O.

f. The MWS-V, IGT must be provided with a suitable maintenance support package to include operation, maintenance and troubleshooting instructions.

g. The MWS-V, IGT must have growth potential capable of readily accepting modifications that conform to product improvements of the basic system.

h. The MWS-V, IGT should allow student observers to view a crew's performance through all situations via a visual monitor and hear the instructor/student interchange.

i. The MWS-V, IGT will be free from mechanical and electrical hazards. Noise levels will not exceed those within the appropriate category of Military Standard 1474A, Noise Limits for Army Material, 3 Mar 75. Toxic gasses and other hazardous atmospheric contaminants will not be produced.

j. RAM: The quantitative RAM requirements contained in the TDR represents the best estimate of the operational and technical requirement for this system based on current available knowledge. However, when information is gained from subsequent studies, trade-off analysis and cost effectiveness evaluations that indicate a change in the threat, need, operational/technical capabilities or breach of thresholds, the combat and materiel developers may jointly initiate a change to the appropriate RAM requirement.

(1) Reliability: The system shall have as a Minimum Acceptable Value (MAV) 54 hours Mean Time Between Mission Failure (MTBMF).

(2) Operational Availability: The system shall have an availability of 90% based on 96 hour scheduled training week.

(3) A mission failure is defined as any malfunction which hinders or stops operation and cannot be corrected by the instructor/operator within 15 minutes. Operator error shall not be considered as a mission failure.

k. Sharing of components (i.e., computer and I/O stations) between the MWS-V, IGT and other MWS-V stand alone training devices is a design goal to reduce costs but is not required.

l. The MWS-V, IGT will provide record transfer capability between external sources of information and/or embedded sources of information.

m. The IGT will have a system to remove the inert mortar round after simulated firing in order to clear the breech/tube for the next simulated firing.

6. TECHNICAL ASSESSMENT: The technology required to develop the MWS-V, IGT exists and is used extensively in the M2/M3 series Conduct of Fire Trainers (COFT) under contract by the Army with commercial interest. The computational systems required for this training device will be off-the-shelf systems which have been in common use by industry for many years. The I/O station and crew compartment are familiar systems to simulator developers, and represent low risk. The software required to control the trainer will be of moderate complexity. Computer generated imagery (CGI) visual systems have matured to meet the trainer requirements. Based on the above, the technical risk associated with the MWS-V, IGT is considered to be low to moderate.

7. SYSTEM SUPPORT ASSESSMENT:

a. Operator and maintenance manuals will be delivered with each trainer. In addition, interim repair parts will be purchased to be delivered with each trainer.

b. The trainer should have, to the maximum extent practicable, GO/NOGO preoperational checks that will also follow fault isolation for maintenance personnel.. The I/O and organizational maintenance personnel will visually inspect the trainer for damage and will perform GO/NOGO checks.

c. Type classification is not required. Total contractor logistics support (CLS) is required.

d. Dedicated I/O personnel (11C) will be required. School or training center trainers may have I/O's permanently assigned for efficiency, but no new MOS is required for initial trainer delivery.

e. I/O training by the contractor will be required for initial trainer delivery.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: MWS-V, IGT will increase manpower and force structure requirements. It is likely that there will be one 11C30 per 1 to 2 units and one civilian operator per 4 to 6 units in the institution.

b. Personnel Assessment: The MWS-V, IGT will be used to train MWS-V crewmembers as gunners and MWS-V commanders. I/O personnel will not require detailed specialized training.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) USAIS will provide training management handbooks as fielding occurs.

(3) Operator's manuals and maintenance manuals will be prepared and validated by the contractor and verified by USAIS prior to government acceptance.

(4) Training effectiveness and transfer will be established in the IOTE.

d. Human Factors Engineering (HFE): Information will come from the M2/M3 COFT and a separate HFE Analysis conducted by the Human Engineering Laboratory.

e. System Safety: MWS-V, IGT will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: MWS-V, IGT will not increase the risk of injury to crewmembers.

g. The MWS-V System MANPRINT Management ;Plan (SMMP) provides detailed information on MWS-V, IGT MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. As shown in para 6 above, the MWS-V, IGT could use preexisting technology.

b. The U.S. Marine Corps could use MWS-V, IGT for training Marine variant of MWS-V.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
DRAFT TDR APPROVAL	TBD
MDR I (IPR)	TBD
TT/IOTE	TBD
MDR III (IPR)	TBD
IOC	3 QTR FY93
CTEA	TBD

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TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL TRAINING (ETT)

IN THE

MORTAR WEAPON SYSTEM VEHICLE (MWS-V)

(MWS-V-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE MORTAR WEAPON SYSTEM VEHICLE (MWS-V-ETT)

b. CARDS REFERENCE NUMBER: TBD.

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contains an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987, signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual, crew and collective sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity to the actual vehicle or the crew compartment. This method while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a solution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics and fire controls (switchology). Embedded Tactical Training may include, but should not be limited to, simulators, on-board computer assisted instruction, laser disc technology, cassette tape and systems connected through a Local Area Network (LAN) This type of training requires a provision for feedback to the user and also records all exercises for After Action Reviews (AAR).

3. IOC: 3rd QTR FY87 (Prototype NLT 4th QTR FY91)

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4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded Tactical Training capability will be used by AC/RC units to provide sustainment training.

b. Tactical training capabilities will be built into the MWS-V to enhance and maintain the skill proficiency necessary to employ the MWS-V.

c. Embedded Tactical Training capability will be used under all environmental and climatic or weather conditions.

d. Embedded Tactical Training capabilities will not require an alternate power source other than the MWS-V on-board source. However, an outside power capability is desired.

e. Embedded Tactical Training capabilities will not adversely impact the operational requirements or capabilities of the MWS-V and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded Tactical Training capability will train individual tasks thru force-level collective tasks.

g. Embedded Tactical Training capability will have the ability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The MWS-V interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

b. Embedded Tactical Training capabilities will provide visual stimuli thru MWS-V optics and aural stimuli thru MWS-V communication systems. Stimuli presented will be responsive to operator or maintainer manipulation of the MWS-V controls, buttons, switches, dials, etc.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an operational MWS-V. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual or crew control movement and switch manipulation required to operate and tactically maneuver the MWS-V.

e. RAM: Must meet the stated RAM criteria for the MWS-V.

f. The system must be capable of operating as part of a local area net (LAN).

g. Must provide an automated OPFOR capability.

h. Maintaining will be done by MWS-V maintenance personnel.

i. Must be capable of transitioning from training to operational mode within 30 seconds.

j. Training systems must operate off either internal or external power.

6. TECHNICAL ASSESSMENT: Although computer based technology has matured to meet trainer requirements, it has not been demonstrated as an Embedded Tactical Training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with Embedded Tactical Training in MWS-V variants is considered moderate to high.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/Operator (I/O) will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded Tactical Training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Modification of existing trackparks/construction of new trackparks with power/networking hook-ups will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded Tactical Training in the MWS-V will not increase manpower or force structure requirements.

b. Personnel Assessment: Embedded Tactical Training will be used to train MWS-V crewmembers. The vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded Tactical Training procedures will be a part of the operators manuals, field manuals and maintenance manuals. The publications will be prepared and validated by the contractor and verified by USAIS prior to government acceptance.

(4) Training effectiveness and transfer will be established in the ITOE. There will be a transfer of training between Embedded Tactical Training and actual tactical training.

(5) MWS-V maintainers will have to be trained in the proper procedure for maintaining the embedded training components.

d. Human Factors Engineering (HFE): HFE information will come from a separate HFE analysis conducted on each Armored Family of Vehicles (AFV) variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for embedded training concepts will be used on other variants of the AFV family.

b. The US Marine Corps could use the training concepts on the Marine variant of the MWS-V.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
Draft TDR Approval	TBD
MDR I	TBD
TT/ITOE	TBD
MDR II	TBD
IOC	3rd QTR FY93
CTEA	TBD

APPENDICES
1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEXES
A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

RATIONALE FOR ESSENTIAL TRAINING CHARACTERISTICS

TRAINING DEVICE REQUIREMENT (TDR) FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE MORTAR WEAPON SYSTEM VEHICLE (MWS-V) (MWS-V-ETT)

1. **PURPOSE:** The purpose of the appendix is to set forth the rationale for selecting Essential Training Characteristics for Embedded Tactical Training in the Mortar Weapons System Vehicle.

2. **GENERAL:** Embedded Tactical Training will be designed to provide a training capability built into the MWS-V such that individual and crew training may be conducted in either a stand-alone or networked configuration using the actual vehicle to operate in a simulated environment. That environment will be simulated through the use of on-board technologies and perceived by the crewmembers such that they will perform those tasks which they would normally perform in an actual situation. The following provides that rationale for selection of the Essential Training Characteristics.

a. The MWS-V interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

Rationale: Embedded Tactical Training will be a means of achieving technical and tactical proficiency, not an end unto itself. As such, it should be transparent to the user to the greatest extent possible. Specifically, the environment of the crew compartment in the MWS-V should be designed to accommodate the normal operation of the vehicle under its stated operational profile and not solely for the purpose of facilitating training.

b. Embedded Tactical Training capabilities will provide visual stimuli thru GPC optics and aural stimuli thru MWS-V communication systems. Stimuli presented will be responsive to operator or maintainer manipulation of the MWS-V controls, buttons, switches, dials, etc.

Rationale: Visual and aural stimulation will be the means by which the crewmembers of the MWS-V will be cued to perform required tasks. The extent to which that stimulation replicates an actual environment will directly impact on the quality of the training conducted. Correct actions by crewmembers should be rewarded by appropriate feedback, and likewise, incorrect actions should result in a realistic continuation or worsening of the situation.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an operational MWS-V. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

Rationale: Crewmember response will be driven by cues which are the result of the simulation of an actual operating environment. Integration of the visual and aural cues into the existing sighting and communications equipment will provide the crewmember with the most realistic and effective cues.

d. Audio and visual feedback will be provided in response to individual or crew maneuver the MWS-V.

Rationale: Crewmember reaction to stimuli must result in realistic effects on the simulated environment. These effects must closely relicate the actual effects in degree and intensity of resulting feedback. For example, if the driver properly responds to a warning gauge, the gauge should react by displaying the correct reading in approximately the same time frame as would be expected under normal conditions.

e. RAM: Must meet the stated RAM criteria for the MWS-V.

Rationale: Because Embedded Tactical Training will be an integral part of the vehicle, RAM must be identical to that of the vehicle.

f. Maintaining will be done by MWS-V maintenance personnel.

Rationale: As an integral part of the MWS-V, the Embedded Tactical Trainer must be maintained in a variety of environments. The fact that embedded training can be conducted in a combat theater of operations will be one of its strongest attributes. As such, the embedded training hardware must be maintainable in that environment, without special personnel requirements.

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TRAINING DEVICE REQUIREMENT (TDR)

FOR EMBEDDED TACTICAL ENGAGEMENT SIMULATOR (TES)
IN THE
MORTAR WEAPON SYSTEM VEHICLE (MWS-V)
(MWS-V, TES)

1. TITLE:

a. EMBEDDED TACTICAL ENGAGEMENT SIMULATOR IN THE MORTAR WEAPON SYSTEM VEHICLE (MWS-V) (MWS-V, TES).

b. CARDS REFERENCE NUMBER: TBD.

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contains an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987, signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide force-on-force collective sustainment training we have historically designed, developed and fielded strap-on training devices which vary in degrees of fidelity to the actual weapon performance. This method while successful in the past, was marginally adequate. This method is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support. Embedded tactical Simulation is proposed as a solution to this conflict. It is believed that state-of-the-art Tactical Simulation technology can be embedded into the actual vehicle optics, electronics and fire controls (switchology). Embedded Tactical Simulation may include, but should not be limited to, blast simulators, on-board computer assisted data collection systems, and eye-safe laser transmitters. This type of training requires a provision for feedback to the user and also records all exercises for After Action Reviews (AAR).

3. IOC: 3rd QTR FY93 (Prototype NLT 4th QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded Tactical Engagement Simulation capability will be used by AC/RC units to provide force-on-force training.

b. Tactical Engagement Simulation capabilities will be built into the MWS-V to enhance and maintain the skill proficiency necessary to employ the MWS-V.

c. Embedded Tactical Simulation capability will be used under all environmental and climatic or weather conditions.

d. Embedded Tactical Simulation capabilities will not require an alternate power source other than the MWS-V on-board source.

e. Embedded Tactical Simulation capabilities will not adversely impact the operational requirements or capabilities of the MWS-V and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded Tactical Simulation capability will train force-level collective tasks while exercising individual, crew, and section tasks.

g. Embedded Tactical Simulation capability will have the ability to expand with the vehicle technology. For example the current configuration for the MWS-V may change to a turreted mortar.

5. ESSENTIAL CHARACTERISTICS:

a. The MWS-V interior will not be significantly altered solely to incorporate Embedded Tactical Simulation capabilities.

b. Embedded Tactical Simulation capabilities will provide visual and aural stimuli of weapon vehicle and other battlefield stimulus. Stimuli presented will be responsive to operator manipulation of the MWS-V controls, buttons, switches, dials, etc.

c. Embedded Tactical Simulation capabilities will provide visual and aural cues to the crew, giving the perception of an operational MWS-V. Blast and firing simulation may be through the Weapons Effect Signature Simulator (WESS).

d. Aural and visual feedback will be provided in response to individual or crew control movement and switch manipulation required to operate and tactically maneuver the MWS-V or its main and supporting armament systems (as required).

e. RAM: Must meet the stated RAM criteria for the MWS-V.

f. Maintaining will be done by MWS-V maintenance personnel.

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g. The engagement simulators will be compatible with the standard Tactical Engagement Simulators for both direct fire and indirect fire weapons. Currently these are Multiple Integrated Laser Engagement System (MILES) and Surface Area Weapons Effects (SAWE), respectively.

h. For the main armament system (120mm Mortar), appropriate surface area effects and battle damage will be simulated/transmitted/reflected at the "did hit" location For example this may be through the transmission of gun data directly to a SAWE launcher servicing that target area. Who would in turn fire SAWE projectiles onto the did hit location.

i. All instrumented targets on the TES battlefield will have a target receptor which will detect and process the MWS-V, TES engagement codes and provide for target damage assessment.

6. TECHNICAL ASSESSMENT: Although tactical engagement simulators (e.g. MILES) have been fielded since the early 1980's, there does not currently exist a satisfactory means to simulate indirect fire weapons. While there are several ongoing initiatives, there have been no demonstrations of an Embedded Tactical Simulation on existing individual tactical vehicles. Based on the above, the technical risk associated with Embedded Tactical Simulation in MWS-V variants is considered very high for the main armament system but low for the supporting self-defense systems.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/Operator (I/O) will be required. Each vehicle commander will serve as an I/O.

b. Type classification is required. It should be type classified along with the tactical system.

c. Embedded Tactical Simulation concepts will be supported by notional training support packages developed and presented by the contractor.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded Tactical Simulation in the MWS-V will not increase manpower or force structure requirements.

b. Personnel Assessment: Embedded Tactical Simulation will be used to train MWS-V crewmen. The vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor in conjunction with the vehicle NET.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded Tactical Simulation procedures will be a part of the operators manuals, field manuals and maintenance manuals. The publications will be prepared and validated by the contractor and verified by USAIS prior to government acceptance.

(4) Training effectiveness and transfer will be established in the ITOE. There will be a transfer of training between Embedded Tactical Simulation and actual gunnery.

(5) MWS-V maintainers will have to be trained in the proper procedure for maintaining the embedded training components.

d. Human Factors Engineering (HFE): HFE information will come from a separate HFE analysis conducted on each Armored Family of Vehicles (AFV) variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmen, however, some of the existing approaches entail the firing of soft projectiles in the vicinity of other troops. This possibility must be evaluated for safety hazards.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmen.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for embedded training concepts will be used on other variants of the AFV family and in any event will have common architecture with all other AFV TESs.

b. The US Marine Corps could use the training concepts on the Marine variant of the MWS-V.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
Draft TDR Approval	TBD
MDR I	TBD
TT/ITOE	TBD
MDR II	TBD
IOC	3rd QTR FY93
CTEA	TBD

APPENDICES
1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEXES
A - LIFE CYCLE COST ASSESSMENT
B - COORDINATION

RATIONALE FOR ESSENTIAL TRAINING CHARACTERISTICS

TRAINING DEVICE REQUIREMENT (TDR) EMBEDDED TACTICAL SIMULATION SYSTEM (TSS) IN THE MORTAR WEAPON SYSTEM-VEHICLE (MWS-V) (MWS-V, TES)

1. PURPOSE: The purpose of the appendix is to set forth the rationale for selecting Essential Training Characteristics for Embedded Tactical Training in the General Purpose Carrier.

2. GENERAL: Embedded Tactical Training will be designed to provide a training capability built into the MWS-V such that each vehicles firepower can be exercised in force-on-force training events. The simulation will reenforce operator skills and will be perceived by the crewmembers such that they will perform those tasks which they would normally perform in an actual situation. The following provides that rationale for selection of the Essential Training Characteristics..

a. The MWS-V interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

Rationale: Embedded Tactical Training will be a means of achieving technical and tactical proficiency, not and end unto itself. As such, it should be transparent to the user to the greatest extent possible. Specifically, the environment of the crew compartment in the MWS-V should be designed to accommodate the normal operation of the vehicle under its stated operational profile and not solely for the purpose of facilitating training.

b. Embedded Tactical Simulation capabilities will provide visual and aural stimuli of weapon vehicle and other battlefield stimulus Stimuli presented will be responsive to operator manipulation of the MWS-V controls, buttons, switches, dials, etc.

Rationale: Visual and aural stimulation will be the ;means by which the crewmembers of the MWS-V will be cued to perform required tasks The extent to which that stimulation replicates an actual environment will directly impact on the quality of the training conducted. Correct actions by crewmembers should be rewarded by appropriate feedback and likewise, incorrect actions should result in a realistic continuation or worsening of the situation.

c. Embedded Tactical Simulation capabilities will provide visual and aural cues to the crew, giving the perception of an operational MWS-V . Blast and firing simulation may be through the Weapons Effect Signature Simulator (WESS).

Rationale: Crewmember response will be driven by cues which are the result of the simulation of an actual operating environment. Integration of the visual and aural cues into the existing sighting and communications equipment will provide the crewmember with the most realistic and effective cues.

d. Aural and visual feedback will be provided in response to individual or crew control movement and switch manipulation required to operate and tactically maneuver the MWS-V or its main and supporting armament systems (as required).

Rationale: Crewmember reaction to stimuli must result in realistic effects on the environment. These effects must closely relicate the actual effects in degree and intensity of resulting feedback. For example, if the driver properly responds to a warning gauge, the gauge should react by displaying the correct reading in approximately the same time frame as would be expected under normal conditions.

e. RAM: Must meet the stated RAM criteria for the MWS-V.

Rationale: Because Embedded Tactical Training will be an integral part of the vehicle, RAM must be identical to that of the vehicle.

f. Maintaining will be done by MWS-V maintenance personnel.

Rationale: As an integral part of the MWS-V, the Embedded Tactical Trainer must be maintained in a variety of environments. The fact that embedded training can be conducted in a combat theater of operations will be one of its strongest attributes. As such, the embedded training hardware must be maintainable in that environment, without special personnel requirements.

g. The engagement simulators will be compatible with the standard Tactical Engagement Simulators for both direct fire and indirect fire weapons. Currently these are Multiple Integrated Laser Engagement System (MILES) and Surface Area Weapons Effects (SAWE), respectively.

Rationale: The MWS-V will have contribute its firepower to a force training event through a family of tactical engagement simulators which have either a common architecture or a common protocol or both. MILES and SAWE are or will be this common core of hardware used to meet the requirement of exercising the total force.

h. All instrumented targets represented on the TES battlefield will have a target receptor which will detect and process the MWS-V, TES engagement codes and provide for target damage assessment.

i. For the main armament system (120mm Mortar), appropriate surface area effects and battle damage will be simulated/transmitted/reflected at the did-hit location. For example, this may be through the transmission of gun data directly to a SAWE launcher servicing that target area. Who would in turn fire SAWE projectiles onto the did-hit location.

Rationale: These paragraphs more specifically state the requirement to integrate the firepower of the MWS-V. The effects of the weapon must be identified and appropriately coded for P_b and P_k against various targets located in the immediate vicinity of where the gun actually would have projected the round to go (did-hit) as opposed to where the crew "thought" the round was to go.

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ANNEX P

TRAINING DEVICE REQUIREMENT (TDR)

FOR

GENERAL PURPOSE CARRIER

ENCLOSURE:

Embedded Tactical Training

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TRAINING DEVICE REQUIREMENT (TDR)
FOR
EMBEDDED TACTICAL TRAINING (ETT)
IN THE GENERAL PURPOSE CARRIER GPC)
(GPC-ETT)

1. TITLE:

a. EMBEDDED TACTICAL TRAINING IN THE GENERAL PURPOSE CARRIER (GPC-ETT).

b. CARDS REFERENCE NUMBER: TBD.

2. NEED: "The requirement to train in peace and war continues to exist. Soldiers and units that deploy to combat with equipment that contains an embedded training capability will possess the tools necessary to sustain proficiency in conjunction with combat operations. Further, peacetime constraints on individual and collective training caused by time, space and resource shortfalls are expected to continue", DA letter dated 3 March 1987, signed by VCSA and Under Secretary of the Army.

To meet the requirement to provide individual, crew and collective sustainment training we have historically designed, developed and fielded stand-alone training devices which vary in degrees of fidelity to the actual vehicle or the crew compartment. This method while successful in the past, is no longer feasible as training devices have recently been placed in direct funding competition with the actual vehicles/systems which they support in the institution and unit. Embedded tactical training is proposed as a solution to this conflict. It is believed that state-of-the-art tactical training technology can be embedded into the actual vehicle optics, electronics and fire controls (switchology). Embedded Tactical Training may include, but should not be limited to, simulators, on-board computer assisted instruction, laser disc technology, cassette tape and systems connected through a Local Area Network (LAN) This type of training requires a provision for feedback to the user and also records all exercises for After Action Reviews (AAR).

3. IOC: 3rd QTR FY87 (Prototype NLT 4th QTR FY91)

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. Embedded Tactical Training capability will be used by AC/RC units to provide sustainment training.

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b. Tactical training capabilities will be built into the GPC to enhance and maintain the skill proficiency necessary to employ the GPC.

c. Embedded Tactical Training capability will be used under all environmental and climatic or weather conditions.

d. Embedded Tactical Training capabilities will not require an alternate power source other than the GPC on-board source. However, an outside power capability is desired.

e. Embedded Tactical Training capabilities will not adversely impact the operational requirements or capabilities of the GPC and must be identified early enough to be incorporated into initial prototype designs.

f. Embedded Tactical Training capability will train individual tasks thru force-level collective tasks.

g. Embedded Tactical Training capability will have the ability to expand with the vehicle technology.

5. ESSENTIAL CHARACTERISTICS:

a. The GPC interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

b. Embedded Tactical Training capabilities will provide visual stimuli thru GPC optics and aural stimuli thru GPC communication systems. Stimuli presented will be responsive to operator or maintainer manipulation of the GPC controls, buttons, switches, dials, etc.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an operational GPC. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

d. Audio and visual feedback will be provided in response to individual or crew control movement and switch manipulation required to operate and tactically maneuver the GPC.

e. RAM: Must meet the stated RAM criteria for the GPC.

f. The system must be capable of operating as part of a local area net (LAN).

g. Maintaining will be done by GPC maintenance personnel.

h. Must be capable of transitioning from training to operational mode within 30 seconds.

i. Training systems must operate off either internal or external power.

6. TECHNICAL ASSESSMENT: Although computer based technology has matured to meet trainer requirements, it has not been demonstrated as an Embedded Tactical Training characteristic of existing tactical vehicles. Based on the above, the technical risk associated with Embedded Tactical Training in GPC variants is considered moderate to high.

7. SYSTEM SUPPORT ASSESSMENT:

a. No dedicated Instructor/Operator (I/O) will be required. Each vehicle commander will serve as an I/O.

b. Type classification is not required.

c. Embedded Tactical Training concepts will be supported by notional training support packages developed and presented by the contractor.

d. Modification of existing trackparks/construction of new trackparks with power/networking hook-ups will be required.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Embedded Tactical Training in the GPC will not increase manpower or force structure requirements.

b. Personnel Assessment: Embedded Tactical Training will be used to train GPC crewmembers. The vehicle commander may require some specialized training to apply the training technology effectively.

c. Training Assessment:

(1) New Equipment Training (NET) package will be provided by the contractor.

(2) The contractor will provide a training management handbook. The contractor will be responsible for technical updating while the government will be responsible for doctrinal and training changes. The contractor will incorporate all changes and publish a revised manual.

(3) Embedded Tactical Training procedures will be a part of the operators manuals, field manuals and maintenance manuals. The publications will be prepared and validated by the contractor and verified by USAIS prior to government acceptance.

(4) Training effectiveness and transfer will be established in the ITOE. There will be a transfer of training between Embedded Tactical Training and actual tactical training.

(5) GPC maintainers will have to be trained in the proper procedure for maintaining the embedded training components.

d. Human Factors Engineering (HFE): HFE information will come from a separate HFE analysis conducted on each Armored Family of Vehicles (AFV) variant.

e. System Safety: Embedded training technology will not increase the risk of injury to crewmembers.

f. Health Hazard Assessment: Embedded training technology will not increase the health hazard to crewmembers.

g. The System Manprint Management Plan (SMMP) provides detailed information on MANPRINT issues and concerns.

9. STANDARDIZATION AND INTEROPERABILITY:

a. The technology employed for embedded training concepts will be used on other variants of the AFV family.

b. The US Marine Corps could use the training concepts on the Marine variant of the GPC.

10. Life Cycle Costs: TBD

11. MILESTONE SCHEDULE:

EVENT	DATE
Draft TDR Approval	TBD
MDR I	TBD
TT/ITOE	TBD
MDR II	TBD
IOC	3rd QTR FY93
CTEA	TBD

APPENDICES
1 - RATIONALE
2 - CTEA
3 - RAM RATIONALE
4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE

ANNEXES
A - LIFE CYCLE COST ASSESSMENT
B - TDNS
C - COORDINATION

RATIONALE FOR ESSENTIAL TRAINING CHARACTERISTICS

TRAINING DEVICE REQUIREMENT (TDR) FOR EMBEDDED TACTICAL TRAINING (ETT) IN THE GENERAL PURPOSE CARRIER (GPC) (GPC-ETT)

1. PURPOSE: The purpose of the appendix is to set forth the rationale for selecting Essential Training Characteristics for Embedded Tactical Training in the General Purpose Carrier.

2. GENERAL: Embedded Tactical Training will be designed to provide a training capability built into the GPC such that individual and crew training may be conducted in either a stand-alone or networked configuration using the actual vehicle to operate in a simulated environment. That environment will be simulated through the use of onboard technologies and perceived by the crewmembers such that they will perform those tasks which they would normally perform in an actual situation. The following provides that rationale for selection of the Essential Training Characteristics..

a. The GPC interior will not be significantly altered solely to incorporate Embedded Tactical Training capabilities.

Rationale: Embedded Tactical Training will be a means of achieving technical and tactical proficiency, not an end unto itself. As such, it should be transparent to the user to the greatest extent possible. Specifically, the environment of the crew compartment in the GPC should be designed to accommodate the normal operation of the vehicle under its stated operational profile and not solely for the purpose of facilitating training.

b. Embedded Tactical Training capabilities will provide visual stimuli thru GPC optics and aural stimuli thru GPC communications systems. Stimuli presented will be responsive to operator or maintainer manipulation of the GPC controls, buttons, switches, dials, etc.

Rationale: Visual and aural stimulation will be the means by which the crewmembers of the GPC will be cued to perform required tasks The extent to which that stimulation replicates an actual environment will directly impact on the quality of the training conducted. Correct actions by crewmembers should be rewarded by appropriate feedback and likewise, incorrect actions should result in a realistic continuation or worsening of the situation.

c. Embedded Tactical Training capabilities will provide visual and audio cues to the crew, giving the perception of an operational GPC. Computer Generated Imagery (CGI) may be appended or may be part of the on-board computer system.

Rationale: Crewmember response will be driven by cues which are the result of the simulation of an actual operating environment. Integration of the visual and aural cues into the existing sighting and communications equipment will provide the crewmember with the most realistic and effective cues.

d. Audio and visual feedback will be provided in response to individual or crew control movement and switch manipulation required to operate and tactically maneuver the GPC.

Rationale: Crewmember reaction to stimuli must result in realistic effects on the environment. These effects must closely relicate the actual effects in degree and intensity of resulting feedback. For example, if the driver properly responds to a warning gauge, the gauge should react by displaying the correct reading in approximately the same time frame as would be expected under normal conditions.

e. RAM: Must meet the stated RAM criteria for the GPC.

Rationale: Because Embedded Tactical Training will be an integral part of the vehicle, RAM must be identical to that of the vehicle.

f. Maintaining will be done by GPC maintenance personnel.

Rationale: As an integral part of the GPC, the Embedded Tactical Trainer must be maintained in a variety of environments. The fact that embedded training can be conducted in a combat theater of operations will be one of its strongest attributes. As such, the embedded training hardware must be maintainable in that environment, without special personnel requirements.

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ANNEX Q

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

ADVANCED FIELD ARTILLERY SYSTEM CANNON

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TRAINING DEVICE REQUIREMENT (TDR) FOR THE ADVANCED FIELD ARTILLERY SYSTEM CANNON (AFAS-C)

1. TITLE:

a. ADVANCED FIELD ARTILLERY SYSTEM CANNON (AFAS-C) OPERATOR TRAINER AND UNIT MAINTENANCE TRAINER.

b. CARDS REFERENCE NUMBER: TBD.

2. NEED: These devices satisfy the need to provide realistic training for operator and maintenance personnel without the use of tactical equipment.

3. IOC: FY93

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The training devices will be used both in TRADOC schools/centers and in tactical AFAS-C units. The institutional training effort requires training devices which address operation and maintenance of the equipment associated with the advanced cannon system's command and control function.

b. The training devices developed for the institutional training effort will also be field exportable:

(1) To user units to complement training on tactical equipment which may not always be available. The use of the training device will also minimize training time spent on tactical equipment, thus reducing operational hours and system down time.

(2) To National Guard and Reserve units to maintain operator efficiency.

c. Institutional Training:

(1) Operator training. The operator training device will support operator training in the 13B10/20/30 Programs of Instruction at USAFAS. It will also be used to familiarize/refresh 13B40 soldiers and officer students.

(2) Maintenance training. The maintenance training device will support maintenance training at the appropriate institution.

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5. ESSENTIAL CHARACTERISTICS:

a. Operator Training Device:

(1) The training device will exactly duplicate all operator functions (operational/crew level maintenance) associated with command and control of the advanced cannon system to include fire control, position navigation, ballistic computation, computer activated defence mechanisms, computer/Artificial Intelligence based aids and communications.

(2) Description. The training device will be a dismounted version of the tactical equipment. Characteristics include:

(a) A mobile frame will house actual tactical components; maximizes commonality with tactical equipment thus allowing a readily available Operationally Ready Float (ORF) supply for mobilization and other contingencies. It will be used in a laboratory type environment. The frame must accommodate future configuration changes.

(b) A configuration that accommodates orientation/familiarization and task specific instruction.

1. Group instruction, for orientation/familiarization, will feature a student to equipment ration not to exceed 10:1.

2. More individualized instruction for task specific training, will feature a student to equipment ration not to exceed 5:1.

(c) An instructor's console which controls training device operation by simulating those tactical circumstances normally expected in a tactical environment.

1. The instructor will be able to program the training device with preset scenarios (operational/maintenance related) or be able to activate a series of randomly selected situations.

2. The instructor will be able to program the training device to operate over the same broad range of autonomy as does the tactical equipment.

(d) A networking capability which permits the configuration of up to eight training devices thereby simulating tactical operations in a tactical battery. This feature accommodates:

1. Command Post Exercise (CPX) training in the institution and in the unit.

2. Field Training Exercise (FTX) training in the unit. The FTX training, conducted at the battalion level, is beneficial for specialized training situations where it may not be practical to use tactical equipment; e.g.., Tactical Exercises Without Troops (TEWT).

(e) A central processing unit in the instructor's console which performs instructional related administrative tasks. Embedded capabilities include:

1. Storing, administering and processing various levels (by MOS skill level) performance oriented, hands-on tests.

2. Monitoring, processing, and storing records of student progress to include the capability to print copies of those records.

(f) A capability for instant, on-site reprogramming to keep pace with changed software/procedures resulting from changing doctrine and P^{3}I modifications.

1. Applications of changed software will be accomplished with self-contained reprogramming cassettes (magnetic) which are insertable into the instructor console's central processing unit.

2. An alternate means of reprogramming could be by direct link (digital or modem) with the agency responsible for controlling and distributing software changes.

(g) Operation through appropriate transformers/converters which convert commercial power into tactical vehicle power.

b. Maintenance Trainer:

(1) The training device will be an operator training device with additional maintenance related modules:

(a) Test Measurement Diagnostic Equipment (TMDE).

(b) Plug In Test Equipment (PITE).

(c) Other prognostic/diagnostic equipment.

(2) Instructor programmed/randomly generated scenarios (operational/maintenance) will include more detailed maintenance related activities.

c. Meet the following Reliability, Availability, and Maintainability (RAM) and Ao readiness objectives at any point from type classification to disposal.

Objective			Readiness		
Ao	ALDT		M	OMF	MTTR
.95					

d. Be designed to meet the following requirements:

(1) Operate in buildings using commercial power.

(2) Be capable of operating in classrooms with temperatures between 55-85 degrees Fahrenheit and a relative humidity of percent.

6. TECHNICAL ASSESSMENT: As the training devices are tactical components assembled into a dismounted laboratory configuration, the technical risk for training device development will be no greater than that of the tactical components. Training device development is dependent upon final operational and configuration characteristics of the tactical components.

7. SYSTEM SUPPORT ASSESSMENT:

a. The system support assessment will consist of a combination of government furnished and contractor logistical support. Operator's manuals will be prepared to government specifications.

b. Software support of this device will transfer to the government at the same time as the AFAS-C system software transition occurs.

8. MANPRINT ASSESSMENT:

a. Manpower/Force structure: Adding this system to the Program of Instruction will not create any impact on force structure. Instructors supporting Cannon courses will conduct the training sessions using this trainer.

b. Personnel Assessment: There will be no new personnel constraints required by introduction of this trainer. The personnel standards existing for Cannon training will be satisfactory for this trainer.

c. Training Assessment:

(1) This trainer will be used to train replacement (sustainment) personnel for assignment to fielded units once fielding of AFAS-C has begun.

(2) Training device technical manuals are required to be provided IAW Chapter 1, AR 510-1.

(3) This trainer will require training of instructors and other key personnel (IKP) prior to its full implementation at USAFAS.

d. Human Factors Engineering (HFE): An HFE Analysis will be performed by the Human Engineering Laboratory. The following are HFE considerations and restraints for training devices.

(1) Minimize personnel (instructor) skill requirements and training time during Initial Operating Test (IOT).

(2) Provide positive, easy to use, operator input features to include maximum use of menus and prompts.

e. System Safety: No significant safety hazards have been identified or are anticipated with the AFAS-C training devices IOT development, test, or use. The training must not create any vision, electrical, or noise hazards A system safety analysis will be conducted by the materiel developer prior to the AFAS-C initial operational test and evaluation (IOTE) IAW AR 385-16 and other applicable Army safety regulations.

f. Health Hazard Assessment (HHA): No significant health hazards are anticipated with the AFAS-C training devices development, test, or use. A system HHA will be conducted by the materiel developer prior to the IOTE, IAW AR 40-10.

9. STANDARDIZATION AND INTEROPERABILITY: Other service, NATO/ABCA, or allied interest is anticipated.

10. Life Cycle Cost: See Annex A, Life Cycle Cost Assessment. (TBP)

11. MILESTONE SCHEDULE: TBD

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APPENDICES	5A-1	- RATIONALE	TBP
	5A-2	- CTEA EXECUTIVE SUMMARY	TBP
	5A-3	- RAM RATIONALE	TBP
	5A-4	- OPERATIONAL MODE SUMMARY/ MISSION PROFILE	TBP
ANNEXES	5A-A	- LIFE CYCLE COST ASSESSMENT	TBP
	5A-B	- COORDINATION	TBP

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ANNEX R

TRAINING DEVICE REQUIREMENT (TDR)

FOR

FIRE SUPPORT COMBAT OBSERVATION LASING SYSTEM

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TRAINING DEVICE ANNEX

FOR THE

FIRE SUPPORT COMBAT OBSERVATION LASING SYSTEM (FSCOLS)

1. TITLE.

a. Fire Support Combat Observation Lasing System (FSCOLS) Trainer.

b. CARDS reference number _____.

2. NEED. This device satisfies the need to provide realistic training in identification, location, and engagement of targets without the use of tactical equipment.

3. TACTICAL OPERATING CAPABILITY. FY93

4. OPERATIONAL/ORGANIZATIONAL PLAN.

a. The FSCOLS trainer will be used to train new soldiers as well as maintain the skills of seasoned soldiers in institution and field units. This trainer must permit use in a controlled environment, yet simulate field conditions on actual equipment. The trainer, in conjunction with existing equipment and new proposed equipment, must produce a safe, yet realistic training situation.

b. The FSCOLS will be a frame device that houses a real FSV Turrent system complete hydraulics. Power requirements will be supplied by a 220 volt power converter. The FSCOLS should have a complete or simulated communications station that would provide for at least the installation of the fire support Team digital Message Devices (FIST-DMD).

5. ESSENTIAL CHARACTERISTICS. The FSCOLS Trainer will:

a. Interface with the Field Artillery Fire Support Training System.

b. Utilize interactive videodisc technology.

c. Present simulated tactical scenarios.

d. Provide interactive replication of DMD or FIST DMD.

e. Present terrain scenes and maps.

f. Stress the student/operator in target management, fire planning, and fire support coordination.

g. Have a scoring capability.

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h. Provide visual representation of effects of student/operator target plan and target management.

i. Train the student/operator on conventional and laser guided munitions.

j. Operate on 110/220v (50/60 Hz) commercial power with the capability for battery power or 12V DC power for unit training requirements.

k. Hot require special safety precautions to operate.

l. Have sufficient hardware replication for accurate operator interface and high training transfer for the G/VLLD and FIST V targeting station.

m. Meet the following Reliability, Availability, and Maintainability (RAM) and Ao readiness objectives at amy point from type classification to disposal:

Objectives		Requirements	
Ao	ALDT	MTBOMF	MTTR
.95			

n. The device must be capable of operating in classrooms with temperature between 65-85 degrees fahrenheit and a relative humidity of 50 percent. In addition, it shall meet the health and safety standards imposed upon the U.S. Army for training devices.

6. TECHNICAL ASSESSMENT. The FSCOLS Trainer will be designed to simulate the actual equipment in an operational environment. The trainer will facilitate full task, part task or team training using simulated scenarios. The trainer will be designed for instructor monitoring and control, and will have the capability to store large amounts of data and the capacity to retrieve, manipulate, generate and display data rapidly. The technical and developmental risks associated with the requirement are considered to be low based upon development of training devices having similar characteristics.

7. SYSTEM SUPPORT ASSESSMENT.

a. Type system support assessment will consist of a combination of government furnished and contractor logistical support. Operator's manual will be prepared to government specifications.

b. Software support of this device will transfer to the government at the same time as the FSCOLS system software transition occurs.

8. MANPRINT ASSESSMENT.

a. Manpower/Force Structure Assessment. Adding this system to the Program of Instruction will not create any impact on force structure. Instructors support FIST courses will conduct the training sessions using this trainer.

b. Personnel Assessment. There will be no new personnel constraints required by introduction of this trainer. The personnel standards existing for FIST training will be satisfactory for this trainer.

c. Training Assessment.

(1) This trainer will be used to train replacement (sustainment) personnel for assignment to fielded units once fielding of FSCOLS has begun.

(2) Training device technical manuals are required to be provided IAW Chapter 3, AR 510-1.

(3) This trainer will require training of instructors and other key personnel (IKP) prior to its full implementation at USAFAS.

d. Human Factors Engineering (HFE). An HFE Analysis will be performed by the Human Engineering Laboratory. The following are HFE considerations and restraints.

(1) FSCOLS-IOT will minimize personnel (instructor) skill requirements and training time.

(2) FSCOLS-IOT will provide positive, easy to use, operator input features to include maximum use of menus and prompts.

e. System Safety. No significant safety hazards have been identified or are anticipated with the FSCOLS-IOT development, rest, or use. the training must not create any vision, electrical, or noise hazards. A system safety analysis will be conducted by the material developer prior to the FSCOLS initial operational test and evaluation (IOTE) IAW AR 535-15 and other applicable Army safety regulations.

f. Health Hazard Assessment (HHA). No significant health hazards are anticipated with the FSCOLS Training device development, seat, or use. A system HHA will be conducted by the materiel developer prior to the IOTE, IAW AR 40-10.

9. STANDARDIZATION AND INTEROPERABILITY. Other service, NATO/ABCA, or allied interest is anticipated.

10. LIFE CYCLE COST ASSESSMENT. See Annex 4, Life Cycle Cost Assessment. (TBP)

11. MILESTONES SCHEDULE. TBD

APPENDICES/ANNEXES:

APPENDIX 5A-1 - RATIONALE	TBP
APPENDIX 5A-2 - CTEA EXECUTIVE SUMMARY	TBP
APPENDIX 5A-3 - RAM RATIONALE	TBP
APPENDIX 5A-4 - OPERATIONAL MODE SUMMARY/ MISSION PROFILE	TBP
ANNEX 5A-A - LIFE CYCLE COST ASSESSMENT	TBP
ANNEX 5A-B - COORDINATION	TBP

ANNEX S

TRAINING DEVICE REQUIREMENT (TDR)

FOR

ELEVATED TARGET ACQUISITION SYSTEM

TRAINING DEVICES ANNEX

FOR THE

ELEVATED TARGET ACQUISITION SYSTEM (ETAS)

1. TITLE.

a. Elevated Target Acquisition System (ETAS) Institutional Operator Trainer, Unit Maintenance Trainer, and Intermediate Maintenance Trainer.

b. CARD reference number _____.

2. NFEC. These devices satisfy the need to provide realistic operator and maintenance training without the use of tactical equipment.

3. INITIAL OPERATING CAPABILITY. FY93

4. OPERATIONAL/ORGANIZATIONAL PLAN.

a. The training devices will be used to provide classroom training for ETAS personnel at USAFAS. The Institutional training effort requires training devices which address operation and maintenance of the equipment associated with the ETAS system.

b. Institutional Training.

(1) Operator training.

(a) The operator trainer will support the 13XX skill level 1 operator training on the operation of the system's hardware. The operator trainer will allow one instructor to effectively train four students. USAFAS requires five operator trainers to accomplish the above training.

(b) The following chart indicates expected student load for ETAS instruction:

CLASS	STUDENT/CLASS	CLASSES/YEAR
ETAS Operator	35	19
ETAS Technician	3	2
ETAS Operator BNCOC	4	1
FATACCC	30	1

(2) Unit maintenance training.

(a) The ETAS unit maintenance training device will support the 13XX additional skill identifier maintenance tasks and diagnostic/troubleshooting tasks. The unit maintenance trainer will allow one instructor to effectively train four students. USAFAW requires three unit maintenance trainers to accomplish the above training.

(b) The following chart indicates expected student load for ETAS instruction:

CLASS	STUDENT/CLASS	CLASSES/YEAR
ETAS Operator/Mechanic	10	15
ETAS Technician	6	2

(3) Intermediate maintenance training.

(a) The ETAS Intermediate Maintenance Training devices will support MOS 39C maintenance and diagnostic/troubleshooting tasks. The intermediate maintenance trainer will allow one instructor to effectively train four students. USAFAS requires the unit maintenance trainers to accomplish the above training.

(b) The following chart indicates expected student load for ETAS instruction:

CLASS	STUDENT/CLASS	CLASSES/YEAR
ETAS Technician	6	2
Target Acquisition Surveillance and Repair	11	16

5. ESSENTIAL CHARACTERISTICS.

a. Operator Training Device.

(1) Compatibility with existing systems.

(a) Train tasks involving the interface between the ETAS computer system and the operator, and manual data entry during a mission, using the operator training device.

(b) Respond to manual, mechanical, and electrical inputs.

(c) Facilitate the training/evaluation of operator skills.

(d) Provide continuous computer assessments of individual and class training progress at the instructor station.

(e) Incorporate the use of a display unit at each station.

(f) Provide hard copies of student input and responses through the printer at the instructor station.

(g) Contain a general purpose alphanumeric keyboard with special function switches that will allow the instructor to call up, display and print out information.

(2) Continuity of operations. The ETAS Operator Trainer must:

(a) Train the ETAS operator personnel in those critical tasks associated with the operation of the tactical system.

(b) Incorporate training through the demonstration, practice, and skill development stages of hands-on training.

(c) Provide transfer of developed skills acquired on the trainers to the tactical hardware.

(d) Have five operator trainers each consisting of one instructor console and two-two student stations. The student-instructor ratio will be 4:1.

(e) Be designed with features which allow selection of various simulated operational scenarios by the instructor.

(f) Be developed and programmed to allow the instructor to stop the individual student scenario at any time.

(g) Require no more than 15 minutes initialization of the device to conduct operator training.

(3) Meet the following Reliability, Availability, and Maintainability (RAM) and Ao readiness objectives at any point from type classification to disposal:

Objectives		Requirements	
Ao	ALDT	MTECUF	MTR
.95			

(4) Be designed to meet the following requirements:

(a) Power requirements. The equipment will operate in buildings using commercial power.

(b) Environmental considerations. The devices must be capable of operating in classrooms with a temperatures between 33-35 degrees Fahrenheit and a relative humidity of 50

percent. In addition, it shall meet the health and safety standards imposed upon the U.S. Army for training devices.

(c) Desired computer language. The devices will operate on ADA.

(d) Student evaluation. Based on performance during the training scenario, the ETAS computer will assess student performance and prepare evaluation for the instructor, indicating areas of specific training deficits.

b. Unit Maintenance Trainer.

(1) Compatibility with existing systems.

(a) Respond to manual, mechanical, and electrical inputs.

(b) Facilitate the training/evaluation of maintenance skills.

(c) Provide continuous computer assessments of individual and class training progress at the instructor station.

(d) Incorporate the use of a display unit at each station.

(e) Provide hard copies of student input and responded through the printer at the instructor station.

(f) Contain a general purpose alphanumeric keyboard with special function switches that will allow the instructor to call up, display and print out information.

(g) Duplicate, with necessary fidelity, the features of the operational ETAS which are required for training.

(h) Be designed with the capability for programming and modification of training scenarios.

(2) Continuity of operations. The ETAS unit maintenance training device must:

(a) Train the unit maintenance personnel in those critical tasks associated with the maintenance of the practical system.

(b) Incorporate training through the demonstration, practice, and skill development stages of hands-on training.

(c) Provide transfer of developed skills required on the ADS trainers to the tactical mariners.

(d) Have three unit maintenance trainers each consisting of one instructor console and two-two student stations. The student-instructor ratio will be 4:1.

(e) Be designed with features which allow selection of various simulated operational scenarios by the instructor.

(f) Be developed and programmed to allow the instructor to stop the individual student scenario at day time.

(g) Require more than 15 minutes initialization of the device to conduct unit maintenance training.

(3) Meet the following Reliability, Availability, and Maintainability (RAM) and Ao readiness objectives at any point from type classification to disposal:

Objectives		Requirements	
Ao	ALDT	MTECUF	MTR
.95			

(4) Be designed to meet the following requirements:

(a) Power requirements. The equipment will operate in buildings using commercial power.

(b) Environmental considerations. The devices must be capable of operating in classrooms with a temperatures between 33-35 degrees Fahrenheit and a relative humidity of 50 percent. In addition, it shall meet the health and safety standards imposed upon the U.S. Army for training devices.

(c) Desired computer language. The devices will operate on ADA.

(d) Student evaluation. Based on performance during the training scenario, the ETAS computer will assess student performance and prepare evaluation for the instructor, indicating areas of specific training deficits.

c. Intermediate Maintenance Trainer.

(1) Compatibility with existing systems.

(a) Respond to manual, mechanical, and electrical inputs.

(b) Facilitate the training/evaluation of maintenance skills.

(c) Provide continuous computer assessments of individual and class training progress at the instructor station.

(d) Incorporate the use of a display unit at each station.

(e) Provide hard copies of student input and responded through the printer at the instructor station.

(f) Contain a general purpose alphanumeric keyboard with special function switches that will allow the instructor to call up, display and print out information.

(g) Duplicate, with necessary fidelity, the features of the operational ETAS which are required for training.

(h) Be designed with the capability for programming and modification of training scenarios.

(2) Continuity of operations. The ETAS unit maintenance training device must:

(a) Train the unit maintenance personnel in those critical tasks associated with the maintenance of the practical system.

(b) Incorporate training through the demonstration, practice, and skill development stages of hands-on training.

(c) Provide transfer of developed skills required on the ADS trainers to the tactical mariners.

(d) Have three unit maintenance trainers each consisting of one instructor console and two-two student stations. The student-instructor ratio will be 4:1.

(e) Be designed with features which allow selection of various simulated operational scenarios by the instructor.

(f) Be developed and programmed to allow the instructor to stop the individual student scenario at day time.

(g) Require more than 15 minutes initialization of the device to conduct unit maintenance training.

(3) Meet the following Reliability, Availability, and Maintainability (RAM) and Ao readiness objectives at any point from type classification to disposal:

Objectives		Requirements	
Ao	ALDT	MTECUF	MTR
.95			

(4) Be designed to meet the following requirements:

(a) Power requirements. The equipment will operate in buildings using commercial power.

(b) Environmental considerations. The devices must be capable of operating in classrooms with a temperatures between 33-35 degrees Fahrenheit and a relative humidity of 50 percent. In addition, it shall meet the health and safety standards imposed upon the U.S. Army for training devices.

(c) Desired computer language. The devices will operate on ADA.

(d) Student evaluation. Based on performance during the training scenario, the ETAS computer will assess student performance and prepare evaluation for the instructor, indicating areas of specific training deficits.

6. TECHNICAL ASSESSMENT. Reference ETAS ROC paragraph 6, the developmental risk associated with this device is moderate to low.

7. SYSTEM SUPPORT ASSESSMENT. All maintenance for the institutional devices will be performed by the contractor. The low density of ETAS training devices will not allow stockage of spare parts other than those considered running spares. Since the ETAS Institutional Training Devices will be low density items, exemption from type classification will be required.

8. MANPRINT ASSESSMENT.

a. Manpower/Force Structure Assessment. Adding this system to the Program of Instruction at USAFAS should not create any impact on force structure. The manpower to support these trainers should be provided by the Field Artillery School with instructors who are presently teaching on current generation ground surveillance radars. There may be a sight reduction in instructor personnel.

b. Personnel Assessment. There should be no new personnel constrained required by introduction of this trainer. The personnel standards existing for Firefinder training should be satisfactory for this trainer.

c. Training Assessment. This trainer will require training of instructors and other key personnel (IKP) prior to its full implementation at USAFAS.

d. Human Factor Engineering (HFE). An HFE analysts will be performed by the Human Engineering Laboratory. The following are HFE considerations and restraints.

(1) ETAS trainers will minimize personnel (instructor) skill requirements and training time.

(2) ETAS trainers will provide simplicity of operation such that the soldier-machine interface permits the most effective achievement of systems utilization.

e. System Safety. No significant safety hazards have been identified or are anticipated with the ETAS training devices. A system safety analysis will be conducted by the materiel developer prior to the initial operational test and evaluation (IOTE) IAW AR 385-15 and other applicable Army safety regulations.

f. Health Hazard Assessment (HHA). No significant health hazards are anticipated with the ETAS Trainer development, test, or use. A system HHA will be conducted by the materiel developer prior to the IOTE, IAW AR 40-10.

9. STANDARDIZATION AND INTEROPERATION. Other service, NATO/ADCA, or allied in anticipated.

10. LIFE CYCLE COST ASSESSMENT. See Annex A, Life Cycle Cost Assessment (TDP).

11. MILESTONE SCHEDULE. TBD.

APPENDICES/ANNEXES:

APPENDIX 50-1 - RATIONALE	TBP
APPENDIX 50-2 - CTEA EXECUTIVE SUMMARY	TBP
APPENDIX 50-3 - RAM RATIONALE	TBP
APPENDIX 50-4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE	TBP
ANNEX 5C-A - LIFE CYCLE COST ASSESSMENT	TBP
ANNEX 50-B - COORDINATION	TBP

UNCLASSIFIED

ANNEX T

TRAINING DEVICE REQUIREMENT (TDR)

FOR

ROCKET AND MISSILE SYSTEM

UNCLASSIFIED

TRAINING DEVICE ANNEX

FOR THE

ROCKET AND MISSILE SYSTEM (RAMS)

1. TITLE.

a. Rocket and Missile System (RAMS), Fire Control Panel Trainer, Rocket Pod Trainer with Fault Simulation Device, and Unit Maintenance Trainer.

b. CARDS reference number _____.

2. NEED. These devices satisfy the need to provide realistic training for operator and maintenance personnel without the use of tactical equipment.

3. INITIAL OPERATING CAPABILITY. FY95.

4. OPERATIONAL/ORGANIZATIONAL PLAN.

a. The training devices will be used both in TRADOC schools/centers and in tactical RAMS units. The institutional training effort requires training devices which address operation and maintenance of the equipment associated with the rocket and missile systems command and control functions.

b. The training devices developed for the institutional training effort will also be field exportable:

(1) To user units to complement training on tactical equipment which may not always be available. The use of the training devices will also minimize training time spent on tactical equipment, thus reducing operational hours and system down time.

(2) To National Guard and Reserve units to maintain operator efficiency.

c. Institutional Training.

(1) Fire Control Panel Trainer. The Fire Control Panel Trainer will support operator training in the 13M10/20/30 Programs of Instruction at USAFAS. It will also be used to familiarize/refresh 13M40 soldiers and officer students.

(2) Rocket Pod Container (RPC). The RPC with Fault simulation device will support training an loading/unloading procedures and operator/organizational maintenance of the RAMS

Rocket Pod System. The RPC trainer will be used in the institutional as well as tactical RAMS units.

(3) Maintainer Training. The maintainer training device will support maintainer training at the appropriate institution.

5. ESSENTIAL CHARACTERISTICS.

a. Fire Control Panel Training Device.

(1) The training device will duplicate all operator functions (operational/crew level maintenance) associated with command and control of the rocket and missile system to include fire control, position navigation, ballistic computation, computer activated defense mechanisms, computer/Artificial/ Intelligence based decision aids and communications.

(2) Description. The training device will be a dismounted version of the tactical equipment. Characteristics include:

(a) A mobile frame will house actual tactical components; maximizes commonality with tactical equipment thus allowing a readily available Operationally Ready Float (ORF) supply for mobilization and other contingencies. it will be used in a laboratory type environment. The frame must accommodate future configuration changes.

(b) A configuration that accommodates orientation/ familiarization and task specific instruction.

1 Group instruction for orientation/ familiarization, will feature a student to equipment ratio not to exceed 10:1.

2 More individualized instruction, for task specific training, will feature a student to equipment ratio not to exceed 6:1.

(c) An instructor's console which controls training device operation by simulating those tactical circumstances normally expected in a tactical environment.

1 The instructor will be able to program the training device with preset scenarios (operational/maintenance related) or be able to activate a series of randomly selected situations.

2 The instructor will be able to program the training device to operate over the same broad range of autonomy as does the tactical equipment.

(d) A networking capability which permits the configuration of up to eight training devices thereby simulating tactical operations in a tactical battery. This feature accommodates:

1 Command Post Exercise (CPX) training in the institution and in the unit.

2 Field Training Exercise (FTX) training in the unit. The FTX training, conducted at the battalion level, is beneficial for specialized training situations where it may not be practical to use tactical equipment; e.g., Tactical Exercises Without Troops (TEWT).

(e) A central processing unit in the instructor's console which performs instructional related administrative tasks. Embedded capabilities include:

1 Storing, administering and processing various levels (by MOS skill level) performance oriented, hands-on tests.

2 Monitoring, processing, and stapling records of student progress to include the capability to print copies of those records.

(f) A capability for instant, on-size reprogramming to keep pace with changed software/procedures resulting from changing doctrine and P^3I modifications.

1 Applications of changed software will be accomplished with self-contained reprogramming cassettes (magnetic) which are insertable into the instructor console's central processing unit.

2 An alternate means of reprogramming could be by direct link (digital or modem) with the agency responsible for controlling and distributing software changes.

(g) Operation through appropriate transformers/ contractors which convert commercial power into tactical vehicle power.

b. Rocket Pod Container.

(1) The trainer will have characteristics which will facilitate efficient training and optimal transfer of knowledge and skills related to the operational RAMS vehicles. The training will facilitate instructional functions through the demonstration, practice, and skills development stages of hands-on equipment training so as to realize optimal use of self-paced instruction and will enable the student to progress in the operation of the tactical equipment after a maximum of 40 hours.

(2) The trainer will incorporate an actual, tactical RPC identical to the RPC normally mounted on a tactical RAMS self-propelled launcher loader. This RPC will be mounted on a platform and placed in an institutional classroom environment.

(3) The trainer will be designed and constructed so that use and handling does not degrade trainer performance.

(4) The trainer shall be designed and constructed so that negligible personnel safety hazards exist.

(5) The RPC trainer should have its own power source to operate dismounted from the RAMS.

(6) The RPC trainer must be capable of operation in an institutional environment.

(7) Means will be provided to ensure that inappropriate control inputs by the instructor or student will not damage the trainer.

(8) The trainer shall respond to manual, mechanical, and electrical inputs with speeds representative of the tactical equipment. The trainer shall also provide features which allow deliberate instructor stopping of actions or responses for the purpose of illustration or demonstration.

(9) The training device will enable the student to be transmit an operator and organizational maintenance tasks.

(10) Environmental conditions for the trainer shall be the same as for the tactical equipment except that temperature limits shall be 0^{0}C to 51^{0}C and operating shock and vibration is nonapplicable.

(11) The trainer should be designed to ensure optimum economy and ease of maintenance. The design should be one that would all but eliminate the need for depot maintenance. There shall be no special installation of operation requirements in order to use the trainer in a standard classroom environment. As many repairs as possible should be performed at the lowest levels of maintenance.

(12) The trainer should be designed to allow expansion/ modification to incorporate future system developments/ modifications.

(13) In order to train operational/organizational maintenance personnel in the removal/replacement of modular components of the fire control system located on the RPC, "dummy" fire control system modules must be included in the design of the RPC trainer. These modules must be of similar size, weight, and appearance as actual modules in order to facilitate an effective transfer of knowledge. However, these

modules are not required to possess the electronic capabilities of tactical modules.

(14) This training device will incorporate a tactical RPC mounted on a platform. this platform must exactly simulate all conditions and actions/reactions the RAMS chassis offers during loading/unloading procedures. It must maintain the RPC at the same height from the floor as the RPC would be from the ground when mounted on a tactical RAMS. Also, the platform must articulate the RPC during loading/unloading of RPC's. In essence, this platform must allow the RPC to mechanically function as if it were mounted on the tactical RAMS.

c. Maintenance Trainer.

(1) The training device will be an operator training device with additional maintenance related modules:

(a) Test Measurement Diagnostic Equipment (TMDE).

(b) Plug In Test Equipment (PITE).

(c) Other prognostic/diagnostic equipment.

(2) Instructor programmed/randomly generated scenarios (operational/maintenance) will include more detailed maintenance related activities.

d. Meet the following Reliability, Availability, and Maintainability (RAM) and Ao readiness objectives at any point from type classification to disposal.

Objectives		Readiness	
Ao	ALDT	ATBOMF	MTTR
.95			

e. Be designed to meet the following requirements:

(1) Operate in a building using commercial power.

(2) Must be capable of operating in classrooms with temperatures between 55-85 degrees Fahrenheit and a relative humidity of 50 percent.

6. TECHNICAL ASSESSMENT. As the training devices are tactical components assembled into a dismounted laboratory configuration, the technical risk for training device development will be no greater than that of the tactical components themselves. Training device development is dependent upon final operational and configuration characteristics of the tactical components.

7. SYSTEM SUPPORT ASSESSMENT.

a. The system support assessment will consist of a combination of government furnished and contractor logistical support. Operator's manual will be prepared to government specifications.

b. Software support of this device will transfer to the government at the same time as the RAM system software transition occurs.

8. MANPRINT ASSESSMENT.

a. Manpower/Force Structure Assessment. Adding this system to the Program of Instruction will not create any impact on force structure. Instructors supporting RAMS courses will conduct the training sessions using this trainer.

b. Personnel Assessment. There will be no new personnel constraints required by introduction of this trainer. The personnel standards existing for RAMS training will be satisfactory for this trainer.

c. Training Assessment.

(1) This trainer will be used to train replacement (sustainment) personnel for assignment to fielded units once fielding of the RAMS has begun.

(2) Training device technical manuals are required to be provided IAW Chapter 3, AR 310-1.

(3) This trainer will require training of instructors and other key personnel (IKP) prior to its full implementation at USAFAS.

d. Human Factors Engineering (HFE). An HFE Analysis will be performed by the Human Engineering Laboratory. The following are HFE considerations and restraints.

(1) RAMS-IOT will minimize personnel (instructor) skill requirements and training time.

(2) RAMS-IOT will provide positive, easy to use, operator input features to include maximum use of menus and prompts.

e. System Safety. No significant safety hazards have been identified or are anticipated with the RAMS-IOT development, test, or use. The training must not create any vision, electrical, or noise hazards. A system safety analysis will be conducted by the material developer prior to the RAMS initial operational test and evaluation (IOTE) IAW AR 385-16 and other applicable Army safety regulations.

f. Health Hazard Assessment (HHA). No significant health hazards are anticipated with the RAMS Training Device development, test, or use. A system HHA will be conducted by the material developer prior to the IOTE, IAW AR 10-10.

9. STANDARDIZATION AND INTEROPERATION. Other service, NATO/ABCA, or allied is anticipated.

10. LIFE CYCLE COST ASSESSMENT. See Annex A, Life Cycle cost Assessment (TBP).

11. MILESTONE SCHEDULE. TBD.

APPENDICES/ANNEXES:

APPENDIX 5A-1 - RATIONALE	TBP
APPENDIX 5A-2 - CTEA EXECUTIVE SUMMARY	TBP
APPENDIX 5A-3 - RAM RATIONALE	TBP
APPENDIX 5A-4 - OPERATIONAL MODE SUMMARY/MISSION PROFILE	TBP
ANNEX 5A-A - LIFE CYCLE COST ASSESSMENT	TBP
ANNEX 5A-B - COORDINATION	TBP

ANNEX U

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

LINE-OF-SIGHT FORWARD HEAVY (LOS-AT)

TRAINING DEVICES

TO

FORWARD AREA AIR DEFENSE SYSTEM (FAADS)

1. (U) Title: FAADS Troop Proficiency Trainer (TPT)

a. (U) Operational and Organizational Concept

(1) (U) Operational Concept. The TPT should be a fire unit level training system used to train operators and crews in garrison and field environments. As a minimum, a strap-on TPT capability will be provided. It must remain operable when the weapon system carrier is inoperable. The TPT will be interactive with the FAAD C2I components, without special modification required beyond operator switch action and quick release strap-on attachments. When the device/training system is inoperable, fire unit operation must not be degraded. The TPT will have the capability to train individual and collective tasks. Engagement training scenarios should be subject to modification at the fire unit. Scenarios will display realistic engagement sequences which stimulate the full range of operator procedural reactions.

(2) (U) Organizational Concept. The TPT should be a strap-on device (not applicable to NLOS), or embedded in the software of the system. It is desired to be embedded. The TPT will be at all unit locations where FAADS fire units are assigned; or, at a minimum, platoon level.

b. (U) Essential Characteristics. The TPT will:

(1) (U) Provide real time, free play, single or two sided interactive simulation representative of tactical operations.

(2) (U) Provide track history reports, operator actions, and summary reports, and at the trainer's request, be outputted to hardcopy printout and recorded internally. The system will provide the capability for playback of the simulated exercise including any live data. A method for measuring proficiency will be established to determine performance to standard.

(3) (U) Provide the capability for preparing, storing and executing prescribed scenarios consisting of air tracks and weapons control orders which represent the threat and operational environments at the designated fire unit.

(4) (U) Provide instructor selectable scenarios and presentations. Scripting of scenarios must be a simple

operation. The device must be capable of allowing the instructor and/or operator to generate training scenarios.

(5) (U) Be capable of loading scenarios and be simulation-ready within 5 minutes.

(6) (U) Operate in a classroom environment with minimal requirements for environmental control.

(7) (U) Contain BIT capability to isolate faults to the modular level to facilitate replacement and ease of maintenance.

(8) (U) Provide the capability for conducting garrison and field training using tactical equipment and conducting Skill Qualification Training.

(9) (U) Be capable of operation on system or vehicle power or external 120 VAC, 60 Hertz/220 VAC, 50 Hertz power.

(10) (U) Be designed to be used in all worldwide locations, and specifically under climatic, motion and shock induced environments expected where FAADS will be deployed.

(11) (U) conform to safe visual and aural training standards.

(12) (U) Include technical manuals and other appropriate documentation prior to IOC.

(13) (U) Provide the capability for conducting individual operator and single unit training without the use of special purpose support equipment.

c. (U) Technical Assessment. The development of the TPT with each of the above characteristics is considered a low risk due to similarities in technologies and trainers developed for other systems.

d. (U) Logistic Assessment. The training device will have some impact on the current logistic support concept. There may be an impact on unit and intermediate maintenance if the TPT is embedded. If the device is strap-on, a contractor maintenance contract may be required to IOC or later.

e. (U) Training Assessment. The TPT will be used by instructors and unit trainers to train and evaluate the performance of personnel who must search, acquire, identify, track and engage targets in a realistic environment. Instructor and maintainer New Equipment Training (NET) may be required to establish correct use and maintenance of the device. Individual soldiers should require no special or prerequisite training. A technical manual and/or computer software program compatible with the Army's Electronic Information Delivery System (EIDS) outlining pre-operation, operation, and post operation

instruction will be produced by the manufacturers as part of the training support package.

f. (U) Manpower/Force Structure Assessment. There will be no increase in personnel requirements as a consequence of fielding the TPT. Currently authorized TOE personnel will operate the device and perform unit maintenance. No requirements for new MOSs are anticipated. Minimal additional training should be required to perform necessary user tasks.

g. (U) Funding. TBD.

h. (U) RAM. TBD.

2. (U) Title: FAADS Maintenance Part Task Trainer (MPTT).

a. (U) Organizational/Operational Plan.

(1) (U) Operational Concept. This maintenance trainer will be used to train maintenance and troubleshooting procedures and replacement of LRU's to the unit maintainer or operator/unit maintainer on the FAADS. The trainer should have the capability of training maintenance tasks. Training areas will have facilities to protect the trainer from the environment and have electrical power compatible to the trainer. It may be configured with a variety of input/output devices to permit delivery of technical data and instruction, 2D/3D simulation, testing, training management, and evaluation using appropriate service school unique software and courseware. The MPTT will reduce the tactical equipment training time.

(2) (U) Organizational Concept. The MPTT will be used at USAADASCH, Ft Bliss and other supporting institutions, to include Reserve Components with FAADS, where maintenance training will be required. These schools will provide a sheltered facility to contain the training device and for the conduct of maintenance training.

b. (U) Essential Characteristics:

(1) (U) Performance characteristics. The MPTT will:

(a) (U) Be a fully integrated 2D/3D trainer.

(b) (U) Provide hands-on instruction. (Be physically similar to actual equipment/assemblies).

(c) (U) Include a monitor.

(d) (U) Include a video disc player.

(e) (U) Include a computer floppy disc drive.

(f) (U) Include instruction for the cathodray tube (CRT).

(g) (U) Include a keyboard.

(h) (U) Include a hard copy printer.

(i) (U) Realistically simulate the operation and performance of actual equipment.

(j) (U) Be cable of accepting fault-insertion via software not possible with actual equipment.

(k) (U) Have the capability of safety training.

(l) (U) Be capable of accepting a variety of institutional strategies not possible with actual equipment such as:

1 (U) Expert modeling of hands-on tasks followed by immediate student hands-on applications.

2 (U) Guided application of tasks through audio/visual presentation of prompts and cues.

3 (U) Proficiency building of tasks in a drill and practice mode.

4 (U) Remediation through program branching and looping.

5 (U) Fully developed, self-paced adaptive lesson material to meet curriculum needs.

(m) (U) Have an instructor station to include:

1 (U) Microprocessor.

2 (U) Floppy disc data base.

3 (U) Temporary memory.

(n) (U) Have a video disc with stop action, motion and sound.

(o) (U) Have a capacity of over 50K (still or motion) instructional frames per disc sides.

(p) (U) Have the capability of providing individually paced performance training.

(q) (U) Nuclear survivability is not required.

(r) (U) NBC contamination survivability is not required.

(s) (U) The trainer will meet all applicable human factors engineering criteria specified in MIL-STD 1472.

(t) (U) Tempest qualifications will be added as a preplanned product improvement (P3I).

(u) (U) RAM for non-developmental items will satisfy mission requirements.

(v) (U) There are not ECM/ECCM requirements.

c. (U) Technical Assessment. The development of the MPTT with each of the above characteristics is considered a low risk due to similarities in technologies and trainers developed for other systems.

d. (U) Logistics Assessment. This trainer may be an off-the-shelf item with little development effort anticipated. The system will have some impact on the logistics support concept. Contractor maintenance support may be required for a minimum of one year.

e. (U) Training Assessment. The contractor will be required to provide training for the instructors and will provide appropriate operating/training guides. NET will be required for the FAADS unit maintenance personnel and intermediate maintenance personnel prior to the expiration of contractor furnished support.

f. (U) Manpower Assessment. No new MOSs will be required to maintain the MPTT.

g. (U) Funding. TBD.

h. (U) RAM. TBD.

3. (U) Title: FAADS System Peculiar Institutional and Unit Conduct of fire Trainer (ICOFT) (UCOFT).

a. (U) Operational/Organizational Concept.

(1) (U) Operational Concept.

(a) (U) The Unit conduct of fire trainer (UCOFT) will provide a stand-alone or integrated training capability to train FAADS Systems Peculiar Operations. It is desired that the UCOFT or another battalion level training system be capable of interactive participation in the close combat heavy task force tactical trainer, thereby providing FAADS platoon or battery tactical training in conjunction with company/team or battalion/ task force combined arms training. It may be combined with

training simulation capabilities which incorporate other elements of the Forward Area Air Defense system. The UCOFT at unit level may be an extension of the capabilities provided with the TPT, but must include the capability to exercise tasks and skills appropriate to platoon and battery level integrated training. A SIMNET-TYPE simulation capability for combined arms integrated training may be an adjunct to the unit COFT or it may stand alone depending on technological and cost effectiveness factors.

(b) (U) The Institutional Conduct of Fire Trainer (ICOFT) will provide the FAADS System peculiar equipment training at the institution. The device will be used to train performance tasks.

(2) (U) Organizational Concept. The ICOFT will be located at the United States Army Air Defense Artillery School (USAADASCH) Fort Bliss, Texas. The UCOFT derivative will be available at battalion level and at designated National Guard and Reserve forces training sites.

b. (U) Essential Characteristics.

(1) (U) This training device will provide full training of all identified tasks through the use of video. computer generated battlefield scenarios/targets must require the gunner to perform all anticipated mental processes and physical reactions in a time frame consistent with combat. All learned skills and knowledges will be directly transferable to the tactical hardware.

(2) (U) The ICOFT will provide:

(a) (U) A minimum of 3 active targets projected with applicable IR signatures and visual countermeasures.

(b) (U) High resolution, projected video targets which allow early target recognition and aircraft identification.

(c) (U) User friendly, menu driven software which informs the instructor of all the options available to him at a given time.

(d) (U) Accurate sound simulation to provide the trainee precise aircraft direction and distance cues. Battlefield sounds and scenario introductions will be instructor selectable.

(e) (U) Laser disc video allowing instant access to any scenario using the most durable medium available.

(f) (U) Accurate IR signature via computer control as a function of target range, type, and attitude.

(g) (U) IR countermeasure (flare drop) simulation provided for each target at the instructor's option.

(h) (U) IFF interrogation and early determination of friend/foe.

(i) (U) Target interception and impact simulation which will show the target exploding when a "hit" is scored.

(j) (U) Gunner scoring by computer evaluation of the weapon output signals. These signals are constantly displayed to the instructor.

(k) (U) Built-in self-test features that monitor the vital functions of the COFT.

(l) (U) Hardcopy output of the student's performance after each exercise that will consist of a timed event sequenced for:

1 (U) Target (Initial Cue)

2 (U) Contact (Visual Acquisition)

3 (U) Identification (Friend/Unknown)

4 (U) Army/Trigger Switch

5 (U) IR Tone

6 (U) Missile Launch

7 (U) Kill Assessment

8 (U) New Target (Multiple Targets)

(m) (U) Real-time display of aircraft trajectory image, range, bearing and weapon status consistent with the weapon system display.

(n) (U) Controls and indicators that will function/operate in the same manner as the tactical equipment.

(o) (U) A netted communications interface to the gunner which is capable of:

1 (U) Issuing command and Control Orders (i.e., Weapons Control Status, Air Defense Warning, Fire Control Orders).

2 (U) Simulated Missile Infrared Tone (Basic and Improved).

3 (U) Simulated Identification Friend/Foe (IFF) audio response.

4 (U) Simulated Interlock and Warning Signals.

(p) (U) An active emulator representing the peculiar system to be used in place of the actual weapon system. It will be a part task trainer in a total task environment.

(q) (U) Capability to operate on 110 VAC single phase, 60 Hz, 15 AMP power switchable to 220 VAC, 50 Hz commonly found at the Air Defense Artillery School (USAADASCH), National Guard, and Active Army FAADS units.

(r) (U) Associated computer power equipment that will not require any additional line conditioners/surge will not require any additional line conditioners/surge resistors, etc., (i.e., it will be a plug in the operate device).

(s) (U) Design of the console and sound generation that conforms to safe training visual and aural standards. The trainer must be engineered for movement by resources/equipment commonly available in a TDA/TOE FAADS unit. Use of the ICOFT will comply with military standards for toxic gas emissions, human factors engineering and design and will not introduce any health hazard.

(3) (U) The UCOFT will provide fully integrated training (command, control and intelligence) for personnel at the battalion, battery, and platoon. The UCOFT must be able to interface with the TPT.

c. (U) Technical Assessment. The development of the COFT with the above characteristics is considered low risk due to similarities in technologies and devices developed for other systems.

d. (U) Logistics Assessment. The training device will have some impact on the logistic support concept. It is anticipated that maintenance support will be by Contractor Logistical Support (CLS). A contractor maintenance contract will be required for a minimum of one year.

e. (U) Training Assessment. The contractor will be required to provide operator training for instructor personnel. An operator/training guide will be required. NET will be required for maintenance personnel required to assume the COFT maintenance mission after the maintenance contract expires.

f. (U) Manpower Assessment. No new MOSs will be required for operation and maintenance for the training device.

g. (U) Funding. TBD.

h. (U) RAM. TBD.

4. (U) Title: FAADS Target Requirements.

a. (U) Organizational/Operational Concept. Based upon current ADA training experience, it is imperative to redefine the training targets concept. The use of physical and simulated targets must be redefined within the training subsystems. The USAADASCH training concept is device-based and therefore the bulk of training will be conducted with simulators and/or devices which totally simulate the target environment. Physical targets will only be used as a means for crew qualifications, field situational training exercises (STX), and field support ARTEP mission training plans, and must be compatible with STRAC standards. The operational test (OT) requirements are also considered in identifying target requirements.

b. (U) Essential Characteristics.

(1) (U) The targets required to support the concept are a suite of 1/5 scale air platforms replicating all existing threat aircraft. the three basic targets are the fixed wing replication of the MIG-27, rotary wing, and the pop-up threat helicopter replicating the Hind-D. The current emphasis on the use of subscale targets is motivated by cost. Operationally, the subscale target is presented within a narrow "visually-scaled" window at close range to approximate the size and speed of a full-sized threat aircraft at a greater proportional range and speed. The resulting crew reaction time, gun lead angles, slew rate, etc., are the same thus making these targets valid. Because they are scaled targets and do not provide sufficient target volume, very few targets will actually be killed with direct hits. this requires a method of scoring hits rather than "flaming" the target. For instance, due to the lack of target size some weapons may never score direct hits on the subscale targets. All the targets must be capable of carrying interchangeable modules which give the platform the capability to simulate the technical characteristics of the threat platform and be able to stimulate the ADA acquisition systems of the respective FAADS weapons systems. The platforms must have shoot back, evaluation, multiple array, scoring and MILES/AGES capabilities.

(a) (U) Pop-up Targets. The pop-up targets shall be three-dimensional, 1/5 scale (plus or minus 5%), hollow models of the MI-24 HIND-D, HAVOC, and MI-8 HIP threat helicopters. They shall be constructed of fiberglass and painted "sand and spinach" in a camouflage pattern scheme using FM 44-30 as a general guide. They shall be capable of emulating hover (remain stationary with rotor blades rotating) and of being rotated in azimuth to provide varying perspectives. The target must be capable of sustaining multiple hits in non-vital

areas from 5.56 to 40 millimeter TPT rounds with minimum operational degradation. (vital areas are defined to be the rotor blade drive motor, electronics, controls, and mounting platform). The targets shall be easily repaired and, if necessary, replaced with one hour from start of work. they shall be capable of operating in temperatures ranging from 0 through 125 degrees Fahrenheit, and in winds up to 40 miles per hour. they must be adaptable to MILES equipment, must be capable of providing sufficient reflectivity (at scale distances) to actuate laser range finders, and capable of accommodating IR sources.

(b) (U) Stand/lift Mechanism. The stand/lift mechanism shall be a pneumatically-operated, remotely command-controllable (both wire and radio), telescoping mechanism. It must be capable of rotating the target in azimuth and of elevating the target from its defilade (nested) position to any height up to a maximum of twenty-six feet above the ground within 20 seconds upon receipt of command, and lowering the target to its defilade position 20 seconds upon receipt and command. It shall be capable of operating in temperatures ranging from 0 throught 125 degrees Fahrenheit, and in winds up to 40 miles per hour. The on-board generator shall be gasoline driven and capable of providing 110 VAC for sustained periods of up to seven hours duration in a desert environment. The stand/lift mechanism must be adaptable to the moving target carrier system of the Multi-Purpose Range Complex (MPRC).

(c) (U) Fixed Wing Targets. The fixed wing targets shall be three-dimensional, 1/5 scale, remotely piloted vehicle models of the MIG-27 FLOGGER D and SU-25 FROGFOOT threat aircraft, closely resembling the actual aircraft in scale, speed, and visual appearance. they shall be highly maneuverable and capable of executing attack profiles in both live fire and engagement simulation environments. They will be capable of payload operations including IR sources, near-miss indicators, pyrotechnics and have a growth capability option of fire-back with kill assessment.

(d) (U) Flat Panel Targets. The flat panel target shall be a full scale front view panel of the MI-24 HIND-D helicopter. Dimensions shall be 14 feet high and 7 feet wide with an attachable 8-foot winglet on each side, for a total width of 23 feet, plus or minus 5%. They shall be constructed of 3/4 inch plywood, painted olive drab with white and black markings and be braced in a manner which will enable them to function in winds up to 40 miles per hour and in temperatures ranging from 0 through 125 degrees Fahrenheit.

(e) (U) Radio Controlled Threat Helicopter Target (RCTHT). The RCTHT must present the physical appearance of the primary threat helicopter in 1/5 scale to satisfy aircraft recognition requirements. The target mechanism must have the

capability for interchanging parts to allow future expansion of additional threat as well as friendly helicopters. The RCTHT will:

1 (U) Be capable of controlled flight for vertical velocities (ascent and descent) of 3 feet per second as an altitude from 5 to 15 meters above ground level (AGL).

2 (U) Hover at controlled altitude (5 to 25 meters) for 1 minute, and perform jinxing maneuvers (limited side-to-side movements) while hovering.

3 (U) Operate at forward speeds of 0-30 knots, between 5 and 25 meters AGL.

4 (U) Be capable of controlled flight and hover in winds of 25 knots.

5 (U) Maintain 20 minute flight duration.

6 (U) Be capable of accepting a payload of 35 pounds without compromising flight characteristics.

7 (U) Be capable of controlled flight at 10,000 feet above mean sea level (MSL).

8 (U) Maintain radio-controlled flight to a range of 3000 meters from the operator.

9 (U) Operate on radio frequencies other than those used for radio controlled miniature aerial targets (RCMAT).

(2) (U) Radio Control Devices. Radio control equipment shall be capable of operating in a high electronic environment and have an effective range of at least 3 km. Radio controlled equipment shall operate on designated frequencies of 25.350 MHZ and 26.900 MHZ.

(3) (U) Scoring Device. The scoring device must be capable of scoring live fire rounds of 5.56mm, 7.62, cal .50, 30mm, 25mm, 30mm, and 40mm, and provide near-real time readout and hardcopy results of both hits and near-misses including missiles. It must be readily transportable and capable of operating in temperatures ranging from 0 to 125 degrees Fahrenheit.

(4) (U) Modular Concept. Interchangeable modules will give the target the capability to simulate the technical characteristics of the threat target and stimulate the FAADS component acquisition systems. These modules must provide:

(a) (U) Radar modulation.

(b) (U) Detectable infrared (IR) source.

(c) (U) MILES/AGES hit kill indicator.

(d) (U) Identification (IFF) device compatible with FAADS.

(e) (U) MILES/AGES shoot back capability.

(f) (U) Thermal detection device.

(g) (U) Radar cross section lenses.

c. (U) Technical Assessment. These targets, with the characteristics described, are considered low risk based on previous usage with other FAADS units.

d. (U) Logistic Assessment. No new MOS specialties will be required for organizational maintenance of these targets. It is anticipated that all maintenance and operations will be performed by assigned range personnel. Flight services personnel with ASI E-7 can be trained to operate the family of identified targets. A contractor maintenance contract will be required for a minimum of one year.

e. (U) Training Assessment. Targets will be used by instructors and unit trainers to train and evaluate the performance of personnel who must search, acquire, identify, track and engage targets in a realistic environment. Instructor and maintainer New Equipment Training (NET) may be required to establish correct use and maintenance of the targets. A technical manual and/or computer software program compatible with the Army's Electronic Information Delivery System (EIDS), outlining pre-operation, operation, and post operation instruction, will be produced by the manufacturers as part of the training support package.

f. (U) Manpower/Force Structure Assessment. There will be no increase in personnel requirements as a consequence of fielding these. Currently authorized TOE personnel will operate these devices and perform user maintenance. No requirements for new MOSs will be generated. Minimal additional training would be required to perform necessary user tasks.

g. (U) Funding. Approved air defense training target requirements are identified at the annual target requirements conference held in May of each year at the Target Management Office USA MICOM. All requirements are programmed, and the budget is established by FUSA MICOM.

h. (U) RAM. TBD.

5. (U) Title: FAADS Part Task Trainer (PTT).

a. (U) Operational/organizational Concept:

(1) (U) Operational Plan. The PTTs will be used to train FAADS operators and maintainers. Some of these devices will be used with the actual equipment, others with trainers, or as stand-alone devices. These devices may be configured with a variety of input/output devices to permit delivery of technical data, instruction, 3D simulation, testing, training management, and evaluation. The PTTs will reduce the requirements for training on the tactical equipment.

(2) (U) Organizational Plan. The PTTs will be used by all Active Army and Reserve components equipped with FAADS as removable and installation training devices. The PTT will be located at the United States Army Air Defense Artillery School (USAADASCH), Fort Bliss, Texas, United States Army Ordnance, Missile, Munitions Center and School (USAOMMCS), Restone Arsenal, Alabama and classrooms, learning centers, National Guard Armories, United States Army Reserve Centers, local training areas and field locations. These areas will be facilities to protect the trainer from the environment and provide electrical power compatible to the trainer.

b. (U) Essential Characteristics.

(1) (U) The PTTs can be in the form of training missiles (both dumb and smart). The dumb missile will be utilized to train reloading procedures. It will be completely inert and duplicate the actual missile in appearance and weight. The smart missile will be used to train actual engagement procedures. It will not contain any explosives or fuel. It will contain the other functional components that would provide feedback and allow the gunner to go through the entire firing cycle. The smart missile will also be used for fire unit operational checkout. These type trainers will be utilized at both the institution and unit.

(2) (U) PTTs can be mock-ups of LRUs and other components of FAADS that the operator and unit maintainer are authorized to replace IAW the MAC. These type trainers will be utilized within the institution.

(3) (U) A gun maintenance trainer will be required if the FAADS candidate selected has a gun. This device will be used to train operator and maintainer maintenance on the gun at the institution.

(4) (U) An organizational maintenance trainer will be required for the institution. This device will be used to train unit maintainers on maintenance tasks associated with FAADS components.

(5) (U) A Feed system trainer will be required for the institution. This device will be used to train operators and

unit maintainers on loading and unloading procedures. It will also be used to train hangfire, misfire and back-off procedures.

(6) (U) A training device to train maintenance and operator functions will be required, if the candidates have a complementary missile or rockets.

c. (U) Technical Assessment. The development of a trainer with the above characteristics is considered low risk due to similarities in technologies and trainers developed for other FAADS components.

d. (U) Logistics Assessment. These trainers may be off-the-shelf items with little development effort anticipated. These trainers will have some impact on the logistics support concept. No new MOSs will be required to maintain the PTTs. FAADS unit/intermediate MOSs will perform limited maintenance. Contract maintenance support will be provided in accordance with the guidelines for non-war time missions equipment in AR 750-1, Army Materiel Maintenance Concepts and Policies. Contractor maintenance support will be required for a minimum of one year.

e. (U) Training Assessment. This device will be used by instructor and unit trainers to train and evaluate the performance of personnel who must search, acquire, identify, track and engage targets in a realistic environment. Instructor and maintainer New Equipment Training (NET) may be required to establish correct use and maintenance of the PTTs. A technical manual and/or computer software program compatible with the Army's Electronic Information Delivery System (EIDS) which outlines pre-operation, during operation, and after operation instruction will be produced by the manufacturers as part of the training support package.

f. (U) Manpower/Force Structure Assessment. There will be no increase in personnel requirements as a consequence of fielding these PTTs. Currently authorized TOE personnel will operate these devices and perform user maintenance. No requirements for new MOSs will be generated.

g. (U) Funding. TBD.

h. (U) RAM. TBD.

6. (U) Title: Forward Area Air Defense System (FAADS) Maintenance Institutional Trainer.

a. (U) Operational/Organizational Plan.

(1) (U) Resident. This system will be used by the US Army Ordnance Missile and Munitions Center and School to train IM personnel. Weather conditions are not a factor since this trainer will be used in a classroom environment at the institutional training location. This device will be operated

and maintained by Table of Distribution and Allowances (TDA) personnel with initial contractor logistics support. The projected sustained student load for US Army personnel is 100 students per year.

(2) (U) Unit. The devices must be capable of supporting sustainment training in both the Active Army and Reserve Components as applicable. Projected load will depend on each site location.

b. (U) Essential Characteristics.

(1) (U) The IM trainer shall include but not be limited to the following:

(a) (U) Computer Based Instruction (CBI) Student Stations.

(b) (U) Instructor Station.

(2) (U) Additional weapon-specific characteristics:

(a) (U) NLOS:

1 (U) System Alignment Sequence Simulator

2 (U) Missile Launcher Erect/Retract

3 (U) Gunner Control Station Simulator

(b) (U) C^2I:

1 (U) Active and passive Sensor Suite Simulator

2 (U) Graphics Display and Associated Components Simulator

3 (U) Hand Held Remote Displays Simulator

(c) (U) LOS-R:

1 (U) Missile Fire Control Simulator

2 (U) System Sensor Suite Simulator

3 (U) Hydraulic/Electric Drive Systems Simulator

(d) (U) LOS-F:

1 (U) Gun/Missile Fire Control Simulator

2 (U) Active and Passive Sensors Simulators

3 (U) Hydraulic/Electric Drive Systems Simulators

(3) (U) The IM trainer will utilize to the maximum extent possible the software to be developed for the Operator and Organizational Maintenance Trainers.

(4) (U) The IM trainer will be capable of supporting the projected student load provided in paragraph 3.

(5) (U) The IM trainer will support training on IM tasks that will be defined. The maintenance trainer must provide programmed faults/malfunctions that utilize procedures beyond flow chart and BIT/BITE capabilities for diagnostic techniques with man-machine interface response to test, trouble shoot, fault isolate, and validate repair before continuing to the next programmed fault.

(6) (U) The IM trainer will possess the following characteristics:

(a) (U) It must provide performance oriented training to the maximum extent possible.

(b) (U) All tasks learned on the trainers shall be directly transferable to the tactical equipment.

(c) (U) It must provide tutorial/remedial training and fault insertion capability consistent with the skills and knowledge needed for IM personnel.

(d) (U) It must provide computer-assisted instruction and computer management of student achievement, i.e., scoring/recording.

(e) (U) System simulation developed in paragraph 3a must be capable of independent operation and integrated operation between simulators, so as to simulate the entire system. Three-dimensional (3D) simulator with instructor station. Each instructor station will be capable of controlling up to six simulator student stations.

(f) (U) It must simulate equipment faults/ malfunctions and built-in test equipment and provide practice in performing checks and adjustments.

(g) (U) It must provide realistic practice in the operation and use of test and measurement equipment for adjusting, aligning or diagnosing a tactical system.

(h) (U) It must take advantage of two-dimensional simulation for economy and three-dimensional simulation to ensure physical skill learning.

(i) (U) The man-machine interface feedback must simulate the tactical equipment responding in the same manner and shall have fidelity of performance approaching that of tactical equipment.

(j) (U) Must be capable of permitting easy modification of scenarios from the instructor station.

(k) (U) The trainer's performance must not be degraded by routine use and handling.

(l) (U) It must be designed to operate on 115/230 vac, 50/60 Hz; it must not require special environment controls, i.e., air conditioning, heat, humidity, or shielding from low to medium level of nonionizing radiation.

(m) (U) It must not provide a hazard to personnel. Health, safety, and human factors consideration will be IAW MIL-STDS 454F, 882B, 1472C and other appropriate standards.

(n) (U) Turn on and checkout of the equipment must not exceed 30 minutes and will include BIT/BITE functions for user maintenance. It must have instructor entry points for each training exercise that do not require more than an average of three minutes of repeated material.

(o) (U) The trainers, in their classroom configuration, must not require an area greater than 1,800 square feet and must fit through standard double door opening.

(p) (U) It must be designed for entry level training and must require the use of system technical publications.

(q) (U) It must have the capability to enable the instructor to monitor each student station and allow the instructor to generate the same or different malfunctions at any student stations. The instructor station must be capable of controlling up to 6 student stations, evaluating the students' progress and maintaining the students' records.

(r) (U) Reliability, Availability, and Maintainability.

1 (U) The preventive maintenance downtime allowable shall be less than .75 hours/per day.

2 (U) The Mean Time Between Operational Mission Failure (MTBOMF) shall be greater than 162 hours.

3 (U) The operational availability shall be at least 88 percent.

4 (U) The system trainer readiness goal is 77 percent.

(s) (U) Sufficient software capability will be retained to allow continuous upgrade of software during post deployment software support to support future growth requirements.

(6) (U) MANPRINT elements will be reviewed and considered in the development of IM trainer.

c. (U) Technical Assessment. The trainer shall be based on existing technology and lessons learned from the concepts, development, and use of mixture-type trainers. A good example is the Army Maintenance Test and Evaluation System (AMTESS). Using that and compatible Army technology available with existing Electronic Information Delivery System (EIDS) could produce a low to moderate technology risk.

d. (U) System Support Plan.

(1) (U) Unit maintenance shall be resident school TDA Maintenance personnel repair by removal/replacement of modules or chassis. Maximum use of BIT/BITE is required to identify faults within the trainer. Maintenance beyond unit maintenance shall be provided by contractor unless proven not to be cost effective. Operator and maintenance manuals will be provided in accordance with MIL-M-8276A.

(2) (U) AMC shall be responsible for planning, programming, budgeting and executing the contractor logistic support for the IM trainer through its life cycle or its replacement if it becomes impractical or not cost effective to maintain, IAW AR 700-17.

(3) (U) Configuration management of the trainer, including both hardware and software, shall be the responsibility of AMC for the life cycle of the trainer. Changes to the trainer shall occur concurrently with changes to the FAAD systems or technical manual.

(4) (U) The System Support Plan will be available prior to delivery and acceptance of equipment. It will include substitution of components because of obsolescence.

e. (U) MANPRINT Assessment.

(1) (U) Manpower/Force Structure Assessment. New new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA); tactical organization force structures are not affected.

(2) (U) Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

(3) (U) Training Assessment. The device will be an integrated part of the total training subsystem and will support the MOS skill development for the system.

(a) (U) Resident training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(b) (U) Unit training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(c) (U) New equipment training will be required for instructor and player/test personnel prior to full production.

(d) (U) Training devices will be available for evaluation by player/test personnel as parts of OT II.

(e) (U) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

(4) (U) Human Factor Engineering (HFE).

(5) (U) System Safety.

(6) (U) Health Hazard Assessment (HHA).

f. (U) Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

g. (U) Life Cycle Cost Assessment. TBD by material developer.

h. (U) Milestones. TBD.

(U) Different configurations of the devices listed above, or additional devices may be required for specific weapon system. (See TAB A.)

ANNEX V

TRAINING DEVICE REQUIREMENTS

FOR

NON LINE OF SIGHT VEHICLE

TRAINING DEVICES

TO

ANNEX I

NLOS

1. The development of a training subsystem to support the NLOS is essential to ensure that representative Army soldiers are able to effectively operate and maintain the system. A collective effort must occur in the development of a training subsystem, with equal emphasis provided by the material combat and training developers. Sophisticated state-of-the-art air defense weapon systems can no longer be fielded without accompanying training devices to train-up and sustain training in the field due to the following reasons:

a. The high costs of using tactical equipment with attendant maintenance, fuel, ammunition, and target costs require that the training base move from an equipment dependent solution to a training devices-based solution.

b. The limited availability of training areas and ranges to support deployed units mandate the use of training devices to sustain engagement skills at the unit level.

2. The NLOS training devices for institutions and units follow:

a. The training devices to be installed for institutional training are:

(1) Institutional Conduct of Fire Trainer (ICOFT) (USAADASCH) (MOS 16Y).

(2) Maintenance Part Task Institutional Trainer (MPTT) (USAADASCH) (MOS 24Y).

b. Additonal training devices to be located at USAADASCH to conduct officer, gunner and maintainer training in operation and unit maintenance are:

(1) Unit Conduct of Fire Trainer (UCOFT).

(2) Troop Proficiency Trainer (TPT) (Embedded).

(3) Launch Pod Trainer (LPT).

(4) Missile Assembly Trainer (MAT) (single round).

c. The Intermediate Maintenance Institutional Trainer (IMT) will be installed at USAOMMCS and used train intermediate maintenace personnel (MOS 27U and 27Y).

d. The Electronic Maintenance Delivery System (EIDS) courseware will be developed for each MOS to sustain learned skills and knowledges. This system will be used to assist soldiers in institutional (USAADASCH and USAOMMCS) and unit sustainment training.

e. The training devices to be developed and used for unit and field sustainment training are:

(1) Unit Conduct of Fire Trainer (UCOFT).

(2) Troop Proficiency Trainer Capability (TPT) (Embedded).

(3) Launch Pod Trainer (LPT).

(4) Missile Assembly Trainer (MAT).

3. The operational concepts for the NLOS training devices follow:

Institutional Conduct of Fire Trainer (ICOFT).

a. The ICOFT will be used for entry level training for NLOS gunner training. This training will have an instructor console/ station and six gunner stations. These gunner stations will be representative of the tactical fire unit in physical dimensions, operation and technical capabilities. Software developed for instructor operation of the ICOFT and scene and target generations for gunner training.

Maintenance Part Task Institutional Trainer (MPTT).

b. The MPTT will be used to train the NLOS unit maintainers. This device will be instructor operated with four student positions. These positions will allow unique trouble-shooting and maintenance training that will be both 2D/3D and permit student training in maintenance technique to isolate system malfunctions. These techniques will be for both scheduled and unscheduled maintenance actions.

Intermediate Maintenance Institutional Trainer (IMT).

c. The Intermediate Maintenance Trainer will be used to train intermediate (DS) maintenance personnel (Both DS contact teams and IFTE operators) in the performance of NLOS maintenance in missile support units. This trainer will be used in the instruction for electronic, mechanical and hydraulic fault isolation and repair.

Unit Conduct of Fire Trainer (UCOFT).

d. The UCOFT will provide the platoon leader a stand alone or integrated training capability to train and sustain his

gunners for fire unit crews, squads, platoon and platoon headquarters section. At the platoon level the UCOFT will be capable of interactive participation with the Combat Heavy Task Force Tactical Trainer thereby providing the NLOS platoon or battery tactical training with elements of the combined arms task force training (for example: simulation network (SIMNET)). The UCOFT can be combined with training interfacing capabilities which incorporate other components of the FAADS through the FAADS C2I subsystem. Each NLOS platoon will be issued a UCOFT.

Troop Proficiency Trainer Capability (TPT) (Embedded).

e. The fire unit TPT will be used for sustainment training of NLOS gunners in the field. This trainer will use embedded techniques, displaying video engagement sequences that stimulate gunner procedural reactions for mission success. The displayed scenarios will be of the assigned theater of operations and tactics of the command.

Missile Trainers (MT).

f. NLOS missile trainers will be provided to sustain crew missile loading, unloading and safety skills. Also, the missile trainers will contain an electrical interface to permit training in the connection of the umbilical cables.

4. The training provided by these devices will start at the known, and processed to the unknown, and from the simple to the complex.

5. The NLOS component will require:

a. A multi-media training subsystem, including interactive video disk (IVD) for the Electronic Information Deliver System (EIDS), will be developed IAW TRADOC Circular AR 351-86-Interactive Courseware Management Plan dated 30 Sep 86. The development of training material will be IAW TRADOC Regulation 350-7, Systems Approach to Training (SAT).

b. A training subsystem must train a minimum of 80% of individual tasks to standard in the institution and include an exportable training package that trains the remaining 20% and sustains all individual tasks to standard at the unit location and field environment. Additionally, an exportable training package containing the training material/material necessary to allow the functional chain of command to train and sustain all collective tasks will be required.

c. A standardized architecture of methods and media will be used to train and perform these tasks. Institutional and Unit Conduct of Fire Trainers (COFT) will be developed to initially train and sustain individual and collective crew tasks. An embedded Troop Proficiency Trainer (TPT) is required to provide

gunner sustainment training in the field environment. Both the UCOFT and the TPT will have the capability of inserting scenarios at the NLOS locations to exercise the primary NLOS staff officer and gunner tasks. The NLOS training subsystem will be capable of interfacing with FAADS components and with their training subsystems through the FAADS C^2I subsystem. Three dimensional (3D) mock-ups interfaced with IVD based multi-media two dimensional (2D) teaching machines are required to train and sustain individual gunner and maintenance tasks.

d. Detailed analysis of institutions and exportable training packages will be defined in the front end analysis (FEA) of the SAT process. Design and development effort shall ensure a media mix of training devices, mock-ups, and tactical equipment. Utilization of tactical equipment shall be minimized.

e. Mobility, survivability and sustainment training will be addressed in drills and Situation Training Exercises (STX), to include the Air Defense Exercises (ADX) and any variation thereof. FAADS will employ a suite of 1/5 scale (NLOS requires full scale) platforms, carrying interchangeable modules, which give the platform the capability to simulate the technical characteristics of the threat platforms, thus allowing the ability to simulate the sensing systems of the FAADS and satisfy the target requirement. With these resources, the unit commander's training can progress to cooperative training among the FAADS elements to a 3-dimensional Combined Arms Live Fire Exercise (CALFEX), and finally to a 3-dimensional force-on-force exercise.

f. To actively participate in force-on-force and war gaming, the NLOS system, an in-direct fire weapon, must be Combined Arms Training Integrated Evaluation System (CATIES) compatible. If possible, this device should be embedded in the fire unit.

6. The following NLOS training subsystem development requirements are the minimum which must be provided and supported:

a. All systems training requirements will be based on equipment data, functional data, and the task data worksheets, IAW MIL-M-63035, and will be generated as early as feasible.

b. A signed agreement on a complete task list developed IAW MIL-STD 1388-1A/MIL-STD 1388/2A/LSA/LSAR will be produced for operator, crew, and maintenance personnel through general support (GS) level. TRADOC will provide to material developer the target population description and will assist material developer in identifying any unusual training requirements.

c. An outline of all preliminary draft documentation and story board training materials for selected tasks will be

developed. Deliverable products for FDT&E will be determined on a case-by-case basis by agreement between TRADOC and material developer. The draft documentation, training devices and training materials will be used to train gunner/crew and maintenance personnel.

d. Doctrine and Tactics Training (DTT) will be provided by the TRADOC proponent school as part of the New Equipment Training (NET).

e. New Equipment Training (NET) will: Provide the initial gunner, maintenance, and technical training for the individual and collective tasks needed to operate and maintain the system. NEW will be conducted IAW AR 350-35. The training provided during NET must be the same or representative of that training intended to support the fielded system. The materiel developer will provide on site NET to the first unit equipped, to include all gunner, maintenance, and technical training needed to operate and maintain the system. The materiel developer will also provide all necessary gunner and maintenance publications needed to support training. The materiel developer will continue to provide NET until the school is capable of assuming all training responsibilities IAW contract agreement. The United States Army will furnish the necessary prerequisite training, the required doctrine and tactics training, and new organization training.

f. The training support package will be tested during FDT&Es (light and heavy).

INSTITUTIONAL CONDUCT OF FIRE TRAINER

1. Title: NLOS Institutional Conduct of Fire Trainer (ICOFT).

2. Operational/Organizational Concept.

a. Operational Concept. The institutional conduct of fire trainer (ICOFT) provides a stand alonge or integrated training capability to initially train NLOS gunners. The ICOFT will be used to train individual and collective tasks. This trainer (NLOS emulator) will have a minimum of one instructor control station and six gunner stations.

b. Organizational Concept. The ICOFT will be located at the United States Army Air Defense Artillery School (USAADASCH) Fort Bliss, Texas. A minimum of 80% of critical tasks and 100% of the survival skills will be trained at the institution.

3. Essential Characteristics.

a. This training device will provide training of all identified tasks through the use of computer generated realistic battlefield scenarios/targets. This training device must require the gunner to perform all antiticpated mental and physical actions and reactions. All learned skills and knowledges will be directly transferable to the tactical hardware.

b. The NLOS ICOFT will provide:

(1) A multi-missile training capability for training in multiple target environments.

(2) Up to 3 active targets projected with applicable IR signatures and visual countermeasures.

(3) Tactical system resolution video targets which allow early target recognition and aircraft identification.

(4) User friendly, menu driven software which informs the instructor of all the options available to him at a given time.

(5) Battlefield aircraft and missile sounds and scenario introductions will be instructor selectable.

(6) Laser disc video allowing instant access to any computer generated realistic scenario using the most durable medium available.

(7) Accurate IR signature via computer control as a function of target range, type, and attitude.

(8) IR countermeasure (flare drop) simulation provided for each target at the instructor's option.

(9) At least eight different background landscapes with selectable rain and fog.

(10) Target interception and impact simulation will be shown.

(11) Gunner scoring by computer evaluation of the weapon output signals. These signals are constantly displayed to the instructor.

(12) Built-in self-test features monitoring the vital functions of the ICOFT.

(13) Hardcopy output of the student's (gunner) performance after each exercise.

(14) Real time display of aircraft trajectory, image, range, bearing and weapon status consistent with the weapon system display.

c. Controls and indicators at the fire control station consoles will function/operate in the same manner as the tactical equipment fire control consoles.

d. The ICOFT will provided a netted communications interface to the gunner which is capable of issuing Command and Control Orders (i.e., Weapons Control Status, Air Defense Warning, Fire Control Orders).

e. The ICOFT will be capable of monitoring, recording and scoring each tactical engagement exercise and provide a printed, timed event sequenced for:

Target (Initial Cue)

Arm/Trigger Switch

Missile Launch

Search

Detect

Discriminate

Acquire

Attack

Assessment

New Target (Multiple Targets)

f. Interactive Video Disc (IVD) targets will be representative of present threat aircraft.

g. The ICOFT will operate on 100 VAC single phase, 60 HZ, power switchable to 220 VAC, 50 HZ. The associated computer power requirements should be such that the user/facility does not require any additional line conditioners/surge resistors, etc., (i.e., it will be a plug in and operate device).

h. The ICOFT shall not introduce any health hazard. Design of the console and sound generation must conform to safe training visual and aural standards.

4. Technical Assessment. The development of the ICOFT with the above characteristics is considered low risk due to the similarities in technologies and devices developed for other systems.

5. Logistics Assessment. The training device will have some impact on the logistic support concept. It is antiticpated that maintenance support will be by Contractor Logistical Support (CLS).

6. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. No new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA): tactical organization force structures are not affected.

b. Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

c. Training Assessment. The devices will be an integrated part of the total training subsystem and will support the MOS skill development for the NLOS system.

(1) Resident training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(2) Unit training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(3) New equipment training will be required for instructor and player/test personnel prior to full production.

(4) Training devices will be available for evaluation by player/test personnel as part of IOT&E.

(5) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

d. Human Factor Engineering (HFE). TBD.

e. System Safety. TBD.

f. Health Hazard Assessment (HHA). TBD.

7. Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

8. Life Cycle Cost Assessment. TBD by material developer.

9. Milestones. TBD.

10. RAM. TBD.

MAINTENANCE PART TASK INSTITUTIONAL TRAINER

1. Title: NLOS Maintenance Part Task Trainer (MPTT).

2. Organizational/Operational Concept.

a. Operational Concept. This maintenance trainer will be used to train unit maintenance personnel in troubleshooting procedures and replacement of Line Replacement Units (LRC). Training areas will have facilities to protect the trainer from the environment and have electrical power compatible to the trainer. It may be configured with a variety of input/output devices to permit delivery of technical data and instruction. The MPTT will reduce the tactical equipment training time.

b. Organizational Concept. The MPTT will be used at USAADASCH, Ft. Bliss and other supporting institutions whre maintenance training will be taught. These schools will provide a facility for the training device and for maintenance training. A minimum of 80% of critical tasks and 100% of the survival skills will be trained at the institution.

3. Essential Characteristics:

a. Performance characteristics: The MPTT will:

(1) Be a fully integrated trainer.

(2) Provide hands-on instruction. (Be physically similar to actual equipment/assemblies.)

(3) Include a monitor.

(4) Include a video disc player.

(5) Include a computer disc drive.

(6) Include an instructor console.

(7) Include a keyboard for alphanumeric entry.

(8) Include a hard copy printer.

(9) Include a BIT to identify faults within the trainer.

(10) Realistically simulate the operation and performance of actual equipment.

(11) Be capable of accepting fault-insertion via software not possible with actual equipment.

(12) Have the capability of safety training.

(13) Be capable of accepting a variety of institutional strategies not possible with actual equipment such as:

(a) Expert modeling of hands-on tasks followed by immediate student hands-on applications.

(b) Guided application of tasks through audio/visual presentation of promts and cues.

(c) Proficiency building of tasks in a drill and practice mode.

(d) Remediation through program branching and looping.

(e) Fully developed, self-paced adaptive lesson material to meet curriculum needs.

(14) An instructor station to include:

(a) Microporcessor.

(b) Compact disc data base.

(c) Short term memory.

(15) Have a video optical disc with stop action, motion and sound.

(16) Have a capacity of over 50K (still or motion) instructional frames per disc side.

(17) Have the capability of providing individually paced performance training.

b. Nuclear Survivability is not required.

c. NBC contamination survivability is not required.

d. The trainer will meet all applicable human factors engineering criteria specified in MIL-STD 1472.

e. There are no ECM/ECCM requirements.

4. Technical Assessment. The development of the MPTT with each of the above characteristics is considered a low risk due to similarities in technologies and trainers developed for other systems.

5. Logistics Assessment. This training device will have some impact on the logistics support concept. It is anticipated that maintenance support will be by Contractor Logistics Support (CLS).

6. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. No new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA); tactical organization force structures are not affected.

b. Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

c. Training Assessment. The devices will be an integrated part of the total training subsystem and will support the MOS skill development for the NLOS system.

(1) Resident Training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(2) Unit Training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(3) New equipment training will be required for instructor and player/test personnel prior to full production.

(4) Training devices will be available for evaluation by player/test personnel as part of IOT&E.

(5) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

d. Human Factor Engineering (HFE). TBD.

e. System Safety. TBD.

f. Health Hazard Assessment (HHA). TBD.

7. Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

8. Life Cycle Cost Assessment. TBD by material developer.

9. Milestones. TBD.

10. RAM. TBD.

INTERMEDIATE MAINTENANCE INSTITUTIONAL TRAINER

1. Title: Non Line of Sight. NLOS Intermediate Maintenance Institutional Trainer (IMT).

2. Operational/Organizational Plan.

a. Operational concept. This trainer will be used to train IM personnel. Training areas will have facilities to protect the trainer from the environment and have compatible electrical power. It may be configured with a variety of input/output devices to permit delivery of technical data and instruction. The IMT will reduce the tactical equipment training time. The projected sustained student load for U.S. Army personnel is 120 students per year.

b. Organizational Concept. The IMT will be located at the U.S. Army Ordnance Missile and Munitions Center and School (USAOMMCS), Redstone Arsenal. Table of Distribution and Allowances (TDA) personnel will operate and maintain the IMT with initial contractor logistics support. Project load will depend on each site location.

3. Essential Characteristics.

a. The IM Trainer will include but not be limited to the following:

(1) Computer Based Instruction (CBI) Student Stations.

(2) Instructor Station.

(3) Fire Control System Simulator.

(4) Passive Sensors Simulation.

(5) Hydraulic/Electric Drive Systems Simulator.

b. The NLOS IM trainer will utilize to the maximum extent possible the software to be developed for the Maintenance Part Task Trainer.

c. The NLOS IM trainer will be capable of supporting the projected student load provided in Paragraph 2a.

d. The NLOS IM trainer will support training on IM tasks that will be defined. The maintenance trainer must provide programmed faults/malfunctions that utilize procedures beyond flow chart and BIT/BITE capabilities for diagnostic techniques with man-machine interface response to test, troubleshoot, fault isolate, and validate repair before continuing to the next programmed fault.

e. The NLOS IM trainer will possess the following characteristics:

(1) It must provide performance oriented training to the maximum extent possible.

(2) All tasks learned on the trainers shall be directly transferable to the tactical equipment.

(3) It must provide tutorial/remedial training and fault insertion capability consistent with the skills and knowledge needed for IM personnel.

(4) It must provide computer assisted instruction and computer management of student achievement, i.e., scoring/ recording.

(5) System simulation developed in paragraph 3a must be capable of independent operation and integrated operation between simulators, so as to simulate the entire system. Three-dimensional (3D) simulator should be able to operate independently of two-dimensional (2D) simulator with instructor station.

(6) It must simulate equipment faults/malfunctions and built-in test equipment and provide practice in performing checks and adjustments.

(7) It must provide realistic practice in the operation and use of test and measurement equipment for adjusting, aligning or diagnosing a tactical system.

(8) It must take advantage of two-dimensional (2D) simulation for economy and three-dimensional (3D) simulation to ensure physical skill learning.

(9) The man-machine interface feedback must simulate the tactical equipment responding in the same manner and shall have fidelity of performance approaching that of tactical equipment.

(10) Must be capable of permitting easy modification of scenarios from the instructor station.

(11) The trainer's performance must not be degraded by routine use and handling.

(12) It must be designed to operate on 115/230 VAC, 60 HZ: It must not require special environment controls, i.e., air conditioning, heat, humidity, or shielding from low to medium level of nonionizing radiation.

(13) It must not provide a hazard to personnel. Health, safety, and human factors consideration will be IAW MIL-STDS 454F, 882B, 1472C and other appropriate standards.

(14) Turn on and checkout of the equipment must not exceed 30 minutes and will include BIT/BITE functions for user maintenance. Must have instructor entry points for each training exercise that do not require more than an average of three minutes of repeated material.

(15) The trainer's, in their classroom configuration, must not require an area greater than 10,000 square feet and must fit through standard double door opening.

(16) It must be designed for entry level training and must require the use of system technical publications.

(17) It must have the capability to enable the instructor to monitor each student station and allow the instructor to generate the same or different malfunctions at any student stations.

f. MANPRINT elements will be reviewed and considered in the development of NLOS IM trainer.

4. Technical Assessment. The trainer shall be based on existing technology and lessons learned from the concepts, development, and use of mixture-type trainers. A good example is the Army Maintenance Test and Evaluation System (AMTESS). Using that and compatible Army technology available with existing Electronic Information Delivery System (EIDS) could produce a low to moderate technology risk.

5. System Support Plan. Institutional maintenance shall be resident school TCS maintenance personnel repair by removal/ replacement of modules or chassis. Maximum use of BIT/BITE is required to identify faults within the trainer.

6. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. No new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA); tactical organization force structures are not affected.

b. Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

c. Training Assessment. The devices will be an integrated part of the total training subsystem and will support the MOS skill development for the NLOS system.

(1) Resident Training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(2) Unit Training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(3) New equipment training will be required for instructor and player/test personnel prior to full production.

(4) Training devices will be available for evaluation by player/test personnel as part of IOT&E.

(5) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

d. Human Factor Engineering (HFE). TBD.

e. System Safety. TBD.

f. Health Hazard Assessment (HHA). TBD.

7. Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

8. Life Cycle Cost Assessment. TBD by material developer.

9. Milestones. TBD.

10. RAM. TBD.

UNIT CONDUCT OF FIRE TRAINER

1. Title: NLOS Unit Conduct of Fire Trainer (UCOFT)

2. Operational/Organizational Concept.

a. Operational Concept. The UCOFT will provide a stand alone or integrated training capability to train NLOS gunners for fire unit crews, squads, platoon, and the platoon headquarters section. The UCOFT will be capable of training individual and collective tasks. The UCOFT, as a platoon level training system, should be capable of interactive participation with the Combat Heavy Task Force Tactical Trainer, thereby providing the NLOS platoon or battery tactical training in conjunction with company/team or battalion/task force combined arms training (e.g., simulation network (SIMNET)). It may be combined with training simulation capabilities which incorporate other elements of the FAADS through the FAADS C2I subsystem. The UCOFT basis of issue will be one per NLOS firing platoon.

b. Organizational Concept. The UCOFT will be located in the NLOS platoons, the United States Army Air Defens Artillery School (USAADASCH) Fort Bliss, Texas.

3. Essential Characteristics.

a. This training device will provide full training of all identified tasks through the use of video. Computer generated battlefield scenarios/targets must require the gunner to perform all anticipated mental processes and physical reactions in real time.

b. The NLOS UCOFT will provide:

(1) An integrated training capability for FAAD weapons.

(2) Up to 3 active targets projected with applicable IR signatures and visual countermeasures.

(3) Tactical system resolution video targets which allow early target recognition and aircraft identification.

(4) User friendly, menu driven software which informs the trainer of all the options available to him at a given time.

(5) Laser disc video allowing instant access to any scenario using the most durable medium available.

(6) Accurate IR signature via computer control as a function of target range, type, and attitude.

(7) IR countermeasure (flare drop) simulation provided for each target at the trainer's option.

(8) At least eight different background landscapes with selectable rain and fog.

(9) Target interception and impact simulation will be shown.

(10) Gunner scoring by computer evaluation of the weapon output signals. These signals are constantly displayed to the trainer.

(11) Built-in self-test features monitoring the vital functions of the UCOFT.

(12) Real time display of aircraft trajectory, image, range, bearing and weapon status consistent with the weapon system display.

c. The UCOFT will provide a netted communications Control Order (i.e., Weapons Control Status, Air Defense Warning, Fire Control Orders).

d. The UCOFT will be capable of monitoring, recording and scoring each tactical engagement exercise and provide a timed event sequenced for:

Target (Initial Cue)

Arm/Trigger Switch

Missile Launch

Search

Detect

Discriminate

Acquire

Attack Assessment

New Target (Multiple Targets)

e. Interactive Video Display (IVD) targets will be representative of present threat aircraft.

f. The UCOFT will operate on 110 VAC single phase, 60 HZ switchable to 220 VAC, 50 HZ. The associated computer power requirements should be such that the user/facilitator does not require any additonal line conditioners/surge resistors, etc., (i.e., it will be a plug in and operate device).

g. The UCOFT will not introduce any health hazard. Design of the console and sound generation must conform to safe

training and aural standards. The simulator must be engineered for movement by resources/equipment commonly available in a TDA/TOE NLOS unit.

4. Technical Assessment. The development of the UCOFT with the above characteristics is considered low risk due to similarities in technologies and devices developed for other systems.

5. Logistic Assessment. The training device will have some impact on the logistic support concept. System RAM requirements will be determined by analysis.

6. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. No new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA); tactical organization force structures are not affected.

b. Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

c. Training Assessment. The devices will be an integrated part of the total training subsystem and will support the MOS skill development for the NLOS system.

(1) Resident Training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(2) Unit Training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(3) New equipment training will be required for instructor and player/test personnel prior to full production.

(4) Training devices will be available for evaluation by player/test personnel as part of IOT&E.

(5) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

d. Human Factor Engineering (HFE). TBD.

e. System Safety. TBD.

f. Health Hazard Assessment (HHA). TBD.

7. Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

8. Life Cycle Cost Assessment. TBD by material developer.

9. Milestones. TBD.

10. RAM. TBD.

TROOP PROFICIENCY TRAINER

1. Title: NLOS Troop Proficiency Trainer Capability (TPT).

2. Operational and Organizational Concept.

a. Operational Concept. The TPT will be used for sustainment training of NLOS gunners in the field environment. This trainer will use embedded techniques and will have fewer capabilities than the UCOFT. When the device is nonoperational it must not degrade the operation of the tactical equipment. The TPT will have the capability to train individual tasks of the gunner. Scenarios will display engagement sequences that stimulate gunner procedural reactions. The TPT will have the capability to interface with the UCOFT for a battalion network configuration.

b. Organizational Concept. The TPT should be embedded in all NLOS systems.

3. Essential Characteristics. The TPT will:

a. Provide real time, free play interactive simulation representative of tactical operations.

b. Provide the capability for executing preplanned scenarios consisting of air tracks and weapons control orders which represent the threat and operational environments of the NLOS fire unit.

c. Provide the gunner selectable scenarios and presentations. Scripting of scenarios must be a simple operation. The device must be capable of allowing the trainer and gunner to select training scenarios.

d. Be capable of loading scenarios quickly.

e. Contain BIT capability to isolate faults to the modular level.

f. Be capable of operation on vehicle power system.

g. Be designed to be used in worldwide locations, and specifically under climatic, motion and shock induced environments expected where NLOS will be deployed.

h. Conform to safe visual and aural training standards.

i. Include technical manuals and other appropriate documentation prior to IOC.

j. Provide the capability for conducting individual gunner and netted unit training with the added capabilities of the UCOFT.

4. Technical Assessment. The development of the TPT with each of the above characteristics is considered a medium risk.

5. Logistics Assessment. The training device will have some impact on the current logistics support concept. There may be an impact on unit and intermediate maintenance.

6. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. No new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA); tactical organization force structures are not affected.

b. Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

c. Training Assessment. The devices will be an integrated part of the total training subsystem and will support the MOS skill development for the NLOS system.

(1) Resident Training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(2) Unit Training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(3) New equipment training will be required for instructor and player/test personnel prior to full production.

(4) Training devices will be available for evaluation by player/test personnel as part of IOT&E.

(5) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

d. Human Factor Engineering (HFE). TBD.

e. System Safety. TBD.

f. Health Hazard Assessment (HHA). TBD.

7. Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

8. Life Cycle Cost Assessment. TBD by material developer.

9. Milestones. TBD.

10. RAM. TBD.

LAUNCH POS TRAINER

1. Title: NLOS Launch POD Trainer (LPT)

2. Operational/Organizational Concept.

a. Operational Concept: The Launch POD Trainer (LPT) will be used to train NLOS gunners loading/reloading and launching skills at the institutions and sustainment training in the field units. The LPT will be capable of training individual and collective tasks. The NLOS light version will have LPTs consisting of training missile containers. The heavy version will have 6 LPTs consisting of 4 training missile containers.

b. Organizational Concept: The LPTs will be located at the United States Army Air Defense Artillery School (USAADASCH), Fort Bliss, Texas, and all field units. A minimum of 80% of critical tasks and 100% of the survival skills will be trained at the institution.

3. Essential Characteristics:

a. This training device will provide training of all identified tasks by individual and collective instruction. The LPT must require the gunner to perform all anticipated mental and physical reactions. All learned skills and knowledges will be directly transferable to the tactical hardware.

b. The NLOS training Launch POD Container will provide:

(1) Same center of gravity as tactical model.

(2) Same mechanical assembly points for vehicle mounting.

(3) Same lift points.

(4) Same attach points for additional LPCs.

(5) Same physical size, weight, and cubic measurements.

4. Logistics Assessment: The training device will have some impact on the logistics support concept. May require IM support.

5. MANPRINT Assessment.

a. Manpower/Force Structure Assessment. No new MOS or civil service specialties will be required to operate or maintain this device. A reduction in current numbers of instructors and maintainers is anticipated. However, a precise number cannot be determined until completion of a Front End Analysis (FEA); tactical organization force structures are not affected.

b. Personnel Assessment. The skills and knowledges required will not be greater than those needed for other air defense systems. The training device will not increase soldier prerequisites.

c. Training Assessment. The devices will be an integrated part of the total training subsystem and will support the MOS skill development for the NLOS system.

(1) Resident Training. New equipment training will be required for TDA personnel operating and maintaining this device. Training packages are required for sustainment training.

(2) Unit Training. New equipment training will be required. Training packages will be required to be exported to TOE personnel.

(3) New equipment training will be required for instructor and player/test personnel prior to full production.

(4) Training devices will be available for evaluation by player/test personnel as part of IOT&E.

(5) Instructor and test player personnel training will be required prior to production. NET will be required to support initial fielding of the system. Resident and extension training materials will be determined by the ILS process.

d. Human Factor Engineering (HFE). TBD.

e. System Safety. TBD.

f. Health Hazard Assessment (HHA). TBD.

6. Standardization and Interoperability. There is no other service or allied equipment in development that would meet this requirement.

7. Life Cycle Cost Assessment. TBD by material developer.

8. Milestones. TBD.

9. RAM. TBD.

MISSILE ASSEMBLY TRAINER

1. Title: NLOS Missile Trainer (MT).
2. Operational/Organizational Concept. To be determined.
3. Essential Characteristics. To be determined.

UNCLASSIFIED

ANNEX W, X, Y, Z, AA, BB

TRAINING DEVICE REQUIREMENTS (TDR)

FOR

SAPPER VEHICLE
COMBAT MOBILITY VEHICLE
MINE DISPENSING VEHICLE
COMBAT EXCAVATOR
COMBAT EARTHMOVER
COMBAT GAP CROSSER

NOTE: All TDR for engineer vehicles listed above are identical in content with exception of the title.

UNCLASSIFIED

DRAFT
TRAINING DEVICE REQUIREMENT (TDR)

1. TITLE:

a. EMBEDDED TRAINING SUBSYSTEMS AND/OR DEVICES

b. CARDS REFERENCE NUMBER.

2. NEED: The Armored Family of Vehicles (AFV) will eventually replace the entire fleet of currently fielded and projected armored engineer vehicles throughout Active Components (AC), Reserve Components (RC), and the Army National Guard (ARNG). The AFV will be characterized by incorporation of modularity, component commonality (with a goal of total commonality). Embedded training subsystems and/or devices will be required to train maintenance personnel on the hull of the SV. Embedded training can be especially useful to RC units. An embedded training subsystem and/or device that is effective, efficient, and requires little maintenance is necessary to reduce the restrictive costs associated with training on actual equipment. The embedded training subsystems and/or devices will enable maintenance personnel to obtain hands-on-training at reduced costs (POL, PLL, maintenance from actual equipment. Maintenance personnel will receive a viable alternative to critical "sticktime" without being adversely affected by climatic conditions

3. IOC: 1st QTR FY95

4. OPERATIONAL AND ORGANIZATIONAL PLAN:

a. The Combat Engineer AFV Variants are designed to provide the maneuver commander with critical AirLand Battlefield support in the area of mobility, countermobility, survivability and limited general engineering. The goal is to have survivable, capable combat engineer resources at the right time and place on the AirLand Battlefield enabling the maneuver commander to concentrate his maneuver and fire support assets on their primary tasks. The Engineer variants of AFV will be assigned to combat engineer units in armored and mechanized divisions and to supporting corps combat engineer units. They will be supported by the standard Army maintenance and logistics systems.

b. The embedded training subsystems and/or devices will be used in selected CONUS and OCONUS locations for institutional training and at the battalion level for unit training.

c. Weather and climatological factors are to be considered since the embedded training subsystems and/or devices are intended for indoor or outdoor use worldwide.

d. The embedded training subsystems and/or devices will be used world wide for individual training of AC/RC.

5. ESSENTIAL CHARACTERISTICS:

a. The AFV will be designed with advanced technology and all the features may not integrate with the existing training system. It is envisioned that the training will provide programmed scenarios which allow the student to interact with the embedded training subsystems and/or devices to take action such as required maintenance actions. This training will be controlled, with trainee evaluation data provided, by means of an instructor console. The instructor console will contain the controls required to simulate the desired inputs and the devices necessary for monitoring, recording, and scoring the performance of each student.

b. Continuity of operations is not considered to create any problems in training schedules, rescheduling or loss of training caused by interruptions.

c. Existing security procedures for physical security of equipment or systems is adequate. There is no foreseen requirement for additional personnel or training.

d. Reliability, availability, and maintainability (RAM): TBD.

e. The AFV will be characterized by incorporation of modularity, component commonality (with a desired goal of total commonality) and standardization for maintenance of the hull of the Engineer Family of Vehicles.

f. Communications: as required.

g. Adverse weather and reduced visibility conditions will not affect use of maintenance training.

h. The embedded training subsystems and/or devices will be transportable between training sites.

6. TECHNICAL ASSESSMENT: To be provided by the Materiel Developer/PM TRADE.

7. SYSTEM SUPPORT ASSESSMENT: To be provided by the Materiel Developer/PM TRADE.

8. MANPRINT ASSESSMENT:

a. Manpower/Force Structure Assessment: The embedded training subsystems and/or devices will have no adverse impact on the force structure. No new MOS's will be generated for maintenance personnel.

b. Personnel Assessment: There will be no additional requirements for maintenance personnel training since the embedded training subsystems and/or devices will be designed to require no new MOS's and existing training programs will be adequate. The contractor will prepare a training support package consisting of operator and maintenance training. Pertinent publications will include, as a minimum, handbooks/manuals which cover all maintenance tasks associated with the subsystems and/or devices. Documentation will be validated and verified for technical accuracy and adequacy prior to acceptance by the government.

c. Training Assessment: The subsystems and/or devices are not intended to place any additional manpower requirements for instructor personnel. Those instructor personnel who are responsible for conducting "hands-on training" on actual equipment will be used to train personnel on the embedded training subsystems and/or devices. The subsystems and/or devices will be used to supplement training in situations where actual equipment may not be available due to adverse weather conditions and maintenance downtime. It will also be used to train-up personnel before placing them on actual equipment. The planned training strategy assumes that the embedded training subsystems and/or devices will have the capability to support training of maintenance on a variety of engineer equipment which includes: Sapper Vehicle (SV), Combat Mobility Vehicle (CMV), Mine Dispensing Vehicle (MDV), Combat Gap Crosser (CGC), Combat Excavator (CEX), and Combat Earthmover (CEM).

It is not known at this time whether a single subsystems and/or devices with interchangeable operating controls or a family of equipment specific subsystems and/or devices will support this capability. However, any such embedded training subsystems and/or devices will emphasize hand/eye coordination and safe, effective equipment operation The embedded training subsystems and/or devices must be within the scope of a total training system, teach critical concepts and skills, and be less expensive to operate than the actual equipment.

All high driver tasks identified in early comparability analyses will be eliminated or simplified. All critical tasks are to be taught in the institution. The contractor will conduct the Initial Instructor and Key Personnel Training (IKPT) and the materiel developer will conduct new equipment training for the subsystems and/or devices. The contractor will, in conjunction with the Army needs, furnish a complete stand-alone program capable of providing all phases of instructor training required to effectively operate the embedded training subsystems and/or devices.

d. Human Factors Engineering (HFE): Ensure crew performance of all critical tasks with .95 reliability by not less that 90% of the population. Develop workspace layout that facilitates crew performance of the 5th to 95th percentile soldier. Ensure equitable distribution of crew workload during peak workload. Reduce error likelihood of high, and moderately high, critical errors to less that 5%.

e. System Safety/Health Hazard Assessment: The systems must remove or design-out any identified hazardous conditions in the system. Real and potential hazards will be removed. Residual hazards or unsafe conditions will be reduced. Any adverse effects will be minimized to levels acceptable by the government. This will be done by the development of safety-specific design features, devices, procedures, training, or personnel protective equipment.

9. STANDARDIZATION AND INTEROPERABILITY: The concept of the Armored Family of Vehicles is to standardize the embedded training subsystems and/or devices, maximizing component commonality and modularity. The goal is to maximize efficiencies in support, training, and other resources within existing and projected doctrinal applications. The possibility may exist for the U.S. Marine Corps to establish a joint venture and share the cost of development and procurement.

10. Life Cycle Cost Assessment: To be provided by the Materiel Developer/PM TRADE.

11. MILESTONE SCHEDULE:	DATE (FY and QTR)
List one:	
a. TDR Approval	
b. MDR I	
c. TT/IOTE begin and end	
d. MDR II	
e. TT/IOTE begin and end	
f. MDR III	
g. IOC	
List two:	DATE (FY and QTR)
a. TDNS approval	
b. TDR submission	FY87, 4th QTR
c. JWG I	FY86, 3d QTR
d. JWG III	
e. TDR approval	
f. MDR I/II	
g. DT/OT	
h. MDR III	
i. IOC	FY95, 1st QTR

APPENDIX 1

RATIONALE ANNEX

1. Ref 5a.

In order to provide realistic training, the embedded training subsystems and/or devices must replicate actual maintenance procedures and provide recording and scoring abilities for individuals being trained.

2. Ref 5b.

The embedded training subsystems and/or devices must be able to survive continuous operations to support training in the institutional and unit environments.

3. Ref 5c.

The embedded training subsystems and/or devices will be secured and accounted for by use of the TOE or TDA.

4. Ref 5d.

The RAM requirements are to be determined.

5. Ref 5e.

The goal of the engineer variants of the AFV is total commonality and standardization.

6. Ref 5f.

Communications will be provided as required for operation of the training system.

7. Ref 5g.

The embedded training subsystems and/or devices must be able to function under all weather conditions worldwide.

8. Ref 5h.

This requirement is to allow flexibility for the training unit to use organic vehicles to transport the training system between training sites.

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THE FOLLOWING ANNEXES (TDR)
WERE NOT SUBMITTED

CC - MAINTENANCE ASSISTANCE AND REPAIR SYSTEM

DD - RECOVERY VEHICLE

EE - INTELLIGENCE AND ELECTRONIC WARFARE VEHICLE

FF - NUCLEAR, BIOLOGICAL AND CHEMICAL WARFARE SYSTEM

GG - COMBAT SMOKE VEHICLE

HH - ARMORED SECURITY VEHICLE

II - ARMORED AMBULANCE

JJ - ARMORED BATTALION AID STATION

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APPENDIX B

(U) TRAINING

TO TRANSITION

THE ARMORED FAMILY OF VEHICLES

INTO

THE ARMY

(This Appendix Is Unclassified)

SEPTEMBER 1987

TRAINING TO TRANSITION THE ARMORED FAMILY OF

VEHICLES INTO THE ARMY

1. Problem.

a. Historically, the Army essentially replaces old systems with new systems on a one-for-one basis. This process has been accomplished with relative ease as a coordinated effort between the Combat and Materiel Developer and receiving MACOM. The structure for the process is prescribed in AR350-35, New Equipment Training Plan (NETP).

b. The scope, complexity, and enormity of modernizing Active Component and Reserve Component Roundout units with the AFV in force packages -- dramatically changes the approach to new equipment training. This Appendix contains a concept and methodology for transitioning the AFV into the Army.

2. Assumptions. To develop an analytical base the following assumptions were made:

a. AFV will contain about 42,000 vehicles of which 2400 will be fielded annually.

b. AFV transition will be a brigade slice package each quarter and a division fielded each a year.

c. All required AFV systems will be available within a fielding cycle.

d. The required elements of the AFV training subsystem will be in place to support each fielding cycle.

e. A training center capable of training a brigade size force with full-time live fire and maneuver capability is required.

f. Fielding will begin 1996 and continue until entire force has transitioned to AFV.

g. Storage facilities will be required if production is not adjustable to fielding cycle. It is not cost effective to keep production line warm for low density items.

h. Central management of AFV transition training will be accomplished through the AFV Program Executive Office.

3. Facts Bearing on the Problem.

a. AFV fleet will be the basis of armored vehicle inventory for mid 1990's through next AFV.

b. AFV O&O Plan lists 29 mission roles.

c. Historically, the Army has not fielded Armored Vehicles as force packages.

d. The most capable and available brigade size training areas are in CONUS, e.g., a brigade level fielding program of the AH64 is on-going at Ft. Hood, Texas.

e. Facility availability in Europe is becoming more constrained, e.g., the AGB 75 process and restationing 1st Brigade, 1st Armored Division at Vilseck.

f. Capability to build or modify facilities in Europe is constrained.

g. Force readiness while brigades are transitioning must be maintained.

4. Discussion.

a. The training concept for AFV transition is based upon:

(1) Development and execution of the requirements contained in the New Equipment Training Plans (NETP) for each AFV system IAW AR 350-35.

(2) Availability of the training subsystem for each training cycle.

(3) Certification of proficiency by simulation or devices before operation of full service equipment.

(4) Capability to train the following categories to proficiency:

(a) Individual

(b) Crew

(c) Unit

(d) Combined Arms

b. Because of the scope, complexity, and duration of the AFV transition, the management concept for transition training is based upon:

(1) A closely coordinated effort with displacement of the current fleet of armored vehicles into the Reserve Components.

(2) A closely coordinated effort with receiving MACOM and Combat and Materiel Development agencies for AFV materiel.

(3) Central programming, direction, and execution by the AFV Program Executive Office.

c. To accomplish the AFV transition, three alternatives are considered.

(1) Alternative 1. One Facility (CONUS). This alternative requires assembly of personnel and AFV equipment at one central CONUS location. The facility will have the capability for training one brigade equivalent force to standard each quarter employing maneuver and live fire as required. When training is complete personnel and equipment return to home station.

(2) Alternative 2. Two Facilities (One CONUS, One FRG.) This alternative requires assembly of personnel and AFV equipment at a CONUS facility for training CONUS units and a facility in Germany for training European based units. Each facility will have the capability to train a brigade equivalent force to standard each quarter employing maneuver and live fire as required. When training is complete, units return to appropriate home station.

(3) Alternative 3. Fielding Team. This alternative requires establishment constitution of a fielding team that would travel to the unit home station to execute AFV transition. AFV equipment would be assembled and positioned to facilitate unit acceptance and training. The fielding team would transition a brigade force equivalent each quarter.

d. Analysis of the alternatives will measure each in terms of:

(1) Resource requirements

(2) Training requirements

(3) Readiness requirements

A detailed analysis is in Annex A. A summary of each alternative follows.

e. Single CONUS facility.

(1) Advantages.

(a) One dedicated facility with permanent training and transition staff capable of force level training.

(b) Best format for training uniformity, consistency and quality control.

(c) Best range and maneuver capability for brigade level training. All weather, day, and night.

(d) Adequate air/rail capabilities.

(e) Can be selected near production centers and/or port facilities.

(f) Large operational CONUS facility will require the lowest facility and personnel start-up costs.

(g) AFV equipment and personnel match-up, hand-off and acceptance simplified.

(2) Disadvantages.

(a) Readiness impact associated with OCONUS to CONUS movement.

(b) Resources required to offset readiness impact when forward deployed units are transitioned.

(c) Dedicated site, staff, equipment, and facilities will be required.

(d) Start-up costs can be extensive if under developed location selected.

(e) Transportation costs associated with personnel and equipment movement.

f. Two facilities (CONUS/FRG).

(1) Advantages.

(a) Eliminates moving personnel from Europe to CONUS.

(b) Enhances USAREUR readiness by keeping GDP oriented combat forces in country.

(2) Disadvantages.

(a) Severe maneuver, firing, facility, and real estate constrains exist in FRG.

(b) A dedicated full-time facility capable of training brigades quarterly is not available in FRG.

(c) Training, transitioning, and readiness can be severely compromised by competing demands for scarce facilities.

(d) Duplicate facilities required.

f. Fielding Team.

(1) Advantages.

(a) Forward deployed forces remain in operational area.

(b) Unit turbulence reduced.

(c) Major transportation costs reduced by eliminating unit movement from home station to a central training site.

(2) Disadvantages.

(a) Training facilities and capabilities not consistent or necessarily available when required.

(b) As team moves about, training uniformity and quality not consistent across the force.

(c) Unique facilities required at most transition locations to support team activities.

(d) Due to transitory nature of team transitioning, coordination requirements will be extensive.

(e) Economy and synergism of centralization is lost.

(f) Many personnel and family problems associated with long standing, traveling teams.

5. Conclusions.

a. Army modernization by transition to the AFV is an unparalleled effort.

b. Each brigade force fielding cycle requires full participation of all TRADOC proponents, integrating centers, AMC, and MACOM.

c. Due to the enormity and complexity of the effort, a central CONUS training facility provides:

(1) The best assurance that brigade slice packages of personnel and equipment will be assembled, trained to Army standards and deployed to home station.

(2) Single source of transition management and coordination across the Army.

(3) Army level consistency, continuity, and quality control.

(4) Best capability for maintaining readiness. Returns units to home station consistently trained to Army standards.

(5) The best ROI compared to other alternatives.

d. Central management of transition training effort at the PEO level is essential.

6. Action Required. Implement concept to transition AFV into the Army using a central CONUS facility.

ANNEX A

Analysis of Fielding Options

APPENDIX C

(U) UNIT AND INSTITUTIONAL SUSTAINMENT TRAINING

FOR

THE ARMORED FAMILY OF VEHICLES

(This Appendix Is Unclassified)

SEPTEMBER 1987

UNIT AND INSTITUTIONAL SUSTAINMENT TRAINING

FOR THE

ARMORED FAMILY OF VEHICLES

1. Problem. Determine unit and institutional sustainment training concept and program for the Armored Family of Vehicles.

2. Assumptions. To establish an analytical base, the following factors are considered.

a. AFV will replace current armored vehicle fleet.

b. AFV transition will begin in 1996 with 42,000 vehicles being fielded at the rate of 2400 each year.

c. The current fleet of armored vehicles will be transitioned into the Reserve Components.

d. All TRADOC proponent schools and Integrating Centers will be directly involved with:

(1) AFV New Equipment Training (NET).

(2) AFV Sustainment Training (Unit and Institution).

(3) Reserve Component Displaced Equipment Training (DET).

(4) Training development efforts in the areas of new/revised MOS, POI, training support materiels, etc.

e. The existing training/support base is inadequate to concurrently:

(1) Support AFV NET and transition training,

(2) Sustain fielded AFV,

(3) Sustain current fleet until replaced, and

(4) Support DET for Reserve Components.

f. Large inventories of nonsystem and strap-on devices are impractical, expensive to buy and maintain and cumbersome to use.

g. Future training technology will be sufficiently mature to provide:

(1) An embedded training capability integral and organic to each AFV system that can provide a significant

capability to train and maintain critical individual, crew, and collective tasks in the unit. This includes the capability to net with other embedded training systems enabling collective and combined arms training, and an ARTEP/AMTEP/SQT capability.

(2) Stand-alone simulations/devices that can provide basis for preponderance of institutional training:

(a) Common driver, operator and maintainer simulation can replace significant amounts of operational equipment and training ammunition.

(b) Common simulations and AFV MOS adjustment can lead to more centralized maintenance and driver training.

h. With state of the art embedded and stand-alone devices and simulations, attainment, and sustainment of individual, crew, collective, and combined arms training will be possible with reduced training ammunition, OPTEMPO, Class III and IX consumption and facilities. Savings are estimated at twenty percent.

i. Simulation may be the only way to realistically train unsafe, impractical or uneconomical to train tasks to standard.

j. Once certified by simulation, live fire and operational equipment can be used to:

(1) Validate proficiency.

(2) Provide the "feel" of the battlefield.

(3) Provide realism and stress the command and control system.

k. Heavy reliance on operational equipment, live fire, and OPTEMPO will not be affordable, particularly in the future.

l. An AFV training subsystem can be developed, tested, validated and fielded with operational equipment that is both cost and training effective.

3. Facts Bearing on the Problem:

a. The AFV:

(1) Is an integrated armored force equipped with a variety of subsystems.

(2) Will modernize the Active Army and roundout units.

(3) Will result in the modernization of the Reserve Components.

b. AFV modernization provides signal opportunity to:

(1) Modernize heavy force Army training.

(2) Field training subsystem with operational equipment.

(3) Essentially eliminate the requirement for after the fact simulations and devices.

(4) Reduce training costs in the unit and institution.

c. AFV training subsystem must provide capability to train and sustain force readiness.

4. Discussion.

a. The current Army training scenario can be summarized as follows:

(1) The training subsystem for new equipment historically follows fielding.

(2) When funds are curtailed, training is usually first on the list to be cut.

(3) The Non-System Training Device Program was established to essentially fill the gap between training which should have been developed and fielded and that which was actually developed and fielded.

(4) Units/commands fabricate devices and materiels to fill perceived/real training gaps.

(5) System training devices tend to be large, complex and require a sustainment program in their own right (UCOFT).

(6) The field is required to maintain large quantities of training devices and equipment in ware houses to strap-on equipment or emplace to train (MILES).

(7) Unit commanders are not totally aware of what training equipments are available and how to use them.

(8) Institutional training depends in large part on operational equipment and training ammunition.

(9) Department of the Army and TRADOC have initiated programs consisting of standards for qualification and suggested training strategies using combinations of devices, simulation and ammunition to achieve and maintain those standards. The programs are:

(a) Standards in Weapons Training (DA PAM 350-XX), and

(b) The Battalion Level Training Model.

(10) There continues to be a heavy reliance in the field and institution on live fire and operational equipment to attain and maintain readiness.

b. There is no question that devices and simulation can provide the capability to attain and sustain training proficiency to standard.

(1) A well designed simulator can often do a better job of developing and sharpening skills than does live ammunition. Simulators have a measurement capability that can be used to precisely diagnose errors in technique while feedback from live rounds is often vague. When a tank misses a target, for example, it could be caused by a commander error, gunner-error, ammunition dispersion, mechanical problems, bad boresight or a combination of these and other factors.

(2) Examples of device and simulation applications are:

(a) The German Army found it could train tank crews 30% faster by simulation than with the tank. Also the crews did 18% better on crew qualification and 10% better on tank section live fire exercises.

(b) The FAA now certifies pilots in the flight simulator alone.

(c) During the Viet Nam War, the Navy improved aviator kill ratio by six fold through an engagement simulation program.

(d) At Gowan Field, Idaho, an ARNG Cavalry Regiment trained to Gunnery Table VIII standards using a combination of part task trainers and simulations.

(e) At Gowan South, Ft. Benning, it was determined that 30 percent of the annual live fire requirement for the Bradley Fighting Vehicle could be accomplished through simulation.

(f) Training with the UCOFT has resulted in a 25 percent improvement in opening times and probability of hit improvements of up to 38 percent.

(g) At the National Training Center, an enemy force is replicated on the ground by simulation in real time.

(3) It must be understood, however, that "live ammunition" is essential to validate system and crew training and to progress from marksmanship skills to combat training.

(a) Crews react differently when using live ammunition.

(b) Psychological training in handling live high explosives is as important as technical training.

(c) Live fire and maneuver provides realism and stress to the command and control system not duplicated by other means.

(4) The central issue regarding simulation is not, "Can it train?" - but, "How much of the training equation do we want it to fulfill?"

c. The slate is clean with the AFV. The Army is in perfect position to:

(1) Design, test, and field coordinated organic training subsystem with supported operational equipment for:

(a) AFV force training.

(b) Individual AFV system training.

(c) Institutional training.

(d) Unit training.

(e) All training support requirements.

(2) Use extensive AFV commonality, modularity, and multiple mission features to:

(a) Compress/centralize/consolidate training particularly in the institution.

(b) Develop common/generic simulations/devices for multi-proponent use.

(c) Expand commonality and applicability of ranges and other training facilities.

(3) Develop complete simulation/device requirements during design, test, and validation.

(4) Eliminate need for non-system or gap filler training equipment and documentation.

(5) Develop cost effective stand-alone simulations for high volume institutional requirements.

(6) Shift training/readiness dependency from operational equipment to simulation.

d. The issue becomes therefore, how to meet the AFV sustainment training requirements in the most cost and training effective manner. The following course of action appears the most suitable:

(1) Industry, directed through SOW/RFP:

(a) Include an embedded training capability in each AFV system that will replicate system capabilities to the extent that soldiers can train and maintain critical individual, crew, and collective tasks. Embedded training should provide the capability to train individual and crew operation and maintenance. Also, embedded systems should be capable of being netted with other embedded systems. This will to enable collective and combined arms training including ARTEP, AMTEP, and SQT.

(b) Develop cheap multistation stand-alone simulations that can be used for high volume training at central locations.

(2) Unit sustainment training. As a result of the embedded training capability, unit commanders can:

(a) Accomplish significant portions of their individual and collective training in the motor pool using organic vehicles.

(b) Use live fire and operational equipment to validate training proficiency.

(c) Gain a high degree of training and readiness flexibility through advanced technology and capabilities not previously available.

(d) Reduce training costs (Class III and IX) and OPTEMPO requirements, and

(e) Essentially eliminate the responsibility of maintaining warehouses of devices and simulations.

(3) Institution training. As a result of stand-alone simulations, service school commandants can:

(a) Provide the bulk of initial entry training, e.g., operator and crew proficiency with simulation.

(b) Use maintenance training simulation that provides predominance of training for all skill levels. Maintenance simulation beyond operator/crew requirements may be stand-alone in both unit and institution.

(c) Use common driver, maintenance and operator simulations that are adaptable to multiple proponent users.

(d) Use live fire and operational equipment to validate training proficiency.

(e) Significantly reduce ammunition and operational equipment requirements.

(f) Gain considerable flexibility through technology to offset scheduling, weather, equipment, range and ammunition problems.

(4) Advantages.

(a) Train to individual and collective standards with reduced ammunition, spare parts and OPTEMPO.

(b) Maintain readiness despite resource reductions.

(c) Train to standard despite facility availability or capability restrictions.

(d) Reduce training costs.

(e) Reduce wear and tear on operational equipment.

(f) Schedule "collective live fire" training anytime.

(g) Capability to train activities that are not practical, safe, or economical to practice:

1) Laser and HPM weapons.

2) Offensive/defensive electronic jamming.

3) Catastrophic situations (emergency procedures).

4) Reconnaissance, battlesite selection in locations not available for training.

5) Maintenance and support activities.

6) Wargaming and leader/supervisor training.

(h) No limit regarding:

1) How many rounds fired - where.

2) How many miles driven.

3) How often parts are changed.

4) How loud the noise.

5) Weather conditions or time of day.

6) How often the hill is taken.

7) Range/training area availability.

(i) Train and evaluate beyond capabilities of current qualification tables, ranges or exercises.

(j) Train and evaluate full range of battlefield conditions.

(k) Provide common measure of proficiencies, capability to score, evaluate and maintain records.

(l) Maximize commanders options and flexibility.

(5) Disadvantage. Lack of confidence that devices/simulations will train as well as or better than live fire and full service equipment.

e. Specific cost and training benefits and options that can result from a predominate device based training strategy are described in detail at Annex A. A summary of the findings are that training ammunition and OPTEMPO can be reduced by 20 percent in both the unit and institution.

f. Maintaining a high level of OPTEMPO and ammunition for AFV unit and institutional training would only seem to increase cost, require more equipment, spare parts, POL, maneuver areas, range time etc. There are disadvantages associated with this:

(1) Training not necessarily possible or adequate:

(a) Budget cuts.

(b) Ammunition/OPTEMPO restrictions.

(c) Local/host nation limitation or curtailment.

(d) Weather/fog.

(e) Equipment breakdown.

(f) Supporting unit non-availability.

(g) Inadequate time.

(h) Range/training area availability.

(2) Some equipment capability or situations cannot be trained.

(a) Unsafe.

(b) Catastrophic.

(c) Terrain not available.

(d) Ranges cannot accommodate weapon system.

(3) Limited fall back capability to train if ammunition, facilities, or full service equipment not available.

(4) Readiness can suffer.

5. Conclusions.

a. AFV provides signal opportunity to modernize Army training.

b. Historically, training has been a stepchild. Requirements, funding, and products seldom synchronized with Army training needs.

c. Current training system:

(1) Combination of system, non-system and locally fabricated devices.

(2) Considerable device/simulation gaps and redundancy.

(3) Non-system device program behind Army training requirements and normally more expensive than embedding.

(4) Heavy reliance and operational equipment, training ammunition and range/training area time to attain and sustain readiness.

d. A coherent device based training strategy can:

(1) Shift Army training emphasis to:

(a) Train up and sustainment by simulation.

(b) Readiness validation by operational equipment/live fire.

(2) Reduce unit and institutional training costs.

(3) Provide commanders and commandants capability and flexibility to attain and sustain force readiness.

6. Action Required.

a. Implement AFV device based training strategy for the unit and institution.

b. Ensure each AFV ROC contains specific language to cause contractors to develop, test, and validate desired training subsystems.

c. As AFV embedded capabilities and stand-alone simulation begin to emerge, determine a more precise definition of how much of the unit and institution training load can be accomplished by simulation and how much live fire and operational equipment will be required to validate training proficiency.

ANNEX A

Analysis to Support AFV Institutional and Unit Sustainment Training

ANNEX A

ANALYSIS TO SUPPORT AFV UNIT AND INSTITUTIONAL SUSTAINMENT TRAINING

(U) ARMORED FAMILY OF VEHICLES

TASK FORCE

PHASE I REPORT

PART I

(U) INSTITUTIONAL TRAINING

UNCLASSIFIED

(U) GENERAL

(This Part Is Unclassified)

1. Essential to AFV development and fielding is reducing force and system operations and support costs. The purpose of this Annex is to provide an analysis of how the AFV training subsystem, developed and fielded concurrently with operational equipment, can result in significant savings.

2. In the analysis, the AFV training subsystem will be categorized in terms of the institution and the unit. The following assumptions are constant to both categories.

a. The AFV operational systems features of commonality, modularity, and multiple mission capability provide an equally high potential for training commonality, modularity, and multiple mission capability when operational equipment and its training subsystem are developed concurrently.

b. Training programs and resource allocation will be based upon:

(1) Initial and sustainment training will be accomplished with simulation requiring soldiers to "qualify" on simulation before operational equipment and/or live fire are used.

(2) Validation of training proficiency will be accomplished with operational equipment and live fire as appropriate.

c. The simulation package will be sufficiently mature and inclusive to provide a high level of training independent of ammunition, facility, and budget allocations.

3. This annex is in three parts:

a. Part I. Institutional Training.

b. Part II. Unit Training.

c. Part III. Summary.

Part I. Institutional Training

1. Purpose. The purpose of this part is to provide the concept and analytical basis for the AFV institutional training program that will produce trained soldiers at an affordable cost. This capability is possible because the AFV provides the unique, once in a life time opportunity to design and install an effective and efficient institutional training system -- that reaches across all proponent boundaries -- concurrently with equipment design, development and fielding.

2. Assumptions. The following assumptions were applied:

a. Current MOS inventory will be compressed.

b. Training tasks will be simplified.

c. Large, cheap, nettable, multistation stand alone simulations will significantly reduce requirements for operational equipment and training ammunition.

d. An embedded training capability in operational equipment used for institutional training will reduce training costs.

e. Instructor and facility requirements will be lower because of AFV equipment commonality, e.g., training simulation will have application to multiple proponents.

f. Significant reductions can be made in institutional training requirements.

g. A top down directed strategy will be required to change current institutional training concepts.

3. Data. To gain an understanding and insight of the budgetary implications associated with institutional training, the following data are provided:

a. Program 8, Training, FY 1987 Budget:

Requirement	Cost (Mil)
Recruit Training	10,031,000
One Station Training	27,539,000
Specialized Training	293,298,000
Professional Education	59,177,000
Training Support	507,347,000

Base Operations (-)	752,716,000
Base Operations (Real Property, Maintenance Account)	646,301,000 (Bil)
Total	$2,286,438,000

b. Projected institutional Ammunition requirement for 1987 as provided by Program and Resources Directorate, TRADOC. $250,000,000

c. Estimated cost increases (Encl 1) for AFV institutional training (25 year life cycle for: cell number 5.07, System Specific Replacement Training AMMO/Missiles and System Specific Replacement Training Services), when projecting "business as usual" training development activities:

(1) Current System Costs - 11,815.2 (Bil)

(2) Projected AFV Costs - 14,235.2 (Bil)

Increase - 2,420.0 (Bil)

d. The tables on pages A4 to A6 contain a summary of high cost courses for selected proponent schools. Each table contains: course title, number of trainees, the cost for one trainee, and the cost for all trainees that will be cycled through the course each year. Cost data is based upon 1984 dollars provided by TRADOC. Student pay and TDY expenses were not included.

e. AFV projections indicate:

(1) AFV maintenance support requirements as developed by the US Army Logistics Center (Encl 2), indicate an increase of 9% in Maintenance Support MOS (CMF 63 and 77) from the current base training load. This amounts to a personnel training increase of 7567.

(2) Crew reductions as determined by the AFV Task Force (Encl 3) indicate personnel reduction for 13B and 19K in a type corps to be 3242.

4. Data Resolution. The data in 3 above resolves into three distinct issues:

a. The number of personnel to be trained in the training base is not significantly different between the current load and AFV projections. However, some course expansion and contraction will be required to adjust for MOS changes.

(1) Field Artillery

DIRECT COSTS	13B OSUT (8876)			FAOBC (1154)			BASIC TNG (3747)		
MISSION:	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $
OMA	281	5	2.5	395	3	.5	70	3	.3
TRAINERS	2299	37	20.4	2057	16	2.4	46	2	.2
AMMUNITION	1437	23	12.7	6656	53	7.7	1017	45	3.8
EQUIP	317	.5	2.8	1515	12	1.7	47	2	.2
INDIRECT COSTS									
BASE OPERATIONS	1513	25	13.4	1696	13	2.0	912	41	3.4
SUPPORT COSTS	313	5	2.8	294	2	.3	151	7	.6
TOTAL	6160	100	54.6	12613	100	14.6	2243	100	8.5

(2) Armor

DIRECT COSTS	AR CREW (OSUT) (4673)			BASIC TNG (9917)			AR OFF BASIC (121)		
MISSION:	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $
OMA	864	6	4.4	140	4	1.4	1643	6	1.0
TRAINERS	3283	24	15.3	1394	40	13.8	8291	30	5.1
AMMUNITION	2994	22	14.0	333	10	3.3	11072	40	6.9
EQUIP	3592	27	16.8	23	1	.2	1249	4	.8
INDIRECT COSTS:									
BASE OPERATIONS	2450	18	11.5	1375	40	13.6	5057	18	3.1
SUPPORT COSTS	318	2	1.5	178	5	1.8	488	2	.3
TOTAL	13501	100	63.5	3443	100	34.1	27800	100	17.3

(3) Infantry

DIRECT COSTS	INF OSUT (17685)			INDIRECT FIRE CWMN (4159)			INF OFF BASIC (1305)		
MISSION:	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE %	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $
OMA	207	4	3.7	193	4	.8	730	7	1.0
TRAINERS	1825	39	32.3	1689	32	7.0	4242	40	5.5
AMMUNITION	362	8	6.4	1322	25	5.5	1869	17	2.4
EQUIPMENT	79	2	1.4	95	2	.4	507	5	.7
INDIRECT COSTS:									
BASE OPERATIONS	1819	39	32.2	1684	32	7.0	2878	27	3.8
SUPPORT COSTS	334	7	5.9	309	6	1.3	490	5	.6
TOTAL	4625	100	81.9	5292	100	22.0	10716	100	17.0

(4) Air Defense

DIRECT COSTS:	CHAP OSUT (529)			SHORAD OSUT (766)			ADA OFF BASIC (415)		
MISSION:	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $
OMA	323	2	.2	320	2	.2	1277	13	.5
TRAINERS	3891	22	2.1	3878	30	3.0	2675	27	1.1
AMMUNITION	2425	14	1.3	724	6	.6	1819	18	.8
EQUIPMENT	7496	42	4.0	4264	33	3.3	51	1	.02
INDIRECT COSTS:									
BASE OPERATIONS	2954	17	1.6	2941	23	2.3	3420	35	1.4
SUPPORT COSTS	616	3	.3	615	5	.5	658	7	.3
TOTAL	17705	100	9.5	12742	100	9.9	9900	100	4.12

(5) Ordnance

DIRECT COSTS:	TRACK VEH REP (1882)			TANK TURRET REP (307)			ORD OFF BASIC (269)		
MISSION:	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $
OMA	629	5	1.2	894	6	.3	580	7	.2
TRAINERS	1450	12	2.7	2062	15	.6	2482	30	.7
AMMUNITION	--	--	--	--			82	1	.02
EQUIPMENT	5773	47	10.9	4471	32	1.4	38	.5	.01
INDIRECT COSTS:									
BASE OPERATIONS	4259	34	8.0	6081	44	1.9	4613	57	1.2
SUPPORT COSTS	277	2	.5	395	3	.1	297	4	.08
TOTAL	12388	100	23.3	13903	100	4.3	8137	100	2.21

(6) Missile and Munitions

DIRECT COSTS:	IH FIRE CONT REP (64)			PERSH ELECT REP (92)			TOW/DRAGON REP (554)		
MISSION:	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $	COST/ TRNEE $	%	TOTAL (MIL) $
OMA	9152	19	.6	6051	16	.6	2681	16	1.5
TRAINERS	11160	23	.7	10557	27	1.0	4537	27	2.5
AMMUNITION									
EQUIPMENT	11512	24	.7	9490	24	.9	3084	18	1.7
INDIRECT COSTS:									
BASE OPERATIONS	12774	26	.8	9787	25	.9	5035	30	2.8
SUPPORT COSTS	3744	8	.2	2868	7	.3	1476	9	.8
TOTAL	48342	100	3.0	38753	100	25.7	16813	100	9.3

b. Ammunition, equipment and base operations requirements constitute the bulk of training costs.

c. Training costs will continue to increase unless direct action to stem the tide is under taken.

5. Concept Formulation.

a. To have cost effective and efficient training, a training strategy that prescribes cost effective and efficient training must be directed from the top down. If the current training development situation remains unconstrained in regards to what each proponent can develop under the guise of the Systems Approach to Training (front and analysis) concept -- The AFV will be priced out of the market by continued heavy reliance on training ammunition and operational equipment. The $2.4 billion increase shown at 3.C. above is testimonial to business as usual training development.

b. Problem solution lies in executing a strategy that is focused on two distinct phases.

(1) Phase I. Initial training and proficiency certification is accomplished with simulation, devices and electronic information delivery systems.

(2) Phase II. Validation of training proficiency is accomplished with live fire and or operational equipment as appropriate -- after completion of Phase I.

6. Simulation Capability. The fact that simulation can provide effective and efficient training is not in question. There are many examples that describe its worth:

a. At Enclosure 4 is an extract from the Weapons Crew Training Study (WCTS), prepared by the US Army Training Support Center, November 1980 - February 1982, which clearly describes a situation where combat capability is increased six fold by investment in improved training as an alternative to investment in more or improved materiel.

b. At Enclosure 5, also from the WCTS, is an extract that contains a discussion regarding the use of simulation by foreign armies. The point of the extract is not to advocate foreign training philosophy, but to point out that sophisticated, high technology training equipment has been available and used extensively to attain a fairly high level of proficiency before firing full caliber ammunition.

c. At Enclosure 6, another extract from the WCTS, contains a discussion regarding the use of live ammunition. There are three significant points to consider.

(1) Many situations exist where simulation does a better job of training than does live ammunition.

(2) Within the forseeable future, there will always be a requirement to operate war fighting equipment and fire live ammunition.

(3) The issue is to determine the most effective and efficient mix between simulation and live fire.

d. Recent events continue to build the case for an expanded role of simulation in training. The following examples are not necessarily institutionally oriented, but contain a description of what simulation can provide for training groups of people.

(1) In 1982 and 1983 a test was executed with the 116th ACR, Idaho ARNG to determine if the regiment could train to and meet training readiness tasks, conditions and standards using a combination of devices and simulations. The simulation "packages" included:

(a) Small cheap table top devices that provided the gunner and tank commander the ability to practice realistic target engagement.

(b) Appended simulations that provided the crew the capability to practice realistic day and night multiple target engagements using the tank.

(c) Sub-caliber ranges that provided the crew the capability to fire at moving targets.

(d) A full crew interactive simulator that provided the crew the capability to engage main gun and machine gun targets with MILES, load and fire retrievable "full-service" rounds and maneuver to engage enemy targets. Included with the package was a through-site-video capability that provided trainers video tape information regarding crew performance.

The test culminated with a Table VIII shoot off between a squadron which had been trained in the conventional manner using live fire and operational equipment and a test squadron which trained using the simulations and devices just described. The results indicated:

(a) There was no significant difference in Table VIII firing results.

(b) Simulation trained machine gunners were better because in training they had to strike the target directly to receive credit for a hit. (lasers don't ricochet).

(c) Fire commands and basic operation of the tanks was more crisp and efficient. This was because the devices

"provided" gunners and TC's audio feedback (integration) of proper fire commands.

(d) Soldiers can be trained to attain combat standards using simulation.

(e) The feedback and repetitive iteration capability of simulation generally provides much more precise and reliable training management information than does live firing.

(f) As they gained in proficiency and compared their knowledge with others, simulation trained soldiers developed a high level of confidence in the ability of simulation to:

1) Train the tasks that were important to their job.

2) Train more precisely because the level of instruction never varied as it does with trainers.

(2) In 1984, the Army initiated the STRAC program for unit training. STRAC provided commanders a menu for combinations of simulation, devices and live fire to meet readiness standards. The program resulted in a reduction of ammunition requirements on the order of one billion dollars. Enclosure 7 contains a more detailed description of what was and will continue to be accomplished through the STRAC program.

(3) Also in 1984, the Battalion Level Training Model (BLTM) was adopted for Army use. The purpose of BLTM is to prescribe training events for units in terms of OP TEMPO and simulation authorizations that will allow units to sustain readiness. The BLTM events are complemented in terms of training ammunition by STRAC. At Enclosure 8 is the challenge and background that lead to BLTM. At Enclosure 9 is an example of how the BLTM is programmed for a type unit.

(4) Gowan Field, STRAC and the BLTM have been Army efforts to describe and prescribe programs that will result in efficient and effective training using the best combination of simulation, live fire and operational equipment to meet readiness requirements with in the constraints of:

(a) Available time.

(b) The budget.

(c) Weapon sophistication and modernization.

(d) Training resources (ranges, targets, ammunition, devices, simulation etc).

e. At Enclosure 10 is a forecast of new training simulation and device initiatives. The projected cost is 1.9 Billion. Although well intentioned, many of the requirements are the result of business as usual training development, i.e., plugging a training problem that should have been solved 10 years previously when the system was developed and most likely at a much lower cost. This does not take into account the time that soldiers and units were denied a first rate training system and had to make do with improvision. As stated earlier, AFV provides a once in a lifetime opportunity -- up front capital investment for concurrent development of a complete training subsystem. The return on investment will be reduced O&S costs enhancement of training capability and reduced life cycle costs.

There are developments in the forecast that show great promise and can be a part of a training strategy that will move the Army into the 21st Century.

(1) The first is SIMNET. At Enclosure 11 is a detailed description of SIMNET. In summary:

(a) It is an multistation simulation that can train individuals, crews and leaders.

(b) It can be used for training research and development.

(c) It can be netted with other SIMNET to practice various levels of unit and combined arms training.

(d) It is relatively easy and inexpensive to adapt from one system to the other e.g., tank to Infantry Fighting Vehicle.

(e) It is relatively easy to change system capabilities through software.

(f) SIMNET is already in use at the Army School and programmed for the Infantry School.

(g) But most significant, 240 SIMNET trainers cost $92.3 million. This amounts to about $384,000 per set. The UCOFT, which only trains the TC and the gunner, costs over one million each.

> The central issue of SIMNET is that the concept is the institutional foundation for training simulation that can train large numbers of soldiers to proficiency - cheaply.

(2) Next the Electronic Information Delivery System EIDS, can dramatically change institutional training.

(a) It is a fully interactive training system. The unit combines a 16-bit, MS-DOS compatible computer system with a 12-inch laser videodisc player in one compact package. It can read both analog and digital data on a single optical disc. This means that information can be presented as any combination of movie like motion sequences-still images, audio tracks, text, graphics, and computer programs - all contained on one 1.8 gigabyte laser disc.

(b) It can also maintain complete trainee records. Records may be saved within the system on one of the two microfloppy disk drives or in a separate host system connected over an RS-232C communication link.

(c) It will be configured as trainee workstations.

(d) Authoring or development versions of the EIDS units will be fielded to courseware development activities. Enclosure 12 contains a detailed description of the system.

On 4 November 1986, the Army awarded the EIDS contract to the Canadian Commercial Corporation, a company specializing in high-performance computer display boards and systems. Funding currently provides for the purchase of about 15,000 units. The procurement unit cost will vary between 7.0 and 4.9K depending on the size of the eventual buy. The authoring system to develop the training courseware is owned by the Government. The Army Training Support Center, Ft. Eustis, VA has contracted for the development of courses to provide proponent school staffs the capability to effectively develop and produce interactive course ware. The potential of EIDS is essentially a function of the imagination of the training developer. The following, from the DOTD Ft. Belvoir, provides one use.

> "Construction equipment supervisors will soon use interactive video discs to practice basic supervisory, management, and technical skills. The videodisc is part of a training package that includes a student guide with job directives, maps, and notes. Video sequences let students solve problems they are likely to encounter on the job.
>
> For example, the platoon sergeant in the video gives the students a mission: build a 1/2 mile road leading to a heliport. The students then make choices about supply support, medical support, maintenance support, status of personnel and equipment, time frame, security, and grid coordinates. The first sergeant on the video critiques the choices as students make them.

The video then takes students on a simulated route reconnaissance, showing the road and terrain. Students also look at the job site to determine where they should place the equipment park and command post. They use the computer to report back to the platoon sergeant who critiques their plans and the problems they overlooked like a truck getting stuck because the bridge clearance was too low or a bridge collapsing because it couldn't carry the weight of the equipment. The students then have a chance to watch work in progress at the job site, identifying problems with equipment operation. For example, the dozer may be making the guide cut too deep.

Half the trick of being a good supervisor is being able to anticipate. The videodisc program for 62N teaches students to foresee problems before real lives and heavy equipment are at risk. NCOs can learn from their mistakes before the mistakes become costly.

The computer simulation is currently being tested at the Engineer School as part of the 62N basic noncommissioned officers course (BNCOC). This will be a boon to heavy equipment operators who are promoted to staff sergeant and given supervisory responsibility before they attend BNCOC. Eventually, once EIDS is fielded, all 62N NCOs will be able to call up the simulation at their units."

To date, 14 proponent schools have requested contractor assistance for development of interactive courseware.

(3) GUARDFIST is another program that shows great promise. It was developed for the Reserve components to allow training to standard at home station without driving operational equipment or firing live ammunition. It is an application of interactive EIDS to operational equipment, and provides the capability to operate or shoot a system in a realistic manner. In the case of the Field Artillery, a standalone mode provides the capability to train forward observers will FDC personnel to standard without firing ammunition. In the case of a driver it provides him the capability to "operate" his vehicle over surrogate terrain he views through his vision block. The important aspects of GUARDFIST is that it is cheap, it works and has great potential to enhance and supplement SIMNET type technology.

(4) At Enclosure 13 are descriptions of maintenance trainers and at Enclosure 14 are selected devices that address

other training deficiencies. The obvious indications are the Army is searching for cheaper and more training effective and efficient means to attain and sustain soldier proficiency. Unfortunately as discussed earlier, a large share of device and simulation procurement is aimed at correcting rather than preventing training deficiencies. The following discussion contains insight regarding a way to bring the litany of device and simulation procurement into more central focus and direction.

(5) Not yet included in the current device and simulator projection, but a concept that is within our grasp and can have a revolutionary impact on both institutional and unit training is: Large Scale simulator networks. At Enclosure 15 is a paper prepared by the Defense Advanced Research Projects Agency (DARPA) that describes large scale simulator networking in detail. The essential technologies that will make the initiative possible are:

(a) Computer Networking.

(b) Advanced Communications.

(c) Distributed Computing Architecture.

(d) Advanced Simulator Design.

(e) Special effects - sound and illusion technologies.

(f) Advanced graphics.

(g) Rapid prototyping R&D process.

An excerpt from Enclosure 15 best describes what can be anticipated:

> o Communications - The communications capacity for running networks is expanding rapidly. C band wideband satellite capabilities are moving over to Ku band with reduced cost and size requirements. Fibre optic land lines, including those to Europe are proliferating at a rapid rate. Whereas previously point to point schemes predominated, it is possible to consider a variety of hybrid, reconfigurable schemes featuring land lines that feed regional satellite uplinks which then exchange with each other and broadcast back to each site equipped with a small receiver antenna.
>
> o Distributed computing Architecture - Operating on a LAN, a completely distributed

computing architecture distributes all computing power to the simulators. No mainframe or central computers are employed in a central control role.

This allows a plug in modularity like the telephone system where each simulator is a self-contained, stand alone entity with its own host microprocessor, graphics and sound system, a complete copy of the terrain database, and everything else needed to create a bubble of reality for its crew. The network communications functions live in each host processor in each simulator. Simulators plug together via cable, transmitting and receiving data units from other simulators and gaming stations. When a simulator fails, the network continues but without the contributions of the failed device. Malfunctions are soft and graceful.

In overview, large scale computer networking can be the glue that binds for example, the capabilities of SIMNET technology, EIDS, GUARDFIST and other maintenance and operator devices and simulators into a common capability that reaches across the training base. This concept is particularly attractive when considered in terms of the commonality and multiple mission capabilities offered by AFV. Not only is the networking concept applicable to a particular institution, it has the capability to link institutions and integrating centers, and for example, to include the NTC and the field. The synergism and cross-pollenization offered by this capability vastly expands the dimensions of a technically advanced training capability.

(5) A final observation regarding simulation is the May 1987, MI-UCOFTPost Fielding Training Effectiveness Analysis performed by the US Army TRADOC Analysis Center, White Sands Missile Range. The objectives of the analysis was to determine:

(a) If MI U-COFT can be used as a predictor of crew gunnery.

(b) The contribution U-COFT makes to sustainment training.

(c) If U-COFT alleviates (and to what extent) the effects of crew turbulence on unit gunnery performance.

(d) The relationship between M1 U-COFT training and main gun rounds (pre-qualification) fired prior to Tank Table VIII.

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(e) The leadership's and tank crews' perceptions of M1-COFT training effectiveness.

(f) The units' utilization of the M1 U-COFT.

The results of the analysis indicate:

(a) U-COFT substantially improves the quality of home - station crew gunnery training.

(b) More U-COFT training typically results in improved gunnery performance.

(c) U-COFT cannot be used as an absolute predictor of Table VIII performance.

(d) U-COFT users feel that the U-COFT substantially improves their home-station crew gunnery training.

7. Summary:

a. Analysis information and experience clearly indicate -- that a high level of training can be attained and maintained through the use of devices and simulation. It appears the Army subscribes to this philosophy as evidenced by the multi-billion dollar device and simulation program and the STRAC program that has started the Army along the path of attaining readiness through the most cost and training effective mix of simulation, devices, live fire and operational equipment.

b. Foreign armies have moved much harder in the direction of dependence upon simulation training than the US Army. This is essentially a factor of budget and facility limits, however, the issue remains, our Allies tend to be very proficient and competitive regarding their war fighting capability and on-balance use operational equipment and live fire in a constrained manner.

c. The central and most pervasive issues are:

(1) There will continue to be a heavy reliance on ammunition and operational equipment to train soldiers because there is no strategy that will force a change.

(2) There must be a central top down effort and direction to require definitive levels of training to be accomplished with simulation before operational equipment and live fire is used.

(3) The training concepts and potential contained in the development of AFV programs similar to:

(a) SIMNET: Large, inexpensive, multistation and multicapability simulations that can be used to train large numbers of soldiers to standard.

(b) EIDS: A fully interactive training system from which information in many variations of audio and visual representation can be produced,

(c) GUARDFIST: An inexpensive interactive video disc display system that provides a highly proliferable inexpensive capability to train to standard without a requirement to fire ammunition or maneuver equipment, and

(d) Large scale simulator networking: A capability for transmitting data units needed by netted simulators or other working stations:

Provides the opportunity to develop an institutional training strategy essentially dependent upon simulation for training to standard and certifying proficiency.

8. Conclusions.

a. There is sufficient evidence to indicate that a shift from a predominantly hardware/ammunition based institutional training concept to one that relies on simulation for attaining soldier proficiency is both possible and warranted. Also in most cases, a higher level of training fidelity can be accomplished with simulation at a lower cost than using operational equipment and ammunition.

b. AFV equipment and ammunition will cost more than current equipment, requirements for facilities (ranges, targets, base operations) will continue to grow, budget and facility constraints can be anticipated.

c. Microcomputers, artificial intelligence, interactive videodiscs, and satellite network communication links are revolutionizing the Army's approach to training soldiers. The Army is committed to supporting research to tap the latest technology to nurture the skills in tactics, terrain, and leadership that are essential to success in battle.

d. When AFV is fielded, computers can provide soldiers both active and reserve, diagnostic tests to determine the training they need and don't need and provide the bulk of training they need. Much training will be self-paced, following a prescription of tasks tailored to personal needs and career goals. Computerized records of skills, training, and proficiencies will be continuously updated throughout careers.

As electronic networks expedite communication between military schools and field units, changes to training and doctrine can be accomplished more quickly, making everyone more responsive to the challenges of our rapidly evolving Army.

e. Designing and procuring the training subsystem concurrently with operational equipment is both cost and training effective. Most important, it is time sensitive to user needs.

f. A predominantly simulation based institutional training system can significantly reduce O&S costs by curtailing requirements for training ammunition, operational equipment, base operations, and trainers.

g. A well articulated clear and concise training strategy must be promulgated and understood throughout the Army.

h. A top-down initiative will be required to set a new or modified institutional training strategy into motion.

9. Return on Investment. A minimum of 20 percent reduction in institutional requirements is attainable. A more likely figure after further refinement and definition of simulation and device capabilities is 40-50 percent. As indicated at Enclosure 16, the extent of savings can range from 300 to 600 million a year. Specific initiatives are as follows:

a. On all AFV related POI, initially reduce all ammunition requirements by 40 percent. Based on TRADOC annual institutional training ammunition requirements of $250,000,000 this reduction would result in approximately $1,000,000. As a return on investment, the first year savings would pay for about three SIMNET sets or 125 EIDS.

b. Reduce AFV operational equipment requirements by at least 40 percent. Although exact costs of AFV systems are not available, current projections indicate the tank can cost about $3,000,000. When the M1 Tanks were fielded, 150 were required for the institution. If through simulation this requirement is reduced for the AFV by 40 percent, there is a cost avoidance (savings) of (60X3,000,000): $180,000,000.

c. It is anticipated that over time instructor requirements, base operations and support costs can be reduced by a minimum of 20 percent as a result of:

(1) Less equipment and ammunition to store and maintain.

(2) Training equipment and software commonality that provides the capability to essentially use the same simulation in different installation.

(3) Compression of MOS that reduces the number of different courses to be taught.

(4) Simplification of course content based on ease of training AFV systems.

During the initial years of AFV transition however, the instructor and base operation will probably remain essentially at the current level. This is a function of the requirement to sustain instruction on the current fleet and the AFV. As the AFV gains preponderance, instructional, and support requirements will reduce.

10. Implementation. The essential elements required to implement a new simulation based institutional training strategy are: program definition and direction, requirement document preparation, POI development and execution.

a. Program definition and direction. The operative document that provides direction to the institutional training base and contains the training concept, strategy and prescribes specific actions is the Individual and Collective Training Plan (ICTP). For the AFV, a draft Umbrella ICTP has been prepared and staffed by the TRADOC. The plan directs proponent schools to prepare individual ICTP to support development of their portion of their AFV training subsystem. At Enclosure 17 are extracts from the approved TRADOC umbrella ICTP. This document is the corner-stone for institutional training strategy development. It is the TRADOC Commander's tool for influencing and directing how the AFV institutional training program will be developed. Currently this document is on target. However, as the AFV continues to evolve, specific levels of ammunition and operational equipment requirements will be prescribed. This process is iterative and will continue until the AFV is fielded.

b. Requirement document preparation.

(1) The operative documents that must be used to prescribe specific development of training materiels to support the institutional training strategy are the: Required Operational Capability (ROC), Training Device Requirement (TDR), Request for Proposal (RFP), and Statement of Work (SOW). At Enclosure 18 is an example of the language that is being included in the AFV umbrella ROC to support training. The essential message of this input is the training subsystem will be developed with operational equipment and embedded training and simulation will be used to significantly replace ammunition and operational equipment.

(2) The following are examples of specific requirement description that would apply to institutional training:

(a) A device and simulation package will be developed to provide the capability to train soldiers to

standard without recourse to live ammunition or operational equipment.

(b) A training matrix and certification technique will be developed for each AFV system to prescribe training, determine proficiency and certify ability to operate equipment and fire ammunition. At Enclosure 19 is a training matrix developed for use with the M1 U-COFT. It is an example of the structure that is essential to a coherent training program for all AFV equipment.

c. Program of Instruction (POI). POI are the execution documents of a training strategy. They are the documents that cause students to assemble, ammunition to be consumed and equipment to be used. It is essential that the POI being developed for the AFV (Encl 20) reflect in terms of resources the simulation based strategy for institutional training described through out this annex.

Enclosures:
1. Sustainment Cost Projections
2. Maintenance MOS Requirements
3. Crew Reductions, Corps Level
4. Training Investment
5. Foreign Army Training
6. Use of Ammunition
7. Standards in Training Commission
8. Battalion Level Training Model (BLTM)
9. BLTM Unit Layout
10. Simulation Forecast
11. SIMNET
12. Electronic Information Delivery System (EIDS)
13. Maintenance Trainers
14. Selected Trainers
15. Large Scale Simulation Networking
16. Training Effectiveness
17. Individual and Collective Training Plan (ICTP)
18. Required Operational Capability (ROC)
19. Training Matrix
20. POI Requirements

SUSTAINMENT COSTS (FY88$)

	CURRENT FORCE		AFV	
SYS SPEC REPL TRAINING	11,815.2	4.5%	14,236.2	4.4%
AMMO/MISL/EQUIP	(4,353.3)	(37%)	(4,031.5)	(28%)
SERVICES	(7,461.9)	(63%)	(10,203.7)	(72%)

ENCLOSURE 1

MOS TRAINING IMPACTS

1. PURPOSE.

a. To conduct an analysis in order to determine the differences in training requirements between supporting an Armored Family of Vehicles (AFV), Alternate 2, as opposed to supporting an armored vehicle fleet upgraded through product improvements and selective introduction of new armored vehicles, Alternative 1. The differences in force structure in the theater is based on the Force Analysis Simulation of Theater Administration and Logistical Support (FASTALS) data for logistics support.

b. To lay the foundation for development of a criteria that will be used in the Cost Training Effectiveness Analysis (CTEA) during Phase II follow-on training analysis in support of AFV.

2. SCOPE. The analysis focused on the differences in selected logistics MOSs training requirements between Alternatives 1 and 2 based on the subjective analysis of FASTALS data.

3. BACKGROUND. Tracked vehicle families have evolved over time without a centralized training strategy that addresses all variant requirements early in the life cycle process. The preliminary planning for the AFV focuses on reflecting shortcomings associated with previous developments. Concurrently, the objective of the AFV program is to develop and field a force within emerging Army concepts which will be able to defeat the threat of the 2005 time frame, while at the same time reducing overall systems and force operations and support costs.

4. OBJECTIVES.

a. Determine the changes in types of logistics support MOSs (e.g., consolidation of MOSs).

b. Determine the changes in the number of personnel by MOS.

c. Determine the changes in length of training.

d. Determine the impact of new training resources.

e. Determine the impact on facilities.

f. Lay the foundation of quantifiable and defendable criteria for future follow-on training analysis requirements.

5. ASSUMPTIONS.

a. Current equipment and personnel requirements document by TOE are valid. This limits the analysis to the support

requirements of identified systems rather than an analysis of the need for various systems.

b. AFV will be supported under the current maintenance system.

6. LIMITATIONS.

a. The study examined only Phase 1 of the AFV study and will only address units in an European theater.

b. The study analyzed only selected logistics areas.

c. The study was based on information from FASTALS.

7. METHODOLOGY.

a. The training analysis addressed information from FASTALS in reference to the differences in force structure, densities of equipment, chassis component commonality in order to determine the differences in logistics training requirements for Alternatives 1 and 2.

b. Initially a search of all related literature was conducted to identify known differences in force structure, densities of equipment, and vehicle commonality. Information was obtained from FASTALS for the European theater.

c. The focus of the analysis was concentrated on selected MOSs within two enlisted career management fields, CMF 63 and CMF 77, for each skill level. All other AFV logistics support MOSs had very little or no training impact for Alternatives 1 and 2. The MOSs that were analyzed for each CMF are listed below.

CMF 63 MOS 41C - Fire Control Instrument Repairer

MOS 45D - Self-propelled Field Artillery Turret

MOS 45E - M1 Abrams Tank Turret Mechanic

MOS 45G - Fire Control Systems Repairer

MOS 45K - Tank Turret Repairer

MOS 45L - Artillery Repairer

MOS 45T - Bradley Fighting Vehicle System Turret Mechanic

MOS 62B - Construction Equipment Repairer

MOS 63D - Self-propelled Field Artillery System Mechanic

MOS 63E - M1 Abrams Tank System Mechanic

MOS 63G - Fuel and Electrical System Repairer

MOS 63H - Track Vehicle Repairer

MOS 63J - Quartermaster and Chemical Equipment Repairer

MOS 63T - Bradley Fighting Vehicle System Mechanic

MOS 63Y - Track Vehicle Mechanic

CMF 77 MOS 77F - Petroleum Specialist

Intermediate Turret and Fire Control Repairman

MOS 41C, 45G, 45K, and 45L

8. FINDINGS. The analysis of CMF 63 was divided into 2 subareas, unit and intermediate support MOSs. Figure 1 depicts the number of personnel required to support the base case, Alternatives 1 and 2 for intermediate turret and fire control repairmen. The FASTALS data shows a 6% reduction of personnel required to support Alternative 2 over Alternative 1, which equates to 214 personnel. The impact on the training base would be minimal.

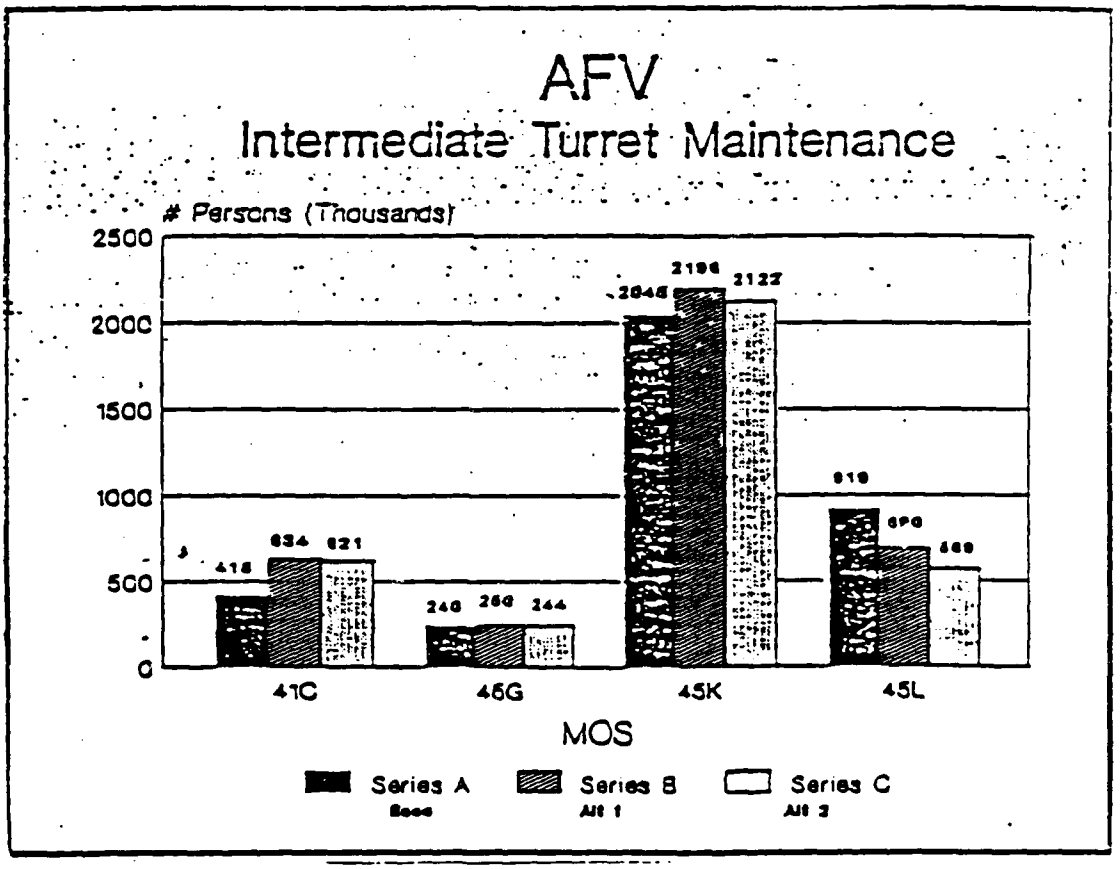


Figure E-1

Intermediate Turret Maintenance

Intermediate Vehicle Repairmen

MOS 62B, 63G, 63H, and 63J

Figure 2 depicts the number of personnel required to support the base case. Alternatives 1 and 2 for intermediate vehicle repairmen. There was an increase of 567 personnel in order to support Alternative 2 over Alternative 1, this represents a 2% increase of personnel. This will be a minimum impact on training, because the training base as it exists now has the ability to absorb this quantity across the board.

The MOS 62B was included with the intermediate vehicle repairmen because the engineers will have six AFV variants that will have common chassis. It is conceivable that this MOS could be consolidated with another intermediate vehicle repairman MOS in support of AFV engineer vehicles.

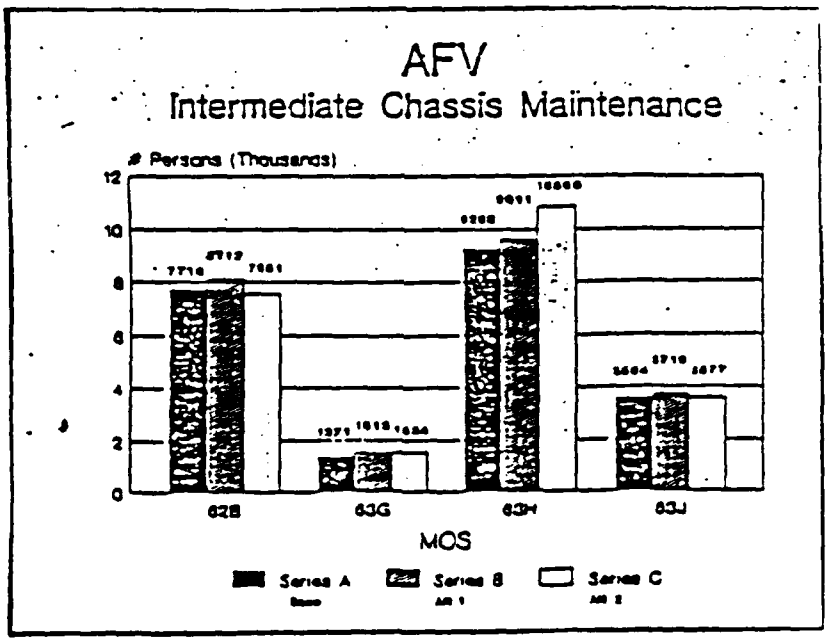


Figure E-2

Intermediate Chassis Maintenance

Unit Turret Maintenance

MOS 45D, 45E, and 45T

Figure 3 portrays the number of personnel required to support the base case. Alternatives 1 or 2 for turret maintenance at unit level. The chart shows an increase of 176 personnel required to support Alternative 2 or Alternative 1, which equates to 5% increase of personnel. The impact on the training base would be minimal.

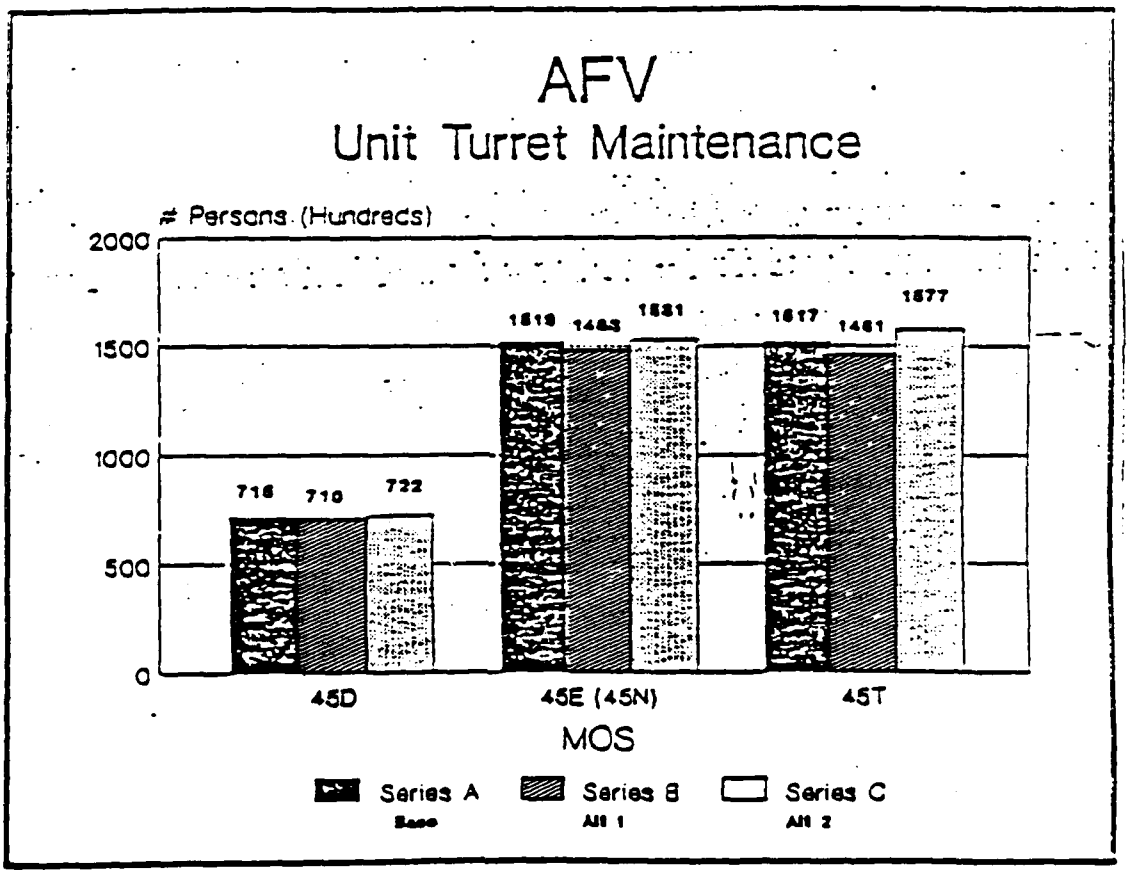


Figure E-3

Unit Turret Maintenance

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Unit Chassis Maintenance

MOS 63A, 63E, 63T, and 63Y

Figure 4 depicts the number of personnel required to support the base case, Alternative 1 and 2 for unit level vehicle mechanic. The chart shows an increase of 547 personnel required to support Alternative 2 over Alternative 1, this equates to a 3% increase of personnel. The impact on the training base would be minimal, again due to the capability of the training base to absorb this quantity across the board.

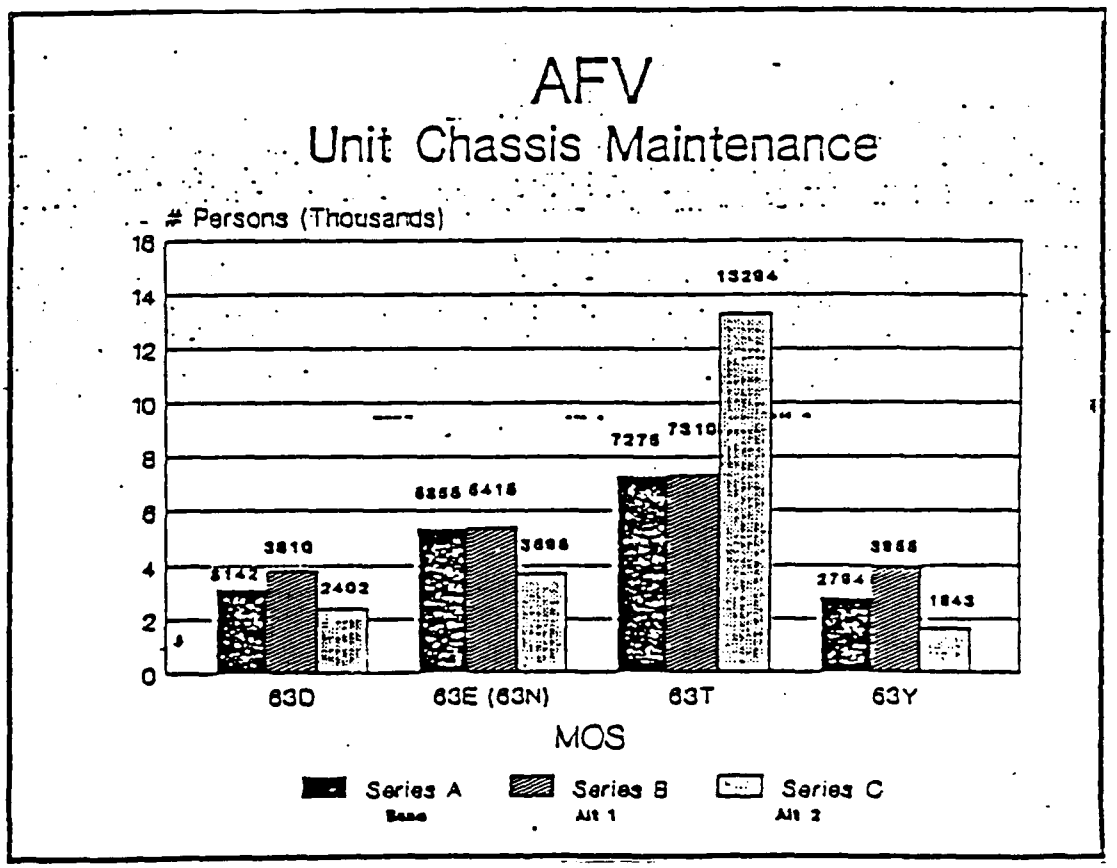


Figure E-4

Unit Chassis Maintenance

Petroleum Supply Specialist

MOS 77F

Figure 5 portrays the number required to support the base case and each alternative for the petroleum supply specialist. The chart portrays 696 more personnel required to support Alternative 2 over Alternative 1, this equates to a 5% increase of personnel. This constitutes a major impact on the already limited training resources and facilities. If the 77F becomes the operator of the refuel variant, which will be a track vehicle, this will constitute an even greater impact on the training base because it already has various limitation now in effect. Area of special concern would be training operators to drive the track vehicle, no real estate available.

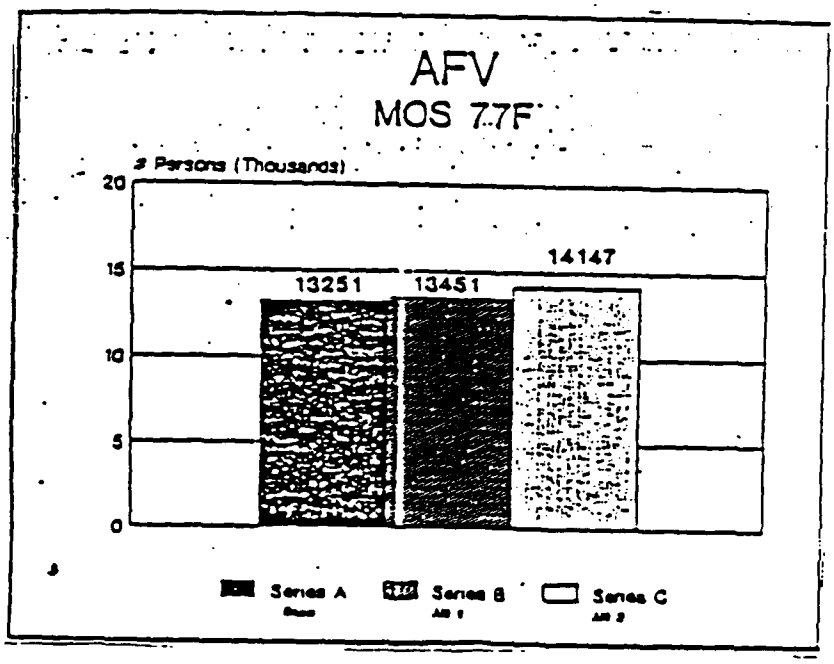


Figure E-5

MOS 77F

AFV

Maintenance Support

Figure 6 reflects the overall number of personnel required to support the base case, and Alternatives 1 and 2. For unit and intermediate level maintenance, there are 1952 more personnel required to support Alternative 2 from Alternative 1, this is an overall 2% increase of personnel. The overall impact on training resources and facilities is minimal, as the training base exists today.

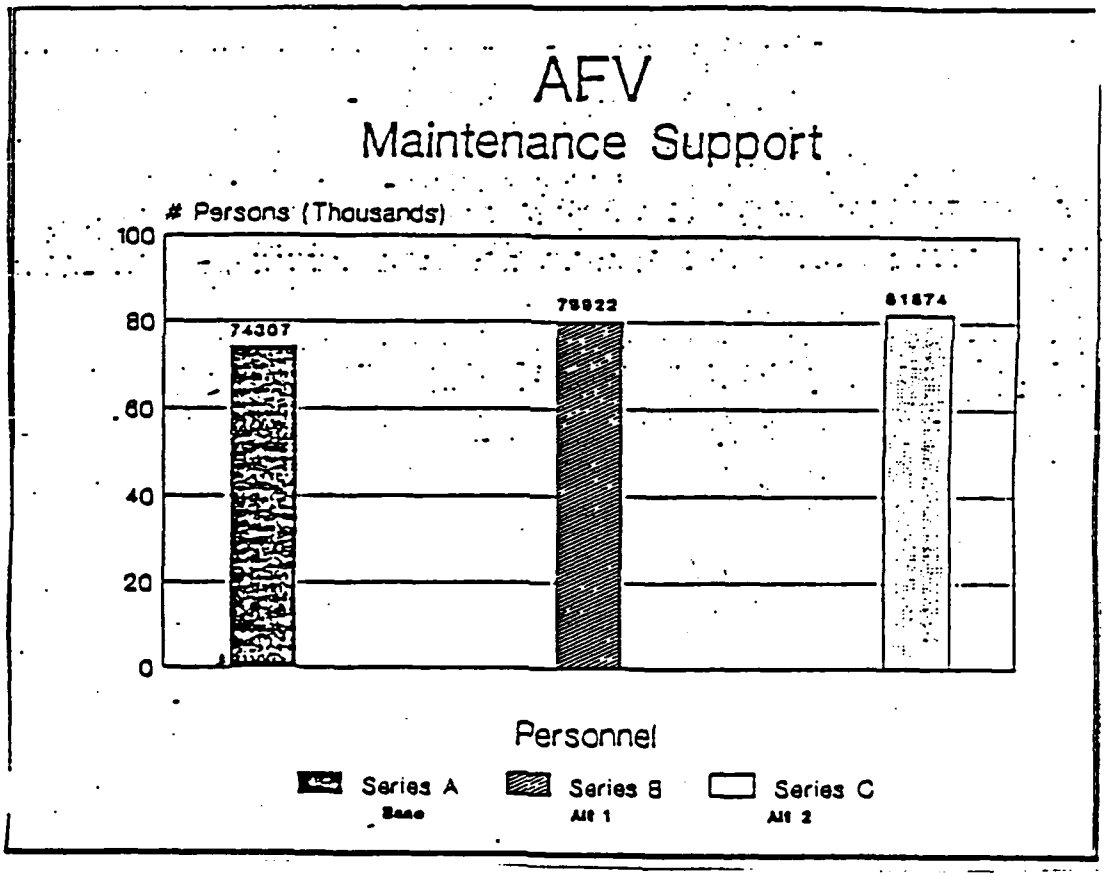
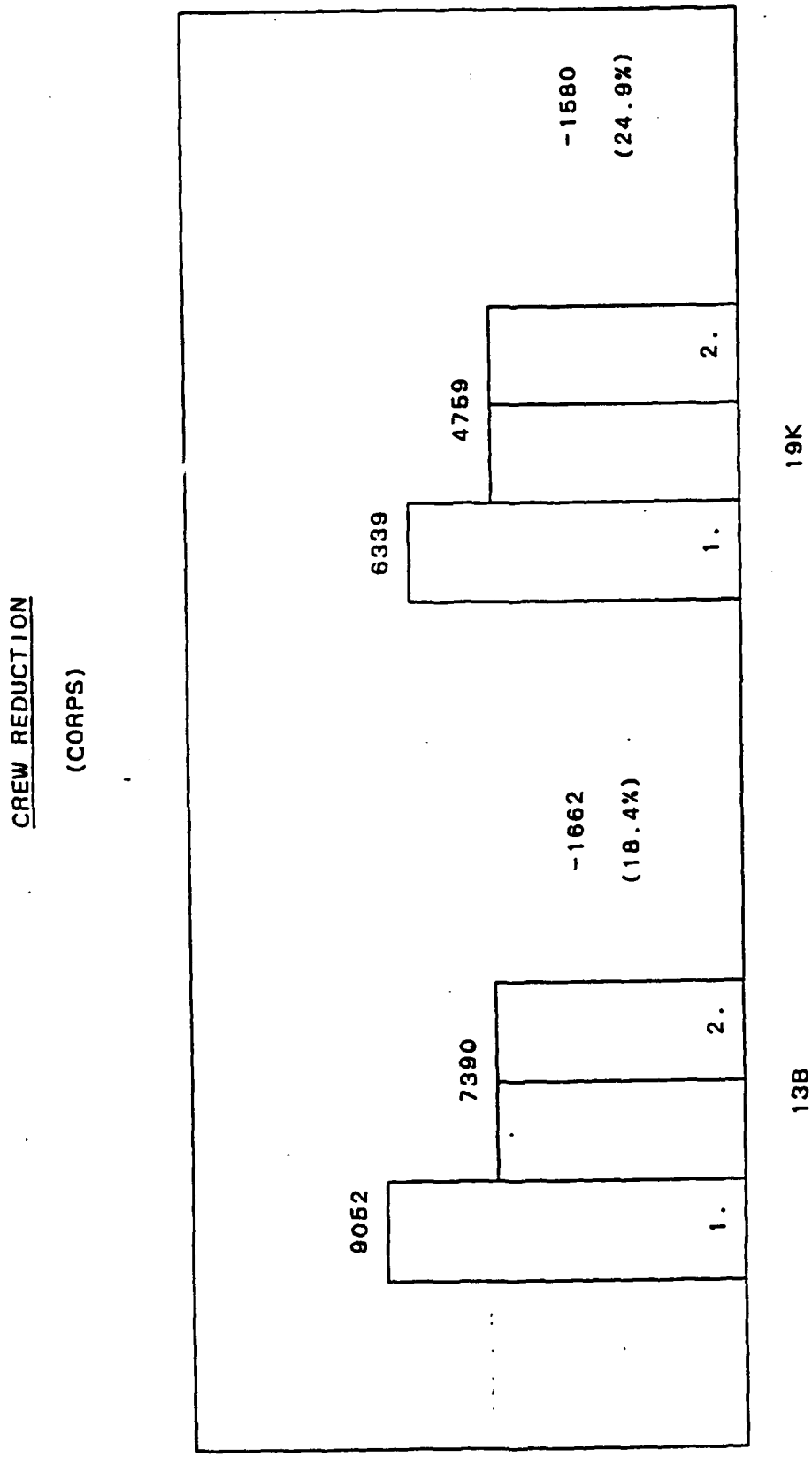


Figure E-6

AFV Maintenance Support



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ENCLOSURE 3

TRAINING INVESTMENT

There is solid, historical evidence that investment in improved training is a realistic alternative to investments in more or improved materiel. One example of enhanced weapon system effectiveness through better training is the air war over North Vietnam during the period 1965-1973. By using engagement simulation during the halt in combat operations over North Vietnam from 1968 to 1970, the Navy was able to achieve a markedly higher kill ratio when fighting resume in 1970. Navy pilots performed, in combat, six times as well as their Air Force counterparts (the Air Force has subsequently developed its own engagement simulation training for fighter pilots). The evidence of combat effectiveness enhancement due to training is everywhere and incontrovertible: the Yom Kippur War; the learning curves generated by RED FLAG, LAW Training, MILES; and the Falklands War.

THE AIR WAR OVER NORTH VIETNAM
1965 - 1973

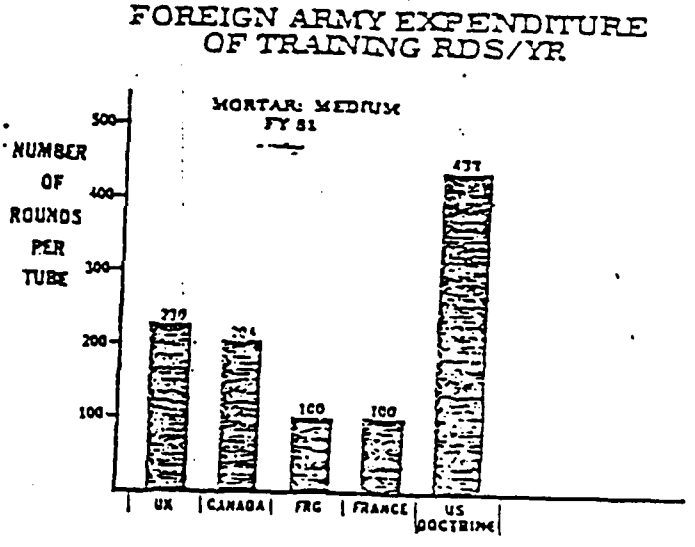
AIR-TO-AIR LOSSES OVERALL

YEARS	MIGs	U.S.	KILL RATIO	USAF RATIO	USN RATIO
1965-1968	110	48	2.29	2.25	2.42
1970-1973	74	27	2.74	2.00	12.50

In every US Army weapons analysis reviewed, the cost effectiveness of training resource investment was simple to establish. The reason for this phenomenon is that there is, in most US weapons systems, a gap between current individual/crew proficiency and design capability.

FOREIGN ARMIES

Comparing the training methodology of different armies is a difficult and potentially misleading procedure. Differing factors in almost every area, from culture to enlistment length, as well as lack of comparison between sustained weapons proficiency are cause for caution in attempting to draw conclusions. They are, however, certain aspects of foreign army training systems which are worthy of consideration and comment. The first obvious difference between the US and all other modern armies is the amount of live ammunition fired by each weapon each year. In every major caliber weapon system the US fires considerably more than other armies. European armies fire less because of limited range space and time, or limited funds, or both. Consequently, the Europeans (and the Israelis) have devoted a greater share of their training time and resources to marksmanship simulators than the US Army.



The second, less obvious, difference is one of philosophy. Foreign armies expect crews to train to a fairly high level of proficiency before firing full caliber ammunition. They generally use a more structured training approach in the units; require more rigorous demonstration of individual skill; and, use larger and more accurate subcaliber devices. Modern European armies also use high technology markmanship training simulators made by SINTRO, HONEYWELL, K. Eichweber (TALISSI); SAAB, DETRAS, MARCONI, and others. Foreign armies vary in how they use live ammunition. Some use a relatively high percentage in combined arms training; others, like the US, use most of their ammunition in developing individual or crew skills.

USE OF AMMUNITION

The US Army, wherever possible, trains weapons crews with live ammunition. Because there were huge stockpiles of ammunition left over after World War II, the Army became accustomed to firing service ammunition to develop individual and crew skills. This habit has become so ingrained, that most officers and NCO's assume that training with live ammunition is the best way to train, and that any substitution for, or simulation of, live ammunition is necessarily less effective training. In many respects this has been correct in the past. Generally, training devices have been crude substitutions for service ammunition. They frequently didn't work properly, bored the troops, and provided suspect training transfer. As a result, weapons training tends to be concentrated into a time period just prior to, and during, full caliber range firing. During the firing period, proficiency rises - how far is dependent upon the weapon system and the unit - then falls with turbulence and skill decay until the next firing period. The fact that skills can or should be sustained between firing periods is part of the general body of wisdom however, we have been unable to apply this concept to training in the field. Even standard terminology reflects this particular approach in that non-qualification shooting is called "sustainment training" (USAREUR has recently shifted away from this concept).

Standardization initiatives are beginning to have an impact; SQT has become a way of life and battle drills and crew drills are being used by an increasing number of units. How often, and in what sequence, these standardized training building blocks are put together remains a matter of local choice. Weapons proficiency is generally not measured - meaningfull yardsticks are not available and their impact on unit readiness is a matter of commander's estimation.

To attain and sustain this state of readiness, training strategies must be designed to cover all the bases from individual skill development to combined arms capability. Each weapon system training strategy will differ, but to make the problem manageable, a common set of training levels, in logical sequence, has been developed:

- Individual proficiency.
- Crew proficiency.
- Crew battlefield marksmanship proficiency.
- Fighting unit (e.g., platoon) proficiency.
- Combined arms proficiency.

In developing unit training requirements, the following questions need to be answered:

- What are the specific skills required at each level?

- What are the most efficient and effective methods to train these skills?

- How is proficiency tested or assured at each level?

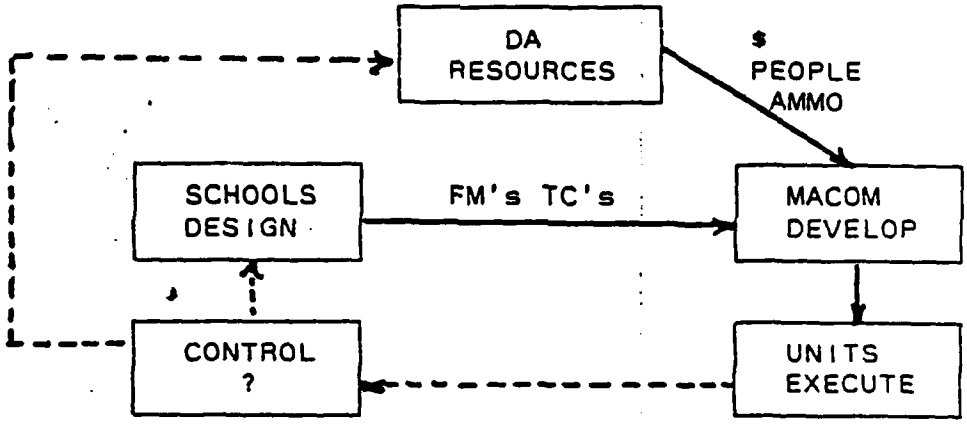
- What triggers the requirement to retrain or revalidate proficiency at each level (e.g., skill decay, crew member change)?

- At what point, and how, does maneuver training become an element of each level?

- where is live ammunition required?

An analysis of weapon system using this methodology can disclose gaps and redundancies and assist in the development of training resource requirements.

ISD MODEL - APPLIED TO UNIT TRAINING



Analysis also required an evaluation of how and where to use live ammunition in the training process. This logical process for unit training design closely parallels the logic of the Instructional Systems Design (ISD) process used in the development of institutional training programs. What is missing from the current unit training approach are a full scale front end analysis and the links that would make it a system - a measurable set of unit standards that can provide feedback to the organizations that design and resource the training process. There is no organized "control" mechanism in the current approach.

LIVE AMMUNITION, SIMULATORS, AND PART TASK TRAINERS

Range firing is a form of battlefield simulation - the targets being simulated. Often these targets are simple, stationary (or slow), non-hostile, and unrealistic. Other types of simulators can be much more realistic and demanding in target presentation and gunnery skills required yet simulate the full caliber ammunition. Well designed simulators can often do a better job in developing or sharpening individual and crew skills than does live ammunition. Simulators have a measurement capability that can be used to precisely diagnose errors in technique while the feedback from live rounds is often vague. When a tank misses a target, the problem could be a commander error, a gunner error, round-to-round dispersion, mechanical problems, bad boresight, or a combination of these and other factors. A simulator can pinpoint the error immediately. Another advantage of simulators is the potential for almost unlimted repetition that is not available on ranges. Examples of these types of simulators are the Weaponeer, the Artillery Training Set, Fire Observation (TSFO), the Conduct of Fire Trainer (COFT) for the M1 and M2/M3, the Vulcan Training System (VTS), and the various European tank gunnery simulators. The German Army found that it could train tank crews 30% faster with their Honeywell simulator than on the tank. Further, these simulator trained crews did 18% better on crew qualification courses and 10% better on the tank section live fire exercise.

No device or method, including live fire, is without its unrealistic elements; however, when examining a device, there is great temptation to look very closely at what it cannot do, what is unrealistic, rather than what it can do. for example, the M31 artillery subcaliber trainer is often maligned because it is not as accurate as the service rounds and does not exercise the "whole system." But the M31 can be used to exercise the vital C^3 system of the battery as well as to diagnose procedural errors in the component parts of the FA system.

Industry has learned how to make use of part task trainers, analyzing what is required to develop the full proficiency spectrum, then obtaining devices to train to that proficiency piece-by-piece. an example of this approach is the methodology used in the airline industry to train and certify flight crews. Pilots, copilots, and flight engineers are trained through the use of part task trainers which may be relatively simple, computer-assisted slide shows and mock-ups. Later, more elaborate devices or a full scale moving simulator with computer generated visual effects are used to integrate the various skills learned on the part-task trainers. The training approach has been proven so many times that the FAA now certifies pilots in the flight simulator alone; training aircrafts are no longer used.

The German Army's approach to training gunners and commander for the Gepard 35mm Anti-Aircraft Tank serves as a military

example of the use of part task training devices. The entire Gepard training program is built on devices. Skills developed on one device lead to training of more difficult tasks developed by the next device, and so on. The complete program is then verified by live fire qualification (live fire is kept to the minimum).

Initial training is conducted on very simple and cost effective devices. These initial devices also serve as a diagnostic tool to eliminate early those who lack the proper coordination and psycho-motor skills to succeed. Subsequent devices are more demanding and help teach more difficult and advanced skills. Benefits include:

- Allows individuals to train on devices suited to their abilities without tying up more costly advanced devices.

- Provides for early indications of success or failure on simple and cheaper devices.

- Maintenance problems with one device does not stop the entire training program, as may be the case where one device is used to train all tasks; and,

- Part task devices, which are not as complicated as a device that can train all tasks, can usually be fielded more quickly and cost much less.

As high technology simulators begin to enter the Army in the field, units must learn how to maximize their potential. Units must learn to program crews through expensive simulators on an "as-needed" basis, one at a time, and keep the simulator working 16-20 hours per day, 6 or 7 days per week. It will be necessary to provide well-trained operators who understand and can exploit the full potential of the system. The TSFO, for example, is unused in some locations, for lack of trained operators because the originally trained personnel have moved on.

In the past, weapons training devices were developed primarily to take the place of live ammunition. The new breed of realistic simulators and part task trainers, if used properly, can:

- Improved realism.

- Reduce training time.

- Increase frequency of training.

- Train to a higher order of skill.

REQUIREMENT FOR LIVE AMMUNITION

In some systems the use of live ammunition to develop basic individual and crew skills may not be the most efficient or effective training method. However, there is no question that live ammunition is absolutely required to validate system and crew training and to progress from marksmanship skills to combat training.

- Crews react differently when using live ammunition; not necessarily better or worse, but almost always differently.

- No simulator can precisely portray the noise, vibration, danger, obscuration or other effects of service ammunition which, in some systems, can cause a significant degradation in accuracy.

- It is vital to check the entire weapon system (including the training component) with full-caliber ammunition.

- The first major "lesson learned" about training during past wars was the requirement for realism during training - meaning the expenditure of large quantities of live ammunition (not to train skills, but to provide the "feel" of the battlefield).

The "psychological training" in handling live high explosives is just as important as the "technical training."

- Soldiers are motivated by firing service ammunition; it is a significant part of job satisfaction.

- The use of live ammunition in platoon and combined arms training provides realism and stress to the command and control systems in ways which cannot be duplicated by other means.

SUBJECT: Device Base Training Strategy

1. Historically, training ammunition was plentiful and readily available to operating units.

2. Beginning in the 1970's and continuing today, is concern by the Congress and others, that the Army is spending large amounts on training ammunition -- and cannot justify the expenditure in terms of readiness.

3. In the early 1980's the Army established the Standards in Training Commission (STRAC) to develop a training strategy that would:

a. Provide standard weapon system training programs for the Army.

b. Incorporate training technologies.

c. Provide levels of training readiness that equate to combat readiness requirements.

d. Be explainable and defendable to Congress in terms of:

(1) Training received and readiness level attained.

(2) Resources required to achieve training readiness.

4. In 1984, the STRAC program was initiated for 38 Army Weapons Systems. STRAC is a device based strategy that applies a mix of devices and simulation with live fire that provides the most cost and training effective combination to meet and maintain readiness. Enclosed is a chart that contains the dollar delta obtained for the first year (85) of STRAC. Essentially there was a drop from a requirement level of $2.3 billion to a STRAC requirement of $1.3 billion, or a savings of about 50 percent. The critical point is that these savings were obtained by using existing simulations and devices. They weren't necessarily state of the art and generally required units bolt-on, strap-on, or emplace.

5. With AFV the slate is clear. New training technology embedded into each AFV system -- as opposed to the strap-on technology of today has the potential to provide at least another 30 percent reduction in ammunition.

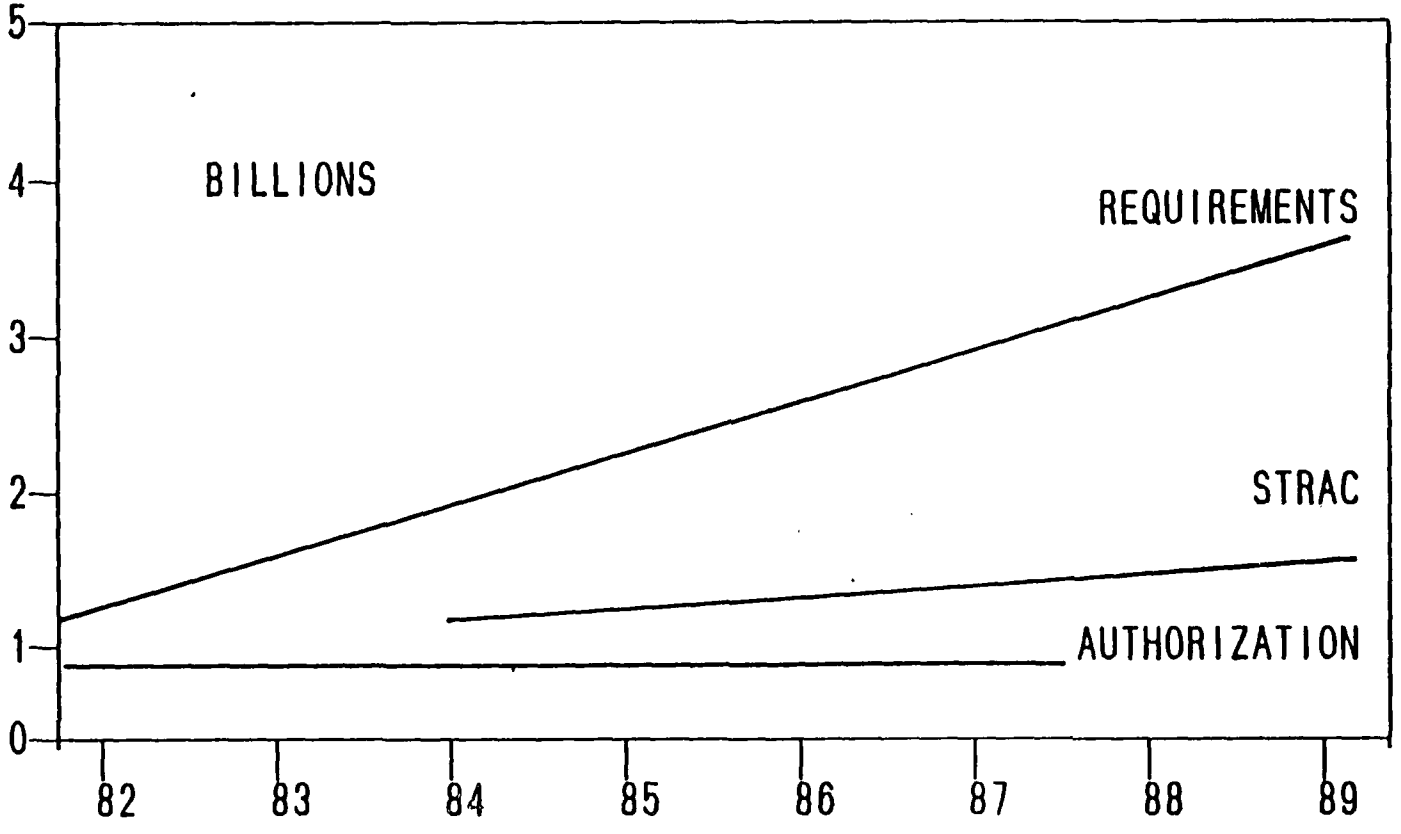
a. An example of how this will transpire is execution of one day of an M1 battalion live fire exercise by simulation. The potential ammunition savings are $85,723. For the Army, $4,714,765 (55 battalion in the active POM force).

b. Another variation for the same battalion is execution of a field training exercise by simulation. This will save about

4000 OPTEMPO miles. At $58.00 a mile this is $232.000. For the Army $12,760,000.

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ARMY TRAINING AMMO



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BATTALION LEVEL TRAINING MODEL

THE CHALLENGE

- TRAINING RESOURCES HAVE BEEN DECREMENTED FOR BUDGETARY REASONS
- FY 84 OPTEMPO WAS 1100 MILES -- NOW 850
- FY 79 TANK MAIN GUN AMMO WAS 210 ROUNDS PER CREW -- NOW 100
- COSTS ASSOCIATED WITH OPERATING MODERNIZED SYSTEMS SIGNIFICANTLY HIGHER
- TRAINING REQUIREMENTS HAVE NOT CHANGED -- UNITS MUST BE COMBAT READY
- AS FORCE MOD MATURES TRAINING COSTS CONTINUE TO ESCALATE
- ARMY TOTAL OBLIGATING AUTHORITY WILL CONTINUE TO DECLINE
- COMMANDERS IN THE FIELD FEEL STRONGLY THAT CURRENT RESOURCES LEVELS CANNOT BE REDUCED
- COMMANDERS FEEL THAT THERE ARE NO ADDITIONAL OFF SETS ASSOCIATED WITH TRAINING DEVICES
- THE ARMY CONTINUES TO MAKE SIGNIFICANT INVESTMENTS IN TRAINING DEVICES

ENCLOSURE 8

BLTM COMPONENTS

COLLECTIVE TRAINING

- BN AND CO LEVEL EVENTS
- SIMULATIONS/SIMULATORS/DEVICES

CREW/INDIVIDUAL TRAINING

- QUALIFICATION GUNNERY
- SUSTAINMENT GUNNERY
- SIMULATIONS/SIMULATORS/DEVICES
- ITEP TRAINING
- INDIVIDUAL WEAPONS QUALIFICATION COMMON MILITARY TRAINING PROGRAM

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BLTM COMPONENTS

OTHER REQUIREMENTS

- MISSION SUPPORT
- POST SUPPORT
- DRIVER TRAINING AND MAINTENANCE

MACOM UNIQUE TRAINING

- TRAINING EXERCISES
  - --- JOINT TRAINING
  - --- COMBINED TRAINING
- OTHER EXERCISES
  - --- RC DEPLOYMENTS FOR TNG
  - --- ROTC SUPPORT

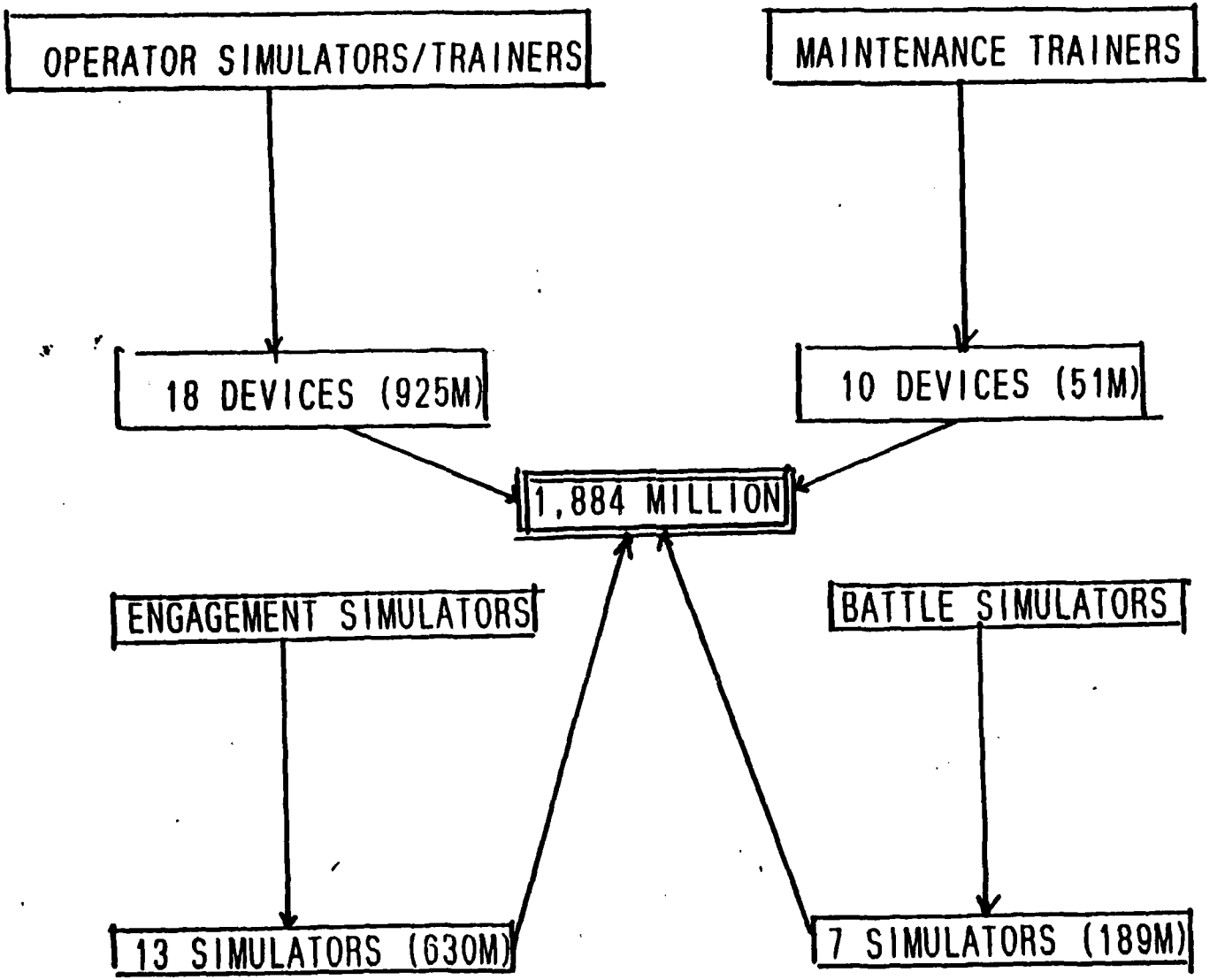
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FORECAST OF NEW INITIATIVES

DURING FY 87 - FY 91



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1. Description of SIMNET

1.0 Overview

SIMNET is an acronym for Large Scale Simulator Networking. SIMNET is a Department of Defense program, managed by the Defense Advanced Research Projects Agency (DARPA), to develop the DoD technology base for distributed, multi-player, real time, continuous simulation. In SIMNET, large numbers of combatants use simulated weapons systems networked by computers within the contest of unit command and control facilities to practice warfighting.

1.1 SIMNET Technical Objectives

The SIMNET program has the following technical objectives:

- o Technical Objective Number 1

Develop the capacity to network large numbers of simulators on a Local Area Network (LAN):

- o Technical Objective Number 2

Develop the capacity to network Local Area Networks (LANS) by Long Haul Network (LHN):

- o Technical Objective Number 3

Develop simple operation of the simulation systems throughout the entire spectrum of individual and collective tasks and skills. This objective involves two significant issues:

(1) How do we use computers to operate the networks, generate sound effects, and constrain units by realistic logistics, fire support, command and control, etc?

(2) How do we use computers manned by soldiers without imposing a new training task?

- o Technical Objective Number 4

Develop low cost, high quality simulator technology rapidly! Today's simulators typically cost $15-40 million each. These costs prohibit procuring numbers sufficient to make a difference in force effectiveness through simulator-based training strategies. The challenge is to develop the technology and procedures to build effective training simulators quickly and inexpensively.

1.2 Functional capabilities

SIMNET provides the following function capabilities:

- o Force-on-force combat can be routinely practiced.
- o Collective skills inherent in crews, squads, and platoons can be practiced.
- o Command and staff tasks and leader tasks can be practiced and evaluated within the context of individual soldier actions in a multi-echelon environment.
- o Weapon system performance factors and tactics can be changed and evaluated easily.
- o Doctrinal and man-machine interface issues can be simulated, studied and resolved inexpensively.

1.3 SIMNET Architecture

SIMNET simulation systems are based on the principle of distributed computing with no central mainframe computers. The architecture is completely modular, with each networked simulator complete in itself and capable of emulating the full range of system simulation. These self-contained simulators have hardware, software, and sound systems linked to their terrain database by microprocessors. Two or more simulators may be easily connected to form a local area network (LAN). The LAN is supported by one additional microprocessor and six MacIntosh terminals to provide a command and control network. The command and control network provides:

- o Resupply of ammunition and fuel.
- o Unit maintenance and replacement of combat and combat service support vehicles.
- o Indirect fire support (155 mm Howitzer and 107 mm Mortars).
- o Close Air Support (CAS).
- o FM Radio nets (Command, Intelligence, Admin. Log, Fire Support and CAS).

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1.4 Expected Payoffs

It is expected that investments in SIMNET technology will result in the creation of new tools allowing routine applications of high quality simulation to a variety of problems. Specifically, it is expected that the following payoffs will accrue:

- o Low cost investigation of new concepts.
- o Enhancement of the validity and reliability of closed loop simulations.
- o Low cost, enhanced computer generated imagery systems, which may of themselves become useful components of future weapon systems (such as IFF, thermal imagery enhancements, protected armor space, surveillance systems).
- o Potential functions include:

Strategy	Tactics	Examples
Reduced Human Exposure	Remote Wpns Systems	Autonomous Killers
	See the Battle	
	Combat extensions	
Prepare for War	Experimental Doctrine	AirLand Battle
	Experimental Organizations	
	New Training Concepts	NTC in a classroom
Future Combat Systems and Support	Replicate the enemy	Automated OPFOR
	Dial-a-Tank	FACS
	Structure to Fight	L Series TOE
	A.I. Tactical Aides	BMS
New Acquisition Model	Adopt New Technology	Parallel Processors
	MANPRINT	COLTSIM
	Stress the Technology	New micro chips

1.5 Summary

In summary, SIMNET is a DARPA RDT&E program designed around the best commercial practices to focus R&D efforts on development of an early prototype through early and continuous coordination with the user. SIMNET is an example of the benefits to be realized by a synthesis of advanced technology research and program management techniques that lead to rapid prototyping. Rapid prototyping allows the user to develop new and untried concepts at low cost in less time. Stated another way, SIMNET allows exploration with a new found "freedom to fail" because the risks of failure in simulation are reduced. Historically such conditions have led to greater creativity and success.

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ELECTRONIC INFORMATION DELIVERY SYSTEM (EIDS)

The Basic Student Workstation

A basic student workstation includes an integrated videodisc player (a modified Hitachi VIP-9550), a 13-inch RGB color monitor, a 16-button keypad, and a light pen. Different sizes and types of monitors can be substituted where necessary. The system includes interfaces for NTSC monitors and standard television sets. It also supports a wide range of different I/O devices that can replace the keypad and light pen, such as a mouse, table, track ball, touch screen, joystick, and full ASCII key board.

Additional system options include a dot matrix line printer, a modem, a rack-mount kit, ruggedized carrying cases, headphones, and external 5 1/4 inch floppy and winchester disk drives.

The system itself is housed in a lightweight desktop chassis with a "footprint" about the size used by a standard PC. The unit contains a front-loading videodisc player capable of using both 12-inch and 8-inch laser video discs, dual 720K-byte 3 1/2-inch microfloppy disk drives, an MS-DOS-based modular computer implemented on three plug-in boards, a processor board, a video overlay board, and a digital data recovery board.

The system can be programmed to interact with the user and present information in a variety of ways, depending on user requests and response. The system can deliver linear motion sequences up to about 30 minutes in length, similar to film strips or videotapes. These motion sequences can be accompanied by an audio sound track. The system can also deliver still-frame slides (up to 54,000 slides on each side of a disc) similar to 35-mm slides or overhead transparencies. Again this material can be accompanied by a digital audio sound track (up to 60 seconds of uninterrupted audio per frame). The unit can also provide a full-screen computer-generated text and graphics overlay to be used either by itself or over videodisc images.

Any combination of motion sequences, slides, digital or analog audio, graphics, text, or computer data can be stored on the video and accessed for playback in an entirely random fashion.

The Encoding Unit

For the audiovisual production facilities, the basic student workstation can be upgraded to a digital data/still-frame audio encoding workstation capable of directly producing a 1-inch premaster videotape containing all courseware material.

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The encoding unit uses a full ASCII keyboard, a 40M-byte winchester disk drive, a module for generating digital audio, a videotape interface, and several software modules which facilitate the transfer of all materials to a master tape.

Future Expansion Capabilities

The delivery system uses a modular industry standard microcomputer bus architecture which allows fast, simple maintenance, easy expansion by adding additional boards, and unlimited capabilities for future expansion needs. The system also has the capability to include local area networks (LANs), 32-bit processors, expanded random access memory (RAM), digit video capture (frame grab), IEEE-488 communications, and voice recognition.

The system will also be able to accommodate new magnetic and optical media expansion capabilities such as CD-ROM (compact disk-read-only memory) and WORM (write once, read many) drives.

Matrix has also publicly announced the availability of an EIDS containing an IBM PC/AT data bus for those users who desire that level of IBM capability. Under the provision of the existing contract, Matrox is obliged to offer this feature to the Army as a technology substitution or value-engineering change proposal. The Army is currently evaluating the IBM PC/AT data bus feature against existing and emerging training requirements. it will also continue to enhance EIDS as technologies and requirements change. The modular design and construction of the system, coupled with the change clauses of the contract, will enable EIDS to stay relatively modern in a rapidly changing technology arena.

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MAINTENANCE TRAINERS

ELECTRICAL TRAINING DEVICE

This device provides for institutional training of essential skills relating to AC/DC circuits, electrical switchboard operation, and troubleshooting techniques for motors and generators on Army marine vessels.

M1 MAINTENANCE TRAINER SYSTEM

The M1 Maintenance Trainer consists of: (1) The tank turret organizational maintenance trainer (TTOMT) which is a full size interactive turret simulator that provides hands-on training in fault isolation using a simulated STE-M1 test set; (2) a programmable panel trainer covering the turret hydraulic and electrical system of the M1 tank for training the organizational mechanic in proper troubleshooting procedures; and (3) a series of five programmable, computer-driven panel trainers, each addressing components of the M1 tank for training of the DS mechanic in troubleshooting procedures. Panels provide visual and audio cues to the student during fault isolation. The panels simulate: turret electrical & hydraulic systems, ballistic computer/laser rangefinder, hull electrical system, engine and transmission.

FIREFINDER FAULT INSERTION DEVICE - STE

The Fault Insertion Device for the mortar (AN/TPQ-36) and artillery (AN/TPl-37) locating radars will be an institutional training device consisting of an instructor/control unit, fault cards and associated cable connections attached to actual radars used in a training role. The instructor unit will have the capability of input and removal of selected faults in the radars.

FIREFINDER INTERMEDIATE MAINTENANCE TRAINER

The Intermediate Maintenance Trainer will be used to train AN/TPQ-36 (Mortar) and AN/TPQ-37 (Artillery) maintenance personnel on fault detection, verification and use of Built-In Test (BIT) elements, and interpretation of BIT language to isolate and verify faults. The trainer will provide for use of actual test equipment during the troubleshooting phase. It also provides mock-ups of faulty or actual components that can be identified, repaired, and tested to insure that the system has been restored to an operational status.

SIGINT/EW MAINTENANCE TRAINER (SIGINT/EW MT)

This training device will provide individual training for the maintenance complex, computer based signal intelligence systems. It consists of a video disk, two 3D panel trainer

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mock-ups and computers (CRT's, keyboards, and peripherals) to teach basic systems level troubleshooting and diagnostics.

HYDRAULIC TRAINING DEVICE

The Hydraulic Training Device is a multi-purpose modular training system for institutional training. It will train troubleshooting, servicing, and repair of the various components of hydraulic systems on Army marine vessels. The device provides for instruction on all components necessary to fully acquaint the apprentice with the principles of fluid power.

HYDRAULIC SYSTEM SIMULATOR, MODEL 421

The Hydraulic System Simulator is a device used to support hands-on training and professional development courses at the USAOCS and USAARMC, Ft. Knox. The simulator will be used with actual equipment, to facilitate the instruction of theory, operation, and troubleshooting for most vehicle series. Malfunctions which teach fault isolation will be inserted into the actual equipment.

DIESEL ENGINE TRAINING DEVICE

Diesel Engine Training Device is a portable, programmable panel trainer to teach maintenance tasks on four cylinder diesel engines.

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SELECTED TRAINERS

MILITARIZED ELECTRONIC INFORMATION DELIVERY SYSTEM (MEIDS)

MEIDS is a hand-held, electronic job performance aid that will deliver technical information in all military environments. The device will: be self-sustaining for eight hours of operation, be the size of a collegiate dictionary, use a flat screen delivery technology,and will interactively delivery the technical data. The Army Authoring system (AAS) is a subsystem of MEIDS and consists of an automated system for the development of technical and/or training materiel. AAS automates the front-end analysis through task selection, task analysis, design and development. AAS automatically queries the appropriate data base and prompts the author throughout the development of the technical and/or training materiel.

AN/UPD-7 SIMULATOR TRAINER

The AN/UPD-7 is a device to train MOS 96H, aerial intelligence specialists, and military intelligence aviator track course officers in system operational parameters of the AN/APS-94F side Side Looking Airborne Radar (SLAR). Skills trained include the ability to read imagery, check critical elements of film reproductions, make adjustments to affect readability, and allow instructor interface in order to teach operations under degraded situations. The system will replicate a SLAR mission profile and emulate original system characteristics.

AVIATION COMBAT TEAM TRAINER (ACTT)

The ACTT system will train scout and attack aircraft crews how to fight as a team in a combined arms environment. It will consist of a combination of scout and attack generic cockpit modules, as well as instructor/operator stations.

COMBAT SERVICE SUPPORT TRAINING SIMULATION SYSTEM (CSSTSS)

The CSSTSS is a device to train U.S. Army units, both active and reserve components. it provides command and control procedures training required for effective interaction between combat service support (CSS) elements. It further provides CSS interaction with combat and combat support elements in support of Airland Battle Doctrine.

COMPUTER ASSISTED HEALTH SERVICES SIMULATOR (CAHSS)

CAHSS is a family of computer simulations which will provide a free play, highly credible, real-time, computer-driven battle environment designed to permit command groups at the various echelons of health services support to develop, refine, and upgrade their staff procedures and decision-making processes to

critical speed and precision necessary to provide medical support to combat operations on the modern battlefield.

DATA AUTOMATED TOWER SIMULATOR (DATS)

DAS simulates a standard Army control tower configuration that accommodates four students and provides for three instructor positions. The device is equipped to accommodate all communications, radio and interphone equipment in addition to a realistic parnoramic view of airport layout no less than 180 degrees around the tower, and computer generated images of aircraft and ground vehicles.

DRIVER - PROCEDURAL EMERGENCY REACTION TRAINER

The simulator will provide a vehicle cab with pedals, dials, and steering wheel to follow a scenario projected on a screen that will help drivers improve emergency decision making processes. (Mr. Jackson, (3050 646-4726, AMCPM-TND-EP).

M-60 TANK DRIVER TRAINER (M-60 TDT)

The M60 Driver Trainer provides realistic vision, motion and audio simulations. Interior will be identical to interior of the M-60 tank. Visual simulation will be provided by using a terrain model board. Instructor will be able to visually monitor student's driving actions and introduce engine, transmission and track suspension malfunctions. The driver trainer will provide for initial driver qualification training for the M-60 series tank and transition training for tank drivers not qualified or current on the M-60 series tank.

BRADLEY GUNNERY AND MISSILE TRACKING SYSTEM (BGMTS)

BGMTS is a device for screen-generated scenarios to be run with laser projectors used to fire as targets present themselves. The current M2/3 configuration will be used to sustain the skills of the crew and command of the BFV when not training on UCOFT or during live fire exercises.

COCKPIT, WEAPONS EMERGENCY PROCEDURES TRAINER (CWEPT) - AH64

This device provides for the most cost effective method of training cockpit, weapons and emergency procedures in a simulated environment. With this device the aircrew can routinely practice those tasks which would otherwise require the use of the combat aircraft or the combat mission simulator.

SIMULATED AREA WEAPONS EFFECTS - INDIRECT FIRE (SAWE-IF)

SAWE-IF is an indirect fire casualty damage assessment system simulating artillery fire in combined arms exercises. It consists of a launcher, micro processor, and an indirect fire cue simulator (IFCS) which provides an airburst signature and an

automatic casualty assessment. An acoustic cue generated in the projectile will be converted into a MILES compatible code which will be transmitted into a standard direct-fire MILES detector.

SIMULATED AREA WEAPONS EFFECTS - NUCLEAR, BIOLOGICAL, CHEMICAL (SAWE-NBC) I

Three devices/simulants which simulate the effects of chemical biological weapons thus providing a realistic CB environment in which to train. SAWE-NBC Phase I includes the Chemical Agent Casualty Assessment System (CACAS) , Persistent Chemical Agent Simulant (PCAS), and the Chemical Agent Decontamination simulant (CADS). The devices will provide for real-time casualty assessment during force-on-force engagement simulation exercises. The CACAS consists of an electronic package resident in protective masks; the PCAS/CADS are simulants which replicate various chemical/biological agents on the battlefield and afford the opportunity to exercise proper CB avoidance, detection, and decontamination procedures.

ADA SFTS IMPLEMENTATION

This is a system engineering feasibility project to accomplish advanced research into the use of the ADA programming language on flight simulators, and to demonstrate new concepts in computer hardware/software modularity. The target of this research is the UH-1 flight training system (DVC 2B24) . The project will redesign the computer system and selected interfaces using modularity concepts developed by the US air Force, but not yet implemented in flight simulators. It will develop the trainer software program using the ADA programming language and ADA software engineering concepts. One 2B24 device will be upgraded. AFSCOM will award a production contract to upgrade the remaining UH-1 flight simulators.

GUARD UNIT ARMORY DEVICE FOR FULL-CREW INTERACTIVE SIMULATION TRAINING-ARTILLERY (GUARDFIST II-ARTILLERY)

GUARDFIST II will be an interactive video disk display system used to train the forward observer (FO) in a stand-alone mode or to train the FO with the fire direction center (FDC), and the howitzer crew in an interactive training mode. GUARDFIST II will train the FO in target identification and call for fire. It will provide FDC personnel training in communications and computing targets and provide howitzer crews training in setting azimuth and elevation.

PRECISION GUNNERY TRAINING SYSTEM (PGTS)

PGTS is an indoor and outdoor training for the TOW and DRAGON anti-armor weapons systems. The indoor trainer may employ video disk or computer generated impagery. The outdoor trainer is expected to employ laser technology and be MILES compatible.

SIMULATED AREA WEAPONS EFFECTS - MINE EFFECTS SIMULATOR (SAWE-MES)

SAWE-MESS is a smoke and flash signature-producing training mine device to be similar to the M15AT/M16AP mines in physical appearance, dimensions, and weight and to be equipped with the same activating options as the real mines. The MES will be MILES interoperable and will provide for a real-time casualty assessment capability. (Mr. Jackson, (305) 646-4726, AMCPM-TND-EP)

SINGLE CHANNEL OBJECTIVE TACTICAL TERMINAL (SCOTT) OPERATOR TRAINER

This training device will be used to train MOS 31C students in the operation, and unit level maintenance tasks associated with SCOTT mobile communications vans.

GUARD UNIT ARMORY DEVICE FOR FULL-CREW INTERACTIVE SIMULATION TRAINING - ARMOR (GUARDFIST I)

GUARDFIST I will consist of interactive scenarios viewed through vision blocks for the driver, the M32 periscope for the tank commander, and the gunner's sight. A series of targets will be introduced by the scenario director. This device will be used by the National Guard in armories to attain and sustain tank gunnery proficiency and will exercise the full crew by drills in situational training exercises.

LAUNCH ENVIRONMENT SIMULATOR (LES) - DRAGON

The Launch Environment Simulator is a field trainer designed to replicate the launch environment associated a Dragon guided missile launch. An electrical interface with the AN/TSQ-TI monitoring set offers missile tracking training. The simulator provides a realistic simulation of the critical seconds after trigger squeeze to include: recoil, sound pressure level, overpressure, flame, smoke, debris and short term target obscuration. These effects are obtained through the combustion of a MAPP gas and oxygen mixture in the launch tube which causes the perforation of biodegradable endcaps. The LES is a supplementary device to the Dragon Launch Effects Trainer.

FIRE SUPPORT TRAINING SYSTEM (FIRST)

An institutional training device for the Field Artillery School to train personnel in fire support procedures in an automated tactical environment. It is designed primarily for training MOS 13F and fire support officers in the basic and advanced officers courses during command post exercises (CPX). The device will allow approximately 70 students to train at all levels of the system (as designated by the instructor) and simulates the digital traffic of those parts of the fire Support System (FSS) not manned by students. The instructor has the capability to

input specific events in the pre-programmed battle scenario prior to, as well as during, conduct of the exercise. Initially the system will simulate the Field Artillery Tactical Data System (FATDS) and be adaptable to the advanced FATDS (AFATDS).

MULTISYSTEM TRAINING SYSTEM

The Multisystem Training system is a strap-on, tactical engagement simulator coupled with computer manipulated video disk based targets with a feedback and scoring system for use in air defense troop proficiency training. The device will allow for realistic gunnery training of all crew members in institutional and sustainment training without ammunition or target and fuel expenditures.

TACTICAL COMMUNICATIONS SIMULATOR (TACOMSIM)

TACOMSIM is a training device utilizing computer assisted instruction to train signal officers, warrant officers, and NCOs in planning, installation, operation, control and management of hybrid and digital tactical communications systems. The device will have one instructor station to 20 student stations.

SPECIAL ELECTRONIC MISSION AIRCRAFT MISSION SIMULATOR (SEMANS)

SEMANS is a device with modules to simulate the pilot, copilot, and observer positions, of a variety of special electronic mission aircraft (SEMA). The simulator cockpit modules replicate the actual aircraft cockpit with all functional controls and equipment. Major components include a computer module, visual system, motion platform, instructor console, and OV/RV-1D, RU-21, EH-1H/-1X, RC-12, and EH-60 cockpit modules. The simulator provides institutional pilot familiarization training to student pilot trainees.

LARGE SCALE SIMULATOR NETWORKING: IMPLICATIONS FOR MASTERING THE ART OF WARFIGHTING

LtCol Jack A. Thorpe (Ph.D), USAF
Defense Advanced Research Projects Agency
1400 Wilson Blvd.
Arlington, Virginia 22209

ABSTRACT

Advances in several core technologies, particularly local and long haul networking, open up a new area in simulation: Large scale simulator networks. This has important implications for training warfighting skills as well as providing tools for other areas. These are discussed along with a description of new capabilities and future directions.

INTRODUCTION

It appears that the ability to construct large networks of simulators is well within our grasp. Local area networking (LAN) technology is established and can be purchased off the shelf for connecting perhaps hundreds of simulators at a given site. Long haul networking (LHN) technology is maturing rapidly and will provide force-on-force gaming between sites. The silicon technologies yield new levels of computational resources every three years with improved performance at reduced cost. And a fresh look at simulator design is making it easier to match the physical and performance characteristics of the simulator to the needs of the combat team member.

This is an important breakthrough. For the first time, we have the opportunity to attack the premier training problem of the military: How to master the art of warfighting.

WARFIGHTING

Modern warfighting is the most complex activity performed by man. It is rooted in each individual's performance with his single weapon system, support system, logistic system, administrative system, or whatever system he or she must operate as part of the broad machine of combat. But it includes the coordination of that individual's activities with others in the crew, and that crew's interaction with other crews, their interactions with other larger teams of similar combat systems, and the team's interaction with combat support and services support of their own branch and their own service. It includes the interactions of combatants between branches (armor interacting with attack helicopters, for example) and interactions with other services (e.g., close air support). On the highest level, it includes cooperating forces of different nations and different languages interacting with each other on a common battlefield.

To be successful at warfighting, combatants must master these interactions at all levels. These are the constants in battle. As the implements of war change as a function of advancing military technology, the common denominator remains the interactions between people. Training of this is training for teamwork, coordination, execution, orchestration of the battlefield. It is the essence of successful warfighting.

Up to now the United States has relied on field exercises to bring together the component skills needed for warfighting. In sports, these would be called the scrimages or preseason games which exercise the whole team: the coaching staff, the equipment and conditioning staff, the spotters, the scouts, the front office, as well as the players on the field and on the bench. The need to exercise the whole team distinguishes this from other types of training: Training for team execution requires involvement and practice of the entire team under conditions represantative of the contest.

Exercises like the Army's National Training Center and the Air Force's RED Flag are the closest examples of scrimages which are practiced in the military. They are particularly good at creating the chaos that accompanies all large human enterprises, chaos which Clausewitz chose to characterize as the fog of war and the principal determiner of failure.

Yet even as good as these field exercises are, training with real combat equipment on ranges has limitations: Because of safety, combatants are limited in how far they can push their systems, and because of cost, participation in these exercises is limited in duration and frequency.

Nonetheless these exercises are valuable. Units learn how to work together under tremendous stress, and leaders learn about the dynamics of unit operations in chaos. Further, the resident opponent or aggressor teams at these centers who provide the threat give us insight into the importance of practice to the mastery of warfighting: They have become consummate, cunning warfighters as a result of the thousands of hours of practice they receive during their tour of duty as the threat force. They have mastered warfighting. They are formidable opponents.

This reinforces what we already know about how teams achieve mastery of their art, be it a sports team, an orchestra, an operating room team or a combat team: Tremendous amounts of practice is required.

If the bad news is that to build proficient warfighting teams we have to provide this practice and that it is impossible to do so in the field, then the good news is that recent developments in technology enable us to think about bringing the field into simulation. This is the developing area of large scale simulator networks, the initial work being done in DARPA's SIMNET program.

CONVERGING TECHNOLOGIES

There are several converging technologies which make this initiative possible.

o Computer Networking - First characterized by the ARPANET packet switching network, local area networking technology has matured into off the shelf, standardized products. Packet switching protocols provide the means for transmitting data units needed by netted simulators and other gaming stations. Long haul networking using wideband satellite or land lines, particularly the new capabilities being created with fibre optics, provide interfaces between LANs via gateways. To be sure, the demands of real time interactions in a simulation network are more stringent than other networking applications but solveable.

o Communications - The communications capacity for running networks is expanding rapidly. C band wideband satellite capabilities are moving over to Ku band with reduced cost and size requirements. Fibre optic land lines, including those to Europe, are proliferating at a rapid rate. Whereas previously point to point schemes predominated, it is possible to consider a variety of hybrid, reconfigurable schemes featuring land lines that feed regional satellite uplinks which then exchange with each other and broadcast back to each site equipped with a small receiver antenna.

o Distributed Computing Architecture - Operating on a LAN, a completely distributed computing architecture distributed computing architecture all computing power to the simulators. No mainframe or central computers are employed in a central control role.

This allows a plug in modularity like the telephone system where each simulator is a self-contained, stand alone entity with its own host microprocessor, graphics and sound system, a complete copy of the terrain data base, and everything else needed to create a bubble of reality for its crew. The network communications functions live in each host processor in each simulator. Simulators plug together via cable, transmitting and receiving data units from other simulators and gaming stations. When a simulator fails, the network continues but without the contributions of the failed device. Malfunctions are soft and graceful.

o Simulator Design - There are many approaches to designing simulators, some which begin with physical or engineering models of the world and others which begin with behavioral or cue driven models of the world. In the first case, fidelity is defined by the match between the simulator's characteristics and measurements from the "real world." In the second case, fidelity is defined by the appropriateness of the cues which the simulator delivers to the operator, cues which are based upon who the operator is and what he is doing in the simulator, i.e., the training objectives.

The attraction of this second approach is that it can lead to the same results as the engineering approach but is not held captive by it. Using the concept of selective fidelity, simulator and simulation characteristics which contribute directly to the goal of the training are represented in high fidelity, and those which do not contribute to the training are in low fidelity or not included at all.

Further, such an approach recognizes the legitimacy of departing from the fidelity curve and including such things as exaggerations and fictions when they do not compromise the training goal, as well as the application of a rule taken from the discipline of industrial design: Do not make something appear to be what it isn't if broken expectations can be damaging. These approaches to simulator and simulation design lead to a different yet very effective new type of device.

o Special Effects - Advances in sound synthesization, projection of infra sound, and application of design concepts from the special effects community have been used successfully to complement other traditional simulator cuing subsystems. Since simulations are illusions, the illusory technologies can enhance the end effect of a cue. Microprocessor based delivery systems make this affordable.

o Graphics - The free wheeling progress in microprocessors, integrated circuit design, and mathematical algorithms is nurturing advances in real time graphics. In almost all cases, the price for comparable performance is dropping, often by one to two orders of magnitude. Further, the methods by which these machines render images are different than in the past making earlier measures of merit less valid.

o Rapid Prototyping R&D Process - Along with the evolution of these technologies comes a rigorous style of development characterized by the "60% Solution" model of R&D. This model recognizes the transient nature of any particular technology and the danger of solidifying progress at a given stage. It uses rapid prototyping to iterate on a specific technological solution but never tries to solve 100% of any problem at any time even if a concise specification could be produced

articulating the desired goal, which is usually impossible to do in the first place. The 60% Solution closes on the goal, continually redefining the objective, has prototypes and mock ups as interim byproducts to verify direction, and cleans up the mess later. The rule is that in a changing technological world, managing change is the principal role of the R&D process, not producing a specific product which is expected to last forever (with a pricetag that suggests the same).

HOW IS THIS DIFFERENT?

The inherent nature of networking gives rise to different ways to think about simulation.

o A simulated world vs. a single simulator - Networking creates a simulated world. A common terrain data base is shared by all simulators in a given networked exercise. Combatants enter that world through their simulator or gaming station, traverse that world, fight in that world, and are supported in that world by combat support and services support (e.g., refueling, rearming, and resupplying). Architecturally, as long as at least one simulator is on and hosting a copy of the data base, the world lives....when other simulators join on the network, their worlds are updated to the current situation and the crews enter the current world.

As with other simulations, the simulated world is rent free, sustains no permanent ecological damage, and commanders can push their weapons, tactics, and organizations to the limit. The principal difference is the scale: Other simulations focus on single crews while networking creates a world of large forces. Any area of the earth can be modeled, or ficticious terrain can be created.

o Experienced teams vs. novices - Because networking allows large teams to engage, the focus is primarily on warfighting and therefore the participants are typically combat personnel in operational units. These personnel have already developed their individual skills: Drivers know how to drive, pilots know how to fly, gunners know how to engage and kill targets. Networking allows them to bring the combat team together and practice the integration of all these skills.

o No reset button - The instructor in the typical simulator session aimed at a given syllabus objective usually initializes the simulator into a particular configuration and then conducts the training. Upon the conclusion of the session, or often during the session, the simulator is reset to its initial conditions.. This is efficient when training individual

skills, but in continual combat operations where the crew is operating in a simulated world with other teammates, reset is a foreign concept. When a combat vehicle runs low on gas, the crew must arrange to be refueled from a fuel truck, coordinating rendezvous position, amount of fuel needed, protection from hostile forces while refueling, rejoining the battle, and so forth. When the fuel supply in a truck is too low to top off each vehicle, commanders must determine how they will modify their combat plan to accommodate this situation.

o No instructors, controllers, or umpires - If warfighting is in progress, the combat team engages its opponent just as it would do in the real world. This means that the chain of command on each side controls the battle to the best of its ability, issues operations orders, receives spot reports, maneuvers on the battlefield, and so forth. Commanders trying to survey the battlefield can be killed and the chain must react and replace. Just as in combat, there are no overlords in this type of exercise other than the chain of command. None are necessary.

o After action reviews performed as in combat - As above, the chain of command performs after action reviews as they would in combat. Even though networking allows for the collection of perfect knowledge about what each member of any conflict is doing at every moment of the battle, the only relevant information which the team requires is the same information available in combat. The combat model dominates training..

o Real time casualty/kill removal - Just as there are greater implications for attending to logistics, administrative, planning and execution factors when operating in a long term interactive world, there are similar concerns when crews who are injured or killed as a result of hostile action or accident must be immediately attended to or removed from the simulation. In both cases, the tactical situation can change drastically because of the reduction in force strength as well as the attendant burden of having to care for the injured, service damaged vehicles if they are serviceable, call for personnel replacements, and insert them at the right time and place in the battle.

WHAT DOES THIS ALLOW US TO TO DIFFERENTLY?

TRAINING

Large scale simulator networking has obvious implications for training combat teams to a level of mastery unseen outside of actual combat. Future networks appear to be growable to sizes which could match the largest organizational structure, an attribute which is understandable when one equates the layered

levels of combat forces with nested networks. Just as the maneuver sectors of several battalions can be encompassed by the sector of an artillery battery, and several of these can be encompassed by the area covered by an aircraft, so too, one giant network or several nested interconnected networks can create the same world. If trends continue, it is likely that theater level exercises could be conducted in networked simulators.

By 1988, networks will be operational which can accommodate several hundred combatants. By 1990 that will expand to a few thousand. Commanders world wide, including Allied commanders, will have the ability to dial up training exercises to practice joint warfighting skills in a garrison setting.

When training is less ambitious, of course, networked interplay can be reduced to the single simulator. Networks, like conferences calls, are continuously reconfigurable.

Configuration, too, allows force-on-force training. Professional fighting forces compete vigorously when opposing each other. This is not true when fighting a computer. Video games become tiring. Networked combat derives its motivation from force-on-force competition.

When the data base is of a crisis area and the order of battle reflects the latest intelligence, the coordination of team operations can be practiced in networked simulators This is most critical. Many special situations in recent memory could have benefited from additional opportunity to practice teamwork under demand conditions. Since networks are easy to set up, it is even possible to conduct dress rehearsal and contingency planning enroute to the scene (e.g., shipboard) or nearby.

The interesting artifact of networked exercises is that they exercise the chain of command in every respect. The chain of command must organize and supervise the use of networks as well as the combat that goes on inside of them. Leaders are trained at every junction and practice what they have learned.

DEVELOPMENT

Team simulation has value to the development of new weapon systems as well as training to use them. This is made possible because the simulators can be employed in simulated combat with the same force size and tactics expected of the candidate system against baseline systems (other networked simulators) representing the expected threat and manned by aggressors trained in the tactics of the opponent. This expands and complements the design data collected in the engineering simulators at Service and contractor R&D centers.

When typical troops are used in this context, training and tactics have to be addressed early in the development cycle. Prototype Training systems must be developed to prepare the troops to use the candidate systems. Potential problems in training, human factors, manning, organization, and implementable tactics are discovered early on. If the weapon system is developed, the training subsystem, including the training simulators, have already been developed.. The training system has a chance of preceding the fielding of the weapon system itself.

Testing and Cost Projections

The testing requirements for new weapon systems are rigorous but often can only be accomplished under restrictive conditions, e.g.., safety constraints that limit realistic maneuver, using a small number of early test vehicles unrepresentative of actual employment strength, and not employing the system as a fightable weapon (adapted by its operators to changing conditions to maximize strengths). Team simulation can complement testing by providing data in these areas.

Similarly, cost projections on life cycle costs often make many assumptions about how forces will use the system. Data from interactive simulations where typical combatants fight the candidate systems against baseline forces can augment cost models.

Future Command and Control Systems

Perhaps the most far reaching and least obvious attribute of simulator networking, however, is that it is mimic of future command and control structures. A joint AIRLAND battle of a multi-battalion size with air, land, command, and support elements networked between several sites by long haul networking is, in effect, a real time, sophisticated command and control system. As the simulator networking technology is developed to allow this level of exercising, there is a direct advance in the state of command and control systems.

In the same sense, networks that span Allied forces for NATO exercises are at the heart of interoperability. Networks which can be successfully constructed across these boundries will aid in the solution of interoperability issues.

WHERE ARE WE GOING?

Ongoing R&D on simulator networking will have several influences on the course of simulation. Some possibilities are listed below.

o It is likely that all simulators procured in the future will be required to be network capable. The major technical issue will be functionally equivalent data bases, specifically the equivalence in cues provided to crews operating in the same world but in different types/manufacturers' simulators.

o This will be aggravated by the pace of technology. We can expect to see many different generations and types of simulators residing on a given network (just as many different styles and ages of telephones are plugged into the telephone network). The increased capability of newer simulators must be coordinated with the capabilities of the older machines as regards their operation by the combatants.

o Because of the numbers of simulators which will be needed for large team practice across the U.S. and NATO spectrum, the unit cost of new simulators must be dramatically lower than simulators today. Because technology is moving so quickly, fixing (and investing heavily) on a given technology level has severe penalties.

o This argues for an R&D approach which uses the 60% Solution model: Develop quickly, be satisfied with good enough, keep the development cost and recurring costs low, plan to throw away earlier than in the past. To keep pace with this model, requirements documents from Service users will have to be modified to allow rapid, iterative development and fielding of less than perfect devices. In the end, however, this process will likely provide a superior solution to the users needs.

ABOUT THE AUTHOR

LtCol Thorpe is the DARPA program manager for advanced research projects in simulation and training. He manages the SIMNET Large Scale Interactive Simulator Networking Program.

AFV TRAINING INITIATIVE

- DOCUMENTATION
  - AFVTF TRAINING ANALYSIS
  - ICTP
  - CTEA PLAN

- AFV TRAINING ENHANCEMENTS
  - IMPROVED TRAINING CAPABILITY
  - GREATER TRAINING FLEXIBILITY
  - GREATER TRAINING EFFICIENCY AT LESS COST
  - IMPROVED TRAINING READINESS

- ACHIEVED THROUGH
  - COMMONALITY
  - SIMPLIFIED MOS STRUCTURE
  - SIMULATION
  - EMBEDDED TRAINING

- ANTICIPATED SAVINGS
  - INSTITUTIONAL TRAINING SAVINGS

CURRENT FORCE	AFV
$2.5B	$1.9B

  - UNIT TRAINING SAVINGS

CURRENT FORCE	AFV
$1.4B	$.8B

XI-C-I-68

UNCLASSIFIED

UNCLASSIFIED

ENCLOSURE 16

UMBRELLA INDIVIDUAL AND COLLECTIVE TRAINING PLAN (ICTP)

FOR

ARMORED FAMILY OF VEHICLES (AFV)

UNITED STATES ARMY COMBINED ARMS CENTER
FORT LEAVEN WORTH, KS 66027-7000

UNITED STATES ARMY LOGISTICS CENTER
FORT LEE, VA 23801-6000

9 JULY 1987

ENCLOSURE 17

1. TRAINING CONCEPT.

a. The AFV training will be developed IAW the Systems Approach to Training (SAT) and executed within the Materiel Acquisition Development Process as regulated by the Army Life Cycle System Management Model (LCSMM). The concept will optimize the use of embedded training to the extent technology permits. Embedded training is defined as that training which results from features designed and built into specific end item equipment to provide training in the use of that end item equipment. Individual and collective training will be thoroughly designed and developed to assure a total training system is maintained for both operators and maintainers. All resource requirements necessary to field this system will be identified, validated, and made available throughout the equipment lifecycle. This concept visualizes a family of armored vehicles that equips the force with its training system in place. The family will be designed with embedded training subsystems to support unit sustainment training and/or device based subsystems to support institutional training. These will encompass all training categories (individual/operator, crew, functional, and force level).

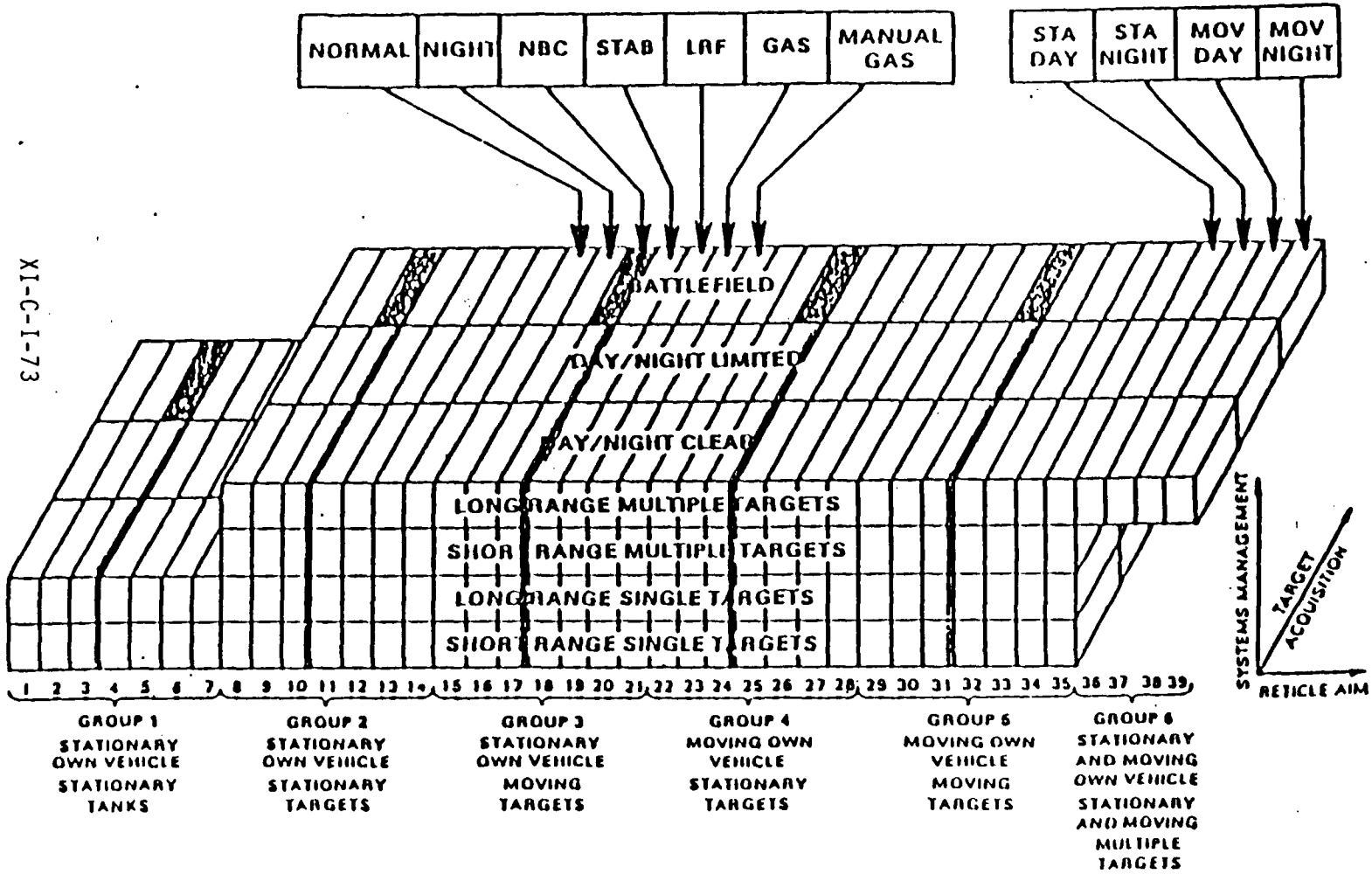
b. Institutional courses of Instruction (new and/or revised). The AFV institutional training will be based on results on Cost and Training Effectiveness analysis (CTEA), Early User Test and Experimentation Test (EUT&ET) during Proof of Principle, and Initial Operational Test and Evaluation (IOT&E) during Development Production Prove-Out. Device-based training will be relied upon to reduce costs and limit training base requirements for operational equipment. appropriate existing officer, NCO, and enlisted courses will be modified to incorporate necessary instruction on doctrinal, tactical and logistics issues. New courses will be implemented if required. Proponent institutional requirements relisted in appendix J.

REQUIRED OPERATIONAL CAPABILITY

1. MANPRINT ASSESSMENT

a. Training Assessment. The material developer and the TRADOC proponent will require the contractor by SOW/RFP to design, develop and validate a complete organic training subsystem for each AFV system. the subsystem will include all training documentation, simulation and devices required for individual and collective training for the institution and unit. Each subsystem will support New and Displaced Equipment Training (NET/DET) and will be available before fielding. All training subsystems will be based upon a device based training strategy. Embedded system trainers are first priority for unit training. Stand-alone simulations and devices are first priority for institutions. Simulation and device priorities are gunnery, maintenance, driver and tactics. All components of the training subsystems will be identified during concept exploration and investigated and validated during proof of principle. Specific device requirements are at Appendix 5.

M1 U-COFT COMMANDER/GUNNER TRAINING MATRIX



XI-C-I-73

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POI REQUIREMENTS

ANNEX	TITLE	PROPONENT
A	Future Armored Combat System (FACS)	USAARMS
B	Light Future Armored Combat System (LT FACS)	USAARMS
C	Future Reconnaissance Vehicle (FRV)	USAARMS
D	Future Armored Resupply Vehicle (FARV)	USAARMS
E	Command and Control Vehicle (C&C)	USAARMS
F	Future Infantry Fighting Vehicle (IFV)	USAIS
G	Directed Energy Weapons Vehicle (DEW-V)	USAIS
H	Kinetic Energy Missile Vehicle (KEM-V/LOS-AT)	USAIS
I	Mortar Weapon System Vehicle (MWS-V)	USAIS
J	General Purpose Carrier (GPC)	USAIS
K	Advanced Field Artillery System - Cannon (AFAS-C)	USAFAS
L	Fire Support Combat Observation Lasing System (FSCOLS)	USAFAS
M	Elevated Target Acquisition System (ETAS)	USAFAS
N	Rocket and Missile System (RAMS)	USAFAS
O	Line of Sight Forward - Heavy (LOS-F-H)	USAADS
P	Non-Line of Sight Vehicle (NLOS)	USAADS
Q	Sapper Vehicle (SV)	USAEC
R	Combat Mobility Vehicle (CMV)	USAEC
S	Mine Dispensing Vehicle (MDV)	USAEC
T	Combat Excavator (CEX)	USAEC
U	Combat Earthmover (CEM)	USAEC
V	Combat Gap Crosser (CGC)	USAEC
W	Maintenance Assistance and Repair System (MARS)	USAORDC

X	Recovery Vehicle (RV)	USAORDC
Y	Intelligence and Electronic Warfare Vehicle (IEW)	USAICS
Z	Nuclear, Biological, and Chemical Reconnaissance System (NBC)	USACMLS
AA	Combat Smoke Vehicle (SMOKE)	USACMLS
BB	Armored Security Vehicle (Security)	USAMPS
CC	Armored Ambulance (Ambulance)	USAAHS/USAIS
DD	Armored Bn Aid Station (ABAS)	USAAHS/USAIS

(U) ARMORED FAMILY OF VEHICLES

TASK FORCE

PHASE I REPORT

PART II

(U) UNIT TRAINING

(U) Part II. Unit Training

(This Part Is Unclassified)

1. Purpose. The purpose of this part is to provide the concept and analytical basis for the AFV unit training program.

2. Assumptions. The following assumptions were considered:

a. Simulation can be used to train and sustain individuals, crews, and units to standard.

b. An embedded capability will be manufactured into each AFV vehicle to provide individual, crew and collective training.

c. Appended or standalone devices and simulations with the exception of maintenance trainers, will be considered only if an embedded capability is not feasible, e.g. not cost effective, interferes with operational equipment, too complicated.

d. An up-front capital investment in training simulation and devices will reduce system life cycle costs.

e. Current levels of training ammunition and OPTEMPO requirements can be reduced by execution of a mature simulation and device strategy developed concurrently with each AFV end item.

f. A mature device and simulation program will provide unit commanders with the capability to maintain readiness despite budget restrictions, resource and real estate curtailments.

g. A top down directed strategy will be required to change the current unit training concepts and strategy as described in the Battalion Level Training Model and the Standards in Weapons Training (DA PAM 350-XX).

3. Data. To provide an understanding and appreciation for the scope of the training issues and the budgetary implications associated with unit training, the following data are provided:

a. The Operations/Training, Program 2 (mission) requirement as contained in the FY 87 Army Budget (Enclosure 1) is: $1.754 Billion. The general increase is approximately 3 percent a year or about $30 Million.

b. The estimated cost of training ammunition as projected by AMC (TACOM) as a 25 year life cycle cost estimate to support AFV unit training is $41.4 Billion. This is an increase of $11.6 Billion above the estimate required to support the current vehicle force.

c. The following table contains data about Operating TEMPO (OPTEMPO) as it pertains to principle combat and combat support units. The information is extracted from the Battalion Level

Training Model (BLTM) used by DA to manage training requirements for the Army that are linked to training readiness. OPTEMPO is defined as the annual operating miles driven in a particular unit required to execute the commanders training strategy.

Table 1. OPTEMPO

TYPE UNIT	CURRENT OPTEMPO AUTH (MILES)		COST PER OPTEMPO MI	OPTEMP COST/ UNIT ($)	ANNUAL OPTEMPO COST POM93 FORCE	
	PER VEHICLE	PER UNIT			#UNITS	COST(BIL)
BATTALION, TANK M1	820	47,554	$58.00	2,758,132	55	15,169.0
BATTALION, MECH M2	965	52,104	$46.00	2,396,784	45	10,786.0
BATTALION, 155 HOW, M109 (3 x 8)	591	14,188	45.00	638,460	36	2,298

d. The following tables contain major ammunition requirements for the battalions discussed above as extracted from the Standards in Weapon Training authorizations, DA PAM 350-XX. Standards in Weapons Training is a DA Program developed to provide the appropriate mix of live fire and simulation to achieve and sustain training readiness. It is the ammunition and simulation companion piece to the BLTM.

TABLE 2. AMMUNITION: M1 TANK BN

AMMO TYPE	ANNUAL ALLOC	COST PER ROUND	$ ANNUAL COST
105 (TPDS-T)	4234	269.00	1,138,946
105 (HEAT-TPT)	1566	209.00	327,294
7.62	112,868	.43	48,533
CAL.50	51,968	1.80	93,542
4.2 ILLUM	2132	260.00	554,320
TOTAL			2,162,635

ANNUAL COST FOR POM 93 FORCE - 55 BNS: $118,965,000

TABLE 3. AMMUNITION: M1A1 TANK BN

120(TP-T)	4234	1480.00	6,266,320
120TPCSDS-T	1566	1140.00	1,785,240
7.62	112,868	.43	48,533
CAL.50	51,968	1.80	93,542
4.2 ILLUM	2132	260.00	554,320
TOTAL			8,747,955

ANNUAL COST FOR POM 93 FORCE - 55 BNS: $481,140,000

TABLE 4. AMMUNITION: M2 MECH BN

AMMO TYPE	ANNUAL ALLOC	COST PER ROUND	$ ANNUAL COST
ADPS	30,120	33.20	999,984
TPT	26,184	15.75	412,398
TOW SIM	1,692	5500.00	930,600
7.62 COAX	158,700	.43	68,241
4.2 ILLUM	32	260.00	112,320
TOTAL			2,523,543

ANNUAL COST FOR POM 93 FORCE - 45 BNS: $113,535,000

TABLE 5. AMMUNITION: M109 HOW BN (155)(3 x 8)

AMMO TYPE	ANNUAL ALLOC	COST PER RD 1/			$ ANNUAL COST
		PROJO	FUZE/CHARGE	$ TOTAL	
155 HE	4292	180.00	141.00	321	1,377,732
155 SMOKE	84	376.00	141.00	517	43,428
155 WP	42	106.00	141.00	247	10,374
155 ILLUM	468	317.00	176.00	493	230,724
TOTAL	4886				1,662,258

ANNUAL COST FOR POM 93 FORCE - 36 BNS: $59,832,000

1/ Projectile costs are as indicated. Charge and fuze costs have been averaged, i.e.:

(1) Charge: 50 percent of missions will be Green Bag (GB) and 50 percent will be White Bag (WB):

WB: $110.00

GB: $ 75.58

$185.58 : 2 = $92.79

(2) Fuzes:

(a) 50 percent of missions with the exception of ILLUM can be fired with PD Fuze. Cost: 17.00 each. Annual PD fuze cost: Total rounds (less ILLUM) = 4418 : 2 = 2209 x $17.00 = $37,553.00. Other fuzes, MTSQ and proximity average $80.00 each. Accordingly: 2209 x $80.00 = $176,720. Average cost for fuze is: 37,553 + 176,720 : 4418 = $48.50 per fuze.

(b) Cost per round is a function of projectile cost plus charge (92.79) and fuze (48.50) = $141.00 for all except ILLUM.

(c) ILLUM requires fuze time at an average cost of $83.00. Cost for ILLUM is projectile cost plus charge (92.79) and fuze (83.00) = $175.79.

e. The following table extracted from a briefing provided by I Corps, Ft. Lewis, Washington, contains a cost comparison between live fire and selected ammunition and simulation training.

TABLE 6. COMPARISON

ITEM	ACTUAL	SIMULATION
TOW DRAGON	$5500/RD 4000/RD	$103 PER DAY IN THE ANTI-ARMOR THEATER
REDEYE STINGER	$25,145/RD 45,000/RD	$585 A DAY IN THE MTS
FIELD ARTILLERY	$225/RD 105 ICM $325/RD 155 ICM	$130 PER DAY THE TRAINING SET FIRE OBSERVATION (TSFO)
INFANTRY BATTALION TRAINING DAY	$7118/DAY	$1261 PER DAY USING BASE AND BABAS SIMULATIONS
INFANTRY DIVISION TRAINING DAY	$195,000	$18,357 PER DAY USING CBS $192 PER DAY USING FB: BC SIMULATION
CORPS TRAINING DAY	$926,250	$18,357 PER DAY USING CBS SIMULATION

f. Training technology maturity indicates vast improvement in training capability with reduced cost.

ITEM	DESCRIPTION	UNIT COST
UCOFT	STANDALONE SIMULATOR THAT TRAINS TC AND GUNNER	$2.2 MIL
EMBEDDED IN FUTURE ARMORED COMBAT VEHICLE	PROVIDES CAPABILITY TO TRAIN INDIVIDUAL, CREW USING ONBOARD OPERATIONAL EQUIPMENT	$3,400

The Army can realize significant savings through embedded training. This is done up front by developing new designs that take full advantage of advanced vetronics technology that will be a part of the AFV. Considering the AFV commonality concept coupled with digital interactive displays that are software driven -- the capability to build in embedded training with a minimal impact on cost is apparent. Software will be peculiar to a specific type vehicle. However, the sub-routines that make the system operate can have a high degree of commonality across the force. For example, if there are two chassis and two engines, the driver's panel could be common between both.

g. The Army is investing $670 mil to upgrade 252 ranges in both CONUS and OCONUS just to bring them in line with current training requirements.

4. Data Resolution. The data in 3 above resolves into six issues that must be considered and resolved.

a. The major training costs associated with unit training are a combination of OPTEMPO and ammunition.

b. Total training ammunition costs for advent of AFV are projected to increase by 29 percent.

c. The cost of individual items of ammunition can increase by a factor of five or more (105 MM TPT: $209. 120 MM TPT: $1480).

d. OPTEMPO costs can be expected to increase resulting from increased cost of spare parts and inflation.

e. Training with simulation is cheaper than training with operational equipment and ammunition.

f. Training costs will continue to increase unless direct action is taken to stem the tide.

5. Concept Formulation.

a. The AFV charter and the AFV Umbrella O&O plan, both direct reductions in O&S costs. With regards to training, and excluding military pay, the most costly aspects are OPTEMPO and training ammunition. The issue then becomes how to modulate these costs, maintain training and combat readiness and prevent escalating costs from pricing training out of the competitive market. The 11.6 billion dollar projected training ammunition increase shown at 3.b. for the AFV is testimonial to the problem.

b. Problem solution lies in providing the commander a capability and strategy to train under the auspices of an Army

directed program that places heavy reliance upon state of the art mature training technology. The essentials are:

(1) Embed a training capability in each vehicle to train and sustain the operator and crew to standard. Include as a minimum, the capability for company level collective training. Enclosure 2 contains a graphic portrayal of the concept. The essential requirements are:

(a) Provide capability to train to individual and collective standards in the motor park and local training area.

(b) Provide capability to sustain training readiness between live fire validation exercises.

(c) Provide flexibility to train and maintain readiness in spite of budget or facility restrictions.

(d) Eliminate necessity to draw and mount training equipment on operational equipment.

(e) Eliminate/reduce requirement to maintain warehouses filled with training equipment.

(f) Move the training location from traditional classrooms and ranges to operational equipment.

(2) Develop a training strategy along the lines of the Battalion Level Training Model (BLTM) and the Standards in Weapon Training program that prescribes specific:

(a) Events and tasks to be trained and certified by simulation

(b) Events and tasks to be trained and validated through the use of OPTEMPO.

(c) Weapon requirements and tasks that will be trained and certified by simulation.

(d) Weapon requirements to be trained and validated by live fire.

(e) Levels of training proficiency to be obtained with simulation -- before live fire or operational equipment is employed.

(f) Live fire and operational equipment exercises to validate training proficiency.

(3) Direct implementation of training strategy by Department of the Army regulations and link with AR 220-1, Readiness.

Enclosure 3 is a display of how the concept can be applied.

It 3 is a portrayal of how the simulation of OPTEMPO components would work together to result in training readiness.

6. Simulation Capability

a. This annex contains many descriptions about the capabilities of simulation in both the institutional and unit mode. Again, the issue is not a question of the value of simulation -- but how best to apply simulation in balance with operational and live fire that will result in trained soldiers and units capable of war fighting and winning. The examples that follow serve to amplify the role of simulation and provide additional insight into its application. However, to set the stage the following passage from the Weapons Crew Training Study, U.S. Army Training Support Center, November 1980 - February 1982, best captures the dynamics and perspectives of training in units. The key as in most endeavors is dedicated, well-informed leadership.

Weapons Training - A System

Attaining and maintaining a high state of combat readiness in a unit requires a large number of interrelated resources. Weapons crew proficiency is only one of the necessary elements of the total training requirement. But even the development and sustainment of crew proficiency is in itself a complex system requiring leadership, the proper number of soldiers time, range, ammunition, devices, and maneuver space. Each one of these variables is dependent upon the others. For example, the time requirement for a given level of proficiency is reduced by better leadership, better devices, less turbulence, and better ranges. Likewise, ammunition requirements are lessened with better leadership, better devices and ranges, and less turbulence. The most significant factors - the dominant variables - are leadership and time (includes turbulence), and not the quantity of training ammunition. When time, leadership, and personnel factors are unfavorable, expenditure of large quantities of training ammunition does not provide a high payoff in terms of sustained proficiency.

b. Because embedded training (ET) is the mechanical keystone to an effective and efficient unit training strategy and because the capability must be built in at the time of manufacture -- it is essential to understand ET and that the capability exists to fabricate it at the level and fidelity required for effective and efficient unit training:

(1) Definitions

(a) The term "embedded training" refers to a training capability designed and built into an item of equipment which provides training in its operation and maintenance. The definition of the term is extended here to include tutorials, scenarios, and job aids (e.g. maps, schematics, or checklists) which may be included in the software of future vehicles to allow individuals or teams to sustain their proficiency and perform their jobs more effectively. An embedded system contains the full range of training functions, including diagnosis, prescription, delivery, and evaluation capabilities. It does not require supporting media. An embedded system contains the capability to monitor training both within the equipment and through the use of an Instructor/Operator (I/O) station.

(b) The terms bolt-on and strap-on refer to simulators or stimulators which are fitted to existing systems for the purpose of training. It does not include a removable modular component which is a planned aspect of an embedded system to satisfy specific limited requirements.

(c) The term "stand-alone device" (SAD) refers to equipment designed specifically for the purpose of training. It includes procedure trainers and part, full, or collective task simulators, wargames and tactical simulations. Stand-alone devices may or may not contain the full range of training functions, hence the need to augment them by the use of supporting media.

(d) The term "supporting media" refers to low fidelity hardware or software which may be used alone or in conjunction with a stand-alone device. It includes Computer-Aided Instruction (CAI), videotape, film, texts, or over the shoulder instruction.

(2) Factors which suggest ET as a viable training tool:

(a) Control/display user interface

(b) System availability for training

(c) Minimal impact on Reliability, Availability or Maintainability

(d) Rapid shift from training to operations

(e) Sufficient computational capability

(f) Stable system design/employment

(g) Cost-effective training with ET

(h) Mission/individual tasks with high failure Consequences

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(i) Tasks requiring frequent refreshing

-Complex procedures

-Variable contingencie

-Application of rules/relationships

Integrated multiple skills

(3) Desired ET functional characteristics:

(a) Menu/adaptive driven

(b) Performance assessment/recording

(c) Segmented training, CAI -simulation

(d) Diagnostic (branching, etc.)

(e) Simulation

Operational Fidelity

Interactive

(f) Authoring/input capability

Training segments/strategies

New Scenarios

Different targets/non-targets

Assessment criteria

(4) ET Capabilities and Benefits

(a) A training capability that is concurrent with fielding and will support mobilization.

(b) Refresher and sustainment training capability resident in the unit. An entry level training capability for MOS-qualified personnel and other types of training also can be provided if the design of the end item equipment will permit it. The design of the ET must accommodate state of readiness (SOR) considerations and can usually do so very well.

(c) Relieve the unit training management burden. To the extent that the ET component can be designed to provide

an assessment capability which is easily accessible by unit training management personnel and does not require onsite trainers and evaluators, unit training managers will better know and execute the state of training, and be able to program accordingly, with a minimum investment.

(d) Minimal logistics impacts for the end item equipment.

(e) Training that is standardized across units and may be more cost effective in meeting essential training requirements and/or cannot otherwise be provided within cost a.id/or safety constraints.

(f) Better job aids (e.g., "help" functions) for the system user. The process for designing tutorials and trainee feedback in support of computer aided instruction (CAI) and simulation exercises, and the resulting products, provide the basis for not only effective ET but also job performance aids.

(5) The following are examples of how industry views the potential of embedded training:

> First, technology is sufficiently mature to provide a sophisticated and coherent training capability. Essentially, embedded training takes the training program out of the stereotyped training environment and builds it into each operational system. In more technical terms, embedded training combines traditional instruction with the advanced technology associated with computer assisted instruction, computer managed instruction, simulation, intelligent computer assisted instruction and artificial intelligence.
>
> To realize the full benefit, potential and cost effectiveness of embedded training, the capability must be implanted into operational equipment during its manufacture and tested and validated along with the development and fielding process. This is an up front capital investment that historically the Army has been reluctant to make, and having made it, reluctant to sustain.
>
> The vetronics system planned for the AFV is the heart and soul of an embedded training capability. It can help the soldier, crew and unit maintain and sustain skills by practicing with the same equipment used to fight. Because vetronics is a software con-

trolled system, training programs can be loaded into that system. Examples are:

(a) Target acquisition

(b) Aiming, tracking and dry firing

(c) Crew exercises

(d) Tactical exercises

(e) Netted exercises between vehicles

(f) Map exercises

Importantly, those exercises are accomplished using onboard reticles, display and vision units and other onboard processors. Also, there is an automatic capability to score a soldier's performance and evaluate his performance against what he should have done, e.g. ammunition selection, target selection. Further, in conjunction with the Battlefield Management System (BMS), on board lasers and laser detectors, force-on-force training is possible. Any number of different training scenarios can be loaded into the system to train individuals, crews and units from the most basic to the most complicated. All of these capabilities are exercised through the operational system and appear on vehicular display units as if it were a combat situation. Another feature is the diagnostic and prognostic feature associated with maintenance. It includes software packages that simulate faults and provides the crew the opportunity to train on their equipment. In total, through graphic displays, the system prompts and guides the crew through maintenance and various system checks required to diagnose current problems and prognosticate future problems. Of significant importance is that the current TMDE requirements can possibly be reduced by 50% which serves to significantly reduce training complexity and the requirement to carry equipment.

NOTE: Presently, numerous MOS's are required to trouble-shoot, service, maintain, and repair electrical and electronic gear in Army vehicles. With vetronics, and associated technology such as BITE, numerous MOS tasks that are

presently associated with a diversity of systems will be eliminated or greatly transformed to a common corpus of skills that are applicable across the fleet. Therefore, there may be merit in replacing these numerous MOS's with a single "Vetronics Systems Specialist" MOS that will service and support the common modular vetronics system of the AFV fleet. The goal of this effort would be to develop a common training curriculum for the vetronics system specialist MOS so trained soldiers could service the vetronics in any mission module on any platform. Such a program would reduce the manpower requirements of the service schools and the actual support personnel. A major goal of this effort is to reverse the trend wherein vehicle crew tasks are reduced and simplified but only at the expense of an increase in maintenance and support.

As a final example, the following are ET activity areas being considered for the Fiber Optic Guided-Missile (FOG-M) program:

(1) Mission planning

(2) System power-up

(3) Land navigation decisions

(4) System alignment

(5) Communications

(6) Missile launch

(7) In-flight control

(8) Target selection

(9) Target lock-on

(10) Multiple missile management

(11) Impact assessment

(12) Gunner maintenance

(13) Contingencies

It is apparent that industry is both poised and capable of providing a mature embedded training capability. The issue then becomes a matter of asking for it. In the information that follows, specific training experiments are discussed that provide insight into what can be done with modern technology and Army level intent and purpose.

c. The Snake River shoot-out phase of the Guns Over Boise Experiment sponsored by the Army Training Support Center was

executed in 1983 at Boise, Idaho. The purpose of the experiment was to evaluate the effectiveness or a tank gunnery training program concentrating on the use of simulation, substitution and miniaturization, as compared with a standard tank gunnery program in which operational equipment, subcaliber and full caliber ammunition is employed.

The objective of the experiment was to develope gunnery training programs through the use of simulation, substitution and miniaturization, then test several of those programs to determine if the current level of gunnery proficiency can be maintained or exceeded. If the amount of ammunition required to reach a trained state could be reduced, then the ammunition could be used for other training -- such as platoon battalion exercise.

A description of the test is at enclosure 4 and the analytical details are at enclosure 5. However, there are two important points to be highlighted.

(1) The Training devices and simulations used for the experiment were extremely crude in comparison to current and 1995 technology. For example, the video disk gunnery trainer was still being developed and tested by the manufacturer at the time of use. The full-crew interactive simulator was a combination of parts taken from other systems and pieced together to form a one-of-a-kind simulation. Yet in the final result --

(2) "THE GROUP WHICH TRAINED USING SIMULATION EQUIPMENT WAS AS CAPABLE OF HITTING TARGETS AS WAS THE GROUP WHICH FOLLOWED A STANDARD TRAINING PROGRAM.

At enclosure 6 is a paper prepared by the Commander of the Army Training Support Center in 1983 which proposes embedding the capabilities of the Full Crew Interactive Simulator into the tank. This paper is essentially a prototype of the concept envisioned for the AFV. In summary it proposes an on-board vehicle capability to:

(1) "Allow all new members to perform all of their individual and collective functions in exactly the same manner as they would be required to operate when fighting the tank."

(2) "Overcome common training hurdles.

- Limited training time at major training areas.

- Limited local training areas.

- A nearby civilian population which have natural understandable concerns about Army tanks training in their community."

d. The Weapons Crew Training Test for tanks (M60A3) also sponsored by the Army Training Support Center was executed between June 1982 and March 1983. Test Design was as follows:

Six armor battalions consisting of 54 platoons participated. For test purposes, a tank crew was defined as a tank commander (TC) and gunner. The tank crews trained under normal tank gunnery subcaliber training strategies for approximately 2 to 4 months. When the training was completed, the crews conducted a Tank Crew Proficiency Course (TCPC) and TT's VI, VII, and VIII exercises. The scores from conducting a TCPC and a TT VIII exercise provided a baseline to use for comparison purposes. The tank crews then began training by using one of three training strategies on TT's I through V. The three training strategies consisted of subcaliber gunnery training per current FM 17-12 Gunnery Manual (no simulation used), mixed gunnery training using a mix of simulation devices and standard subcaliber firing (30 percent simulation), and simulation gunnery training using only simulation devices. The crews completed another 3 to 6 months of training followed by conducting another TCPC and TT's VI, VII, and VIII exercises. A midpoint TCPC was conducted between the initial and the final TT VIII exercises in order to measure training sustainment. The initial and final TT's VI, VII, and VIII exercises were conducted according to one of three firing strategies. The three firing strategies consisted of full-caliber ammunition for all three tables, subcaliber or simulation device for TT VI and full-caliber ammunition for TT's VII and VIII, and subcaliber or simulation device for TT's VI and VII and full-caliber ammunition for TT VIII. Other than the specific gunnery training required by the selected strategies, the units engaged in normal activities during the test period.

The test results are at enclosure 7. In summary:

(1) There was no significant difference in scores attained by groups using different training strategies.

(2) User perceptions of training device value is positive.

(3) User perception of training device acceptability was positive.

e. Other aspects of the M1 UCOFT Post Fielding Training Effectiveness Analysis in addition to that discussed in Part I of this Annex indicate that:

(1) A soldiers U-COFT matrix position and amount of U-COFT training showed significant positive relationships with Tank Table VIII performance. Enclosure 8 contains a graphic portrayal of the relationship.

(2) At Enclosure 9 is a comparison of Tank Table VIII scores, but more important the differences in opening times between U-COFT and non U-COFT equipped battalion. The delta is essentially the difference between survival and destruction on the battlefield.

(3) At Enclosure 10 is a table that compares crew capability as a function of their capability regarding Reticle Aim Group training. The significant aspects of the table are Table VIII scores improve by 7 percent but more important opening time increases by 22 percent for those who are trained with the U-COFT.

(4) Regarding crew turbulence, U-COFT has the capability to reduce negative impact by as much as 50 percent. Enclosure 11 contains a table that clearly describes the process. However, the point that simulation can have this effect on a situation as critical as turbulence is to readiness -- is a significant capability available to the commander.

f. To complete the device and simulation literature search, at Enclosure 12 is Army Family of Vehicles (AFV) Training Study, 7 August 1987, prepared by U.S. Army Project Manager for Training Devices. The study provides analytical data to support the embedded training concept in the unit -- and stand-alone simulation for institutional training as described in Part I.

7. Summary.

a. Based on the analysis contained in Part I, Institutional Training and the Data contained in paragraph 6 above, training proficiency can be attained and maintained by using devices and simulation.

b. With particular regard to unit training, at Enclosure 13 is an extract from the WCTS that deals with ammunition and battlefield realism. A synopsis indicates several points that contribute to a balanced unit training concept.

(1) The majority of peace time training is technical training designed to develop equipment proficiency.

(2) Live fire training for the purpose of motivation, confidence and acclimatization is required.

(3) In peace time, "some quantity" of live ammunition is required for realism.

(4) There is no evidence or proof that can be used to establish a set ammunition figure for a weapon system.

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c. The best summary in regards to unit training and what actions are required is contained in the Final Report of FY86 STRAC Evaluation of DA CIR 350-85-4, Standards in Weapons Training, 21 January 1987. An extract of the more critical issues is at Enclosure 14. However as an overview, the following, excerpt from the report provides appropriate insight:

(1) The Department of the Army directed that an evaluation of the programs contained in DA Circular 350-85-4, Standards in Weapons Training, be conducted during FY 86, the first year of implementation of the circular. The DA Circular contains programs for most weapon systems fielded. It provides weapons qualification standards, notional training programs to attain and sustain the standards, ammunition requirements to support the training programs, and devices and simulators to be integrated into the suggested training programs. The STRAC Program Directorate (SPD) at the Army Training Support Center (ATSC), the DA Executive Agent for STRAC, was charged with executing the evaluation.

(2) The development and refinement of the weapons programs contained in the Circular occurred over a 5-year period beginning in 1980 with the establishment of the Weapons Crew Training Study Group (WCTSG) at the ATSC. The group's findings were:

(a) That there were no standards across the Army for weapons qualification,

(b) Various nonstandard methods were used to determine ammunition requirements,

(c) Many fielded devices and simulators were not being integrated into units' training programs,

(d) Costs of replacement ammunition and particularly ammunition for new weapons systems were increasing geometrically,

(e) Finally, that a credibility gap was growing between what the Army said it needed for training and what it was actually getting. Despite this shortcoming we were reporting a ready Army. This credibility gap is reflected in Table 7.

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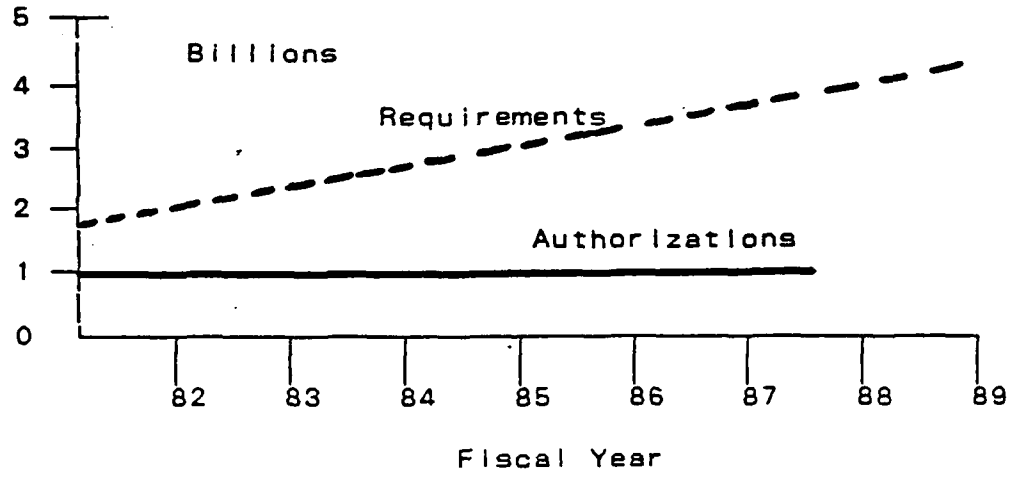


Table 7. Training Ammo Requirements and Authorizations

The STRAC Program Directorate was established at the Army Training Support Center in 1982 with the mission of developing weapons programs for all weapons systems. The draft programs were fielded in 1983 in DA Cir 350-XX, Standards in Weapons Training, and were evaluated for a period of 9 months by approximately 100 battalions. With minor revisions, the programs were first published in December 1984. Prior to the implementation of STRAC in FY 86, further revisions were made and the circular was republished as DA Cir 350-85-4 in 1985. The training ammunition requirements to support the STRAC programs are shown in Table 8.

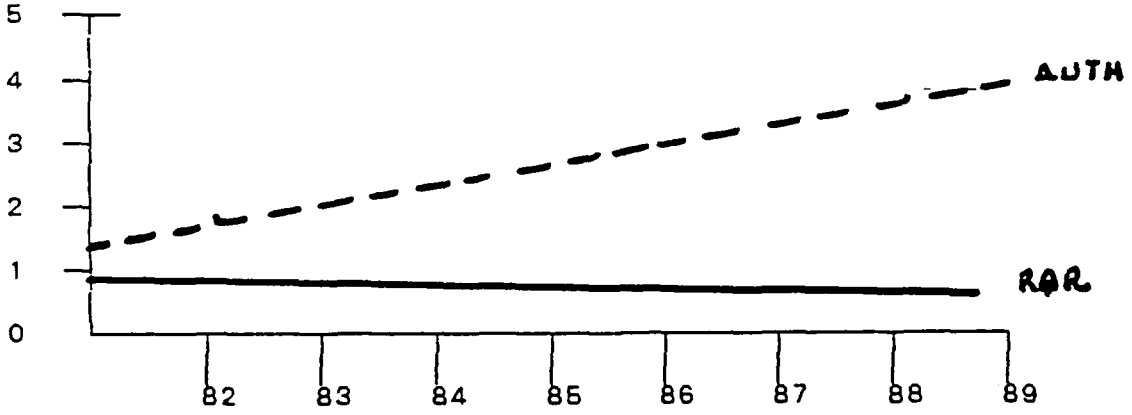


Table 8. STRAC Ammunition Requirements

(3) The purpose of the 1986 evaluation was to:

(a) Assess weapons training standards and determine if the device based training strategy lead to attainment and sustainment of required standards.

(b) Determine if ammunition requirements were of the correct quantity and mix.

(c) Determine if the devices and simulators that are part of the program are available, used as prescribed and the doctrinal literature describing their use is adequate.

(4) Table 9 provides a quick look at the overall attainment of the standards for each weapon system across the Army. Also shown are the major reasons for not attaining the standards. The reasons for not attaining standards are an aggregate and include all TRCs. NOTE. In some instances, total percent may not add to 100%. Variances by TRC and MACOM can be found in the individual weapon annexes.

WEAPON SYSTEM	ARMY % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	40	37	23	14	22	1
45 CAL PISTOL	38	34	33	11	18	1
M249 SAW	15	3	24	0	0	72
M203 GL	38	32	37	13	16	1
38 CAL REV	29	37	34	18	11	0
M60D MG	36	38	28	10	17	0
MK19 40MM MG	0	25	50	0	0	25
HAND GRENADE	23	21	45	9	22	3
M3A1 SMG	45	20	50	11	17	3
BFV	29	50	13	25	13	0
CFV	42	43	29	21	0	7
M901 TOW	40	29	29	11	20	9
GND TOW	56	33	31	15	18	3
M47 DRAGON	31	20	26	19	16	17
M72 LAW	24	24	46	6	15	8
90MM RR	18	37	40	6	9	6
MORTAR	62	21	34	24	18	0
M60 MG	38	36	30	13	17	2
M2 HB .50 CAL	33	42	31	9	15	1

Table 9. Army Training Performance

Of significance, however, all of the reasons for which the STRAC program was established still play a significant part in the inability to attain training readiness -- and provide a compelling reason for a coherent embedded training capability that provides commanders the ability to attain and sustain training readiness with their operational equipment. A discussion is in order.

(a) The most prevalent reason for not attaining standard was the non availability and inadequacy of ranges. With the increased capability projected for the AFV, continued urban crawl and population petulance regarding noise, maneuver and night and weekend activities will only be accentuated and increase the problem.

(b) The lack of ammunition is cited as another reason for not attaining standard. However, in FY 86 the MACOM returned $300 million of conventional ammunition to HQDA -- for non usage. This happened -- even after STRAC had established ammunition requirements -- higher than the previous year. The reason for non usage, again, fit directly into the basic theme of providing a coherent embedded training capability in operation equipment. Commanders must train and maintain standards even if:

(1) Ammunition lots are suspended,

(2) Weather conditions are bad,

(3) Ranges are inadequate or non available

(4) Ammunition is distributed poorly - poor management,

(5) Inefficient range use is practiced,

(6) Sufficient time is not available, and

(7) There are too many requirements --

All the reasons units have stated for not using ammunition -- and are most of the reasons for a coherent embedded training capability.

(c) Personnel turbulence is another compelling reason for not maintaining crew standards. This is a particular problem with tank and field artillery crews that must depend upon a team effort to be ready. As discussed previously, UCOFT can significantly improve this situation for armor but at best there is only one UCOFT per battalion and there are 58 tank crews in that battalion -- all waiting in line for their opportunity to sustain proficiency.

(d) Available time is another reason stated for inability to maintain standard. This is essentially a function of too many requirements, combinations of mismanagement discussed above, weather problems, too many units for available training capability -- and if a unit has a problem -- it probably won't have a chance to make up the lost training. Again -- the commander must be provided the capability to stay combat ready in spite of the adversities that are beyond his control.

(e) Weapon availability essentially translates into unavailable simulation. For example, none of the Redeye and Stinger units could make standard simply because the Stinger Training Launch Simulator (STLS) was -- not available.

(f) Ammunition is fired because it is available, expenditures and authorizations vary from year to year and -- on balance, units fire less ammunition than authorized. The point is that firing a quantity of ammunition becomes a goal to attain similar to collecting for the Red Cross. Training ammunition must be directed at specific training objectives -- and not consumed if training progress indicates further expenditure is not required.

(g) Even today the management of training ammunition in the field is a major problem that must be addressed. At Enclosure 15 is an extract from the WCTS in which the major requirements are articulated. In summary, they are:

(1) Establish a realistic baseline ammunition figure for each weapon system based upon the amount of ammunition required to validate training proficiency attained and sustained through simulation.

(2) Establish a directed ammunition system.

(3) Establish guidelines and doctrine for MACOM.

(h) There will continue to be a heavy reliance on OPTEMPO and ammunition to train units unless there is a top down effort to change based upon a revised training strategy.

8. Conclusion

a. A discrete training program can be developed for each AFV system that will provide the capability to train and certify soldier, crew and unit training proficiency with simulation and validate proficiency with operational equipment and/or live fire.

b. It is possible to manufacture, test and validate the training subsystem concurrently with the manufacture, testing and validation of the operational system. At Enclosure 16 is an extract from the WCTS that very clearly shows the position we find ourselves in when we don't have the foresight or resolve to procure training with the system. The essential problems are:

(1) Unit training needs are not met.

(2) Commanders fabricate their own devices which may or may not solve the training problem and do in fact introduce a degree of training inconsistency between commands, or

(3) Commanders purchase training equipment from domestic and foreign vendors and attempt to fit them into their training program.

(4) From the unit perspective, there is no confidence in the training, combat and materiel development community to provide a coherent and effective training subsystem with operational equipment, therefore

(5) Commanders are extremely reluctant to give up any capability on the promise that a training program is forthcoming that will -- solve their problem.

c. Once achieved, sustainment of training readiness---with limited recourse to major training areas and live fire is possible through the use of simulation. An expanded discussion of the issues taken from the WCTS is at Enclosure 17. The significant points are:

(1) A high level of proficiency is attained during live fire training.

(2) Individual and collective proficiency declines sharply after three to four months.

(3) Crew skills need to be exercised three to four times a year to sustain proficiency.

(4) The use of devices and simulations to overcome training decay between live fire periods is not in widespread use.

(5) A coherent and functional process with an effective feedback system to develop and fine tune unit training does not exist.

(6) The process for attainment and sustainment of training readiness is displayed at Enclosure 18. The essential issue is having the capability to sustain and fine tune the high level of training and experience gained through maneuver and live fire exercises. As depicted, a mature simulation capability available to the commander -- when he needs it -- is the answer.

d. The Battalion Level Training Model (BLTM) and the Standards in Weapon Training program provide the initial framework and management structure under DA control from which to build a top down directed simulation based training strategy for the Armored family of vehicles.

e. Regarding the BLTM, explicit weapon system training programs can be tailored and implemented as follows:

(1) At Enclosure 19 is an example using an Abrams equipped tank battalion. In this example and the others that

follow, under the block entitled ALT 1, the structure of the events in the first two columns of each chart is as contained in the Battalion Level Training Model (BLTM). The OPTEMPO miles are also contained in the BLTM. The ammunition requirements are taken from the Standards in Weapon Training authorization. In total, these are the training events, OPTEMPO and ammunition authorizations currently provided a unit to meet annual level one training requirements. Under the block, ALT 2, a constrained number of events currently executed with OPTEMPO and live fire are replaced with simulation exercises provided by a sophisticated and coherent embedded capability available with the AFV. Dollar savings applied to the POM 93 force of 55 tank battalions, amounts to an annual savings of $131.7 million. This can be "applied" to the up-front capital investment required to purchase the embedded capability. At Enclosure 20 is an example of the same tank battalion with a much larger reduction in OPTEMPO and ammunition that more squarely addresses the training capabilities available through a sophisticated simulation program. Annual savings are approximately $254.5 million.

(2) At Enclosure 21 is an example of a mechanized battalion equipped with the Bradley Fighting Vehicle. In this instance, a baseline reduction results in annual savings with a 45 battalion force of $28.3 million. At Enclosure 22 is an example of the same battalion reduced by a more realistic figure with an annual savings of $73.9 million.

(3) At Enclosure 23 is an example of a Field Artillery Battalion equipped with the M109 (155 MM) howitzer. In this instance, the baseline, OPTEMPO and ammunition reductions result in a $22.4 million annual savings and at Enclosure 24 a more realistic projection indicates a $42.3 million savings.

f. The importance of an effective unit training concept and program is best portrayed in Table 10 below. The issue is that the bulk of a soldiers learning and training life takes place in the organization he will fight with -- which historically is not particularly well equipped to perform the mission.

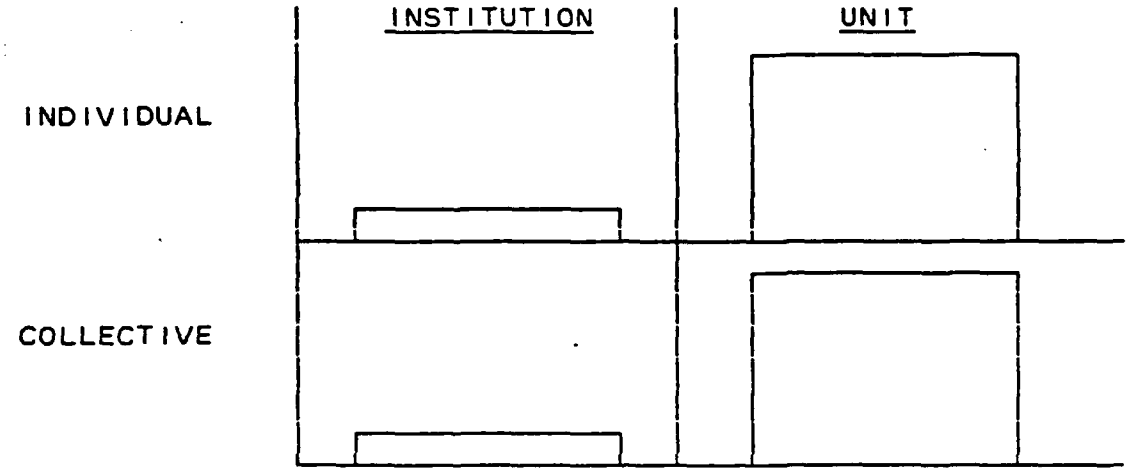


Table 10. Where Learning Really Takes Place

9. Implementation. The essential elements required to implement the AFV unit training strategy are:

- Program definition and direction.
- Requirement document preparation.
- Marketing.

a. Program definition and direction. There are four principle operative documents that provide essential guidance and direction for AFV unit training. They are the Battalion Level Training Model (BLTM); DA PAM 350-XX Standards in Weapons Training, Individual and Collective Training Plan (ICTP) and AR 220-1 Readiness.

(1) The Battalion Level Training Model (BLTM) is a Department of the Army training management tool, the provisions of which are developed and monitored by DADCSOPS (DAMO-TR). The BLTM contains the essential training and training resource guidance for units and their MACOM. Modification of each BLTM to reflect the strategy and requirements of each AFV system as described in paragraph 8 above will -- institutionalize AFV training requirements for the Army. The following are the general BLTM provisions.

(a) For a battalion BLTM prescribes:

(1) Training events per year.

(2) Density of systems on each event.

(3) Miles driven per event.

(4) Hours equipment used per event.

(b) For the MACOM:

(1) Provides OPTEMPO for systems.

(2) Highlights division training requirements.

(3) Identifies MACOM unique requirements.

(4) Assists in budget development.

(5) Enhances affordability analysis.

(c) For Headquarters Department of the Army:

(1) Tool for stating training requirements.

(2) Provides OPTEMPO for systems.

(3) Creates link to training readiness.

(4) Improves defense of training requirements.

(5) Highlights MACOM unique requirements.

(2) DA Pamphlet 350-XX, Standards in Weapons Training is developed by TRADOC under the auspices of DA DCSOPS (DAMO-TR). The PAM contains DA requirements for weapon training programs as stated in AR 350-41, Army Forces Training. The training events and ammunition requirements directly support the events and requirements contained in the BLTM. As a companion piece to the BLTM, the PAM must be modified to reflect the AFV strategy and ammunition requirements. The following are the general provisions for the PAM:

(a) A common set of weapon and weapon system qualification standards.

(b) Weapons training strategies that lead to attainment and sustainment of standards and provide a model for resource allocation.

(c) Measurable standards for evaluating a portion of their overall training readiness.

(3) The Individual and Collective Training Plan (ICTP) is a TRADOC training management tool. It contains appropriate guidance and direction for training development activities by Service School commandants. Currently, a draft Umbrella ICTP for the AFV has been prepared and staffed by the TRADOC (see Appendix A to Volume XI). This Umbrella ICTP provides the initial concept and systematic approaches for the TRADOC and proponent schools to plan, develop, manage and integrate the training sub systems for the AFV. Each proponent school will develop annexes to prescribe the training requirements for their individual AFV systems. In

sum, the ICTP is the TRADOC commanders and school commandants action document for insuring the unit and institutional training programs are developed that support the AFV requirements contained in the BLTM and DA PAM 350-XX, Standards in Weapons Training. Although the Draft Umbrella ICTP has been prepared and staffed, it will require extensive expansion, review and update to insure it and the individual annexes continue to support the thrust of AFV training requirements.

(4) AR 220-1 Readiness, provides specific requirements that units must meet to be combat ready. The issue is not to change the AR, but to insure that the chain of training requirements and events associated with an Army level device based training strategy -- as articulated in revised BLTM and DA PAM 350-XX and as produced in terms of training programs by proponent schools through the ICTP -- all equal a coherent program that improves unit thus Army combat readiness.

b. Requirement document preparation.

(1) The operative documents for prescribing specific development of training materials to support the AFV unit training concept are:

(a) Required Operational Capability (ROC).

(b) Training Device Requirement (TDR).

(c) Request for Proposal (RFP).

(d) Statement of Work (SOW).

(2) The criticality of insuring proper verbage is contained in requirements documents and that contractors develop and validate training subsystems in accordance with that verbage is the difference between program success and failure.

(3) A draft AFV Umbrella ROC has been staffed within the TRADOC. This draft ROC will serve as the point of departure for development of specific AFV system requirements. With regards to unit training, the following are examples of verbage that will be provided to contractors. The complete training input to the Umbrella ROC is at Appendix E to Volume XI.

(a) The contractor will design, develop and validate a complete organic training subsystem for each AFV system.

(b) The training subsystem will include the documentation, simulation and devices required for individual and collective training for the institution and unit.

(c) All training subsystems will be based upon a device based training strategy.

(d) Embedded system trainers are first priority for unit training.

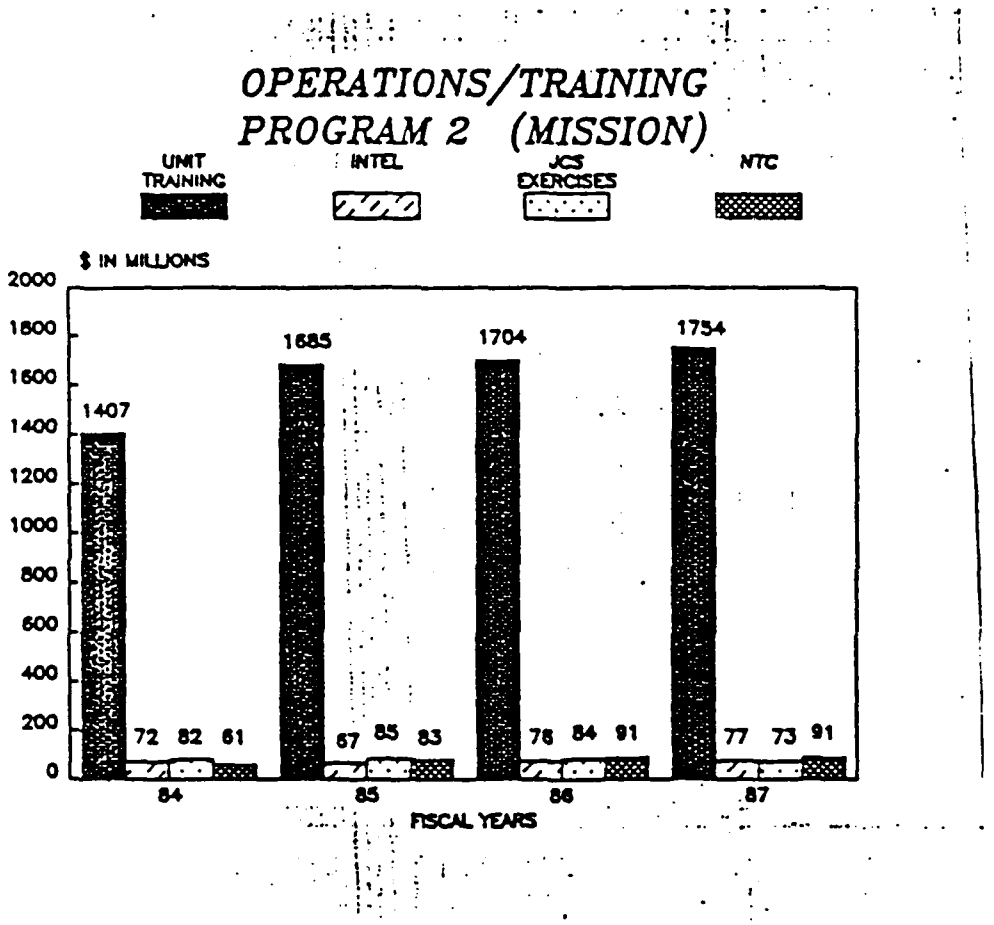
c. Marketing. The most difficult part of an AFV unit training strategy that reduces OPTEMPO and ammunition below current perceived comfort zones and places heavy reliance on simulation is -- acceptance by commanders who are faced with defeating a real enemy. They must believe that the AFV training strategy is credible and will do the job. The process to accomplish this task is as follows:

(1) The training concept must be embraced and directed by Army leadership. The Skill Qualification Test (SQT), Army Training Evaluation Program (ARTEP), the Standards in Training Commission (STRAC) and the Battalion Level Training Model (BLTM) are examples of Army Programs that received heavy Army commitment and emphasis in terms of Regulation development, funding and program management and administration. Key to all of these programs is full MACOM participation in regards to program direction, change and evolution. A viable feedback system is essential.

(2) Training developers -- the TRADOC and proponent schools must interface with their constituency from the beginning, encourage full participation in detailed concept development and be actively involved in the training subsystem validation process. In this way commanders and their soldiers become active participants in developing the training programs they will subsequently execute -- rather than spectators.

ENCLOSURES

1. Program 2 Funding.
2. Embedded Training Requirements.
3. Training Concept Application.
4. Description of Gowen Field Training Experiment.
5. Analysis of Gowen Field Training Experiment.
6. Training White Paper, CG USATSC.
7. M60A3 Tank Training Test.
8. UCOFT Matrix Position Correlation.
9. UCOFT Opening Time Comparison.
10. UCOFT Reticle Aim Comparison.
11. UCOFT Application of Turbulence.
12. AFV Training Study, PM TRADE.
13. Ammunition and Battlefield Realism.
14. STRAC Final Report.
15. Ammunition Training Management.
16. Device Development.
17. Sustainment Training.
18. Training Peaks and Valleys.
19. BLTM-M1 Training - Constrained.
20. BLTM-M1 Training - Unconstrained.
21. BLTM-M2 Training - Constrained.
22. BLTM-M2 Training - Unconstrained.
23. BLTM-M109 Training - Constrained.
24. BLTM-M109 Training - Unconstrained.

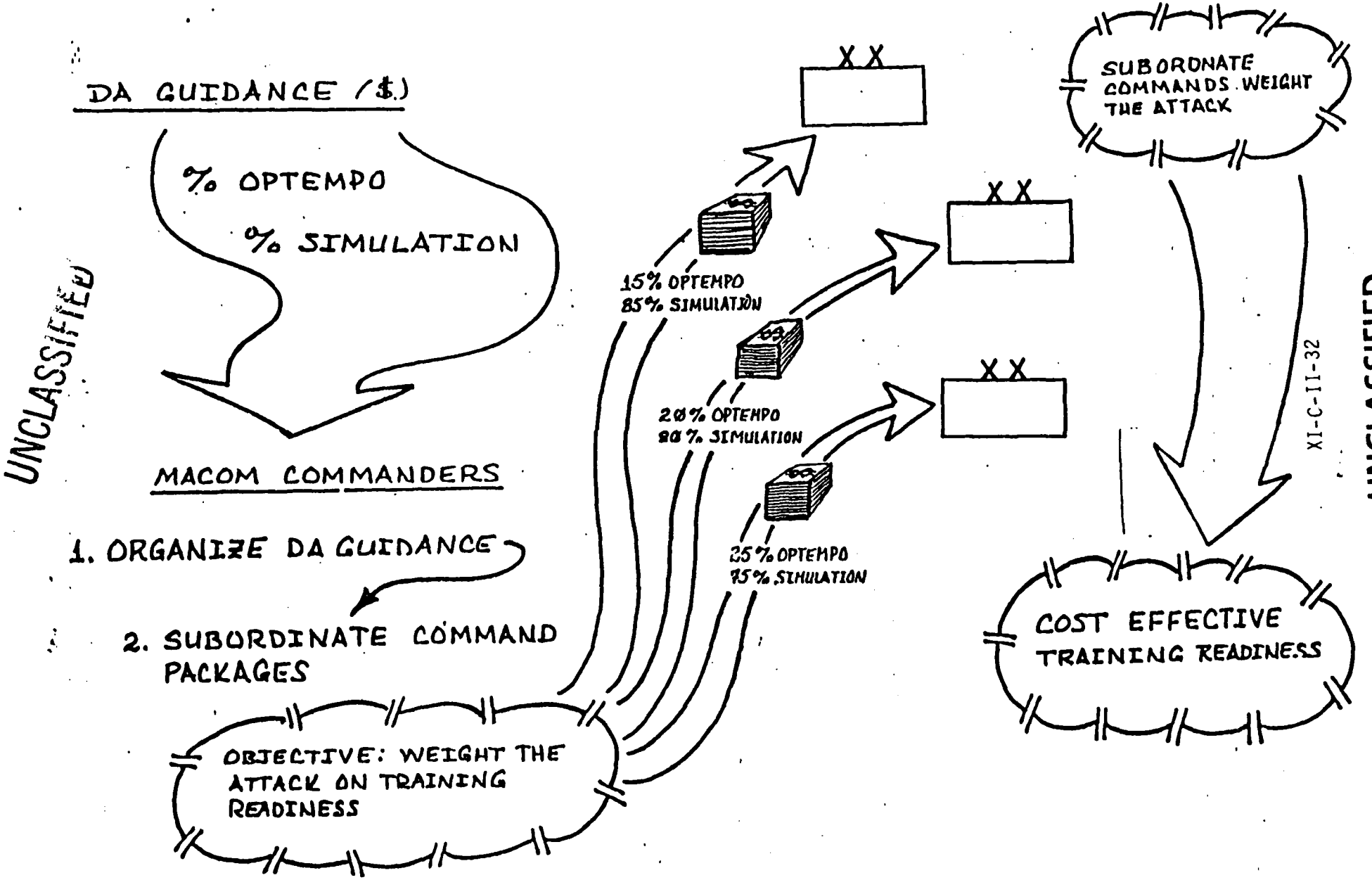

OPERATIONS/TRAINING
PROGRAM 2 (MISSION)
UNIT TRAINING
INTEL
JCS EXERCISES
NTC
$ IN MILLIONS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1407
72
82
61
1685
67
85
83
1704
78
84
91
1754
77
73
91
84
85
86
87
FISCAL YEARS

ENCLOSURE 1

EMBEDDED TRAINING

ENCLOSURE 2

CONCEPT APPLICATION



UNCLASSIFIED

GOWEN FIELD

EXERCISE

UNCLASSIFIED

- THE BOISE EXERCISE AT GOWEN FIELD
  - IS LIMITED TO TANK CREW GUNNERY TRAINING
  - IS THE FIRST STEP TOWARD A LONGER TERM EVALUATION OF TRAINING METHODS AND STRAC PROGRAMS IN THE NATIONAL GUARD
- THE GOWEN FIELD EXERCISE WILL
  - TAKE 2 GROUPS
  - ONE WILL TRAIN UNDER EXISTING ARMOR DOCTRINAL PROGRAMS AND FIRE A PRACTICE FULL CALIBER GUNNER EXERCISE PRIOR TO THE CREW QUALIFICATION EXERCISE
  - THE SECOND WILL USE AN EXPERIMENTAL TRAINING PROGRAM CONSTRUCTED AROUND SIMULATORS, AND NOT FIRE FULL CALIBER AMMUNITION UNTIL THE CREW QUALIFICATION TABLE.
- THE RESULTS, TOGETHER WITH OTHER WEAPONS CREW TRAINING STUDY EFFORTS, WILL YIELD
  - BETTER KNOWLEDGE ON HIGH TECHNOLOGY'S IMPACT ON ARMY TRAINING
  - MORE INFORMATION ON HOW TO STRUCTURE TRAINING TO BETTER USE LIVE AMMUNITION
  - THE TRAINING TECHNOLOGIES TO BE USED ARE ON THE FOLLOWING PAGES
- AS A SIDE ISSUE, THE INTEGRATION OF EVASIVE TARGET GUNNERY TRAINING IN THE TEST GROUP'S PROGRAM, MAY HAVE AN IMPACT, NOT ONLY ON TRAINING, BUT ON COMBAT SYSTEMS FIRE CONTROL DESIGN
  - THE LATTER AREA IS IMPORTANT BECAUSE, WHILE EFFECTIVE

    AGAINST TARGETS TRAVELING IN A CONSTANT DIRECTION AT CONSTANT SPEED, THERE MAY BE PROBLEMS AGAINST TARGETS ACTIVELY ATTEMPTING TO AVOID GETTING HIT BY EVASIVE MANEUVERING

VIDEO DISC GUNNERY

The Perceptronics MK-60 Tank Gunner Trainer is designed to provide soldiers with realistic and effective evasive target engagement skills training in both initial entry and sustainment training modes.

It is a real-time, interactive, part-task training system which is capable of presenting a wide range of engagement scenarios to the gunner, along with accurate visual, audible and tactile cues normal to each engagement exercise, from the initial fire command to "cease fire."

The gunner's score and performance data (e.g., the position of each round fired with respect to the target, the amount of time used to fire each round, etc.), along with an indication of skills which need improvement (such as tracking) are displayed for critique purposes.

	SM GUNNERY TASKS	% SOLUTION *
SKILL (GUNNER LEVEL 1 & 2 • SKILL (TC) LEVEL 3	1. LOAD/UNLOAD MAIN GUN	0
	2. BORESIGHT & SYS CALIBRATE	0
	3. PREP GUNNER STA FOR OPERATION	0
	4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	65
	5. ENGAGE TGTS W/COAX FROM GUN STA	60
	6. PREPARE RANGE CARD	0
	7. ENGAGE TGTS W/RG CD DATA	0
	8. PREP CDRS WPN STATION (CWS)	0
	9. DIRECT MAIN GUN ENGAGEMENT	62
	10. DIRECT MACHINE GUN ENGAGEMENT	10
	11. ENGAGE TGTS W/.50 MG FROM CWS	0
	12. ENGAGE TGTS W/COAX FROM CWS	0
	13. ENGAGE TGTS W/MAIN GUN FROM CWS	0

*Note - percent solution represents an assessment by personnel at Ft. Knox as to the adequacy of the device as it addresses the subtasks in the major task listed. this value is a subjective assessment.

TANK GUNNERY & MISSILE

TARGET SYSTEM (TGMTS)

TGMTS is a 16mm motion picture system consisting of a control console, rearview projector screen, target projector (infrared device), line of sight detector, laser projector (mounted on the control console), line of sight projector, instructor's remote control unit, necessary electronics and electrical controls.

The infrared laser projector and scanning mechanism continuously scan the gunner's aiming point. At the instant of "firing," the trajectory simulation is applied based on the gunner's aiming point and the ballistic data stored in a microcomputer in the control console. The precise point of the "fired" round is shown during flight and at the instant of impact by a brilliant point of laser light.

	SM GUNNERY TASKS	% SOLUTION
SKILL LEVEL (GUNNER/LOADER 1 & 2)		
	1. LOAD/UNLOAD MAIN GUN	0
	2. BORESIGHT & SYS CALIBRATE	70
	3. PREP GUNNER STA FOR OPERATION	100
	4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	98
	5. ENGAGE TGTS W/COAX FROM GUN STA	0
	6. PREPARE RANGE CARD	95
	7. ENGAGE TGTS W/RG CD DATA	100
SKILL LEVEL (TC) 3		
	8. PREP CDRS WPN STATION (CWS)	100
	9. DIRECT MAIN GUN ENGAGEMENT	93
	10. DIRECT MACHINE GUN ENGAGEMENT	0
	11. ENGAGE TGTS W/.50 MG FROM CWS	0
	12. ENGAGE TGTS W/COAX FROM CWS	0
	13. ENGAGE TGTS W/MAIN GUN FROM CWS	100

SCALED RANGE TARGET SYSTEM

(SRTS)

SRTS are modular, subcaliber, remote-controlled, tank target systems which are designed to provide hard targets for .22 caliber and 5.56mm live fire and retroreflective targets for the M55 tank gunnery laser trainer.

This indoor range was designed according to the prescribed FM and is for the purpose of shooting tank Tables I through IV to include IVA and IVB. They are subcaliber tables utilizing .22 caliber, 15 grain, frangible ammunition mounted on the tanks via the Brewster Device. The 1/60 scale targets are tanks -both frontal and flank shots, friendly and enemy helicopters, and moving tanks which can be reversed in direction and simulate speeds up to 30 MPH.

	SM GUNNERY TASKS	% SOLUTION
SKILL (GUNNER/LOADER) 1 & 2	1. LOAD/UNLOAD MAIN GUN	0
	2. BORESIGHT & SYS CALIBRATE	70
	3. PREP GUNNER STA FOR OPERATION	100
	4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	90
	5. ENGAGE TGTS W/COAX FROM GUN STA	0
	6. PREPARE RANGE CARD	77
	7. ENGAGE TGTS W/RG CD DATA	0
SKILL LEVEL 3 (TC)	8. PREP CDRS WPN STATION (CWS)	100
	9. DIRECT MAIN GUN ENGAGEMENT	93
	10. DIRECT MACHINE GUN ENGAGEMENT	0
	11. ENGAGE TGTS W/.50 MG FROM CWS	0
	12. ENGAGE TGTS W/COAX FROM CWS	0
	13. ENGAGE TGTS W/MAIN GUN FROM CWS	0

	SM GUNNERY TASKS	% SOLUTION
SKILL LVL 1 & 2 (GUNNER / LOADER)	1. LOAD/UNLOAD MAIN GUN	100
	2. BORESIGHT & SYS CALIBRATE	100
	3. PREP GUNNER STA FOR OPERATION	100
	4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	67
	5. ENGAGE TGTS W/COAX FROM GUN STA	67
	6. PREPARE RANGE CARD	77
	7. ENGAGE TGTS W/RG CD DATA	0
SKILL LVL 3 (TC)	8. PREP CDRS WPN STATION (CWS)	100
	9. DIRECT MAIN GUN ENGAGEMENT	89
	10. DIRECT MACHINE GUN ENGAGEMENT	88
	11. ENGAGE TGTS W/.50 MG FROM CWS	82
	12. ENGAGE TGTS W/COAX FROM CWS	60
	13. ENGAGE TGTS W/MAIN GUN FROM CWS	65

FULL CREW INTERACTIVE

SIMULATOR

SKILL LVL		SM GUNNERY TASKS	% SOLUTION
S KILL LVL 1 & 2	(GUNNER/LOADER)	1. LOAD/UNLOAD MAIN GUN	100
		2. BORESIGHT & SYS CALIBRATE	100
		3. PREP GUNNER STA FOR OPERATION	100
		4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	67
		5. ENGAGE TGTS W/COAX FROM GUN STA	67
		6. PREPARE RANGE CARD	77
		7. ENGAGE TGTS W/RG CD DATA	0
S KILL LVL 3	(TC)	8. PREP CDRS WPN STATION (CWS)	100
		9. DIRECT MAIN GUN ENGAGEMENT	89
		10. DIRECT MACHINE GUN ENGAGEMENT	88
		11. ENGAGE TGTS W/.50 MG FROM CWS	82
		12. ENGAGE TGTS W/COAX FROM CWS	60
		13. ENGAGE TGTS W/MAIN GUN FROM CWS	65

TANK TABLE VIIC

This tank Table is totally subcaliber utilizing the component coax and M85 and substituting a .50 caliber weapon in a Telfare mount for the main gun. The Table and exercise allows a crew to practice for qualification while teaching crew conduct of fire from a moving or stationary tank, applying battlesight or precision engagement techniques at moving and stationary targets.

TANK TABLE VIIC (SUBCAL)

SKILL LEVEL		SM GUNNERY TASKS	% SOLUTION
(GUNNER/LOADER) 1 & 2		1. LOAD/UNLOAD MAIN GUN	85
		2. BORESIGHT & SYS CALIBRATE	70
		3. PREP GUNNER STA FOR OPERATION	100
		4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	90
		5. ENGAGE TGTS W/COAX FROM GUN STA	100
		6. PREPARE RANGE CARD	77
		7. ENGAGE TGTS W/RG CD DATA	77
SKILL LEVEL 3	(TC)	8. PREP CDRS WPN STATION (CWS)	100
		9. DIRECT MAIN GUN ENGAGEMENT	93
		10. DIRECT MACHINE GUN ENGAGEMENT	100
		11. ENGAGE TGTS W/.50 MG FROM CWS	100
		12. ENGAGE TGTS W/COAX FROM CWS	100
		13. ENGAGE TGTS W/MAIN GUN FROM CWS	90

MINI-TANK

The mini-tank is a M114 reconnaissance track that has been modified by VISMOD Kit to resemble a 6/10 scale T-62 main battle tank. This is a hardened target with turret and side skirts composed of steel plating allowing the vehicle to be fired on by a .50 caliber spotter rifle (service ammunition). The target can either be wire guided or driven by robotics or humans.

The mini-tank is an evasive target fired on by a stationary tank (Table VI Mode) outfitted with the .50 caliber spotter rifle. The exercise is designed to teach the crew to engage and adjust fire on a realistic moving target actively attempting to avoid that fire.

MINI-TANK (M114 + VISMOD)

	SM GUNNERY TASKS	% SOLUTION
SKILL (GUNNER/LOADER) & 2	1. LOAD/UNLOAD MAIN GUN	0
	2. BORESIGHT & SYS CALIBRATE	80
	3. PREP GUNNER STA FOR OPERATION	100
	4. ENGAGE TGTS W/MAIN GUN FROM GUN STA	98
	5. ENGAGE TGTS W/COAX FROM GUN STA	0
	6. PREPARE RANGE CARD	0
	7. ENGAGE TGTS W/RG CD DATA	0
SKILL (TC) & 3	8. PREP CDRS WPN STATION (CWS)	0
	9. DIRECT MAIN GUN ENGAGEMENT	100
	10. DIRECT MACHINE GUN ENGAGEMENT	0
	11. ENGAGE TGTS W/.50 MG FROM CWS	0
	12. ENGAGE TGTS W/COAX FROM CWS	0
	13. ENGAGE TGTS W/MAIN GUN FROM CWS	0

"Guns Over Boise" Analysis Details
Snake River Shoot Out Phase

This Appendix contains the reduced Table VIII firing data for the Test and Control groups, and for the 2nd/116th ACR, as well as the analyses conducted between the three groups. Throughout the analyses, the structure was to first compare the Test and control groups to determine if a difference existed. The attempt to equate pairs of crews between the two groups was not considered adequate to allow paired-comparison statistics to be used in the comparison of the two groups. However, the attempt was considered as being sufficient to assume equality between the two groups (as wholes) at the start of the experiment. Then, the performance of the 2nd/116th ACR was included to determine if that population differed from the Test and Control groups. A confidence level of 95% (alpha=.05) was set for the acceptance or rejection of no difference. A confidence level of 95% (alpha=.05) was set for the acceptance or rejection of no difference.

CONTENTS

TABLE C-1, Table VIII Results, p. C-3.

Contains the results for the the three groups. Main gun hit performance is presented as the number of rounds hit out of the number of rounds fired. First round hits are included in parenthesis. Event times are presented as an average or mean value with the standard deviation in parenthesis. If an outlying value was present, a second mean and standard deviation is printed below with the value excluded. Machine gun events are presented as the number of targets successfully engaged out of the number of targets available.

TABLE C-2, Contingency Table Analyses, pp. C-4, C-5.1

These contingency table analyses for the main gun hits, first round hits, and machine gun successful engagements utilize the chi-square (X^2) statistic to determine if the comparison groups are from the same or from a different population. A "Significant Difference" in this case would be the determination that one or more of the groups are from differing populations due to their differing distributions of hits and misses. Firing events are assumed to be independent.

TABLE C-3, Events Times Analysis of Variance, pp. C-6 to C-9.

These one-way Analyses of Variance (or ANOVA) were conducted between the three groups on the times for each of the firing

[1] Cochran, W.G., and G.M. Cox; Experimental Design, 2nd Edition; New York, John Wiley and Sons, Inc. 1957 pp 103-105.

events. The ANOVA determines if there is a significant difference between the means of the three groups (a significant F test, with the VP(F) equal to or greater than .95), and if a difference is found, to conduct the a priori tests between the Test and Control groups, and between the Test and Control and the 2nd/116th group to determine the reason for the significant difference.

TABLE C-4, Contingency Table Analyses - Qualified Vs. Unqualified, p. C-10.

This is a contingency table analysis conducted between the groups on the number of crews qualified and unqualified on each event. The chi-square statistic was again used.

TABLE C-5, GT Scores to Hit Percentages, p. C-11.

This analysis first compares the GT scores between the Test and Control group TC and Gunner. It then combines the Test and Control groups, and determines whether there is a correlation between the TC and GT scores and their main gun hit performance.

TABLE C-1

TABLE 8 RESULTS	1 1 Stationary Tank	2 1 Stationary 1 Moving Tank	3 Infantry Squad Moving Truck	4 2 Stationary Tanks 1 ATGM Team	6 RPG Team ATGM TEAM Infantry Squad	DAY Overall	7 2 Stat Tanks Infantry Squad	8 Infantry Squad ATGM Team	9 Stationary Tank, Moving Tank	Night Overall
Test Group (M-G)										
Main Gun Hits/rds fired	6/9 (4 first)	11/15 (8 first)		9/17 (7 first)		26/41 (19/30 first)	11/12 (11 first)		10/15 (8 first)	21/27 (19/24)
Machine Gun Tgts Sped/nontgts			10/12	5/6	13/18	28/36	6/6	9/12	15/18	
Event Time Mean (sd)	29.5 (16.1)	41 (24.9) w/o Outlier 31.2 (7.26)5	44.5 (21.14)	46 (18.17)	59.3 (24.3)		37.2 (5.11)	37.7 (18.0) w/o Outliner 31.2 (9.63)5	37.8 (11.9)	
Control Group (N.6)										
Main Gun hits/rds fired	6/8 (4 first)	8/14 (7 first)		9/14 (8 first)		23/36 (19/30 first)	10/13 (9 first)		12/15 (9 first)	22/28 (18/24 first)
Machine gun Tgts Sved/ No. Tgts			10/12	6/6	14/18	30/36	3/6	10/12	13/18	
Event Time Mean (sd)	12.5 (6.4)	20.8 (4.9)	36.7 (15.5)	51.3 (34.6) w/o outlier 37.6 (8.9) 5	56.2 (36.7) w/o outlier 41.4 (6.9) 5		39.2 (5.9)	27.6 (9.5)	28.2 (8.6)	

116th ACR '82

(Note-only one stat tank)

TABLE C-1

(CON'T)

TABLE 8 RESULTS	1	2	3	4	6	DAY	7	8	9	
Main Gun hits/rds fired	18/38 (12 first)	40/52 (36 first)		44/48 (41 first)		102/138 (89/120 first)	25/26 (20/21 first)		39/44 (36/44 first)	64/70 (56/65 first)
Machine Gun Tgts Sved/ No. Tgts			40/48	21/24	59/72	120/144	20/21	44/44		64/65
Event time Mean (sd)	16/8(8.4)24	22.4(7.9)23	26.2 (10.6)24	10.8 (12.6)23	33.0 (12.6)23		21/8(7.7)24	17.5(7.2)24	31(10.2)21	

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TABLE C-2
MAIN GUN
CONTINGENCY TABLE ANALYSIS

Main Gun Total	Test		Control				2/116 AT 82			
Target Set	Hit	Miss	Hit	Miss	X^2	$P(X^2)$	Hit	Miss	X^2	$P(X^2)$
1	6	3	6	2	.02	.11	18	20	2.67	.74
2	11	4	8	6	.28	.40	12	12	2.18	.66
4	9	8	9	5	.07	.21	44	4	13.18	.9986
7	11	1	10	3	.21	.35	25	1	3.66	.84
9	10	5	12	3	.17	.32	39	5	3.81	.85
Day	26	15	23	13	.04	.16	102	36	2.5	.71
Nite	21	6	22	6	.07	.21	64	6	4.39	.89
Total	47	21	45	19	.002	.04	166	42	4.54	.90

Main Gun First Round Results	Test		Control				2/116 AT 82			
	Hit	Miss	Hit	Miss	X^2	$P(X^2)$	Hit	Miss	X^2	$P(X^2)$
1	4	2	2	2	0	-	12	12	0.9	.36
2	8	4	7	5	0	-	36	12	1.41	.51
4	7	5	8	4	0	-	41	7	5.10	.92
7	11	1	9	3	.3	.42	20	1	3.29	.81
9	8	4	9	3	0	-	36	6	2.40	.7
Day	19	11	19	11	0	-	89	31	2.26	.68
Nite	19	5	18	6	0	-	56	7	2.95	.77
Total	38	16	37	17	0	-	145	38	3.58	.83

Note 1. The chi-square values in the 2X2 tables have been corrected for continuity by using the Yates correction.

Note 2. The chi-square values in the 3X2 tables were computed using the Brandt-Snedecor Formula (Cochran and Cox ibid, pp103).

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	Test		Control				2/116 AT 82			
Main Gun Total	Hit	Miss	Hit	Miss	X^2	$P(X^2)$	Hit	Miss	X^2	$P(X^2)$
Target Set										
3	10	2	10	2	0	-	40	8	0	-
4	5	1	6	0	0	-	21	3	.98	.39
6	13	5	14	4	0	-	59	13	.88	.36
7	6	0	3	3	1.78	.82	20	1	9.97	.993*
8	9	3	10	2	0	-	44	0	10.51	.995*
Day	28	8	30	6	.09	.24	120	24	.64	.27
Nite	15	3	13	5	.16	.31	64	1	13.58	.999*
Total	43	11	43	11	0	-	184	25	3.99	.86

Note 1. The chi-square values in the 2X2 tables have been corrected for continuity by using the Yates Correction.

Note 2. The chi-square values in the 3X2 tables were computed using the Brandt-Snedecor formula (Cochran & Cox, ibid, pp 103).

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TABLE C-3
Event Times
Analysis of Variance

Event 1 - One Stationary tank 1400-1600m - Day
Test Group - mean time = 29.5 sec, sd = 16.1, N = 6
Control Group - mean = 12.5 sec, sd = 6.4, N = 6
2nd/116th - mean = 16.8 sec, sd = 8.4, N = 24

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	1008.68	2	504.3	5.34	.99
T vs C	867.0	1	867.0	9.19	.995
116 vs. T & C	141.8	1	141.8	1.5	.77
Error	3114.96	33			
Total	4123.6				

Result - The test group required a longer period of time to complete event 1 than the control group. The 2nd/116th group was not significantly different than the average of the test and control groups.

Event 2 - Two moving tanks 1200-1600m - Day Test Group (without outlier) mean time = 31.2 sec, sd = 7.3, N = 5 Control Group - mean = 29.8, sd = 4.9, N=6 2nd/116th - mean 22.4, sd - 7.9, N = 23.

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	483.7	2	241.9	4.37	.979
T vs C	5.1	1	5.1	.1	.24
116 vs. T & C	483.6	1	483.6	8.7	.994
Error	1715.3	31	55.3		
Total	2198.97				

Result - The test and control groups are equal and different (slower) than the 2nd/116th group witht he outlier in the test group omitted. With the outlier included, the test group mean increases to 41 sec (sd = 24.9). The equality of variance assumption no longer holds. However, an unequal variance t-test between Test and control still show them as equal (t_5 = 1.18, NS).

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TABLE C-3 (Cont)

Event 3 - Infantry squad moving Truck Machine gun Targets-Day
Test Group - Mean = 44.5 sec. sd = 21.1, N = 6
Control Group - Mean = 36.7 sec. sd = 15.5, N = 6
2nd/116th - Mean = 26.2 sec. sd = 10.6, N = 24

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	1837.2	2	918.6	5.05	.988
T vs C	183.9	1	183.9	1.01	.68
116 vs. T & C	1653.1	1	1653.1	9.08	.995
Error	6006.8	33	182.0		
Total	7844.0	35			

Results. The Test group and Control group were not significantly different, and took longer than the 2nd/116th group.

Event 4 - Two stationary tanks 1800 - 2000 m
and 1 ATGM machine gun engagement 1000 m. - Day.
Test group - Mean = 46 sec, sd - 18.2, N = 6
Control group (without Outlier) - Mean = 37.6 sec, sd = 8.9, N = 5
2nd/116th - Mean = 30.8, sd - 12.6 N = 23

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	1152.	2	576.	5.46	.99
T vs C	192.4	1	192.4	1.82	.81
116 vs. T & C	890.5	1	890.5	8.43	.993
Error	3272.5	31	105.6		
Total	4424.5	35			

Results. The Test group and Control group (without the outlier) were equal and different (slower) than the $2^{nd}/116^{th}$ group. With the outlier in the Control group, the mean = 51.3, sd = 34.6. The Test and Control groups are still equal and greater than the $2^{nd}/116^{th}$ group.

Event 5 - Three threat tanks at 800 m
this event was eliminated from the experiment because it was considered unrealistic.

Event 6 - Two cal .50 and one coax machine gun targets. - Day
Test group - Mean = 59.3 sec, sd = 24.3, N = 6
Control Group (w/o outlier) Mean = 41.4 sec, sd = 6.9, N = 5
$2^{nd}/116^{th}$ Mean = 33.0 sec, sd = 12.6, N = 23

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TABLE C-3 (Cont)

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	3325.2	2	1662.6	7.76	.998
T vs C	876.8	1	876.8	4.09	.948
116 vs. T & C	2221.	1	2221.	10.36	.997
Error	6643.5	31	214.31		
Total	9968.7				

Results. The Test group and Control group (without outlier) were equal (marginally) and different (slower) than the $2^{nd}/116^{th}$ group. With the outlier in the Control group, the Mean = 56.2, sd = 36.7, and the Test and Control groups are equal.

Event 7 - Range Card - Two threat tanks 800 - 1000m, infantry squad - Night

Note - The $2^{nd}/116^{th}$ had only one main gun target so was not included in the comparison of times.

Test group - Mean = 37.2 sec, sd = 5.1, N = 6
Control group - Mean = 39.2 sec, sd = 5.9, N = 6

$$t_{10} = -.627 \quad P(t) = .73$$

The Test group and Control group were equal.

Event 8 - Cal .50 and coax machine gun targets - Night

Test group (w/o outlier) Mean = 31.2, sd = 9.6, N = 5
Control group Mean = 27.8, sd = 9.15, N = 6
2^{nd} Mean = 17.5, sd = 7.2, N = 24

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	1092.5	2	546.3	8.7	.999
T vs C	31.	1	31.	0.5	.51
116 vs. T & C	1082.7	1	1082.7	17.2	.9998
Error	2009.6	32	62.8		
Total	3102.2				

Result. The Test group (without outlier) and the Control group are equal, and different (slower) than the $2^{nd}/116^{th}$ group. With the outlier included, the Test group Mean = 37.7, SD = 18.0, and is still equal to the Control group.

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TABLE C-3 (Cont)

Event 9 - Stationary and moving tank - night

Test group - Mean = 37.8 sec, sd = 11.9, N = 6
Control group - Mean = 29.2 sec, sd = 7.8, N = 6
$2^{nd}/116^{th}$ - Mean = 31 sec, sd = 10.2, N = 23

Analysis of Variance Table

Source	SS	df	MS	F	P(F)
Groups	274.9	2	137.4	1.32	.72
T vs C	225.	1	225.	2.15	.85
116 vs. T & C	49.6	1	49.6	.47	.5
Error	3132.6	30	104.4		
Total	3407.5				

Results. There is no difference between the Test and Control group, or between the Test and Control group and the $2^{nd}/116^{th}$ group.

TABLE C-4

Contingency Table Analyses

Comparison of Day, Night, and total events scored as Distinguished,[1] Qualified, or Unqualified.

Day	Test	Control	2nd/116th
Event 1	1Q, 5U	5Q, 1U	7D, 5Q, 12U
Event 2	2Q, 4U	2Q, 4U	11D, 9Q, 4U
Event 3	2Q, 4U	3Q, 3U	3D, 14Q, 7U
Event 4	3Q, 3U	3Q, 3U	7D, 14Q, 3U
Event 6	2Q, 4U	2Q, 4U	3D, 12Q, 9U
	10Q, 20U	15Q, 15U	31D, 54Q, 35U
Night			
Event 7	5Q, 1U	3Q, 3U	16D, 7Q, 1U
Event 8	3Q, 3U	4Q, 2U	11D, 13Q, 0U
Event 9	4Q, 2U	5Q, 1U	4D, 15Q, 5U
	12Q, 6U	12Q, 6U	31D, 35Q, 6U

	Test		Control				2nd/116th			
	Q	U	Q	U		P( )	Q	U		P( )
Day	10	20	15	15	1.09	.70	85	35	16.1	.9997
Night	12	6	12	6	0		66	6	10.8	.995
Total	22	26	27	21	.67	.59	151	41	24.21	.999994

[1]Note that for the 2nd/116th, Distinguished and Qualified are combined. The only major difference between a rating of Distinguished and Qualified is time.

FULL CREW INTERACTIVE SIMULATION "FCIS"

by BG Robert Sunell, CDR, USATSC

There are two concepts of full crew interactive simulation being looked at today. One envisions the replication of elements of the equipment being trained through a union of equipment hardware (i.e., fire controls) and electronic substitution and simulated imagery (e.g., computer generated imagery, weapons effects, and visual/sound presentations). An example of this approach is the Unit-Conduct of Fire Trainer (U-COFT) for the M1 tank. The other is based on the principle of imbedding (or appending) the simulator on the actual equipment and using both the equipment and the imbedded simulator as the trainer.

The US Army has been working on several simulation approaches. They range from a simple launch effects trainer such as the Launch Effects Trainer and Tracker from the DRAGON antitank missile to the sophisticated computer based flight and mission simulator for the Advanced Attack Helicopter (AH-64).

What is being presented in this paper is an approach for imbedded simulators. Recently a prototype full crew interactive simulator (FCIS) for the M60 tank was tested in a training exercise by National Guard troops at Gowen Field, Idaho. This M60 prototype is presented as a representative for all other types of imbedded FCIS.

The goal of the simulator system was to require all crew members to perform all their individual and collective functions in exactly the same manner as they would be required to operate when fighting the tank. In this case, laser transmitters were used to simulate the weapons effects of the tank's 105mm main gun, the 7.62mm coaxially mounted machinegun, and the caliber .50 machine gun in the Commander's Weapons Station (CWS). A hydraulically operated piston was attached to the 105mm main gun which, when the main gun was fired, caused the weapon to recoil and extract "spent" ammunition casings realistically. Blanks and blank adapters were used with the 7.62mm and .50 machineguns. Laser receivers were attached to the targets and electronically linked by interface devices to "pop-up" target mechanisms (automatic tank target system - ATTS and M31 infantry target mechanisms). When lased, the interface devices caused the mechanisms to retract (or drop) the target as if it had been hit with actual ammunition. In addition, a Through-the-Sight Video (TSV) system was imbedded at the gunner's station to tape and record each target engagement; the tape was played back after the training exercise and used for critique and after action review (AAR).

The FCIS permits the full range of tank crew training without the requirement for extensive land areas normally associated when training either subcaliber or full caliber ammunition. Because ammunition safety fans are not a requirement, the FCIS can be used on almost any piece of terrain. Training opportunities are presented when few existed before. Flexibility in the design of crew oriented situational training exercises is enhanced because there are essentially no restrictions on the placement, number or types of targets that can be incorporated into the exercise. What follows is a few examples of the types of situational training exercises that the FCIS can support.

"The 240^{o} Exercise"

Traditionally, the qualification course for tank crews has been characterized by the "lane syndrome;" all targets presented in front or to the flank of the tank crew within an arc of 60^{o} to 90^{o}. Consequently, most tank ranges are narrow and engagements generally straight to the front.

The eye safe laser embodied in the FCIS allows the trainer to break this mold. A realistic tank crew situational training exercise can be developed where a crew has to contend with targets coming in multiple directions. Its use is not restricted to established maneuver or training areas; as explained below, it is most adaptable to US Army Europe (USAREUR) kasernes and to Army National Guard armories.

"The Kaserne (Armory) Approach"

USAREUR and the Army National Guard share some common training hurdles:

- o limited training time at major training areas
- o limited local training areas
- o a nearby civilian population which have natural, understandable concerns about Army tanks training in their community.

It is possible to develop a crew situational training exercise without the training tank crew leaving the confines of the kaserne (or armory) grounds. Here the crew never leaves the kaserne; targets are placed on property outside the fence (necessitating, of course, prior coordination with the property owner). Wooden silhouettes, with or without target lifting mechanisms, can be used; in some instances actual vehicles can be used as targets. The FCIS is flexible enough to accept either course of action.

"Military Operations in Urbanized Terrain"

It is a rare instance where tank crews are permitted to train in villages or towns. Studies now underway have identified unique gunnery training tasks for armor operations in the urban sprawl. For example:

o ranges will be much shorter than we have habitually trained.

o targets will be fleeting-visible and "shootable" over very short times.

o the machinegun increases in importance as infantry becomes the tank's primary enemy.

o SABOT will not be the primary ammunition; HEAT multipurpose (M1), HEP and White phosphorus will be used in increasing amounts.

o buttoned up tanks will be the rule not the exception - snipers will be everywhere.

o close range antitank weapons will prove to be increasingly effective.

Tank crews must not enter the fight in the cities without adequate training. The FCIS' utility is again realized in the development of situational training exercises to meet MOUT training requirements.

The effectiveness of the FCIS was amply demonstrated by the National Guard at Gowen Field. Without having fired a real round of ammunition in training, the test group using simulators including the FCIS, negotiated Table VIII at least as well as a control group (which had fired main gun prior to qualification). The FCIS used at Gowen Field was built on a shoestring - it serves only as a start point in a concept that this paper has shown to be flexible, training effective, and suited for repeated use. A second FCIS is being constructed at Gowen Field now. When completed, extensiye use of the system is planned as part of the Idaho and Oregon Army National Guard 116th ACR gunnery training program.

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8. TEST RESULTS.

a. There was not sufficient evidence to reject the null hypothesis of no difference in training strategies, full-caliber ammunition levels, or the associated interaction as measured by TT VIII performance scores (Table 3).

Separate analyses of variance were performed on the initial and final TT VIII scores for each test location using the model described in paragraph 7a. All statistical tests were conducted at the 95 percent confidence level.

TABLE 3. TT VIII AVERAGE SCORES

Training Strategy	Full-caliber ammo levels Low	Medium	High	Row Average
	Fort Hood initial TT VIII			
Simulation	728	646	596	661
Mixed	658	669	799	714
Subcaliber	813	711	634	722
AVERAGE	733	676	691	- -
	Fort Hood final TT VIII			
Simulation	605	752	890	753
Mixed	803	809	880	835
Subcaliber	720	538	705	654
AVERAGE	712	700	822	- -
	Fort Carson initial TT VIII			
Simulation	556	791	728	711
Mixed	432	510	471	478
Subcaliber	460	349	373	401
AVERAGE	479	582	536	- -
	Fort Carson final TT VIII			
Simulation	676	793	797	759
Mixed	549	744	784	712
Subcaliber	697	757	691	715
AVERAGE	645	764	756	- -

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b. Training sustainment as measured by TCPC scores was not degraded across time for any of the tested strategies. No particular strategy enhanced training sustainment significantly more than the other strategies (Table 4).

The initial, midpoint, and final TCPC results, consolidated by platoon, were analyzed by using a split plot ANOVA with repeated measures. The test was conducted at the 95 percent confidence level.

TABLE 4. TCPC MEAN SCORES

Location	Strategy	Initial	Midpoint	Final
Fort Hood	Subcaliber	422	405	470
Fort Hood	Mixed	475	514	490
Fort Hood	Simulated	420	461	484
Fort Carson	Subcaliber	373	395	499
Fort Carson	Mixed	106	316	310
Fort Carson	Simulated	219	466	444

c. No statistically significant difference existed in TT VIII scores for stable crews compared with those for crews in which either the TC or the gunner changed during the test.

The initial and final TT VIII firing data files were screened, and the 240 final TT VIII scores were subdivided into the groups shown in Table 5. One-way ANOVA's were performed to compare the gunnery proficiency of groups 1, 2, and 3 and groups 1, 4, and 5. The calculated test statistics were not significant at the 95 percent confidence level in either analysis. Nevertheless, the final averages show a trend indicating that the more stable a crew the better the performance. However, the final scores for group 1 on TT VIII varied from a low of 422 points to a high of 1,133 points. Fourteen crews from group 1 actually scored lower on the final TT VIII than on the initial TT VIII. Also note that the total sample size of groups 1, 2, and 3 is seven less than the total sample size of groups 1, 4, and 5. This is due to the fact that seven TC's fired initial and final TT VIII's with different units.

TABLE 5. TT VIII FINAL AVERAGE SCORES BASED ON TC AND GUNNERY TURBULENCE

Group	Composition	Sample Size	Final TT VIII Average Score
1	TC's and gunners were the same for initial and final TT VIII firings	36	802
2	TC's were the same for initial and final TT VIII firings but gunners were different	73	750
3	TC's fired only final TT VIII	124	713
4	Gunners were the same for initial and final TT VIII firings but TC's were different	50	765
5	Gunners fired only final TT VIII	154	715

d. Of the 21 factors measured by the CUAP, only the factor "confidence in unit" was positively correlated with the final TT VIII scores. This factor (regression coefficient 1.69) accounted for 31 percent of the variance in the final mean TT VIII scores.

Company percentile scores of the 21 factors measured by the CUAP questionnaire were used from 15 of the 18 companies in the test (CUAP data for the remaining three companies was not available at the time of analysis). These percentile scores were used as independent variables while the final TT VIII average company score was used as the dependent variable in a multiple linear regression analysis to measure the effect of the independent variables on the variance of average company scores from TT VIII exercises.

e. For tank commanders, the ASVAB aptitude area for mechanical maintenance was positively correlated (regression coefficient of 5.45) with TT VIII gunnery performance but accounted for only 12 percent of the variance in the final scores of the TT VIII exercise. For tank gunners, the ASVAB aptitude area for general mechanical aptitude scores was positively correlated (regression coefficient of 3.23) with TT

VIII gunnery performance but accounted for only 3 percent of the variance in the final scores of the TT VIII exercise.

The SQT score and the ASVAB aptitude scores for general technical, general mechanical, mechanical maintenance, combat, and skilled technical for tank commanders and gunners were used as independent variables in separate multiple linear regression analyses against the final TT VIII gunnery scores, the dependent variable, to measure the effect of the independent variables on the variance of TT VIII final scores. Independent variables were allowed to enter the regression equation only if the level of significance of the measured variable was at least 15 percent.

f. User perceptions of value of training devices, amount of time allocated for training, and acceptability of training devices are shown in Tables 6, 7, and 8 respectively.

TABLE 6. USER PERCEPTIONS OF TRAINING DEVICES VALUE

(Percent)

Device	Effect on gunnery skills		
	Increased	No Change	Decreased
M55 laser and stout board	65	22	13
Brewster mount and .22 cal	67	22	11
Burst-on-target trainer	64	16	20
Telfare mount and .50 cal	54	22	24
MK60 video disk gunnery system (VIGS)	84	8	8
Tank gunnery and missile target system (TGMTS)	77	13	10
Multiple integrated laser engagement system (MILES)	75	12	13
Tank gunnery weapons simulation system (TWGSS)	70	16	14
Through-sight video system (TSV)	73	15	12
Live fire (full-caliber ammunition)	91	3	6

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TABLE 7. USER PERCEPTIONS OF TRAINING CONDUCTED

(Percent)

Device	Training Time		
	Too Much	Not Enough	About Right
M55 laser and stout board	12	34	54
Brewster mount and .22 cal	12	36	52
Burst-on-target trainer	13	41	46
Telfare mount and .50 cal	19	34	47
MK60 video disk and gunnery system (VIGS)	5	50	45
Tank gunnery and missile target system (TGMS)	6	44	50
Multiple integrated laser engagement system (MILES)	12	33	54
Tank gunnery weapons simulation system (TWGSS)	9	52	39
Through-sight video system (TSV)	12	38	50
Live fire (full-caliber ammunition)	2	58	40

TABLE 8. USER PERCEPTIONS OF TRAINING DEVICES ACCEPTABILITY

(Percent)

Device	Device Acceptability		
	Liked	No opinion	Disliked
M55 laser and stout board	53	33	14
Brewster mount and .22 cal	56	26	18
Burst-on-target trainer	56	24	20
Telfare mount and .50 cal	41	27	32
MK60 video disk and gunnery system (VIGS)	82	13	5
Tank gunnery and missile target system (TGMS)	74	16	10
Multiple integrated laser engagement system (MILES)	70	16	14
Tank gunnery weapons simulation system (TWGSS)	63	18	19
Through-sight video system (TSV)	64	20	16
Live fire (full-caliber ammunition)	91	6	3

COMPARISON OF TANK TABLE VIII RESULTS
FOR U-COFT AND NON U-COFT GROUPS

U-COFT TRAINING MEASURES	TOTAL SCORE	TABLE VIII RESULTS OVERALL OPENING TIME	OFFENSIVE OPENING TIME	DEFENSIVE OPENING TIME
TOTAL NUMBER OF U-COFT EXERCISES		X	X	X
U-COFT COMPUTER-SELECTED EXERCISE		X	X	X
U-COFT I/O-SELECTED EXERCISES				
U-COFT COMMANDER EXERCISES	X	X	X	X
U-COFT MATRIX POSITION	X	X	X	

*STATISTICALLY SIGNIFICANT CORRELATION, P<.01

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COMPARISON OF TANK TABLE VIII RESULTS
FOR U-COFT AND NON U-COFT GROUPS

TEST GROUP	NUMBER OF CREWS	TOTAL SCORE	PROBABILITY OF FIRST ROUND HIT	OPENING TIMES		
				OFFENSIVE*	DEFENSIVE*	OVERALL*
NON U-COFT BN	56	763	78	7.3	4.1	5.7
U-COFT BNS	291	792	77	5.9	3.4	4.7

*STATISTICALLY SIGNIFICANT DIFFERENCE, P<.01, T-TEST

RELATIONSHIP BETWEEN U-COFT MATRIX POSITION AND TABLE VIII PERFORMANCE

TABLE VIII RESULTS

U-COFT MATRIX STATUS	NUMBER OF CREWS	TABLE* VIII SCORES	PROBABILITY OF FIRST ROUND HIT	OPENING* TIME (SEC)
NON U-COFT GROUP	56	762.7	80.4	5.72
U-COFT BN CREWS WITH NO RETICLE AIM GROUP	9	765.2	73.4	4.85
RETICLE AIM GROUP 1 - 2	191	781.1	78.1	4.74
RETICLE AIM GROUP 3 - 5	91	816.5	80.8	4.48

* STATISTICALLY SIGNIFICANT CORRELATION, P<.01

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Enclosure 10

PERCENT REDUCTION IN THE TABLE III - TURBULENCE RELATIONSHIP ACCOUNTED FOR BY U-COFT TRAINING

	PERCENT REDUCTION IN VARIANCE		
CONTROLLING FOR	TABLE VIII SCORES	PROBABILITY OF HIT	OPENING TIME
TOTAL U-COFT EXERCISES	25%	52%	53%
NUMBER OF COMPUTER SELECTED EXERCISES	40%	61%	54%
MATRIX POSITION*	51%	43%	69%

*RETICLE AIM CATEGORY

ARMY FAMILY OF VEHICLES (AFV)
TRAINING STUDY

U.S. Army Project Manager for Training Devices
Naval Training Center
Orlando, Florida 32813-7100

7 August 1987
XI-C-II-67

ENCLOSURE 12

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1.0 EXECUTIVE SUMMARY

This report presents training, engineering and cost data for consideration in a trade-off analysis to determine the best training concept for the AFV fleet.

The alternatives analyzed were: Fully Embedded Training (ET), all Stand-alone Device (SAD) training and a combination of ET and SAD. This report examines all three alternatives in terms of training, engineering, cost, and MANPRINT. The training analysis examined:

- o Training Mission - Device concepts as described in available Training Device Requirements (TDRs) from the Armor School were evaluated. These TDRs outlined the overall requirements for direct fire assault vehicles which will require the greatest number and the most complex soldier-machine interfaces.
- o Training Audience - The 22 career management fields (CMFs) to be trained were analyzed in terms of manpower, personnel and training requirements. Consideration was given to the fact that future vehicle commonalities will lead to a consolidation of MOSs. The analysis of jobs/tasks was based on commonalities which are expected to survive that consolidation.
- o Training Tasks - Generic tasks for each major crew position (driver, gunner, track commander, maintainer) were developed based on a taxonomy of learning algorithms which span the gamut of types of learning situations to be addressed by the selected training device.
- o Stimulus Requirements - For each training mission concept the learning algorithms were analyzed in terms of the visual, audio, tactile, and kinesthetic capabilities required in a training device to provide the optimum stimulus/response/feedback mechanism.
- o Level of Fidelity - For each training mission concept, the overall fidelity requirement was estimated. Learning algorithms and types of delivery systems were ranked in order of complexity and level of fidelity, respectively. Algorithms were matched with optimum delivery systems and their rank order values multiplied together to yield a fidelity score. The higher the total fidelity score for a given training mission concept, the

more appropriate it is to address its requirements by embedding training in the operational system.

- o Training Priority - Tasks for each major crew position were evaluated in terms of their importance to the operational mission. Priority was evaluated using estimates of criticality, practice required, and difficulty. The higher the priority score for a given task, the more important is the requirement for sustaining that skill using embedded training devices.

The outgrowth of the above analysis was a set of observations regarding the appropriateness of embedded training for each of the training concepts which have been identified to date. (These concepts are described in section 3.3.2.1.) In general, these observations point to stand-alone devices as the best approach to initial and basic training at the institution and to embedded training devices as the means for sustainment training of advanced and collective skills at the unit level. The impacts of removing operational equipment from the institutions and other training issues that should be addressed during a trade-off analysis are discussed in section 3.3.2.8.

The engineering analysis examined the advantages, disadvantages, and difficulties of building vehicles with training software and hardware included. Problem areas addressed are mechanical/hydraulic actions, out-the-window and through optics vision, voice recognition synthesis, large software and hardware physical space requirements, and networking for combined arms and (force-on-force) training. In general, these are areas where the engineering difficulty is so great that the training benefit may not be justifiable. Engineering issues to be considered during the trade-off analysis are summarized in section 3.3.3.9.

The cost analysis examined the system costs of analagous training devices which satisfy essential characteristics described in the available training device requirements (TDR). Factors included in rough order magnitude (ROM) costs are system engineering, hardware and software design, software coding and unit test, prototype manufacturing, and recurring manufacturing. Cost issues that should be considered in the trade-off analysis are summarized in section 3.3.4.2.

Based on the analysis conducted to date, of the three training alternatives, the best operational approach is a combination of embedded training and stand-alone devices. Limited embedded training technical capabilities preclude full use of ET. Unit training should consist of ET and SAD. Institution training should relay primarily on SAD with some ET.

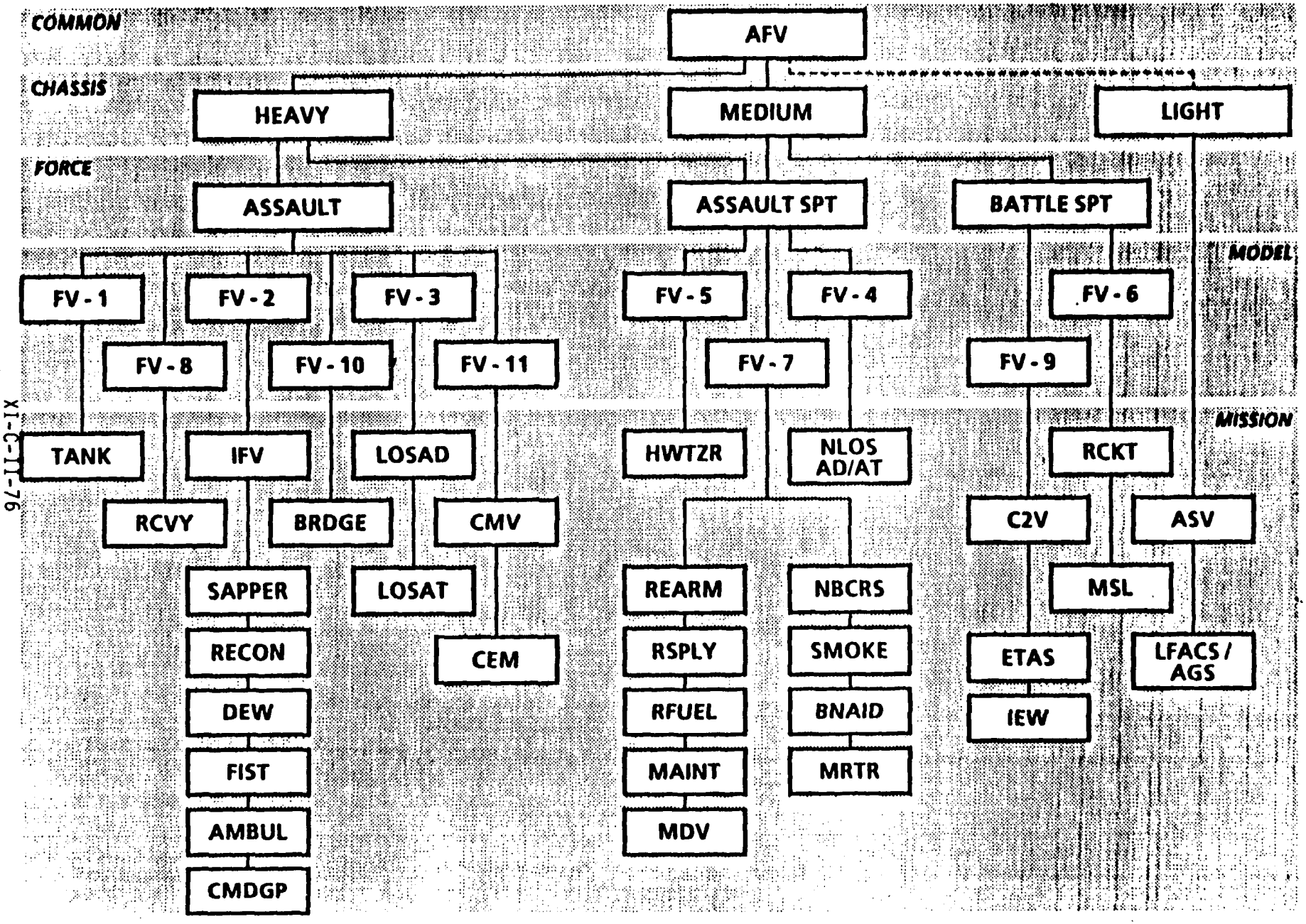
2.0 PREFACE

2.1 Introduction

The Army Family of Vehicles (AFV) is envisioned to be a rationalized, integrated family of armored vehicles featuring commonality, technological advances, operational and logistical flexibility, and affordability. AFV is being developed to field a force within emerging Army concepts which will be able to defeat the threat of the mid-1990s and beyond while, at the same time, reducing overall systems and force operations and support costs. The AFV will be operated throughout the theater by combat, combat support and combat service support units. The AFV fleet will be the basis of the Army's armored vehicle inventory from the mid-1990s through the next AFV.

In the mid-1990s, the AFV will replace the entire fleet of currently fielded and projected armored vehicles throughout the active Army, and the Reserve Components (RC), the latter consisting of the U.S. Army Reserves (USAR), and the Army National Guard (ARNG). Since the fielding will be accomplished in unit sets, it is probable within theatres of operation that a new/old mix of equipment and technology will be present through the year 2000.

The AFV is a system of vehicles that, when manned with trained soldiers and supported by other equipment, creates a total force package. The AFV will be characterized by incorporation of modularity, component commonality, common battlefield signature, common vehicle electronics (vetronics) architecture, and multiple system capabilities. AFV, with 32 variant subsystems (see Figure 1.0-1), involves the orchestrated efforts of at least 10 U.S. Army Training and Doctrine Command (TRADOC) schools as proponents of actual variants, other schools as proponents of mission packages that will be part of one or more of those variant subsystems, and the three integrating centers to integrate the effort.



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The Emerging Armc Family of Vehicles

Figu .0

AFV chassis and crew modules are envisioned to be standardized thereby simplifying the problem of training. AFV will be fielded in sets, and will require the coordination and training of a wide range of tasks associated with the 32 AFV variants and their respective missions and equipment configurations. Since AFV is to be standardized, it is anticipated that much of the training on these vehicles can also be standardized and delivered by systems embedded in the operational equipment. This report examines the feasibility of that approach and makes recommendations on issues to be considered in performing a trade-off analysis.

2.2 Objectives

The objectives of this investigation are to: analyze training alternatives, recommend the best operational approach and assess the training strategy.

2.3 Data Base

Information used to develop this analysis consists of Subject Matter Expert (SME) input, and documentation provided by the Government (ICTP, SMMP) and industry sources.

2.3.1 Input from Subject Matter Experts (SME)

SME information and guidance used in this report were obtained from the following sources:

- o AFV Task Force (AFVTF), Ft. Eustis, VA: (overview of training and operational concepts and MANPRINT).
- o Headquarters, Combined Arms Training Activity (CATA), Ft. Leavenworth, KS.
- o Headquarters, U.S. Army Infantry School, Ft. Benning, GA.
- o Headquarters, U.S. Army Training and Doctrine Command (TRADOC), Ft. Monroe, VA.

2.3.2 Government and Industry Documentation

Documents and associated literature reviewed during this analysis are found at Appendix A.

3.0 AFV PRECONCEPT FORMULATION STUDY

3.1 Background and Assumptions

Currently, and for the foreseeable future, soldier training will continue to be accomplished at both the institution and the unit. Training is often constrained by the availability of training devices, operational equipment, fuel, ammunition, spare parts, funding and training areas. Because of expected funding cuts and higher prices for ammunition, spare parts and fuel, there is a need to reduce or bypass, these constraints in order to better train the soldier of the future.

Traditionally, training at the institutional level proceeds from basic to advanced training, or One Station Unit Training (OSUT) for recruits, and basic branch course training for officers. Institutional training also provides for specialty courses (Airborne, Ranger, Special Operations, etc.), leadership courses, command and staff courses and professional development courses. For purposes of this study, institutional training will be limited to basic and advanced training for entry level enlisted soldiers and basic officer branch training. Most institutional training is delivered by instructors in classrooms and field situations, using training devices (part task trainers, stand-alone devices, etc.). Some institutional training relies upon the use of operational equipment to train students. The use of operational equipment requires appropriate spare parts, fuel and ammunition. This approach burdens the maintenance and supply systems and requires enormous amounts of funding. It is assumed that institutional training will continue the historical practice of training a majority of "critical" skills to minimum entry-level performance criteria.

Based on discussions with the AFV task force and because of AFV's commonality, modularity, and multiple mission capabilities, a centralized or consolidated training facility is envisioned to provide more equipment training in the areas of driver's training, maintenance training and gunnery training. Since AFV is expected to be fielded in unit sets, a requirement for a centralized training facility in the Continental United States (CONUS), U.S. Army, Europe (USAREUR), and Republic of Korea (ROK) exists. Prior to, during and after fielding, the institutions will train

new recruits in basic and advanced training on how to drive, maintain and fire the AFV.

Soldier training in the unit has been controlled and constrained by such concepts as Standards in Training Commission (STRAC), Operational Tempo (OPTEMPO) and Cohesion, Operational Readiness and Training (COHORT), for example. STRAC was formed in 1982 to look directly at quantities and types of munitions essential for soldiers, crews, and units to attain and sustain weapon proficiency relative to readiness levels, making maximum use of aids, devices, simulators, simulations, and subcaliber firing. Based upon the effective use of ammunition, supplemented by the limited number of devices and simulators available to the field, a STRAC program was initiated. This program prescribes the minimum training readiness standards for units, and promotes the training strategies to meet those standards by proceeding through a hierarchy of skills beginning with the individual soldier through crew and unit exercises using traditional ammunition, subcaliber ammunition, and training devices.

OPTEMPO is dictated by the availability of fuel, ammunition, repair parts and mileage/hour availability of the different vehicles (M1, M2/3, etc.). Commanders can cut or increase the mileage/hours per unit so long as the unit's total does not exceed the authorized mileage/hours per vehicle per year. This, combined with availability of training areas and classes of supply, has at times impeded unit field training and has forced commanders to design and develop alternative training options to ensure operational readiness.

COHORT is designed to provide company level units that are created with a commander, platoon leaders, ISG and senior noncommissioned officers (NCOs) while the rest of the unit is filled with recruits. This unit is then taken through One Station Unit Training (OSUT) to a tour as a company in the Active Army. This concept allows the unit commander and senior NCOs to train their soldiers through basic, and advance institutional training and then through two years of unit training.

The initial training, or new equipment training (NET), that a unit will receive on the AFV will occur in conjunction with issue of AFVs and will require a centralized training facility. This training will provide driver and operator maintenance familiarization, unit maintenance training and gunnery familiarization training. After receiving this

initial training, the unit's training during NET will then focus on a compressed training schedule to ensure that precision gunnery and crew drill through force-on-force tactical training standards are met using the AFV.

Presently, most training devices are developed after fielding of the operational system. Therefore, training is an after thought rather than a integral aspect of the system. Embedded training is an alternative to this method, but an inappropriate emphasis on embedded training to meet all training requirements for a particular system presents engineering, cost, and reliability problems. While embedded training technologies offer a wide range of capabilities and alternatives, the logistics, feasibility, cost, availability, and overall training capability constraints must receive a thorough analysis in the overall training system design process. Embedded training often is not the most effective training medium.

This study defines the training concepts and their respective target audiences, identifies engineering constraints and cost considerations, and recommends an optimum training strategy combining embedded training and stand-alone devices. A high level listing of common tasks was developed based upon types of learning algorithms as outlined in TAEG Report No. 16, Table 2, and No. 23. From these tasks stimulus requirements, level of fidelity, and training priority were estimated for each of the training concepts. Finally, this study provides an analysis and recommendations as to an optimum mix of embedded trainers and SADs to meet overall AFV requirements.

3.2 Requirements

3.2.1 Present Training Systems

Traditionally, training systems/devices for new weapon systems have lagged behind production of the major weapon systems and have always been the first elements cut from the program when funding levels are reduced. Also, the training need for new equipment has been one of the last areas to be evaluated and consequently, the area that is least developed, least funded and, in many cases, is least effective. This has resulted in a proliferation of "quick fix" training devices that are designed based on inadequate analyses, fielding of many strap-on training

devices (e.g., MILES, TWGSS) and stand-alone trainers (e.g., COFT and VIGS) and maintenance trainers, and other "field fixes" that are designed to bridge the gap between the actual system requirements and existing training capabilities. This methodology has resulted in fielding many training systems that are difficult to manage, costly to maintain, and burdensome to use.

The AFV program will use these lessons learned to design and development training subsystems as an integral element into the total weapon system to the greatest extent possible, commensurate with engineering and funding constraints. This effort should result in reducing the quantity of SADs and strap-on trainers, reduce the logistics burden, and increase training effectiveness by allowing soldiers to train on the equipment that they will use in combat.

3.2.2 Predecessor Training Systems

Table 3.2.2-1 lists many of the predecessor training devices that are related primarily to tanks. Some of these devices (e.g., MILES) are also used for other major systems. Some (e.g., TOW and DRAGON) represent the other systems that support other combat, combat support and combat service support training. The skills that these devices train will be very similar if not identical to the skills required by the crews of the AFV. The tasks and skills required to fire the main gun, for example, may be similar to the existing requirements. However, robotics and technological advances may eliminate or change basic tasks. For example, mechanical loaders may soon replace human loaders. The tasks and skills listed in 3.3.2.3 were selected as representative of those required for the AFV crews based on the type of systems postulated to date. Although this is by no means all the training devices that are available it does serve as a representative sample for purposes of this analysis. The systems discussed in 3.2.1 above, MILES and TWGSS, are collective trainers while the others are designed as part task trainers. Many of these predecessor systems consist of strap-on devices that must be attached to the vehicle. All of these systems (except the driver trainer) require storage, maintenance, time to pick up from storage, attach to the equipment, removal after training, cleaning and return to storage.

TABLE 3.2.2-1

AFV TRAINING CONCEPTS X FIELDED TRAINING DEVICES

TACTICAL GUNNERY	DRIVER TRAINING	BASIC GUNNERY PROCEDURES	WESS	SUSTAIN. MAINT. TNG.	TACTICAL CREW TNG.
TWGSS	M1 DRIVER TRAINER	COFT	MTG-WESS	FIMT	GUARD FIST
PGS		GUARD FIST	HOFFMAN	FFID	TWGSS
		VIGS	SAAB		PGS
		TGMTS			TGMTS
		TSV			TSV
		TPGIB			MTG-WESS
		DRAGON TRAINER			MILES
		TOW TRAINER			SIMNET

3.2.3 AFV Training Requirements

The AFV Integrated Logistics plan dated June 1987 provides the following information.

Where possible and feasible soldiers will be replaced by robotics or suitable technology to quicken responsiveness in battle and reduce personnel costs and vulnerabilities. Through commonality, modularity and multiple system capabilities, advanced technology systems will reduce training requirements. To provide further O&S savings maximum use of simulators to train AFV equipment operators is desired where ever cost effective and feasible. Training devices that allow drivers to gain experience in all weather, all road type/condition driving will be an integral part of the AFV development program. Training for AFV is expected to make extensive use of embedded training, simulators and training devices. Primary among these may be a programmable training simulator which would allow training of the crew in degraded operational modes and in trouble-shooting and fault isolation. Training will be conducted in both garrison and field environments in collective, crew and individual modes.

From the AFV briefing to DCST TRADOC on 17 June 1987, the training requirements are further defined to state that ET is the cornerstone of unit training, that ET will provide the commander more flexibility to achieve and maintain readiness, and that it will replace the majority of non system training devices. Institutional training will shift from operational equipment and live fire to large multi-station stand-alone trainers. Also, the AFV Task Force desires automated weapons station training (COFT-like capability), maintenance training, MILES-type capability for direct and indirect fire systems, and SIMNET-type capability for collective training. The training concept will optimize the use of devices and simulations embedding them where ever possible in the vehicles. Individual and collective training will be developed in new equipment training. The AFV view is that ideally, all training would be embedded to provide the training that SIMNET, COFT and MILES provide. The ICTP defines embedded training as that training which results from features designed and built into specific end item equipment to provide training in the use of that end item equipment. AFV views ET as the preferred training alternative. The ICTP states that "the family will be designed with embedded training subsystems and/or device based subsystems that encompass

all training catagories (individual/operator, crew, functional, and force level).

3.2.4 AFV Variant Commonalities

Based on the description of the AFV fleet in the ILSP, the AFV will be based on commonality, modularity, and multiple system capabilities using advanced technology systems that will reduce training requirements. Specific commonality will be most apparent in the chassis for each of the now proposed three variants. This will allow for common driver controls, gauges, and positioning of these components, thus allowing common driver training for a wide variety of vehicles. The common chassis will also make automotive maintenance training easier since the mechanics will have to learn only how to maintain one type of equipment. This will be the case for organizational through general support automotive mechanics thus reducing the types of training devices needed at each level. Commonality of turret controls and fire control systems to the greatest extent possible will provide similar advantages to the turret mechanics and to the crewmen. This may result in fewer MOSs required to maintain the AFV than are now required for the existing systems. For vehicles that have unique missions that require special equipment (e.g., Sapper Vehicle, Elevated Target Acquisition System, Combat Excavator, etc.) the opportunities for commonality are reduced, but the capability to use modular components is still a viable option. Modular components will be best used and achieve their best advantage in the area of rapid fault isolation and replacement at the lowest possible level. There will be additional advantages at higher levels of repair since the commonality of components in the modular systems will make it easier to replace the defective component and reduce the number of Test, Maintenance, and Diagnostic Equipment (TMDE) and special tools required to repair the components.

Multiple system capabilities are envisioned to allow easier individual transition from one type of system to another, within a given MOS. For example, the driver on the Sapper vehicle could, with limited training, be taught to operate the combat earth mover, the combat mobility vehicle, or the combat gap crosser to name a few. Similar training capabilities would exist for the artillery systems, the maintenance systems, and the resupply systems. These three factors, modularity,

commonality and multiple system capabilities will also reduce the number and type of new skills that must be taught. These commonalities may enable the consolidation of MOS's.

3.2.5 Embedded Training

The definition of embedded training as stated in AR 350-38 was adopted for the purpose of this report and a clear distinction was then drawn between embedded and stand-alone devices.

The term "embedded training" refers to a training capability designed and built into or added onto operational systems to enhance and maintain the skill proficiency necessary for operation and maintenance. It includes features such as tutorials, scenarios, and job aids (e.g., maps, schematics, or checklists) and any displays, printouts, computers, and other equipment which are permanently installed in the vehicle to support training. Embedded training systems may be netted together to support combined arms training. An embedded system must be capable of the full range of training functions including diagnosis, prescription, delivery, and evaluation of training. It should not require an instructor/operator (I/O) but should provide the capability for an I/O to monitor training either within the vehicle or from a remote IOS.

3.2.6 Stand-Alone Device

The term "stand-alone device" (SAD) refers to equipment designed specifically for the purpose of training. It includes procedure trainers and part, full, or collective task simulators, wargames and tactical simulations.

3.3 Technical Analyses

3.3.1 Assumptions

The following assumptions, definitions, and constraints pertain to the findings reported here:

a. The scope of this analysis is limited to evaluating three training alternatives; fully embedded training, fully stand-alone training, and a combination of embedded and stand-alone training devices. Further, this analysis relied heavily on training needs identified for those systems

currently having Training Device Requirements (TDR) documents. These systems were chosen because they have draft TDRs that define training requirements and because they represent the most critical training tasks that require continual updating and refresher training. They will also probably be the most difficult to simulate and may be the most costly. There are six training concepts: Gunnery Embedded Training System (GETS), Institutional Driver Trainer (IDT), Institutional Gunnery Trainer (IGT), Weapons Effects Simulator System (WESS), Operator Maintenance Embedded Training System (OPMETS) and Embedded Tactical Training (ETT)] that were evaluated. A summary of the training requirements for each of these missions is presented in Section 3.3.2.1. A complete list of all AFV variants grouped according to these missions is presented in Table 3.3.2.1-1. These training requirements were then evaluated to determine the relative training effectiveness, engineering requirements and cost considerations for using fully embedded, fully stand-alone and integrated approach.

b. As described in the ICTP, embedded training is the preferred alternative for all levels of unit training, unless it is shown to be technically or economically infeasible. It is also the desirable alternative for new and displaced equipment training and brigade set training requirements.

c. As described in the ICTP, stand-alone devices are the preferred alternatives for high volume, institutional training.

d. Significant basic task commonality exists among AFV variants such that many MOSs currently trained as unique jobs may be consolidated. Initial training on common tasks will be accomplished in the institution. Sustainment training for tasks that need frequent refreshing will be considered as candidates for embedded training.

e. Crew station configuration will be common to all vehicles of similar type. Analysis of task requirements assumes a commonality of tasks for each operator/maintainer position across all 32 missions.

f. Vehicle designs will not incorporate a requirement for "dynamic seats." These would present an additional engineering effort.

g. AFV crew members will not have special video display helmet systems.

h. AFVs will not operate in an open hatch mode. Further, the primary outside vision mechanism will be through a sensor-based electronic medium with a faster scan TV-like display.

i. AFVs will have a common computer electronics bus architecture.

j. All vehicles in the AFV family will have an intercom system so the method of presenting audio signals (intelligence as well as noise) can be assumed to be included in the basic vehicle.

k. AFVs will have built-in audio warning systems like the automotive industry is using today.

l. Other technological advances will be incorporated into the training devices based on system and function training requirements.

m. AFV will be manned by at least a two man crew with variants requiring three or more person crews.

n. Some AFVs will not require a loader position due to robotics.

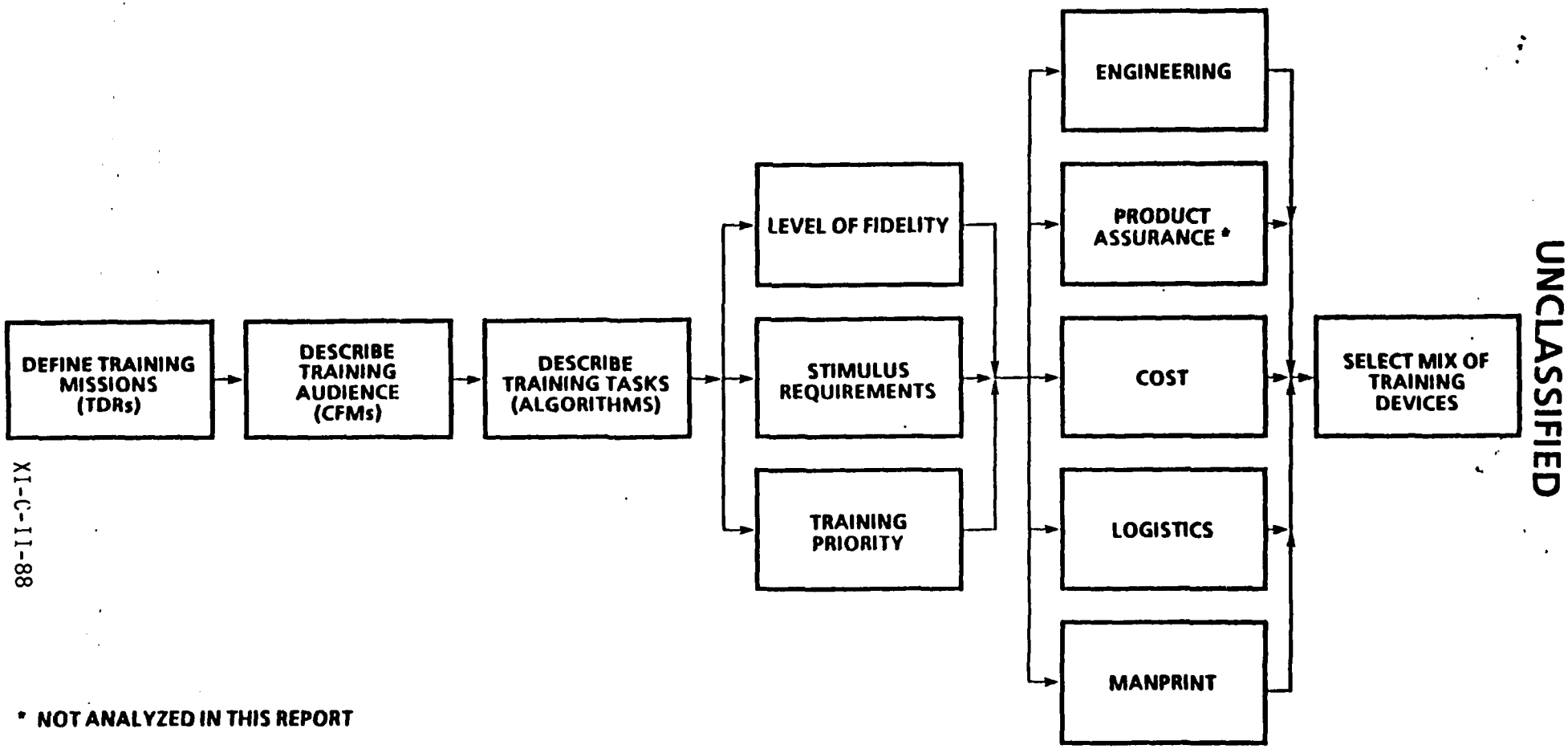
3.3.2 Training Analysis

In order to determine the appropriate media mix for AFV training, a multi-stage analysis was conducted which took into consideration AFV missions, target audience, generic tasks, stimulus requirements, and levels of fidelity needed for effective training. The steps in this analysis are depicted in Figure 3.3.2-1. The methodology is based upon research conducted by the Training Analysis and Evaluation Group (TAEG) and described in reports No. 16 and No. 23. The TAEG methodology was modified slightly for the purpose of this analysis due to the lack of a full task and skills analysis. The methodology is summarized in the following sections.

3.3.2.1 Training Concepts

Based upon available Training Device Requirements (TDRs), six AFV training concepts were identified. These concepts are summarized here in terms of their overall objectives, levels of training, and location (insti-

AFV TRAINING STUDY METHODOLOGY



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* NOT ANALYZED IN THIS REPORT

FIGURE 3.3.2-1

UNCLASSIFIED
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tutional vs. unit). The six training concepts and the AFV missions for each are shown in Table 3.3.2.1-1 and their Needs Statements are summarized below.

- o Gunnery Embedded Training System (GETS): GETS is required to train a crew in precision gunnery in a tactical environment at both the institution and unit level. Crew training assumes that the individuals possess the basic background knowledge commensurate with their skill level. Crew training is designed for collective or team training.
- o Institutional Driver Trainer (IDT): IDT is designed to provide driver training at the institution for initial, basic, advanced and transition level training. IDT is an individual trainer.
- o Institutional Gunnery Trainer (IGT): IGT is designed to provide individual gunnery training at the institutional level. IGT must provide initial, basic, advanced and transition training. IGT will train only the gunners and Track Commanders (TCs) of combat and combat service vehicles.
- o Weapons Effects Simulator system (WESS): WESS is to provide a replication of the effects of using the main gun through an audio and visual signature. WESS is used in conjunction with GETS for tactical training by simulating the effects of main gun firings.
- o Operator Maintenance Embedded Training System (OPMETS): OPMETS is to provide operator maintenance in both tactical and nontactical environments at the institution and the unit. OPMETS is intended to train both the individual and the crew.
- o Embedded Tactical Training (ETT): ETT is to provide tactical training from the individual through crew up to force-on-force training. ETT is envisioned to provide sustainment training between crews in small units (platoon and company) up through battalion or brigade-size units in force-on-force engagements.

3.3.2.2 Target Audience

The total training requirement for AFV encompasses over 83 Military Occupational Specialties (MOSs). There are a total of 22 Career Management Fields (CMF) to be trained as shown in Table 3.3.2.2-1. The MOSs and CMFs stated here are presently used by the Army in its fielded

TABLE 3.3.2.1-1

TRAINING CONCEPTS X APPLICABLE VEHICLES

TACTICAL GUNNERY	DRIVER TRAINING	BASIC GUNNERY PROCEDURES	WESS	SUSTAIN. MAINT. TNG.	TACTICAL CREW TNG.
TANK	*ALL	TANK	TANK	**ALL	***ALL
LFACS		LFACS	LFACS		
RECON		RECON	RECON		
IFV		IFV	IFV		
DEW		DEW	DEW		
LOSAT		LOSAT	LOSAT		
MRTR		MRTR	MRTR		
HWTZR		HWTZR	HWTZR		
RCKT		RCKT	RCKT		
MSL		MSL	MSL		
ASV		ASV	ASV		
LOSAD		LOSAD	LOSAD		

* All vehicle concepts have a driver training requirement

** All vehicle concepts have a maintainer training requirement

*** Embedded Tactical Trainer is envisioned to incorporate all vehicle crew positions

TABLE 3.3.2.2-1

CAREER MANAGEMENT FIELDS (CMF)
TO BE TRAINED

CMF	TITLE
11	Infantry
12	Combat Engineer
13	Field Artillery
16	Air Defense Artillery
19	Armor
23	Air Defense Systems Maintenance
27	Land Combat/Air Def Sys Intermediate Maintenance
29	Communications Electronics System Maintenance
31	Communications-Electronics Operations
33	EW/Intercept Systems Maintenance
51	General Engineer
54	Chemical
55	Ammunition
63	Mechanical Maintenance
74	Automatic Data Processing
76	Supply and Service
77	Petroleum and Water
88	Transportation
91	Medical
95	Military Police
96	Military Intelligence
98	EW/Cryptologic Operations

systems. It is envisioned that through commonality and the reduction in the crew size that the quantity of MOSs and CMFs may be reduced. For the purpose of this analysis, projected vehicle concepts were matched with predecessor vehicles having similar operation and maintenance profiles. The list of AFV mission concepts and their predecessors (fielded vehicles) is shown in Table 3.3.2.2-2. These predecessor systems were assumed as a baseline for defining the AFV target audience. Soldier Manuals for these predecessors were used to identify generic tasks for the operators and maintainers of these vehicles. The task analysis reported here is based on commonalities which are expected to survive the AFV consolidation of MOSs.

It must be noted that the manpower pool is declining whereas the design-driven demand for higher levels of aptitude has been increasing. The individuals to fill the vacancies between now and the mid-1990s is declining. With this decline the Army may not be able to fill its demand for recruits without having to lower its entry level standards and behaviors. This decline in the manpower pool may cause the Army to recruit soldiers whose skill level is not commensurate with the soldier of the 1980s, i.e., high school education. This will inevitably cause such training concerns as the ability to comprehend information written at today's level and possession of required prerequisite skills to perform these jobs. The training methods for the AFV must be designed to ensure that the 1995 soldier can be effectively taught. Training material might have to present background information on tasks and skills that the soldier of the 80s knew prior to his enlistment that the soldier of the 90s will not know. System documentation may need to be written at a level that can be understood by the soldier reading at or below the 8th grade level (according to the Kincaid Readability Formula contained within MIL-M-38784B).

3.3.2.3 Common Tasks

For the purpose of this analysis, common tasks for AFV crew positions across all vehicles were identified. These drive the soldier machine interface requirements for AFV mission variants.

TABLE 3.3.2.2-2

FUTURE VEHICLE CONCEPTS X PREDECESSOR VEHICLES

TANK	M60A3, M1/A1
LT FACS	M551, LAV
FRV	M2/3, M114/M113, M151
FARV	AFARV, 5-TON/2½-TON TRUCKS, M113, M548
CC	M577, M113
IFV	M2/3, M113
DEW-V	*NONE
KEM-V/LOS-AT	ITV
MWS-V	M113
GPC	M113
AFAS-C	M109, M110
FSCOLS	FIST-V
ETAS	*NONE
RAMS	MLRS, LANCE
LOS-F-H	M113
NLOS	CHAPPERAL, VULCAN
SV	M113
CMV	ACE
MDV	FASCAM DISPENSER (TOWED)
CEX	ACE, SCOOP LOADER
CEM	ACE, SCOOP LOADER
CGC	AVLB
MARS	M113, M576, M88
RV	M88, M578
IEW	M577
NBC	M113
SMOKE	M113, 2½- or 5-TON TRUCK
SECURITY	M8 SCOUT CAR
AMBULANCE	M113, M577
ABAS	M113, M577

* No predecessor has been identified

3.3.2.3.1 Tank Commander (TC)

- Recall system functions
- Choose appropriate sights or controls
- Select proper weaponry
- Choose tactics in combat
- Detect targets
- Classify targets as friend or foe
- Identify targets
- Issue fire commands
- Operate cupola machine gun
- Track moving targets
- Manually traverse
- Comply with directives/commands

3.3.2.3.2 Gunner

- Recall system functions
- Choose correct equipment to use
- Select proper weaponry
- Evaluate threats
- Detect targets
- Classify targets as friend or foe
- Identify targets
- Respond to fire commands
- Operate the laser range finder
- Track moving targets
- Manually fire
- Comply with commands

3.3.2.3.3 Driver

- Select proper switch to start engine
- Choose proper route
- Apply the "rules of the road"
- Evaluate the situation and choose route accordingly
- Detect problems with the engine, track, etc.
- Classify targets as friend or foe
- Identify symbols in the -10 Manual

- Communicate with Bn Level Maintenance Personnel
- Follow before/during/after maintenance checks
- Steer vehicle in direction wanted
- Perform maintenance using hand tools
- Conform to proper maintenance standards.

3.3.2.3.4 Maintainer

- Recall equipment nomenclature
- Determine the type of fault that exists in an internal system
- Troubleshoot malfunctions
- Choose a strategy for diagnosing a fault
- Detect a malfunction
- Classify malfunction in terms of source
- Read schematic drawing
- Report/describe problems
- Perform visual inspections and daily readiness checks
- Regulate engine RPM
- Make minor repairs/adjustments with hand tools
- Comply with maintenance request/schedule

3.3.2.3.5 Crew Training

- Recall equipment functions
- Choose the correct course of action
- Select proper weapon to utilize
- Choose the best combat tactics dictated by situation
- Detect target(s) within sector
- Classify target as friend or foe
- Identify target as T72, Chieftan, Leopard, etc.
- Communicate effectively as a crew
- Adjust fire
- Provide continuous movement on selected route
- Perform manual use of firing mechanism or transverse arms
- Comply with directives/orders/commands.

3.3.2.3.6 Force-on-Force Training

- Recall tactics required by situation
- Determine courses of action required
- Choose a course of action
- Formulate plans, develop mission
- Monitor sections of subordinate and enemy forces
- Determine action to take to solve problem
- Identify map symbols
- Advise/direct subordinate units on their respective courses of action or missions
- Adjust forces based upon situation
- Maneuver unit for effective fire power and the goal of winning the battle
- Write OPLANS, etc.
- Exhibit behavior consistent with ALB doctrine.

3.3.2.4 Stimulus Requirements

In order to define which AFV missions/tasks are the best candidates for embedded training, the generic tasks described above were translated into categories of learning algorithms (based on TAEG Report Number 16). These algorithms represent broad categories of learning which must be supported by the chosen training device. The stimulus requirements for any given algorithm vary depending upon (1) the types of tasks involved, (2) levels of training, and (3) the training environment.

The analysis illustrated in Table 3.3.2.4-1 was performed by a team of developers consisting of an instructional developer, a training analyst with extensive tank gunnery experience, and a senior systems engineer. The complete analysis is contained in Appendix C. Team members made their input to the analysis in terms of the following question: Given a specific AFV mission task associated with a given training concept (regardless of training environment/locale), what are the minimal stimulus capabilities required to train that task using a training device? For example: Given the types of decisions to be made by the track commander and gunner (trained by a tactical gunnery device see Section 3.3.2.3), what stimuli are required to provide necessary input and response modes for learning to make those decisions?

AFV INSTRUCTIONAL DELIVERY REQUIREMENTS

TRAINING DEVICE CONCEPT :E11
TRAINING REQUIREMENTS :INDIVIDUAL & COLL. COMBAT OPERATION IN TACTICAL ENVIRONMNT-UNIT SUSTAIN
TARGET AUDIENCE :ALL FUTURE VEHICLE CREWS

MEDIA CHARACTERISTICS	MEDIA DESCRIPTION	KNOWLEDGE	VERBAL INFORMATION	RULES	DECISIONS	DETECTION	CLASSIFICATION	SYMBOLS	VOICE COMMUNICATION	PROCEDURES	STEERING/ GUIDING	MOTOR SKILL	ATTITUDES
00 CONTENT OF FEEDBACK													
CORRECT RESPONSE DATA	An indication of correct response is provided the trainee either immediately after he responds or automatically in the event he does not respond within a specified time.	X	X	X		X	X		X				
SCORE DATA	The trainee receives quantitative information about his performance (such as account, percent and rate data).			X		X	X						
DIAGNOSTIC DATA	The trainee is informed of inadequate performance, its cause, and prescribed remedial actions.			X	X	X	X	X	X	X	X	X	
SYSTEM PERFORMANCE DATA	The trainee observes changes in the state of a system as a consequence of his actions in the system.				X				X	X	X	X	X

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TABLE 3.3.2.4-1

Example: Analysis of Stimulus Requirements for Learning Algorithms

Based upon these analyses a rough description of stimulus requirements was created for each learning algorithm within each training concept. For example, the training of procedures associated with GETS (which focuses on precision gunnery training in a tactical environment) was determined to require the following:

- o Voice communication
- o Sound reproduction
- o Full visual motion, tactile, and kinesthetic cues
- o Verbal, gross motor, and fine motor trainee responses
- o A full range of instructional feedback including diagnostic and system performance data
- o Dynamic simulation model for instructional event sequencing.

In contrast, the training of procedures associated with sustainment maintenance training devices which focus on operational maintenance, was determined to require:

- o Three-dimensional replications
- o Still and limited-movement (black and white) visual presentation
- o Full range sound, ambient sound, and tactile cues
- o Written, gross motor, and fine motor trainee response modes
- o Full range of instructional feedback including diagnostic and system performance data
- o Linear, branched, and instructor or machine selected instructional event sequencing

These rough descriptions are not presented in this report because they are lengthy and represent only a transitional step.

3.3.2.5 Levels of Fidelity

The next step in the training analysis was to estimate, for each learning algorithm associated with each training concept, the minimum effective level of fidelity required in the training device. This was done by developing a hierarchy of generic delivery systems which range from 100% fidelity (i.e., the actual operational equipment in the field) to little or no fidelity (i.e., classroom instruction using a textbook only). These delivery systems were rank ordered on a scale of 2 to 10. The taxonomy of learning algorithms used in the previous analysis were rank ordered from least complex (i.e, recalling bodies of knowledge) to most complex (i.e.,

applying attitudes) on a scale of 1 to 12. These values were used as multipliers to obtain an estimate of training device total fidelity requirements. This analysis is displayed in Appendix D. An example is shown in Table 3.3.2.5-1. A low score indicates the system is better suited to SADs and a high score indicates it is better suited to ET.

The overall fidelity scores for the six training concepts are:

WESS (256)

IGT (338)

IDT (345)

OPMETS (365)

GETS (506)

ETT (534)

These results are consistent with expectation. WESS, lowest ranked on fidelity, is a training-enhancement device and, therefore, has the fewest requirements. ETT, the highest ranked on fidelity, is a full-scale crew-interactive, combat operations trainer and, therefore, has the most complex requirements. This analysis indicates the likelihood that the training system will need to be embedded in the operational equipment in order to satisfy the instructional delivery fidelity requirements described in its Training Device Requirements document. This analysis indicates that GETS and ETT are excellent candidates for embedding while other concepts can be better handled by SADs or, possibly, a combination of ET and SAD.

3.3.2.6 Training Priority

In order to estimate the degree to which sustainment/refresher training is required for each type of learning, a training priority index was developed. A team of subject matter experts rated generic tasks for each crew position on the dimensions of criticality, difficulty, and practice required. The criteria for these ratings is described below.

- Criticality - If the task is not performed correctly by the designated crew member(s), the mission will be:
  - Code 0: Unaffected; the task is noncritical to mission success.
  - Code 1: Degraded slightly; no important effect on equipment or personnel.
  - Code 2: Degraded significantly; equipment damaged or personnel injured; mission compromised.

AFV TRAINING CONCEPT : E11
TRAINING REQUIREMENTS : INDIVIDUAL & COLLECTIVE COMBAT TRAINING IN TACTICAL ENVIRONMENT
TARGET AUDIENCE : ALL FUTURE VEHICLE CREWS

LEARNING ALGORITHM	CONCEPT APPLICABILITY	OPERATIONAL SYSTEM (FIELD) (10)	OPERATIONAL SYSTEM (LABORATORY) (9)	COMPUTER SIMULATION (COLLECTIVE) (8)	COMPUTER SIMULATION (FULL TASK) (7)	COMPUTER SIMULATION (PART TASK) (6)	PROCEDURE/ MECHANICAL TRAINER (5)	COMPUTER ASSISTED INSTRUCTION (4)	VIDEO TAPE/ TELEVISION (3)	INSTRUCTOR/ TUTOR (2)	FIDELITY SCORE
1 PERFORMING GROSS MOTOR SKILLS	1						1				6
2 STEERING AND GUIDING CONTINUOUS MOVEMENT	2	1									20
3 IDENTIFYING SYMBOLS	3							1			12
4 DETECTING	4				1						28
5 RECALLING BODIES OF KNOWLEDGE	5							1			20
6 USING VERBAL INFORMATION	6							1			24
7 RECALLING PROCEDURES, POSITIONING MOVEMENT	7				1						49
8 APPLYING RULES	8							1			32
9 CLASSIFYING	9				1						56
10 MAKING DECISIONS	10				1						70
11 COMMUNICATING BY VOICE	11			1							88
12 LEARNING/APPLYING ATTITUDES	12	1									120
*** Total ***											525

TABLE 3.2.5-1
Example: Analysis Levels of Fidelity

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Code 3: Aborted; irreparable damage to equipment and loss of life.

- Difficulty - The complexity of skill required to perform the task in the operational environment is:
  - Code 0: None; no special skill above entry level behavior required.
  - Code 1: Minimal; easy to perform; normal ambient conditions have no effect on performance.
  - Code 2: Normal; complex skills; constraints in the operational setting or restrictions caused by clothing, headgear, etc. may degrade performance.
  - Code 3: Significant; very complex skills; operational environment can produce errors in performance.
- Practice Required - In order to maintain proficiency in the task, practice is required:
  - Code 0: Never; once learned, the skill is never forgotten.
  - Code 1: Annually; one to four times a year.
  - Code 2: Monthly; one to four times a month.
  - Code 3: Weekly; one to five times a week.

To create the total priority score, the values entered for each of these dimensions were added together. This score provides a gross estimate of the degree to which continued sustainment training is required for that task and, therefore, the value of embedding training in operational equipment. It is probable that many low priority tasks will be embedded due to their logical relationship with other embedded features or because it is easy and inexpensive to include them in an embedded trainer. On the other hand, certain types of tasks that may be discussed here as having sufficient priority to justify embedded training may fail to qualify from an engineering/cost standpoint. The estimated training priority for the list of generic tasks is presented in Appendix E. The total score for a given task appears in the last column.

3.3.2.7 Media Selection

3.3.2.7.1 Tactical Gunnery Training (TGT)

- o Unit Training - Given the high fidelity requirement of learning algorithms and the large number of high priority tasks, TGT is generally a good candidate for embedded training. Virtually all the gunner and track commander tasks require sustainment training and fidelity approaching the operational equipment. Only the recall of knowledge about the system and its functions is considered of low priority and, like all background knowledge learning requires little or no fidelity in the delivery medium.
- o Institutional Training - From a strict training perspective, stand-alone devices are not required at the institution to support TGT provided that all features described in the Training Device Requirement discussed below can be embedded in operational equipment.
- o Training Device Requirement (TDR) - The essential characteristics for TGT as described in the TDRs are sufficient to begin development of an embedded training concept for the applicable vehicles.

3.3.2.7.2 Driver Trainer (DT)

- o Unit Training - There is no unit requirement. DT is an institutional trainer; therefore, does not lend itself to embedded training.
- o Institutional Training - Most initial and basic driver tasks will tolerate low fidelity in the trainer and could be trained by part-task trainers, computer-assisted instruction, and videotape. Advanced skills, such as "evaluating terrain" (a decision skill) could be supported by a full task simulation on a laboratory-based operational system with computer generated imagery (CGI) and other crew positions automated. This device could also be used for New Equipment Training when AFV is initially fielded.
- o Training Device Requirement (TDR) - The TDRs for IDT are sufficient as written to begin concept formulation for a stand-alone device which will train common driver tasks for all variants. The requirement for a motion platform in the simulator is of

questionable training value and is discussed more fully in the engineering analysis.

3.3.2.7.3 Basic Gunnery Trainer

- o Unit Training - There is no unit requirement for basic gunnery training. It is envisioned as an institutional trainer only. It should be developed proactively with GETS to ensure proper integration with unit-level training.
- o Institutional Training - The training of initial, basic, and advanced gunnery skills for gunners and track commanders can be accomplished in the institution using a full-task simulator with supporting media. This same simulator should be able to satisfy the requirement for transition training when AFV is initially fielded. The simulator should have fidelity great enough to prepare students to transition to operational equipment having embedded training (i.e., TGT) but should not duplicate features of the embedded trainer. For example, basic gunnery training need not replicate the weapons effects simulation used in TGT.
- o Training Device Requirement (TDR) - Some TDR characteristics may not be required of an institutional gunnery trainer. For example, the requirement for "vehicle noise (track, engine and weapons firing) corresponding to the environmental conditions, speed of the engine and targets being fired on" seems to be more fidelity than is indicated by this analysis. These enhancements would be more appropriate for an embedded trainer (see 3.3.2.7.6).

3.3.2.7.4 Weapons Effects Simulator System (WESS)

- o Unit Training - There are only three generic tasks associated with the WESS. Two of the three tasks are considered above average in priority and one is estimated as requiring maximum fidelity. Since the WESS is envisioned as a device to add realism to TGT training, WESS is a good candidate for embedded training in vehicles equipped with GETS.
- o Institutional Training - The need for WESS in the institutional setting is very questionable. Its primary value is in increasing

the realism of tactical training and, according to the TDR, it is only to be used in conjunction with GETS and with SRS (Sight Recording System). Therefore, eliminating the GETS concept of institutional training (see section 3.3.2.7.1) eliminates 50% of the institutional application of WESS. (The SRS concept has not been analyzed in this report). Given its relationship to GETS, WESS does not appear to be required at the institution.

- o Training Device Requirement (TDR) - As currently written, the WESS TDR calls only for replication of the audio signature of the main gun.

3.3.2.7.5 Sustainment Maintenance Training System

- o Unit Training - The skills required for operator maintenance do not demand a high degree of fidelity in the trainer. Most of them can be trained with manuals, facsimiles, procedure trainers, etc. The priority of these tasks is generally average. Only the tasks associated with detecting, diagnosing, and tracing malfunctions were ranked as very high priority and, therefore, in need of frequent reinforcement and practice. Based upon these observations, the OPMETS appears to be a candidate for embedded training of transitional and advanced skills related to the following categories of tasks:
  - Detecting faults
  - Troubleshooting and diagnosing faults (especially rare events)
  - Using unique vehicle schematics
  - Following standard operating procedures for certain repairs

  Essentially, the unit/embedded training capability can be focused on vehicle differences, crew readiness for emergency procedures, and individual advancement skills. Therefore, ET should be limited to BIT/BITE and teach fault isolation, troubleshooting, etc.
- o Institutional Training - Most of the burden for initial and basic operator maintenance training should be assigned to the institution and addressed using SADs and supporting media.

Commonality among AFV chassis will streamline and extend the applicability of initial and basic maintenance training. Therefore, a substantial investment in institutional SADs will be more justifiable. The institutional maintenance trainer(s) should be developed in conjunction with the operator maintenance embedded trainer(s) to ensure meaningful integration of both training missions.

- o Training Device Requirement (TDR) - The TDRs are not sufficient to begin concept formulation for embedded training. Moreover, they do not describe essential characteristics appropriate to institutional devices. All the essential characteristics point to operational equipment with built-in or appended training components. The requirement for some of these components is questionable. For example, it is not clear why an audio visual recording capability is necessary. There are very few voice communication tasks associated with operator maintenance. If watching a procedure performed is necessary, video tapes of any crew performing the procedure correctly will accomplish training. It seems unnecessary to record the actual crew making repairs and adjustments. These requirements and characteristics need clarification before any concept development can begin.

3.3.2.7.6 Tactical Crew Training

- o Unit Training - As it is currently envisioned, the tactical crew training is a state-of-the-art training technology to provide the capability for "individual, crew, and unit sustainment training." The potential for this type technology is promising but it is difficult to say whether embedding the capability to train any/all individual and crew tasks at the unit is logical or desirable. If it is developed, it will probably incorporate or replace the TGT trainer described above. It will also include the sustainment maintenance unit training requirement and it will support some limited driver training so that the driver can participate in crew and force-on-force exercises.
- o Institutional Training - Tactical crew training is envisioned strictly as a unit sustainment trainer. There is no

institutional requirement. It should be developed in conjunction with the driver, gunnery, and maintenance trainers to ensure maximum training integration and effectiveness.

- o Training Device Requirement (TDR) - The current TDRs call for a fully interactive training device with computer-generated imagery. These essential characteristics are insufficient to begin a concept formulation effort. At a minimum, the crew positions to be trained and the interactions desired in the system need to be specified.

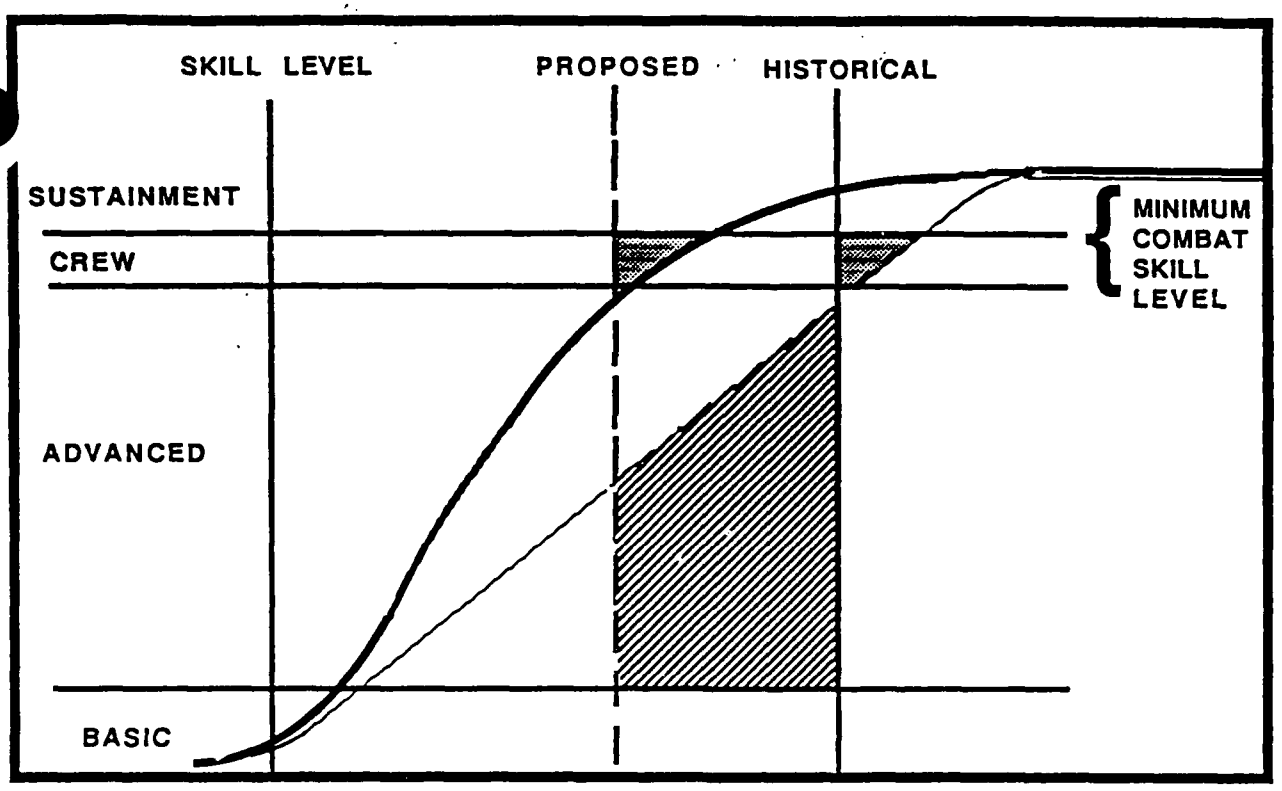
3.3.2.8 Summary of Training Issues

The following issues, which arise from the observations above, are factors to be considered during the trade-off analysis:

- o Skill acquisition for all types of learning should be carefully distinguished from skill sustainment to ensure integration of SAD and embedded features.
- o The removal of operational equipment from the institution will create a training shortfall which represents the amount of OJT required to bring a soldier to a combat-ready level of training. Figure 3.3.2.8-1 depicts the increased combat-ready shortfall which would result from reassigning the training of some portion of institutionally-taught hands-on tasks to the unit. To overcome this problem, either the institution will need to train-up faster to the crew performance level, or embedded trainers at the unit will have to train more of the advanced individual skills.
- o Even though an embedded trainer is designed to prescribe, deliver, and evaluate training in the absence of an I/O, there should also be a provision made for the monitoring of training by an I/O if desired. The features required for a crew or force-on-force trainer IOS are complex. The requirements for a remote IOS should be evaluated.

3.3.3 Engineering Analysis

The engineering analysis is based on a study of comparable predecessor systems. As previously noted in section 3.3.2.2, there is a



HANDS- ON TRAINING BURDEN TRANSFERRED TO UNIT

COMBAT READY SHORTFALL

Figure 3.3.2.8-1
IMPACT OF REMOVING OPERATIONAL EQUIPMENT AT INSTITUTIONS

predecessor for each one of the proposed trainers in the AFV set. Based on the current devices, the difficult areas of simulation engineering are: (1) out-the-window or through optics visual simulation, (2) heavy mechanical/hydraulic action such as gun recoil and full vehicle motion, (3) mechanical/hydraulic control system feel, (4) full context voice recognition, (5) computer system, (6) software program development, (7) network linking, and (8) other engineering areas. Each of these will be discussed in greater detail in the following paragraphs.

3.3.3.1 Out-the-Window or Through Optics Visual

Out-the-window or through optics visuals are the most difficult visual environment to provide. The demand on the visual system begins with the data base and progresses through the computer generator to a relay/processor (typically TV) which is again converted through projection for display on a screen or other optical device. At present, visual systems are almost always limited by the display subsystem. The exception is a CGI system which is usually limited by the data base or the total number of polygons available for construction of figures. Visual movement is a common capability given for almost any visual system today. However, there are some limitations to eyepoint movement. For example, videodisc systems are limited to routes that have been recorded. Therefore, a videodisc based system is only partially free to travel. Visual system spectrum utilization has also advanced rapidly over the recent past. Nevertheless, few onboard sensors require color as part of the operational system. Therefore, color almost always shows up only as part of the out the window or through optics scene. Embedding visual systems for training is not difficult unless out the window visuals are added. Networking visual systems, however, is not an easy or inexpensive task. Signal transmissions and receiving equipment require extra facilities that are not normally found in combat vehicles. Resolution requirements for target detection, recognition, and identification impose tight restrictions on the specification of the visual system. As previously noted, almost all systems in use today and likely to be available in the near future, are limited by the display system.

3.3.3.2 Heavy Mechanical/Hydraulic Action

Any attempts to simulate heavy mechanical/hydraulic action are challenging engineering tasks. However, there are numerous successful precedents in fixed base flight simulators. The same techniques (platforms) can be employed to provide motion cues for vehicle dynamics. If motion cues are found to be essential for training, then individual crew seats as opposed to crew compartments might be mounted on platforms. This change would lessen the mass to be moved and thus would lower the overall motion system requirements. Dynamic seats have also been used recently as surrogates for platforms. Results have been encouraging and the technology could be employed for the fixed based institutional devices. Both of the motion solutions are expensive. Hydraulic systems also introduce extensive maintenance and support problems. There are leaks to contend with as well as fluid cooling and pumping problems. These systems also create safety hazards which must be carefully controlled. Attempts to embed hydraulic motion into a tank chassis would require some form of built-in hydraulic strut similar to the stabalizer arms used with earth moving equipment. However, to provide the correct vehicle dynamics, the hydraulic arms would have to have large pistons and very powerful pumps. The arms would have to be mated with hardpoints in order to keep from sinking into the surface. The other element of heavy mechanical/hydraulic action (gun recoil) has not proven to be cost effective to include in recent devices. In all probability, neither of these actions will be cost effective in the AFV set of devices. Gun recoil was considered important because it was an initiating cue for the loader to perform the reload procedure. Now that there is a mechanical/robotic reloader, there does not appear to be any reason to include the capability.

3.3.3.3 Mechanical/Hydraulic Control System Feel

Control system feel includes the effects of break-out force, inertia, damping, and lag. In addition to matching actual equipment dynamics, the controls are key input devices for the visual system and the motion system (assuming one is included). Time constants, damping ratios, as well as break-out forces are critical components for consideration in developing simulations. Embedded training would use the existing equipment and avoid the problem of matching feel. However, if the operational system

has a hydraulic control system, there it would have to be energized to provide the correct responses. Powering-up introduces requirements for extra hydraulic power and cooling. A special problem may arise with respect to ET and mechanical back-up control systems. Unless there are disconnects or training conditions designed into the system, it is usually not possible to go through back-up procedures. For example, mechanical rotation of the turret or elevation/depression of the gun are procedures which would not be possible to perform. Fortunately, control loading units may be purchased as off-the-shelf items.

3.3.3.4 Full Content Voice Recognition/Generation

The full content voice recognition response mode is very difficult to include. There are systems that provide the capability; however, they are expensive, limited, and of questionable value. However, there may be specific instances in which the requirement for a pseudo crewmember is critical to the individual's performance. Pseudo crewmember capability of voice generation is usually associated with artificial intelligence requirements because the responses require interpretation as part of the training device. There would be no significant difference in implementation between SADs and embedded training. There are limited voice recognition systems available; however, the evolution rate into increased capability is unknown.

3.3.3.5 Computer System

Fortunately, computer capacity has increased dramatically in the last few years and will continue to do so in the future. Very large scale integrated circuits are coming into use. The future will provide special circuits to accommodate training programs running in parallel with the operational programs. Physical dimensions of the computers have decreased even as capacity has increased. However, the desire to do more with the computers has continually filled the new system capacity. As a net result, there has been increasing cost of the hardware/software combination. Although the requirements for the simulations may be reduced, the simulation requirements may have increased dramatically since there are many more systems on-board. Another trend in computer system architecture has been toward the multiplex bus which allows equipment subsystems to be

added or changed with relative ease. If this technique is used, it may be possible to add a training computer (to add processing power and add the game environment) through a multiplex port provided the original design includes the basic wiring. This technique will apply to both ET and SAD.

3.3.3.6 Software Program Development

Although there are prospects of more thoroughly organized and modularized software through development using the standardized programming language, Ada, there are no new architectures which overcome the inherent problems of simulation. That is, partitioning the simulation problem so that all required calculations can be completed in the time available. Nevertheless, there is considerable work being devoted to architecture and there are some interesting approaches being tried. Whereas these notes are applicable to SADs, the real challenge in ET would be to include the appropriate constructs in the weapon system programs. Unless the original equipment design incorporates the capabilities for artificial stimulation, it will be expensive and difficult to add.

3.3.3.7 Network Linking

Network communications techniques are well known and are being employed with some of the current training devices. The major concerns are bandwith and data rate requirements. Both of these elements are controllable, to a large extent, by attention to detail during the design process. However, if communication requirements are not included in the initial design, it may be impossible to link the systems and have a realtime exercise. With onboard computers and communication links, it is certainly possible to link more than one player together. As long as there are no demands for visuals, it is not particularly difficult to achieve a communications link that can pass data between elements at a rate sufficient to support almost any form of training.

3.3.3.8 Other Engineering Areas

3.3.3.8.1 Audio

An audio engineering challenge will be in determining how to generate the intelligence or desired signals within a cluttered background

signal. Depending on skill level and training objective, it is desirable to control the signal to noise ratio (S/N) as the student makes progress. Therefore, access to both elements of the audio signal should be available as instructor-controllable items. Another audio engineering challenge is dependent on the level of interrupt, that is if a dialogue occurs or if the communication sequence is uninterrupted from end to end. The former requires random access or branching whereas the latter may be satisfied by a recording (disk or tape). Although vehicle equipment warning messages fall into the category of prerecorded items, it may be advantageous to synthesize the voice/audio as the need arises. Audio technology has advanced so rapidly that audio signal demand should not be a cost driver element in the engineering design of any future training device.

3.3.3.8.2 Scale

Embedded training (ET) will require full-scale components at the student interface. However, scaling is also an appropriate, and a very important technique for an accurate depiction of any optical scene in the visual system, especially one which goes through the optical components of the operational equipment. On the other hand, if the visual is some variation of a videodisc system, alternative video frames must be available for all scenes. Computer generated imagery (CGI) systems can handle movement and selection more effectively than other forms of media. However, the size, complexity, computing requirements, and investment cost are all limitations that visual systems must address. This element must be considered in conjunction with the visual system.

3.3.3.8.3 Tactile Cues

Embedded training includes full fidelity in tactile cues (touch, texture, size, shape) because the student is using the actual equipment. These cues must be replicated in the SAD.

3.3.3.8.4 Information Feedback Logic, Content and Time Schedule

Feedback is a necessary component of any training system. Feedback is intrinsic in the embedded device. However, stimuli from motion probably will not be available in the AFV devices because, as previously discussed, there does not appear to be any cost effective way to provide

motion cues as part of an embedded trainer. Action feedback, on the other hand, is the direct stimulation of the inherent instrumentation of the vehicle. There are fewer and fewer direct reading analog instruments in almost every type of vehicle. However, the few remaining instruments will prove to be difficult to stimulate. Augmented feedback can usually be provided without too much difficulty if the system has an onboard computer. The challenge is in preparing the software. Reconstructive feedback is usually expressed as the after-action replay requirement, and may include recording of some or all actions which can be replayed during a critique. As noted with augmented feedback, the major burden is on the simulation software. One of the more difficult aspects of stimulation is the requirement to sense and record switch action on control input. Once again, this sensing must be built into the basic system. Regardless of the form of the feedback, the content is a software driver. Scoring, diagnostics, response and system performance are all available in the training application software. In fact, it is the collection and replay of feedback that really distinguishes a training device from a pure simulation. Another aspect of feedback is the timing of the information. If there are specific time relationships that exist between action and response, it is imperative that the training device approximate them with sufficient accuracy that students do not reject the utility of the device.

3.3.3.8.5 Event Sequence Logic

The major discriminator in this category is the difference between the linear sequence often presented as a panel/procedure trainer, and dynamic modeling which presents the student with a working model of the system and allows the student to observe the effects of his own actions. The former is a straightforward programming problem that has been around for several years and works very well. The latter is a recent adaptation of the aircraft simulator model to other vehicles. As an operator trainer, it does have merit; however, it is a more expensive approach than the linear sequence form.

3.3.3.8.6 Equipment Considerations

Another area of major concern is the interface requirements between the hardware system and the training system. This is technically

possible with very close coordination between the developers. A self test capability for the interface should be included in the system to ensure reliability. The other engineering consideration is the potential problem that when the training system becomes nonoperational this may result in operational equipment failure. This problem can be avoided by incorporating a redundant capability in the entire system, however, this is also at additional cost. Even this redundancy may not alleviate the problem.

The issues of space and weight in the design configuration of the entire system must also be considered. Traditionally, the size and weight constraints imposed on the developer of major systems leaves very little room for adding anything else to the system. With a prototype scheduled to be fielded in late 1990 or early 1991 the current and near term technology will not permit significant gains in these areas.

3.3.3.9 Advantages and Disadvantages of Embedded Training

The following paragraphs discuss the advantages and disadvantages of embedded training devices.

3.3.3.9.1 Advantages to Embedded Training

There are several advantages to embedded training from a support viewpoint. First, embedded training eliminates the large number of strap-on and stand-alone devices. Second, embedded training provides a means of providing realism and the use of the actual equipment in the shortest period of time. ET can provide cost savings in the areas of ammunition expenditures and range construction and utilization. These advantages come about through ET's capability to simulate the actual live fire of the weapon system without using the ammunition and the ranges normally required. ET may reduce the development required to field a new training device in addition to fielding a major system. Cost savings on development with a combined approach have not been verified. From a training perspective, the crew would use all control functions and displays used in the actual equipment in a real mission environment without some of the hazards normally associated with its use. From an engineering perspective, a mix of embedded plugs and cables with some SADs can be employed to allow integrated, collective task training. Specifically, SIMNET-like technology

could be integrated such that several vehicles could participate in a training session at various locations simultaneously. This would require that a stand-alone device be connected to the heads-down display operational equipment so that all the players could get the same information simultaneously. Communication links exist now that would allow the use of SIMNET technology between various stations at great distances from one another. Also, embedding portions of gunnery simulations like TWGSS or MILES into the fire control software may be possible, but problems in partitioning the software and increasing the hardware size to accommodate the software must still be addressed. This will not eliminate the requirement for strap-on components like retroreflectors.

This engineering study addressed primarily the combat arms requirements associated with ET. This area is the one that has the greatest benefit to receive from ET and also the area that is the hardest to simulate. Much of what was discussed in the preceding paragraphs applies equally well to the combat support and combat service support vehicles. Generally, the engineering capabilities to embed training into a system exists. However, it must be clearly understood that to do so requires time and money. How much of these two resources are available will dictate how much training can be embedded. Clearly, many trade-off areas exist that must be evaluated; but the results of this study indicate that totally embedded training is not the best alternative from an engineering standpoint. The rationale for this is based on the technological problems associated with providing the interfaces to the operational equipment, the reduced reliability, and availability and the resultant increased maintainability of the combined systems. The problems of providing the desired capabilities in the space and within the expected weight constraints are also key factors leading to this conclusion. This is also supported by the anticipated reduction in Operations and Support funds in the out years.

3.3.3.9.2 Disadvantages of Embedded Training

Although the hardware on the operational equipment is designed for rugged use, the additional use that it receives as a result of providing training as well as operational use will result in higher repair and replacement rates. Based upon recent experience with the helicopter

simulator. Helicopter components that are used for training are experiencing much higher down times and lower availability than the same components on the operational aircraft. This is caused by the increased use and by the very nature of the training itself. The training is intense and highly repetitive. This increases the risk of equipment failure and thus reduces availability. The support contractor is currently charging more to repair the training system than to repair the identical components on the operational aircraft. The term "hanger queen" was coined years ago to refer to a very similar problem of using one system for spare parts in order to keep the other systems operating. Embedding training into all AFVs will spread the problem of decreased availability over the entire fleet because of the increased complexity and number of additional components required in the system. Although the number of personnel using the vehicles would be limited to the crew, the additional burden associated with the training and operational requirements will still reduce the operational availability.

Other considerations include the fact that the procurement, operation and maintenance of the operational system is more expensive and more difficult than using a simulator. This again was one of the primary reasons for going to a stand-alone device and simulators.

Another consideration is the possibility that if the training is embedded in the system when the training portion becomes nonoperational, then the total system may be nonoperational. Embedding training may also require attaching an item to an existing operational piece of equipment. For example, it may be necessary to attach an optical viewer device to the actual sight on a fire control system in order to provide the visual image required for training. In this example, the optical component and the associated equipment must be stored on the vehicle. Implicit in this is the requirement that the additional components must be hardened to meet the requirements of operational use in field conditions. Another problem is the degradation of the system that may result directly from having the embedded training system on the vehicle.

The next area of concern is that of the interface between the operational equipment and the training simulation equipment requirements. Some method must be provided to allow a smooth transition between the training mode and the operational mode, yet allow for rapid and total

transfer within a few moments without endangering the crew or the system's mission functionality. Along these lines it is imperative that certain safety constraints be considered in the design and development of ET. For example: the transition between operation and training must provide for eliminating the possibility of firing live ammunition when in the training mode, it must not send a laser beam at full force toward a friendly target, the turret may not traverse inside the tight confines of a motor pool, but a complete 360° view with targets must be provided. Many other similar constraints could exist. Each of these must be considered from an engineering and cost viewpoint. Looking at these three as strictly examples, the engineering requirements for the first one are not difficult to meet. A simple toggle switch or other device can solve this problem. The second problem; not sending a full force laser beam, may also be easily solvable. The third issue, not allowing the turret to traverse, yet requiring a full view, could be done using Computer Generated Image or videodisc technology. However, the technology currently available and in the foreseeable future can provide this but it is expensive. Also, the capability to totally embed this technology into the AFV may not be possible since the hardware required is not available to meet the expected weight and size requirements of AFV. Also, the software required to provide the terrain and target images is very expensive. No appreciable cost savings are expected through engineering effort alone over the next three to five years in hardware or software design. Actually integrating the training into the operational equipment is also a difficult engineering problem since the exact location depends on many variables. For example, should the ET interface outside the sensor, between the sensor and the processor, or inside the processor? How often should the ET stimulate the operational equipment? How should the soldier be evaluated and how frequently? Answers to these questions will drive the engineering design effort, and have significant cost impacts.

The technology is available to embed a plug-in capability so that a separate device, large enough to generate the images and process the data, could be attached to the vehicle. Technology also exists that would allow several vehicles to plug-in to a central processor that would drive the visuals on these vehicles. This would allow use of SIMNET-like technology. Based on the definition in this report, this is included in

the area of embedded training. Also, embedded in the vehicle is the required cabling that provides access to the vehicle's CRTs. The disadvantages to this technology are that a new device must be developed, fielded and supported. Cost benefits from this effort have not been evaluated.

The last engineering disadvantage is that of added complexity and resultant reliability and availability degradation. Specifically, the problems associated with this issue include the fact that the ET must interface with the operational system. This requires additional hardware and cables plus modifications to the existing hardware components. This may preclude using off-the-shelf items, and may increase the development time and associated costs of procurement. Integrating all these components will add to the complexity of the system. It will also add to the reliability, maintainability and availability problems simply by having the extra equipment on the system. This will also directly impact the O&S costs of the AFV.

3.3.3.10 Advantages and Disadvantages of Stand-Alone Devices

The following paragraphs discuss the advantages and disadvantages of Stand-Alone Devices.

3.3.3.10.1 Advantages of Stand-Alone Devices

The major advantage of stand-alone devices is the fact that they have been used successfully for many years with various systems. Second, stand-alone devices are designed for specific training after the system has been fully defined. This also permits using stronger materials for components that are used most frequently and subject to breakage more often than the same system components. Technology is available, today, to meet the needs of SADs.

3.3.3.10.2 Disadvantages of Stand-Alone Devices

Traditionally SADs have always been fielded after the system. The delay in fielding causes a training shortfall and a longer training time is required to bring soldiers up the learning curve. Also, SADs have always been the last conceptual element of major systems development to be designed and built and the first element to be cut when budget constraints

arise. SADs generally are designed for part task training. They are primarily used in the institutional setting for training individual tasks rather than for training collective tasks at the unit. Exceptions are COFT, MILES, ARTBASS and similar SADs.

3.3.3.11 Summary of Engineering Issues

This leads to an analysis of what can be embedded from an engineering viewpoint:

- o Clearly, those tasks that are repetative and require very little in terms of hardware and software are candidates for ET. This translates into a combination of SAD and ET. Software packages or plug-in systems that can be included in such systems as the fire control system to allow checks on the crew during their crew drill to verify that they followed the correct procedures in operating the weapon system or provide collective training are examples.
- o Providing optical input to the sighting system may be possible and practical if there is no requirement for full graphics displays of terrain and targets and assuming that the hardware to generate these images is external to the vehicles. Stand-alone devices will still be required for such tasks as driver training and initial gunnery training.
- o Training of combat support and combat service support personnel will require less embedded training since these tasks are performed on a more routine basis and hence do not require the simulation/stimulation that combat arms training demands. The major issue for this area is where to interface the ET in the operational equipment and how to measure soldier performance given that the ET stimulates the operational equipment.
- o Motion platforms embedded in the vehicles are ruled out categorically since drivers will use existing or similar driver trainers.
- o Some form of communications simulation/stimulation technology that uses existing communications systems and soon-to-be-fielded communications systems together with long distance networks to connect battle simulations to the actual crews through an

external hardware configuration may also be a viable method. Some of the technology may be available to embed portions of such training systems as TWGSS and Through-Sight Video in the AFV. However, some components such as the retroreflectors and the laser range finder may still have to be strapped on.

In summary, technology will not provide the capability to completely embed all the training into the AFV. Some training can be embedded. This training is designed and best suited for use at the unit level. Some stand-alone training devices will still be used at the unit and most assuredly in the institutions. Therefore, from an engineering perspective, a combination of ET and SAD is the best approach.

3.3.4 Cost Analysis

A rough order of magnitude (ROM) cost estimate was performed using the three alternatives discussed in this document. It is envisioned that new and improved technologies will provide additional capabilities for AFV; however, for purposes of this analysis, costs are based on current analagous programs. Due to the expected advancement in technology and the volatile nature of advanced programs these costs are preliminary and any change in the assumed variables will result in a compound change in these costs. Given this level of uncertainty, these costs should not be used for planning purposes because they are of a very rough nature. Appropriate adjustments to the cost data were made as required to reflect current information on the systems. The basis of issue for each system was provided by the AFV Task Force. Table 3.3.4-1, is a breakdown of the costs by device according to the Work Breakdown Structure, where applicable, and the Big 5 chart of accounts for the remaining elements. The totally embedded column represents the summary of the costs for the ETT device in Appendix F. The SAD column represents the sum of GETS, WESS, IDT, IGT, and OPMETS devices. The ETT and SAD column represents a combination of the two approaches. With the inclusion of stand-alone devices it is assumed that fewer ETTs will be required. It is also estimated that the 2,891 ETTs required under this approach will be the combat ETTs discussed in Appendix F in addition to the stand-alone devices. Appendix F contains a detailed explanation of these cost elements.

SUMMARY COSTS

TABLE 3.3.4 - 1

CONSTANT FY88 $(K)

COA	TOTALLY EMBEDDED	ETT & SAD	SAD
1.0 & 2.0	$10,954,697	$1,091,285	$824,500
3.0			$5,496
4.0	$213	$213	$3,589
5.0	$572,675	$45,444	$430,514
	$11,527,585	$1,136,942	$1,264,099

UNCLASSIFIED

UNCLASSIFIED

3.3.4.1 Factors Included in ROM Costs

For each of the six training concepts, several factors were examined: Total system engineering for development and production phases; hardware and software design; software coding and unit test; production planning and prototype manufacturing; recurring manufacturing; training; personnel pay and allowances; and logistic support. Given the innovative engineering required for AFV, the system development and hardware design costs may be considerably higher than estimated for the embedded systems. The stand-alone devices should closely approximate the cost for devices currently in use. The accuracy of the sustainment maintenance estimate will depend on how much trouble-shooting, fault isolation, and BIT/BITE training are embedded in the vehicle.

3.3.4.2 Summary of Cost Issues

The following issues, which arise from the cost analysis, are factors to be considered during the trade-off analysis:

- o Embedded training of hands-on training at the organizational level results in a diseconomy of scale. This results from more training devices being located at less central locations.
- o Embedded training can result in less efficient utilization of the training resources, due to the crew-level nature of embedded training, and having more training devices than needed.
- o Embedded training can significantly increase both the production and maintenance of the weapon system. Considering that these are combat vehicles and that they can be destroyed, there may be a concern that loss of the vehicle also means loss of a training device.
- o Those issues stated as difficult to accomplish in the engineering analysis also carry a very high cost to accomplish.

3.4 Market Survey

A very limited market survey was conducted to determine the technical capabilities currently available to meet the expected training needs of AFV. The survey consisted of research into past, present and near term technologies that are evidenced by existing training devices and training devices for which concept formulation and recent production

contracts have been awarded. Discussions with the primary contractors working with the AFV task force were also used to prepare this portion of the report as well as input from a questionnaire sent to various training device manufacturers. Based on these inputs and considered engineering judgement, an attempt was made to ascertain what technology is available now, what technology will be available in the time frame that the AFV will be developed and produced and what capabilities are required and how technology can meet the perceived training needs.

The results of this survey effort indicate that some of the technology required the embedded training and stand-alone devices envisioned for AFV already exists in various stages of development and at various cost levels to reach a fully developed stage. It is conceivable that given adequate funding and definitive training requirements that some of the training requirements envisioned for AFV can be embedded in the systems as a part of the development effort, but that many requirements must still be satisfied by SADs. As mentioned in 3.2.4 there are areas that are not conducive to embedded training and that must be satisfied by part task, or stand-alone devices. This survey indicates that technology is not readily available now to embed the training that is currently provided by such devices as MILES, COFT, TWGSS, VIGS, TSV and SIMNET. Therefore, a mix of ET and SAD is recommended.

3.5 MANPRINT

The proposed System Manpower and Personnel Integration (MANPRINT) Management Plans (SMMP) for the U.S. Army Armor School's Army Family of Vehicles (AFV) (FACS, LTFACS, FRV, FC^2V, FARV), and the SMMP for the AFV, Version 1, dated March 1987, adequately cover MANPRINT concerns for the umbrella concept. However, subsystem MANPRINT Management Plans must be developed for each of the 32 mission variants. The following MANPRINT issues should be addressed in addition to those already stated for the AFV because of the concept of embedded training.

3.5.1 Manpower

(1) What manpower changes can be expected from additional training scheduling, record keeping, etc. and other tasks that may be brought about by an embedded trainer?

(2) If supervisory personnel are used to instruct, how do they obtain their teaching expertise? What standards will be implemented?

(3) Will additional logistic support personnel be required to maintain the training device or embedded training equipment?

3.5.2 Personnel

Will training device design take into consideration the skills and aptitude of the personnel who will operate, supervise instruction, and maintain the device?

3.5.3 Training

(1) Can sufficient capability be embedded to provide automated training performance evaluation and diagnostic feedback?

(2) What features of the embedded training differ from the operational system (e.g., lack of motion)? How will this affect the transfer of training?

(3) Will there be any negative training effects from the stand-alone devices to the actual equipment? From ET to tactical missions?

3.5.4 Human Factors Engineering

(1) How will the training device measure student performance under stress and fatigue conditions?

(2) Will data from operational "lessons learned" be automatically stored for scenario development, changes in training procedures, etc.? How will scenarios be changed/developed to avoid student boredom?

3.5.5 System Safety

What constraints will be included in the training device to prevent the student from accidentally or intentionally converting from a training mode to an operational mode?

3.5.6 Health Hazards

(1) How will the system simulate health hazards that could realistically occur (e.g., fumes from toxic substances)?

(2) Will the training system design take into consideration the possibility of simulator sickness? Eye strain?

3.6 Training Strategies

A number of strategies for implementing embedded training might be possible. Any of them will involve some adjustment in the institutional-unit pipeline, a recognition of the new equipment training requirement, and a plan for preventing or accommodating an additional training burden at the unit. One general approach is suggested in Figure 3.6-1.

The general strategy indicated by analyses in this report is that a totally embedded AFV training capability is not an effective approach. There is no need, from a training perspective, to deliver basic skills instruction in the vehicle. Given that engineering embedded into the system is difficult and expensive, it will be advisable to deliver basic skills training at the institution using stand-alone devices. There is clearly a justification for training certain perishable skills, especially those which involve collective procedures, using the operational equipment at the units. For precision gunnery training, crew procedure training, and combined arms training, embedded capabilities are needed and may be able to support the full unit training responsibility in these areas. For operation maintenance training, some combination of embedded training and stand-alone devices will be needed. New equipment training will require stand-alone devices and embedded systems at a centralized facility. Therefore, of the three approaches being considered at this point, a totally embedded system, a totally stand-alone system, and a system which integrates both embedded and stand-alone devices, the results of this study indicate the best method is an integrated approach. It will require further analysis, based on specific mission modules and interfaces, to identify the appropriate integration for a given mission variant/vehicle type.

3.7 Acquisition Strategy

Those portions of the training devices that are embedded will be acquired as part of the AFV system using the acquisition strategy for that system. Those systems that are either stand-alone, or strap-on will require a fixed price contractual relationship since the technology is expected to be available at the time and within the capabilities of several

SUGGESTED AFV TRAINING STRATEGY

	INSTITUTION	CENTRALIZE FACILITY		UNIT		
	(BASIC SKILLS)	(NEW EQUIPMENT TRAINING)		(SUSTAINMENT)		
	STAND ALONE DEVICE	EQUIP	MIX	EMBEDDED DEVICES SAD	ET	EQUIP
DRIVER	X	X	X		X	X
MAINTAINER	X	X	X		X	X
GUNNERY (GN/TC)	X	X	X	X	X	
CREWS			X	X	X	X
TEAMS			X	X	X	X

*LIMITED APPLICATION

Figure 3.6-1

manufacturers to complete the requirements. There is no requirement envisioned for sole source bidding. A fixed price arrangement will allow the Government to select the lowest bidder while allowing as much competition as possible among bidders. This will also allow the Government to review several different alternatives for solving the training needs. It is expected that the same companies that develop the AFV will also bid for the stand-alone devices since they will have a significant advantage in knowing the systems and the functions of each system. Due care must be exercised by the Government to ensure that all bidders receive the same requirements and information concerning the systems' performance characteristics and the desired training capabilities.

If the Government desires to bid the new equipment training and training support packages, a time and materials type contractual arrangement may be appropriate. The bidders would include the companies expected to bid on the AFV as well as the companies expected to bid on the stand-alone and strap-on devices. There may also be companies that are primarily support services contractors that may desire to bid on providing the training for the new equipment training and any institutional training that the government may wish to contract. A time and materials contract may be appropriate here since the time and materials could be approximated and hence bidders could be characterized as within reasonable cost guidelines and they could be easily monitored for budgetary and training effectiveness.

4.0 BEST OPERATIONAL APPROACH

Evaluation of the three alternatives: fully embedded training, fully stand-alone devices, and a combination of embedded training and stand-alone devices based on training requirements, engineering requirements, cost considerations, MANPRINT, and a short market survey indicate that the best operational approach is to use a combination of ET and SAD. This will provide the optimum mix of training and devices at both the institutional and the unit at an affordable cost and within current engineering capabilities. This is also in keeping with the AFV fielding plan which projects Initial Operational Capability of 1995. Over the next ten years, as technology progresses there may be significant advances which could reduce the requirements for SADs and provide more capabilities for

ET. Until such time as that occurs, the combination of ET and SADs outlined in this paper, based on the limited capabilities of ET listed in the engineering section, is the best approach.

5.0 CONCLUSIONS

a. Sustainment training at the unit can be supported by a combination of embedded training and SAD. A new training strategy including ET at the unit will place new demands on operational vehicles and the unit.

b. Stand-alone devices should be the primary delivery system at the institutional level.

c. Reading skill and general aptitude of the entry-level soldier of the 1990s is likely to be lower and this may impact the effectiveness of AFV training and training support materials.

d. Current research indicates that technology is available or will soon become available to satisfy many of the training requirements for both embedded and stand-alone devices.

e. All MANPRINT issues have not been satisfactorily addressed.

f. The proportional cost of stand-alone and embedded training devices cannot be fully broken out until new TDRs for the AFV are provided.

6.0 RECOMMENDATIONS

a. Additional study is required on the impact of transferring training from the institution to the unit. This study should investigate existing training requirements of unit commanders and how embedded training would impact these requirements.

b. Additional research is needed to confirm that SADs can satisfy the institutional requirement without support from operational equipment.

c. The Training Device Needs Statement needs to project the reading level and general aptitude of the soldier of the 1990s and make recommendations to the engineering design and O&M documentation for the AFV.

d. A detailed market survey is needed to determine existing and potential training technologies that will satisfy the training requirements particularly for embedded training.

e. A SMMP for each of the AFV mission variants must be provided by the proponent agencies.

f. Engineering analyses based on the TDRs need to be performed. TDRs need to be consolidated and written to the model level (see Figure 1.0, page 2) with mission variations described in the applicable documents. Each variant description must specify differences in the BOIP, TASA, rationale, TDNS, RAM, scheduling, fielding, etc., to provide the basis for cost and engineering analyses.

AMMUNITION AND BATTLEFIELD REALISM

Today's weapons crew training must meet the demands of tomorrow's battlefield. The weapons crew must learn to be proficient on the training range, as well as under the stress of the modern battlefield. Smoke, noise, recoil, the proximity of high explosives, and the requirements to perform in concert with crews under similar stress are all elements of the battlefield which impact in complex ways on the proficiency of the crew. Army trainers may not be able to precisely measure the impact of battlefield realism or the requirement for live fire in training, but they know it is significant. Therefore, the firing of live ammunition for the purpose of battlefield realism is necessary if we are to prepare our soldiers for tomorrow's battlefield.

Currently, the majority of training conducted involving live fire is designed to develop technical weapons proficiency (i.e., skills). In addition to live fire, training devices can also be used for certain weapons systems (Hawk, Chaparral, Redeye/Stinger, and Lance) to develop technical competence. Technical training requirements can be measured empirically and provide justification for resources requirements. Technical proficiency training is very important to the professional soldier but it is only the first step in developing combat readiness.

Training and live fire for the purpose of motivation, confidence, battlefield acclimatization, and realism is a second step. There is a distinction between live fire training for the purpose of technical proficiency and live fire for realism. Acclimatization training is not nearly as precise and doesn't provide unequivocal conclusions as to the amount of ammunition required. Since factual documentation (scientific, mathematic, etc.) is lacking, we must turn to other means to make a case for ammunition requirements associated with acclimatization training. Justification for ammunition can probably only be developed using historical evidence. Even the available historical evidence is limited and not nearly as precise as would be desired.

When making a historical case for acclimatization live fire some of the better evidence can be found in Studies in Social Psychology in World War II, Volume 2. Using attitude surveys, criticisms, and suggestions from combat veterans on the subject of precombat training and the control of fear in combat, the researchers discovered some interesting results. The most frequently mentioned deficiency in combat training was lack of experience with live ammunition and realism. As stated in the study: "The results which we have presented on the responses of combat veterans to questions about deficiencies in their own training indicate that many men, on the basis of their own experience in combat, felt that there was a considerable need for exposure to live ammunition realistic battle conditions in

precombat training." In summary, the use of live ammunition in training (realism training) was proven to be most productive in reducing psychological stress (fear) and preparing soldiers for combat.

The use of live fire and realism training also contributes to the development of confidence by individuals/crews in their weapons system, making them more effective in combat. During World War II many divisions established training sections for training reinforcements (replacements). One of their primary missions was to instill weapon confidence in the individuals and crew. By requiring reinforcements to fire or witness the fire of all division's weapons, the individuals develop confidence and came to the realization that U.S. weapons were superior or equal to those of the enemy. These findings are detailed in Report of the General Board, United States Forces, European Training: Reinforcement System and Reinforcement Procedures in European Theater of Operation.

Exposure to battlefield realism during training enables soldiers to develop a realistic expectation of what combat is like and decreases the probability that fear reactions will interfere with successful performance in combat. Tank crews in World War II were required to fire four service ammunition courses. One of these service ammunition firing was labeled Combat Firing and was designed to recreate realistic combat firing. Tank crews were required to conduct quick accurate shooting to kill an enemy (targets) before the crew was judged to have been killed. Combat experience showed that this course helped develop tankers into more capable and combat effective crews. This firing was based on a factual analysis of the strategy, tactics, and administration employed by the United States Forces in the European Theater.

The products of live fire confidence courses (reduced psychological stress, confidence in one's weapon system, improved combat effectiveness) are just as important to the modern soldier as it was to his father or grandfather. Today, as in the past, ammunition must be provided for battlefield realism. Even as we move to more and more devices for developing technical proficiency, some rounds will be required to provide realism. The questions of the exact number of rounds remains. Realism and ammunition are a "gut" issue. There is no evidence or proof, historical or otherwise, that can be used to establish a set ammunition figure for any weapon system. One weapon system may suffice with one round per battery (Lance) whereas another system may need more rounds. The cost of the ammunition is usually the factor that currently determines the number of rounds that will be fired for acclimatization purposes.

We may not be able to precisely measure the impact of the battlefield and the requirement to live fire, but we know it is

significant. Therefore, we must provide live ammunition to prepare our soldiers for the modern battlefield even if they are fully trained in the skills necessary to operate their weapon. Sometimes sufficient ammunition is fired in crew and individual skill development to satisfy realism and motivation requirements. For other systems, special allocations must be made.

FINAL REPORT
of
FY 86 STRAC EVALUATION
of
DA CIR 350-85-4
STANDARDS IN WEAPONS TRAINING
1 October 1985-30 September 1986

21 January 1987

STANDARDS IN TRAINING COMMISSION (STRAC) PROGRAM DIRECTORATE
U.S. ARMY TRAINING SUPPORT CENTER
FORT EUSTIS, VIRGINIA 23604-5166

XI-C-II-133

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EXECUTIVE SUMMARY
FY 86 STRAC EVALUATION OF STANDARDS
IN
WEAPONS TRAINING
(FINAL REPORT)
15 January 1987

BACKGROUND. The information contained in this Summary is a synopsis of the main report. The reader should consult Appendix A for the detailed report prepared by the proponent school on a specific weapon system.

1. INTRODUCTION. The Department of the Army directed that an evaluation of the programs contained in DA Circular 350-85-4, Standards in Weapons Training, be conducted during FY 86, the first year of implementation of the circular. The DA Circular contains programs for most weapon systems fielded. It provides weapons qualification standards, notional training programs to attain and sustain the standards, ammunition requirements to support the training programs, and devices and simulators to be integrated into the suggested training programs. The STRAC Program Directorate (SPD) at the Army Training Support Center (ATSC), the DA Executive Agent for STRAC, was charged with the conduct of the evaluation.

The development and refinement of the weapons programs contained in the Circular occurred over a 5-year period beginning in 1980 with the establishment of the Weapons Crew Training Study Group (WCTSG) at the ATSC. The group's findings were: that there were no standards across the Army for weapons qualification, that various nonstandard methods were used to determine ammunition requirements, that many fielded devices and simulators were not being integrated into units' training programs, that costs of replacement ammunition and particularly ammunition for new weapons systems were increasing geometrically and, finally, that a credibility gap was growing between what the Army said it needed for training and what it was actually getting. Despite this shortcoming we were reporting a ready Army. This credibility gap is reflected in Figure 1.

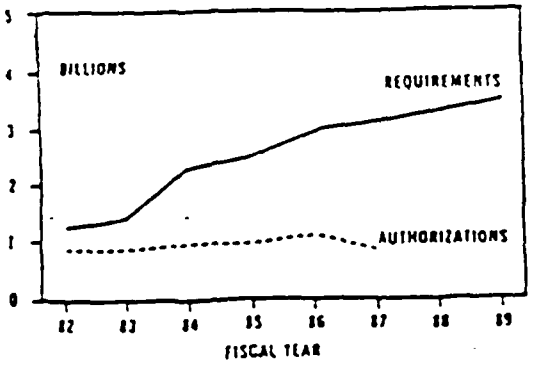


FIGURE 1. TRAINING AMMO REQUIREMENTS AND AUTHORIZATIONS

The SPD was established in 1982 with the mission of developing weapons programs for all weapons systems. The draft programs were fielded in 1983 in DA Cir 350-XX, Standards in Weapons Training, and were evaluated for a period of 9 months by approximately 100 battalions. With minor revisions, the programs were first published in December 1984. Prior to the implementation of STRAC in FY 86, further revisions were made and the circular was republished as DA Cir 350-85-4 in 1985. The training ammunition requirements to support the STRAC programs are shown in Figure 2.

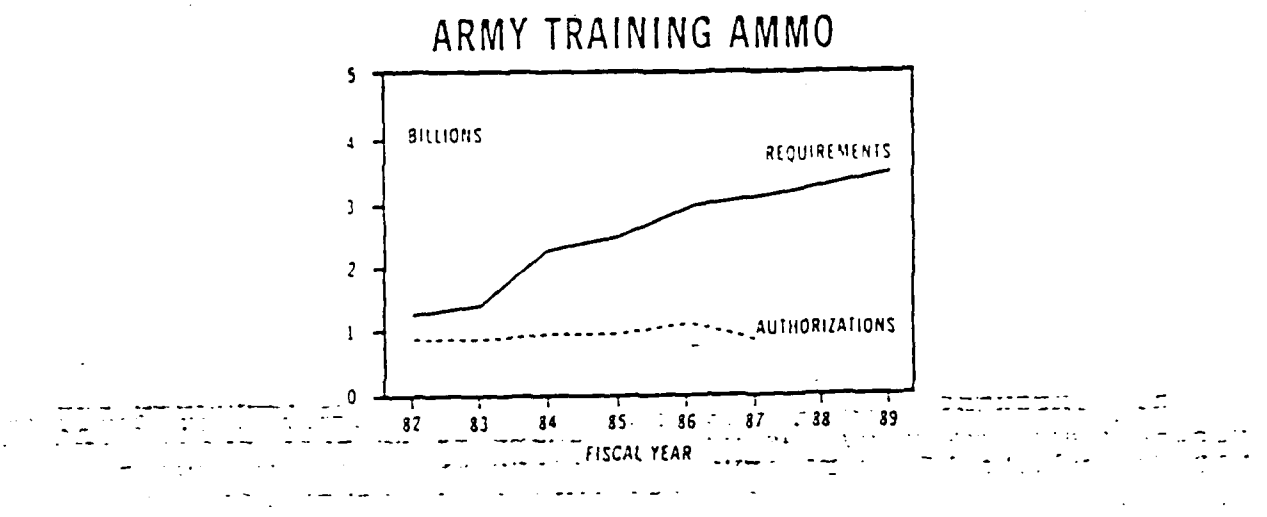


FIGURE 2. STRAC AMMUNITION REQUIREMENTS

The Army Audit Agency (AAA) looked into the management of training ammunition across the Army during the period October 1984-October 1985. They studied the STRAC programs and concluded that while STRAC was a great improvement over prior forecasts, requirements were still overstated based on prior years' expenditures of what had been authorized. (Figure 3).

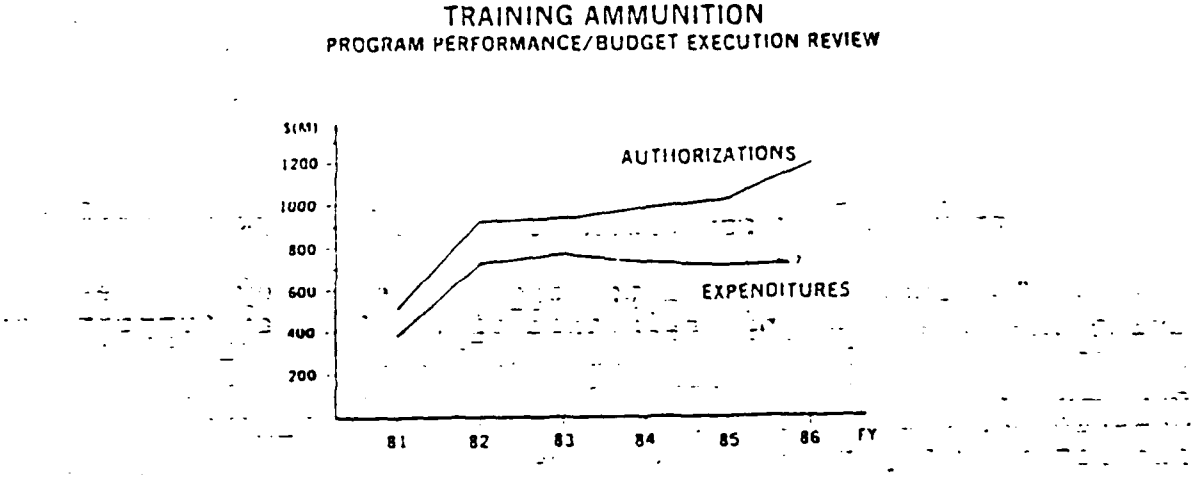


FIGURE 3. EXPENDITURES VS AUTHORIZATIONS

AAA recommended that an evaluation be done of the STRAC programs to assess the new requirements.

2. PURPOSE. The purposes of the FY 86 STRAC evaluation were:

a. To assess weapons standards and to determine if notional training programs lead to attainment and sustainment of the stated standards.

b. To determine if ammunition required under STRAC is of the correct quantities and mix.

c. Finally, to assess fielded training devices and simulators that are part of the programs as to frequency of use, availability, and utility along with the adequacy of the doctrinal literature describing their use.

3. METHODOLOGY. The results of the evaluation will be used by the proponent TRADOC schools (AD, AR, AV, EN, FA and IN) to revise the existing weapons programs where needed in order to republish the programs in a DA Pamphlet in July 1987.

a. Throughout the design of the evaluation, emphasis was placed upon improving the survey conducted in 1983-1984. The MACOMs and the NGB were involved in the selection of units, scheduling of interviews and the evaluation education visits.

b. A representative sample of over 450 battalions was selected for the evaluation from the MACOMs, across the TRCs, and represented both the AC and RC. Approximately 80 percent of the units were selected to participate in quarterly surveys, while the remainder were selected to participate in semiannual visits to take place in the 2nd and 4th quarters of FY 86. A breakdown by MACOM, NG, and USAR is shown in Figure 4.

MACOM DISTRIBUTION

(SURVEY/UNIT VISIT)

FORSCOM	USAR	NG	USAREUR	WESTCOM	EUSA
93/33	30/4	141/26	75/23	5/1	13/6

FIGURE 4. MACOM DISTRIBUTION (SURVEY/UNIT VISIT)

c. The instrument used to conduct the survey was designed using the expertise and assistance of the Soldier Support Center, National Capitol Region Attitude and Opinion Survey Division, the Army Research Institute and the Army Training Board. A questionnaire and accompanying mark sense form were designed to facilitate data processing and analysis.

d. In an attempt to obtain the maximum response to the survey, visits were made to over 50 locations to brief

participating units. Survey packets were mailed directly to the units with either a return envelope for the mark sense form or instructions that the mark sense form would be picked up by the interviewer at the visited units. For the 1st quarter, 71 percent of the 357 surveyed battalions responded. This percentage dropped to 62 percent in the 2nd quarter. Eighty-seven percent of the visited units provided a mark sense form. The proponent schools were provided the input from the 2nd quarter, both survey and visit data (67 percent of 450 units), to prepare their input for an interim report which was published in July 1986.

In an attempt to improve response percentages for the remaining two quarters, survey packets were processed through the MACOM STRAC points of contact. The NG units were processed in the same manner as was used for the first two quarters.

As a result of the changed procedure, responses for the last two quarters improved with 80 percent responding the 3rd Quarter and 84 percent the final quarter. Overall, an acceptable number of responses were received on each weapon system.

e. Throughout the course of the survey, HQDA provided SPD with ammunition usage data by the MACOMs and NGB. This data was used during the unit visits to gain an insight on usage in the field.

4. FINDINGS.

a. Air Defense Artillery. The standards and strategies for most Air Defense weapon systems are attainable and executable. Redeye and Stinger units will not be able to meet STRAC standards until the Stinger Training Launch Simulator (STLS) is fielded in FY 88. Several Vulcan units were unable to meet standards due to a lack of ranges. Army National Guard units have problems acquiring M49 Tracking Head Trainers (THT) for Redeye training and some states do not have a Moving Target Simulator (MTS) facility for ARNG Redeye units. None of the Vulcan units surveyed indicated an overage or shortage of available ammunition; however, Vulcan units have historically expended less ammunition than authorized.

b. Armor. Armywide, surveyed and visited units were meeting STRAC standards for Armor weapon systems less than 60 percent of the time. Personnel turbulence was listed by Active Component (AC) units as the primary reason for not meeting the standards, while Reserve Component (RC) units listed both lack of time and lack of adequate training facilities for not meeting standards. Most Armor units were satisfied with the availability, training strategies and ammunition resourcing for Armor training devices, although several RC units had difficulty in obtaining various devices. Large amounts of blank ammunition were not utilized during FY 86.

c. Aviation. Armywide, very few Aviation units met STRAC standards. A lack of ammunition, a shortage of ranges/training areas and a lack of time were most often cited as reasons why units failed to meet published standards. Only 18 percent of the evaluated units reported receiving their STRAC authorization during FY 86. Although many units did not meet STRAC standards, most indicated that they were achievable. Units also supported the current training strategies, with most being satisfied with the current number of live-fire exercises, system training devices, training device literature and the recommended frequency of use of these devices. There was also general dissatisfaction with the status of aerial gunnery ranges throughout the Army. While most units did not receive their complete STRAC ammunition authorization, most considered it about right. Units also noted that STRAC does not articulate 2.75 inch rocket requirements by type and quantity.

d. Engineer. Armywide, units met STRAC standards for Engineer weapons systems approximately 30 percent of the time. Data indicated that the lack of ammunition, lack of time and lack of range facilities are the most significant reasons for failing to achieve standards. Less than half of the units felt that the evaluated standards were achievable. The majority of the units indicated the number of live-fire exercises are acceptable. Overall availability of training devices and simulators was satisfactory and units were satisfied with the effectiveness of the devices. The exceptions were some USAR units.

e. Field Artillery. The evaluation looked at the performance of Army Howitzers and the MLRS. The vast majority of the participating units reported accomplishing their STRAC standards. A lack of ammunition and a shortage of ranges and training facilities were most often indicated as reasons why units were unable to meet standards. Surveyed and visited units generally rated STRAC standards as attainable in their current configuration. Most units considered the notional training programs or strategies as satisfactory and noted their support for the number of recommended live-fire exercises. Training device effectiveness and availability were rated as satisfactory; however, there was unanimous agreement that the M31 14.5mm training device performed poorly. Participants rated the recommended frequency of use of training devices and the effectiveness of the associated training literature as about right. Most rated their annual authorization of ammunition as about right with the exception of the 14.5mm supporting the M31 which was rated high.

f. Infantry. Armywide, less than half of the surveyed units met the STRAC standards for infantry weapon systems. While critical inhibiting factors varied between MACOMs, the predominate reasons given were inadequate ranges, insufficient ammunition and time constraints. Night firing requirements appear to be the common problem for all MACOMs in attaining qualification standards for small arms weapons.

g. Ranges. The most prevalent reason given by units for not attaining standards was lack of range facilities. A particular problem was the lack of facilities to accomplish the newly introduced night fire requirement in many of the standards. The Army now is beginning to see the results of the efforts of the Directorate of Army Ranges and Targets begun in 1982 when that Directorate was formed at ATSC and designated the DA Executive Agent for the Army Range Program. Many of the ranges begun some years ago are coming on line as shown in Figures 5 and 6.

RANGE MODERNIZATION PROGRAM
PROGRESS UPDATE
1985

TYPE OF RANGE	OPERATIONAL
Marksmanship	1
MPRC	1

1986

TYPE OF RANGE	OPERATIONAL	TARGET INSTALLATION ONGOING	UNDER CONSTRUCTION
MARKSMANSHIP	11	2	12
MPRC	0	1	6
MPTR	3	0	4
MOUT	1	0	2
OTHER	2	0	3

FIGURE 5. 1985 - 1986 RANGE CONSTRUCTION

RANGE MODERNIZATION PROGRAM
PROJECTION FY 87 - 89

	TYPES OF RANGES				
FISCAL YEAR	MARKSMANSHIP	MPRC	MPTR	MOUT	OTHER
87	4	1	2	1	3
88	6	2	11	2	5
89	17	1	7	2	8
TOTAL	27	4	20	5	16

FIGURE 6. 1987 - 1989 RANGE CONSTRUCTION

The Army National Guard has numerous on going projects for range construction in addition to those identified in the DA Master Range Plan.

h. Training Ammunition. After ranges, lack of training ammunition was given by many units for not attaining standards. For FY 86, the MACOMs returned $300 million of conventional ammunition (less missiles) to HQDA for nonusage. While STRAC requirements were slightly higher than previous years' authorizations, turn back by the MACOMs for nonusage remained at

previous years' levels, $250 to $300 million. Some of the factors that preclude usage are: lot suspensions, weather (dry conditions creating fire hazards, snow, rain and fog), nonavailability of ranges as discussed above, ammo distribution, ranges not efficiently utilized to attain maximum thru-put, and too many sustainment exercises in the notional programs. The AAA in its 1984-85 audit of training ammunition stated that while STRAC had done a good job in identifying more realistic training ammunition requirements, further adjustments should be made if the usage in FY 86 followed the historical trend.

5. CONCLUSIONS.

a. Air Defense Artillery. The majority of surveyed SHORAD units met STRAC standards. The Redeye and Stinger gunners cannot meet standards until field units receive the STLS and STLS eject missiles. Army National Guard units have severe equipment (M49 THT) and facility (MTS) limitations precluding Redeye gunners from meeting STRAC standards. This requires many units to fund additional travel to the nearest MTS facility. The range problem, several Vulcan units reported, is due to the range fan not being wide enough to accommodate aerial engagements. The current 5-year range program does not include a range fan expansion for Vulcan aerial gunnery. The historical usage coupled with range problems indicated Vulcan units cannot fire all the ammunition authorized for their units. These factors imply that a reduction in Vulcan training ammunition should be considered. The phase out of RCATS will leave ARNG Duster units without targets for aerial gunnery.

b. Armor. Despite the fact that most units did not meet the STRAC standards, most units felt that standards were achievable but that detractors, such as turbulence, should be "fixed". Units are generally not executing the current three-density program. The 34-round reduction in main gun ammunition caused by the UCOFT fielding precluded adequate distribution of ammunition into a three-density program. National Guard main gun ammunition turn-ins seem to indicate that the program may be over resourced. Telfare ammunition turn-in data indicated many units are not using this device. The increasing popularity of Tactical Tables will significantly reduce the large quantities of blanks turned-in. Use of the red phosphorus smoke grenade is a significant problem due to the environmental/fire hazard.

c. Aviation. Units consider the requirements for 2.75 rockets and other ammo lines as stated in the Circular as adequate; however, HQDA resourced only 65 percent of the Army requirement for 2.75 inch rockets. While the authorizations of the remaining Aviation munitions were significantly closer to STRAC levels, the lack of 2.75 inch rockets made it extremely difficult for many units to meet established standards. Lot suspensions of TOW and the "newness" of DA Cir 350-85-4 exacerbated the problem. Likewise, a lack of suitable ranges

and training areas made it impossible for many units to attain STRAC standards and effectively train. Ongoing training device and range modernization efforts will improve aviation gunnery ranges.

d. Engineer. While more than half of the units responded that the Engineer standards are not achievable, it should be noted that the U.S. Army Engineer School has completely revised their STRAC standards. The shortage of ammunition experienced by 38 percent of the surveyed units conflicts with DA ammunition usage reports which identifies the fact that ammunition supporting these systems was turned in during the last quarter of FY 86, thus pointing to a possible distribution and management problem. Several USAR units identified lack of time as the reason for not attaining standards while units in WESTCOM, EUSA, USAREUR and NGB experienced range accessibility problems. Overall, the effectiveness and availability of training devices and simulators are satisfactory with the exception of some USAR units, which are experiencing availability problems with devices at their local TASC.

e. Field Artillery. Of the reasons most cited for failing to meet prescribed standards, a lack of ammunition was most often indicated. For FY 86, however, HQDA resourced Field Artillery at 100 percent of STRAC requirements. Thus, a lack of ammunition at the unit level can be traced to ammunition management and distribution problems. The lack of ranges and training facilities, can be traced to RC unit inability to complete their requirements prior to annual training. Their reliance on this short period of time to complete unit training programs at congested RC training installations may account for this shortfall. Although training devices were available and effective, a significant number of units rated the M31, (14.5mm trainer) as ineffective because of its overall poor performance.

f. Infantry. Night qualification was identified as one of the chief inhibiters for obtaining standards; however, surveyed units continued to support this requirement with the exception of the .38 and .45 Cal pistols. Range modernization projects over the next few years will help to offset the existing range limitations and will increase thru-put of units. The survey data also provided an indication of potential problems in the management/flow of ammunition to the user that will require further investigation. The surveyed units supported the majority of the standards; however, resourcing of strategies needs to be more realistically aligned with what can actually be accomplished given the time constraints of the units.

g. Ranges. As was discussed in the previous paragraph, the Army recognized the existing shortcomings in its ranges and formed the DART Directorate at ATSC to correct existing deficiencies. The results of the DART's efforts are just beginning to influence units' abilities to accomplish the STRAC

standards. The STRAC Evaluation planned for FY 88 should provide a good indication of how well the Army is progressing.

Additionally, the DART Directorate is doing assessments of Local Training Areas (LTA) in the MACOMs and has identified additional construction needs in the LTAs to accomplish STRAC requirements.

On going efforts by the NGB to upgrade ranges in the United States will also assist in alleviating the range shortage problem.

h. Training Ammunition. The survey data indicating non-attainment of standard due to ammunition shortages is not supported by the large MACOM returns on unused ammo to HQDA. If the survey results are true, then there are considerable problems existing in the management and distribution of training ammunition. In the discussion in the preceding paragraph, factors were identified that contribute to nonusage. The extent to which each factor affects nonusage has not been measured in the past and needs to be captured in the future.

6. RECOMMENDATIONS.

a. Air Defense Artillery. The current standard for each Redeye and Stinger gunner to fire two STLS eject missiles should remain the same. The shortage of M49 THTs and MTSs for ARNG units must be surfaced through NGB channels. A reduction in the Vulcan notional LFX tables for the senior gunner and unqualified gunner(s) needs to be examined. The range fan problem for two surveyed Vulcan units does not have an immediate solution. An alternate training device must be developed for duster units since RCATS are being phased out.

b. Armor. Current Armor standards should be revised, with primary consideration paid to the "personnel turbulence" aspect of the standard. The current three-density program should be changed to a two-density program, although TRC A units should conduct three-densities if resources permit. The strategy for TRC C should be reviewed to develop a more efficient use of main gun ammunition. The effect of the UCOFT/MCOFT should be written into the STRAC revision. A training round is needed to replace the red phosphorus grenade.

c. Aviation. Units supported Aviation standards, training strategies, training devices and training literature. While executable, the lack of ammunition in FY 86 made it extremely difficult to evaluate the current standards. Action should be taken to resource Aviation units to STRAC levels until a follow-on evaluation is done. DA Cir 350-85-4 should be changed to reflect the types and quantities of 2.75 inch rockets required. Action should also be taken to survey aerial gunnery ranges throughout the Army to determine facility shortfalls and develop a strategy leading to the construction of sufficiently instrumented and designed ranges and training areas.

d. Engineer. Since all the Engineer programs are essentially new, an evaluation needs to be conducted once implementated in FY 88. Procedures for distribution of ammunition should be evaluated to ensure STRAC allocations are available to units.

e. Field Artillery. Field Artillery unit success in attaining STRAC standards and implementing training strategies has validated their value and achievability. Although fielded for quite some time, the M31 is not supported. As a result, its effectiveness should be reevaluated and a decision made to maintain it or replace it with another suitable device. In the interim, its use should be reviewed to determine how often it should be used by crews, FDC and FIST personnel. Likewise, current ammunition authorizations should be adjusted to accommodate the device's reduced use.

f. Infantry. It is recommended that small arms requirements be reduced, with a buffer zone established above FY 86 expenditures. Continue to support night qualification standards with the exception of the pistol, which should be dropped. Examine the weapons training strategies to determine what is reasonably executable.

g. Ranges. Range assessments by DART Teams in LTAs need to continue. Since it would be impracticable for DART to do an assessment of every local LTA, consideration should be given to training MACOM teams to conduct local assessments in the same professional manner as is being done by the DART teams.

h. Training Ammunition. The FY 88 STRAC Evaluation needs to focus more on distribution and usage of training ammunition. Prior to the FY 88 evaluation, a team headed up by HQDA and supported by SPD should look into the management and distribution of training ammunition. HQDA and the MACOMs need to capture lack of usage due to weather and lot suspensions. Continuing range assessments are needed to identify deficiencies. Small arms and machine gun sustainment programs need to be reduced from the present optimum levels. Other ammo lines need to be examined on a case by case basis to compare FY 86 and historical expenditures for further refinements. Any adjustments made must provide a reasonable buffer to allow execution as the deficiencies cited are rectified.

Chapter I. - Origin of the Standards in Weapons Training Programs.

GENERAL. This chapter outlines the Standards in Training Commission (STRAC) efforts from its inception, beginning with the work of the Weapons Crew Training Study Group, and progressing to the publication of Department of the Army (DA) Cir 350-85-4, Standards in Weapons Training.

1. WEAPONS CREW TRAINING STUDY.

a. In early 1980, a Weapons Crew Training Study Group (WCTSG) was formed at the Army Training Support Center (ATSC) to examine how US forces and some of our NATO allies and Warsaw Pact forces conduct weapons training. Their findings disclosed that the U.S. Army's training programs are ammunition-based with a minimal use of devices as contrasted with our allies who use less ammunition and place more reliance on devices. For example, the number of tank rounds expended in training varies from as low as 6 for the USSR to 134 for US forces. (Figure 7)

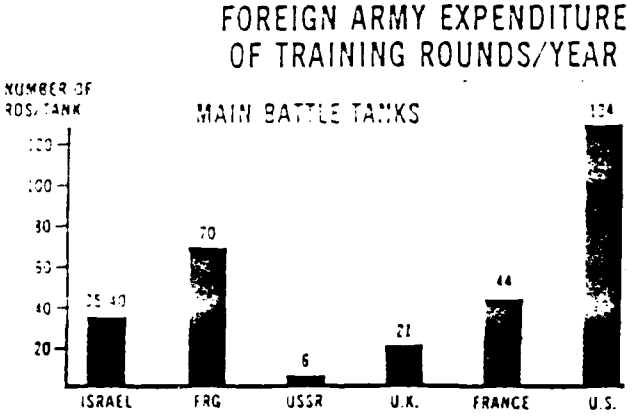


FIGURE 7. FOREIGN VS U.S. ARMY TANK ROUNDS EXPENDED IN TRAINING

b. The study group found that there was no standard methodology employed in the U.S. Army for determining yearly training ammunition requirements. Additionally, there were no weapons standards across the U.S. Army against which units could measure relative readiness. The costs of training ammunition were escalating geometrically and stockpiles remaining from previous conflicts were almost exhausted. An example of the increasing cost of rifle training ammunition is at Figure 8.

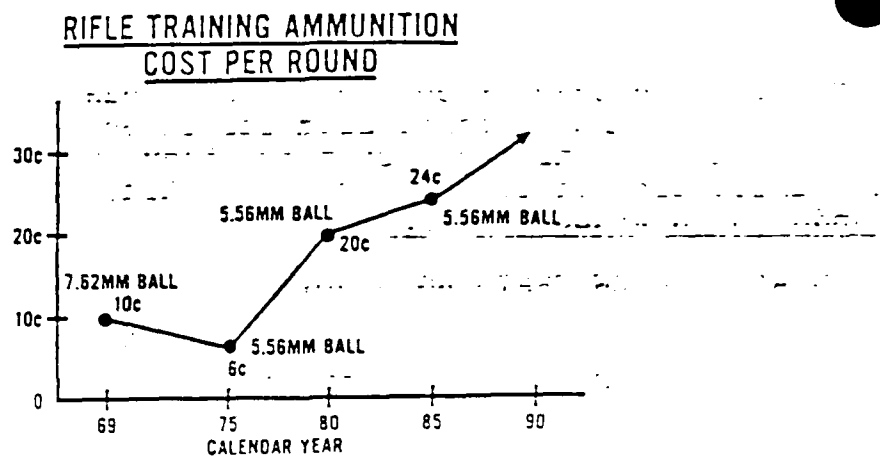


FIGURE 8. RIFLE TRAINING AMMO COSTS

c. The escalating cost of ammunition was occurring across all systems. Simultaneously, force modernization of our weapons systems was taking place. The new systems fire ammunition of greater lethality and range and have an associated cost increase. Examples of the average cost of training ammunition c three systems and their replacements are shown in Figure 9.

AMMUNITION COST COMPARISION

SYSTEM	CURRENT	FUTURE
APC/BFV MAIN ARMAMENT	M113.50 CAL ($1.37)	M2 25MM ($17.97)
TANK	M60 105MM ($227.90)	M1A1 120MM ($924.56)
MANPADS	REDEYE ($25.1K)	STINGER ($36.1K)

AMMUNITION COST FIGURES AS OF 29/OCT/85

FIGURE 9. TRAINING AMMO COST COMPARISON

d. The net effect of the escalating costs and force modernization was an unsupportable training ammunition bill sh at Figure 10.

XI-C-II-150

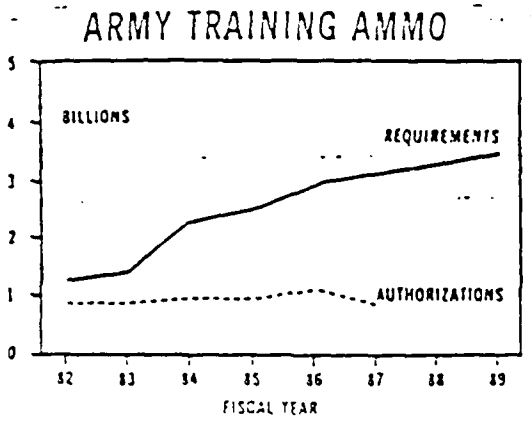


FIGURE 10. TOTAL TRAINING AMMO FORECAST

e. The Army was also facing a credibility problem with its stated requirements versus what was actually being authorized. The field was requesting almost twice as much ammunition as it was receiving. Despite these shortages, we were reporting a ready Army. As will be shown later, a substantial portion of that which was authorized was not used. Additional facts that surfaced showed that the increased ranges of the new weapons systems were taxing the available ranges, particularly in Europe. Requirements also were surfacing for limited range training ammo that would allow live firing.

2. STRAC ESTABLISHED.

a. Following the WCTSG study efforts and report, the Standards in Training Commission (STRAC) Program Directorate (SPD) was formed in 1982 as part of the Army Training Support Center (ATSC) and was appointed the DA Executive Agent for STRAC. Personnel that filled SPD came from the WCTSG. Their missions were to:

(1) Develop standards for all weapons systems in the Army for both the Active and Reserve Components.

(2) Develop notional training programs that would lead to the attainment and sustainment of the standards.

(3) Integrate existing devices and simulators into the training programs.

(4) Determine the ammunition required to support the notional training programs.

b. The three committees that were formed to oversee the development of the STRAC programs are shown in Figure 11.

STRAC ORGANIZATION

COMMITTEE	CHAIRMAN
EXECUTIVE	DA, DCSOPS
STEERING	DA, DCSOPS TRAINING
WEAPONS	CMDT/ASST CMDT

FIGURE 11. STRAC ORGANIZATION

The Executive Committee, consisting of general officers from the DA Staff, MACOMs, National Guard Bureau (NGB), Office of the Chief Army Reserve (OCAR), Training and Doctrine Command (TRADOC), and the Commandants of the six proponent schools provided the overall policy direction. The Steering Committee, composed of representatives from Forces Command (FORSCOM), U.S. Army, Europe (USAREUR), TRADOC, NGB, and OCAR provided guidance and approved the developed programs.

A Weapons Committee's composition is shown in Figure 12.

WEAPONS COMMITTEE

SCHOOL COMMANDANT OR ASSISTANT COMMANDANT

MACOM REPRESENTATION

ARMY NATIONAL GUARD

UNITED STATES ARMY RESERVE

SCHOOL REPRESENTATION

FIGURE 12. WEAPONS COMMITTEE

The Weapons Committee has the responsibility of developing the specific weapons programs. Representatives from the field are a part of each committee and ensure existing field conditions are incorporated into the programs.

c. The Weapons Committees proceeded to develop programs for each weapons system using current doctrine. Standards were developed for each weapon system along with a training program that, when executed, would lead to the attainment and sustainment of the standards. Ammunition requirements to support the training programs were determined. Devices and simulators were also integrated into the program. Training Readiness Conditions (TRC) were developed to recognize the

onstrained training time available to the National Guard (NG) and the U.S. Army Reserve (USAR) units. The methodology followed is summarized in Figure 13.

METHODOLOGY

Review ARTEP/FM/SM/FC Tasks

Determine tasks for each firing level

Integrate input from field considering

- Current live-fire programs
- Frequency of firing to attain/sustain standard

Integrate training devices

Determine ammunition requirements

Establish training requirements for each training readiness condition

FIGURE 13. METHODOLOGY

3. DRAFT DA CIR 350-XX FIELDED. The first version of the STRAC Circular, DA Cir 350-XX, was fielded in 1983 and was tested in approximately 100 units. The test included both monthly surveys and unit visits. Shortcomings of the survey included: Inadequate sample size, poor response from field, no Major Command (MACOM) or NGB involvement in the survey, manual processing of the returned data and, finally, termination of the survey after only 9 months of the 1 year it was scheduled to last.

4. DA CIR 350-84-2, STANDARDS IN WEAPONS TRAINING, FIELDED.

a. Based on the limited data obtained from the survey, along with additional field input, minor modifications were made to the programs contained in DA Cir 350-XX and it was published in December 1984 as DA Cir 350-84-2.

b. Following distribution, an extensive education of the field was undertaken by a team headed by the MACOM's, STRAC Program Directorate and representatives from the six proponent schools. In addition, a television tape (TVT) was prepared and distributed to the field explaining the contents of the program. Separate versions were prepared for the Active Component (AC) and Reserve Component (RC).

5. DA CIR 350-85-4, STANDARDS IN WEAPONS TRAINING, FIELDED.

a. Following fielding of the 1984 version of the Circular and prior to implementation at the start of FY 86, three major changes were made to the 1984 published programs.

(1) Weapons training programs for the USAR Training Divisions were developed and added.

(2) The RC Armor training programs were revised to allow weapons qualification and maneuver training on alternate years.

(3) Lastly, additional artillery missions were added to the 105mm program for the 82nd, 101st and Light Infantry Divisions (LID) for their inherent close support missions. These, coupled with some minor revisions, resulted in DA Cir 350-85-4 which was fielded in September 1985.

6. AAA REPORT ON AMMUNITION MANAGEMENT.

a. During October 1984-October 1985, the Army Audit Agency (AAA) conducted an audit of training ammunition management in the Army. While it acknowledged that the STRAC methodology provided a more realistic statement of the requirements (Figure 14), it felt that they were still excessive, particularly in the small arms areas.

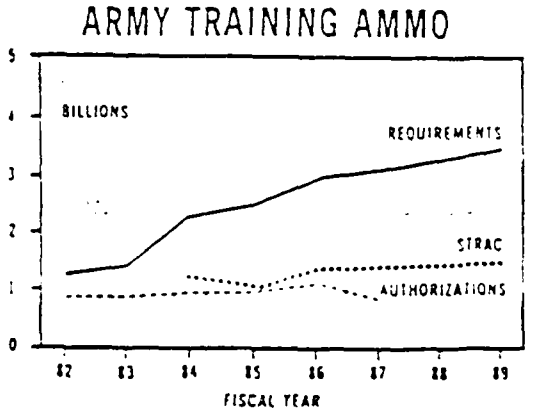


FIGURE 14. ARMY TRAINING AMMO AUTHORIZATIONS

b. AAA cited past usage in supporting its allegations. (Figure 15)

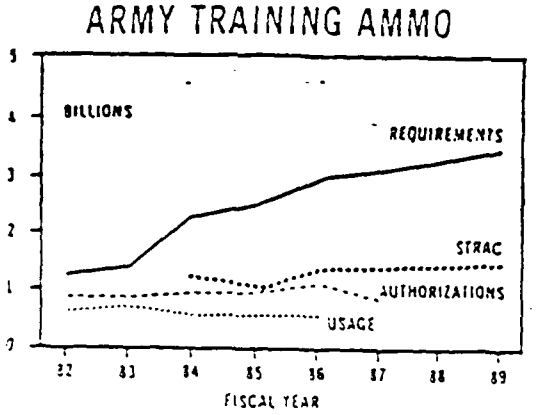


FIGURE 15. ARMY TRAINING AMMO USAGE

c. Excerpts from the AAA report are cited below:

"Ammunition requirements, estimated at about $1 billion annually, developed by STRAC are a significant improvement over prior estimates."

"For FY 85, requirements without consideration of the new training strategies totaled about $2.8 billion. Based on the new training strategies, total requirements dropped to $1.3 billion."

"Requirements developed by STRAC were a significant improvement over those previously developed. The commission significantly reduced overall requirements, but the new requirements were excessive compared to historical expenditures."

The AAA recommended that an evaluation of STRAC be conducted to ensure that authorizations were realistic.

d. DA subsequently directed an evaluation of the STRAC program during FY 86, the first year of STRAC implementation by the total Army. The STRAC Program Directorate, Army Training Support Center was designated as the evaluation agency. A Vice Chief of Staff of the Army (VCSA) message to the MACOM's on the STRAC evaluation is summarized below:

During FY 86 STRAC is being evaluated Armywide to validate the STRAC training strategies and requirements.

Results of STRAC evaluation will be used to refine STRAC training strategies and requirements.

Future authorizations will be based on the revised requirements.

This evaluation, where appropriate, must be supported by commanders from company through MACOM.

e. Impact of Problem. In order to justify its training ammunition requirements, the Army must link ammunition authorizations to measurable standards which must be linked to readiness. Failure to do so will result in further cuts in training dollars, as occurred in the ammo line in 1984, to support force modernization. (Figure 16)

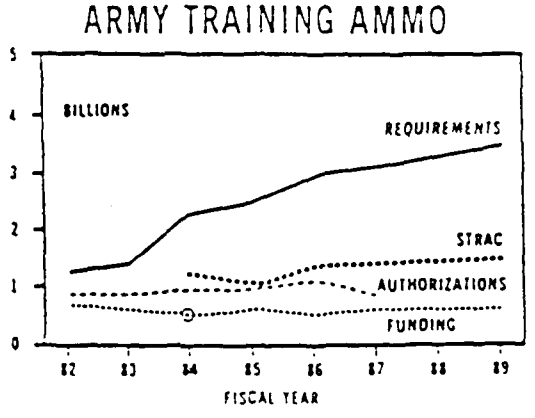


FIGURE 16. ARMY TRAINING AMMO - FUNDING

7. SUMMARY. The development and fielding of the weapons programs in the DA Circular occured over 5 years with many different players participating. A partial evaluation was conducted from 1983-1984 and additional refinements were made. Some of the misunderstandings of what STRAC is and is not are being corrected. STRAC does not prescribe training programs for every unit, yet it does prescribe common standards for all weapon systems across the Army. STRAC's mission is not to reduce training ammunition but rather to determine the quantity of ammunition that, when integrated with devices and simulators, will allow units to both attain and sustain proficiency standards. The ammunition prescribed supports the notional training programs; however, the commander can use that ammunition as he sees fit based on his analysis of the strengths and weaknesses of his unit. As outlined in the AAA audit, there may still be too much training ammunition in the weapons' programs. The purpose of the FY 86 STRAC Evaluation was to determine what adjustments need to be made in the programs contained in the STRAC Circular so as to ensure that we can in fact put "steel-on-target" when called on to do so.

Chapter II. - Responses to the Survey.

GENERAL. This chapter contains MACOM and NGB performance in responding to the 3rd and 4th Quarter written surveys along with the results of the returns from the 2nd unit visits. A complete description of the evaluation study can be found in ANNEX B along with survey response performance for the 1st and 2nd Quarters and the 1st unit visit.

Section A: Survey Responses

1. RESULTS OF SURVEY RETURNS - 3RD QUARTER. Performance on returns for the 3rd Quarter by MACOM and by Branch are summarized in Tables 1 and 2.

TABLE 1: 3RD QUARTER RETURNS BY COMMAND

MACOM	NUMBER SURVEYED	NUMBER AND PERCENT RESPONDING	
USAREUR	76	58	76%
FORSCOM	92	76	82%
EUSA	13	9	69%
WESTCOM	5	2	40%
NG	140	114	81%
USAR	30	28	93%
TOTAL	356	287	80%

TABLE 2: 3RD QUARTER RETURNS BY BRANCH

BRANCH	NUMBER SURVEYED	NUMBER AND PERCENT RESPONDING	
ADA	27	21	77%
AR	38	33	86%
AV	20	13	65%
CAV	20	15	75%
EN	55	48	87%
FA	87	74	85%
IN	74	58	78%
OTHERS	35	25	71%
TOTAL	356	287	80%

The printouts developed from the survey were provided to proponent TRADOC schools to develop Essential Elements of Information (EEI) for their second unit visit and to begin the revision process based on the 3rd Quarter returns. The revised programs would then be modified as necessary based on the final returns.

2. RESULTS OF SURVEY RETURNS - 4TH QUARTER. Performance on returns for the 4th Quarter by MACOM and Branch are summarized in Tables 3 and 4.

TABLE 3: 4TH QUARTER RETURNS BY COMMAND

MACOM	NUMBER SURVEYED	NUMBER AND PERCENT RESPONDING	
USAREUR	76	60	78%
FORSCOM	92	79	85%
EUSA	13	12	92%
WESTCOM	5	3	60%
NG	140	119	85%
USAR	30	26	86%
TOTAL	356	299	83%

TABLE 4: 4TH QUARTER RETURNS BY BRANCH

BRANCH	NUMBER SURVEYED	NUMBER AND PERCENT RESPONDING	
ADA	27	22	81%
AR	38	30	78%
AV	20	15	75%
CAV	20	15	75%
EN	55	53	96%
FA	87	72	82%
IN	74	61	82%
OTHERS	35	31	88%
TOTAL	356	299	83%

Extraordinary measures were taken to ensure a good return for the last survey. MACOMs were provided with a unit listing of those battalions who had been delinquent in the past. MACOM STRAC representatives contacted many of the units to remind them of the importance of the final quarter survey.

3. RESULTS OF SURVEY RETURNS - 2ND VISIT. The second of the the two visits to 92 battalions was conducted during the period Aug-Oct 86. Visited units were asked to hold their mark sense response forms and provide them to the interviewer at the time of the visit. Those units who had failed to complete their forms by the time of the visit were asked to mail them to SPD. Performance on the returns from the units for the second visit by MACOM and Branch are summarized in Tables 5 and 6.

TABLE 5: 2ND VISIT RETURNS BY MACOM

MACOM	NUMBER VISITED	NUMBER AND PERCENT RESPONDING	
USAREUR	22	19	86%
FORSCOM	33	30	90%
EUSA	6	4	66%
WESTCOM	0	0	0%
NG	27	25	92%
USAR	4	3	75%
TOTAL	92	81	88%

TABLE 6: 2ND VISIT RETURNS BY BRANCH

BRANCH	NUMBER SURVEYED	NUMBER AND PERCENT RESPONDING	
ADA	6	4	66%
AR	17	16	94%
AV	4	4	100%
CAV	3	3	100%
EN	13	12	92%
FA	20	20	100%
IN	23	17	73%
OTHERS	6	5	83%
TOTAL	92	81	88%

4. RESULTS OF 4TH QUARTER SURVEY PLUS 2ND UNIT VISITS. A rollup of the performance by units for the 4th Quarter survey plus 2nd unit visit is summarized in Tables 7 and 8 by MACOM and Branch.

TABLE 7: 4TH QUARTER + 2ND VISIT RETURNS BY MACOM

MACOM	NUMBER	NUMBER AND PERCENT RESPONDING	
USAREUR	98	79	80%
FORSCOM	125	109	87%
EUSA	19	16	84%
WESTCOM	5	3	60%
NG	167	144	86%
USAR	34	29	85%
TOTAL	448	380	84%

TABLE 8: 4TH QUARTER + 2ND VISIT RETURNS BY BRANCH

BRANCH	NUMBER SURVEYED	NUMBER AND PERCENT RESPONDING	
ADA	33	26	78%
AR	55	46	83%
AV	24	19	79%
CAV	23	18	78%
EN	68	65	95%
FA	107	92	85%
IN	97	78	80%
OTHERS	41	36	87%
TOTAL	448	380	84%

Section B: Summary

Throughout the design of this FY 86 STRAC Evaluation, emphasis was placed on improvment of the 1983-84 survey. The MACOMs and the NGB were involved throughout the evaluation in unit selection, the education visits and interview scheduling. They assisted in emphasizing the importance to units to submit their surveys in a timely manner. Particular emphasis was placed on completing the 4th quarter responses as most weapons system standards are tied to the 12 month period and the 4th quarter results would be very important for our analysis. Midway through the evaluation, we altered our return procedure and had the units submit their responses through their MACOM to SPD. However, the NG units continued with the original procedure as we were experiencing few problems in getting their cooperation. The high percentage of responses obtained for the final quarter was excellent and provided the necessary sampling for final analysis.

Chapter III. - Findings.

General. The six TRADOC proponent schools were provided the results and comments generated with the data collected from the field. Using that data, they developed separate reports for each individual weapon system which are contained in Annexes A thru AL in Appendix A. As part of each individual weapon report, there are graphs depicting attainment of standards, delineated by TRC and by MACOM, and the reasons for not attaining STRAC standards Armywide. There are, additionally, charts portraying reasons for not attaining the STRAC standards by MACOM, NGB and USAR. This chapter, as do the next two, contains a more general discussion on the proponent weapons systems. The annexes should be consulted regarding the details of each system. This chapter and the following chapters, also contain a discussion on ammunition and ranges.

Section A: Overall Performance

1. Table 9 provides a quick look at the overall attainment of the standards for each weapon system across the Army. Tables 10 thru 15 provide the detailed information for MACOMs, NG and USAR units. Also shown are the major reasons for not attaining the standard. The reasons for not attaining standards are an aggregate and include all TRCs. NOTE. In some instances, total percent may not add to 100%. Variances by TRC and MACOM can be found in the individual weapon annexes.

TABLE 9: 4TH QTR OVERALL PERFORMANCE - ARMY

WEAPON SYS	ARMY % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	40	37	23	14	22	1
45 CAL PISTOL	38	34	33	11	18	1
M249 SAW	15	3	24	0	0	72
M203 GL	38	32	37	13	16	1
38 CAL REV	29	37	34	18	11	0
M60D MG	36	38	28	10	17	0
MK19 40MM MG	0	25	50	0	0	25
HAND GRENADE	23	21	45	9	22	3
M3A1 SMG	45	20	50	11	17	3
BFV	29	50	13	25	13	0
CFV	42	43	29	21	0	7
M901 TOW	40	29	29	11	20	9
GND TOW	56	33	31	15	18	3
M47 DRAGON	31	20	26	19	16	17
M72 LAW	24	24	46	6	15	8
90MM RR	18	37	40	6	9	6
MORTARS	62	21	34	24	18	0
M60 MG	38	36	30	13	17	2
M2 HB .50 CAL	33	42	31	9	15	1

TABLE 9: 4TH QTR OVERALL PERFORMANCE - ARMY (CONT.)

WEAPON SYS	ARMY % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M1 TANK	27	18	24	35	12	0
M60A3 TANK	33	44	0	25	25	6
M60A1/M48A5	42	34	7	21	38	0
105MM HOW	69	44	22	22	11	0
155MM HOW	78	18	71	0	6	6
8" HOW	96	0	0	50	0	50
MLRS	80	100	0	0	0	0
REDEYE	45	31	24	14	0	24
HAWK	100	0	0	0	0	0
STINGER	29	34	37	7	0	20
VULCAN	77	50	0	0	0	0
DUSTER	100	0	0	0	0	0
CHAPARRAL	83	0	33	67	0	0
CEV	46	27	36	18	0	18
AP MINES	19	16	38	10	26	8
AT MINES	15	14	34	9	32	9
M18 CLAYMORE	26	19	35	9	29	7
DEMOLITIONS	33	21	38	11	25	3
AH-1	29	37	42	11	0	5

TABLE 10: 4TH QTR OVERALL PERFORMANCE - USAREUR

WEAPON SYS	USAREUR % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	35	46	28	11	13	1
45 CAL PISTOL	39	41	25	18	16	0
M249 SAW	0	0	50	0	0	50
M203 GL	29	38	36	13	8	1
38 CAL REV	22	55	18	18	9	0
M60D MG	43	67	0	0	17	0
HAND GRENADE	26	32	55	5	7	2
M3A1 SMG	51	27	55	9	6	3
BFV	25	60	0	20	20	0
CFV	44	50	38	13	0	0
M901 TOW	33	36	36	9	9	9
GND TOW	50	25	25	0	25	25
M47 DRAGON	23	25	38	25	6	6
M72 LAW	13	30	55	4	1	9
90MM RR	22	42	50	0	0	8
MORTARS	64	33	58	8	0	0
M60 MG	29	45	28	19	7	1
M2 HB .50 CAL	24	51	30	9	9	2

TABLE 10: 4TH QTR OVERALL PERFORMANCE - USAREUR (CONT.)

WEAPON SYS	USAREUR % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M1 TANK	25	11	33	33	11	0
M60A3 TANK	50	40	0	60	0	0
155MM HOW	75	0	100	0	0	0
8" HOW	100	0	0	0	0	0
MLRS	67	100	0	0	0	0
REDEYE	100	0	0	0	0	0
HAWK	100	0	0	0	0	0
STINGER	40	35	45	10	0	5
VULCAN	75	0	0	0	0	0
CHAPARRAL	100	0	0	0	0	0
CEV	80	0	100	0	0	0
AP MINES	33	31	45	3	14	3
AT MINES	31	37	41	4	19	0
M18 CLAYMORE	23	38	41	0	15	3
DEMOLITIONS	51	41	28	14	14	3
AH-1	0	33	33	22	0	0

TABLE 11: 4TH QTR OVERALL PERFORMANCE - FORSCOM

WEAPON SYS	FORSCOM % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	52	15	32	26	23	2
45 CAL PISTOL	38	17	44	18	17	1
M249 SAW	36	11	22	0	0	67
M203 GL	50	20	44	19	13	1
38 CAL REV	45	13	63	13	13	0
M60D MG	55	14	43	14	14	0
MK19 40MM MG	0	25	50	0	0	25
HAND GRENADE	29	8	57	19	16	0
M3A1 SMG	52	4	67	15	11	4
BFV	33	33	33	33	0	0
CFV	44	40	20	40	0	0
M901 TOW	67	0	40	20	40	0
GND TOW	83	25	50	25	0	0
M47 DRAGON	59	5	40	30	15	10
M72 LAW	35	11	55	12	12	8
90MM RR	14	50	50	0	0	0
MORTARS	78	0	43	43	7	0
M60 MG	53	23	39	16	17	3
M2 HB .50 CAL	39	27	37	19	12	1

TABLE 11: 4TH QTR OVERALL PERFORMANCE - FORSCOM (CONT.)

WEAPON SYS	FORSCOM % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M1 TANK	29	25	13	38	13	0
M60A3 TANK	20	60	0	20	20	0
M60A1/M48A5	60	67	0	33	0	0
105MM HOW	100	0	0	0	0	0
155MM HOW	94	0	100	0	0	0
8" HOW	100	0	0	0	0	0
MLRS	100	0	0	0	0	0
REDEYE	58	25	50	0	0	13
HAWK	100	0	0	0	0	0
STINGER	13	25	50	8	0	17
VULCAN	75	67	0	0	0	0
CHAPARRAL	67	0	33	67	0	0
CEV	40	17	50	33	0	0
AP MINES	10	7	52	18	15	7
AT MINES	8	3	53	15	19	7
M18 CLAYMORE	33	7	43	20	23	7
DEMOLITIONS	19	4	49	18	25	2
AH-1	67	50	50	0	0	0

TABLE 12: 4TH QTR OVERALL PERFORMANCE - EUSA

WEAPON SYS	EUSA % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	60	67	22	0	11	0
45 CAL PISTOL	58	50	33	17	0	0
M203 GL	67	40	40	20	0	0
38 CAL REV	0	13	38	50	0	0
M60D MG	20	50	25	25	0	0
HAND GRENADE	30	11	67	22	0	0
M3A1 SMG	25	0	50	50	0	0
M901 TOW	50	50	50	0	0	0
GND TOW	67	0	100	0	0	0
M47 DRAGON	80	0	50	50	0	0
M72 LAW	29	31	31	13	6	19
90MM RR	50	0	50	50	0	0
MORTARS	100	0	0	0	0	0
M60 MG	33	39	39	17	6	0
M2 HB .50 CAL	27	46	46	8	0	0
M60A3 TANK	100	0	0	0	0	0
155MM HOW	50	50	50	0	0	0

TABLE 12: 4TH QTR OVERALL PERFORMANCE - EUSA (CONT.)

WEAPON SYS	EUSA % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
STINGER	100	0	0	0	0	0
VULCAN	100	0	0	0	0	0
CHAPARRAL	100	0	0	0	0	0
CEV	0	100	0	0	0	0
AP MINES	25	33	44	0	11	0
AT MINES	14	14	71	0	14	0
M18 CLAYMORE	25	31	38	0	15	15
DEMOLITIONS	50	43	57	0	0	0
AH-1	0	50	50	0	0	0

TABLE 13: 4TH QTR OVERALL PERFORMANCE - WESTCOM

WEAPON SYS	WESTCOM % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	0	100	0	0	0	0
.45 CAL PISTOL	50	50	50	0	0	0
M203 GL	0	50	50	0	0	0
.38 CAL REV	0	100	0	0	0	0
M60D MG	100	0	0	0	0	0
HAND GRENADE	50	0	100	0	0	0
GND TOW	0	100	0	0	0	0
M47 DRAGON	0	0	50	0	0	50
M72 LAW	0	33	67	0	0	0
M60 MG	0	25	50	0	25	0
M2 HB .50 CAL	0	60	40	0	0	0
155MM HOW	0	0	100	0	0	0
AP MINES	0	50	50	0	0	0
AT MINES	0	50	50	0	0	0
M18 CLAYMORE	50	100	0	0	0	0
DEMOLITIONS	50	50	50	0	0	0
AH-1	0	50	50	0	0	0

TABLE 14: 4TH QTR OVERALL PERFORMANCE - NGB

WEAPON SYS	NG % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	35	40	18	10	29	1
45 CAL PISTOL	34	40	29	5	23	1
M249 SAW	0	0	0	0	0	100
M203 GL	34	34	32	7	27	0
38 CAL REV	30	50	30	0	20	0
M60D MG	11	25	38	0	38	0
HAND GRENADE	18	23	34	4	33	5
M3A1 SMG	39	20	40	9	29	2
CFV	0	0	0	0	0	100
M901 TOW	15	29	18	12	24	12
GND TOW	45	32	32	12	24	0
M47 DRAGON	14	26	17	15	22	15
M72 LAW	23	26	39	3	23	7
90MM RR	17	46	35	0	15	4
MORTARS	52	23	30	20	25	0
M60 MG	33	37	25	8	24	2
M2 HB .50 CAL	38	43	24	6	25	0
M60A3 TANK	0	33	0	0	50	17
M60A1/M48A5	39	32	8	16	44	0
105MM HOW	50	44	22	22	11	0
155MM HOW	74	25	63	0	13	0
8" HOW	100	0	0	0	0	0
REDEYE	29	33	14	19	0	29
STINGER	0	50	0	0	0	50
DUSTER	100	0	0	0	0	0
CHAPARRAL	100	0	0	0	0	0
AP MINES	21	13	27	7	36	13
AT MINES	14	13	18	6	44	15
M18 CLAYMORE	24	18	28	5	40	7
DEMOLITIONS	31	23	33	5	31	4
AH-1	0	0	50	0	0	50

TABLE 15: 4TH QTR OVERALL PERFORMANCE - USAR

WEAPON SYS	USAR % ATTAINING STANDARD	REASON FOR NOT ATTAINING STANDARD (%) RANGES	AMMO	TURNOVER	TIME	WEAPONS
M16A1/A2 RIFLE	34	35	15	18	21	0
45 CAL PISTOL	45	39	39	7	11	0
M249 SAW	0	0	33	0	0	67
M203 GL	24	34	39	16	11	0
HAND GRENADE	0	36	29	7	29	0
M3A1 SMG	29	50	38	0	0	13
GND TOW	0	50	0	50	0	0
M47 DRAGON	0	15	23	8	8	46
M72 LAW	15	23	33	7	27	3
90MM RR	17	29	29	14	14	14
MORTARS	25	33	0	33	33	0
M60 MG	29	38	32	11	16	3
M2 HB .50 CAL	21	39	42	6	9	0
M60A1/M48A5	50	0	0	100	0	0
155MM HOW	75	0	50	0	0	50
8" HOW	67	0	0	50	0	50
STINGER	0	33	0	0	0	67
CEV	0	33	0	0	0	67
AP MINES	15	13	25	13	50	0
AT MINES	23	13	20	13	47	7
M18 CLAYMORE	15	19	31	13	31	6
DEMOLITIONS	36	0	43	29	0	14

Section B: Summary of Performance by Proponent

1. AIR DEFENSE ARTILLERY. Armywide, 90 percent of SHORAD units evaluated are meeting STRAC standards with the exception of Redeye and Stinger units. Approximately 45 percent of the Redeye units reported they were meeting standards and 29 percent of Stinger units reporting met standards. None of the Redeye and Stinger units, in fact, are able to meet the standards because the Stinger Training Launch Simulator (STLS) will not be fielded until FY 88. Two surveyed Vulcan units reported they were unable to meet standards due to a lack of ranges. A small percentage of Chaparral units reported they were unable to meet standards due to personnel turnover. Sixty-seven percent of SHORAD units participating in the evaluation felt the standards were achievable and only 26 percent reported a need to change the current standards. A majority of units participating in the survey responded that the recommended Live-Fire Exercises (LFX) in the training strategies were adequate. Training devices and simulators were available to most of the reporting units. The ARNG reported that Duster training devices are not available.

The consensus of all units surveyed indicated training devices and simulators were effective and the frequency of use should remain the same. The training literature supporting SHORAD weapons systems was considered effective by all surveyed units. Eight-two percent of the participating units reported that the full caliber ammunition authorized was adequate except for Redeye and Stinger units. They reported that ammunition for the STLS was unavailable. A small percentage of HAWK and Chaparral units indicated missile authorizations were low. Ammunition resourcing for the HAWK and Chaparral missile systems are tied to Lot certification which limits authorizations.

2. ARMOR. Armywide, surveyed and visited units were meeting STRAC standards for Armor weapon systems less than 60 percent of the time. The primary reason given for Active Component (AC) units not meeting the standards was personnel turbulence, with the primary Reserve Component (RC) reasons listed as lack of time and lack of adequate training facilities. Despite the fact that the majority of units are not able to meet the current standard, many units felt the standards were achievable; a viable alternative to the present standard was not proposed by any unit. The majority of the units stated that the standard did not need to be "fixed". Conversely, the detractors that prevented units from meeting the standard need to be corrected (i.e. personnel turbulence, lack of training time, inadequate range facilities, etc). The fielding of the Unit Conduct of Fire Trainer (UCOFT) is tied to a reduction in the yearly allocation of training ammunition. The main gun ammunition allocation will be reduced from 134 rounds per tank to 100 rounds per tank within 2 years of reception of the UCOFT. The vast majority of Armor units were extremely satisfied with the availability, training strategies, and ammunition resourcing for Armor training devices. The only discrepancies were in RC units. Several RC units do not have access to MILES equipment, SAAB target lifters, Hoffman firing devices, and Pye Watson Boresight devices, although availability has markedly improved during the past year. Finally, vast amounts of blank ammunition were not utilized during FY 86. Tactical table usage is increasing as more Armor units are conducting these tables. This will place an increased demand on blank ammunition and should increase consumption rates. Based upon the data received during this evaluation, changes should be considered in the following areas: revision of the standard, frequency of main gun firing, blank round allocation, 4.2 inch illumination round allocation, smoke grenade launcher ammunition allocation, Hoffman allocation and development of a training round for the smoke grenade launcher.

3. AVIATION. Armywide, an average of 69 percent of the surveyed and visited aviation units are not meeting STRAC standards for the AH-1 and M60D weapon systems. A lack of ammunition and a shortage of ranges and training areas were most often cited as reasons why AC units failed to meet published standards. While many RC units reported problems with ammunition, many also noted that a general lack of time impacted

on their ability to achieve STRAC standards. Of those attack units participating in the evaluation, only 18 percent reported having the authorization of ammunition specified in DA Cir 350-85-4 available for training during FY 86. Although many units were unable to meet STRAC standards, 68 percent indicated that they felt the standards were achievable and even less felt it important to change them. Unit support for the existing strategies is evident, with the majority being satisfied with the current number of live-fire exercises, training devices, training device literature and the recommended frequency of use of weapon system training devices. Input from participating units indicated general dissatisfaction with the availability of adequate aerial gunnery ranges on which to conduct required door gunnery and attack helicopter weapons training. Even though most units did not receive their annual STRAC ammunition authorization, most rated the current authorization as about right. Information from participating units also indicated that the current training program does not articulate 2.75 inch rockets requirements by type and quantity.

4. ENGINEER. Armywide, units met STRAC standards for Engineer weapons systems approximately 30 percent of the time. Approximately 15 percent of the units achieved AP and AT mine standards while the standards for the CEV system were accomplished by 46 percent of the units surveyed. Thirty percent of the units achieved demolition weapons standards. Data indicated three major reasons for the failure to achieve standards. These detractors are lack of sufficient ammunition, lack of time and lack of range facilities. The survey revealed that the failure of the units armywide to meet standards for the above fell into the following percentages: ammunition, 38 percent; time, 28 percent; and range facilities, 18 percent. Exceptions to this was several USAR and NGB units and some AC units (i.e., WESTCOM and USAREUR) which experienced range availability and time problems. The survey also indicated that less than 50 percent of the units felt the standards were achievable. Almost 75 percent of the units supported the collective tasks to the STRAC standards. Armywide, on all Engineer weapon systems, approximately 66 percent of the units indicated the number of live-fire exercises was reasonable. Exceptions were some MACOMs; i.e., WESTCOM, EUSA, and USAR units. The overall consensus of availability of training devices and simulators revealed that 75 percent of the units had devices available and 89 percent responded that they were satisfied with the effectiveness of the devices.

5. FIELD ARTILLERY. Armywide, an average of 81 percent of the surveyed and visited units met Field Artillery weapons system STRAC standards. While most organizations were successful in achieving their training programs, none of the participating TRC X 155mm Howitzer battalions and only 56 percent of the TRC C 105mm Howitzer battalions met theirs. A lack of ammunition and a shortage of ranges and training areas were indicated as

principal reasons for units not attaining standards, although most of the participating units reported receiving the annual allocation of ammunition specified in DA Cir 350-85-4. Participating units overwhelmingly noted that STRAC standards were executable. At the same time, very few organizations indicated the need to change the current standards. Seventy-one percent of responding units reported that the recommended number of live-fire exercises was about right, while all of the TRC X 155mm Howitzer battalions responded that they considered the current number of live-fire exercises too high. Although most of the participating units reported that training devices and training literature were available and effective, there was unanimous agreement that the M31 was an ineffective training device. With the exception of this item, participants indicated that the current recommended frequency of use of training devices should remain the same. Although the majority of Field Artillery units met their STRAC standards, most rated the annual authorization of service ammunition as low to about right. They also considered the annual authorization of subcaliber ammunition high.

6. INFANTRY. Armywide, less than 50 percent of the surveyed and visited units are meeting the STRAC standards for infantry weapons, with the exception of the .45 caliber pistol, TOW, and mortar weapon systems. Predominant reasons given for not obtaining standards are lack of adequate ranges, insufficient ammunition and time constraints. Specific key problem areas have varied between the MACOMs with USAREUR indicating insufficient ranges, FORSCOM highlighting lack of ammunition and NGB pointing out their training time limitation. All of the MACOMs have indicated significant problems with the STRAC night qualification requirements due to the lack of adequate facilities. Also, training devices and, specifically, the lack of certain devices have degraded the training for some weapon systems. Prime examples are: availability problems with the .22 caliber Rim Fire Adapter, the shortage of MILES equipment for CS/CSS units, the poor operational capability of the Launch Effects Trainer (LET) for the Dragon and the shortage of subcaliber devices for the 90mm recoilless rifle. All of these have had significant impact on training strategies.

Section C: Ranges and Ammunition

1. RANGES.

a. The most prevalent reason given by units for not attaining standards was alack of range facilities. This is not altogether surprising. It was recognized as a major problem some years ago and as a result the Directorate of Army Ranges and Targets/National Training Center (DART/NTC) at ATSC was designated as the Department of the Army Executive Agent for ranges in 1982. Their mission was to develop strategy, doctrine and direction for the Army Master Range Plan and standardizatio and mordernization of ranges armywide.

b. The Army is beginning to see the results of the DART/NTC effort now. Figure 17 shows the completed and near completions for 1985 and 86 while Figure 18 provides a projection on range completion thru 1989.

RANGE MODERNIZATION PROGRAM
PROGRESS UPDATE

1985

TYPE OF RANGE	OPERATIONAL
Marksmanship	1
MPRC	1

1986

TYPE OF RANGE	OPERATIONAL	TARGET INSTALLATION ONGOING	UNDER CONSTRUCTION
MARKSMANSHIP	11	2	12
MPRC	0	1	6
MPTR	3	0	4
MOUT	1	0	2
OTHER	2	0	3

FIGURE 17. 1985 - 1986 RANGE CONSTRUCTION

RANGE MODERNIZATION PROGRAM
PROJECTION FY 87 - 89

	TYPES OF RANGES				
FISCAL YEAR	MARKSMANSHIP	MPRC	MPTR	MOUT	OTHER
87	4	1	2	1	3
88	6	2	11	2	5
89	17	1	7	2	8
TOTAL	27	4	20	5	16

FIGURE 18. 1987 - 1989 RANGE CONSTRUCTION

c. The Army National Guard has numerous on going projects for range construction in addition to those identified in the DA Master Range Plan. The NGB has 74 additional range projects, beyond those identified and funded by DA, with approved range construction in 36 states during FY 87-89. The NG projects extend from upgrading existing individual qualification ranges to new construction of record fire and tank qualification ranges. During FY 90-92, there are 14 additional major range projects (MPRCs and ARFs) identified by HQDA for funding and construction.

2. AMMUNITION.

a. While lack of ammunition was given by many units as the reason for not attaining standards, turn-in of unused training ammunition remained at about the same levels as previous years. Approximately $300 million of conventional ammunition was turned in. Isolated problems identified during unit visits included: higher headquarters holding ammo for contingencies until late in the training year and then passing it to units who could not use it; ammunition not arriving in an overseas MACOM when needed; range availability and scheduling not timed with ammunition requisitioning procedures; etc.

b. While there were isolated instances which interfered with ammunition getting to the right place at the right time, overall, many of the current training strategies have more events than can be executed by the units and hence more ammunition than can be used.

c. Other factors that precluded use of available training ammunition were lot suspensions, weather, i.e. range areas with fire hazards existing because of dry conditions, snow, rain and fog conditions restricting visibility. In some instances, better scheduling of existing ranges would allow greater thru-put. Lack of adequate or nonexistent range facilities as described above also contributed to nonexpenditure of ammunition.

d. Overall, time served as a constraint because many of the strategies contain more sustainment events than the unit could execute. Other factors contributing to nonexpenditure were post and school support missions.

Chapter IV. - Discussion and Conclusions.

GENERAL. This chapter is divided into two sections. The first section covers, by proponent, the weapons systems that are covered in detail in Appendix A. The second section of this chapter addresses training ammunition and ranges.

Section A: Summary by Proponent

1. AIR DEFENSE ARTILLERY. The majority of surveyed SHORAD units met STRAC standards. The Redeye and Stinger gunners cannot meet standards until field units receive the Stinger Training Launch Simulator (STLS) and STLS eject missiles. Various ARNG units reported they were unable to obtain M49 Tracking Head Trainers (THT) or that there was only one M49 THT for all units in the state. Several ARNG units reported there is no Moving Target Simulator (MTS) in their state. Twenty-eight percent of surveyed Vulcan units indicated an inability to meet standards due to lack of ranges. The ranges available for these units did not have a wide enough range fan to accommodate aerial Vulcan engagements. Two Vulcan units suggested that the one standard for aerial and ground engagements should be two separate standards, one standard for aerial and one for ground. The current engagement standard is 8 of 12. The suggested standards are 6 out of 8 aerial engagements and 3 out of 4 ground engagements. Vulcan units surveyed indicated that limited MILES/AGES/AD devices are available to support notional training strategies. Several Vulcan units reported the Vulcan Television Trainers are not available. None of the Vulcan units surveyed indicated an overage or shortage of available ammunition. Armywide, the utilization of Vulcan A652 TPT rounds was only 72 percent of STRAC authorizations for FY 86. A 5-year usage comparison with Vulcan ammunition authorizations depicts an overall 60-70 percent expenditure rate. These factors coupled with range problems suggest Vulcan units cannot fire all the ammunition authorized for their units. Training devices for most weapon systems were adequate; however, the ARNG units reported that RCATS are being phased out and there are no OPFOR aircraft target models available.

2. ARMOR. The overwhelming reason given by AC units not achieving standards was personnel turbulence; RC units listed both lack of time and lack of adequate training facilities. Although most units felt the standards were achievable, nearly half of the surveyed and visited units felt that the standards should be revised. Units are not executing the current three density program as described in the current STRAC. The 34 round reduction in main gun ammunition caused by the UCOFT fielding precluded adequate distribution of ammunition into a three density program. The RC program has been accepted by the field; however, large NG main gun ammunition turn-ins seem to indicate that the program may be over-resourced based on the limited training time available. General satisfaction was expressed with the current training devices. Telfare ammunition turn-in data indicated many units are not using this device. Changes in

STRAC allocations are required to account for the effect of the current Combat Tables for each model tank. Use of the red phosphorus smoke grenade is a significant problem due to the environmental/fire hazard.

3. Aviation. Of the reasons cited for failing to meet prescribed standards, a lack of ammunition and a shortage of ranges and training areas were most often indicated. For FY 86, HQDA resourced approximately 65 percent of the Army STRAC requirement for 2.75 inch rockets. While the authorizations of TOW, 7.62mm, 20mm, and 40mm were significantly closer to STRAC levels, the general lack of 2.75 inch rockets made it extremely difficult for many units to achieve established standards. Lot suspensions of TOW missiles, local ammunition management and distribution procedures and the "newness" of DA Cir 350-85-4 exacerbated the problem. Likewise, a lack of suitable ranges and training areas made it impossible for many units to attain STRAC standards. General shortages of suitable door gunnery and aerial gunnery ranges throughout the Army have made it difficult for units to accurately and effectively train with their weapon systems. Ongoing training device development and range modernization efforts will appreciably improve the quality of Aviation gunnery ranges in the near future. Ammunition requirements as stated in the Circular, while not resourced to STRAC levels, were supported by participating evaluation units.

4. ENGINEER. Recognizing that more than half of the units responded that the Engineer standards are not achievable, it is noted that the U.S. Army Engineer School revised STRAC standards, not necessarily as a result of this survey, but to make the standards more compatible with present Soldier Manual requirements, ARTEP standards, and to make the standards more user friendly to non-engineer units. Future evaluations will reveal the effectiveness of the new standards. The shortage of ammunition experienced by the surveyed units conflicts with the DA ammunition allocation to support Engineer systems and ammunition usage data. Armywide, substantial ammunition supporting Engineer systems was turned in by all MACOMs the last quarter of FY 86. Data additionally indicated the lack of time and ranges hindered units Armywide from achieving standards. Some MACOM units (i.e., USAREUR, EUSA, and WESTCOM) experienced range accessibility problems while several USAR and NGB units were hindered by a lack of training time and ranges due to geographical location. Additionally, some USAR units are experiencing a high turnover rate which requires more time to train new unit members.

5. FIELD ARTILLERY. Field Artillery STRAC standards require units to complete battery and battalion ARTEP tasks. Of the reasons cited for failing to meet prescribed standards, a lack of ammunition and a shortage of ranges were most often indicated. For FY 86, HQDA resourced 100 percent of Artillery STRAC requirements. At the unit level, a shortage of service ammunition can ostensibly be traced to ammunition management and

.istribution problems. While AC units generally have access to suitable ranges, many RC units do not. Their reliance on completing STRAC requirements during annual training may account for this shortfall. Participating units supported current training strategies, with some units noting the need to recognize requirements for nuclear capable artillery organizations. While devices were available and effective, a significant number of organizations rated the M31 14.5mm training device as ineffective due to its poor performance, shortage of ranges on which to use it and difficulty in calculating its firing data. Although many units did not receive their entire annual STRAC ammunition authorization, 52 percent of those responding to the survey rated it about right. Comments from participating units who had trained at NTC indicated a need to increase allocations of special munitions (illumination, smoke). In the area of subcaliber ammunition, 47 percent considered the annual authorization high. Ammunition usage reports indicate that only 17 percent of the three different M31 rounds were used throughout the year.

6. INFANTRY. The major reason given by units for not meeting STRAC standards for the M16A1 rifle and other small arms weapons was the lack of adequate ranges, specifically for night qualification. However, the MACOMs continue to support the requirement for night qualification, with the exception of the .38 and .45 caliber pistols. Insufficient ammunition was the econd most commonly given reason for not meeting standards even though, Armywide, usage and turn-in of ammunition for FY 86 does not support this claim. MACOMs expended only 50 percent of their total STRAC allocations during FY 86, indicating a possible need for reduction in future allocations. The NGB continued to be hampered by time constraints with only 38 available traini. days per year and the inaccessibility of sufficient ranges due to time/distance problems. Principle obstacles cited for failing to achieve standards with the Bradley Fighting Vehicle (BFV) and Cavalry Fighting Vehicle (CFV) were personnel turbulence and lack of adequate ranges. While range modernization will help to offset part of this problem in the future, personnel turbulence will continue to plague the Bradley as it has armor crews in the past. Among other training detractors surfaced were the availability and reliability of the .22 caliber Rim Fire Adapter that so many NGB units are dependent upon for local training. Also cited was the shortage of MILES equipment for CS/CSS units for sustainment training during ARTEPs and force-on-force exercises. Another interesting finding was that all MACOMs agreed that the amount of live-fire requirements should be increased for the hand grenade and that adequate facilities should be made available for this weapon system. All of the antiarmor weapons (TOW, DRAGON, LAW) cited ammunition as a limiting factor and felt the full caliber live-fire requirements should be increased. The LET consistently received negative comments about its operational availability and its susceptibility to damage during transportation. Because of this, many units were using MILES equipment for DRAGON qualification

which is not a viable alternative to the LET. The LAW was cited for the shortage of 35mm subcaliber ammunition to support the training strategy. There were no significant problems indicated for the indirect fire weapons (60mm, 81mm, and 107mm mortars), however, the lack of mortar ammunition was cited as a major problem for USAREUR. The M60 and .50 caliber machinegun findings stated both lack of ammunition and inadequate ranges (night qualification) as primary reasons for not obtaining standards. Approximately 40 percent of the units indicated they did not receive their full STRAC authorization. This may require a follow-on evaluation to determine if there is a management flow problem as neither resource was in short supply and unit expenditure rates did not exceed 65 percent. The achievement of standards or problem areas for SAW and MK19 (40mm MG) could not be adequately determined due to the low density of these weapon systems. Future evaluations will be needed to determine proper resourcing and strategies for these systems.

Section B: Ranges and Ammunition

1. RANGES.

a. STRAC was initiated in 1982 and first used by the Army in FY 86. Prior to the time the first STRAC Circular was printed, there was no single document that provided both weapons standards and training programs for every weapon system.

b. The ATSC Directorate of Army Ranges and Targets has been conducting range assessment studies in communities in Europe and Korea for the last couple of years. Their assessment team includes a STRAC Program Directorate member and the team incorporates the STRAC Circular together with other documents as references. As evidenced by the teams' assessment reports and recommendations, considerable construction needs to be accomplished in the Local Training Areas (LTA) to permit both improved thru-put of the troop density using the LTA and provide ranges of a type that will permit attainment of the STRAC standards.

c. As was described in Chapter III, major range construction is under way throughout the army to support both active and reserve component training. The impact of these new ranges coming on line is only now affecting units' capabilities to attain STRAC standards. The STRAC evaluation planned for FY 88 will provide a measure of how well the programmed construction is accommodating the STRAC requirements.

2. Ammunition.

a. During their study of the Army's Training Ammunition management in 1984-85, the Army Audit Agency commented that STRAC had made significant progress in identifying training ammunition requirements but that STRAC requirements were still excessive, particularly for small arms and machine guns, considering historical usage.

b. Throughout the FY 86 STRAC Evaluation, SPD monitored the consumption of ammunition by quarter and then analyzed year end expenditures. Expenditures were fairly consistent with historical usage. An increase in the usage of tracer ammunition occurred as a result of the introduction of a night fire qualification requirement in the standards for a number of small arms' weapons systems. Generally the expenditure of other types of ammunition did not change appreciably.

c. An attempt was made to identify those factors causing nonexpenditure. Figure 19 graphically portrays STRAC requirements, expenditures, a revised target for new requirements and those factors causing nonexpenditure which are discussed below.

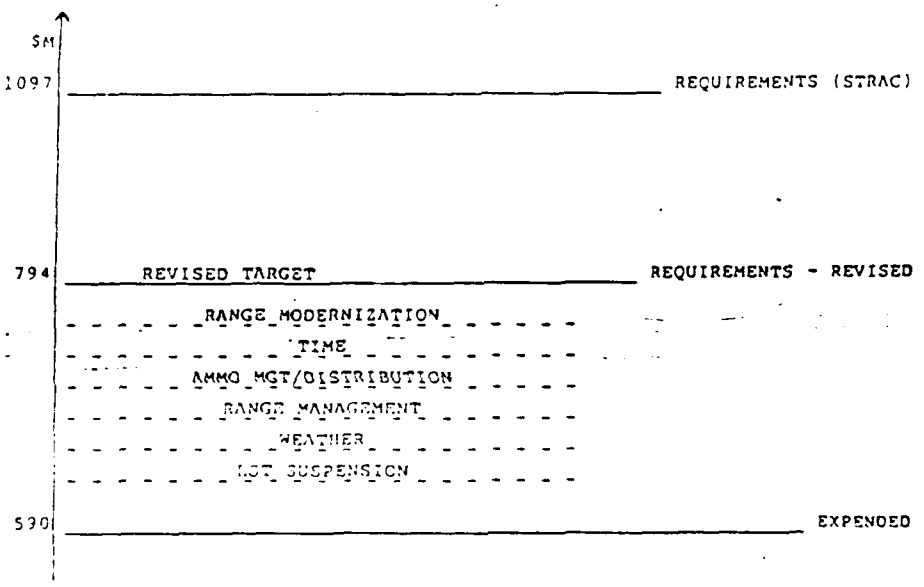


FIGURE 19. FY 86 TRAINING AMMUNITION
[FORSCOM (USAR), USAREUR, EUSA, WESTCOM, NG]

(1) Lot Suspension. Lots of ammunition are suspended for various reasons during the training year. This factor will continue to affect expenditures. The percentage of nonexpenditure attributed to this factor is unknown.

(2) Weather. Some training areas are closed down during dry periods due to extensive fires caused by live firings. Other areas are not usable during periods of fog, rain and snow. These factors will continue to occur. Nonexpenditure for these factors is unknown.

(3) Range Management. More efficient use of available ranges would increase thru-put of using units.

(4) Ammo Management/Distribution. Ammo management practices that were in effect in the field prior to STRAC were still in effect. Ammo was being retained at higher headquarters for contingencies and not being issued to units until late in

the training year. Other practices indicated other problems in the management and distribution of training ammunition.

(5) Time. Many of the training strategies are optimized for each individual weapon system. Units do not have sufficient time to fire all the suggested and resourced sustainment exercises and this resulted in large nonexpenditures.

(6) Ranges. The range modernization program is covered in the first part of this section.

d. In summary, six factors have been identified that contributed to the nonexpenditure of ammunition. The extent to which each of these factors contributes to the shortfall has not been measured in the past.

Chapter V. - Recommendations.

GENERAL. This chapter is also divided into two sections with the first providing a proponent summary and the second addressing ranges and targets.

Section A: Summary by Proponent

1. AIR DEFENSE ARTILLERY. The STRAC standard for most Air Defense weapons systems are adequate and attainable. The current standard for each Redeye and Stinger gunner to fire two STLS eject missiles annually is not attainable. This requirement should remain the same to provide the high visibility needed to acquire this excellent training device. The standard should be reevaluated once all field units are able to train with the STLS eject missile in FY 88. The requirement for ARNG Redeye units to conduct four MTS end-of-course comprehensive tests annually is difficult for states without an MTS facility. The funding requirements for unit travel to the nearest MTS facility must be surfaced through NGB channels. The lack of M49 THTs appears to be a problem area for selected ARNG Redeye units. This problem also needs to be surfaced through NGB channels. Two Vulcan units surveyed reported the range problem does not have an immediate solution. The current 5-year range program does not include a range fan expansion for Vulcan aerial gunnery. The ammunition currently authorized Vulcan units appears to be excessive. The Vulcan units surveyed indicated ammunition resourcing was adequate but 28 percent was turned in armywide. A reduction in the ammunition resourced each gunner would narrow usage and authorizations. The reduction should not come from rounds resourced for qualification. The notional LFX tables should be reduced for the senior gunner and unqualified gunner(s). An alternate training device must be developed for Duster units since RCATs are being phased out.

2. ARMOR. The current standards should be reviewed for possible revision. The turbulence based portion of the standard, the primary reason given for not attaining the standard, should be the focus of the review. The current three density program should be changed to a two-density program that eliminates Telfare as the sole pretrainer for crew qualification. TRC A units should conduct a third density if resources permit. TRC C strategy should be revised to permit a more efficient use of main gun ammunition. The effect of the UCOFT/MCOFT on the gunnery program should be reflected in the rewritten STRAC programs. A training round for the red phosphorus grenade should be developed.

3. Aviation. Unit support for the current aviation standards, training strategies, training devices and training literature has enhanced the importance of these particular items in the current aviation weapons training programs. While executable, the lack of ammunition during FY 86 has made it extremely difficult to evaluate the current standards. In that regard, action should be taken to resource Aviation units to levels recommended in DA Cir

350-85-4 until such time that a follow-on evaluation can determine if changes in the current standard should be implemented. In addition, DA Cir 350-85-4 should be changed to designate the types of 2.75 rockets required to support the attack helicopter fleet. Action should be taken to survey the availability of aerial gunnery ranges throughout the Army to determine facility shortfalls and to develop a strategy that will lead to development and construction of sufficiently instrumented and designed aviation ranges and training areas.

4. ENGINEER. The evaluated STRAC standards and ammunition usage reports indicated that a reduction in ammunition for Engineer weapon systems is needed. Because of the revision of the evaluated standards and noting the Armywide range upgrade projects, the recently revised standards should be resourced and evaluated in the future for effectiveness. As the various MACOMs execute the range upgrade plans, the Engineer weapon systems and STRAC standards must be considered, particularly for units to conduct related collective training tasks. (i.e., demolitions requiring ring mains and road craters). Presently, in some areas units are hindered because of the limited quantity of Engineer-type munitions that can be expended simultaneously due to noise and shockwave problems. Lack of time and geographical location distractors for some USAR and NGB units can be managed by evaluating the newly revised standards. The range problems for these type units must be actively pursued by the leadership at all levels. Lastly, current procedures to supply ammunition to units Armywide must be evaluated to ensure STRAC allocations are in fact available to units at all levels, especially the various AP and AT mines.

5. FIELD ARTILLERY. Unit success in attaining STRAC standards validates their value and achievability. Similar success with training strategies, training devices, literature and ammunition authorizations has enhanced the importance of these particular items in the current Field Artillery weapons training programs. Although fielded for some time, the M31 14.5mm subcaliber trainer is not supported by the various Howitzer units. Its effectiveness and future as a Field Artillery training device should be reviewed and appropriate action taken to improve, eliminate, or replace it. At the same time, its frequency of use should be evaluated to determine the recommended frequency Howitzer crews, FIST and FDC personnel should train with it annually. Action should be taken to quantify the number and type of 14.5mm rounds required to support the adjusted strategy. In addition, full caliber ammunition allocations should be reviewed to determine if special munitions requirements are adequately addressed.

6. INFANTRY. STRAC ammunition allocations appear to be high for all infantry weapon systems, based on both historical and FY 86 expenditures. The current training strategies contain more sustainment exercises than most units are able to accomplish due to range and time limitations. Substantial reductions in small

arms ammunition could be accomplished through the elimination and/or reduction of frequency of selected events in the training strategies. It is recommended that a buffer zone of 20-30% above the FY 86 expenditure rate be established to offset future variations due to range modernization, Lot suspensions or inadequacy of management techniques. No other major changes to the STRAC standards are recommended with the exception of eliminating the night firing requirements for the .38 and .45 caliber pistols. All of the MACOMs continue to support the night qualification requirements even though most range facilities require upgrading to accomplish it. Future training will be enhanced as additional MILES equipment is procured and made available to CS/CSS units. However, in view of the incorrect use of MILES for Dragon qualification, command emphasis must be placed on the correct employment of the LET for STRAC qualification. As mentioned in previous paragraphs, the survey highlighted discrepancies in ammunition distribution to users, that will require investigation during future STRAC evaluations. Finally, no major conclusions were made on the standards for the BFV or MK19 (40mm MG) due to the low density of the weapon systems presently in the field. Continued monitoring and evaluation of these systems are recommended to determine if standards and strategies are appropriate.

Section B: Ranges and Ammunition

1. Ranges. The range assessment visits sponsored by the DART/NTC Directorate of ATSC should continue. Ideally, an assessment of all training areas needs to be accomplished now with the teams of expertise available to DART/NTC. Since this would be impracticable, DART/NTC might consider training MACOM teams on a one-time basis and providing the appropriate reference materials for local assessments.

2. Ammunition.

a. The FY 88 STRAC Evaluation needs to focus in greater detail on ammunition.

b. HQDA needs to capture nonexpenditure rates caused by range and weather.

c. An assessment needs to be made of range availability in each training area supporting a given density of units.

d. The possibility of automating range scheduling needs to be explored.

e. The training strategies for some of the weapons systems need to be reduced and an assessment made on the time available to execute all the tasks required, not only in STRAC, but as it applies to units' entire training year.

f. A team headed by HQDA and assisted by SPD should enquire into problems associated with ammo management and distribution within the MACOMs.

g. SPD should establish revised requirements for the proponents taking into consideration historical usage, FY 86 usage and those factors that constrain expenditures. The revised requirements should encompass a buffer that will allow expenditures as the new ranges come on line and as other inhibiters are corrected.

TRAINING AMMUNITION MANAGEMENT SYSTEM

Training resources are limited; the day of unconstrained resources is passed. Training ammunition is one of these limited resources; it is also a very costly one. In order to get the greatest benefit from the available ammunition, effective management is required.

The Army has established a training ammunition management system to regulate the multifaceted process involving ammunition requirements, authorizations, budgeting, and expenditures. Army regulation 5-13, dated 1 August 1979, prescribes this training ammunition management system and sets procedures and responsibilities.

The training ammunition management system is essentially a resource process. Firing/using units develop their yearly ammunition requirements based on historical data, current training program, doctrinal guidance found in FM's and ARTEP's, and other pertinent factors. These requirements are then sent to the appropriate major army command. The major army command ensures that the requirements of all its subordinate units are included, regardless of installation or theater to which assigned. Consolidated requirements are forwarded to Headquarters, Department of the Army (DA). These requirements are expressed in number of rounds.

At Headquarters, DA these figures, along with direction and guidance from interested groups/agencies (Office of Management and Budget, Office of the Secretary of Defense, Congress, and US Army Materiel Development and Readiness Command), are used to develop yearly ammunition authorizations. Experience has shown that yearly authorizations are less than the major army command's requirements. This is caused by such factors as ammunition availability, the size of the defense budget, and high requirements from the field. The final product is a fine balance between what is requested, what is affordable, and what will achieve the Army's training objectives. Unlike requirements, authorizations are developed and expressed in dollars.

Authorizations are converted to number of rounds and then provided to the major army commands. There the ammunition is suballocated to the firing/using units. Units are to consume these suballocations during training within the applicable fiscal year. For a number of valid reasons (e.g., weather, problems with firing ranges, crews don't need all the ammunition allocated to complete qualification, changes to unit training schedules, ammunition allocated but unavailable when needed, and the accuracy of Training Ammunition Management Information Systems itself) units, as a group, never consume all the ammunition allocated. Allocated ammunition not consumed is lost, since allocations will not normally be carried over into a new fiscal year.

Ammunition management is not a relatively simple process. In reality a number of phenomena surface. These phenomena include: 1) requirements are always greater than authorizations and expenditures are always less than requirements or authorizations; 2) the amount of ammunition allocated for like weapon systems varies greatly between major commands; 3) ammunition requirements, authorizations, and expenditures for like weapon systems vary from year to year; 4) the amount of ammunition required for training is unknown; no standard figures are available (if there exist any doctrinal figures, they are not followed by the field); and 5) the fact that a unit shoots less than authorized is not prima facie evidence that the unit needs less than authorized to maintain readiness. Unfortunately, many groups involved in the ammunition process (Congress, Office of the Secretary of Defense, and Office of Management and Budget) have only a cursory understanding of the entire system and these phenomena only add confusion and misunderstanding. This all leads to a bottom line: the training ammunition management system is flawed, lacks credibility, delegates decision making to a relatively low level, and establishes a market place atmosphere and approach for decision making.

With these weaknesses, the current ammunition management system must be improved and the overall ammunition process placed in proper perspective. Steps that could be taken towards these aims are: 1) Establish realistic baseline ammunition figures on which to base requirements. These figures must be affordable, based on best data available, unit mission, and only be for unit proficiency and readiness. 2) Establish a directed ammunition system which would reduce or eliminate the market place atmosphere and place the decision making at the proper level. 3) Establish guidelines and doctrine (at the field know what is expected) and ensure it is followed by the major commands. 4) Close the gaps in the Training Ammunition Management Information System (TAMIS) which tends to keep many commands and decision makers in the dark as to the current ammunition status.

A number of these steps towards improvement are being addressed by the Standards in Training Commission (STRAC) established by Headquarters, DA. The purpose of the STRAC is to determine levels of training ammunition required to attain and sustain specified levels of individual, crew or unit weapons proficiency for both Active and Reserve Components. The results of the STRAC are to take effect in FY 84. Two facts are clear: first, training ammunition management is a complex business and an easy target for the budget cutter's knife, and second, if the Army is to get the required training ammunition in the future, it must do a better job of articulating and managing training ammunition resources. It is a difficult and challenging task that must be faced now.

US ARMY TRAINING DEVICE DEVELOPMENT

1. Introduction

a. The US Army has embarked on programs to field high technology trainers and simulators to meet the training challenge of new combat systems. The system established to manage this effort, the Training Developments System, is administered by the Training and Doctrine Command (TRADOC) in coordination with the Army's commodity commands.

b. Despite the emphasis placed in this arena, the system is plagued with problems. The DAIG report on training devices characterized the system as "indecisive, and plagued by redirection, vacillation, excessive testing, and changing requirements in attempts to reach for the next technology."

2. Training Needs are unmet

a. As Figure 1 shows, inordinate delays occur between the time a need is identified and when a training device is fielded. For example, the field artillery forward observer simulator (Training Set Fire Observation - TSFO) was identified as a requirement in 1970. Simulators were successfully demonstrated in 1977, and again in 1980. Fielding of the device, however, was not scheduled before fiscal year 1982, 12 years after the need was established. Such delays are not limited to medium technology items such as the TSFO. A relatively simple mechanical device, the M179 TELFARE mount (the mount for the .50 caliber machine gun used as a tank main gun subcaliber substitute) was successfully demonstrated in 1971 but not fielded until 1980. A similar situation occurred with the Vulcan Training System (VTS).

Device	Need Identified	TDR	Fielding
TSFO	1970	1977 (1st) 1980 (2nd)	1982
TELFARE	1971	1977	1980
VTS	1972	1981	?

Figure 1

b. The delays in fielding required systems result in the procurement of a myriad of nonstandard training devices. The major commands, grown tired of waiting for the TRADOC system to be responsive, buy commercially available systems to meet their training needs. Between 1977 and 1981 US Army Europe bought and fielded TSFO's built by SAAB-Scandia (the BT33) and Marconi. In 1981, the "Army accepted the TSFO built by INVERTRON as the Army standard System. For want of a Unit Conduct of Fire Trainer (U-COFT) (still in development) US Army Europe contracted for a film and computer system built in England. (The Detras Tank Gunnery and Missile Target System - TGMTS) Similar training device vacuums still exist for the Vulcan Training System (VTS),

DRAGON trainer, a Combat Engineer Vehicle (CEV) subcaliber weapon, and eye safe devices for training with the laser range finders on the M60A3 and M1 tanks. In some cases, the major commands are either fabricating or procuring their own devices.

Type Classified Device or Candidate Item	Local Procured/ Fabricated Device	MACOM
TSFO (INVERTRON)	BT 33 OFT	USAREUR
	Marconi OFT	USAREUR
U-COFT (M60A1/3)	Detras TGMTS	USAREUR
CEV Subcaliber Wpns	75mm Inbore	ARNG
Tank Appended Gunnery Trainer	Thru-Sight Video (TSV)	FORSCOM
Tank Subcaliber Wpns (TELFARE)	NACCA Device	USAREUR
	.50 Cal Inbore (105mm)	NJARNG
	20mm Riley Device	FORSCOM
Eye Safe Laser Range Finder	Swiss-made Filter for LRF (Europe CTDR)	USAREUR

Figure 2

3. Maintenance and Supply

a. The situation is exacerbated by an unresponsive maintenance and supply system for training devices. The Training Aids Support Centers (TASC), managed by each major command, are tasked to support training devices. These TASC are poorly organized for this function. The training device maintenance system was found to be in less than satisfactory; the system was unresponsive, inadequate, and in some cases, lacking altogether.

b. The problem has been that devices, either type classified or locally produced, were issued without provision for direct support and general support maintenance and spare parts. Consequently, maintenance, if it was performed, was placed on unit TOE maintenance organizations or installation DIO.

c. The problem has been acknowledged. Most new devices provide for the contractor and developer for systems fielded in the future; but for those already fielded, the situation still exists.

4. Staffing/Training of Training Developers Inadequate

a. The source of these problems can be found within TRADOC training device development structure suffers from understaffing and the lack of requisite training and experience in the training developments process. The DAIG characterized the structure as a bureaucratic, cumbersome development process which stifles initiative, complicates coordination between developers and the user, and incorporates redundant and time consuming review procedures as a "hedge against failure."

b. The Army officer career field that should have provided a corps of trained and experienced training developers (career field 28) will soon merge with field 54 (Operations and Force Developments). Even with the 28 specialty in effect, the Army, according to the DAIG report, failed to take advantage of the Operations Research and Systems Analysis (ORSA) schooling available within the military service school system. The skills and techniques of ORSA are as equally applicable to training developments as they are to combat developments; up to now combat developments has received the emphasis.

c. Consequently, there is a lack of required training developer expertise. As a result, TRADOC systems design processes are characterized by poor or incomplete action. Thus, the Army has found itself fielding only partially validated training devices.

5. Total System Approach

a. The final area which has contributed to failures in training system design is the Army's "total system approach." Problems associated with this approach are centered around an Army policy against sole source acquisition in favor of competitive bidding.

b. Sole source acquisitioning would permit the developers to pursue modifications to developmental or prototype designs without encountering proprietary issues. Competitive bidding is purported to be the more responsive method. Experience would say otherwise.

(1) In 1980, the US Army Training Support Center contacted Atari, the manufacturer of coin operated video games. Atari was asked to modify its popular Battlezone game to incorporate the firing controls of the M2/3 Fighting Vehicle, M60 tank, and Chapparal air defense system. A sole source contract would have delivered 14 systems to the Army in December 1981. Department of the Army disapproved a sole source contract in favor of competitive bidding. As of the date of this report (Feb 1982), the contractor has not been selected.

(2) Total system development should result in concurrent development of the training system with the weapons system. However, training system contractors, selected again by competitive contract, are often unable to develop the training device until the supported system is ready for verification. Even then, training device developers run into "competition sensitive" information "walls" as they attempt to gain access to the weapons systems design and capability data in order to build the supporting training system.. Thus, today the Army is issuing Laser Range Finder equipped tanks without eye-safe laser devices, thermal sights without thermal targets and other training packages, M1 tanks (which have a training strategy built around Conduct of Fire Trainers) without a fielded COFT, and M1 tanks without a MILES suit.

6. The Instructional Design Process

a. The Instructional Systems Design (ISD) process is required to be used in the development of institutional and unit training products.

b. The DAIG report concluded that the process was plagued by:

(1) poor, or incomplete Front End Analysis.

(2) inadequate concept planning.

(3) late identification of training needs.

c. "TRADOC requires that the ISD process be applied to the analysis, design, development, implementation, and evaluation of all new training programs and associated training and support materials." Institution commanders are required to "insure training developments are integrated with the system acquisition cycle..."

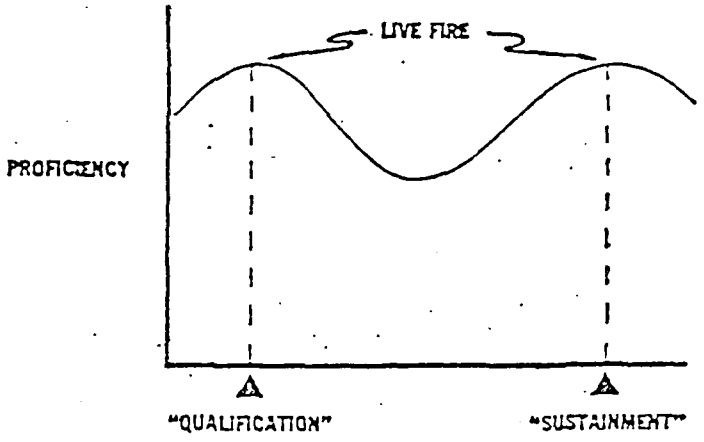
d. There is an absence of an effective feedback loop, as it pertains to the development of training programs and devices for training in units. Without feedback and control there is no system. This results in the failure of the Front End Analysis to adequately integrate:

(1) Resource constraints that characterize the field training environment; these take the form of ammunition allocations well below doctrinal levels, range design restrictions, range availability, available training time, and lack of adequate maneuver areas.

(2) The impact on unit training of the availability of trained instructors (the NCO), turbulence, mission requirements and other associated training profiles mandated by major command commanders.

SUSTAINMENT

The key to the weapons proficiency component of unit readiness, lies not only in attaining a specified level of capability, but in sustaining that level. As discussed previously, most units attain a high level of training during a live fire exercise then experience a drop in proficiency until the next live fire period. The factors which cause this drop are individual and collective skill decay. Individual skill decay is a function of the individual, his level of expertise, the type of skill involved (i.e., procedural, cognitive, or psycho-motor) and the complexity of the skill



Collective skill decay is a function of individual skill decay and changes in the crew. The complexity of skill decay is such that an attempt to estimate it specifically for each type of weapon system would be an exercise in futility (each crew would vary greatly from the mean). It is apparent, however, from numerous tests involving a wide range of skills, that proficiency declines sharply after 3 to 4 months with no practice. As a general rule, crew skills need to be fully

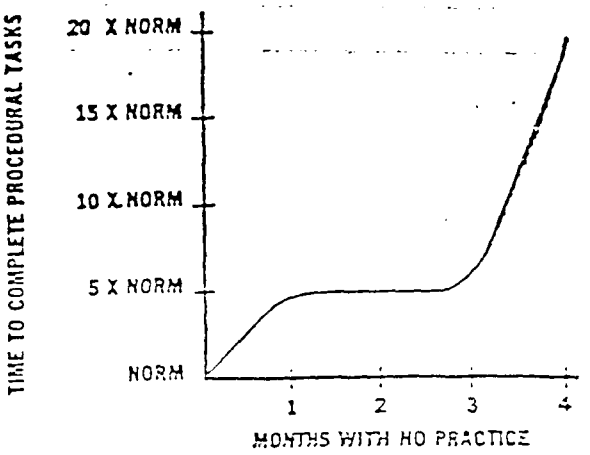
DECAY RATE	SKILL	EXAMPLE
HIGH ↑	PROCEDURAL	LAYING PARALLEL WITH AIMING CIRCLE
	COGNITIVE	VEHICLE IDENTIFICATION
LOW	PSYCHO-MOTOR	TRACKING A TARGET WITH OPTICS

exercised three of four times annually to sustain proficiency. High turbulence rates will increase this frequency requirement. How to achieve this training frequency will vary with the weapon. In most cases, devices are available or could be purchased to exercise required skills. In a few systems no devices are available and the only current option is live fire. The use of devices in order to sustain proficiency between full-caliber live fire exercises is not a general practice with units in the field. Sustainment training which should be defined as the method of sustaining proficiency between live fire exercises, is usually limited to the "other" live fire periods during the year.

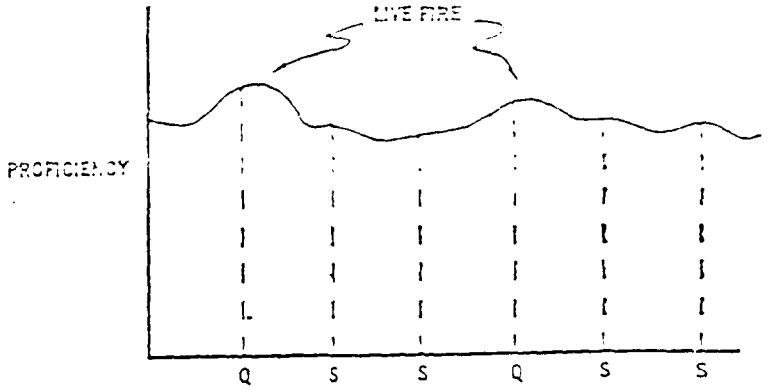
TRAINING SYSTEM DESIGN

Although the scope of this effort was originally limited to weapon training up to the "crew qualification" level, it becomes clear that weapons training beyond the crew level is so interrelated to all prior training that it had to be considered. The ultimate goal is combat ready units capable of functioning in the full, combined arms environment.

RETENTION OF MANNED SPACECRAFT OPERATIONS



IDEAL:



Q QUALIFICATION OR VALIDATION

S SUSTAINMENT, USING NON-LIVE FIRE METHODS

To attain and sustain this state of readiness, training strategies must be designed to cover all the bases from individual skill development to combined arms capability. Each weapon system training strategy will differ, but to make the problem manageable, a common set of training levels, in logical sequence, has been developed:

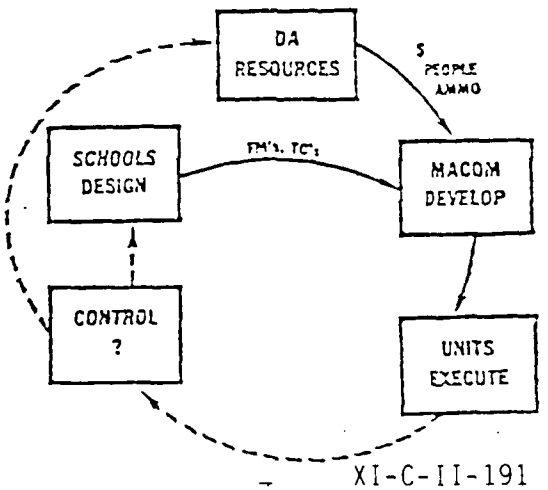
- Individual proficiency.
- Crew proficiency.
- Crew battlefield marksmanship proficiency.
- Fighting unit (e.g., platoon) proficiency.
- Combined arms proficiency.

In developing unit training requirements, the following questions need to be answered:

- What are the specific skills required at each level?
- What are the most efficient and effective methods to train these skills?
- How is proficiency tested or assured at each level?
- What triggers the requirement to retain or revalidate proficiency at each level (e.g., skill decay, crew member changes)?
- At what point, and how, does maneuver training become an element of each level?
- Where is live ammunition required?

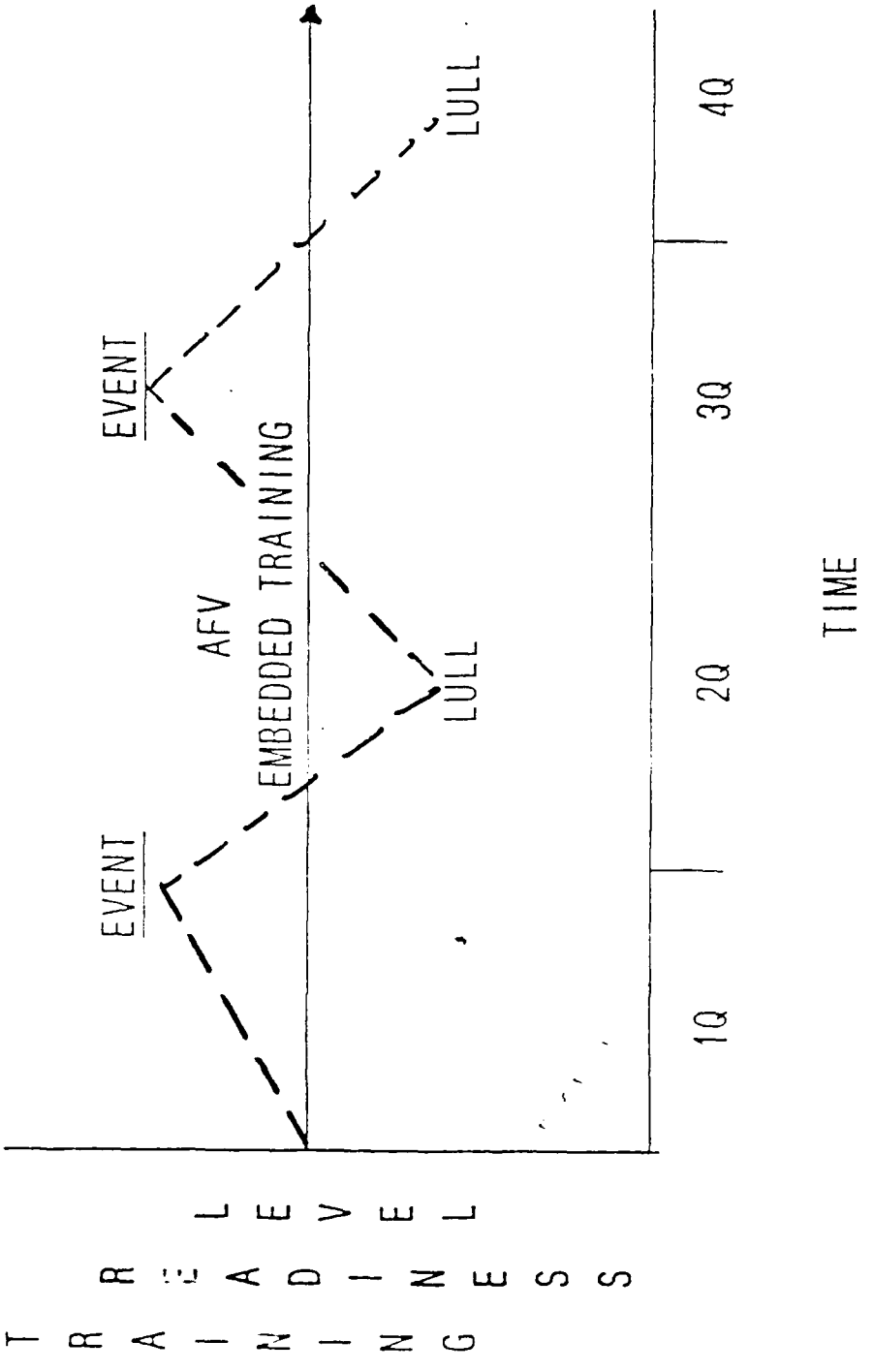
An analysis of a weapon system using this methodology can disclose gaps and redundancies and assist in the development of training resource requirements.

ISD MODEL - APPLIED TO UNIT TRAINING



Analysis also required an evaluation of how and where to use live ammunition in the training process. This logical process for unit training design closely parallels the logic of the Instructional Systems Design (ISD) process used in the development of institutional training programs. What is missing from the current unit training approach is a full scale front end analysis and the links that would make it a system - a measurable set of unit standards that can provide feedback to the organizations that design and resource the training process. There is no organized "control" mechanism in the current approach.

INCREASING AND SUSTAINING UNIT TRAINING READINESS



ENCLOSURE 18

UNCLASSIFIED

ENCLOSURE 19

XI-C-II-194

SUSTAINMENT TRAINING

TANK BATTALION EXAMPLE #1

TE/TK/YR

ALT 1

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG BASE	OPTEMPO	AMMO TYPE I	AMMO TYPE II	AMMO 7.62	AMMO 30MM	AMMO 120MM
COLLECTIVE TRAINING										
A	CPX	3(7)	3(4)	12	Ø					
B	LFX	3(2)	1(1)	2	12,552					
C	DEPEX	1	4	4	2328					
D	NTC	3(3)	2(1)	9	20865					
E	FTX	3(3)	3(1)	12	11,592					
F	FCX	1(1)	1(1)	2	774					
G	LFX	4(4)	1(1)	12	16052	286	112	66,018	17,978	3096
H	SIMU									
CREW/INDIVIDUAL TRAINING										
A	QUAL	D	1	10	7254	3258	1392	12,276	3060	1161
B	SUST	2	1	10	3354					
C	SIMU	1	15	10	Ø					
D	TIER	1	6	20	Ø					
E	I/QUAL	2	1	10	Ø					
F	MILTNG	1	3	6	Ø					
G	PRTNG	1	60	60	3480					
	TOTAL			183	47,554	3544	1504	12,818	3060	4257

ALT 2

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG BASE	OPTEMPO	AMMO TYPE I	AMMO TYPE II	AMMO 7.62	AMMO 30MM	AMMO 120MM
COLLECTIVE TRAINING										
A	CPX	1(1)	1(1)	1	Ø					
B	LFX	1(1)	1(1)	1	1812					
C	DEPEX	1	4	4	2328					
D	NTC	2(2)	1(1)	2	1810					
E	FTX	3(3)	2(1)	2	1452					
F	FCX	1(1)	1(1)	1	354					
G	LFX	3(3)	1(1)	1	2488	672	112	4,704		336
H	SIMU									
CREW/INDIVIDUAL TRAINING										
A	QUAL	4	1	4	1618	2352	1176	16,464		1344
B	SUST	4	1	4	1618					
C	SIMU	1	1	10	Ø					
D	TIER	1	1	10	Ø					
E	I/QUAL	1	1	10	Ø					
F	MILTNG	1	1	6	Ø					
G	PRTNG	1	1	10	3620					
	TOTAL			82	33,326	3024	1288	16,464		1344

CL III / CL IX

ALT 1	ALT 2	Δ
47,554	− 33,326	= 14,228

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG BASE	OPTEMPO	AMMO TYPE I	AMMO TYPE II	AMMO 7.62	AMMO 30MM	AMMO 120MM
COLLECTIVE TRAINING										
A	CPX									
B	CFX			2	1812					
C	DEPEX									
D	NTC			3	2718					
E	FTX			8	7248					
F	FCX									
G	LFX			4	1354	294	56	1,354		168
H	SIMU									
CREW/INDIVIDUAL TRAINING										
A	QUAL			2	905	672	448	2,352		336
B	SUST			2	452					
C	SIMU									
D	TIER									
E	I/QUAL									
F	MILTNG									
G	PRTNG			10	1130					
	TOTAL			31	14,228	966	504	3,706		504

MAIN GUN ROUNDS

ALT 1	ALT 2	Δ
5800	− 4524	= 1276

POM 93 FORCE TRANSITION (55 BNS)

24%

ALT 1		ALT 2		
$544,641,450	[redacted]	$412,965,740	[redacted]	$131,675,720

UNCLASSIFIED

SUSTAINMENT TRAINING

TANK BATTALION SAMPLE #2

ALT 1

EVENT #	EVENT DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION 120MM TPT-T	120MM HEAT-MP	7.62	CAL .50	5.56
COLLECTIVE TRAINING										
A	CPX	3(1)	3(4)	13	0					
B	CFX	2(2)	1(1)	5	7332					
C	DEPEX	1	4	4	2320					
D	MCX	3(3)	3(1)	9	2880					
E	EFX	3(3)	3(3)	24	21,456					
F	ECX	1(1)	1(1)	2	234					
G	LFX	4(4)	1(2)	12	10032	986	774	163,104	42,906	546
H	SIMU									
CREW/INDIVIDUAL TRAINING										
A	QUAL	5	2	10	7334	5278	1382	12,760	1060	1654
B	SUST	5	2	10	5326					
C	SIMU	1	10	10	0					
D	STEP	1	2	10	0					
E	I/OSUT	5	2	10	0					
F	MIL TNG	2	3	6	0					
G	MI TNG	1	20	60	1580					
-	TOTAL			185	47,334	42,34	1566	176,864	17,966	2151

ALT 2

EVENT #	EVENT DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION 120MM TPT-T	120MM HEAT-MP	7.62	30MM	5.56
COLLECTIVE TRAINING										
A	CPX	3(1)	3(4)	15	0					
B	CFX	2(1)	1(1)3	5	2870					
C	DEPEX	1	4	4	2320					
D	MCX	3(3)	1(1)3	6	1920					
E	EFX	3(3)	1(1)3	8	7332					
E	ECX	1(1)	1(1)	2	234					
G	LFX	4(4)	1(1)3	8	2688	696	116	42,456	31,959	339
H	SIMU									
CREW/INDIVIDUAL TRAINING										
A	QUAL	6	1 3	6	2213	1634	696	6382	2090	812
B	SUST	6	1 3	6	1036					
C	SIMU	1	10	10+63	0					
D	STEP	1	8	20	0					
E	I/OSUT	1	2	10	0					
F	MIL TNG	2	3	6	0					
G	MI TNG	1	30S	30	1740					
	TOTAL			295	23,238	2330	812	23,118	33,969	1151

ENCLOSURE 20

UNCLASSIFIED

XI-C-II-195

UNCLASSIFIED

CL III / CL IX

ALT 1 — ALT 2 = Δ

47,554 − 22,745 = 24,809

EVENT #	EVENT DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION 120MM TPT-T	120MM HEAT-MP	7.62	30MM	5.56
COLLECTIVE TRAINING										
A	CPX			2	1872					
B	CFX									
C	DEPEX			3	960					
D	MCX			16	14,304					
E	EFX									
F	ECX			4	1344	290	58	33,349	13,969	169
G	LFX									
H	SIMU									
CREW/INDIVIDUAL TRAINING										
A	QUAL			4	1809	1627	696	2380	2090	812
B	SUST			4	2560					
C	SIMU									
D	STEP									
E	I/OSUT									
F	MIL TNG									
G	MI TNG			30	1740					
	TOTAL			63	27,596	1914	754	39,715	17,989	981

MAIN GUN ROUNDS

	ALT 1		ALT 2		Δ
TTHS	4234	−	2320	=	1914
TPT	1566	−	812	=	754

POM 93 FORCE TRANSITION (55 BNS)

46.7%

ALT 1

$544,641,450

ALT 2

$290,152,830

= $254,488,620

Encl 23

SUSTAINMENT TRAINING MECH BATTALION #1

UNCLASSIFIED

UNCLASSIFIED

ALT 1

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION AUTHORIZATIONS (TRAC) ADFS	TPT	TOW	COAX	30 MM	ILLUM
	COLLECTIVE TRAINING										
A	CPX	3(1)	2(1)	9	Ø						
B	CFX	3(2)	2(2)	18	2538						
C	DEPEX	1	4	4	2160						
D	MCX	3(3)	3(1)	12	7200						
E	FTX	3(3)	3(3)	24	18,126						
F	FCX	1(1)	1(2)	2	198						
G	LFX	2(2)	1(1)	4	2334	1440	1320	12	12,000	960	
H	SIMU										
	CREW / INDIVIDUAL TRAINING										
A	QUAL	10	2	20	3,672	2280	2304		18,000		432
B	SUST	1	12	12	2,880						
C	SIMU	1	10	10							
D	TREP	3	4	20							
E	T/QUAL	5	2	10							
F	MILTNG	2	3	6							
G	IR TNG	1	60	60	3240						
	TOTAL			201	47,274	22,080	23,304	12	138,120	960	432

ALT 2

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION AUTHORIZATIONS (TRAC) ADFS	TPT	TOW	COAX	30 MM	ILLUM
	COLLECTIVE TRAINING										
A	CPX	3(1)	2(1)	9	Ø						
B	CFX	3(2)	1(1)	3	2538						
C	DEPEX	1	4	4	2160						
D	MCX	3(3)	2(1)	9	5400						
E	FTX	3(3)	2(2)	16	12,372						
F	FCX	1(1)	1(1)	2	198						
G	LFX	2(2)	1(1)	4	2334	1440	1320	12	12,000	960	
H	SIMU			12							
	CREW / INDIVIDUAL TRAINING										
A	QUAL	9	2.5	18	3,366	21,984	22,311		138,000		384
B	SUST	1	1a3	10	5,602						
C	SIMU	1	10	10-21							
D	TREP	3	4	20							
E	T/QUAL	5	2	10							
F	MILTNG	2	3	6							
G	IR TNG	1	303	300	2280						
	TOTAL			201	55606	21,984	23,311	12	48,820	960	384

CL III / CL IX

ALT1 — ALT2 = △

47,274 — 35,606 = 11,668

PRINCIPLE ROUNDS

ALT1		ALT2		△
29,280	—	27,444	=	1836
25,344	—	23,751	=	1593
138 900	—	148 920	=	9780
432	—	389	=	43

ALT 1 — ALT 2 = POM 93 FORCE (45 BNS)

#166,352,535 — #138,080,477 =

#28,272,058 (16.99%)

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION AUTHORIZATIONS (TRAC) ADFS	TPT	TOW	COAX	30 MM	ILLUM
	COLLECTIVE TRAINING										
A	CPX				1836						
B	CFX										
C	DEPEX										
D	MCX				1683						
E	FTX				6626						
F	FCX										
G	LFX										
H	SIMU										
	CREW / INDIVIDUAL TRAINING										
A	QUAL				3006	1836	1593	978		43	
B	SUST				880						
C	SIMU										
D	TREP										
E	T/QUAL										
F	MILTNG										
G	IR TNG				1080						
	TOTAL				14668	1836	1593	978		43	

SUSTAINMENT TRAINING MECH BATTALION #2

ALT 1

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION AUTHORIZATION (STRAC) ABMS	TPT	TOW	COAX	80 MM	ILLUM				
	COLLECTIVE TRAINING														
A	CPX	3(1)	2(1)	7	Ø										
B	CFX	3(2)	2(2)	30	2610										
C	DEPEX	1	4	4	2160										
D	MCX	3(3)	3(1)	12	7200										
E	ETX	3(3)	3(3)	24	19170										
F	FCX	1(1)	1(1)	2	198										
G	LFX	2(2)	1(1)	4	2544	1440	1470	14	12,852	960					
H	SIMU														
	CREW/INDIVIDUAL TRAINING														
A	QUAL	10	2	20	3,672	2880	2,352		1176.00		432				
B	SUST	1	12	12	4,980										
C	SIMU	1	10	10											
D	IREP	3	4	20											
E	T/QUAL	3	2	10											
F	MILTWO	2	3	6											
G	RETNG	1	60	60	3,240										
	TOTAL			201	27,234	29,280	13,356	14	13,780	960	432				

ALT 2

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION AUTHORIZATION (STRAC) ABMS	TPT	TOW	COAX	80 MM	ILLUM				
	COLLECTIVE TRAINING														
A	CPX	3(1)	2(1)	7	Ø										
B	CFX	3(2)	1(1)S	5	1524										
C	DEPEX	1	4	4	2160										
D	MCX	3(3)	3(1)S	6	2880										
E	ETX	3(3)	3(1)M	8	6120										
F	FCX	1(1)	1(1)	2	198										
G	LFX	2(2)	1(1)	4	2544	1440	1470	14	12,852	960					
H	SIMU														
	CREW/INDIVIDUAL TRAINING														
A	QUAL	10	15	10	1836	1,920	1,176		71,358		216				
B	SUST	1	12	12	4,980										
C	SIMU	1	10	10.27											
D	IREP	3	4	20											
E	T/QUAL	3	3	10											
F	MILTWO	2	3	6											
G	RETNG	1	30	30	1620										
	TOTAL			201	27,382	15,360	11,352	14	85,350	960	216				

CL III / CL IX

ALT1 — ALT2 = △

49,274 — 27,382 = 19,892

PRINCIPLE ROUNDS

ALT1		ALT2		△
29,280	—	15,360	=	13,920
25,344	—	28,452	=	11,952
158,700	—	85,350	=	73,350
432	—	216	=	216

ALT 1 — ALT 2 = △

#166,352,535 — #92,481,435 = POM 93 FORCE (45 BNS)

#73,871,100 (44.4%)

EVENT #	DESCR	DAYS/EVENT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION AUTHORIZATION (STRAC) ABMS	TPT	TOW	COAX	80 MM	ILLUM				
	COLLECTIVE TRAINING														
A	CPX														
B	CFX				1236										
C	DEPEX														
D	MCX				2760										
E	ETX				12,180										
F	FCX														
G	LFX														
H	SIMU														
	CREW/INDIVIDUAL TRAINING														
A	QUAL				1836	11,520	11,352		71,358		216				
B	SUST														
C	SIMU														
D	IREP														
E	T/QUAL														
F	MILTWO														
G	RETNG				1620										
	TOTAL				27,852	27,312	11,352		71,358		216				

UNCLASSIFIED

UNCLASSIFIED

XI-C-II-197

SUSTAINMENT TRAINING

FA BATTALION EXAMPLE #1

ALT 1

EVENT #	EVENT DESCR	DAYS / EVENT	CREW	AMMUNITION PER RND	AMMUNITION PROGRAMMED	AMMUNITION EXPENDED HE	SMOKE	WP	ILLUM	OTHER
	COLLECTIVE TRAINING									
A	CFX	3(2)	3(2)	8						
B	CEX	3(2)	1(1)	3	192					
C	OPFOR	1	4	4	960					
D	TACX	3(1)	2(1)	1	240					
E	FTX	3(1)	3(3)	3Ø	7,2Ø					
F	FCX	2(1)	2(8)	4	1,536					
G	LFX	2(2)	2(3)	1Ø	2,88Ø	2777	6Y	32	466	
H	STIMU									
	CREW / INDIVIDUAL TRAINING									
A	QUAL	3	2	1Ø		38				
B	SUST	3	2	6						
C	STIMU									
D	TEEP	3	4	2Ø						
E	T/OTM	6	2	1Ø						
F	MI INS	3	3	9						
G	MI INS	1	6Ø	6Ø	1,44Ø					
	TOTAL			187	17,188	12992	6Y	32	466	

ALT 2

EVENT #	EVENT DESCR	DAYS / EVENT	FREQ	AMMUNITION PER RND	AMMUNITION PROGRAMMED	AMMUNITION EXPENDED HE	SMOKE	WP	ILLUM	OTHER
	COLLECTIVE TRAINING									
A	CFX	3(1)	2(2)	8						
B	CEX	3(2)	1(1)	3	192					
C	OPFOR	1	4	4	960					
D	TACX	3(1)	0(1)	1	240					
E	FTX	3(1)	3(3)S	32	4,224					
F	FCX	2(1)	1(1)S	2	128					
G	LFX	2(2)	1(2)S	6	1,536	2898	6Ø	1Ø	324	
H	STIMU									
	CREW / INDIVIDUAL TRAINING									
A	QUAL	3	2	1Ø		38				
B	SUST	3	2	6						
C	STIMU				135					
D	TEEP	3	4	2Ø						
E	T/OTM	3	2	1Ø						
F	MI INS	3	3	9						
G	PRTNG	1	2Ø3	4Ø	8,16Ø					
	TOTAL			187	10,123	2898	6Ø	1Ø	324	

CL III / CL IX

ALT 1	ALT 2	Δ
14,188	1Ø,424	3764
$638,46Ø	$469,Ø8Ø	$169,38Ø

1/5 mi

EVENT #	EVENT DESCR	DAYS / EVENT	FREQ	AMMUNITION PER RND	AMMUNITION PROGRAMMED	AMMUNITION EXPENDED HE	SMOKE	WP	ILLUM	OTHER
	COLLECTIVE TRAINING									
A	CFX									
B	CEX									
C	OPFOR									
D	TACX									
E	FTX				1,728					
F	FCX				228					
G	LFX				960	1365	2Y	12	144	
H	STIMU									
	CREW / INDIVIDUAL TRAINING									
A	QUAL									
B	SUST									
C	STIMU									
D	TEEP									
E	T/OTM									
F	MI INS									
G	PRTNG				288					
	TOTAL				3764	1365	2Y	12	144	

MAIN QUAL ROUNDS

ALT 1	ALT 2	Δ
4886	3402	1484
$1,335,552	$993,Ø48	$452,5Ø4

POM 93 FORCE TRANSITION (36 BNS)

ALT 1

$75,Ø24,432

ALT 2

$52,636,6Ø8

$22,387,824

ENCLOSURE 23

XI-C-II-198

FA BATTALION SAMPLE #2

ALT 1

EVENT #	DESCR	DAYS / EVNT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION HE	AMMUNITION SMOKE	AMMUNITION WP	AMMUNITION ILLUM	STRAC
COLLECTIVE TRAINING										
A	CPX	3(2)	2(2)	8						
B	CFX	3(2)	1(1)	5	772					
C	DIVEX	1	4	4	360					
D	TECX	3(1)	0(1)	1	240					
E	FTX	3(4)	1(5)	10	2220					
F	FCX	1(1)	2(2)	4	1836					
G	LFX	2(2)	2(5)	10	2400	4245	53	32	388	
H	SIMU									
CREW / INDIVIDUAL TRAINING										
A	QUAL	5	2	10		28				
B	SUST	3	2	6						
C	SIMU									
D	IITP	3	4	20						
E	I/QUAL	5	2	10						
F	MET/TNG	3	3	9						
G	OTHR	1	60	60	1776					
	TOTAL			187	14188	7292	81	32	388	

[redacted]

ALT 2

EVENT #	DESCR	DAYS / EVNT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION HE	AMMUNITION SMOKE	AMMUNITION WP	AMMUNITION ILLUM	STRAC
COLLECTIVE TRAINING										
A	CPX	3(2)	2(2)	8						
B	CFX	3(2)	1(1)	5	772					
C	DIVEX	1	4	4	360					
D	TECX	3(1)	0(1)	1	240					
E	FTX	3(4)	1(3)	9	1728					
F	FCX	1(1)	1(1)	2	528					
G	LFX	2(2)	1(1)	4	960	1980	40	20	218	
H	SIMU									
CREW / INDIVIDUAL TRAINING										
A	QUAL	3	2	10		28				
B	SUST	3	2	6						
C	SIMU			60						
D	IITP	3	4	20						
E	I/QUAL	5	2	10						
F	MET/TNG	3	3	9						
G	OTHR	1	30	30	780					
	TOTAL			187	5348	1988	40	20	218	

[redacted]

ENCLOSURE 24

UNCLASSIFIED

X1-C-II-199

UNCLASSIFIED

CL III / CL IV

ALT 1	ALT 2	Δ
14,188	— 5,348	= 8,840
$638,460	— $240,660	= $397,800

$45/mi

EVENT #	DESCR	DAYS / EVNT	FREQ	ANNUAL TNG DAYS	OPTEMPO	AMMUNITION HE	AMMUNITION SMOKE	AMMUNITION WP	AMMUNITION ILLUM	STRAC
COLLECTIVE TRAINING										
A	CPX									
B	CFX									
C	DIVEX									
D	TECX									
E	FTX				2142					
F	FCX				528					
G	LFX				1430	2304	34	22	234	
H	SIMU									
CREW / INDIVIDUAL TRAINING										
A	QUAL									
B	SUST									
C	SIMU									
D	IITP									
E	I/QUAL									
F	MET/TNG									
G	OTHR				220					
	TOTAL				6840	8304	34	22	234	

MAIN GUN ROUNDS

ALT 1	ALT 2	Δ
4886	— 2262	= 2624
$1,445,552	— $669,226	= $776,326
	$644,281	$800,114

DOM 93 FORCE TRANSITION (36 BNS)

ALT 1

$75,024,432

[redacted]

ALT 2

$32,755,896

[redacted]

$42,268,536

56.3

(U) ARMORED FAMILY OF VEHICLES

TASK FORCE

PHASE I REPORT

PART III

(U) SUMMARY

(U) PART III. SUMMARY

(This Part Is Unclassified)

1. Purpose. The purpose of this part is to summarize the major conclusions from Part I, Institutional and Part II, unit analysis.

2. Recapitulation. The following represent the major issues and requirements regarding the AFV training subsystem.

a. A simulation based training subsystem developed concurrently with operational equipment can result in better cost ratios for comparing current O&S costs with those projected for the AFV and will:

(1) Improve the capability to train.

(2) Provide high fidelity representation of specified individual and collective tasks conditions and standards.

(3) Provide commanders/commandants with a much higher degree of flexibility than currently available because a complete training system can be readily at hand to be exercised when required.

(4) Provide insulation (insurance) against the uncontrollable, e.g.,

(a) Budget cuts.

(b) Weather.

(c) Facility constraint.

(d) Maneuver and live fire constraints.

(e) Advanced technology that results in systems that can only be trained with simulation, e.g., directed energy weapons.

b. Technology is sufficiently mature to provide a training capability at essentially any level of complexity desired and with fidelity adequate to realistically portray the conditions and exact the standards required for combat tasks.

c. Industry is capable of manufacturing required training capability into combat systems (embedded) or as standalone simulation that replicates combat system functions.

d. An up front investment for embedded training at the unit and standalone simulation at the institution can reduce AFV system life cycle costs. This is done by lowering the current ratios associated with ammunition and OPTEMPO required for

readiness and reducing the requirements for facilities, ranges, literature and training associated force structure.

e. Specific training programs can be developed and validated to train soldiers and units to combat standards and sustain those standards through the use of simulation.

f. The role of live ammunition and operational equipment -- can shift to validating the training proficiency attained through simulation and providing the realism and confidence associated with actually firing and operating combat equipment.

g. A top down Army level program developed with full MACOM participation and consensus will be required to execute a new institutional and unit training concept that significantly reduces the current levels (ratios) of training ammunition and OPTEMPO.

h. All training concepts and programs must be developed and validated with full participation of the user.

i. The credibility, applicability and effectiveness of each AFV system training program must be demonstrated to the Army in terms of soldier and unit capability to execute combat tasks under appropriate conditions to required standards.

j. Once effectiveness is accepted and consensus is gained, Army Regulations and MACOM directives must be changed to reflect training changes.

k. An effective feedback system must be established between the developer and the user to provide two-way communication and the capability to fine tune training programs.

3. Summary. The following tables summarize the major issues in graphic format.

a. The assumption used to develop the institutional and unit training strategies are as displayed in Table 1.

AFV TRAINING ASSUMPTIONS

- NECESSARY TECHNOLOGY WILL BE AVAILABLE
  - Vetronics
  - Modular Fire Control
  - VHSIC
  - Software
- EMBEDDED TRAINING SUBSYSTEM WILL HAVE THESE CAPABILITIES
  - Individual Training
  - Crew Training
  - Collective Training Up to Company
  - Force on Force
  - Driver Training
- STANDALONE TRAINING SUBSYSTEM WILL BE PART OF INITIAL ACQUISITION
- STANDALONE SUBSYSTEM WILL SUPPORT TRANSITIONAL INSTITUTIONAL AND RC TRAINING

Table 1. Training Assumptions

b. The basic AFV training concept is displayed in Table 2. The essential point is that with the proper mix of simulation, operational equipment and live fire, Army wide training readiness can be attained and sustained.

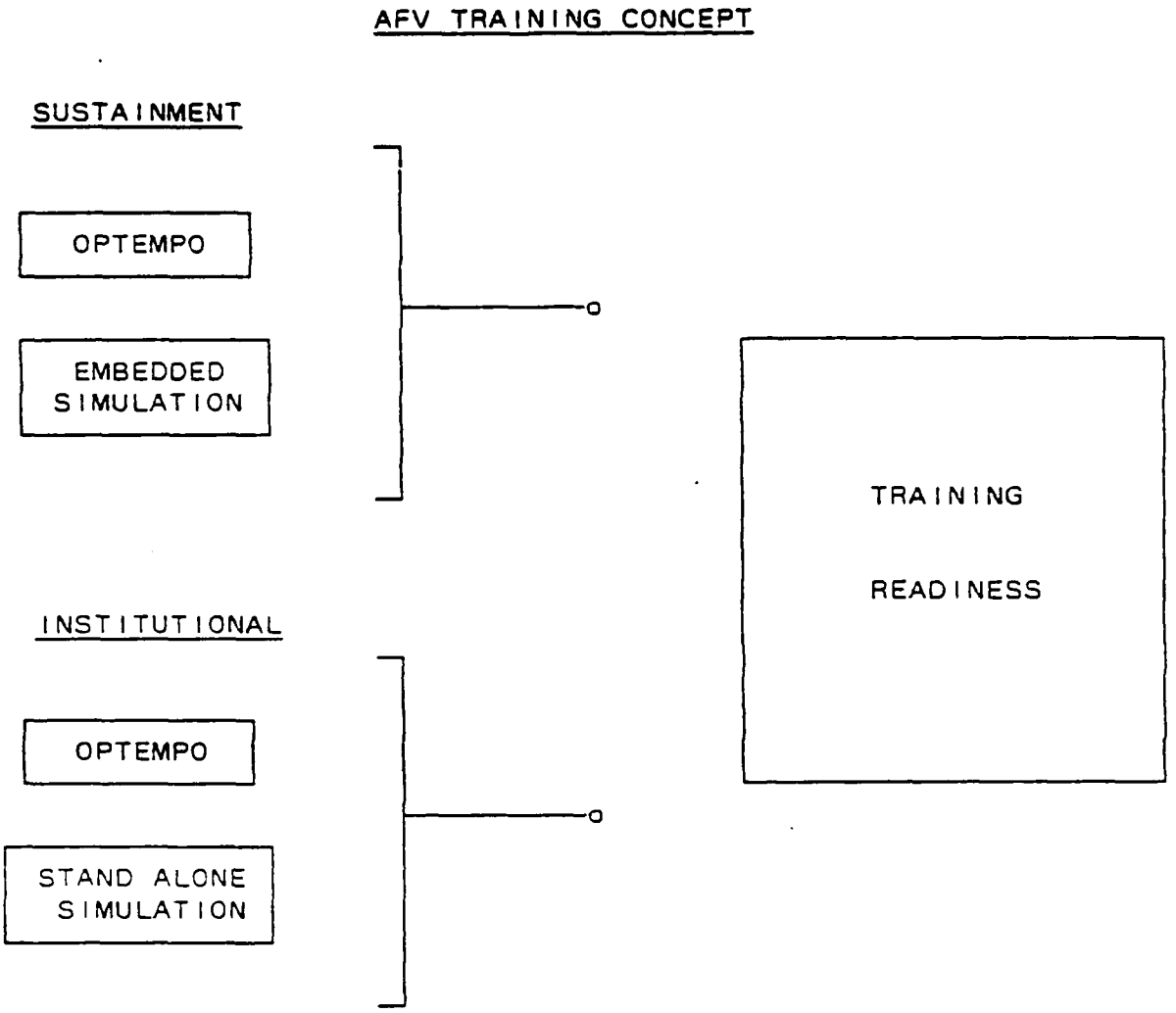


Table 2. Training Concept

c. In the field, the AFV training concept would be executed as displayed in Table 3.

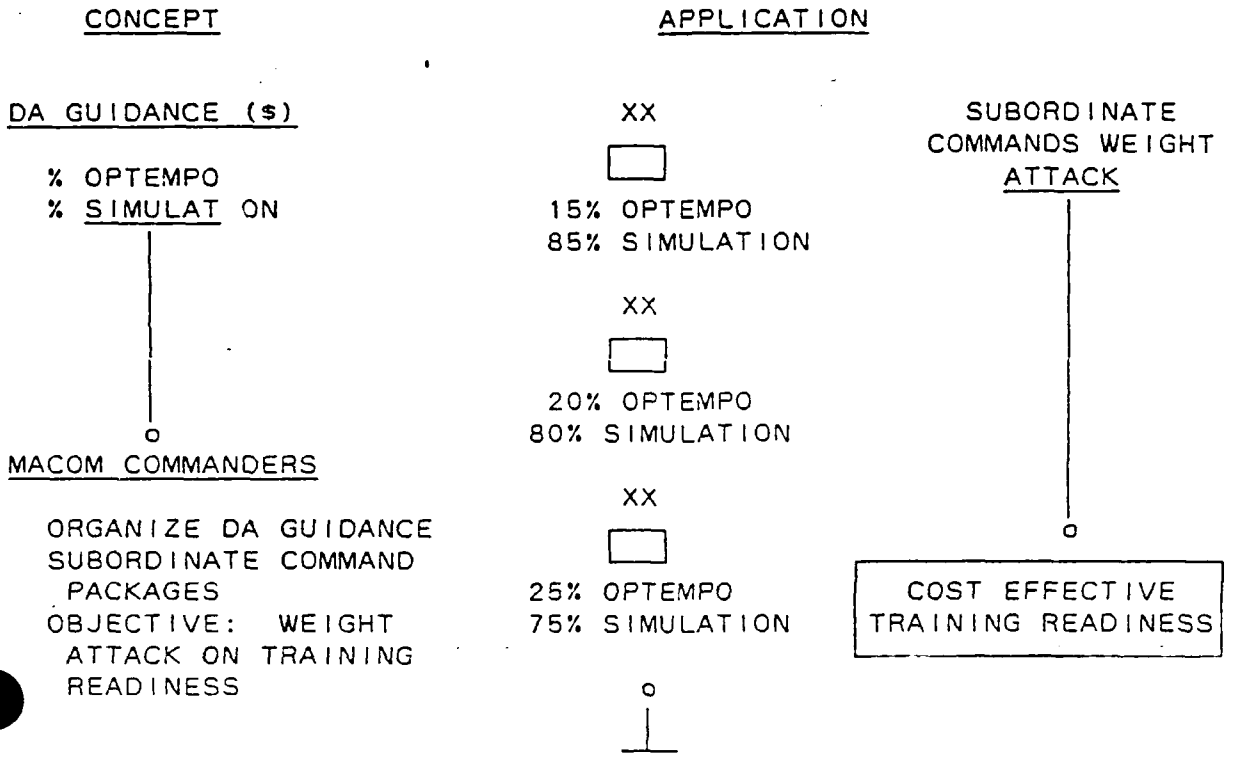


Table 3. Application

The essential issue is that within DA guidance, MACOM commanders would be provided the flexibility to "weight the training attack" towards the units they feel require a greate: or lesser amount of ammunition or OPTEMPO to attain and sustain readiness.

d. An embedded training capability will be the corner-stone of unit training. The concept is shown in Table 4.

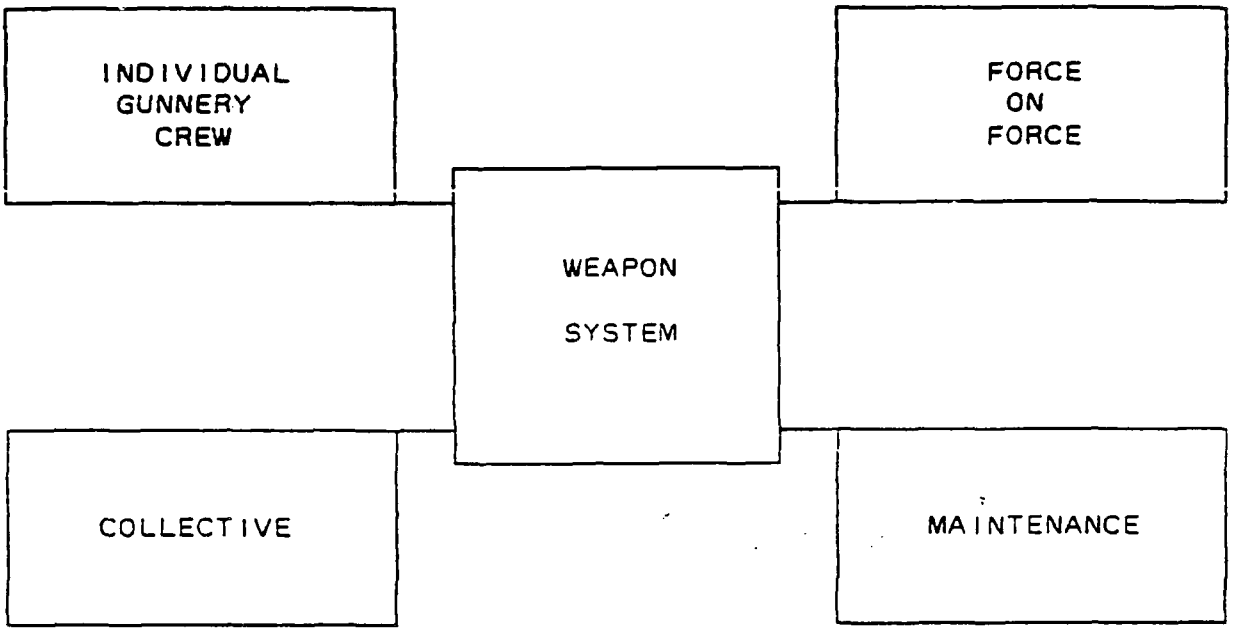


Table 4. Embedded Training

The essential issue is that the unit commander is provided an internal capability to attain and sustain his required level of training readiness within his own resources.

e. The flexibility provided by a coherent and nettable (vehicle to vehicle linkage) embedded capabilities is as shown in Table 5.

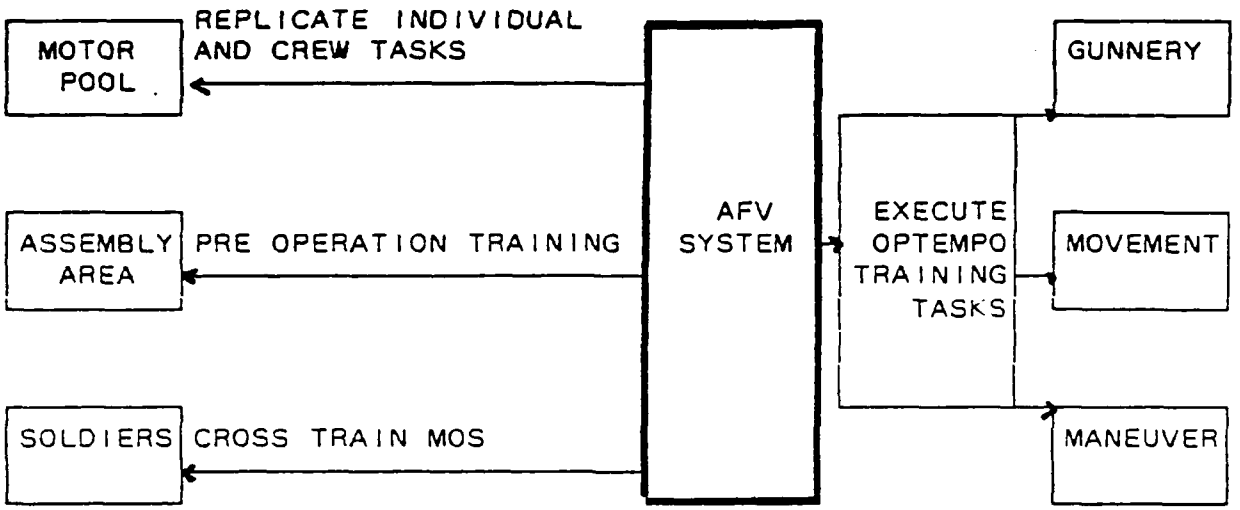


Table 5. Embedded Flexibility

The essential issue is that the commander has the readily available in-house capability to maintain combat readiness.

f. The AFV institutional training concept is displayed in Table 6.

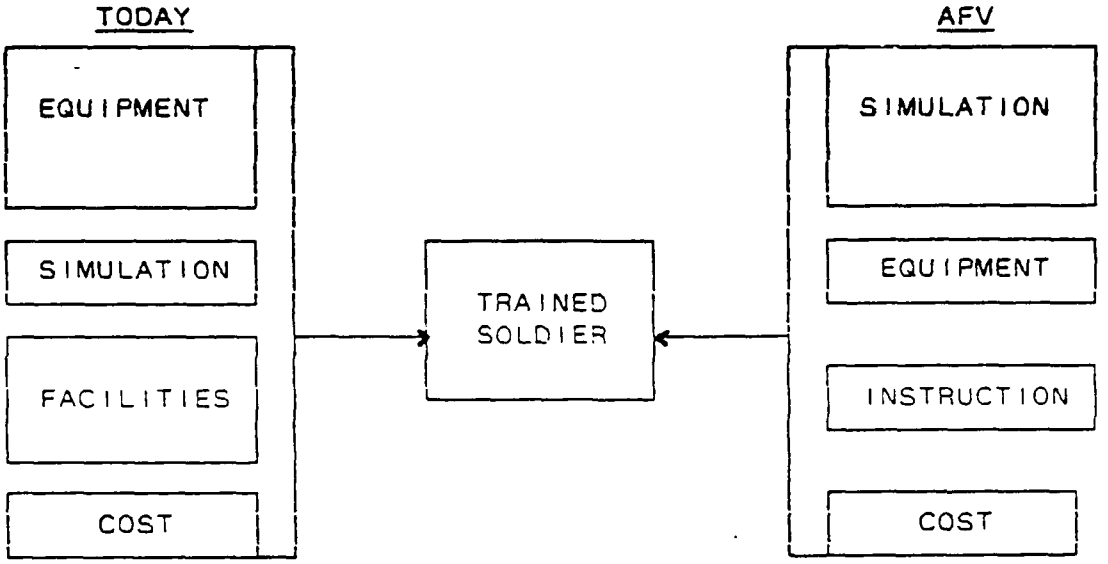


Table 6. AFV Institutional Training

The issue is that with an up front investment in large multistation cheap simulation, the bulk of institutional training can be accomplished with simulation and validated with live fire and operational equipment.

g. Table 7 portrays the annual savings for the POM 93 force by type battalion using various levels of simulation to accomplish the events contained in the Battalion Level Training Model.

UNIT	# BNS POM 93 FORCE	CURRENT COST POM 93 FORCE	COST WITH CONSERVATIVE SIMULATION	COST WITH EXTENSIVE SIMULATION	ANNUAL SAVINGS	
					CONSERVATIVE SIMULATION	EXTENSIVE SIMULATION
FABN M109	36	75,024,432.0	52,636,608.0	32,755,896.0	22,387,824.0	42,268,536.0
MECH BN M2	45	166,352,535.0	138,080,477.0	92,481,435.0	28,272,058.0	73,871,100.0
TANK BN M1	55	544,641,450.0	412,965,740.0	290,152,830.0	131,675,720.0	254,488,620.0

Table 7. Cost Comparisons

The essential issue is that a coherent and mature embedded training capability can result in O&S savings from 20% to 50% based upon the level and extent of simulation the Army is willing to accept.

h. In terms of commitment the message portrayed in Table 8 is the decision the Army must make if O&S costs are to be reduced and a high level of training readiness maintained.

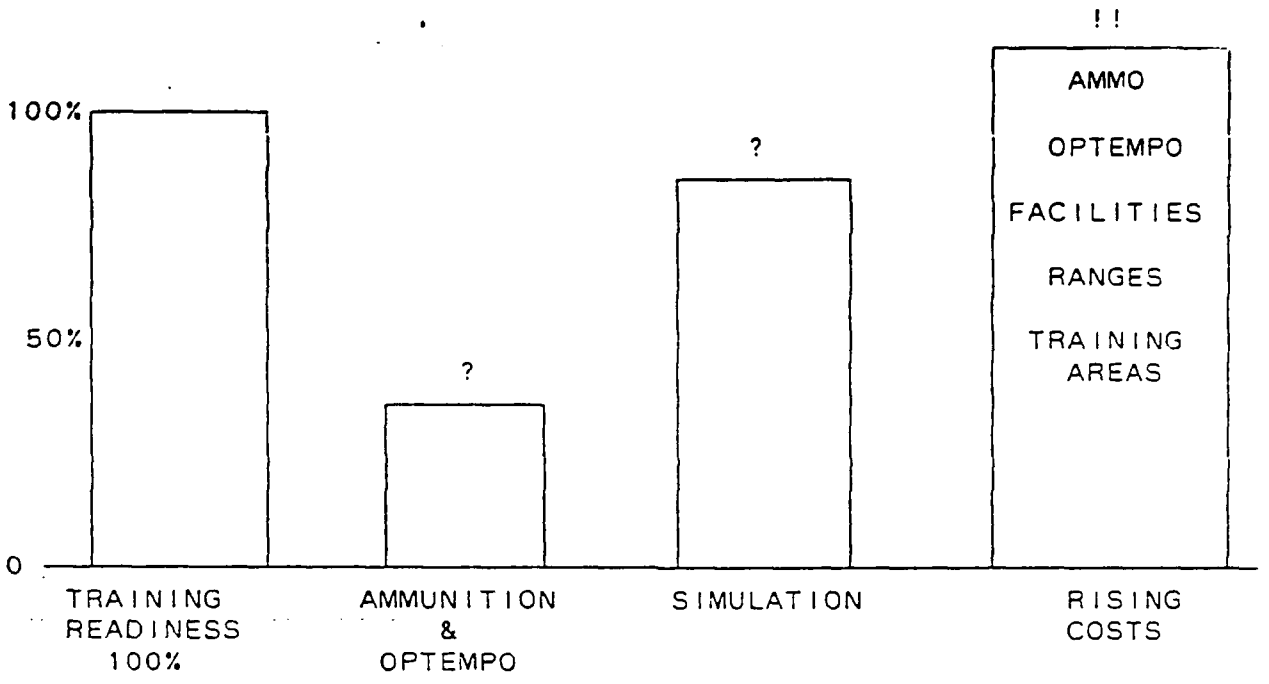
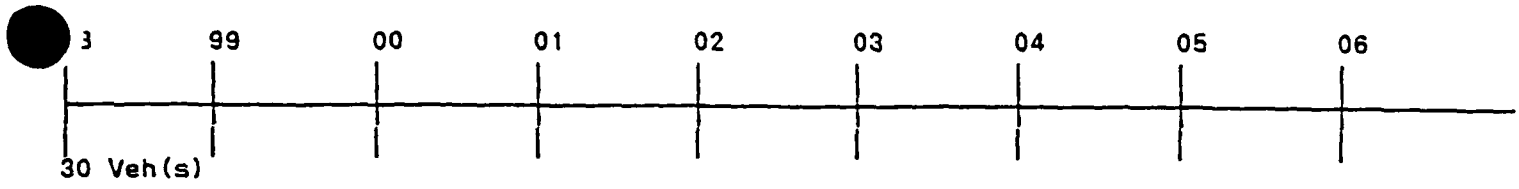


Table 8. The Decision

The essential issue is that if the Army doesn't break from the traditional mold of business as usual training and invest upfront -- the opportunity to effect the action will be missed and training will be priced out of the competitive market.

i. The final table is a graphic lay down of what can accrue to the Army in terms of combat operational equipment if an embedded training capability is manufactured into the AFV.



30 Veh(s)

60 Veh(s)

90 Veh(s)

120 Veh(s)

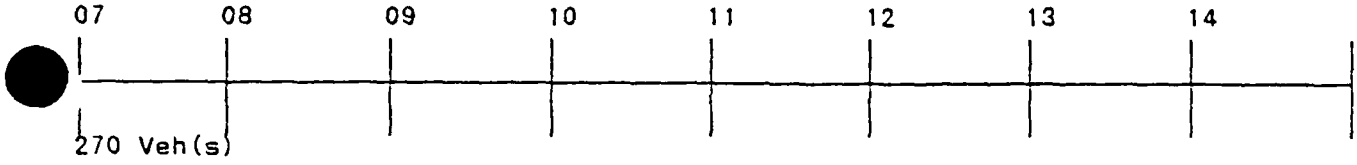
150 Veh(s)

180 Veh(s)

210 Veh(s)

240 Veh(s)

240 Veh(s)



270 Veh(s)

300 Veh(s)

330 Veh(s)

360 Veh(s)

390 Veh(s)

420 Veh(s)

450 Veh(s)

480 Veh(s)

* Based on the following data sources

1. TACOM estimate to embed training $3,349
2. TACOM total vehicle cost estimate $3M

TOTAL: 4080

Table 9. AFV Training Savings Procurement Opportunity Schedule

The essential issue is that with an up front investment in training -- the Army can accrue approximately 4000 combat vehicles over a 15 year period -- that would not have been available if -- we continue to train along the lines of

- BUSINESS AS USUAL -

APPENDIX D

(U) DISPLACED EQUIPMENT TRAINING

TO SUPPORT TRANSITION

OF

THE ARMORED FAMILY OF VEHICLES
(This Appendix Is Unclassified)

SEPTEMBER 1987

DISPLACED EQUIPMENT TRAINING (DET) TO SUPPORT TRANSITION

OF THE

ARMORED FAMILY OF VEHICLES (AFV)

1. Problem. Determine the displaced equipment training program associated with transitioning the current fleet of armored vehicles from the Active to the Reserve Components (RC). This action is concurrent with transition of the AFV into the Active Component (AC) and RC Roundout units.

2. Assumptions.

a. AFV will:

(1) Be transitioned into the Army beginning 1996.

(2) Contain about 42,000 vehicles of which 2400 will be fielded annually.

(3) Transition at the rate of a brigade slice a quarter and a division fielded each year.

(4) Be transitioned into RC roundout units along with active counterpart.

b. There are 228 battalion-size units that will exchange the current armored fleet for the AFV. The breakout by unit type is as follows:

(1) 19 Ground Cavalry Squadrons,

(2) 45 Mechanized Battalions,

(3) 55 Armor Battalions,

(4) 36 155 SP Battalions,

(5) 17 8-Inch SP Battalions,

(6) 8 Lance Battalions,

(7) 5 MLRS Battalions, and

(8) 48 Combat Engineer Battalions

c. The current AC armored vehicle fleet will be transitioned into the RC.

d. All maintenance equipment (tools, TMDE, PLL, literature) and training equipment (simulation, devices, literature) will be transferred with the vehicles.

e. Armored vehicles currently in the RC will be replaced by new equipment and phased out of the Army inventory.

f. Brigade size quantities of displaced armored vehicles will be available for transition to RC on a quarterly basis beginning in 4Q96.

g. The RC will transition at essentially the same rate as the AC.

h. The ARNG and USAR will develop their respective unit priorities and transition schedules in coordination with FORSCOM.

i. Sufficient facilities appear to exist in the RC to accomplish an orderly and efficient transition. Included are:

(1) 2000 Armories in existence.

(2) 19 Regional Training Sites currently under construction.

(3) At least one Consolidated Maintenance Site (CMS) in each state.

(4) At least one Mobilization and Training Equipment Site (MATES) in each state.

(5) 54 ARNG academies, one per state and territory.

(6) 90 US Army Reserve Forces (USARF) Schools.

(7) 12 USAR Training Divisions.

(8) An USAR Equipment Training Sites (ETS) located at major mobilization sites.

(9) At least one Army Maintenance Support Activity (AMSA) in each state.

j. Some storage requirement is anticipated to hold equipment the RC cannot immediately accept.

k. Transition and train up will be accomplished within current RC annual training time authorizations.

l. CMS, MATES, ETS and AMSA can continue to accommodate unit configurations in regards to maintenances, parking and security.

m. Contractor support will be required for in and out processing of old and new equipment and technical training.

n. A central management facility as a part of the AFV Program Executive Office will be required by the RC to ensure long range planning, funding, orderly flow of equipment in and out of units and efficient transition training.

p. Transition of displaced equipment into the RC is of the same order of magnitude and complexity as transitioning the AFV into the AC.

3. Facts.

a. The following ARNG units may be affected by AFV (Roundout) or displaced equipment:

(1) 48 Armor Battalions,

(2) 43 Mechanized Battalions,

(3) 16 Ground Cavalry Squadrons,

(4) 44 Combat Engineer Battalions,

(5) 36 155mm SP Battalions,

(6) 34 8-inch Battalions

b. The following USAR units can be affected:

(1) 2 Mechanized Battalions,

(2) 2 Armor Battalions,

(3) 3 155 SP Battalions,

(4) 9 8-inch Battalions,

(5) 33 Combat Engineer Battalions,

(6) 7 Company Size Roundout Units (2 MI and 5 EN).

c. Upon mobilization, the majority of ordnance and maintenance units to support the current fleet of armored vehicles and the new Armored Family of Vehicles are located in the RC.

d. Development and execution of a comprehensive and detailed Displaced Equipment Training Plan is essential to transition success.

4. Discussion.

a. All factors indicate that with proper planning and programming, coordination, notification and leadtime, the transition effort can be essentially accomplished within the

current and projected RC capabilities, facilities, and infrastructure. The process would be essentially as follows:

(1) Army makes decision to transition AFV into AC and Roundout units.

(2) Current armored fleet programmed for transition into RC.

(3) ARNG/USAR establishes central management facility (8-12 personnel) at the national level to transition new equipment into their respective units and dispose of old equipment.

(4) DA DCSOPS publishes schedule for AC transition two to three years ahead of deployment.

(5) RC central management facility identifies units to receive displaced equipment. The following activities begin:

(a) Receiving State Adjutants General (AG) notified.

(b) State Maintenance Officers briefed.

(c) Facilities at CMS, MATES, ETS and AMSA are evaluated to ensure they can accommodate incoming equipment. New requirements identified and programmed for solution.

1) CMS and ETS provide heavy duty maintenance and repair capability and is staffed with full-time personnel.

2) MATES and AMSA store equipment for using units and maintain it at operational levels. Each is staffed with full-time personnel.

(d) Full-time CMS, ETS, AMSA and MATES personnel identified for training. Training programs and materiels are developed or provided by appropriate service schools.

(e) Maintenance training subsystem (publication, devices, and simulations) identified for installation at CMS, ETS, AMSA, and MATES.

(f) PLL, Tools, TMDE, etc. required to receive and maintain new equipment are identified and programmed.

(g) Individual and collective training programs developed for operation and maintenance for initial train up (DET), additional training required to enhance DET and sustainment training for readiness.

(6) Regional Training Sites (RTS), situated at high density heavy equipment locations, alerted to begin planning and

programming for new training requirements. Their purpose is to provide maintenance training facilities for maintainers and leaders. The principle objective of the RTS will be to provide maintenance transition and sustainment training for new equipment.

(7) USAR Schools alerted to begin planning and programming training requirements associated with introduction of new equipment. The USARF schools are MOS producing and will provide significant support to the transition effort. The provision of course ware and course content by proponent schools is essential to their success.

(8) USAR Training Divisions alerted, briefed and directed to begin planning. Although training divisions are oriented towards mobilization missions, they have a capability to assist with OSUT requirements, and must prepare themselves to instruct the new equipment in case of mobilization.

(9) The 54 RC academies, primarily oriented on OCS and NCOES, will be directed to assist in MOS training. New course content will be required from proponent schools.

(10) When specific equipment is identified for transition and a date established:

(a) Displaced Equipment Training Teams (DETT) are identified and positioned.

(b) Representatives from CMS, ETS, AMSA and MATES liaison with AC unit to establish hand-off procedures.

(c) Arrangements are made for transportation, fuel, maintenance, and drivers to move equipment from local rail heads to receiving facilities.

(d) Old equipment is out processed.

(e) New equipment is inspected, serviced and put on-line for training.

(11) Operational units receive DET and program for normal sustainment training.

b. Advantages:

(1) Uses system, facilities concepts and framework currently in existence and specifically tailored and established for RC operation and sustainment.

(a) MATES and ETS currently store and maintain equipment used by units.

(b) MATES and ETS are located on or contiguous to training areas and facilities used by RC units.

(c) Personnel assigned to MATES, ETS, AMSA and CMS are employed by the RC to accomplish a mission that facilitates transition of a new fleet of vehicles.

(d) RTS, USAR schools and ARNG academies are dedicated assets to promote and sustain RC training.

(2) Provides RC the capability to program and execute the transition process in such a way as to take maximum advantage of available training time and facilities.

(3) The strategic selection and use of DETT and contractor support can provide essential early assistance and accomplish training tasks beyond RC capabilities.

(4) Places the leadership of the ARNG and the USAR directly in charge of executing a most significant RC modernization effort.

c. Disadvantages:

(1) Management and execution of the transition effort will tax the capability of the RC over the long term.

(2) Unless carefully sequenced and closely monitored, the transition effort can overwhelm existing facilities.

d. Other alternatives for transitioning must be considered in light of the finite level of flexibility available to the RC. The essential elements are:

(1) ARNG units, facilities (CMS, MATES) and training areas are essentially fixed and subject to the relative autonomy of the state they support.

(2) Unless there is mobilization, the RC are authorized 39 training days a year (ARNG, 38 for the USAR).

(3) A large share of maintenance and repair activities are accomplished by full-time civilian employees. Therefore, the central issue is recognition of problem areas and requirements well in advance of equipment fielding and programming of solutions. Examples are:

(a) Ensuring proponent schools develop course ware and content for initial and sustainment individual and collective training.

(b) Training RC full-time personnel in advance of equipment receipt.

(c) Ensuring facilities can accommodate new equipment.

(d) Ensuring PLL, spares, tools, TMDE will be available.

(e) Determining where contractor support can best supplement or enhance capabilities. Examples are:

1) Processing, inspection, and maintenance of new equipment.

2) Out processing old equipment.

3) Training in technical areas.

4) Movement and delivery of equipment from active unit to CMS, MATES, ETS and AMSA.

5) Security.

6) Additional storage.

5. Conclusions.

a. Modernizing the RC with the current fleet of armored vehicles is a large and complex task requiring central focus and management effort.

b. The RC leadership should be directly in charge of the transition effort.

c. An AFV Displaced Equipment Training Office and appropriate RC manning should be established as part of the AFV Program Executive Office.

d. Through strategically selected and placed DETT and contractor support, the RC are capable of the transition effort without major organizational and facility changes.

e. Early planning and identification of problems and requirements are essential to successful transition.

f. Use of existing RC infrastructure provides the most rational and effective approach to the transition effort.

6. Action Recommended.

a. Approve concept to transition the current fleet of armored vehicles under the auspices of the RC leadership using

current RC infrastructure supported by DECL and contractor support that supplement capabilities.

b. Brief and staff concept with NGB and USAR.

c. Develop detailed implementation plan and schedule.

APPENDIX E

(U) TRAINING INPUT TO SUPPORT REQUIRED OPERATIONAL CAPABILITY

(This Appendix Is Unclassified)

8. MANPRINT ASSESSMENT

c. Training Assessment. The material developer and the TRADOC proponent will require the contractor by SOW/RFP to design, develop and validate a complete organic training subsystem for each AFV system. The subsystem will include all training documentation, simulation and devices required for individual and collective training for the institution and unit. Each subsystem will support New and Displaced Equipment Training (NET/DET) and will be available before fielding. All training subsystems will be based upon a device based training strategy. Embedded system trainers are first priority for unit training. Stand-alone simulations and devices are first priority for institutions. Simulation and device priorities are gunnery, maintenance, driver and tactics. All components of the training subsystems will be identified during concept exploration and investigated and validated during proof of principle. Specific device requirements are at Appendix 5.

APPENDIX 5

TRAINING DEVICES

1. Title. Device/simulation requirements for AFV.

2. Operational/Organizational Plan.

a. This annex is the AFV Capstone strategy document for device and simulation development. It provides the concept and approach to integrate training devices and simulations into the development, testing and fielding of the AFV. Proponent School Training Device Annex as will reflect the direction contained in this annex.

b. Training for the AFV systems will be developed using a device based training strategy: competence in individual and collective combat critical tasks will be attained and maintained by simulation. Operational equipment and live fire will be used to validate readiness. This strategy is in consonance with the Standards in Training Commission (STRAC) program as prescribed in DA circular 350-85-4, 16 September 1985.

c. AFV modernization provides a signal opportunity to modernize Army training. The following initiatives are essential to effective forward thinking training development.

(1) The design, test, and fielding of an organic training subsystem concurrent with supported operational equipment for:

(a) AFV force training.

(b) Individual AFV system training.

(c) Institutional training.

(d) Unit training.

(e) All training support requirements.

(2) The use of extensive AFV commonality, modularity, and multiple mission features to:

(a) Compress/centralize/consolidate training particularly in the institution.

(b) Develop common/generic simulations/devices for multi-proponent use.

(c) Expand commonality and applicability of ranges and other training facilities.

(3) Development of complete simulation/device requirements during design, test, and validation.

(4) Elimination of need for non-system or gap filler training equipment and documentation.

(5) Development of cost effective stand-alone simulations for high volume institutional requirements.

(6) Shifting of training/readiness dependency from operational use of equipment to simulation subsystems in the equipment or in stand-alone facilities for the institution.

3. Operational Characteristics.

a. The AFV device based training strategy will provide capability to train and sustain combat critical tasks, individual and collective, in the institution and field.

b. The following are AFV developmental requirements:

(1) Produce combination of embedded capabilities in AFV systems and stand-alone simulations/devices for institutions that replicate system capabilities to the extent that critical individual crew and collective tasks can be trained and maintained to standard.

(2) Develop embedded systems that:

(a) Will net with other embedded systems enabling collective and combined arms training.

(b) Provide unit training capability from individual to ARTEP.

(3) Develop institutional stand-alone simulations/devices that accommodate bulk of initial entry training.

(4) Develop maintenance training simulation that provides predominance of training for all skill levels. Maintenance simulations beyond operator/crew responsibilities may be stand-alone in both the unit and institution.

(5) Develop common driver, maintenance and operator simulations that are adaptable to multiple proponent users.

c. The tested and validated AFV training subsystem should result in the following breakout of available training time:

(1) 60-80%: Train up and sustainment by devices and simulation.

(2) 20-40%: Readiness validation/certification by operational equipment/live fire.

4. Technical Assessment.

a. Embedded training should be integral to the wartime/combat capability. For example, detectors that sense simulated attack in peacetime force on force engagement could sense the vehicle is being painted by enemy radar in combat.

b. The embedded training capability should be transparent to the crew and not interfere with operational/combat capabilities.

c. New training technology (leading edge) equivalent in stature and maturity to that used for operational equipment development will be actively pursued.

d. Refurbishment of current concepts, devices and simulations will not be considered training policy.

e. Gold plating the replication of operational and maintenance capabilities will be avoided. The requirement is to provide the ability to train and maintain critical tasks at standard. Replication of every operational capability is unnecessary and cost prohibitive.

f. Malfunction of embedded training capability should not detract from operational capability.

g. The change from operational to training mode should be done by simple switchology and software exchange.

h. Power for embedded training should be both commercial wall socket and vehicular.

5. Logistic Support Assessment.

a. Specific training subsystem performance requirements will be identified through LSA and based on state of the art technology and good design practices.

b. As the training programs mature, firm, measurable requirements will be specified and contractors will identify and project qualitative and quantitative training device and simulation requirements.

c. Maintenance characteristics and resource requirements for training subsystems will be identified, projected and integrated.

d. Training support requirements will be fine-tuned using LSAR, MANPRINT and front-end analysis/CTEA.

6. Training Assessment.

a. The materiel developer and the TRADOC proponent will require the contractor by SOW/RFP to design, develop and validate a complete organic training subsystem for the AFV system.

b. All training subsystems will be based upon a device based training strategy.

c. Embedded system trainers are first priority for unit training.

d. The subsystem will include all training documentation, simulation and devices required for individual and collective training for the institution and unit.

e. The primary delivery means for training and maintenance documentation will be embedded in AFV systems.

f. Each training subsystem will support New and Displaced Equipment Training (NET/DET) and be available before operational equipment is transitioned.

g. Stand-alone simulations and devices are first priority for Institutions.

h. Simulation and device priorities are gunnery, maintenance, driver and tactics.

i. All components of the training subsystems will be identified during concept exploration and investigated and validated during proof of principle.

7. Manpower/Personnel/Force Structure Assessment.

a. The essential AFV features that will impact manpower/personnel and force structure are commonality, modularity and multiple mission capabilities. These features may result in:

(1) MOS compression/restructure

(2) Density decrease in some MOS because of new robotics (auto loaders).

(3) Migration of personnel from one MOS to another.

(4) Resident course restructure to reflect new AFV requirements.

(5) Increase of common stand-alone simulations for institutions that will reduce requirement for operational equipment and instructor personnel.

(6) Capability to develop common courses, using common simulations that will reduce current facility and personnel overhead requirements.

(7) Embedded training capabilities to include built in test and test equipment (BIT/BITE) will provide a high fidelity self-train capability for the unit.

b. The exact quantity, nature and level of changes resulting from AFV will be identified and projected by contractor and TRADOC personnel and programmed for execution.

8. Life Cycle Cost Assessment.

a. A goal of the AFV training subsystem is to reduce training related O&S costs, in particular training ammunition and OPTEMPO reduction in operational equipment use will result in a similar reduction of spare parts, maintenance and repair requirements.

b. MOS compression, institutional course consolidation and extensive use of common simulation and devices will reduce training base force structure overhead and instructor personnel requirements.

UNCLASSIFIED

(U) ARMORED FAMILY OF VEHICLES
TASK FORCE
PHASE I REPORT

CTEA

(U) COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA)

COMPILED BY:
COMBINED ARMS TRAINING ACTIVITY
(CATA)

UNCLASSIFIED

APPENDIX F

(U) COST AND TRAINING EFFECTIVENESS ANALYSIS

(This Appendix Is Unclassified)

SUBJECT: Armored Family of Vehicles (AFV) Cost and Training Effectiveness Analysis (CTEA)

SEE DISTRIBUTION

1. Purpose. This plan describes the basic elements of the AFV CTEA in terms of objectives, scope, limitations, constraints and methodology. This is a multi-year effort beginning in Apr 87 and continuing through Sep 92. Updates will be performed after each major testing event and/or just prior to each milestone decision point. It states the estimated resource and support requirements and identifies tentative milestones in support of AFV decision/fielding milestones. This study will identify all training requirements for AFV (common hull/chassis and individual variant mission modules) and baseline the media requirements in support of AFV training. This study effort will be phased into three specific efforts and will combine the output of other supporting analyses. The phased execution of this effort involves the conduct of: a Preliminary Training Effectiveness Analysis (PTEA), a Cost and Training Effectiveness (CTEA) to support the Cost and Operational Effectiveness Analysis (COEA) and at least one update to support Milestone III decision.

2. References. See Appendix A.

3. Study Sponsor. Deputy Chief of Staff for Training (DCST), TRADOC, ATTN: ATTG-YC, Fort Monroe, VA 23651-5000; MAJ Victor, AUTOVON 680-3835.

4. Study Agencies.

a. Proponent. USACATA, ATTN: ATZL-TAS-T, Ft. Leavenworth, KS 66027-7000; CPT Mayes, AUTOVON 552-2495/3445.

b. Support analytic agency. TRADOC Analysis Center (White Sands, NM), ATTN: ATRC-THE, White Sands Missile Range, NM 88002-5502; DR. Dale Dannhaus, AUTOVON 978-2038.

c. Study monitor. Armored Family of Vehicles Task Force, ATTN: DAMO-AFV-C, Fort Eustis, VA 23604-5597; MAJ Rozman, AUTOVON 927-1465/1466.

5. Terms of Reference:

a. Problem. The development of training subsystems to support the fielding/implementation of AFV requires an integrated and standard program. These training subsystems must have cross-proponent applications with mission specific flexibility. Candidates for embedded training and stand alone devices/simulators must be identified early and developed concurrent with or prior to AFV fielding. This study is required by AR 71-9 with Update 1 (para 4-2 f) and TRADOC Reg 350-4.

b. Objective (s)

(1) Enchance battlefield effectiveness through standardization of soldier-training subsystem interfaces for AFV.

(2) Establish a baseline to ensure the effective initiation of baseline CTEAs for individual mission modules.

(3) Determine the elements of a training management program to ensure standardization of development, analyses and data collection relative to AFV training.

(4) Determine soldier capability for effective system operation.

(5) Determine the most cost effective ways to train the AFV.

(6) Determine the need to fine tune contractor provided training support packages.

(7) Determine specific elements of AFV training subsystems, to include transitional training for displaced equipment, Doctrine and Tactics Training (DTT), institution and unit sustainment training.

(8) Determine potential training issues related to the fielding of AFV.

(9) Reduce simultaneous and costly excursions.

c. Scope. *This study will address:*

(1) The commonality of training for the AFV variants at the family level.

(2) The commonality of training for the AFV at the mission module level.

(3) Friendly C2 issues.

(4) All AFV Training areas (new equipment, institutional, unit and Reserve Component (RC)).

(5) All AFV embedded training and simulation issues.

(6) Scenario: TBD

(7) Forces: AOE Force Structure.

(8) Size of Forces: Battalion through Corps

(9) Doctrine: Airland Battle

(10) Combat Posture in Mission Areas:

(a) low intensity conflict

(b) mid intensity conflict

(c) high intensity conflict

(11) All environmental and combat conditions (e.g.. NBC) will be considered.

d. Time frame.

(1) Phase I - 1996.

(2) Phase II/III - 2005 and beyond.

e. Essential Elements of Analysis (EEA) for Phase I, PTEA:

(1) What is the composition of the target audience for each of the mission areas and how do they compare in terms of ASVAB scores? (e.g. EL, RC, etc)

(2) What is the predecessor for each of the AFV mission variants?

(3) Which AFV mission variants have no predecessor system?

(4) What are the high driver individual/collective tasks common to each of the predecessor systems? Which tasks are applicable to AFV?

(5) Of those systems evaluated in EEA 2, what has been found to be the most prevalent problems? How were or are they being corrected?

(6) What are the alternatives for the AFV training subsystems? (i.e. stand-alone, appended, embedded, computer based/assisted instruction)

(7) For each of the tasks identified in EEA 4, what is the POI time allocated to each (by location) at the institution?

(8) Which of these tasks are candidates for embedded training?

(9) What will be the impact on training of fielding an AFV wheeled variant?

f. Essential Elements of Analysis (EEA) for Phase II/III, CTEA and CTEA Update:

(1) What are the current 20 year life cycle cost estimates for the devices, simulators and simulations used in support of the AFV predecessor systems?

(2) What are the current 20 year life cycle cost estimates for present instruction, less mission specific tasks, at the institution and in units?

(3) What is the estimated cost of training, as indicated by present POI and DSS costs, for the AFV?

(4) What is the estimated cost of embedding candidate capabilities?

(5) What is the effect of Robotics and Artificial Intelligence (AI) on training workloads and task responsibilities of AFV crews and maintainers.

(6) What are the manual backup means for the Robotics and AI requiring training?

(7) What are the effects of computer/vectronics systems on mission task requirements and how do they impact on the skill, training and aptitude requirements for AFV crews?

(8) What are the maintenance troubleshooting tasks that will remain the responsibility of the maintainer and what skill levels, aptitudes and training will they require?

(9) What are the trainer attitudes and perceptions of embedded, stand-alone and CAI/CBI training alternatives?

(10) What are the tasks and levels of effort for player/user personnel pretest training as demonstrated during Early User Test and Experimentation?

(11) What is the demonstrated post test proficiency of player/user personnel after EUT&E?

(12) What are the deficiencies found during post test evaluation fro EUT&E?

(13) What are the player/trainer personnel's attitudes and perceptions of the training and hardware systems for EUT&E?

(14) What are the estimated comparative costs of common AFV training using actual vehicles and embedded training/DSS?

(15) What are the estimated tradeoffs of a generic training subsystem in terms of degraded training effectiveness and reduced costs associated with its development?

(16) What are the effects on reliability and maintainability for the operational hardware for the various training alternatives when embedded?

(17) What are the effects on reliability and maintainability for the operational hardware for the various training alternatives when appended?

(18) What is the reliability, availability and maintainability of stand-alone training subsystems for AFV predecessor systems? (i.e. COFTs, TVDTs, etc.)

(19) What is the comparative learning decay of the various alternatives?
]

(20) When do cost increases or performance decreases cause rankings of alternative training subsystems to change? (sensitivity analysis)

g. Alternatives.

(1) Certain alternatives may/will be identified and explored by the Study Advisory Group (SAG).

(2) Other alternatives may/will also be identified by studying the predecessor systems and conducting literature searches during the early stages of the study.

6. Support and Resource Requirements.

a. <u>AFV Task Force.</u>

(1) Serve as study monitor

(2) Serve as Co-chair on SAG

b. HQ TRADOC.

(1) Provide representation on SAG

(2) Provide technical assistance, as required

(3) Establish priority and availability of analytic support required to complete the study

(4) Review and approve the study plan and reports

c. CAC.

(1) CATA.

(a) Establish and Co-chair the SAG.

(b) Conduct the study assisted as appropriate by TRADOC Centers, schools and agencies.

(c) Prepare and submit reports required by AR 5-5 directly to HQ TRADOC, DCST, System Training Directorate.

(d) Provide briefings on the status of the study to the SAG or HQ TRADOC as requested.

(e) Develop Project Coordination Sheets (PCS) as required NLT JUL 87 SAG

(2) CACDA-MID.

(a) Assist CATA in development of Study Plan

(b) Provide support as requested by CATA

(c) Coordinate results of MANPRINT decision processes

(d) Participate as SAG member

(3) CGSC.

(a) Provide doctrinal assistance in development of Study Plan

(b) Provide support as requested by CATA

(c) Participate as SAG member

d. TRAC-HQ. (ATRC-CAQ)

(1) Provide methodology and quality assurance for the study

(2) Participate as SAG member

e. TRAC-WSMR. (ATRC-THE)

(1) Serve as supporting analytical agency.

(2) Provide support as specified in PCS and study plan.

(3) Assist in the development of detailed data requirements for analysis.

(4) Coordinate potential problem resolution with PM TRADE for Best Technical Approach (BTA) for Embedded Training, Devices, Simulators and Simulations.

(5) Ensure incoming data is properly referenced.

(6) Prepare report outline and start report preparation as soon as the study plan is approved.

(7) Perform cost analysis and prepare cost analysis section of the study.

(8) Perform analysis to establish costs and effectiveness of any feasible candidate alternative.

(9) Produce final reports as approved by the CATA.

(10) Participate as desired/required in presentation of CTEA final report.

(11) Execute PCS with CATA NLT 12 JUN 87 for inclusion as an appendix to this study plan.

f. TRADOC Centers, Schools, and Agencies. Provide support as requested by CAC. Tentative requirements are identified on the Study Program Description Sheet and Outline Data Collection/Analysis Plan. (Appendix B and C)

7. Administration.

a. Milestone schedule.

EVENT	SCHEDULED COMPLETION
(1) TRADOC Study Directive	20 MAR 87 (actual)
(2) AR 5-5 Submission	23 MAR 87 (actual)
(3) Draft Study Plan Complete	30 APR 87 (actual)
(4) SAG to review Draft Study Plan	01 MAY 87 (actual)
(5) AFVTF Tng Analysis Sub-SAG Mtg	14 May 87 (actual)
(6) Project Coordination Sheet between CATA & TRAC-WSMR	12 JUN 87
(7) Final Draft Study Plan submitted to DCST TRADOC for approval	12 JUN 87
(8) Approved Study Plan presented to SAG, support requirements confirmed	26 JUN 87
(9) Study initiated for Phase I, PTEA	01 JUL 87
(10) Study initiated for Phase II, CTEA	01 OCT 87
(11) SAG (Interim report-PTEA)	31 MAR 88
(12) AFV TD IPR	MAY 88
(13) SAG	JUL 88
(14) SAG (Interim report-CTEA in support of Milestone I/II decision	SEP 88
(15) SAG	NOV 88
(16) AFV TD IPR	JAN 89
(17) SAG	MAY 89
(18) AFV TD IPR	MAY 89
(19) Final Report Due-CTEA	JUL 89
(20) CTEA update complete for Milestone III decision	SEP 92

b. Control procedures. The AFV CTEA will be managed by CATA, Combined Arms Training Support Directorate, Plans, Programs and Analysis Division.

c. Action control number/category. The ACN is 067576, PUIC ATZLT-_____. The AFV CTEA is listed in the FY88 TRADOC AR 5-5 Study Program under category E at priority ____of____..

FOR THE COMMANDER:

Encl

APPENDIX A

ARMORED FAMILY OF VEHICLES (AFV)
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA)

REFERENCES

a. Defense Science Board Summer Study, Armor/Anti-Armor Competition, 1985.

b. Charter, Armored Family of Vehicles Task Force, 10 Oct 85.

c. AFV Operational and Organizational Plan, 28 Oct 85

d. AFV Justification for Major System New Start (JMSNS).

e. FY89-03 DA Long Range Research,, Development, and Acquisition Plan (LRRDAP).

f. DCSOPS Message, Subject: Armored Family of Vehicles Task Force, 13 Mar 86.

g. Training Strategy Executive Committee Meeting 1-87, Ft. Eustis, VA, 4 Feb 87.

h. TRADOC Reg 5-3, The TRADOC AR 5-5 Study Program

i. TRADOC Reg 350-4, Training Effectiveness Analysis

j. Training Effectiveness Handbook (First Draft)

k. Letter, DAMO-AFV-M, Subject: Armored Family of Vehicles (AFV) Study Plan, 14 Jul 86.

l. Letter, ATTG-YC, Subject: Cost Training Effectiveness Analysis (CTEA) for the Armored Family of Vehicles (AFV), 20 Mar 87.

m. Letter, ATZL-TAS-I, Subject: Minutes of the 27 April - 1 May 87 Armored Family of Vehicles (AFV) Individual and Collective Training Plan (ICTP) Joint Working Group (JWG), 7 May 87.

n. AFV System MANPRINT Management Plan (SMMP), Version #1, 1 Apr 87.

o. AFV System Integrated Logistics Support Plan (ILSP) 87-3, Mar 87.

p. AR 71-9, Materiel Objectives and Requirements, with Update 1.

q. AR 350-38, Training Devices: Policies and Procedures

r. AR 602-2, Manpower and Personnel Integration (MANPRINT)

TRADOC FY 88 AR 5-5
Study Program Description Sheet

1) Study Title: DEVELOPMENTAL TRAINING EFFECTIVENESS ANALYSIS FOR THE ARM FAM OF VEH

2) Short Title: DTEA AFV

3) Study Priority: _____

4) Study Description:
THIS DTEA WILL ASSESS TRAINING SUPPORTABILITY AND IDENTIFY TRAINING REQUIREMENTS FOR THE ARMORED FAMILY OF VEHICLES. IT CONSISTS OF A PTEA FOR THE FORMULATION OF TNG STRATEGIES, A CTEA TO SUPPORT COEA AT MILESTONE AND A TDS TO ANALYZE THE COST AND TNG EFFECTIVENESS OF AN AFV DRIVER.

6) Sponsor:	AFV TF	MAJ ROZMAN	DAMO-AFV	927-1465
7) Study Agency:	USACATA	CPT DERR	ATZL-TAS-P	552-3445
	AGENCY	NAME	SYMBOL	AUTOVON

8) Status: P P / O / C / D / T

9) Type of Study: T C / T / O

10) Not used

11) PUIC: _____

12) Criterion One: 9

13) Criterion Two: 7

14) Criterion Three: 9

15) Criterion Four: 10

16) Criterion Five:

17) Criterion Six: 4.70588

18) Estimated/Actual Start Date: 8708 YYMM

19) Estimated/Actual Completion Date: 9103 YYMM

20) Method of Performing Study: B Contract / Inhouse / Both

21) Application: ALL COM / CS / CSS / OTH / ALL

22) DTIC Number: _____

23) Contract Number: _____

24) Category: E A - H

25) Actual Funds: $ 0 (K)

26) Planned Funds: $ 941 (K)

27) Actual PSY: 0.0

28) Planned PSY: 20.9

29) ACN: _____

30) Issue Assessment: II F

31) Funding Requirements (K):

	FY 87	FY 88	FY 89	FY 90
AR 5-5	$ 0	$ 0	$ 0	$ 0
TRAINING:	$ 0	$ 341	$ 400	$ 200
OTHER:	$ 0	$ 0	$ 0	$ 0

TRADOC FY 88 AR 5-5
Study Program Description Sheet

32) Professional Staff Year Requirements:

SCH/CEN	FY 88	FY 89	FY 90	SCH/CEN	FY 88	FY 89	FY 90
ADA	0.2	0.2	0.2	ARMC	0.2	0.2	0.2
AVLS	—.—	—.—	—.—	AVNC	—.—	—.—	—.—
CHAP	—.—	—.—	—.—	CMLS	—.—	—.—	—.—
ENGS	0.2	0.2	0.2	FAS	0.2	0.2	0.2
INFS	1.0	1.0	0.2	INTL	0.2	0.2	0.2
JFKSWC	—.—	—.—	—.—	MMCS	—.—	—.—	—.—
MPS	—.—	—.—	—.—	ORDS	0.2	0.2	0.2
QMS	—.—	—.—	—.—	SIGS	0.2	0.2	0.2
TSCH	—.—	—.—	—.—	CACDA	0.1	0.1	0.1
CATA	0.2	0.2	0.2	LOGC	0.2	0.2	0.2
SSC	—.—	—.—	—.—	HQTD	—.—	—.—	—.—
T/FLVN	—.—	—.—	—.—	T/WSMR	4.0	6.0	3.0
T/LOGC	—.—	—.—	—.—	T/SSC	—.—	—.—	—.—
T/HQLVN	—.—	—.—	—.—	T/HQFM	—.—	—.—	—.—
OTHER	—.—	—.—	—.—				

33) Coordination Certification (See Instructions)

(Signature of Study Agency POC)

APPENDIX C
ARMORED FAMILY OF VEHICLES (AFV)
COST AND TRAINING EVVECTIVENESS ANALYSIS (CTEA)

OUTLINE DATA COLLECTION/ANALYSIS PLAN

The purpose of this appendix is to clearly set out the rationale and methodology for the collection and analysis of data in conjunction with the AFV CTEA.

The AFV CTEA is divided into three phases: the first involves the conduct of a Preliminary Training Effectiveness Analysis (PTEA) to identify the "who, what, when, where and how" associated with the AFV predecessor systems and relationships to the AFV training concept and strategy, the second involves costing and specific tradeoff determinations associated with the hardware design features of Robotics, Artificial Intelligence, standard vectronics, fire control and embedded training and the last phase involves updated costing and effectiveness analyses relative to Early User Test and Evaluation for both the AFV hardware system and the training subsystem.

For clarity of exposition, the objectives of each phase of the analysis are presented and discussed followed by a discussion of the individual essential elements of the analysis (EEA) which, in most cases are common to all phases of the overall plan.

PHASE I (PTEA)

OBJECTIVE: Establish a baseline assessment to ensure the effective initiation of the CTEA (Phase II) and the supporting TEA efforts by proponent schools for specific mission module analysis. Contribute to the formulation of training strategies for the AFV. Determine trainability requirements, problems associated with AFV technology complexity, relationships between individual aptitudes and potential training alternatives.

REQUIREMENT: Analyze soldier variables in terms of individual characteristics, abilities and experience. Determine common areas of training for the proposed AFV variants. Determine potential "bill players" to reduce training O&S costs through the use of embedded and/or stand-alone training devices.

METHOD: Perform a thorough literature search of DTIC/NTIS data bases using keywords: armored vehicles, training, army training, job training, individualized training, teaching methods, computer aided instruction, computer assisted instruction, programmed instruction, driver training, driver trainer (s), simulator (s), simulator training, simulator training devices, tvdt, simnet computer program, simnet (large scale simulation network), simnet (simulation network),

simulation network (ing), computer generated imagery, computer generation of imagery, cgi, computer generated images, armored family of vehicle (s), armored fighting vehicle (s), afv, and tanks for a five year period preceding the initiation of this effort. Consolidate Early Comparability Analyses (ECA) findings for each of the predecessor systems and components. Perform data reduction of information contained in the Enlisted Master File maintained by the Military Personnel Center (MILPERCEN) to compare composition and characteristics of the target population in terms of Army Services Vocational Aptitude Battery Scores (ASVAB). Consolidate Course Administrative Data (CAD) provided by proponent schools and compare common and disjoint areas of instruction in terms of POI time allocated, Instructor Contact Hours (ICH) and methods of instruction (i.e. CAI/CBI, 2D/3D mockups, actual equipment, etc). Collect and catalog the Training Device Need Statements (TDNS) approved or received by ATSC (DMD) for AFV predecessor systems. Obtain Best Technical Approach Data (BTS) prepared for each of the above TDNS by PM TRADE. Survey soldiers and trainers and examine in detail their previous training/experience, attitudes toward training devices, concerns and attitudes toward the concept of embedded training, and demographics.

RATIONALE: Successful execution of the CTEA requires the establishment of a data base in support of Phase II and Phase III efforts addressing the commonality of component design and operation and demanding a standardized approach to training design and analysis. The AFV program goals for the reduction of peacetime (training) O&S costs requires the identification of potential candidates for embedded and/or device supported training.

DELIVERABLES: The basic deliverable of this phase in the study is a report. The report as a minimum will provide:

a. A data base of AFV predecessor system training requirements by location, candidates for embedded, appended and stand-alone training devices, target audience characteristics, shortfalls and deficiencies of current programs and a listing of high driver individual/collective tasks common to each of the AFV variants.

b. A discussion of each of the areas above, with emphasis on:

(1) Driving

(2) Gunnery (to include self defense weapon systems)

(3) Maintenance and Diagnostics

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(4) Communications

(5) Common Vectronics, Displays and Controls

(6) Combat Skills and Tactics (to include force-on-force training)

c. A discussion and comparison of training subsystem requirements and recommended solutions.

d. A discussion and comparison of training requirements, as perceived by the trainers and users.

e. An appendix of the data collected from surveys as described in paragraphs a. and d.

f. A discussion of the impact of including wheeled and tracked variants on common training.

ESSENTIAL ELEMENTS OF THE ANALYSIS (EEA).

EEA 1 WHAT IS THE COMPOSITION OF THE TARGET AUDIENCE FOR EACH OF THE MISSION AREAS AND HOW DO THEY COMPARE IN TERMS OF ASVAB SCORES?

REQUIREMENT: Describe quantity and qualification of the soldiers who will operate, maintain and support the AFV. Describe the range of individual qualifications on relevant ASVAB criteria. Describe the current and projected user population in terms of qualifications and demographics.

METHOD OF DATA COLLECTION.

a. Obtain information about the user population from the Enlisted Master File.

b. Reduce information included in AR 611-201, AR 611-101, and "Retain" criteria for generic MOS/Officer SC provided for each of the mission areas.

c. Obtain information from USAREC/SSC-NCR and the MILPERCEN Force Management Book concerning postulated user population for 1996 and 2005 and beyond.

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METHOD OF DATA ANALYSIS.

a. Descriptive statistics of the present general user population.

b. Descriptive statistics of the present mission area populations.

c. Descriptive statistics of postulated general user population in 1996.

d. Descriptive statistics of postulated general user population for 2005 and beyond.

RESPONSIBILITY. TRAC-WSMR

EEA 2 WHAT IS THE PREDECESSOR FOR EACH OF THE AFV MISSION VARIANTS?

EEA 3 WHICH AFV VARIANTS HAVE NO PREDECESSOR SYSTEM?

REQUIREMENT: Establish a framework for the identification of those training "high driver" tasks which must be trained for the AFV based on lessons learned with predecessor systems.

METHOD OF DATA COLLECTION.

a. Obtain completed Early Comparability Analysis (ECA) data as published by the CAC for AFV.

b. Obtain HARDMAN analysis plan from TRAC-WSMR HARDMAN Division.

METHOD OF DATA ANALYSIS.

a. Perform systems analysis to identify mission (s) for each of the variants. (HARDMAN data)

b. Crosswalk each proposed mission variant with a known predecessor system. (ECA data)

c. Crosswalk common components with known predecessor components. (ECA data)

d. Identify specific variants/components having no predecessor.

e. Prepare matrix and description presenting a compilation of the above data.

RESPONSIBILITY. TRAC-WSMR

EEA 4 WHAT ARE THE HIGH DRIVER INDIVIDUAL/COLLECTIVE TASKS COMMON TO EACH OF THE PREDECESSOR SYSTEMS? WHICH TASKS ARE APPLICABLE TO AFV?

EEA 5 OF THOSE SYSTEMS EVALUATED IN EEA 2, WHAT HAS BEEN FOUND TO BE THE MOST PREVALANT PROBLEMS? HOW WERE OR ARE THEY BEING CORRECTED?

REQUIREMENT: Specify training "high driver" tasks which should be eliminated or limited by design of the AFV. Identify training requirements which should appear on candidate lists for embedded training, appended or stand-alone major training devices and which can be expected to require modifications to existing training courses.

METHOD OF DATA COLLECTION.

a. Obtain completed ECA data as published by CAC for AFV.

b. Obtain final report prepared by PM TRADE/ARI for definition of training alternatives, training strategy, and selection criteria for AFV embedded training.

c. Administer task criticality, frequency and training survey(s) based on task list.

d. Obtain results of "hands on" portion of SQT for predecessor systems.

METHOD OF DATA ANALYSIS.

a. Prepare matrix and description presenting a compilation of ECA and PM TRADE data.

b. Generate descriptive statistics to indicate degree of agreement among user/trainer personnel surveyed on relative criticality, frequency and training presently received on each task.

c. Compute descriptive statistics to indicate degree of proficiency based on SQT results.

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RESPONSIBILITY.

a. TRAC-WSMR

(1) Prepare survey instrument(s)

(2) Compile data

(3) Compute statistics

(4) Administer FORSCOM and Reserve Component portions of survey

b. Schools and Centers

(1) Administer survey instrument(s) per TRAC-WSMR instructions

(2) Provide subjective input to "high driver" task list and current or proposed corrective action.

c. PM TRADE/ARI: Provide final report, as stated

EEA 6 WHAT ARE THE ALTERNATIVES FOR THE AFV TRAINING SUBSYSTEMS?

REQUIREMENT: Prepare candidate lists for embedded training, appended or stand-alone major training devices, computer based/assisted instruction and training on the hardware system, itself.

METHOD OF DATA COLLECTION.

a. Obtain and review Individual and Collective Training Plans (ICTPs).

b. Obtain and review System MANPRINT Management Plans (SMMPs).

c. Obtain and review System Requirement Documents. (O&O and ROC).

d. Obtain and review results of PM TRADE/ARI Training Analysis.

e. Obtain and review results of AFV contractor Market Surveys.

METHOD OF DATA ANALYSIS.

a. Analyze documentation for concepts, strategies and proposals.

b. Prepare matrix and description presenting compilation of the above data for institutional training.

c. Prepare matrix and description presenting compilation of the above data for unit training.

RESPONSIBILITY: Joint TRAC-WSMR, CATA, and PM-TRADE effort

EEA 7 FOR EACH OF THE TASKS IDENTIFIED IN EEA 4, WHAT IS THE POI TIME ALLOCATED TO EACH (BY LOCATION) AT THE INSTITUTION?

EEA 8 WHICH OF THESE TASKS ARE CANDIDATES FOR EMBEDDED TRAINING?

REQUIREMENT: Determine the potential manpower, personnel (instructors) and training costs for use in tradeoff determinations and sensitivity analysis in Phases II and III. Determine potential institutional base modifications resulting from embedded training applications.

METHOD OF DATA COLLECTION.

Obtain CAD and POI data from proponent schools for predecessor systems.

METHOD OF DATA ANALYSIS

a. Generate descriptive statistics comparing common and disjoint areas of instruction in terms of POI time allocated, instructor contact hours (ICH), and methods of instruction.

b. Contrast and compare common and disjoint areas of instruction for common areas, with emphasis on:

(1) Driving

(2) Gunnery (to include self defense weapon systems)

(3) Maintenance and Diagnostics

(4) Communications

(5) Displays and Controls

(6) Combat Skills and Tactics (to include force on force training)

c. Annotate compiled data with results of EEA 6.

RESPONSIBILITY.

a. Schools and Centers will provide detailed breakout of POI time, ICH, methods of instruction and other pertinent CAD requested by TRAC-WSMR.

b. TRAC-WSMR will compile data and compute statistics.

EEA 9 WHAT WILL BE THE IMPACT ON TRAINING OF FIELDING AN AFV WHEELED VARIANT.

REQUIREMENT: Determine which skills associated with training on the AFV chassis lose their commonality if both a wheeled and a tracked version of AFV is fielded.

METHOD OF DATA COLLECTION. (See EEA 4, 7, and 8)

METHOD OF DATA ANALYSIS.

a. Determine specific requirements for the wheeled variant differing from those of the tracked variant.

b. Prepare matrix and description presenting compilation of this data.

c. Apply subjective judgement of the impact on a common training subsystem.

RESPONSIBILITY. Joint TRAC-WSMR and CATA

PHASE 2 (CTEA)

OBJECTIVE: Provide a detailed comparison of the costs and effectiveness of proposed embedded, appended and stand-alone training device alternatives Identify the most efficient training strategy and perform an assessment of the impact of Robotics and Artificial Intelligence on training workloads and responsibilities. Support decisions at the completion the Proof of Principle Phase (Concept Exploration/Demonstration Validation) by providing cost/effectiveness data for incorporation in the AFV COEA at Milestone I/II.

SCOPE AND REQUIREMENTS: TBD

Phase 3 (CTEA UPDATE)

OBJECTIVE: Use data collected during EUT&E to assess the notional training program, contractor Training Test Support Packages, training devices and programs of instruction. Support decisions throughout Development and Production Prove Out (Full Scale Development) and update costs and effectiveness data for incorporation in the AFV COEA at Milestone III.

SCOPE AND REQUIREMENTS: TBD

APPENDIX D
ARMORED FAMILY OF VEHICLES (AFV)
COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA)

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21. Project Manager for Training Devices (PM TRADE)
ATTN: AMCPM-TND-EC/Dr. Dybas
ATTN: AMCPM-ARD/Mr. Sprinkle
Orlando, FL 32813-7100

22. Director, Training Effectiveness Analysis Directorate
U.S. Army TRADOC Analysis Center
ATTN: ATRC-THE/Dr. Dannhaus
White Sands Missile Range, NM 88002-5502