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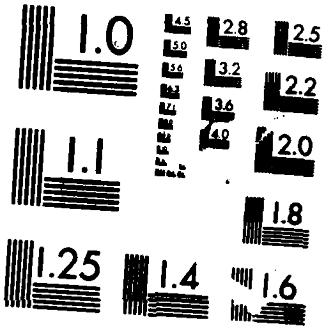
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ARMY TRAINING STUDY

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TRAINING EFFECTIVENESS ANALYSIS (TEA) 1978
SUMMARY

VOLUME I

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The Army Training Study (ARTS Study) conducted a comprehensive overview of Army training. The research probed across a wide range of training issues as the study group sought a broad perspective of army training. The study group conducted a field surveys at numerous continental US Army posts and schools. The data obtained was analyzed using the Training Effectiveness Analysis (TEA).

The Training Effectiveness Analysis (TEA) summary volumes explain the analysis of the data gathered on both institutional training and unit training across a range of combat, combat support and combat service support systems and skills, supplemented by research into such completed tests as CAMMS, REALTRAIN and Chaparral. It provided some of the data necessary for the formulation of the Battalion Training Model and provided insight into the general state of training in the army.

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PART I: Retention of Basic Armor Training Skills Within the Unit

Item	Page	Para	Line	Change	Rationale
1	3-2	1	2	"distrinct" should read "distinct"	Editorial
2	5-7	2	10	"These sizes" should read "These sample sizes"	Clarity
3	5-15	2	12	Insert the following between "NO" and "GO's": "GO performance. A positive tau value indicates that lower mental category personnel receive more NO/"	Completeness
4	5-20	2	8	"uits" should read "units"	Editorial
5	5-21	1	2	"whle" should read "while"	Editorial
6	5-25	1	12	"dgit" should read "digit"	Editorial
7	5-31	2	7	"xperience" should read "experience"	Editorial
8	6-12	2	11	"amoung" should read "among"	Editorial
9	C-5	1c	1	"th" should read "the"	Editorial
10	C-11	11a	1	"tomouth" should read "to mouth"	Editorial
11	D-3	12	1	"th" should read "the"	Editorial

12	D-4	36	1	insert "as" between "gun" and "a"	Editorial

PART II: Retention of Basic Armor Skills Within the Institution

Item	Page	Para	Line	Change	Rationale
1	4	2	8	"G-G)." should read "retention"	Clarity
2	8	5	2	delete ","	Editorial
3	19	1	5	"ar" should read "at"	Editorial
4	25	3	5	"Apendix" should read "Appendix"	Editorial
5	27	3	3	"adminstered" should read "administered"	Editorial
6	33	2	11	"not sensitive" should read "not a sensitive"	Editorial
7	44	1	3	"reservists" should read "Reservists"	Editorial
8	44	1	4	"national guardsmen" should read "National Guardsmen"	Editorial
9	75	A5	1	"Traiing" should read "Training"	Editorial
10	75	-	last	"SUPERCEDES" should read "SUPERSEDES"	Editorial

PART I

RETENTION OF BASIC ARMOR TRAINING SKILLS WITHIN THE UNIT

Army Training Study

M60A1 WEAPONS SYSTEM

RETENTION OF BASIC ARMOR TRAINING SKILLS

WITHIN THE UNIT

A STUDY REPORT

Fort Knox, Kentucky

"The view, opinions, and/or findings contained in this report those of the System Work Team and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other official documentation."

RETENTION OF BASIC
ARMOR TRAINING SKILLS
WITHIN THE UNIT

STUDY REPORT

Prepared by

Army Training Study

Systems Work Team

M60A1 Weapons System

Fort Knox, Kentucky

May 1978

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CHAPTER I

EXECUTIVE SUMMARY

The Army Training Study (ARTS) is a Training and Doctrine Command (TRADOC) sponsored study tasked with analyzing the relationship between training resources and combat effectiveness for the Army of today and tomorrow. This analysis will support development of training programs for complex weapons systems scheduled for delivery in the next decade. System Work Teams (SWT's) were established at Army Service Schools to support the ARTS effort; this report presents results of a retention testing program conducted by the Armor SWT at Ft Knox, KY.

Early in the ARTS effort it was recognized that the temporal course of military skills must be thoroughly examined prior to the reformulation of training programs. The temporal course of any learning and retention process is key to planning for initial and subsequent exposures of the student to the subject matter. A review of the literature indicated that long-term retention of realistic military skills had not been extensively studied. The present study was thus designed to provide insights into the retention curves for armor skills and to identify factors that affect those curves. From this initial information, detailed, long range, and comprehensive studies can be developed to meet the objectives within the ARTS training effectiveness analysis.

The subjects for the study were 270 Skill Level 1 soldiers who had graduated from basic armor training during the December 1977 - March

1978 time frame. The basic procedure was to track the men to their first unit of assignment and to readminister to them a combination of the mid-cycle and end-of-cycle tests which had previously been administered to them by First Training Brigade personnel. The criterion referenced retention test was administered by field-trained test teams under conditions as analogous as possible to those in First Training Brigade, in various CONUS and USAREUR units. Time intervals between graduation from basic armor training and the field retention test varied from two to twenty-five weeks. A survey was administered to examinees at the time of the retention test to capture demographic, background, and experience information. A total of 85 performance measures relating to numerous basic armor skills were tested, with scoring on a GO/NO GO basis.

Results indicated that personnel in the units received a GO on an average of about 80% of the performance measures tested. The types of skills showing relatively low performance levels were map reading, M85 MG, and breechblock tasks. The majority of NO GO's received related to failure on relatively cognitive skills (involving reading, interpreting, and remembering stimuli and procedures), indicating that these types of skills are forgotten most rapidly. Following the initial performance drop upon leaving the institution, the overall retention curve was essentially flat; performance was at about the 80% GO level regardless of the number of weeks since graduation. Performance on a few tasks improved over time, while performance on others worsened, resulting in no net change in performance over time.

The only demographic variable significantly related to retention test performance was mental category; lower aptitude personnel performed at a significantly lower level overall, and their difficulties were concentrated in cognitive tasks involving memory retrieval and decision making. The only general background variable significantly related to overall retention performance was unit of assignment. Different units performed at significantly different levels; data were not available to allow analysis of the relationship of these differences to types of unit training programs. Unit experiences as reported by examinees were significantly related to performance in some areas, but the effect was not widespread. Results of the tests indicated that although its use was not extensive, TEC lessons did benefit retention and it may be that limited experience on basic skills does not have much influence upon retention.

Further research is needed to more precisely identify types of tasks forgotten and reasons therefore. Implications of the study for training are that the use of TEC lessons should be expanded, certain types of tasks are candidates for training in the unit rather than in the institution, and improved training approaches are needed for tasks involving memory of a sequence of steps or other cognitive operations, particularly for lower aptitude personnel. As armor duties become more complex, future training must be developed with long-term retention in mind.

CHAPTER II

INTRODUCTION

BACKGROUND

The Army Training Study (ARTS) was conceived at the Training and Doctrine Command (TRADOC) in August 1977 with approval by the Vice Chief of Staff, Army. TRADOC was designated as the study sponsor with Department of the Army, Office of Deputy Chief of Staff, Operations as study proponent. The study group was established at Ft Belvoir, VA with System Work Teams (SWT's) located at selected Army Schools; Armor (Ft Knox, KY), Field Artillery (Ft Sill, OK), Ordnance (Aberdeen Proving Grounds, MD), Signal (Ft Gordon, GA), Infantry (Ft Benning, GA), and Air Defense Artillery (Ft Bliss, TX).

INTRODUCTION

The total Army's training task is to train the units and soldiers of the Army to the required level of combat effectiveness as efficiently as possible. Given the reality of dwindling resources, efficiency in the use of these resources is imperative. Given that the Army must be prepared to fight and win, combat effectiveness is absolutely paramount.

To that end the Army Training Study was tasked to conduct an in-depth examination designed to determine the relationship between training resources and combat effectiveness for the Army of today and tomorrow. As importantly, the study is to begin the blueprinting of the training programs for the complex weapons systems scheduled for incorporation in the next decade, and this process is to be accomplished with the relationship of resources to combat effectiveness clearly foremost in mind. This task will be accomplished by first determining relationships among resources allocated for both the institutional training system and the unit training effort. These categories will be further divided into those training programs directed at the individual and those designed for training the collective group. This functional relationship will be examined by its resultant training readiness, and finally the all important combat readiness.

The blueprinting of training for the next decade will focus on the development of efficient, effective, and manageable training systems. The study will be working from a broad overview perspective, developing a conceptual training framework for achieving the optimum combat effectiveness as new weapons systems are added to the inventory.

MISSION

The mission of ARTS is to examine links between training resources, training programs, training readiness, and combat effectiveness. The purpose of this examination is three-fold; (1) to convince executive agencies that reductions in the Army's training resources must be supported by solid analytical effort as well as professional assessment of senior military personnel, (2) to develop a logical and more analytical way to tie resources to combat effectiveness, and (3) to begin to formulate training programs for the complex weapons of the 1980's with the relationship of resources to combat effectiveness in mind. Working from an Army-wide perspective, ARTS will develop a conceptual training framework for achieving the optimum combat effectiveness when the major new weapons systems are fielded in the mid-1980's. In this regard, ARTS began evaluating selected systems using specific data available in 1977-78. ARTS can then propose a guideline for training policies and programs to bridge the transition from today's Army to the mid-80's. Additionally, insights can be gleaned from this study that will enable senior Army commanders to make timely assessments and decisions about the current training system with the aim of modification toward optimization of cost and training effectiveness in the training base.

PURPOSE/OBJECTIVE

While the Army Training Study was still in its formative period, it was suggested that before effective training programs could be developed some insight must be gained into the retention of basic skills. It was thought essential that the temporal course of military skills be examined thoroughly prior to the reformulation of training programs. Obviously, the temporal course of any learning and retention process is key to the planning for the initial and subsequent exposures of the student to that subject matter.

The long-term objective of ARTS is to provide general policy alternatives to guide further study efforts toward cost effective, proficient training for the weapons systems of the mid-1980's. The near-term objective can be translated into careful examination of differing Army training programs to determine the optimum training mix for combat effectiveness through individual and collective training proficiency. Data obtained from studies conducted will provide input to war models for use as parameters in computer simulated war games with the end result of more accurately evaluating overall combat effectiveness at optimum level with minimum of expenditure of both personnel and material resources.

The retention testing program described in this paper was designed to provide insights into the retention curves for armor skills and to identify factors that affect those curves. From this initial information; detailed, long range, and comprehensive studies can be developed to meet the objectives within the ARTS training effectiveness analysis. The specific objectives of this initial retention testing program (conducted by Armor SWT as input to the overall ARTS effort) are:

1. To provide insights into establishing retention curves for armor skills by determining the amount, temporal course, and distribution of proficiency loss for a high priority set of critical tasks for individual armor crewmen over a period of up to twenty-five weeks after graduation from basic armor training.

2. To provide insights into factors which influence the retention curves for armor skills by examining general training and demographic variables.

3. To provide insights into the feasibility and methods of running further retention tests, throughout the Army.

CHAPTER III

REVIEW OF LITERATURE

GENERAL

Within the fields of education and psychology, interest in skill learning and retention has fluctuated over the years, with interest high during the early twentieth century, waning and then resurging since 1940 with the application of learning theory within military and industrial settings. This review of the literature emphasizes the study of skill retention within the military context. A review of the general skill retention literature and summaries of specific military studies is preceded by a brief discussion of clarifications and definitions of the concepts of skill and retention.

DEFINITION OF SKILL

Emphasizing the idea that skills are behaviors which involve the coordination of physical movements, skills are often referred to as motor skills[1] or psychomotor skills.[2] Fitts identifies the characteristics of skills as the interplay of receptor-effector-feedback processes (spatial-temporal patterning), and such attributes as timing, anticipation, and the graded response.[3] The study of skill

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[1] J. E. Oxendine, The Psychology of Motor Learning. (New York, Appleton-Century-Crofts, 1968).

[2] C. E. Noble, "The Learning of Psychomotor Skills" in Annual Review of Psychology (vol 19), ed. P.R. Farnsworth, (Palo Alto, CA: Annual Reviews, Inc., 1968), pp. 203-250.

[3] P. M. Fitts, "Perceptual-motor Skill Learning" in Categories of Human Learning, ed. A.W. Melton (New York, Academic Press, 1964), pp. 30-158.

learning and retention has often been conceived of as a field distrinct from the study of cognition, or the acquisition and retention of knowledge, which has been the primary subject matter of verbal learning and cognitive psychology. Vineberg and Taylor divide skills into categories of perceptual skills, motor skills, cognitive skills, and social skills and they delineate two important components of a job as job knowledge (information about a job) and job skills (abilities).[4] The basic distinction is between knowing what to do versus being able to do it. Being able to do a job requires the perception of information, the coordination of motor movement, and at least a limited amount of cognitive processing of stimuli and feedback. The application of knowledge also requires the use of motor movements, for example, speech can be thought of as a motor skill. Thus, the distinction between skills and knowledge is not clear-cut. For the purposes of the present paper, skills are defined as behaviors which emphasize physical movement rather than knowledge.

Motor skills have been divided into numerous categories, but the principal division of interest in this paper is that of continuous versus discrete skills. Continuous motor activities such as walking or bicycle riding, are those which require repetitive or sustained effort. Discrete skills such as a dart throw or a soccer kick,

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[4] R. Vineberg and E. N. Taylor, Performance in Four Army Jobs by Men at Different Aptitude (AFQT) Levels: 4. Relationships Between Performance Criteria. HumRRO Tech Report 72-23 (Alexandria, VA: Human Resources Research Organization, August, 1972).

require a singular exertion or short-term effort. Again, the distinction cannot be clearly delineated. Some tasks, such as bowling or operating a computer terminal, are sequential or serial; requiring a sequence of discrete movements which are not repetitive. In this paper, skills will be categorized with sequential or procedural task falling somewhere in between continuous or discrete.

DEFINITION OF RETENTION

While the point must be made that this area cannot be separated from skill learning and transfer, the primary focus here is on skill retention. The three topics have been studies primarily in isolation, but the amount of initial learning affects the amount retained and transfer studies are often very similar to retention studies.[5] Leonard, Wheaton, and Cohen define transfer as the maintenance of a skill over changes in context and retention as the maintenance of a skill over time and/or interpolated activity.[6] While transfer studies emphasize changes in performance with different apparatus or context with interpolated activities held constant and very short time frames used, retention studies emphasize changes in performance over time with apparatus and other aspects of context held constant to the extent possible. One could argue that this distinction is impossible

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[5] A. S. Blaiwes and J. J. Regan, An Integrated Approach to the Study of Learning, Retention, and Transfer--A Key Issue in Training Device Research and Development. NAVTRADEVCEN Tech Report IH-178. (Orlando, FL: Naval Training Device Center, August 1970).

[6] J. L. Leonard, Jr., C. R. Wheaton, and F. P. Cohen, Transfer of Training and Skill Retention. ARI Tech Report 76-A3. (Alexandria, VA: US Army Research Institute, October, 1976).

to maintain; context can never be held completely constant and all transfer studies involve at least a short time interval between contexts. The difference is one of degree. The present review emphasizes studies of changes in motor skill performance over time and intervening training.

GENERAL SKILL RETENTION LITERATURE

Naylor and Briggs have provided an extensive review of skill retention literature in which they conclude that most retention research has been related to verbal rather than motor learning and that most skill retention research has involved short time intervals.[7] In summarizing research on long-term skill retention as a function of the task, they conclude that there is no adequate evidence of an intrinsic superiority for retention of motor habits over verbal habits (it may be that retention of arbitrary response sequences is less than that of meaningful sequences or patterned organizations). It appears that continuous tasks are better retained than are discrete ones, although other authors argue that continuous tasks are often over-learned, involve less physical proficiency, and involve lower skill levels.[8] With respect to conditions surrounding original

[7]J. C. Naylor and G. E. Briggs, Long-Term Retention of Learned Skills: A Review of the Literature. ASD Tech Report 61-390. (Wright-Patterson AFB, OH: Aeronautical Systems Division, Air Force Systems Command, August, 1961).

[8]Oxendine, Psychology of Motor Learning.

learning, retention is related positively (but negatively accelerated) to amount of original learning; distributed practice facilitates learning but not retention; whole learning may lead to better retention that part learning; actual motor practice leads to better retention than does verbal practice, which is better than none; and, conditions leading to more rapid learning do not necessarily result in better retention. Conditions existing during the retention period influence retention with the function depending on the situational parameters; rehearsal facilitates skill retention, particularly if it involves overt activity; and rehearsal produces better results if fidelity to the original task in maintained. Conditions surrounding the retention test influence retention in that the measure used (first trial recall versus savings in retraining) affects the degree of retention (the criterion should be the one that is most important in the operational task); retention is directly related to the degree of replication of the learning context during the test (see discussion of retention versus transfer above); and warm-up facilitates retention. These reviewers conclude that the major need is for studies using fairly extended time periods between learning and recall, that no experimental approach has proved completely satisfactory, that it is critical to determine the relationship of task "organization" to retention, and that there is a need to study the effects of different measures on retention.[9] Similar conclusions have been echoed

[9] Blaiwes and Regan, An Integrated Approach.

throughout the skill retention literature, along with the observation that most skills studied have been simplistic ones which did not involve a great deal of cognitive processing or complex procedure following.[10]

More recently, Schendel, Shields and Katz conducted an extensive literature survey dealing with the variables known or suspected to affect the retention of learned motor behaviors over no-practice intervals. Emphasis was given to research conducted by or for the military. The variables which may affect the retention of motor skill were dichotomized into task variables and procedural variables. The task variables which may underlie the long-term retention of motor skill include: (a) duration of the no-practice period, or retention interval; (b) nature of the response required to accomplish a particular motor task; (c) degree to which the learner can organize or impose order upon the elements which define the task; (d) structure of the training environment; and (e) initial or "natural" ability of the learner in performance of a task without prior practice. The researchers conclude that procedural variables which may affect the long-term retention of motor skills include: (a) degree of proficiency attained by the learner during initial training; (b) amount and kind of refresher training; (c) transfer of skills on one part-task versus whole-task training methods; and (g) introduction of task to performance on another task; (d) presence of interfering

[10] Leonard, Wheaton, and Cohen, Transfer of Training.

activities; (e) distribution of practice during training; (f) use of extra test trials prior to final testing.[11]

SPECIFIC MILITARY STUDIES

Military skills run the gamut from simple continuous tasks (marching) to complex perceptual, procedural, and cognitive tasks (engaging the enemy in a tank battle). The most frequent criticisms of studies of military skill retention are that there have not been enough of them, they have involved relatively short time periods, and they have addressed only simple tasks. Several examples of studies of military skill retention are summarized below.

McDonald has obtained retention data in several basic combat proficiency areas: basic rifle marksmanship, physical combat proficiency, and end-of-cycle tests (military courtesy, military justice, drill and ceremonies, first aid, guard duty, individual tactical training, hand-to-hand combat, and bayonet).[12] Independent groups of soldiers were tested at the end of basic combat training (BCT), infantry and non-infantry groups were retested using the same tests after fourteen to sixteen weeks in the Army, non-infantry groups were retested after twenty-four to fifty-two weeks, and infantry and non-infantry groups were retested on basic rifle marksmanship after ninety-six weeks. There were approximately sixty personnel in each

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[11] J. Schendel, J. Shields, and M. S. Katz, "Retention of Motor Skills: Review," Unpublished paper, U.S. Army Research Institute, Alexandria, VA; June 1978.

[12] R. D. McDonald, Retention of Military Skills Acquired in Basic Combat Training. HumRRC Tech Report 67-13. (Alexandria, VA: Human Resources Research Organization, December, 1967).

group tested. Results showed significant performance decrements over time for all areas except physical combat proficiency. At the end of BCT, 95.5 percent of soldiers tested qualified on basic riflemarksmanship, and on the first retest (after fourteen to sixteen weeks in the Army) 92 percent of infantry personnel and 85 percent of non-infantry personnel qualified. After twenty-four to fifty-two weeks, only 53 percent of non-infantry personnel qualified, and after ninety-six weeks 75 percent of infantry personnel qualified. At the end of BCT, 99.9 percent qualified on the end-of-cycle tests, but after twenty-four to fifty-two weeks in the Army only 45 percent of non-infantry personnel were able to qualify on these tests. McDonald argues that the performance decrements were small, since most personnel who failed to qualify on retention testing were barely under the criterion. However, if one accepts the criterion as valid, significant performance decrements were shown over one year.

A preliminary examination was conducted of the retentive qualities of basic armor crewman skills on approximately 436 enlisted trainees undergoing basic armor training in the First Training Brigade, Fort Knox, Kentucky.[13] A test-retest methodology utilizing both the midcycle and end-of-cycle examinations was administered in the seventh and eleventh weeks of training. The midcycle test was subsequently

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[13]U.S. Department of Army, Headquarters, First Training Brigade (Armor), "The Learning and Retention of Basic Armor Skills within the Institution," Major James S. Cary, Ft Knox, KY; 1978.

readministered in the eighth, ninth, and tenth weeks and the end-of-cycle test in the twelfth and final week of training on a sample without replacement basis. Test results were limited somewhat in measuring degree of proficiency retention by GO/NO GO criterion for scoring these criterion-referenced test instruments, but insights gained indicate the multiple-step procedural/cognitive tasks were generally more difficult to learn/retain than were tasks involving fewer subtasks.

Generally, task learning and retention were quite high within the institution, but procedural/cognitive tasks showed greater retention loss, particularly in communications, first aid, and vehicle recognition. Remedial training results in these areas indicate learning improvement and show that overtraining (training beyond the time necessary to learn a task) in problem areas may be productive. Future studies should include subtask analysis under more rigid scoring procedures to determine training pitfalls.

Grimsley trained sixty Advanced Individual Training (AIT) trainees to operate the control panel of the Nike-Hercules guided missile system under three levels of trainer fidelity.[14] While trainer fidelity had no effect on learning or retention, mean performance scores dropped from 91.4 to 74.6 with retesting after four weeks. Time to retrain after six weeks averaged 19.7 minutes, compared to

[14] D. L. Grimsley, Acquistion, Retention, and Retraining: Effects of High and Low Fidelity in Training Devices. HumRRO Tech Report 69-1. (Alexandria, VA: Human Resources Research Organization, February, 1969).

115.1 minutes for original training. So there was a significant performance decrement over a relatively short time interval, but considerable savings in retraining were demonstrated. It should be noted that the task studied here was not a basic combat skill, but rather a procedural task in which discrete, principally "all-or-none" responses were made to specific values of cues in a continuous series of stimuli (tasks were done in a sequential order). Grimsley replicated the results obtained in the previous study in a further study comparing the performance of low-aptitude (Category IV) trainees with high-aptitude trainees.[15] Category IV trainees took longer to master the task but demonstrated retention levels almost as high as high aptitude trainees.

Vineberg obtained retention data on the basic combat skills of drill and ceremony, first aid, individual tactical training, guard duty, M16 rifle, chemical, biological, and radioactivity training, and M60 machinegun.[16] Two hundred soldiers were tested upon completion of BCT and retested six weeks later by the same test team. Results showed that the probability of passing the overall test was .81 at the end of BCT, was .63 six weeks later, and was .55 for passing both.

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[15] D. L. Grimsley, Acquisition, Retention, and Retraining: Training Category IV Personnel with Low Fidelity Devices. HumRRO Tech Report 69-12. (Alexandria, VA: Human Resources Research Organization, June, 1969).

[16] Vineberg and Taylor, Performance in Four Army Jobs.

Depending on the measure used, the average decrease was 18 to 26 percent. Individual tasks showed decrements from 5 to 44 percent and Category II personnel were superior to Categories III and IV, who performed alike.

Leonard, Wheaton, and Cohen examined transfer and retention performance over periods of six and seventeen weeks for hand grenade subtasks of selecting, maintaining, arming, throwing positions, and identifying components.[17] One hundred and fifty enlisted personnel showed no significant retention loss in hands-on performance, but performance on written subtests was lower upon retest than upon initial testing, with an indication that the longer the retest interval was, the greater the decrease became. The authors point out that the tasks studied did not require a great deal of cognitive processing or complex procedure following, and that relatively short time periods were employed.

Germas trained operators of a tactical data system using lectures and computer-assisted instruction.[18] The mean error rate for eighteen trainees immediately after training was 6.8 (on a performance-based pencil and paper test), and the mean error rate on a retest one month later was 11.9. This study provides an indication of rapid retention

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[17] Leonard, Wheaton, and Cohen, <u>Transfer of Training</u>.

[18] J. E. Germas, "Embedded Training: Utilization of Tactical Computers to Train Computer Operators," Unpublished memorandum, US Army Research Institute, Alexandria, VA; November, 1976.

loss on a complex procedural task, although results on a performance test would have been more relevant to skill retention than would results on a pencil and paper test.

Another retention research area in a military context is studies of flying skills. Wright found that visual flying rules (VFR) skills remained acceptable for up to three years without any flying, but that instrument flying rules (IFR) skills became less than acceptable after one year for nearly one-half of the Army aviators surveyed, even if minimum flight practice was obtained.[19] The loss rate was greatest soon after training and experience, and decreased to near zero after one year. Roscoe concludes that perceptual-motor skills (landing a plane) are not quickly forgotten, but that procedural skills (starting a plane) are forgotten more rapidly.[20] Prophet reviews the flight retention literature and concludes that basic flight skills can be retained fairly well for extended periods of non-flying, but some decrement of concern does occur, particularly for instrument and procedural skills.[21] Little is known about the retention and

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[19] R. F. Wright, Retention of Flying Skills and Refresher Training Requirements: Effects of Nonflying and Proficiency Flying. HumRRO Tech Report 73-32. (Alexandria, VA: Human Resources Research Organization, December, 1973).

[20] S. N. Roscoe, "Incremental Transfer and Cost-Effectiveness of Flight Training Simulators" in Proceedings of NTEC/Industry Conference (7th). (Orlando, FL: Naval Trainng Equipment Center, November 1976), pp 3-9.

[21] W. W. Prophet, Long-Term Retention of Flying Skills: A Review of the Literature. HumRRO Tech Report 76-35. (Alexandria, VA: Human Resources Research Organization, October, 1976).

retraining of higher level pilot skills within tactical units. Baldwin, Cliborn, and Foskett looked at the area of visual aircraft recognition skills and found a 14 percent decrease in accuracy over a period of ten weeks.[22]

SUMMARY

Studies of military skill retention have shown significant retention loss over relatively short periods of time. Although the data are limited, it appears that retention loss is more severe for complex procedural tasks than for basic military skills. Problems in drawing final conclusins in this area are summarized below.

A common criticism of both the general and military skill retention literature is that research has concentrated on simple, non-procedural, primarily discrete skills. Practically nothing is known about the retention of complex tactical skills used in military, such as engaging the enemy in tank warfare. Another general criticism is that most studies have employed relatively short time intervals and have looked only at end-points or at a few points on the retention curve. Further analysis of skill retention curves over long priods of time is needed. Such an analysis is important for determining the optimal distribution of retraining over time for various types of tasks. With adequate retention data, a program could be designed to

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[22] R. D. Baldwin, R. E. Cliborn, and R. J. Foskett, The Acquisition and Retention of Visual Aircraft Recognition Skills. ARI Tech Report 76-A4. (Alexandria, VA: US Army Research Institute, November, 1976).

retest personnel at times when they are likely to have experienced retention loss and to provide retraining to those who fail to meet the criterion. A third area of concern relates to retention measures and the conditions under which retention is tested. First trial recall and retraining savings measures have both been used in the retention research summarized, and they do not necessarily lead to the same results and conclusions. Much of the military retention data is in terms of pass-fail measures, which may not be adequate to provide precise retention curves. Also, the gathering of skill retention data by use of pencil and paper tests may not be as adequate as the hands-on tests. A final point here is that test and retest conditions need to be carefully controlled, in order to distinguish performance decrements related to transfer from those related to retention loss.

RELEVANCE OF PRESENT RESEARCH

Numerous criticisms of previous studies of military skill retention have appeared in the literature review. The research described in this paper was not designed to answer all these criticisms, but rather was designed as a first step to initiate further research in the right direction. The review of the literature indicates that retention of basic military skills has not been studied extensively and that retention of specific armor skills has been systematically studied only in a First Training Brigade pilot study. The present paper provides initial data on armor skill retention in the unit; some of these skills are comparable to basic military skills studied previously, and some are more complex procedural ones. In order to answer some of the criticisms and meet some of the objectives brought out in the review, it is necessary to refine retention tests procedures and to standardize test conditions. The present study is of relevance here in providing a look at the usefulness of hands-on institutional tests as retention tests, in providing an initial study of unit retention over various time intervals and, in providing an initial analysis of general factors influencing retention. The present paper may serve as a model for future, relatively long-term retention testing in the Army.

CHAPTER IV

TEST METHODOLOGY/TEST DESIGN

SUBJECTS

The sample for this study consisted of male, entry level, US Army personnel who graduated from basic armor training during the period 16 December 1977 through 17 March 1978 at the First Training Brigade, Fort Knox, Kentucky. A total of 270 personnel were tracked to their first unit of assignment and were retested on the combined mid-cycle and end-of-cycle tests which they had taken successfully during BAT. The subjects were from the following units: the 24th Inf Div (Mech), Fort Stewart, GA; the 194th Armored Brigade and the School Brigade, Fort Knox, KY; the 1st Armored Division, the 3d Armored Division, the 3d Inf Div (Mech), the 8th Inf Div (Mech), the 2d Armored Cavalry Regiment, and the 11th Armored Cavalry Regiment, FRG. Detailed demographic information on the subjects was maintained by First Training Brigade, and further demographic, background, and experience data were obtained on a questionnaire given at the time of retesting. A detailed presentation of these demographic and background data is contained in the first section of Chapter V. The demographic characteristics were found to be generally typical of those for personnel entering the Army at the time of this study.

TEST INSTRUMENTS/APPARATUS

The instrument used to test and retest the examinees was a combined mid-cycle and end-of-cycle, Tanker Skills Qualification Test (TSQT). At the time of this study, these were the standard instruments used by the First Training Brigade to measure the progress of trainees. These were criterion-referenced instruments which for the most part provided performance-oriented testing. The particular skills tested were ones judged as critical armor crewman skills by First Training Brigade and senior Armor Center personnel. The performance test items were selected as representative samples of critical basic armor crewman, skill level one performance requirements. Stations on the post graduation test were: loader's duties, breechblock, M219 machinegun (coax), M85 machinegun, tank gunnery, general subjects, communications, maintenance, advanced driving, caliber .45 pistol and M3A1 submachinegun, and first aid. A detailed listing of specific test performance measures (tasks on which the individual was evaluated) within each of these stations can be found in Appendix C, Annex B. Detailed descriptions of performance measures, test standards, conditions, and associated apparatus are also included in the lesson plans in Appendix C. Examination of Appendix C shows that there were 85 performance measures recorded on the post graduation test. The number of performance measures was not equally divided across stations; e.g., there were 20 performance measures on the advanced driving station and 5 measures on the first aid station. Stations were also not completely comparable in terms of test conditions; some measures were obtained by a slide test or other classroom exercises, some were obtained on training devices, and some were obtained on actual tanks. Scoring on both tests was in terms of GO/NO GO categories: if an examinee performed all critical sub-tasks on a performance measure properly, he received a GO; if he performed any sub-task improperly, he received a NO GO (fail) for that performance measure. The number of sub-tasks within performance measures was not constant on these tests; some measures involved two sub-tasks which had to be performed properly, and some involved seven or more. These test design factors impact on comparability of test results across stations and performance measures, and will be further discussed later. The purpose of the present study was to examine overall failure rates within the existing testing system, and not to redesign the testing system for statistical purposes.

TEST PROCEDURES

The basic design of the study was very simple; given that a man had passed all performance measures on the mid-cycle test and TSCT in order to graduate, he was tracked to his first unit and was readministered the same tests under similar conditions and standards in order to determine what he remembered. Subjects were readministered a combined mid-cycle test and TSCT, with the standards and conditions of this combined test replicating those of the First Training Brigade's testing to the fullest extent possible. A county fair type testing scenario was utilized, as in the First Brigade, with small groups of examinees rotating between test stations. Units within which personnel were retested were selected as ones receiving a large influx of troops from the First Training Brigade at the time of the study.

Standardization of test conditions was critical to the success of this retention study. Although different teams of evaluators conducted the retesting, possible standardization problems were minimized by providing the test teams with training, standardization, and validation testing on the test procedures (Appendix B). Training procedures insured that evaluators had experience in following test procedures prior to testing, and the need for accurate, consistent standardized scoring was highly emphasized. Identical test condtions, standards, and apparatus were used for the retests. Scoring procedures were also identical for tests and retests; GO/NO GO results were recorded by evaluators on a similar score sheet as those used by the First Training Brigade. Standardization training and test materials were provided by a team of ARTS personnel who travelled to each test site standardizing testors, after which they monitored testing. Members of the ARTS team were former First Trainng Brigade personnel, and they were highly experienced with the tests given. Testors were NCO's provided by the participating units; many of whom had previous experience as test evaluators. Examinees were personnel in the selected units who had graduated during the period 16 December 1977 through 17 March 1978; thus, personnel were retested from two to twenty-five weeks after graduation.

A questionnaire was administered to each examinee immediately prior to retesting (Appendix D). This questionnaire was designed to obtain additional demographic information and to address the experiences of examinees since graduation. Examinees were asked general questions about their duty position and tank commander, and they were asked to estimate the number of times they had performed various tasks since graduation from basic armor training. These tasks were ones upon which the examinees were to be tested later in the day. It was clearly emphasized that estimates were to be as accurate as possible and based upon duties since leaving Fort Knox.

The ARTS M60A1 SWT developed a matrix to capture training data associated with the tasks that were to be retention tested. This matrix was designed to go to the platoon sergeants or tank commanders of the subjects in the test sample. Several significant problems were encountered with these matrixes. The matrix was developed too late to capture the majority of the target population; because the 11E MCS program was to be replaced by a new program, the brigade distributed the matrixes only to those companies in the new program. This resulted in the remainder of the 11E MCS data not being available.

The collection of data within the unit also encountered problems. The foremost problem was getting the matrix to the supervisor of the examinee. This problem was never overcome. The personnel being assigned to units where retention retesting was to be conducted were identified by name. Packets of the matrix were produced for each of these individuals. The packets contained a letter to the commander with instructions on filling in the matrix and mailing instructions on returning packets to ARTS M60A1 SWT. For those who had already departed Fort Knox, the packets were mailed to divisional POC's with instructions to forward them to the individual's unit.

It was discovered that these packets did not get to company level. For those personnel who had not graduated, the packets were put in envelopes addressed to the company commander and given to the individual along with his personnel records. Very few of these were returned. Exact reasons are not known, but several reasons which could contribute include: failure of service member to give packet to unit, or unit not filling out matrix. One problem encountered was that assignments were to either divisions or replacement battalions and often changes were made in assignments. This resulted in communication breakdowns and difficulty in tracking, by name, individuals to division or lower.

LIMITATIONS

In the post graduate retention testing study, certain factors limited the results from the outset. These limitations, which were taken into consideration when the desired results were outlined, can be grouped into the categories of time, funding, and resources.

The available data sources for this retention study were reviewed with the First Training Brigade. It was found that records would be inadequate for anyone graduating prior to 15 December 1977. The basic armor training course was redesigned and changed drastically for all classes beginning January 1978, resulting in a new fourteen week course that reached the first end of cycle during April 1978. Because of the July 1978 suspense for this report, the evaluation was limited to approximately a four-month period, from 16 December 1977 to 17 March 1978, and the number of personnel available to be evaluated was also limited. The number of personnel when coupled with other factors discussed later, limits the results than can justificably be expected to provide insights.

A small-scale investigation conducted within the First Training Brigade indicated that the educational level and previous employment status of trainees entering the basic armor training program may differ from one training cycle to another. The time frame from December to March in any year may tend to include a higher proportion of non-high school graduates (although the data indicate that this was not the case for this sample) and the unemployed or unemployables than other time frames. The full implications of these factors must be considered when generalizing from the results obtained.

It was deemed cost effective to limit data acquisition instruments to combined mid-cycle and end-of-cycle evaluation instruments that were already set up and being used in the First Training Brigade. These evaluation instruments test many tasks that the Armor Center has identified as critical and provide "GO/NO GO" measures which indicate only whether or not a trainee meets the established standard. Exact level of individual proficiency is not recorded. Because of time involved in developing a new test and the problems that would be encountered in getting evaluators, equipment, and trainees together to take the test, the existing evaluating instruments were used recognizing their limitations as a retention testing instrument.

The retention testing was further limited in the results that could be expected in that only eighty-five performance measures were tracked, and these measures were tracked for a four-month period, with classes graduating 16 December 1977 through 17 March 1978. Only limited insights into the decay curves and factors affecting the curves could be obtained. The test program is intended to provide a basis for future studies and to point out areas of special interest and pitfalls to be avoided.

An additional limiting factor is the possible lack of absolute continuity as far as the test administrators in the field environment where concerned. Although each testor was carefully standardized, one cannot be completely certain that the standards and conditions of the test were adhered with scrupulously. Resources did not provide for permanent team of testors throughout the study.

CHAPTER V

TEST RESULTS/DATA ANALYSIS

INTRODUCTION

This chapter consists of a detailed presentation of the extensive data collected in this study; a more general discussion and a comparison with other relevant studies is presented in Chapter VI. First, detailed demographics of the sample are presented; these data were obtained from First Training Brigade records and from the pre-retention test survey (Appendix D). Next, general background variables of the sample are discussed, followed by a discussion of specific experience factors; these data were obtained from the pre-test survey. Finally, performance data are presented for the overall retention test, by test station, and by individaul performance measures, followed by breakouts and analyses of these measures by the variables summarized above. All data tables are presented in Appendix A.

Data tabulation and statistical analysis for this study were accomplished by use of the Statistical Package for the Social Sciences (SPSS).[1] Results were tabulated by use of subprogram FREQUENCIES, and breakouts of performance measures by demographic, background, and experience variables were accomplished by use of subprograms CROSSTABS and BREAKDOWN. The performance measures yielded ordinal data (e.g.,

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[1] N. H. Nie, C. H. Hull, J. C. Jenkins, K. Steinbrenner, and D. H. Bent, Statistical Package for the Social Sciences, Second Edition, New York: McGraw-Hill, 1975.

mental category). The primary appropriate statistical tests yielded by the SPSS procedures were Kendall's tau and one-way analysis of variance (ANOVA). These statistics are applied and discussed where appropriate throughout the chapter.

DEMOGRAPHICS OF SAMPLE

As described in Chapter IV, the sample for this study consisted of 270 male soldiers who completed basic armor training at Ft Knox, Kentucky during the December 1977-March 1978 time frame. Detailed demographics for the sample at the time of field retention testing are presented below.

The vast majority of examinees held the rank of E1 or E2 when retention tested in the field; 29.3% were E1, 64.2% were E2, 4.8% were E3, and 0.7% (2 individuals) were E4 (with prior Regular Army enlistment). The preponderance of lower ranks is due to the fact that most examinees were in their first field assignment at the time they were retention tested.

The mean age of examinees was 19.6 years (median was 19.2 years), with the range being 17 to 36 years. The majority (72%) fell in the range of 18 to 20 years of age, and only 6.0% were above 22 years old.

Marital status data were collected on the pre-test survey and revealed that 84.7% of the sample were single and the remainder (15.3%) were married. No further details (divorces, separations, etc.) on marital status were collected.

Mental category data were available for all but 20 members of the sample, and the following distribution was obtained: Category I - 3.6%; Category II - 17.2%; Category III - 70.8%; and, Category IV - 8.4%. The scarcity of Category I and preponderance of Category III personnel were typical attributes of the armor trainee population at the time of the study.

Data on the education level of examinees were obtained from 1st Training Brigade records and revealed that the majority (72.0%) had completed 12 years of education (had completed high school and had no further education). Also 26.3% had not completed high school (had 9 to 11 years of education), and 1.6% had obtained education beyond the high school level.

Service history data were collected from 1st Training Brigade in order to identify members of the sample who had prior service. Results indicated that 90.1% of the sample were non-prior service accessions.

Further demographic information collected on the pre-test survey addressed the career intentions of the examinees. They were asked to assess, on a 5-point scale, the probability that they would remain in the Army for a career. Results showed that 7.4% answered "yes", 14.1% "probably yes", 40.4% "undecided", 8.1% "probably no", and 30.0% "no".

Overall, demographics of the sample appear typical for the armor trainee population. The majority had no prior service, were 18 to 20 years old, single, in mental category III, and high school graduates with no further education. There was some concern that a sample taken during winter months would be atypical of Army trainees, but this reservation does not appear to have been supported by the demographic data.

GENERAL BACKGROUND OF SAMPLE

Retention testing was conducted in various units, as described in Chapter IV. The distribution of examinees within tested units was as follows: 1st Armored Division, 8.5% of examinees; 2d Armored Cavalry Regiment, 9.6%; 3d Armored Division, 24.4%; 8th Inf Div (Mech), 6.3%; 11th Armored Cavalry Regiment, 7.0%; 24th Inf Div (mech), 30.7%; 3d Inf Div (Mech), 7.8%; and 194th Armored Brigade, 5.6%. Thus, 36.3% of the sample were assigned to CONUS units and the remainder were assigned to USAREUR.

The period between graduation and time of retention testing varied from two to twenty-five weeks for individual examinees, with an average of 13.9 weeks. The sample sizes corresponding to each number of weeks from graduation to retesting are presented in Table 1. Also listed in this table are sample sizes by three week blocks of time; e.g., the number retention tested 2, 3, or 4 weeks after graduation. The grouping into three week blocks was performed primarily for statistical purposes. Large variation was obtained in the number of examinees tested per week, and very small sample sizes (as small as 0 or 1) were obtained for some weeks. Grouping into three week blocks is the smallest grouping which provides sufficient sample sizes for analysis of performance by time; such an analysis will be presented later in this chapter.

Most of the data in the remainder of this section and the next section were obtained from the pre-test survey, and 100% accuracy in examinees' responses cannot be guaranteed since precise unit records were not available. An attempt was made to obtain accurate unit training records via a data matrix distributed to the units and examinees; this effort did not prove to be successful (see Chapter IV for discussion). Examinees were asked to estimate time periods and numbers of times numerous tasks has been performed; for those who had been in the unit for more than a few weeks, this was a difficult task. Assistance was provided during survey completion, and completed surveys were reviewed with examminees to the extent possible and unreasonable repsonses were corrected. Review of surveys indicated that the responses provide a generally accurate record of experience in the units.

A variable closely related to the time period between graduation and retention testing is the number of weeks assigned to a tank after leaving Ft Knox. Examinees were asked to estimate this time period on the pre-test survey, and estimates ranged from zero to twenty-four weeks, with a mean of 7.1 weeks. A large percentage (25%) of examinees indicated that they had never been assigned to a tank since leaving Fort Knox (some had been assigned to M551 Sheridans).

Examinees were asked the number of tanks they had been assigned to since leaving Ft Knox, and the following response distribution was obtained: None, 22.3%; one, 56.3%; two, 17.4%; and three, 3.0%. There is a slight discrepancy between this and the previous variable in terms of the percentage who had never been assigned to a tank (23.3% versus 25%). This is probably due to the fact that responses to the previous question were rounded off to the nearest week. Thus, a man assigned to a tank for three days or less would have been assigned to one tank for zero weeks.

Examinees were asked to indicate their current position within a tank crew; 28.5% indicated that they had no position, 30.0% were drivers, 39.6% were loaders, and 1.9% were gunners. They were also asked to estimate the number of weeks they had spent in other crew positions. Due to the limited time most individuals had been assigned to the units, the percentage of personnel having had more than one crew position provided no significant relationships. In the case of drivers, the range was zero to twenty-three weeks with an average of 3.0 weeks; 63% indicated that they had not been a driver. For the loader position the range was zero to twenty-four weeks, with an average of 3.8 weeks and 51% of the sample not having been a loader. For gunners the range was zero to six weeks, with an average of 0.1 weeks and 96.7% not having been a gunner. As would be expected during initial weeks of the first assignment, the majority of examinees were drivers or loaders, with very few serving as gunners. The large number without a crew position indicates a possible problem which will be discussed in Chapter VI.

The number of tank commanders (TC) they had had and the rank of their current TC were also indicated by the examinees. The majority (55.6%) had had one TC, while 10.7% had none, 25.6% had two, 7.4% had three, and 0.7% had four. Most TC's were in the rank of E5 or E6; 2.1% were E4, 32.8% were E5, 39.8% were E6, 9.5% were E7, and 15.8% were officers.

During a previous institutional retention research project within 1st Training Brigade described earlier in this report, trainees were retested on the mid-cycle and end-of-cycle tests within the institution from 1 to 3 weeks after original testing. In order to consider tying the results of this study together with those of the previous study and to analyze the effect of institutional retesting upon later retention testing, participants in the previous study also in this study were identified. It was found that 6 participants in this study had been retested on the mid-cycle test in the previous study, and 30 had been retested on the end-of-cycle test. These sizes are sufficient to allow a longitudinal analysis of retention within the institution and the unit. However, possible effects of institutional retesting upon later retention will be briefly addressed later in this chapter.

SPECIFIC EXPERIENCE FACTORS

Data summarized in this section were obtained via the pre-test survey and involve examinees' estimates of unit training and experience directly related to specific retention test performance measures. Data relating to specific types of training are presented, followed by data pertaining to the number of times various tasks were performed in the unit.

Examinees were questioned as to their use of Training Extension Course (TEC) lessons overall and by specific categories, since it was suspected that use of TEC lessons might be related to skill retention. In general, extensive use of TEC lessons was not reported; overall, 36.7% of the sample reported using TEC lessons. By specific categories, 19.3% reported having used gunnery TEC, 20.7% had used NBC TEC, 9.6% had used communicatons TEC, 16.3% had used maintenance TEC, 16.3% had used first aid TEC, 21.1% had used vehicle recognition TEC, and 4.4% had used map reading TEC. Examinees estimated the number of times they had used TEC lessons in the above categories; in all cases the majority of those who reported having used TEC lessons had used them only once or twice.

Data were also obtained on specific types of first aid training in the unit; overall, 38.5% of examinees reported having received first aid training since leaving Ft Knox. By specific categories, 32.6% reported receiving training on treatment for burns, 29.3% on treatment of broken bones, 30.4% on mouth-to-mouth resuscitation, 30.7% on control of bleeding, and 31.5% on treatment for shock.

Training on map reading was also addressed; 31.1% reported having received such training, with the bulk having received it for 1 to 4 hours. By categories, 18.5% reported having received training on determining elevation on a map, 29.3% on finding a position on a map, and 28.1% on determining ground location.

Finally, vehicle recognition training was addressed in general and in terms of specific training media. Overall, 44.8% reported having received such training, in most cases two hours or less. By media categories, 24.8% reported having had training with slides, 32.2% with cards, and 10.7% with models.

Examinees estimated the number of times since leaving Ft Knox that they had performed various tasks which had potential relationships to the performance measures on the retention test. Summary statistics for these estimates are displayed in Table 2. Most estimates were in terms of the number of times a task had been performed; a few (indicated in Table 2) were in terms of number of rounds or number of miles. The first data column in the table indicates the percentage of respondents who had performed the task at least once. The tasks are listed in descending order of these percentages. The mean, standard deviation, and median or middle response are presented for each task. The median is the more appropriate measure of central tendency here, since it is less influenced by the few extremely large estimates obtained. For most tasks, there were large numbers of examinees who had never performed them in the unit. Only 11 of the 29 tasks had been performed by 50% or more of the sample. Gunnery tasks were the least commonly performed; only 7% of the sample had fired the main gun. Many of the examinees were recent arrivals in their unit (examinees had been in units for from two to twenty-five weeks) and had not participated in major training exercises; this largely accounts for the lack of experience indicated by the low median values. Many tasks had not been practiced by many examinees, and those practiced were practiced only a few times, on the average. The sample thus offered the opportunity for study of skill retention without extensive practice in the units.

OVERALL PERFORMANCE MEASURES

As described in Chapter IV, results of performance measures for each examinee were recorded on scoresheets in terms of CC/NC CC categories. Overall performance can thus be succintly described in terms of the percentage of examinees receiving a CC or NC CC. Such data are presented in this section for the total test, test stations, and individual performance measures.

The mean number of CC's received by the 270 examinees on the 85 performance measures was 67.71, with a standard deviation of 8.46. Thus, examinees performed 79.7% of tested tasks correctly, on the average. This performance will be broken out by time, demographics, and other variables in later sections. The median number of CC's received was 68.00, and the mode was 67, in close agreement with the mean. The total number of CC's for individuals ranged from 19 to 85 (2 examinees "maxed" the test). These data indicate that on the average, soldiers can pass the institutional test criterion on about 80% of critical skill level one tasks during the first few months of their first assignment.

During test adminstration, performance measures were grouped into 11 test stations; the number of performance measures per station varied from two to twenty-four. Results on these stations are not completely comparable due to the differing numbers of performance measures involved, the differing test conditions (e.g., slide test vs. hands-on test) and the fact that stations conceptually "fit together" to various degrees (e.g., first aid vs. general subjects). For further discussion of performance measures grouped into each station, see Chapter IV and Appendix C (such a listing is also provided in Table 4, to be discussed below). However, analysis of performance by test station does provide an initial general indication of where retention problems lie. Such an analysis is displayed in Table 3; the percentages presented were calculated by dividing the mean number of CC's by the total number of performance measures on each station. Stations showing highest performance levels were advanced driving, gunnery subjects, and maintenance, while stations on which relatively low performance was demonstrated included breechblock, M85 MC, and general subjects. A more precise breakdown in terms of individual performance measures is present below.

Performance on the retention test is summarized in Table 4 in terms of the percentage of the 270 examinees who received a CC on each performance measure. Review of this table indicates specific areas where performance was relatively poor. The 10 measures on which performance was worst in rank order were: map marginal info (20.4%), map 6-digit coordinate (22.6%), map elevation (24.4%), M85 MC assembly/disassembly (43.1%), breechblock assembly and installation (48.7%), coax MG stoppage (49.8%), breechblock removal and disassembly (50.9%), map colors (54.8%), emergency driving situations (56.3%), and clear M85 MG (56.5%). This breakout of the data indicates that most of the difficult on the general subjects station involved map reading, that difficulties on the breechblock station were encountered with both assemby and disassembly, and that all aspects of the M85 MC station were relatively difficult. Further discussion of the types of tasks on which performance was relatively low and possible reasons therefore is included in Chapter VI.

Performance measures in Table 4 are grouped in terms of the way they were organized and scored on the test; other groupings are conceivable. Many of the performance measures (e.g., hand and arm (H/A) signals, flashlight (FL) signals, and ammunition recognition) were scored in terms of responses to individual stimuli. Other individual performance measures involved several subtasks and responses to several stimulus situation (e.g., breechblock removal and disassembly). If ammunition recognition was grouped together as one performance measure (all types of ammunition would have to be correctly identified to receive a CC on the measures), the expected CC percentage would be 50.4% (the product of the 7 individual CC rates), assuming independence in recognition of different types of ammunition. This would considerably change the picture of ammunition recognition performance. This example indicates that CC rates can be affected by the way performance measures are defined, particularly by the number of subtasks involved in the measure. Perhaps breechblock tasks are not inherently more difficult, but just involve more subtasks in the performance measure. These problems in comparison of performance measures will be further discussed in Chapter VI.

PERFORMANCE BY DEMOGRAPHIC CATEGORIES

Earlier in this chapter demographic categories of the sample and overall retention test performance were discussed. In this section the cross tabulation of major demographic variables by performance on the retention test is described, in order to determine the relationships, if any, between demographics and performance on armor tasks. The demographic variables were cross tabulated with total number of CO's on the retention test, and with individual performance measures where such a detailed analysis appeared fruitful. The demographics analyzed were rank of examinee, age, marital status, mental category, education level, and career intention.

The breakout of performance on the total retention test by rank of examinees indicated that rank is not significantly related to retention performance. Since there were only two E4's in the sample, their data were combined with the E3's, thus making subsample sizes adequate for statistical analysis. The mean percent CO's on the total test by ranks were: E1 - 80.2%, E2 - 79.2%, and E3 and E4 - 80.3%. A one-way ANOVA indicated that the mean CO rates were not significantly different ($F(2,267) = .3046$, $p > .05$). Thus, rank of examinee did not affect retention test performance.

The breakout of total retention test performance by age of examinees revealed that age is not significantly related to retention performance, within the age range addressed in this study. Since there were few examinees in the sample above 23 years old (12 examinees fell in the range of from 24 to 36 years old), their data were combined with those for 23 year olds, thus providing sufficient subsample sizes for statistical analysis. The mean percent CO's on the total test by age groups were: 17 year olds - 80.0%, 18 - 80.3%, 19 - 79.3%, 20 - 80.6%, 21 - 76.7%, 22 - 83.2%, and 23 and above - 82.7%. A one-way ANOVA indicated that the mean CC rates by age groups were not significantly different (F (6,236) = .8656, p> .05). Thus, the appropriate conclusion is that age of examinees was not related to retention test performance.

Performance on the total retention test was cross tabulated with marital status of examinees, and results indicated that marital status had no effect upon retention test performance. The mean percent CC's on the total test for single examinees was 79.5%, and the corresponding figure for married was 80.7%. A one-way ANOVA revealed that the mean CC rates by marital status were not significantly different (F (1,266) = .4826, p> .05). Thus martial status was not significantly related to retention test performance.

Cross tabulation of performance on the total retention test by mental cataegory of examinees indicated that mental category is significantly related to retention test performance. The mean percent CC's on the total test by mental category groups were: Category I - 89.9%, Category II - 85.0%, Category III - 78.5%, and Category IV - 76.5% (See Figure 1). Since there were only nine category I personnel in the sample, their data were combined with that of Category II personnel for statistical purposes; the mean CC percentage for categories I and II combined was 85.9%. A one-way ANOVA on the means for Categories I and II combined, Category III, and Category IV revealed that the means for these groups were significantly different (F (2,247) = 13.9671, p< .0001). Thus, mental category was significantly related to retention test performance; on the average, Category II personnel received NC CC's on about six more tasks than Category I and II personnel did, and Category IV personnel received about two more NC CC's than Category III personnel did. Based upon these data, the bulk of the effect appears to be that Category III and IV personnel performed less well on the retention test than Category I and II personnel did.

Since the overall effect of mental categories was found to be significant, and since mental category was considered a relatively important demographic variable in this study, the effect of mental category was examined on each of the 85 performance measures. Displayed in Table 5 are the percentages of examinees by mental category groupings (I and II combined, III, and IV) who received a CC on each performance measure, along with Kendall's tau values and their associated probabilities. Kendall's tau is a rank correlation coefficient which is appropriate if at least ordinal measurement of both variables has been achieved, as is the case here.[2] It provides a measure of the degree of association or correlation between the ranks on the variables of mental category and CO/NC CC's than higher category personnel did, and a negative tau value indicates the opposite. Tau values with an associated probability of less than .05 indicate a statistically significant effect; i.e., a case where

[2]Siegel, S. Nonparametric Statistics. New York: McGraw-Hill, 1956, p. 213.

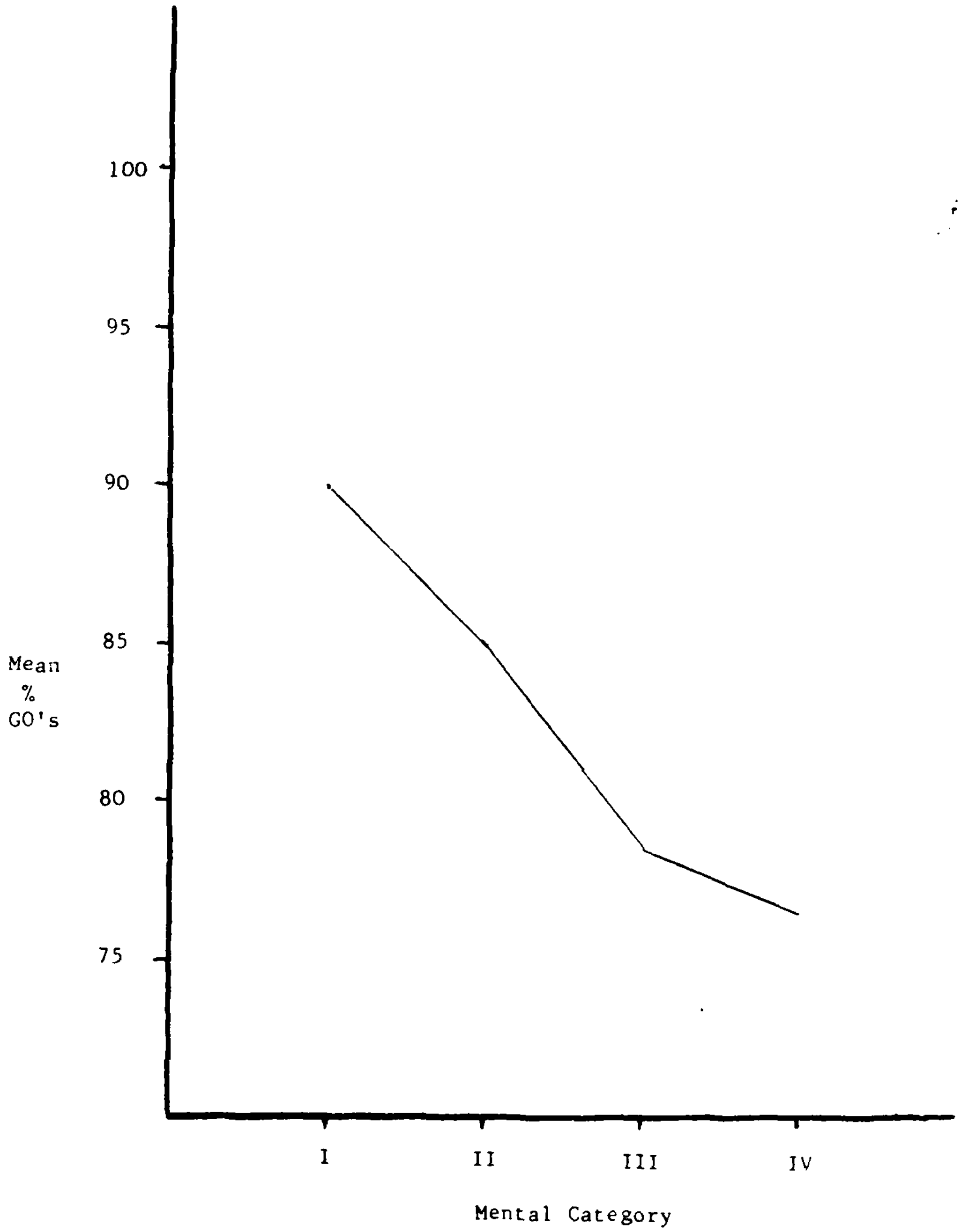

Figure 1. Overall Retention Test Performance by Mental Categories

different mental category groupings performed differently. With 85 different performance measures, one would expect four or five of the relationships to be significant by chance (.05 multiplied by 85). A total of 27 significant tau values are noted in Table 5, indicating a significant relationship between mental category and retention test performance on many more measures than would be expected by chance, as reflected in the overall significant effect discussed above. All significant tau values obtained are positive, indicating that lower category personnel performed significantly poorer. Specific significant effects are discussed below. On the loader's duties station, the only significant relationship was found on loading the coax MG ammunition box; Categories I and II performed better than Categories III and IV, who performed at approximately the same level. Stowing main gun ammo also showed a nearly significant effect. Several tank gunnery performance measures showed a significant relationship; two out of four measures for the replenisher tape, four out of five range flags measures (the fifth was almost significant), four of seven ammo recognition measures, both mounting tanks measures, and two of six vehicle recognition measures. These performance measures were all obtained on a slide test, and most showed a consistent downward trend to CC rate as one moves down the mental category scale. All map reading and the NBC markers measures showed a highly significant relationship. Lower category personnel performed very poorly on map reading. The only communication task showing a significant relationship was placing the AN/VRC 64 into operation, and likewise the only maintenance task was track and suspension. Two driving tasks showed a significant relationship and these involved starting and stopping procedures. One individual weapons measure was significant (disassembly, assembly, and functions check of M3A1 SMG, and two (mouth to mouth resuscitation and burns) of the five first aid tasks showed a significant relationship. In general, it appears that task involving memory retrieval and cognitive processing of information (e.g., map reading) showed a significant relationship. Lower mental category personnel tended to perform such tasks more poorly (i.e., they had higher NO GO rate). Further discussion of types of tasks showing relatively low retention performance by mental category and other variables is contained in Chapter VI.

The cross tabulation of performance on the total retention test by educational level of examinees indicated that education is not significantly related to retention performance. Educational level was defined in terms of number of years education successfully completed. Since only four examinees had complete more than 12 years of education, their data were combined with the 12-year group to provide adequate subsample sizes for statistical analysis. The mean percent GO's on the total test by years of education were: 9 years - 79.5%, 10 years - 78.4%, 11 years - 79.5%, and 12 years or more - 80.3%. A one-way ANOVA indicated that the mean GO rates were not significantly different ($F(3,239) = .2911$, $p > .05$). Thus, number of years of education did not affect retention test performance.

The final demographic variable cross tabulated with total retention test performance was career intention, and a nonsignificant relationship was found. Career intention categories were defined in terms of responses along a five-point scale on the pre-test survey, as described earlier in this chapter. The mean percent GO's on the total test by responses to the question "Do you plan to remain in the Army for a career?" were: "yes" - 78.0%, "probably yes" - 83.3%, "undecided" - 80.0%, "probably no" - 77.8%, and "no" - 78.4%. A one-way ANOVA indicated that the mean GO rates were not significantly different ($F_{(4,265)} = 2.0256$, $p > .05$). However, the relationship was nearly significant ($p = .09$), and review of the GO percentages above indicates a trend for those not planning to stay in the Army to do worse, except for those who definitely planned to stay in the Army, who did as poorly as those definitely planning not to stay. The group responding "yes" was influenced by an aberrant case; an individual who received only 19 GO's on the test definitely planned to stay in the Army. There appears to be slight, though not quite significant trend for those planning not to stay in the Army to perform more poorly, except for the aberrant case of those definitely planning to stay in.

In summary, the only demographic variable having a significant statistical relationship with retention test performance was mental category; lower category personnel do worse on many tasks. Rank, age, marital status, education level, and career intention did not show a significant relationship.

PERFORMANCE BY GENERAL BACKGROUND VARIABLES

Presented in this section is the cross-tabulation of general background variables described earlier in this chapter with performance on the total test and on specific performance measures, where appropriate. The background variables addressed are unit of assignment, period between graduation and retention testing (in one and three week blocks), number of weeks assigned to a tank, number of tanks assigned to, current crew position, weeks served as a driver, weeks served as a loader, rank of current TC, and institutional retention testing.

As described earlier, retention testing was conducted within eight active Army units. The CC rate for each identified unit will not be listed here (with one exception discussed below), since participating units were assured that test results were nonevaluative and would not reflect back on them. The cross tabulation of units within which examinees were assigned by performance on the total retention test showed that the mean percentage of tasks evaluated as CC ranged from 72.3% to 95.4% for particular uits. A one-way ANOVA on the mean CC rates for each unit indicated that the differences between units were significant ($F\ (7,262) = 9.4086$, $p < .001$). Thus, performance on the retention test varied significantly, depending upon the assigned units of examinees.

Examination of the mean CC rates for each unit revealed that one unit was particularly aberrant from the rest. Since this unit performed especially well, it can be identified; it was the 194th

Armored Brigade at Ft Knox. The 194th's mean GO percentage was 95.4%, while other units ranged from 72.3% to 83.2%. Since the 194th data contributed largely to the significant statistic discussed in the previous paragraph the one-way ANOVA was recalculated with the 194th excluded. The result was significant ($F(6,248) = 2.5727$, $p < .05$), although not as highly as before. Thus, there were significant differences among units other than the 194th. Such differences were probably due to differing training programs and activities in the various units. Precise data on training approaches of various units were not available during this study, and such data could not be discussed without risking identification of individual units' GO rates. The difference did not lie between CONUS and USAREUR units; their overall GO percentages were approximately the same (77.2% for OCONUS and 79.5% for CONUS, excluding 194th).

Why did the 194th Armored Brigade perform so relatively well? First, it must be pointed out that the 194th results are based upon a sample of only 15 men; any conclusions based upon this size sample are tentative ones. It may be that since the 194th was located at Ft Knox, they received superior training, or they may have received valuable experience in support of First Training Brigade. In addition, units of the 194th Armored Brigade had recenty completed, or were currently involved, in tank gunnery cycle. Another possibly important factor is that the 194th personnel were retention tested by First Training Brigade, whereas other units were tested by test teams trained in the field by ARTC personnel. Although every attempt was made to duplicate 1st Training Brigade testing conditions in the field, testing conditons may have differed somewhat. Field teams of testors were given extensive testing experience the day before retention testing, and the need for accuracy was strongly emphasized. First Training Brigade testors may not have had such recent training and encouragement. There may be different underlying motivation and attention factors for one-time field testors versus testors who continually test hundreds of men a week. Regardless of the underlying reason, if First Training Brigade testors evaluated examinees less strictly than the field testors did, the implications for this study are important. Decreases in performance in the field may be due to a change in test standards, as well as due to retention loss. This point will be elaborated upon in Chapter VI.

A relationship of prime interest in this study is that between retention test performance and the length of time between graduation and administration of the retention test. As discussed earlier, this time interval is analyzed here in terms of three week blocks of time. Such a grouping provides sufficient sample sizes for each block of time to allow valid statistical testing and drawing of proper conclusions. Displayed in Figure 2 are the mean percentages of tasks on which a GO was received by retention interval in three week blocks. The first block represents 2, 3, and 4 week intervals, and succeeding blocks represent succeeding three week groupings. The figure indicates that overall retention test performance did not change much as a function of time since graduation. This conclusion is supported

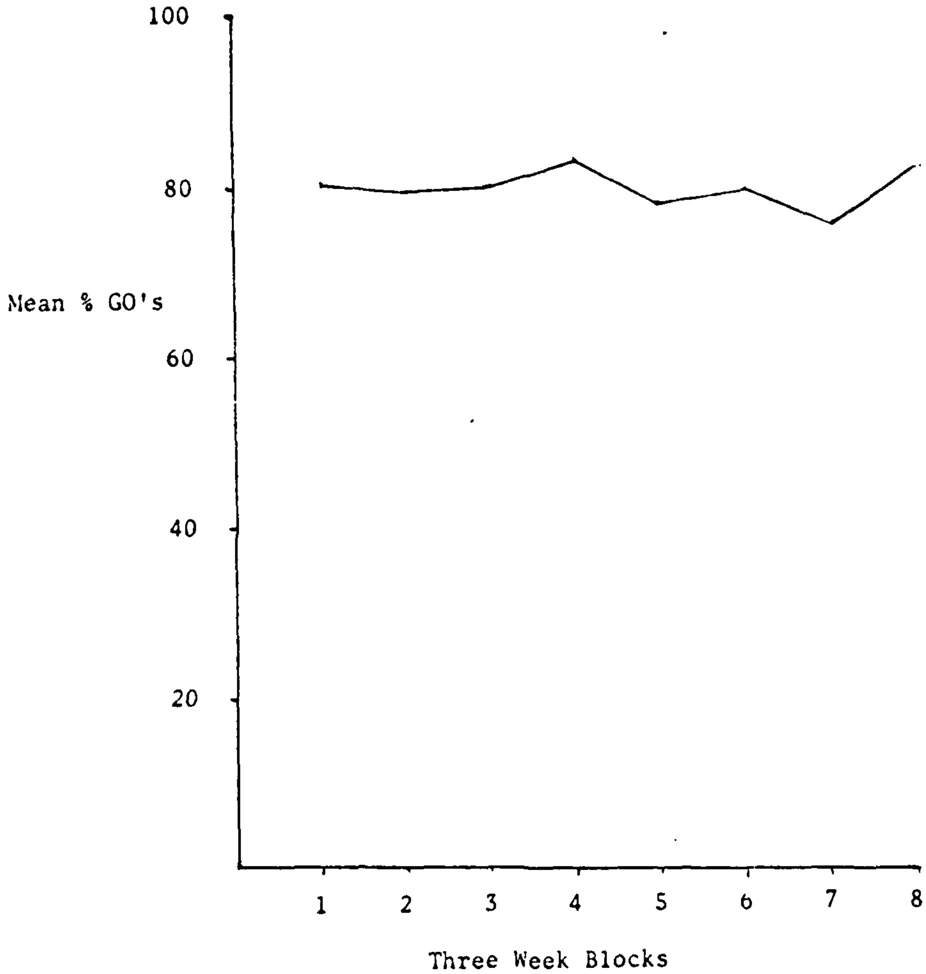

Figure 2. Mean Percentages of Tasks Evaluated as GO by Period Between Graduation and Testing, in Three Week Blocks.

by a one-way ANOVA on the mean CC rates for three week blocks, which yielded a nonsignificant result (F (7,262) = .9542, p> .05). This result indicates that the overall mean CC rates for the various three week block were not significantly different; i.e., the overall retention curve was essentially flat over time. If one assumes that performance was at the 100% CC level at the time of graduation from the institution (this assumption may not be entirely correct; see discussion in Chapter VI), performance dropped to about 60% CC level two weeks later, and remained at approximately the same level over time. There is no overall retention interval effect, after the initial drop upon leaving the institution; whether this initial drop is due to retention loss or change in testing conditions is addressed in Chapter VI.

The lack of an overall retention effect could be due to a decline in performance on some tasks and a balancing improvement on others. An analysis of retention over time for individual performance measures is presented in Table 6. Space does not permit listing of the average CC rate for each of the eight three-week blocks of time in the table, but the Kendall's tau values and their associated probabilities indicate the significant relationships. Measures with a significant negative tau value showed significant performance improvement over time in the unit, and measures with a significant positive tau value showed significant performance decrement over time. Overall there are 18 significant relationships indicated in Table 6 (nine positive and nine negative), which is considerably more than the four or five that would be expected by chance. Thus, significant effects of time were found with several specific performance measures. The average CC rates over time for these 18 measures are displayed in figures 3a, b, and c. Measures showing significant improvement over time in the unit were: main gun misfire; unload main gun misfire; AN/VRC-64 into operations; transmit message; H/A start engine; FL move in reverse; clear cal .45 pistol; disassembly, assembly, and function check for cal .45 pistol; and, mouth-to-mouth resuscitation. Measures showing significant decrement over time were: remove and disassemble breechblock; assemble and install breechblock; clear M85 MG; disassemble and assemble M85 MG; mounting tanks, stationary range; two of six threat vehicles; map 6-digit coordinate; and, NBC markers. While some of these effects are isolated ones and may be due to chance, certain trends are apparent; main gun misfire, some communications, and cal .45 pistol tasks show improvement over time (perhaps because they receive extensive practice); breechblock and M85 MG tasks show declining performance over time (perhaps because they are not generally performed by skill level one soldiers). In summary, there are significant changes in performance on specific measures over time, and their effects balance out so there is not a significant overall change in the 80% CC rate. Possible reasons for improvement and decline in performance on specific tasks will be further addressed later.

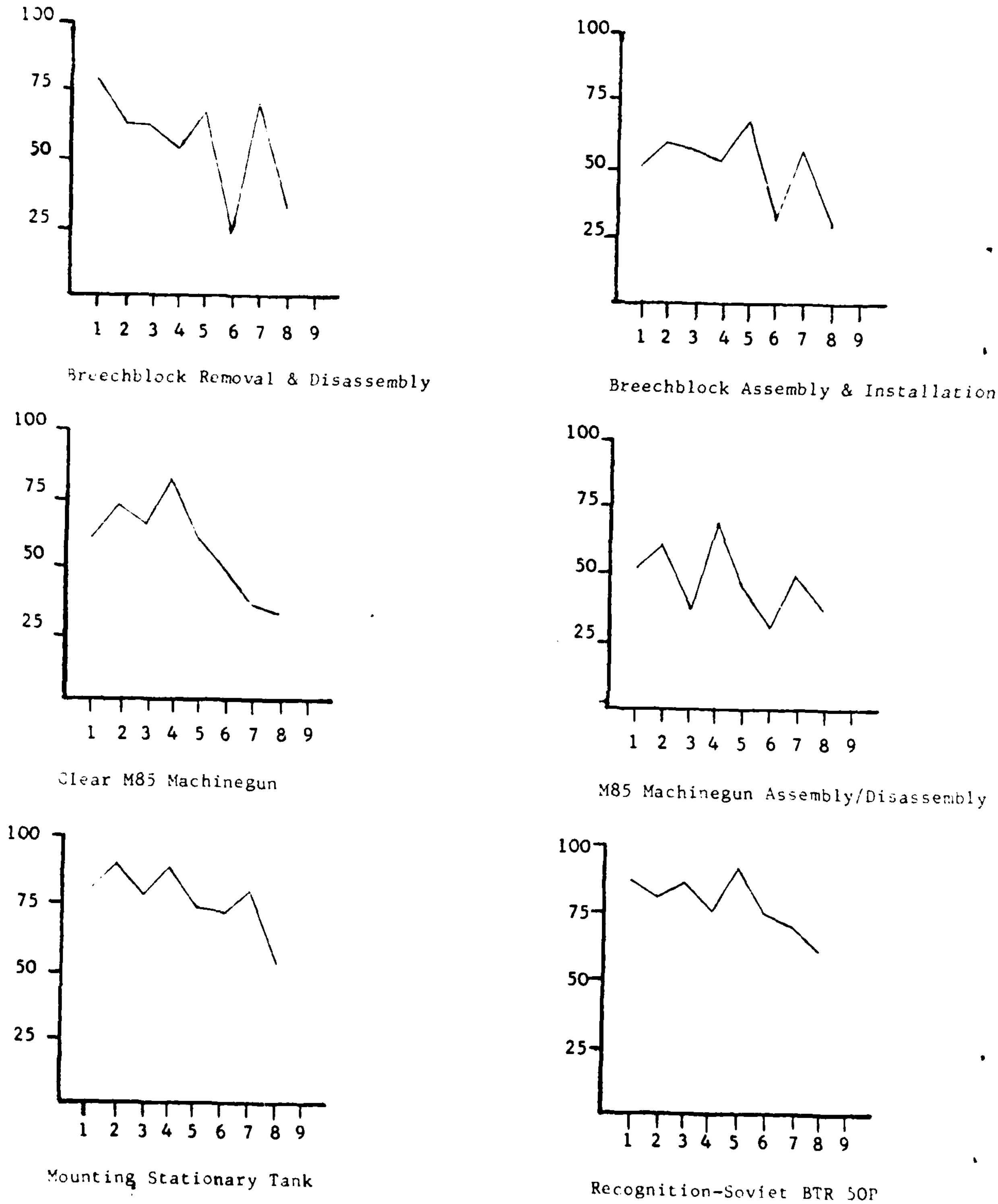

Figure 3a. Performance measures showing significant decrease over time (Horizontal axis - 2 week block; vertical axis - mean % CC's).

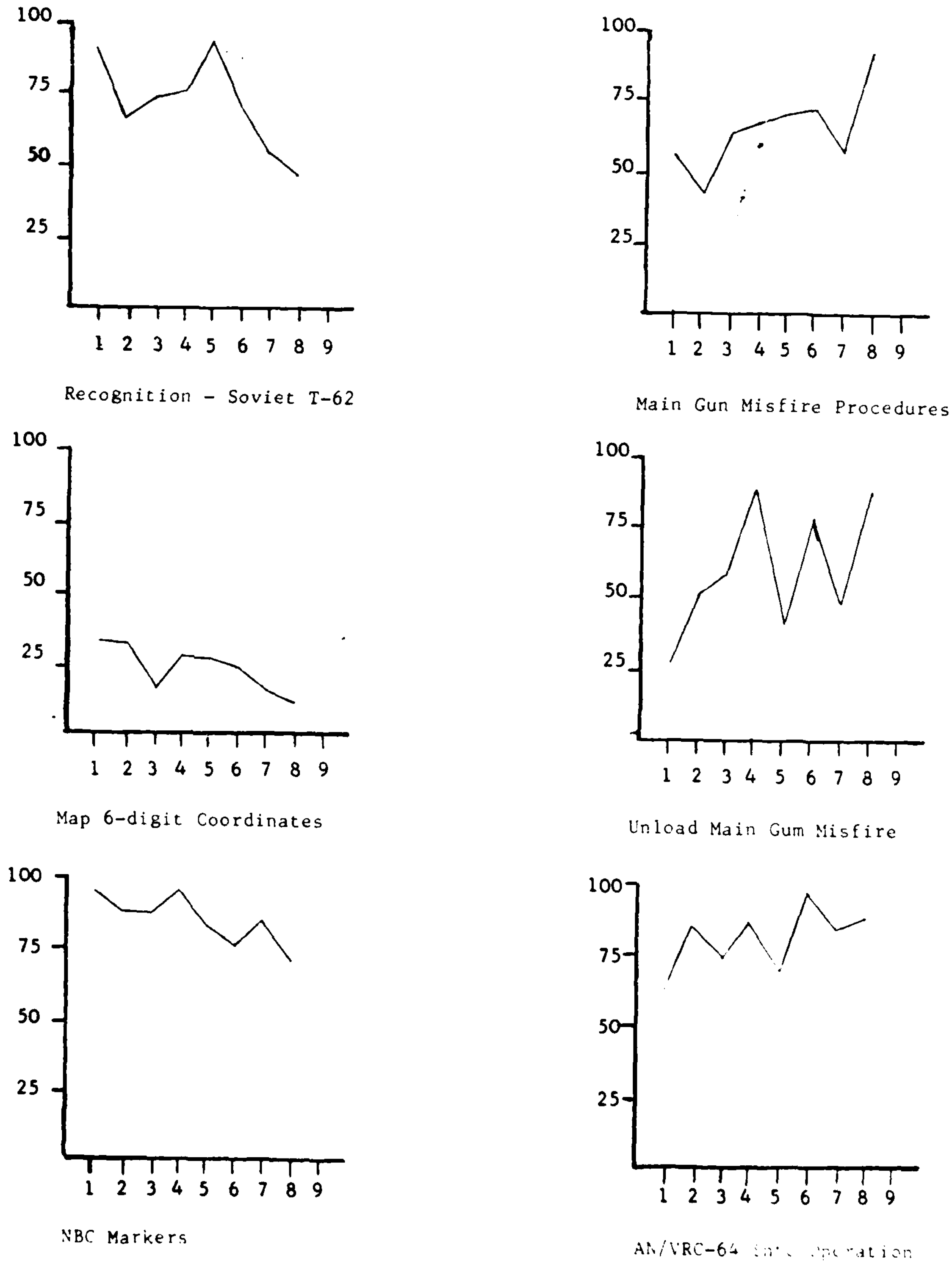

Figure 3b. Performance measures showing significant decrease (left column) and significant increase (right column) over time. (Horizontal axis - 3 week blocks; vertical axis - mean % GO's).

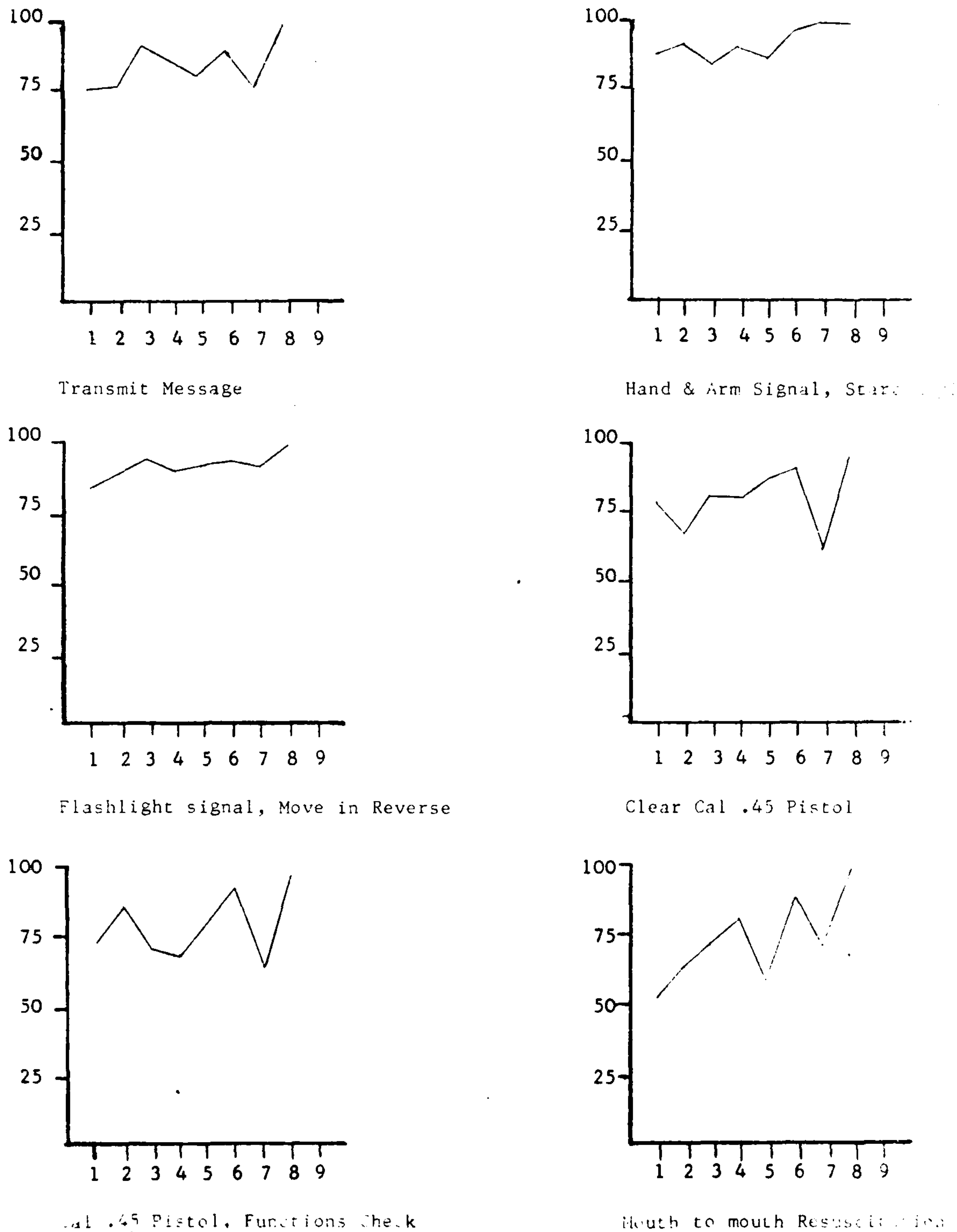

Figure 3c. Performance measures showing significant increase over time. (Horizontal axis - 2 week blocks; vertical axis - mean % CO's.)

The number of weeks in the unit for which the examinees reported having been assigned to a tank was also cross-tabulated with total retention test performance. A statistical test of this potential relationship yielded a not quite significant result (Kendall's tau = .067, p = .06). The negative tau value indicates that there was a trend for those assigned to tanks for longer periods of time to receive fewer GO's on the test, but the trend was not quite significant. At least, the results indicate that increased experience in a tank crew did not lead to improved performance. Of course, experience is confounded with time and effects of these two variables (learning and forgetting) may have cancelled each other out somewhat. Performance results for those who had never been assigned to a tank crew (79.2% GO overall) versus those who had (81.0% GO overall) did not show a large difference either. Thus, experience in a tank crew in terms of number of weeks assigned did not have a significant effect upon total retention test performance.

The analysis of total test performance by current position of examinees did not show a significant effect. Gunners were eliminated from this analysis, since there were only five of them in the sample. The mean GO percentages by positions were: no position - 80.5%, drivers - 79.9%, and loaders - 78.4%. A one-way ANOVA indicated that these mean GO rates were not significantly different ($F(2,262) = 1.0734$, $p > .05$). Thus, current positon, or the lack of position, did not affect overall performance.

Of greater interest than the effects of position on overall performance are the effects on specific performance measures. That is, did drivers perform better on driving tasks, while loaders performed better on loading tasks? The answer is an unequivocal no. Out of the 85 performance measures, only 5 showed a significant relationship between position and performance (as indicated by Kendall's tau values). This is no more than would be expected by chance, so position did not affect individual performance measures. Drivers' and loaders' GO rates on specific driving and loading tasks were reviewed, and no consistent trends were noted. The lack of an effect here may be due to the fact that members of the sample had not had extensive experience in their crew positions. As would be expected from the above result, neither weeks spent as a driver nor weeks spend as a loader showed a significant relationship with total test performance, or with more individual performance measures than would be expeced by chance.

Rank of TC was found to have a nonsignificant relationship to performance on the retention test. Since only five examinees had TC's in the rank of E4, these data were combined with those having E5 TC's to provide sufficientt subsample sizes for statistical analysis. The mean GO percentages by rank of TC were: E4 and E5 - 80.1%, E6 - 80.1%, E7 - 77.2%, and officer - 77.2%. A one-way ANOVA indicated that the mean GO rates were not significantly differently ($F(3,237) = 1.2350$, $p > .05$).

Performance of examinees who had been retested on the mid-cycle or end-of-cycle test in the earlier institutional retention study was contrasted with that of examinees who had not been so retested, to determine the effects, if any, of institutional retention testing upon unit retention. The mean GO percentage for those retested on the mid-cycle test was 80.9%, and for those not retested it was 79.1%. This difference is not statistically significant (F (1,268) = 1.7116, p> .05). The mean GO percentage for those retested on the end-of-cycle test was 80.7%, and for those not retested it was 79.5%. This difference is also not significant (F (1,268 - .3998, p> .05). Thus, institutional retesting did not affect later retention in the unit. Retesting did not produce learning which significantly influenced later retention.

PERFORMANCE BY SPECIFIC EXPERIENCE FACTORS

The final set of variables which were cross-tabulated with retention test performance involve examinees' extimates of specific experience factors. Experience factors were cross-tabulated with overall test performance or with specific performance measures to which they relate. Types of experience examined included use of TEC lessons, first aid training, map reading training, vehicle recognition training, and various other types of xperience close related to specific performance measures.

The overall effect of use of TEC lessons was examined by comparing the GO percentage on the retention test for those who had used TEC lessons, versus that for those who had not. The average GO percentages obtained were 81.3% for users of TEC lessons and 78.7% for non-users. A one-way ANOVA indicated that this difference is significant ($F(1,260) = 4.1417$, $p < .05$). Thus, users of TEC lessons did tend to perform better on the retention test.

Results on each first aid performance measure were compared for groups who reported having received first aid training versus those who reported not receiving such training. Results on specific performance measures were also compared for groups who had or had not received training directly related to that measure (e.g., treatment of burns performance was compared for those who had or had not received training on treatment of burns). In no case was a significant relationship found between first aid training and first aid performance. This indicates either that first aid training received was not beneficial, or that examinees' estimates of first aid training received were not accurate.

A similar analysis was conducted on map reading; map reading performance results were compared for those who had and had not received training on map reading in general and by specific types. Again, no significant relationships were found. Training on map reading as reported by examinees did not affect map reading performance.

The same result was obtained with vehicle recognition training. Examinees who reported having received training on threat vehicle recognition did not show higher performance that those who had not received such training. Perhaps the unit training received utilized media which did not generalize to the slides used in this test; completely adequate training should generalize across types of media.

Experience factors estimated by examinees on the pre-test survey were cross-tabulated with performance measures to which they were functionally related. A total of 46 comparisons were made, and are listed in Table 7. The first element in each row of the table is the experience factor, or examinees' estimates of the number of times tasks were performed in the unit; the second element is the corresponding performance measure. Space does not allow the display of the distribution of performance (CC percentages) by the number of times each task had been performed in the unit. However, the Kendall's tau values in the table do provide an index of relationships between experience and performance. A significant negative tau value indicates that, as more experience was obtained on a task, performance improved. A significant positive tau value indicates the opposite. A nonsignificant tau value indicates that experience with a task did not affect performance of that task on the retention test. A total of twelve significant tau values were obtained, nine negative and three positive. Relationships showing a significant improvement in performance as a result of experience were: disassembly and assembly of M85 MG with experience on disassembly; clearing .45 pistol with experience on disassembly; functions check on .45 pistol with disassembly; functions check on M3A1 SMG with disassembly; clearing .45 pistol with firing of .45 pistol; NBC knowledge with number of NBC classes; placing AN/VRC-64 into operation with number of times having turned on radios; completing DA Form 2404 with number of times completed previously; and, track and suspension with number of times having broken track. Relationships showing a significant decrement in performance as a result of experience were: loading coax MG ammunition box with number of times having stowed belt ammo; recognizing NBC markers with number of NBC classes; and, recognizing NBC markers with number of mine field classes. The number of significant relationships obtained between experience and retention test performance was less than expected. While experience does lead to improved retention in some areas, the effect was not widespread. Experience appears even to hinder performance in some areas; reasons for this are presently unknown. Some of the expected effects may have been obliterated by inaccurate estimates of experience on the part of examinees. Or, since examinees did not have extensive experience in most areas, it may be that experience does not have much effect upon task performance at this level.

CHAPTER VI

DISCUSSION

In this chapter results presented in the preceding chapter are summarized and their implications are addressed. The overall retention test performance results are discussed, followed by consideration of the effects of demographic, background, and experience variables. These findings are then compared with those of previous relevant studies, and implications for future retention research and the armor training system are discussed.

OVERALL PERFORMANCE RESULTS

Overall, examinees received about 50% GO's on critical tasks retention tested in the unit. If one defines "combat ready" as being able to perform at least 95% of critical tasks correctly, then very few men in this sample met the criterion. But when one considers that members of this sample were relatively new enlistees who had had little field experience when retention tested, and that some of the tasks on which a large number of NO GO's were received were ones which a Skill Level 1 soldier would not normally be required to perform (e.g., M85 MG disassembly/assembly and map reading), the results are not disheartening. Results of this study in general augur fairly well for the armor training system.

What type of tasks showed relatively low performance, and why? Categories showing lowest performance levels were map reading, M85 MG, and breechblock tasks. As mentioned above, two of these groupings (map reading and M85 MG) represent skills not ordinarily required of a skill level one soldier; the M85 MG is the TC's weapon and is primarily his responsibility, and map reading is usually accomplished at platoon level or higher. Thus, these tasks may have received less training emphasis and less practice than other more basic tasks: 53% of the sample reported having disassembled the M85 MG, but most had done so only once or twice; no experience data were collected on map reading, but most members of the sample could not have read a map, even if required to. Reasons for NO GO's were annotated on score sheets by testors. These data indicate that the prime reason for failing M85 MG tasks was exceeding the time limit. On map reading tasks, no answers were given in most cases, since examinees did not even know how to begin. On breechblock tasks, the prime reason for a NO GO was the performing of tasks in improper sequence; these tasks involve many steps which must be performed by the novice in a set sequence for safety considerations. Major reasons for NO GO's on other tasks were: on coax MG stoppage, weapon was not functioned in full cycle; on emergency driving situations, many examines did not know meaning of gauge readings or forgot second shot on fire extinguisher; on starting procedures, many did not know proper warm-up time or RPM's; on stopping procedures, many did not know how to use manual shut-off or proper RPM's for cool down; on main gun misfire, many failed to rotate round in the breech or to follow safety procedures; and, on loading main gun misfire, many performed steps in improper sequence and disregarded safety procedures. Review of these reasons for NO GO's indicates that the majority involve knowledge or cognitive elements; i.e., knowing proper sequence of steps, proper RPM's, or how to read gauges or maps. The prime reason for NO GO's appears to have been loss of cognitive elements of tasks.

Which skills showed improvement over time, which showed a decrement, and why? Main gun misfire tasks showed improvement, even though only 34% of the sample reported having practiced misfire procedures. Two communications tasks showed improvement, and such tasks had been practiced extensively (68% had turned on radios). The .45 cal pistol tasks also showed improvement, and disassembly of .45 cal pistol was one of the most commonly practiced tasks (by 73% of sample). These findings provide some support to the hypothesis that tasks practiced extensively showed improvement (main gun misfire results remain a puzzle). The major task categories showing significant performance decrement over time were breechblock and M85 MG tasks. Breechblock disassembly had been practiced by 40% of the sample, and M85 MG disassembly by 53%; thus it is not altogether true that tasks forgotten were ones which were not practiced. The relationship (or lack of a relationship) between experience and performance in this study is further discussed in a later section of this chapter.

Three cautions should be applied to interpretation of the results of this study. First, retention intervals were calculated from the date of graduation from the institution, and were reported as two to twenty-five weeks. In actuality, many of the tested tasks were trained early in the training cycle and originally tested on the mid-cycle examination, while others were trained and tested shortly before graduation. Examinees may not have been able to perform all tasks correctly on the day of graduation; some forgetting may already have occurred. But retention intervals were calculated as they were, because it was impossible to identify when every task had been practiced by and tested on every individual in the institution. This fact has two implications: retention intervals may actually have been somewhat longer than those indicated in the preceding chapter, and retention intervals may not have been exactly equal for all tasks, which may have influenced relative performance levels for various performance measures. These implications do not impact greatly on this study, which provides a general picture of retention in the unit, but any future studies attempting to precisely model relative retention performance over time should more precisely identify and control retention intervals.

The second caution relates to whether performance decrements found in this study were due to retention loss or a testing difference. Overall, performance was found to be at the 80% level in the units (indicating a 20% decrement; if one assumes 100% performance upon leaving the institution), regardless of the retention time interval (two to twenty-five weeks or more, see above). One could then question whether forgetting occurred, or whether the performance decrement was due to the field test being more difficult (administered more strictly) than the First Training Brigade operational tests. The institutional and field tests were equated to the extent possible, but were administered by different personnel for different purposes. A hint that a testing difference occurred was noted in the 194th Brigade results; these 15 examinees were retention tested by First Training Brigade testors rather than field-trained testors, and their performance was significantly higher than that of any other unit. However, these personnel had recently completed tank gunnery training. The data in this study provide measures of the capabilities of men in their first unit of assignment; relatively low performance on some tasks cannot be strictly attributed to retention loss or a testing difference. Retention loss on a task in this paper means the task is performed relatively poorly in the unit, whatever the reason. The need for constant test conditions and testors in future retention research is clear.

The final caution relates to comparison of individual performance measures. When testing a large set of operational tasks, it is impossible to equalize them in terms of their number of steps. Some of the performance measures in this study involved grossly different numbers of steps; e.g., assembling a breechblock may involve 20 or more steps, while recognizing a threat vehicle involves one decision. Concluding from this study that assembling a breechblock is inherently more difficult than recognizing a threat vehicle may not be proper; we may be comparing apples and oranges. The breechblock task may be more difficult because of an entirely different new requirement: cognitively organizing a sequence of steps. Future task analysis should be more oriented toward behavior analysis; i.e., identify number of steps in a task by type, according to stimulus/response and cognitive requirements. Then perhaps more definitive conclusions regarding types of tasks forgotten and reasons therefore can be drawn.

The cautions summarized above relate more to future research needs than to criticism of the present research. The data summarized in this study represent the most extensive analysis, to date, of the performance of basic armor skills in the first unit of assignment. Implications of these data for armor training are discussed in a later section.

EFFECTS OF DEMOGRAPHIC VARIABLES

Of all the demographic variables addressed in this study (rank, age, marital status, mental category, educational level, and career intention), the only one showing a consistent, significant relationship with retention performance was mental category. Lower mental category personnel (III's and IV's) performed at a significantly lower level overall, and this decrement appeared to be concentrated in tasks involving cognitive knowledge elements (e.g., map reading). These personnel appeared to have problems with tasks involving recognition of stimuli and indication of appropriate action (e.g., range flags, ammo types, NBC markers), and with tasks involving retrieval of information from memory (e.g., map reading, starting and stopping procedures). One could hypothesize that lower category personnel have not organized the knowledge required for these tasks properly in memory, and therefore cannot retrieve the needed information. Reasons for performance differences by mental category groups, on various types of tasks, is an appropriate area for future research. The training implication for now is that lower mental category personnel should be given increased or improved training in tasks involving memory retrieval and cognitive processing of information, in order to increase their learning and retention.

EFFECTS OF BACKGROUND VARIABLES

The only background variable which was significantly related to total retention test performance was unit of assignment; this held true even when the aberrant 194th Brigade results were excluded from the analysis. Unfortunately, reasons for this finding cannot be discussed here, since accurate records of the types of training conducted in the various units were not available. A review of the experiences reported by examinees from the various units did not reveal any large differences. It could be that performance differences were more related to intangibles, such as unit leadership. Testing differences could also be involved here, since different units were retention tested by different teams of testors.

It is somewhat surprising that an overall retention effect (decrement in overall performance over time) was not found in this study. The analysis indicated that performance on some tasks improved over time, while performance on others decreased, balancing out to an overall 50% level of performance at any time. Some degrees of retention loss may not have been detected, due to the use of GO/NO GO measures. Such measures detect only a drop in performance below the criterion, and do not detect changes which remain above the criterion.

For example, if the criterion is 20 seconds, these measures do not detect a change in performance from 10 seconds to 19 seconds. The results did indicate certain areas in which increased practice is needed in order to maintain performance at an acceptable level; e.g., M85 MG, breechblock, map reading, and some coax MG tasks. However, results indicate that for many tasks forgetting is not a major problem; further, more precise study is recommended before drawing any final conclusions here.

Other background variables studied (number of weeks assigned to a tank, number of tanks assigned to, current position, rank of TC, institutional retesting, and type of training program) did not significantly affect performance of basic skills. Study of such variables over a longer period of time might yield significant relationships; there was not much variance in many of these variables over the time period of this study.

EFFECTS OF EXPERIENCE

The effects of experience upon retention performance were not widespread. One meaningful relationship was found with the use of TEC lessons; personnel who reported having used TEC lessons demonstrated significantly higher performance. This finding indicates that use of TEC lessons has beneficial effects upon retention, and that their use should be more strongly encouraged. Only about 37% of the sample reported having used such lessons.

In contrast to the TEC lesson result, training in first aid, map reading, and threat vehicle recognition was not significantly related to corresponding performance measures. Such training as presently given apparently has little effect. The cross tabulation of examinees' reports of hands-on experience with performance also did not show a consistent trend. Only 12 of 45 such relationships examined were significant, and three of these were in the wrong direction (experience hindered performance). We cannot conclude that experience did not generally improve performance, but rather that examinees' reports of experience were not generally related to performance. We do not know that their reports were entirely accurate, since no unit records were available for verification. However, these data do provide an indication that experience or practice does not have a great effect upon performance, with limited amounts of practice upon generally basic skills. Further study within a more controlled environment with greater varieties of practice is needed to precisely determine the effects of practice upon skill retention.

COMPARISON WITH PREVIOUS STUDIES

The previous study with which the present study most directly relates is the First Training Brigade study of skill retention within the institution.[1] The institutional paper examined the same basic

[1] U.S. Department of Army. Headquarters First Training Brigade (Armor), "The Learning and Retention of Basic Armor Skills Within the Institution:, by Major James S. Cary. Ft Knox, KY, 1978.

armor skills examined in the present paper, with retention analyzed over a period of three weeks in the institutional environment. Both papers reported the lack of an overall consistent trend in retention loss over time. The previous study found an approximately 95% GO rate on the retention test, while this study found an approximately 80% GO rate on a similar test administered in the unit; neither study found a consistent change in the GO rate for various time intervals between original institutional testing and retention testing in the unit. So both studies support the conclusion that there is not a significant overall change in basic armor skill performance over time in the operational environment; some tasks show a decrease in performance levels and some show improvement, resulting in lack of a net change. The difference in overall GO rates found (95% versus 80%) may be due to the differing retention intervals involved (one to three weeks versus two to twenty-five weeks), or to differing test conditions in the institution versus in the field.

An area in which the two studies do not agree is that of which specific types of tasks showed a performance decrease over time. The previous study found that the primary tasks were communications, individual weapons, first aid, and coax MG stoppage tasks. The present study found that the primary corresponding tasks were map reading, M85 MG, coax MG stoppage, and breechblock tasks. Reasons for this difference can only be speculated upon at the present time. Some tasks may have shown relatively improved performance on the field retention study because they had been extensively practiced in the units (e.g., caliber .45 pistol tasks). However, it seems strange that map reading is not forgotten in the institution (well over 90% GO's were received), but very few men can read a map in the unit (only about 20% received GO's). Either map reading skills are very quickly forgotten after three weeks, or there is a possible problem in testing procedures. A carefully controlled longitudinal study with a constant team of testors would be necessary to clarify retention trends across the institution and the unit. At the present time it is felt that the present unit retention study, with its longer retention time intervals and more carefully controlled testing, provides the most accurate picture of basic armor skill retention.

Another area in which the two studies agree is in mental categories data. Both reported lower retention performance by lower mental category personnel, particularly on cognitive types of tasks. There is a scarcity of previous data on retention of skills having cognitive or procedural elements by mental aptitude groups. One study[2] found that Category IV personnel took longer to learn a procedural task, but retained it almost as well as high aptitude personnel, once learned. Whether the relatively low performance of lower aptitude personnel on some tasks is due to initial learning or retention problems is not presently clear (it's probably due to both). Regardless of its underlying reason, the finding should have impact

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[2] D.L. Grimsley, Acquisition, Retention, and Retraining: Effects of High and Low Fidelity in Training Devices. HumRRO Tech Report 69-1. (Alexandria, VA: Human Resources Research Organization, June 1969).

upon the training of lower aptitude personel.

The comparison of the present study with other studies summarized in Chapter III is difficult. Most reported a drop in performance on retention tests in the general magnitude of that reported in this study. Some reported finding higher retention loss on procedural or cognitive-oriented tasks, as reported here. Previous studies have each looked at only one or two points on the retention curve. Thus, whether performance drops off rapidly and then remains constant in general over time as reported here, or steadily decreases over time, cannot be determined at present. Further longitudinal research is needed for establishing retention curves.

IMPLICATIONS FOR FUTURE RESEARCH

Many suggestions for future research have been alluded to throughout this chapter. One criticism of the present research project would be that it was too ambitious in scope. A large number of variables were examined and there cannot help but be some confounding of such variables in an operational environment. For example, unit of assignment was somewhat confounded with time of retention testing in this study. In some units tested, the bulk of examinees were relatively new arrivals to the unit. In other units tested near the end of the study, all examinees had been in the unit for 15 weeks or more. Since there was a significant performance difference among units, this difference was confounded with time between graduation and retention test, and perhaps affected retention results over time. But this problem could only have been avoided by sending out several test teams at the same time, and by assuring that OSUT graduates in the December 1977 - March 1978 time frame were assigned uniformly to tested units. Resource and practical constraints did not allow such and approach.

An ideal study of retention of armor skills would be impossible to conduct in an operational environment. Learning in the institution would have to be tightly controlled and measured to ascertain that all tasks were learned to the same level by all men. Tests would have to be validated to measure task performances at equivalent behavioral levels. Constant, well-trained teams of testors would be necessary for testing in the institution and in the units. Unit training would have to be tightly controlled and recorded to determine the effects of different approaches. Resource and practical constraints make such an approach impossible in a study having the scope of this one. However, research can start in the right direction by looking at limited, carefully analyzed sets of tasks in controllable situations. This study provides a general picture of armor skill retention; next perhaps such retention can be more carefully analyzed in small independent segments.

Several specific future directions for retention research have been suggested in this paper. Skills need to be further analyzed into their components, so that specific elements which are difficult to retain can be identified. This may lead to a model predicting skill retention for various types of skills; e.g., mechanical, procedural, cognitive, etc. Research is needed to further address whether cognitively organized skills are indeed harder to retain, and why, particularly for lower aptitude personnel. Is this finding related to the organization of skill representation in memory? Are there ways in which these skills can be better organized (e.g., by mnemonic devices) to improve retention? Work is also needed in studying retention using measures more analytic than GO/NO GO ones. Such work may eventually lead to models accurately predicting skill retention by specific types; optimal training and retraining programs could then be developed.

IMPLICATIONS FOR TRAINING

What implications does this study have for training in the institution and in the units? The overall implication is that the present training system is not too bad, but could be improved in some areas. For example, training on map reading is obviously not effective for a long period of time. If lower skill level armor personnel are not often required to read maps, then should they be given such training in the institution? If the institutional training is necessary to form a background upon which map reading skills will be developed at a later career point, then the training should be organized so it can be remembered. A decision needs to be made whether to train map reading effectively in the institution, or to omit training it until a later career point. The same argument can be developed for M85 MG tasks. The M85 MG is the TC's weapon, and skill level one soldiers seem to rapidly forget how to work with it. It might be desirable to postpone M85 MG training from the institution until appropriate in the unit. Tasks involving a required sequence of steps (e.g., breechblock and main gun misfire) show low retention performance; perhaps job aids or mnemonic devices are needed to improve memory in these areas. Lower aptitude personnel appear to have difficulties with tasks involving memory retrieval and cognitive processing; they may need more basic training and practice in these areas. TEC lessons showed a positive influence upon retention in this study, even though they had not been used extensively. Their use should be more strongly encouraged. Other types of unit training (e.g., first aid, threat vehicle, map reading) did not show a positive influence; their effectiveness needs to be re-examined.

Listed above are few possible implications of this study for the armor training system. Hopefully, experienced personel can review this and related research and develop useful applications. As armor duties become more complex, future training systems must be developed with long-term retention in mind.

CHAPTER VII

CONCLUSIONS

Personnel were able to properly perform (i.e., receive a GO) on about 80% of basic armor skills tested in this study, during the first two to twenty-five weeks of their assignment to a unit. The general types of skills showing relatively low performance levels were map reading, M85 MG, and breechblock tasks. Since the first two types of tasks listed above are ones which a Skill Level 1 soldier is not frequently required to perform, the results augur fairly well for the armor training system. The majority of NO GO's received related to failure on relatively cognitive skills; e.g., remembering the proper sequence of steps or reading and interpreting stimuli. These types of skills appear to be forgotten most rapidly.

There was not a significant overall change in performance over the retention intervals used in this study. Performance on a few tasks (e.g., main gun misfire, communications, caliber .45 pistol) improved over time, while performance on others (e.g., M85 MG, breechblock) worsened, resulting in no net change in performance over time. The overall retention curve was essentially flat; performance was at about the 80% GO level regardless of the number of weeks since graduation.

It is not possible to attribute the performance drop between the institution and field retention test (from about 100% GO to about 80% GO) found in this study strictly to retention loss or a testing difference. Institutional and retention tests were equalized to the extent possible, but they were given by different personnel for different purposes. There was an indication in the study that the field retention test was administered more strictly, thus perhaps resulting in lower performance levels. Regardless of the reasons underlying the performance levels demonstrated, results of this study provide a good general picture of the capabilities of armor personnel in their first unit of assignment.

The only demographic variable significantly related to retention test performance was mental category. Lower aptitude personnel (categories III and IV) performed at a significantly lower level overall. Their difficulties appeared to be concentrated on cognitive tasks involving memory retrieval and decision making; e.g., map reading and recognition of various stimuli. Rank, age, marital status, educational level, and career intention did not significantly affect task performance.

The only general background variable significantly related to overall retention performance was unit of assignment. Units performed at significantly different levels; the relatively high performance of one particular unit's personnel may be due to the fact that they were retention tested in the institutional environment. Other performance differences among units could not be attributed to differing experiences in units, largely because precise unit training records were not available. Number of weeks assigned to a tank, number of tanks assigned to, current position, rank of TC, institutional retesting, and type of training company did not significantly affect performance. Some of these variables deserve further study.

Unit experiences as reported by examinees were significantly related to performance in some areas, but the effect was not widespread. The use of TEC lessons benefitted retention performance, but training on first aid, map reading, and threat vehicle recognition did not. Only nine of the 46 relationships examined showed that experience significantly improved retention. It appears that within the situation examined here (rather limited practice on basic skills learned well initially), experience or practice does not have a large general affect upon retention.

Results of this study agreed with those of the previous institutional retention study in finding a flat overall retention curve and a significant effect of mental category. However, specific tasks forgotten in the institution and in the unit were not generally the same; this may be due to practice, and testing environment differences in the two studies.

Further research is needed to identify specific aspects of tasks which make them easy or difficult to remember, and to identify reasons for lower aptitude personnels' difficulties on cognitive tasks. While ideal retention research can never be accomplished in an operational environment, the analysis of a few well understood tasks in a controlled situation would be an initial step in the right direction.

Implications of this study for armor training include the following: use of TEC lessons should be more strongly emphasized; certain tasks (e.g., map reading and M85 MG) should be considered for training in the unit rather than in the institution; tasks involving memory of a sequence of steps or other cognitive operations are areas for development and application of job aids or techniques to improve memory, particularly for lower aptitude personnel; and certain types of unit training (e.g., first aid, map reading, threat vehicle recognition) need to be reevaluated. Examination of the data by experienced training personnel may lead to further implications.

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AD-A136 323 ARMY TRAINING STUDY: TRAINING EFFECTIVENESS ANALYSIS (TEA) SUMMARY VOLUME I ARMOR(U) ARMY TRAINING AND DOCTRINE COMMAND FORT MONROE VA F J BROWN 08 AUG 78 3/5

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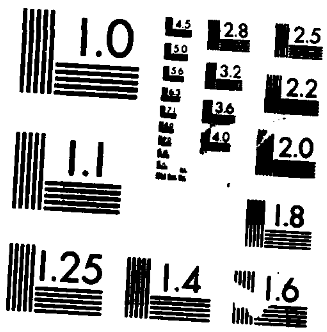

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX A

GENERAL DATA TABLES

TABLE 1

SAMPLE SIZES BY INTERVAL BETWEEN GRADUATION AND RETENTION TEST (ONE AND THREE WEEK BLOCKS)

Week	Sample Size	Three Week Block	Sample Size
2	14		
3	9		
4	2	1	25
5	15		
6	11		
7	2	2	28
8	5		
9	19		
10	16	3	40
11	12		
12	9		
13	1	4	22
14	0		
15	33		
16	8	5	41
17	14		
18	47		
19	12	6	73
20	5		
21	4		
22	5	7	14
23	0		
24	0		
25	27	8	27
TOTAL	270		270

TABLE 2

SUMMARY STATISTICS FOR ESTIMATES OF NUMBER OF TIMES VARIOUS TASKS WERE PERFORMED IN UNITS

Task	% Who Performed	Mean	Standard Deviation	Median
Put on mask	76	4.4	6.8	2.6
Disassembled 45	73	6.8	15.0	2.4
Turned on radios	66	6.6	14.7	1.8
Received NBC Class	63	2.2	3.3	1.1
Disassembled M219	61	4.4	12.0	1.3
Before opns checks	60	8.9	22.1	1.4
Miles driven	59	34.6	84.7	2.6
Transmitted message	56	5.7	13.7	1.1
Disassembled M85	53	2.9	8.4	0.6
Ammo rounds stowed	51	23.4	55.5	0.9
Disassembled M2A1	50	3.8	13.1	0.5
Lube	47	1.9	7.0	0.5
DA Form 2404	45	4.2	14.3	0.4
Serviced air cleaners	44	1.0	1.8	0.4
Fired 45	42	1.0	4.8	0.4
Disassembled breechblock	40	1.2	3.2	0.3
Performed prep to fire	39	2.0	5.9	0.3
Loaded main gun	37	10.4	24.0	0.3
Broken track	36	1.2	3.1	0.3
DA Form 2408-1	35	4.5	14.8	0.3
Loaded M219	35	3.3	11.2	0.3
Practiced misfire	34	1.2	2.8	0.3
Checked track tension	32	1.3	6.5	0.2
Belt ammo stowed	31	4.0	15.7	0.2
Field phone into opn	28	1.2	6.4	0.2
Received mine field class	26	0.5	1.2	0.2
Received gunner training	19	0.5	1.7	0.1
Fired main gun	7	0.2	0.9	0
Rounds fired	7	1.0	6.0	0

TABLE 3

AVERAGE PERCENT GO PERFORMANCE BY TEST STATIONS

Station	Average % GO
1. Loader's duties	75.0
2. Breechblock	49.7
3. M219 (Coax)	66.3
4. M85	49.7
5. Gunnery subjects	84.3
6. General subjects	53.3
7. Communications	81.6
8. Maintenance	82.3
9. Advanced driving	90.3
10. Cal .45 and SMG	83.6
11. First aid	81.8
TOTAL TEST	79.7

TABLE 4

PERCENT OF 270 EXAMINEES WHO RECEIVED A GO ON EACH PERFORMANCE MEASURE

Performance Measures	% GO
STATION 1 - LOADER'S DUTIES	
Stow main gun ammo	86.2
Load banana box	80.7
Load coax machine gun	64.7
Coax fire command	90.0
Main gun fire command	74.7
Main gun misfire	66.9
Unload main gun misfire	63.6
STATION 2 - BREECHBLOCK	
Remove and disassemble	50.9
Assemble and install	48.7
STATION 3 - M219 (COAX) MACHINE GUN	
Stoppage	49.8
Clear	78.4
Disassemble, assemble	71.4
STATION 4 - M85 MACHINE GUN	
Clear	56.5
Disassemble, assemble	43.1
STATION 5 - TANK GUNNERY SUBJECTS	
Replenisher tape - rough and smooth	79.6
- two rough	94.1
- two smooth	83.7
- two long notches	75.6
Range flags - green	91.1
- red	91.9
- red and green	81.9
- red and orange	91.1
- green and orange	80.7
Ammunition - HEAT	96.3
- APDS	98.9
- HEP	82.6
- APHERS	89.6
- WP	86.7
- HEAT-TPT	85.6
- COAX	96.3

TABLE 4 (continued)

Performance Measures	% GO
Mounting tanks - moving range	76.3
- stationary range	74.8
Threat vehicles - Soviet BTR 50P	80.4
- Soviet T-10	80.0
- Soviet T-62	74.8
- Soviet PT-76	84.4
- British Chieftain	77.0
- M48	70.7
STATION 6 - GENERAL SUBJECTS	
Map colors	54.8
Map elevation	24.4
Map 6 - digit coordinate	22.6
Map marginal info	20.4
NBC markers	83.7
Masking M25A1	90.7
NBC knowledge	77.4
STATION 7 - COMMUNICATIONS	
Field phone TA-312	70.3
AN/VRC-64 into operation	83.3
Radio check	87.4
Transmit message	86.6
STATION 8 - MAINTENANCE	
Track and suspension	70.7
Air cleaner	86.3
Maintenance checks	83.7
Operator's maintenance checks	88.5
DA Form 2404	77.4
DA Form 2408-1	83.0
Read lube chart	86.3
STATION 9 - ADVANCED DRIVING	
Prepare to fire checks	74.8
Starting procedures	62.6
Emergency situations	56.3
Stopping procedures	72.6
H/A start engine	92.6
H/A stop tank	98.1
H/A move forward	98.1
H/A turn left	98.1
H/A turn right	98.9
H/A move in reverse	98.9

TABLE 4 (continued)

Performance Measures	% GO
H/A reverse to left	96.3
H/A reverse to right	97.4
H/A neutral steer	97.8
H/A stop engine	98.1
FL start engine	91.5
FL turn left	95.6
FL turn right	96.3
FL move in reverse	93.0
FL stop tank	96.3
FL move forward	93.7
STATION 10 - CALIBER .45 AND SMG	
Clear cal .45 pistol	84.4
Disassembly, assembly, and function check	81.4
Clear M3A1 SMG	94.1
Disassembly, assembly, and function check	76.1
STATION 11 - FIRST AID	
Mouth to mouth	74.8
Control bleeding	86.3
Treat for shock	87.4
Burns	79.3
Broken bones	81.1

TABLE 5

PERCENT GO'S BY MENTAL CATEGORY, KENDALL'S TAU VALUES, AND CORRESPONDING PROBABILITIES, FOR EACH RETENTION TEST PERFORMANCE MEASURE

Performance	Cat I&II	Cat III	Cat IV	Tau	P
STATION 1 - LOADERS DUTIES					
Stow main gun ammo	90.2	85.9	76.2	.088	.076
Load banana box	92.2	76.8	81.0	.116	.030*
Load coax machine gun	58.8	65.0	66.7	-.049	.209
Coax fire command	98.0	88.7	95.2	.076	.110
Main gun fire command	72.5	75.1	76.2	-.025	.346
Main gun misfire	74.5	65.5	66.7	.062	.157
Unload main gun misfire	68.6	62.1	66.7	.031	.307
STATION 2 - BREECHBLOCK					
Remove and disassenble	54.9	50.8	38.1	.070	.129
Assemble and install	56.9	46.9	47.6	.066	.141
STATION 3 - M219 (COAX) MACHINE GUN					
Stoppage	61.5	49.4	47.6	.090	.072
Clear	78.8	80.1	76.2	.005	.468
Disassemble, assemble	84.6	67.0	85.7	.069	.132
STATION 4 - M85 MACHINE GUN					
Clear	65.4	57.4	52.4	.073	.118
Disassemble, assemble	53.8	41.5	42.9	.082	.091
STATION 5 - TANK GUNNERY SUBJECTS					
Replenisher tape					
- rough and smooth	86.5	78.0	66.7	.118	.028*
- two rough	96.2	94.4	90.5	.055	.187
- two smooth	90.4	81.9	71.4	.123	.023*
- two long notches	80.8	74.0	71.4	.064	.149
Range flags					
- green	100.0	89.8	85.7	.152	.007*
- red	98.1	90.4	90.5	.098	.056
- red and green	94.2	79.7	76.2	.148	.008*
- red and orange	98.1	91.0	81.0	.148	.008*
- green and orange	90.4	78.5	76.2	.114	.032*
Ammunition					
- HEAT	98.1	96.0	95.2	.045	.230
- APDS	100.0	98.3	95.2	.087	.080
- HEP	96.2	79.7	81.0	.148	.008*
- APHERS	98.1	88.1	76.2	.174	.002*
- WP	98.1	84.7	85.7	.136	.014*
- HEAT-TPT	94.2	83.1	81.0	.119	.027*
- COAX	98.1	96.0	95.2	.045	.233

* Significant beyond .05 level.

TABLE 5 (continued)

Performance Measures	Cat I&II	Cat III	Cat IV	Tau	P
Mounting tanks					
- moving range	84.6	76.1	66.7	.107	.041*
- stationary range	84.6	74.4	61.9	.130	.018*
Threat vehicles					
- Soviet BTR 50P	84.6	81.3	71.4	.071	.123
- Soviet T-10	80.8	79.5	90.5	-.034	.289
- Soviet T-62	75.0	77.3	66.7	.022	.362
- Soviet PT-76	94.2	82.4	81.0	.121	.025*
- British Chieftain	88.5	73.9	66.7	.147	.009*
- M48	76.9	69.9	61.9	.082	.091
STATION 6 - GENERAL SUBJECTS					
Map colors	76.9	46.0	71.4	.133	.016*
Map elevation	51.9	17.0	14.3	.295	.000*
Map 6 - digit coordinate	46.2	17.6	9.5	.268	.000*
Map marginal info	48.1	13.1	14.3	.297	.000*
NBC markers	90.4	83.5	66.7	.138	.012*
Masking M25A1	92.3	89.7	95.2	.000	.497
NBC knowledge	84.6	73.3	81.0	.063	.152
STATION 7 - COMMUNICATIONS					
Field phone TA-312	74.5	69.9	76.2	.012	.420
AN/VRC-64 into operation	92.2	80.7	81.0	.105	.046*
Radio check	94.1	85.2	90.5	.067	.140
Transmit message	88.2	87.5	85.7	.017	.395
STATION 8 - MAINTENANCE					
Track and suspension	84.6	69.3	52.4	.178	.002*
Air cleaner	92.3	83.5	100.0	.011	.428
Maintenance checks	86.5	83.0	81.0	.042	.246
Operators maintenance checks	92.3	86.9	85.7	.064	.151
DA Form 2404	84.6	75.0	81.0	.057	.178
DA Form 2408-1	84.6	83.0	71.4	.064	.148
Read lube chart	88.5	86.4	81.0	.047	.223
STATION 9 - ADVANCED DRIVING					
Prepare to fire checks	82.7	72.9	71.4	.084	.086
Starting procedures	69.2	61.0	47.6	.104	.046*
Emergency situations	61.5	53.7	57.1	.044	.239
Stopping procedures	80.8	73.4	52.4	.135	.014*
H/A start engine	88.5	92.7	95.2	-.069	.131
H/A stop tank	98.1	97.2	95.2	-.009	.439
H/A move forward	98.1	97.7	95.2	.034	.289

* Significant beyond .05 level.

TABLE 5 (continued)

Performance Measures	Cat I&II	Cat III	Cat IV	Tau	P
H/A turn left	96.2	97.7	100.0	-.060	.165
H/A turn right	98.1	97.2	95.2	.038	.268
H/A move in reverse	98.1	98.3	100.0	-.028	.323
H/A reverse to left	98.1	94.9	95.2	.051	.204
H/A reverse to right	96.2	97.9	95.2	-.009	.443
H/A neutral steer	98.1	97.2	95.2	.038	.268
H/A stop engine	98.1	97.7	100.0	-.018	.386
FL start engine	94.2	92.1	81.0	.092	.068
FL turn left	98.1	94.9	90.5	.085	.083
FL turn right	98.1	95.5	95.2	.048	.217
FL move in reverse	96.2	92.1	90.5	.065	.146
FL stop tank	98.1	95.5	95.2	.048	.217
FL move forward	98.1	92.7	90.5	.092	.069
STATION 10 - CALIBER .45 PISTOL AND SMG					
Clear cal .45 pistol	92.3	84.7	81.0	.094	.064
Disassembly, assembly, and function check	88.5	81.8	76.2	.085	.083
Clear M3A1 SMG	98.1	94.9	95.2	.051	.203
Disassembly, assembly, and function check	96.2	72.6	71.4	.201	.001*
STATION 11 - FIRST AID					
Mouth to mouth	88.5	71.8	66.7	.153	.007*
Control bleeding	92.3	88.1	85.7	.059	.171
Treat for shock	90.4	90.4	76.2	.074	.114
Burns	94.2	76.3	85.7	.120	.026*
Broken bones	84.6	81.4	81.0	.031	.306

* Significant beyond .05 level.

TABLE 6

KENDALL'S TAU VALUES AND ASSOCIATED PROBABILITIES FOR GO RATES ON EACH PERFORMANCE MEASURE OVER TIME

Performance Measures	Tau	P
STATION 1 - LOADER'S DUTIES		
Stow main gun ammo	-.073	.087
Load banana box	.014	.400
Load coax machine gun	-.074	.084
Coax fire command	.085	.055
Main gun fire command	.019	.364
Main gun misfire	-.176	.001*
Unload main gun misfire	-.224	.000*
STATION 2 - BREECHBLOCK		
Remove and disassemble	.257	.000*
Assemble and install	.159	.002*
STATION 3 - M219 (COAX) MACHINE GUN		
Stoppage	.051	.168
Clear	.019	.364
Disassemble, assemble	.009	.435
STATION 4 - M85 MACHINE GUN		
Clear	.192	.000*
Disassemble, assemble	.121	.012*
STATION 5 - TANK GUNNERY SUBJECTS		
Replenisher tape		
- rough and smooth	.001	.494
- two rough	.053	.161
- two smooth	-.038	.241
- two long notches	.027	.306
Range flags		
- green	.022	.341
- red	.054	.157
- red and green	-.031	.283
- red and orange	.068	.100
- green and orange	.088	.049
Ammunition		
- HEAT	-.064	.115
- APDS	-.058	.139
- HEP	.060	.130
- APHERS	.055	.150
- WP	.045	.198
- HEAT-TPT	-.153	.002
- COAX	-.076	.078

* Significant beyond .05 level.

TABLE 6 (continued)

Performance Measures	Tau	P
Mounting tanks		
- moving range	.066	.110
- stationary range	.152	.002*
Threat vehicles		
- Soviet BTR 50P	.144	.004*
- Soviet T-10	.062	.124
- Soviet T-62	.154	.002*
- Soviet PT-76	-.043	.211
- British Chieftain	-.022	.339
- M48	.097	.035
STATION 6 - GENERAL SUBJECTS		
Map colors	.016	.385
Map elevation	-.078	.074
Map 6 - digit coordinate	.091	.045*
Map marginal info	.057	.143
NBC markers	.162	.001*
Masking M25A1	.049	.180
NBC knowledge	.061	.129
STATION 7 - COMMUNICATIONS		
Field phone TA-312	.002	.484
AN/VRC-64 into operation	-.170	.001*
Radio check	-.056	.146
Transmit message	-.108	.022*
STATION 8 - MAINTENANCE		
Track and suspension	-.008	.442
Air cleaner	.032	.277
Maintenance checks	.061	.129
Operators maintenance checks	.048	.184
DA Form 2404	-.003	.476
DA Form 2408-1	.070	.095
Read the lube chart	.076	.078
STATION 9 - ADVANCED DRIVING		
Prepare to fire checks	.029	.307
Starting procedures	.007	.447
Emergency situations	-.078	.073
Stopping procedures	-.044	.203
H/A start engine	-.141	.004*
H/A stop tank	-.048	.185
H/A move forward	-.031	.281
H/A turn left	-.005	.465

* Significant beyond .05 level.

TABLE 6 (continued)

Performance Measures	Tau	P
H/A turn right	-.004	.468
H/A move in reverse	-.015	.389
H/A reverse to left	-.018	.367
H/A reverse to right	-.030	.288
H/A neutral steer	-.013	.407
H/A stop engine	-.011	.419
FL start engine	-.063	.118
FL turn left	-.048	.186
FL turn right	-.023	.331
FL move in reverse	-.104	.025*
FL stop tank	-.086	.054
FL move forward	-.057	.144
STATION 10 - CALIBER .45 PISTOL AND SMG		
Clear cal .45 pistol	-.124	.010*
Disassembly, assembly, and function check	-.133	.006*
Clear M3A1 SMG	.018	.366
Disassembly, assembly, and function check	.076	.077
STATION 11 - FIRST AID		
Mouth to mouth	-.266	.000*
Control bleeding	-.021	.349
Treat for shock	.024	.327
Burns	-.029	.294
Broken bones	-.012	.410

* Significant beyond .05 level.

TABLE 7

RELATIONSHIPS OF EXPERIENCE FACTORS AND PERFORMANCE MEASURES, TESTED BY KENDALL'S TAU

Experience Factor - Performance Measure	Tau	P
Belt ammo stowed - load banana box	.117	.020*
Loaded coax - load coax	.045	.215
Loaded coax - coax fire command	.027	.317
Loaded main gun - main gun fire command	-.020	.361
Practiced misfire - main gun misfire	-.060	.149
Practiced misfire - unload misfire	.021	.354
Disassemble breech - remove and disassemble breech	-.020	.360
Disassemble breech - assemble and install breech	-.083	.073
Disassemble coax - clear coax	.046	.199
Disassemble coax - disassemble/assemble coax	-.040	.231
Disassemble M85 - clear M85	.021	.350
Disassemble M85 - disassemble/assemble M85	-.153	.003*
Disassemble .45 - clear .45	-.158	.001*
Disassemble .45 - functions check .45	-.151	.002*
Disassemble M3A1 - clear M3A1	.010	.425
Disassemble M3A1 - functions check M3A1	-.178	.001*
Fired .45 - clear .45	-.137	.009*
Fired .45 - functions check .45	-.059	.156*
Put on mask - masking M25A1	-.021	.346
NBC class - NBC markers	.143	.004*
NBC class - maksing M25A1	-.033	.274
NBC class - NBC knowledge	-.095	.040*
Turned on radios - AN/VRC 64	-.144	.004*
Mine field class - NBC markers	.159	.003*
Transmitted message - radio check	-.053	.163
Transmitted message - transmit message	-.072	.091
Field phone - field phone	-.029	.307
DA Form 2404 - DA Form 2404	-.092	.048*
DA Form 2408-1 - DA Form 2408-1	-.075	.092
Lube - lube chart	-.006	.459
Checked track tension - track and suspension	-.048	.201
Broken track - track and suspension	-.113	.024*
Air cleaners - air cleaner	-.028	.309
Preparation to fire - replinisher tape, rough and smooth	-.040	.242
Preparation to fire - replinisher tape, two rough	.002	.488
Preparation to fire - replinisher tape, two smooth	.007	.448
Preparation to fire - replinisher tape, two long notches	-.046	.208
Preparation to fire - preparation to fire	-.056	.162

* Significant beyond .05 level.

TABLE 7 (continued)

Experience Factor - Performance Measure	Tau	P
Gunner training - range flags, green	-.027	.321
Gunner training - range flags, red	-.080	.088
Gunner training - range flags, red and green	-.042	.241
Gunner training - range flags, red and orange	.001	.491
Gunner training - range flags, green and orange	-.072	.112
Miles driven - starting tank	-.016	.382
Miles driven - emergency situations	.044	.207
Miles driven - stopping tank	-.004	.470

* Significant beyond .05 level.

APPENDIX B

Armor Crewman Retention Testor

Validation Lesson Plan

ARMOR CREWMAN RETENTION TESTOR VALIDATION

A. ADMINISTRATIVE INSTRUCTIONS:

1. Training conducted: Testor Validation.

2. Time: Eight (8) hours.

3. Presented to: Selected Non-commissioned Officer (Testors).

4. Instructors: Four (4) test supervisors.

5. Training aids: See Annex D. (Note: Testors will validate on stations prepared for normal test cycle.)

6. Training location: Test site TBA.

7. References: FM 21-11, FM 21-41, FM 17-12, FM 23-41, FM 23-35, FM 21-26, TM 3-4240-255-14, TM 3-4240-202-14, TM 11-5820-401-12, TM 11-5820-466-12, TM 11-5820-667-12, TM 9-2350-215-10, TM 9-2350-258-10, LO 9-2350-215-12.

B. ORGANIZATION FOR TRAINING:

1. Arrangement, information, or breakout of examinees: See Annex A.

2. Use of troop personnel: As test coordinators and scorecard data collectors.

3. Motivation of competition: Individual level.

4. Expected time each examinee participated in primary training: Three hundred (300) minutes.

5. Expected time spent moving, cleaning the training site or on examinees break: Eighty (80) minutes.

C. INTRODUCTION BRIEFING: 150 minutes

ATSB-ARTS 22 March 1978
Armor Crewman Retention Testor Validation

1. Reason: To verify proficiency in the areas of gunnery, weapons, safety, general subjects, communications, maintenance, and advanced driving as appropriate for the purpose of test administration.

2. Objectives:

a. Task: Each testor will perform all training objectives of assigned station and be knowledgeable of complete subject matter.

b. Conditions: See conditions for each station.

c. Standards: See standards for each station.

D. TEACHING POINTS: Ten (10) minutes.

Test supervisor will briefly explain conduct and requrements for the eleven (11) stations.

E. APPLICATION: N/A.

F. VALIATION: Three hundred (300) minutes.

G. REVIEW AND CRITIQUE: (As required.)

Examinees will be critiqued at the completion of each station.

H. ANNEXES:

A - Procedures

B - Examinee Performance Requriements

C - Scorecard

D - Personnel/Training Aids Requirements

E - Safety

ANNEX A

PROCEDURES

1. SPECIAL INSTRUCTIONS:

a. All personnel to be validated will be assigned to a test station prior to arrival at the testing site. The testors will be on the site by 0730 hours the day of the test for their briefing.

b. The unit will maintain group integrity.

c. The testors will receive their briefings from the chief testor and then assigned to test stations by the chief tester.

d. Individuals will move to assigned stations and begin station orientation and train-up for test administration.

e. Each testor will be evaluated/validated at assigned station by the chief testor to assure uniformity in testing standards.

f. The examiners at each station will critique the individual prior to departing to the next station so that testors are knowledgeable in expected performance standards to be used during testing.

2. GENERAL INSTRUCTIONS: The test supervisor will briefly explain what will be requried of the testor at each of the eleven (11) stations, the layout of the station, and the method of rotation that will be used.

a. Station #1 - Loader's tank duties.

b. Station #2 - Breechblock. (Assembly/Disassembly)

c. Station #3 - M219 Machinegun.

d. Station #4 - M85 Machinegune.

e. Station #5 - TO #1 Replenisher Tape. (Slides)

f. Station #5 - TO #2 Range Flags. (Slides)

g. Station #5 - TO #3 Ammunition. (Slides)

h. Station #5 - TO #4 Mounting Tank. (Slides)

i. Station #5 - TO #5 Threat Vehicle. (Slides)

j. Station #6 - General Subjects.

k. Station #7 - Communications.

l. Station #8 - Maintenance.

m. Station #9 - Advanced Driving.

n. Station #10 -Cal .45 Pistol and M3A1 Submachinegun.

o. Station #11 - First Aid.

ANNEX B

ARMOR CREWMAN RETENTION TESTOR VALIDATION

1. STATION #1 - TANK LOADER'S DUTIES

a. TC #1 - The examinee within one minute will have to stow a main gun round passed to him through the loader's hatch, in the ready rack, on a tank.

b. TC #2 - The examinee within three minutes will have to stow a belt of 200 (7.62) rounds in the banana storage box on a tank.

c. TC #3 - The examinee within one minute will have to load an M219 coax Machinegun with ammunition previously loaded in the banana storage box on a tank.

d. TC #4 - The examinee will have to respond to a coax Fire Command on a previously loaded coax Machinegun on a tank.

e. TC #5 - The examinee will have to respond to a main gun fire command, using the main gun round previously stowed in the ready rack on a tank.

f. TC #6 - The examinee within fifteen seconds will have to respond to a main gun misfire on a previously loaded main gun round on a tank.

g. TC #7 - The examinee within one minute, will have to unload and hand to a simulated range safety officer, through the loader's hatch, a previously loaded, misfired main gun round, on a tank.

2. STATION #2 - BREECHBLOCK

a. TC #1 - The examinee within six minutes will have to remove and disassemble completely the breechblock on a tank.

b. TO #2 - The examinee within six minutes will have to assemble completely and replace the breechblock on a tank.

3. STATION #3 - M219 MACHINEGUN

a. TC #1 - The examinee will within one minute reduce a coax stoppage on an already loaded M219 machinegun.

b. TO #2 - The examinee within thirty seconds will have to clear an already loaded M219 machinegun in a classroom.

c. TO #3 - The examinee within four minutes will have to completely disassemble, assemble, and perform a functions check on an M219 machinegun in a classroom.

4. STATION #4 - M85 MACHINEGUN

a. TO #1 - The examinee within thirty seconds will have to clear an already loaded M85 machinegun in classroom.

b. TO #2 - The examinee within seven minutes will have to completely disassemble, assemble, and perform a function check on the M85 machinegun in a classroom.

5. STATION #5 - TANK GUNNERY SUBJECTS

a. TO #1 - Replenisher Indicator Tape:

(1) The examinee will have to explain the meaning and corrective action for a rough and a smooth reading in a classroom.

(2) The examinee will have to explain the meaning and corrective action for two roughs in a classroom.

(3) The examinee will have to explain the meaning and corrective action for two smooths in a classroom.

(4) The examinee will have to explain the meaning and corrective action for two long notches in classroom.

b. TO #2 - Range Flags:

(1) The examinee will have to know the meaning of a green flag in a classroom.

(2) The examinee will have to know the meaning of a red flag in a classroom.

(3) The examinee will have to know the meaning of a red and green flag display in a classroom.

(4) The examinee will have to know the meaning of a red and orange flag display in a classroom.

(5) The examinee will have to know the meaning of a green and orange flag display in a classroom.

c. TO #3 - Ammunition

(1) The examinee will have to identify a HEAT round from a fire command, state its primary use, and state its full name in a classroom.

(2) The examinee will have to identify an APDS round from a fire command, state its primary use, and state its full name in a classroom.

(3) The examinee will have to identify a APHERS round from a fire command, state its primary use, and state its full name in a classroom.

(4) The examinee will have to identify a HEP round from a fire command, state its primary use, and state its full name in a classroom.

(5) The examinee will have to identify a WP round in the fire command, state its primary use, and state its full name in a classroom.

(6) The examinee will have to identify a HEAT-TPT round in the fire command, state its primary use, and state its full name in a classroom.

(7) The examinee will have to identify 7.62 mm linked ammunition from a fire command, state its primary use, and state its full name in a classroom.

d. TO #4 _ Mounting Tanks:

(1) The examinee will be asked where to mount a tank on a moving tank range in a classroom.

(2) The examinee will be asked where to mount a tank on a stationary tank range in a classroom.

e. TO #5 - Threat Vehicles:

The examinee will have ten seconds each to determine if six (6) various NATO and WARSAW PACT vehicles are "kill" or "no kill."

6. STATION #6 - GENERAL SUBJECTS

a. TO #1 - The examinee must demonstrate knowledge of the basic map colors by naming the five main colors and their basic meanings.

b. TO #2 - The examinee must determine elevation on a map.

c. TC #3 - The examinee must locate positions on a map using six (6) digit coordinates.

d. TC #4 - The examinee must identify in writing objects or type of roads, using the marginal information tables on the map from a given point on a map.

e. TC #5 - The examinee must demonstrate knowledge of NBC mine and contamination markers, by identifying the markers when shown by the testor.

f. TC #6 - The examinee within nine seconds will have to properly don the M25A1 protective mask and give the alarm for a gas attack.

g. TC #7 - The examinee will be required to respond to two NBC first aid questions.

7. STATION #7 - COMMUNICATIONS

a. TC #1 - The examinee within two minutes will be required to place the field telephone, TA 312, into operation and conduct a telephone check.

b. TC #2 - The examinee within two minutes will be required to place the AN/VRC-64 into operation, given an assigned frequency, then demonstrate knowledge of the CVC helmet three position switch by placing switch in position to perform functions stated by testor in a communications classroom.

c. TC #3 - The examinee must perform a radio check on a complete and operational AN/VRC-64 radio.

d. TC #4 - The examinee must transmit a prepared message, using proper radio telephone procedures on a complete and operational AN/VRC-64 radio.

8. STATION #8 -MAINTENANCE

a. TC #1 - The examinee will have to either perform measuring track tension or disconnecting track up to removal of outer end connector, on a tank hull, in a maintenance area.

b. TC #2 - The examinee will have to perform checking and servicing the air cleaners of a tank.

c. TC #3 - The examinee, utilizing an operator's manual, will be required to perform two maintenance checks or tasks on the M60A1 tank.

d. TC #4 - The examinee, utilizing an operator's manual, will peform either before, during, or after operations checks and services on the M60A1 tank.

e. TC #5 - The examinee will be required to properly fill out the heading of a DA Form 2404 and list all shortcomings and deficiencies found during his checks on TC #4 above.

f. TC #6 - The examinee will be required to properly complete the daily entry on the DA Form 2408-1 from the information he has already completed on his DA Form 2404 (TC #5) above.

g. TC #7 - The examinee will be required to use the lubrication chart and identify type of lubricants, intervals, and location of item to be lubricated.

9. STATION #9 - ADVANCED DRIVING

a. TC #1 - The examinee will be required to perform the drivers prepare to fire checks on the tank.

b. TC #2 - The examinee will be required to start the tank and identify any deficiencies or equipment malfunctions.

c. TC #3 - The examinee will be required to respond to two malfunctions or emergency procedures in the tank while he is operating the tank.

d. TC #4 - The examinee will be required to properly stop the tank engine.

e. TC #5 - The examinee will have to demonstrate the hand and arm signal to start a tank engine.

f. TC #6 - The examinee will have to demonstrate the hand and arm signal to stop a tank.

g. TC #7 - The examinee will have to demonstrate the hand and arm signal to move a tank forward.

h. TC #8 - The examinee will have to demonstrate the hand and arm signal to turn a tank left.

i. TC #9 - The examinee will have to demonstrate the hand and arm signal to turn a tank right.

j. TC #10 - The examinee will have to demonstrate the hand and arm signal to move a tank in reverse.

k. TC #11 - The examinee will have to demonstrate the hand and arm signal to move a tank in reverse to the left.

l. TC #12 - The examinee will have to demonstrate the hand and arm signal to move a tank in reverse to the right.

m. TC #13 - The examinee will have to demonstrate the hand and arm signal to neutral steer a tank.

n. TC #14 - The examinee will have to demonstrate the hand and arm signal to stop the tank engine.

o. TC #15 - The examinee will have to demonstrate the flashlight signal to start a tank engine with a flashlight.

p. TC #16 - The examinee will have to demonstrate the flashlight signal to turn a tank left with a flashlight.

q. TC #17 - The examinèe will have to demonstrate the flashlight signal to turn a tank right with a flashlight.

r. TC #18 - The examinee will have to demonstrate the flashlight signal to move a tank in reverse with a flashlight.

s. TC #19 - The examinee will have to demonstrate the flashlight signal to stop a tank with a flashlight.

t. TC #20- The examinee will have to demonstrate the flashlight signal to move a tank forward with a flashlight.

10. STATION #10 - CALIBER .45 PISTOL AND M3A1 SUBMACHINEGUN

a. TC #1 - The examinee within fifteen seconds must properly clear the caliber .45 pistol.

b. TC #2 - The examinee within four minutes must properly disassemble, assemble, and perform a function check of the caliber .45 pistol.

c. TC #3 - The examinee within fifteen seconds must properly clear the M3A1 submachinegun.

d. TC #4 - The examinee within five minutes must properly disassemble, assemble, and perform a functions check of the M3A1 machinegun.

11. STATION #11 - FIRST AID

a. TO #1 - The examinee must perform mouth to mouth resuscitation on a simulated victim.

b. TO #2 - The examinee must perform the first aid measures to control bleeding for an arm or leg wound without broken bones.

c. TO #3 - The examinee must treat a victim, who has already been treated for an arm or leg wound, for shock.

d. TO #4 - The examinee, given a simulated victim, will have to perform the first aid treatment for severe burns to include treatment for shock.

e. TO #5 - The examinee, given a simulated victim, will have to perform first aid treatment for broken bones in either arm or leg.

ANNEX C

TESTOR VALIDATION

NAME__________________ RANK______ SSAN__________ DATE______

STA		VALIDATED	VERIFIED
1	Loader's Duties	______	______
2	Breechblock	______	______
3	M219 Machinegun (coax)	______	______
4	M85 Machinegun	______	______
5	Tank Gunner Subjects	______	______
6	General Subjects	______	______
7	Communications	______	______
8	Maintenance	______	______
9	Advance Driving	______	______
10	Caliber .45 & Submachinegun	______	______
11	First Aid	______	______

ANNEX D

PERSONNEL AND TRAINING AIDS REQUIREMENTS

I. PROVIDED BY DIVISION WORK TEAM

a. Examiners - Fifteen

b. Tanks (M60A1) - Two

c. Weapons

(1) Four M219 Coax Machineguns (2 mounted in the tanks)

(2) Two M85 Machineguns

(3) One Cal .45 Pistol w/Magazine

(4) One M3A1 Submachinegun

d. Dummy Ammunition

(1) One main gun round

(2) Two 200-round belts of 7.62 link (one will be broken into ten 20-round belts)

(3) Two 10-round belts of cal .50 link

(4) Two cal. 45

e. Maintenance Equipment

(1) Two sets of breechblock removal & assembly equipment

(2) Two screwdrivers, 8" flat tip

(3) Two (Dash) 10 TMs and LOs for M60A1

(4) Two wrenches, 12" crescent

(5) One set of track breaking equipment

(6) One set of track measuring equipment

f. Communications Equipment

(1) One TA-312 w/batteries & WD1 wire

(2) Five operational AN/VRC-64 consisting of:

(a) CVC helmet

(b) C-2299

(c) AM 1780

(d) AN/VRC-64

(e) All connector cables

(3) Three frequencies to be used for testing

g. First Aid

(1) One respirator training aid

(2) One simulated victim (dummy)

(3) One combat dressing

(4) One blanket

(5) Four simulated wounds

h. Miscellaneous Equipment

(1) One classroom

(2) One slide projector and screen

(3) Seventeen stopwatches

(4) Ten flashlights

(5) One M25A1 protective mask

(6) Nine tables

(7) Ten clip boards

Annex D - Armor Crewman Retention Testor Validation

II. PROVIDED BY FORT KNOX (ARTS)

a. Score Sheets

b. Slides for Station 5

c. Answer Sheets for Station 5

d. Map Boards

e. Mine Field Markers

f. Prepared Messages

g. 2404/2408-1's Cards

h. Start & Stop Charts

i. Visual Signal Tank Charts

j. Standardization Team Personnel (4)

ANNEX E

SAFETY

1. No smoking within fifty (50) feet of tanks.

2. Extreme care will be taken when mounting and dismounting tanks.

3. When conducting the breechblock portion of this test, extreme caution will be taken to insure the safety of the examinee and testor.

4. When entering and leaving the driver's compartment, extreme caution will be taken to prevent falls.

APPENDIX C

Post Graduation Armor Crewman

Testing Lesson Plan

ATSB-ARTS 6 February 1978

POST GRADUATION ARMOR CREWMAN TESTING

A. ADMINISTRATIVE INSTRUCTIONS:

1. Training conducted: Post Graduation Armor Crewman Testing.

2. Time: Eight (8) hours.

3. Presented to: 11E10 OSUT-BAT graduates.

4. Instructors: One (1) test supervisor.

5. Training aids: See Annex D.

6. Training location: TBA.

7. References: First Training Brigade, Fort Knox, KY, lesson plans.

B. ORGANIZATION FOR TRAINING:

1. Arrangement, information, or breakout of examinees: See Annex A.

2. Use of troop personnel: As test coordinators and scorecard data collectors.

3. Motivation or competition: Individual level.

4. Expected time each examinee participates in concurrent training: Three hundred (300) minutes.

5. Expected time each examinee participates in concurrent training: One hundred (100) minutes.

6. Expected time spent moving, cleaning the training site or on examinees break: Eighty (80) minutes.

C. INTRODUCTION: Five (5) minutes.

1. Reason: To test the proficiency of the 11E10 graduates in the areas of gunnery, weapons, safety, general subjects, communictions, maintenance and advanced driving at the loaders level.

2. Objectives:

a. Task: Each examinee will perform all training objectives.

b. Conditions: See conditions for each station.

c. Standards: See standards for each station.

D. TEACHING POINTS: Ten (10) minutes)

Test supervisor will briefly explain conduct and requirements for the eleven (11) stations.

E. APPLICATION: N/A.

F. EVALUATION: Three hundred (300) minutes.

G. REVIEW AND CRITIQUE: (As required.)

Examinees will be critiqued at the completion of each station.

H. ANNEXES:

A - Procedures

B - Examinee Performance Requirements

C - Scorecard

D - Personnel/Training Aids Requirements

E - Safety

ANNEX A

PROCEDURES

1. SPECIAL INSTRUCTIONS:

a. All personnel to be tested will be issued a scorecard upon their arrival at the testing site, and the scorecard will have the heading completed at that time. The examinees will be on site by 0730 hours the day of the test for their briefing.

b. The unit will maintin group integrity.

c. The testing unit will receive their briefing from the chief testor and then will be administered Station #5 immediately afterward. As personnel finish Station #5, they will be broken down into groups by the chief testor.

d. Groups will be assigned initial station locations by the test supervisors and move in a clockwise manner.

e. Groups will rotate through all stations under the direction of the test supervisor.

f. The examiners at each station will critique the individual prior to sending him to the next station.

g. The tested unit will have all required equipment on site and ready for testing by 0730 hours the day of the test.

2. GENERAL INSTRUCTIONS: The test supervisor will briefly explain what will be requried of the examinee at each of the eleven (11)stations, the layout of the stations, and the method of rotation that will be used.

a. Station #1 - Loader's tank duties.

b. Station #2 - Breechblock. (Assembly/Disassembly)

c. Station #3 - M219 Machinegun.

d. Station #4 - M85 Machinegun.

e. Station #5 - TO #1 Replenisher Tape.. (Slides)

f. Station #5 - TC #2 Range Flags. (Slides)

g. Station #5 - TO #3 Ammunition. (Slides)

h. Station #5 - TC #4 Mounting Tank. (Slides)

i. Station #5 - TC #5 Threat Vehicle. (Slides)

j. Station #6 - General Subjects.

k. Station #7 - Communications.

l. Station #8 - Maintenanace.

m. Station #9 - Advanced Driving.

n. Station #10 - Cal .45 Pistol and M3A1 Submachinegun.

o. Station #11 - First Aid.

ANNEX B

BAT GRADUATES PERFORMANCE REQUIREMENTS

1. STATION #1 - TANK LOADERS DUTIES

a. TO #1 - The examinee within one (1) minute will have to stow a main gun round passed to him through the loaders hatch, in the ready rack on a tank.

b. TO #2 - The examinee within three (3) minutes will have to stow a belt of 200 (7.62) rounds in the banana storage box on a tank.

c. TO #3 - The examinee within one (1) minute will have to load an M219 coax Machinegun with ammunition previously loaded in the banana storage box on a tank.

d. TO #4 - The examinee will have to respond to a coax Fire Command on a previously loaded coax Machinegun on a tank.

e. TO #5 - Th examinee will have to respond to a main gun fire command, using the main gun round previously stowed in the ready rack on a tank.

f. TO #6 - The examinee within fifteen (15) seconds will have to respond to a main gun misfire on a previously loaded main gun round on a tank.

g. TO #7 - Th examinee within one (1) minute, will have to unload and hand to a simulated range safety officer, through the loaders hatch, a previously loaded,misfired main gun round, on a tank.

2. STATION #2 - BREECHBLOCK

a. TO #1 - The examinee within six (6) minutes will have to remove and disassemble completely the breechblock on a tank.

b. TO #2 - The examinee within six (6) minutes will have to assemble completely and replace the breechblock on a tank.

3. STATION #3 - M219 MACHINEGUN

a. TC #1 - The examinee will within one (1) minute reduce a coax stoppage on an already loaded M219 machinegun.

b. TC #2 - The examinee within thirty (30) seconds will have to clear an already loaded M219 machinegun in a classroom.

c. TC #3 - The examinee within four (4) minutes will have to completely disassemble, assemble, and perform a functions check on a M219 machinegun in a classroom.

4. STATION #4 - M85 MACHINEGUN

a. TC #1 -The examinee within thirty (30) seconds will have to clear an already loaded M85 machinegun in a classroom.

b. TC #2 - The examinee within seven (7) minutes will have to completely disassemble, assemble, and perform a functions check on the M85 machinegun in a classroom.

5. STATION #5 - TANK GUNNERY SUBJECTS

a. TC #1 - Replenisher Indicator Tape:

(1) The examinee will have to explain the meaning and corrective action for a rough and a smooth reading in a classroom.

(2) The examinee will have to explain the meaning and corrective action for two (2) roughs in a classroom.

(3) The examinee will have to explain the meaning and corrective action for two (2) smooths in a classroom.

(4) The examinee will have to explain the meaning and corrective action for two (2) long notches in a classroom.

b. TC #2 - Range Flags:

(1) The examinee will have to know the meaning of a green flag in a classroom.

(2) The examinee will have to know the meaning of a red flag in a classroom.

(3) The examinee will have to know the meaning of a red and green flag display in a classroom.

(4) The examinee will have to know the meaning of a red and orange flag display in the classroom.

(5) The examinee will have to know the meaning of a green and orange flag display in the classroom.

c. TC #3 - Ammunition:

(1) The examinee will have to identify a HEAT round from a fire command, state its primary use, and state its full name in a classroom.

(2) The examinee will have to identify an APDS round from a fire command, state its primary use, and state its full name in a classroom.

(3) The examinee will have to identify a HEP round from a fire command, state its primary use, and state its full name in a classroom.

(4) The examinee will have to identify an APHERS round from a fire command, state its primary use, and state its full name in a classroom.

(5) The examinee will have to identify a WP round in the fire command, state its primary use, and state its full name in a classroom.

(6) The examinee will have to identify a HEAT-TPT round in the fire command, state its primary use, and states its full name in a classroom.

(7) The examinee will have to identify a 7.62 mm linked ammunition from a fire command, state its primary use, and states its full name in a classroom.

d. TO #4 - Mounting Tanks:

(1) The examinee will be asked where to mount a tank on a moving tank range in a classroom.

(2) The examinee will be asked where to mount a tank on a stationary tank range in a classroom.

e. TC #5 - Threat Vehicles:

The examinee will have ten (10) seconds each to determine if six (6) various NATO and WARSAW PACT vehicles are "kill" or "no kill."

6. STATION #6 - GENERAL SUBJECTS

a. TC #1 - The examinee must demonstrate knowledge of the basic map colors by naming the five main colors and their basic meanings.

b. TC #2 - The examinee must determine elevation on a map.

c. TC #3 - The examinee must locate positions on a map using six (6) digit coordinates.

d. TC #4 - The examinee must identify in writing objects or type of roads, using the marginal information tables on the map from a given point on a map.

e. TC #5 - The examinee must demonstrate knowledge of NBC mine and contamination markers, by identifying the markers when shown by the testor.

f. TC #6 - The examinee within nine (9) seconds will have to properly don the M25A1 protective mask and give the alarm for a gas attach.

g. TC #7 - The examinee will be required to respond to two (2) NBC first aid questions.

7. STATION #7 - COMMUNICATIONS

a. TC #1 - The examinee within two (2) minutes will be recuired to place the field telephone, TA 312, into operation and conduct a telephone check.

b. TC #2 - The examinee within two (2) minutes will be reqsuried to place the AN/VRC-64 into operation, given an assigned frequency, then demonstrate knowledge of the CVC helmet three (3) position switch by placing switch in position to perform functions stated by testor in a communications classroom.

c. TC #3 - The examinee must perform a radio check on a complete and operational AN/VRC-64 radio.

d. TC #4 - The examinee must transmit a prepared message, using proper radio telephone procedures on a complete and operational AN/VRC-64 radio.

8. STATION #8 - MAINTENANCE

a. TC #1 - The examinee will have to either perform measuring track tension or disconnecting track up to removal of outer end connector, on a tank hull, in a maintenance area.

b. TO #2 - The examinee will have to perform checking and servicing the air cleaners of a tank.

c. TC #3 - The examinee, utilizing an operator's manual, will be required to perform two (2) maintenance checks or tasks on an M60A1 tank.

d. TC #4 - The examinee, utilizing an operator's manual, will perform either before, during, or after operations checks and services on the M60A1 tank.

e. TO #5 - The examinee will be required to properly fill out the heading of a DA Form 2404 and list all shortcomings and deficiencies found during hs checks on TC #4 above.

f. TO #6 - The examinee will be required to properly complete the daily entry on the DA Form 2408-1 from the information he has already completed on his DA Form 2404 (TO #5) above.

g. TC #7 - The examinee will be required to use the lubrication chart and identify type of lubricants, intervals, and location of item to be lubricated.

9. STATION #9 - ADVANCED DRIVING

a. TC #1 - The examinee will be required to perform the drivers prepare to fire checks on the tank.

b. TO #2 - The examinee will be required to start the tank and identify any deficiencies or equipment malfunctions.

c. TC #3 - The examinee will be required to respond to two (2) malfuntions or emergency procedures in the tank while he is operating the tank.

d. TC #4 - The examinee will be required to properly stop the tank.

e. TC #5 - The examinee will have to demonstrate the hand and arm signal to start a tank engine.

f. TO #6 - The examinee will have to demonstrate the hand and arm signal to stop a tank engine.

g. TC #7 - The examinee will have to demonstrate the hand and arm signal to move a tank forward.

h. TC #8 - The examinee will have to demonstrate the hand and arm signal to turn a tank left.

i. TC #9 - The examinee will have to demonstrate the hand and arm signal to turn a tank right.

j. TC #10 - The examinee will have to demonstrate the hand and arm signal to move a tank in reverse.

k. TC #11 - The examinee will have to demonstrate the hand and arm signal to move a tank in reverse to the left.

l. TC #12 - The examinee will have to demonstrate the hand and arm signal to move a tank in reverse to the right.

m. TC #13 - The examinee will have to demonstrate the hand and arm signal to neutral steer a tank.

n. TC #14 - The examinee will have to demonstrate the hand and arm signal to stop the tank engine.

o. TC #15 - The examinee will have to demonstrate the flashlight signal to start a tank engine with a flashlight.

p. TC #16 - The examinee will have to demonstrate the flashlight signal to turn a tank left with a flashlight.

q. TC #17 - The examinee will have to demonstrate the flashlight signal to turn a tank right with a flashlight.

r. TC #18 - The examinee will have to demonstrate the flashlight signal to move a tank in reverse with a flashlight.

s. TC #19 - The examinee will have to demonstrate the flashlight signal to stop a tank with a flashlight.

t. TC #20 - The examinee will have to demonstrate the flashlight signal to move a tank forward with a flashlight.

10. STATION #10 - CALIBER .45 PISTOL AND M3A1 MACHINEGUN

a. TC #1 - The examinee within fifteen (15) seconds must properly clear the caliber .45 pistol.

b. TC #2 - The examinee within four (4) minutes must properly disassemble, assemble, and perform a functions check of the caliber .45 pistol.

c. TC #3 - The examinee within fifteen (15) seconds must properly clear the M3A1 submachinegun.

d. TC #4 - The examinee within five (5) minutes must properly disassemble, assemble, and perform a functions check of the M3A1 submachinegun.

11. STATION #11 - FIRST AID

a. TC #1 - The examinee must perform mouth tomouth resuscitation on a simulated victim.

b. TC #2 - The examinee must perform the first aid measuares to control bleeding for an arm or leg wound without broken bones.

c. TC #3 - The examinee must treat a victim, who has already been treated for an arm or leg wound, for shock.

d. TC #4 - The examinee, given a simulated victim, will have to perform the first aid treatment for severe burns to include treatment for shock.

e. TC #5 - The examinee, given a simulated victim, will have to perform first aid treatment for broken bones in either arm or leg.

NAME________________________ RANK________________ SSAN____________
UNIT__________ PLATOON__________ PSG______________ DATE__________

CIVILIAN EDUCATION LEVEL (HIGHEST LEVEL ATTENDED) 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.

TASK	STATION NUMBER (TO)	GO	NO GO 1	NO GO 2	REASON FOR NO GO
	STATION #1 LOADERS DUTIES				
9301	TO #1 Stow Main Gun Ammo				
9301	TO #2 Load Banana Box				
6702	TO #3 Load Coax Machinegun				
7002	TO #4 Coax Fire Command				
7002	TO #5 Main Gun Fire Command				
7004	TO #6 Main Gun Misfire				
7004	TO #7 Unload M/G Misfire				
	STATION #2 BREECHBLOCK				
7001	TO #1 Remove and Disassemble				
7001	TO #2 Assemble and Install				
	STATION #3 M219 MACHINEGUN				
6704	TO #1 Coax Stoppage				
6702	TO #2 Clear				
6703	TO #3 Disassemble, Assemble				
	STATION #4 M85 MACHINEGUN				
6707	TO #1 Clear				
6708	TO #2 Disassemble, Assemble				

TASK	STATION NUMBER (10)	GO	NO GO		REASON FOR NO GO
			1	2	
	STATION #5 TANK GUNNERY SUBJECTS				
7002	TC #1 Replenisher Tape				
	#1 Rough and Smooth				
	#2 Two Rough				
	#3 Two Smooth				
	#4 Two Long Notches				
7701	TC #2 Range Flags				
	#5 Green				
	#6 Red				
	#7 Red and Green				
	#8 Red and Orange				
	#9 Green and Orange				
7003	TC #3 Ammunition				
	#10 Heat				
	#11 APDS				
	#12 HEP				
	#13 APHERS				
	#14 WP				
	#15 HEAT-TPT				
	#16 COAX Ammunition				
7009	TC #4 Mounting Tanks				
	#17 Moving Tank Range				
	#18 Stationary Tank Range				
5902	TC #5 Threat Vehicles				
	#19 Threat Vechiles				

TASK	STATION NUMBER (TO)	GO	NO GO 1	NO GO 2	REASON FOR NO GO
	STATION #6 GENERAL SUBJECT				
3009	TO #1 Map Colors				
5302	TO #2 Map Elevation				
5301	TO #3 Map 6-Digit Coordinate				
3-009	TO #4 Map Marginal Info				
4-003	TO #5 NBC Markers				
0401	TO #6 Masking M25A1				
0401 - 0411	TO #7 NBC Knowledge				
	STATION #7 COMMUNICATIONS				
0404	TO #1 Field Phone TA-312				
6101	TO #2 AN/VRC-64 Into Oper				
6101	TO #3 Radio Check				
6101	TO #4 Transmit Message				
	STATION #8 MAINTENANCE				
13-003	TO #1 Track and Suspension				
13-003	TO #2 Air Cleaner				
7006	TO #3 Maint Check				
1304	TO #5 DA Form 2404				
1304	TO #6 DA Form 2408-1				
7006	TO #7 Read Lube Chart				

TASK	STATION NUMBER (TC)	GO	NO GO 1	NO GO 2	REASON FOR NO GO
	STATION #9 ADVANCE DRIVING				
7007	TC #1 Prepare to fire checks				
7008	TC #2 Starting Procedures				
7009	TC #3 Emergency Situations				
7008	TC #4 Stopping Procedures				
2002	TC #5 H/A Start Engine				
2002	TC #6 H/A Stop Tank				
2002	TC #7 H/A Move Forward				
2002	TC #8 H/A Turn Left				
2002	TC #9 H/A Turn Right				
2002	TC #10 H/A Move in Reverse				
2002	TC #11 H/A Reverse to Left				
2002	TC #12 H/A Reverse to Right				
2002	TC #13 H/A Neutral Steer				
2002	TC #14 H/A Stop Engine				
2002	TC #15 FL Start Engine				
2002	TC #16 FL Turn Left				
2002	TC #17 FL Turn Right				
2002	TC #18 FL Move in Reverse				
2002	TC #19 FL Stop Tank				
2002	TC #20 FL Move Forward				

TASK	STATION NUMBER (TC)	GO	NO GO 1	NO GO 2	REASON FOR NO GO
	STATION #10 CALIBER .45 & SUBMACHINEGUN				
6401	TC #1 Clear Cal .45 Pistol				
6402	TC #2 Disassembly, assembly, and function check				
6711	TC #3 Clear M3A1 SMG				
6712	TC #4 Disassembly, assembly, and function check				
	STATION #11 FIRST AID				
0102	TC #1 Mouth to Mouth				
0103	TC #2 Control Bleeding				
0105	TC #3 Treat for Shock				
0106	TC #4 Burns				
0106	TC #5 Broken Bones				

ANNEX D

PERSONNEL AND TRAINING AIDS REQUIREMENTS

I. PROVIDED BY DIVISION WORK TEAM

a. Examiners (15)

b. Tanks M60A1 - Ten (10)

c. Weapons

(1) Fifteen (15) M-219 Coax Machineguns (5 in the tanks)

(2) Ten (10) M-85 Machineguns

(3) Ten (10) Cal .45 Pistols w/magazines

(4) Ten (10) M3A1 Submachineguns

d. Dummy Ammunition

(1) Five (5) main gun rounds

(2) Six (6) 200-round belts of 7.62 link (one will be broken into ten twenty (20)-round belts)

(3) Ten (10) ten (10)-round belts of cal .50 link.

(4) Twenty-four (24) cal .45

e. Maintenance Equipment

(1) Five (5) sets of breechblock removal & assembly equipment

(2) Ten (10) screwdrivers, 8" flat tip

(3) Ten (10) -10 TMs and LOs for M60A1

(4) Two (2) wrenches, 12" crescent

(5) Three (3) sets of track breaking equipment

(6) Three (3) sets of track measuring equipment

f. Communications Equipment

(1) Ten (10) TA-312's w/batteries & WD1 wire

(2) Ten (10) operational AN/VRC-64 consisting of:

(a) CVC helmet

(b) C-2299

(c) AM 1780

(d) AN/VRC-64

(e) All connector cables

(3) Three (3) frequencies to be used for testing

g. First Aid

(1) One (1) respirator training aid

(2) Four (4) simulated victims (dummies)

(3) Four (4) combat dressing

(4) Six (6) blankets

(5) Four (4) simulated wounds

h. Miscellaneous Equipment

(1) One (1) classroom

(2) One (1) slide projector and screen

(3) Seventeen (17) stopwatches

(4) Ten (10) flashlights

(5) Ten (10) M25A1 protective masks

(6) Nine (9) tables

(7) Ten (10) clip boards

II. PROVIDED BY FORT KNOX (ARTS)

a. Score Sheets

b. Slides for Station 5

c. Answer Sheets for Station 5

d. Map Boards

e. Mine Field Markers

f. Prepared Messages

g. 2404/2408-1's Cards

h. Start & Stop Charts

i. Visual Signal Tank Charts.

ANNEX E

SAFETY

1. No smoking within fifty (50) feet of tanks.

2. Extreme care will be taken when mounting and dismounting tanks.

3. When conducting the breechblock portion of this test, extreme caution will be taken to insure the safety of the examinee and testor.

4. When entering and leaving the driver's compartment, extreme caution will be taken to prevent falls.

APPENDIX D

Post Graduate Questionnaire

Page

This questionnaire is part of a continuing research effort being conducted by the Army Training Study for the Commander of Training and Doctrine Command. The purpose of the research effort is to gain insights into the retention of basic armor skills that you were taught at Ft Knox.

It is important for this research effort that we identify how many times you have done some tasks since you left Ft Knox. This questionnaire is intended to establish just that; how many times you have done certain tasks since you left Ft Knox. It is important that you think carefully and make the most accurate response you can to each question. If you have not done certain tasks, please indicate with a zero (0) or "none" in the response and do NOT include the times you did things in basic armor training at Ft Knox.

All individual answers will be held in strict confidence by the Army Training Study personnel. No personal identification will be released to any individual or organization.

There is a question on the survey that asks for the name of your supervisor; the only purpose of this question is to assist Army Training Study personnel in locating him so that we may administer a survey to him.

POST GRADUATE QUESTIONNAIRE

NAME______________________ UNIT____________ DATE________

SSN____________ BUMPER NO. OF TANK YOU ARE ASSIGNED TO________

Please answer all questions with the most accurate estimates you can make. These questions concern the things you have done in your unit since your graduation at Fort Knox. DO NOT include the things you did while in basic armor training. If the answer is "Never" or "Zero," write that in.

1. How many weeks have you been assigned to duties with your company or platoon without being assigned to a tank crew?

   ________weeks.

2. How many different tanks have you be assigned to? _____tanks.

3. What is the longest time (in weeks) you were in any one tank crew? ________weeks.

4. How many TC's have you had? __________TC's.

5. What percentage of your training in each of the following subjects is conducted by your TC?

   TANK GUNNERY____________________%

   NBC____________________%

   COMMO____________________%

   MAINTENANCE____________________%

   FIRST AID____________________%

   THREAT VEHICLE RECOGNITION__________%

6. What crew positions have you had in the tank? Indicate by placing the number of weeks after each. Please circle current duty position.

   DRIVER____________Weeks

   LOADER____________Weeks

   GUNNER____________Weeks

   If you are not in a tank crew, what job are you doing?______________________________

7. What rank is your TC?__________________.

8. Do you plan to remain in the Army as a career?

Yes____; Probably Yes____; Undecided____; Probably Not____;

No______.

9. Have you ever used TEC lessons? Yes____; No_____.

If yes, indiate the number of TEC lessons you have seen on the following subjects.

TANK GUNNERY ______________________.

NBC ______________________.

COMMO ______________________.

MAINTENANCE ______________________.

FIRST AID ______________________.

THREAT VEHICLE RECOGNITION ______________.

Questions 10 through 37 ask about things you may or may not have done since leaving Fort Knox. Please fill in your best estimate of how many times you have done each of these things since graduation from basic armor training.

10. Stowed ammo in the ready rack? (indicate total number of rounds). ______________________

11. Stowed belt ammo in the banana box?____________.

12. Loaded th M219 machinegun? ________________.

13. Loaded the main gun? ________________.

14. Practice misfire procedures (main gun)? ____________.

15. Disassembled the breechblock? ________________.

16. Disasembled the M219 machinegun?________________.

17. Disassembled the M85 machinegun? ________________.

18. Disassembled a .45 caliber pistol? ______________.

19. Disassembled the M3A1 submachinegun? ______________.

20. Fired the .45 caliber pistol? ______________.

21. Put on a protective mask? ____________________.
22. Received a NBC class? ____________________.

23. Turned on the radios in a tank and set frequency? ________.

24. Received a class on mine field markings? __________.

25. Transmitted a message on the radio? ________________.

26. Put an TA-312 field phone into operation? ____________.

27. Performed before-operations checks on a tank? ______________.

28. Filled out the heading and made entries on DA Form 2404? ______________.

29. Made the driver's entries on the DA Form 2408-1 (daily)? ______________.

30. Lubricated a tank following the lube order? _________.

31. Measured track tension (with block, string, and ruler)? ________________.

32. "Broken" track? ___________.

33. Serviced the air cleaners? ___________.

34. Performed "Prep-to-Fire"? ____________.

35. Received training as a tank gunner? _____________.

36. Fired the main gun a gunner? __________. Approximate number of rounds fired? _____________.

37. Driven a tank? _________. How many miles? (Best estimate) ________________.

Since completing basic armor training, have you received training in the following subjects?:

38. First Aid: Yes___; No ___.

If yes, list the hours for the following subjects:

Treatment for Burns ___________________.

Treatment of Broken Bones _____________.

Mouth-to-Mouth Rususcitation ___________.

Controlling the Bleeding _____________.

Treatment for Shock __________________.

39. Map reading? Yes___; No___.

If yes, how many hours? _____.

Were you required to determine elevation on a map?
Yes___; No ___.

Were you required to locate a position on a map?
Yes___; No ___.

Have you used any TEC lessons on map reading?
Yes___; No ___.

Have you used a map to find your location on the ground?
Yes___; No ___.

40. Threat Vehicle Recognition? Yes ___; No___.

If yes, how many hours? _____.

What type training aids were used? (Put check after each typed used).

TEC __________.

SLIDES _________.

CARDS _________.

MODELS _________.

41. Are you right-handed? Yes___; No ____.

42. Are you married? Yes___; No___.

43. What is your height?______________.

44. What is your weight?______________.

45. If you have completed any schooling since completing One Station Unit Training, please list it here.

____

____

46. What is your rank? _______________.

47. What is your supervisor's name? _________________.

PART II

RETENTION OF BASIC ARMOR TRAINING SKILLS WITHIN THE INSTITUTION

RETENTION OF BASIC ARMOR TRAINING SKILLS WITHIN THE INSTITUTION

STUDY REPORT

Prepared by

Army Training Study

Systems Work Team

M60A1 Weapons System

Fort Knox, Kentucky

May 1978

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APPENDIX

CHAPTER I

EXECUTIVE SUMMARY

BACKGROUND

While Army Training Study (ARTS) was in the formulation stages, managers of First Training Brigade, Ft Knox, Kentucky had become concerned with the retention of basic armor skills. Tests were available and used to measure the initial learning of skills within the institution, but no hard data was available on retention of these skills in the institution and in the unit. ARTS managers recognized the importance of skill retention and loss rates to the determination of overall training effectiveness. The ARTS M60A1 Systems Work Team (SWT), Ft. Knox, was thus assigned the task of refining First Training Brigade retention testing procedures and obtaining initial retention data for basic armor skills in the institution and in the unit. This paper addresses the first part of that effort: the study of relatively short-term skill retention within the institution.

STATEMENT OF THE PROBLEM

The proficiency of the individual armor crew member depends upon how well he remembers certain military skills acquired in the Army's First Training Brigade (Armor) Basic Armor Training (BAT) program. While the armor student is tested at various times during the course to measure his progress and readiness for further training, little evaluation has been carried out over time to determine how much he remembers. Critics of the training systems have offered the opinion that the quality of recent trainees is such that skills are forgotten very rapidly after testing. Empirical data are strongly needed in this area.

TEST DESIGN

The sample for this study consisted of male, entry level, US Army personnel who attended Basic Armor Training during the period 17 Dec 77 through 17 Mar 78 at the First Training Brigade, Ft Knox, Kentucky. A total of 436 personnel were tested and later retested, 286 on the mid-cycle and 150 on the end-of-cycle test (TSCT).

A test-retest methodology was adopted in the study to avoid the selective biases associated with dropout and turnover in the sample. During the study, randomly-selected trainees were retested on the mid-cycle test and TSCT. The samples were drawn from the First Training Brigade without being retested a second time on the same test. By-name lists of those chosen for retesting were sent to the unit on the day of retesting.

Criterion-referenced performance tests administered did not test all skills learned but only those considered critical to the performance of an armor crewman at an established standard appropriate for survival in a combat environment. All tasks were tested on a GO/NO GO criteria. For an individual to receive a GO on any test station, it was necessary for him to score a GO on all subtasks for that station. A NO GO on any subtask made an individual a NO GO for the entire station. Some stations involve as many as eighteen subtasks, while others as few as two subtasks. The GO/NO GO criterion does not distinguish between an individual who barely met the standards and an individual who exceeded the standards. The criterion indicates only that the individual passed the test but it does not indicate any degree of change in individual proficiency.

LIMITATIONS

It was deemed cost effective to limit data acquisition instruments to the evaluation instruments that were already set up and in use in the First Training Brigade. These evaluations test many tasks that have been deemed critical by the Commanding General and provide GO/NO GO measures which only indicate whether the individual tested meets the established standards but does not indicate individual proficiency beyond this standard. Time and cost analysis made it apparent that the development of new test procedures and training of evaluators on the new test procedures were prohibitive to this study. Based on these factors, current GO/NO GO test procedures were utilized recognizing their limitations as a retention testing instrument.

Available data sources were reviewed, and it was determined that sufficient data were not available for proper analysis and comparison for anyone graduating from BAT prior to 17 Dec 77. Due to course redesign and changes in class format beginning in January 1978, the time for which consistent, comparable data were available was limited to the period 16 Dec 77 to 17 Mar 78, the date of graduation of the last class of the old course of instruction. Additionally, small scale investigation by the First Training Brigade indicates that this time frame may contain an abnormally high proportion of the unemployed/unemployable compared to other time frames. The full implication of these factors must be considered in generalizing from the results obtained.

RESULTS AND FINDINGS

Due to the short time available for the testing, relative unsophisticated test design and administration, and small population samples the results cannot be considered as conclusive evidence of learning/retention levels and should not be used for policy decisions. However, test results indicate that individual learning/retention was much greater on those tasks involving fewer subtasks. Retention was greatly reduced on those tasks involving multiple precise, sequential subtasks or that involve accurate retention of subject matter, i.e., communications, first aid, vehicle recognition, maintenance. Detailed examination of individual subtasks was considered, but found not feasible for this study because of the nature of the GO/NO GO method of scoring.

Test results on the mid-cycle initial and retention tests indicate the greatest difficulties on stations involving first aid and communications. Test results for the TSQT indicate the greatest difficulties on stations involving cognitive or multi-step sequential subtasks, i.e., machineguns, breechblock, and communications. The greatest number of NO GO's occurred on the performance measure requiring identification of friendly/threat vehicles (less than 70% G-G).

Although non-conclusive, this trend enforces the supposition that multiple step sequential tasks and cognitive tasks are the most difficult to learn and retain. Retention on cognitive tasks indicates the greatest retention loss in areas of vehicle identification and use and identification of NBC markers.

Retention testing on both mid-cycle test and ISCT indicate that remedial training in problem areas was productive and that individuals receiving remedial training generally retained information once it was learned. This is supportive of the idea that additional training in these areas will increase learning/retention.

CONCLUSIONS

Overall, task learning was high even though there were specific tasks that were relatively low. These include those that are procedural or cognitive. Generally, retention was maintained at a high level in the institution with no consistent retention loss demonstrated over a period up to three weeks. Overall those tasks that were difficult to learn were also difficult to retain and were generally procedural tasks. Remedial training in these tasks appears to be relatively successful, with those individuals receiving remedial training having better retention. Future study of test procedure and task analysis should expand the concept of analysis of subtasks so that a more accurate determination of where actual difficulties lie can be accomplished. This will provide more data on which to base evaluation of training pitfalls and should identify areas where additional training can be beneficial to learning and retention.

CHAPTER II

INTRODUCTION

BACKGROUND

Training resources in the Army have been under scrutiny from various sources (particularly Congress) in recent years. To convince budgeting agencies that training resources should not be reduced arbitrarily, the Army must provide solid empirical data as well as the professional assessments of senior Army managers. Models must be developed to relate readiness and combat effectiveness to training and other resources. Army managers could then present a solid defense of the budget by precisely and quantitively identifying the minimum resources needed to maintain the required levels of combat readiness and effectiveness. The effects of arbitrary reduction could be quickly enumerated in terms of probable consequences in combat, and arbitrary reductions could be headed off and only knowledgeable ones would be implemented.

Additionally, the Army must begin to formulate training programs for the complex weapons of the 1980's with the relationship of resources to combat effectiveness clearly in mind. In the next few years the Army will be acquiring new and sophisticated weapons systems such as the new main battle tank, the XM-1. Recent failures to make maximum use of new and sophisticated weapons systems (e.g., the product-improved, support battle tank (the M60A2) and the Dragon Missile System) have been attributed, to some degree, to both insufficient user and maintenance training. Therefore, it is very important that maximum effort be devoted to efficiently and rapidly training personnel to use these new systems.

As a result of this pressure on the Army's budget and the anticipated acquisition of new weapons, the Army has initiated steps to quantify elements of combat efficiency to training in order to enable the implementation of cost-effective training programs. The Army Training Study was formally initiated within Training and Doctrine Command (TRADOC) during October 1977 with an ultimate two-fold purpose: to determine the relationship between training resources and combat effectiveness for the Army of the 1980's, and to determine the training programs required to optimize the capabilities of new weapon systems programmed for delivery to the force in the 1980's. Long-range ARTS objectives are: to determine the functional relationships among resources for institutional and unit training, the individual and collective training programs of the total Army training system, the resultant training readiness and combat effectiveness, and to determine the optimum mix of individual training programs conducted in the training base and in the force. In the overall ARTS model; combat effectiveness is a function of the weapons system's design capabilities, as influenced by varying levels of readiness of training, personnel, logistics, and the intangibles of tactical and personnel/leadership.

ARTS has begun with a near-term effort to evaluate selected systems by using selected empirical data available in 1977-78. Using insights gained from the 1977-78 near-term effort and selected excursions, the study will develop a "road map" of training policies and programs to transition from the present to the 1984-85 Army. The ARTS near-term effort is based on selected aspects of five major current systems: weapons system-M60A1; combat support system-artillery forward observer system and Pershing (force imbalance problem); combat service support-tank turret mechanics and/or communication maintenance; personnel structure-11B vs 11B/H; and systems with available data-REDEYE and TOW. The present paper is a report of initial results within the M60A1 weapons system.

PURPOSE/OBJECTIVES

The retention testing program was designed to provide insights into the retention curves for armor skills and to identify factors that affect those curves. From this initial information, detailed, long-range, and comprehensive studies can be developed to meet the objectives within the ARTS training effectiveness analysis. The specific objectives of this initial retention testing program are:

To provide insights into establishing retention curves for armor skills by determining the amount, temporal course, and distribution of proficiency loss for a high priority set of critical tasks for individual armor crewmen over a period of up to three weeks after institutional testing of military skills learned in BAT.

To provide insights into factors which influence the retention curves for armor skills by examining general training and demographic variables.

To provide insights into the feasibility and methods of running further retention tests, throughout the Army.

CHAPTER III

REVIEW OF LITERATURE

Interest in skill learning and retention within the fields of education and psychology has fluctuated over the years, with interest having been high during the early twentieth century, then waning, and resurging since 1940 with the application of learning theory within industrial and military settings. This brief review of the literature emphasizes the study of skill retention within the military context. Clarifications and definitions of the concepts of skill and retention are briefly discussed, followed by a review of the general skill retention literature and summaries of specific military studies.

DEFINITION OF SKILL

Skills are often referred to as motor skills[1] or psychomotor skills,[2] emphasizing the idea that skills are behaviors which involve the coordination of physical movements. Fitts identifies the characteristics of skill as spatial-temporal patterning, the interplay of receptor-effector-feedback processes, and such attributes as timing, anticipation, and the graded response.[3] The study of skill

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[1] J. B. Oxendine, The Psychology of Motor Learning. (New York: Appleton-Century-Crofts, 1968).

[2] C. E. Noble, "The Learning of Psychomotor Skills" in Annual Review of Psychology (Vol 19), ed. P. R. Farnsworth, (Palo Alto, CA: Annual Reviews, Inc., 1978), pp. 203-250.

[3] P. M. Fitts, "Perceptual-motor Skill Learning" in Categories of Human Learning, ed. A. W. Melton (New York. Academic Press, 1964), pp. 130-158.

learning and retention has often been conceived of as a field distinct from the study of cognition, or the acquisition and retention of knowledge, which has been the primary subject matter of verbal learning and cognitive psychology. Vineberg and Taylor delineate two important components of a job as job knowledge (information about a job) and job skills (abilities), and they divide skills into the categories of perceptual skills, motor skills, cognitive skills, and social skills.[4] The basic distinction is between knowing what to do versus being able to do it. Being able to do a job requires the perception of information, the coordination of motor movement, and at least a limited amount of cognitive processing of stimuli and feedback. The application of knowledge also requires the use of motor movements; for example, speech can be thought of as a motor skill. Thus, the distinction between skills and knowledge is not clear-cut; for the purposes of the present paper skills are defined as behaviors which emphasize physical movement rather than knowledge.

Motor skills have been divided into numerous categories, but the principal division of interest here is that of continuous versus discrete skills. Continuous motor activities are those which require repetitive or sustained effort, such as walking or bicycle riding. Discrete skills require a singular exertion or short-term effort, such as a dart throw or a soccer kick. Again, the distinction cannot be clearly delineated. Some tasks are sequential or serial, requiring a

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[4] R. Vineberg and E. N. Taylor, Performance in Four Army Jobs by Men at Different Aptitude (AFQT) Levels: 4. Relationships Between Performance Criteria. HumRRO Tech Report 72-23 (Alexandria, VA: Human Resources Research Organization, August, 1972).

sequence of discrete movements which are not repetitive. Examples are bowling or operating a computer terminal. In the present paper, skills will be categorized as continuous or discrete with sequential or procedural tasks falling somewhere in between.

DEFINITION OF RETENTION

The primary focus here is on skill retention, but the point must be made that this area cannot be separated from skill learning and transfer. The three topics have been studied primarily in isolation, but the amount of initial learning affects the amount retained and transfer studies are often very similar to retention studies.[5] Leonard, Wheaton, and Cohen define retention as the maintenance of a skill over time and/or interpolated activity, and they define transfer as the maintenance of a skill over changes in contexts.[6] Retention studies emphasize changes in performance over time with appartus and other aspects of context held constant to the extent possible, while transfer studies emphasize changes in performance with different apparatus or context with interpolated activities held constant and very short time frames used. One could argue that this distinction is impossible to maintain: context can never be held completely constant and all transfer studies involve at least a short time interval between contexts. The difference is one of degree; the present review

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[5] A. S. Blaiwes and J. J. Regan, An Integrated Approach to the Study of Learning, Retention, and Transfer--A Key Issue in Training Device Research and Development. NAVTRADEVCEN Tech Report IH-178. (Orlando, FL: Naval Training Device Center, August, 1970).

[6] J. L. Leonard, Jr., G. R. Wheaton, and F. P. Cohen, Transfer of Training and Skill Retention. ARI Tech Report 76-A3. (Alexandria, VA: US Army Research Institute, October, 1976).

emphasizes studies of changes in motor skill performance over time and intervening training.

GENERAL SKILL RETENTION LITERATURE

Naylor and Briggs have provided an extensive review of skill retention literature in which they conclude that most retention research has been related to verbal rather than motor learning and that most skill retention research has involved short time intervals.[7] In summarizing research on long-term skill retention as a function of the task, they conclude that there is not adequate evidence of an intrinsic superiority for retention of motor habits over verbal habits (it may be that retention of arbitrary response sequences is less than that of meaningful sequences or patterned organizations). It appears that continuous tasks are better retained than are discrete ones, although other authors argue that continuous tasks are often over-learned, involve less physical proficiency, and involve lower skill levels.[8] With respect to conditions surrounding original learning, retention is related positively (but negatively accelerated) to amount of original learning; distributed practice facilitates learning but not retention; whole learning may lead to better retention than part learning; actual motor practice leads to better retention than does verbal practice, which is better than none; and, conditions leading to more rapid learning do not necessarily result in

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[7] J. C. Naylor and G. E. Briggs, Long-Term Retention of Learned Skills: A Review of the Literature. ASD Tech Report 61-930. (Wright-Patterson AFB, OH: Aeronautical Systems Division, Air Force Systems Command, August, 1961).

[8] Oxendine, Psychology of Motor Learning.

better retention. Conditions existing during the retention period influence retention with the function depending on the situational parameters; rehearsal facilitates skill retention, particularly if it involves overt activity; and rehearsal produces better results if fidelity to the original task is maintained. Conditions surrounding the retention test influence retention in that the measure used (first trial recall versus savings in retraining) affects the degree of retention (the criterion should be the one that is most important in the operational task); retention is directly related to the degree of replaction of the learning context during the test (see discussion of retention versus transfer above); and warm-up facilitates retention. These reviewers conclude that the major need is for studies using fairly extended time periods between learning and recall, that no experimental approach has proved completely satisfactory, that it is critical to determine the relationship of task "organization" to retention, and that there is a need to study the effects of different measures on retention.[9] Similar conclusions have been echoed throughout the skill retention literature, along with the observation that most skills studied have been simplistic ones which did not involve a great deal of cognitive processing or complex procedure following.[10]

SPECIFIC MILITARY STUDIES

Military skills run the gamut from simple continuous tasks (marching) to complex perceptual, procedural, and cognitive tasks

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9Blaiwes and Regan, An Integrated Approach.

10Leonard, Wheaton, and Cohen, Transfer of Training.

(engaging the enemy in a tank battle). The most frequent criticisms of studies of military skills retention are that there have not been enough of them, they have involved relatively short time periods, and they have addressed only simple tasks. Several examples of studies of military skill retention are summarized below.

McDonald has obtained retention data in several basic combat proficiency areas: basic rifle marksmanship, physical combat proficiency, and end-of-cycle tests (military courtesy, military justice, drill and ceremonies, first aid, guard duty, individual tactical training, hand-to-hand combat, and bayonet).[11] Independent groups of soldiers were tested at the end of Basic Combat Training (BCT), infantry and non-infantry groups were retested using the same tests after fourteen to sixteen weeks in the Army, non-infantry groups were retested after twenty-four to fifty-two weeks, and infantry and non-infantry groups were retested on basic rifle marksmanship after ninety-six weeks. There were approximately sixty personnel in each group tested. Results showed significant performance decrements over time for all areas except physical combat proficiency. At the end of BCT, 95.5 percent of soldiers tested qualified on basic rifle marksmanship, and on the first retest (after fourteen to sixteen weeks in the Army) 92 percent of infantry personnel and 85 percent of non-infantry personnel qualified. After twenty-four to fifty-two weeks, only 53 percent of non-infantry personnel qualified, and after ninety-six weeks 75 percent of infantry personnel qualified. At the

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[11] R. D. McDonald, Retention of Military Skills Acquired in Basic Combat Training. HumRRC Tech Report 67-13. (Alexandria, VA: Human Resources Research Organization, December, 1967).

end of BCT, 99.9 percent qualified on the end-of-cycle tests, but after twenty-four to fifty-two weeks in the Army only 45 percent of non-infantry personnel were able to qualify on these tests. McDonald argues that the performance decrements were small, since most personnel who failed to qualify on retention testing were barely under the criterion. However, if one accepts the criterion as valid, significant performance decrements were shown over one year.

Grimsley trained sixty Advanced Individual Training (AIT) trainees to operate the control panel of the Nike-Hercules guided missiles system under three levels of trainer fidelity.[12] While trainer fidelity had no effect on learning or retention, mean performance scores dropped from 91.4 to 74.6 with retesting after four weeks. Time to retrain after six weeks averaged 19.7 minutes, compared to 115.1 minutes for original training. So there was a significant performance decrement over a relatively short time interval, but considerable savings in retraining were demonstrated. It should be noted that the task studied here was not a basic combat skill, but rather a procedural task in which discrete, principally "all-or-none" responses were made to specific values of cues in a continuous series of stimuli (tasks were done in a sequential order). Grimsley replicated the results obtained in the previous study in a further study comparing the performance of low-aptitude (Category IV) trainees

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[12] D. L. Grimsley, Acquisition, Retention, and Retraining: Effects of High and Low Fidelity in Training Devices. HumRRC Tech Report 69-1. (Alexandria, VA: Human Resources Research Organization, February, 1969).

with high-aptitude trainees.[13] Category IV trainees took longer to master the task but demonstrated retention levels almost as high as high aptitude trainees.

Vineberg obtained retention data on the basic combat skills of drill and ceremony, first aid, individual tactical training, guard duty, M16 rifle, chemical, biological, and radioactivity training, and M60 machinegun.[14] Two hundred soldiers were tested upon completion of BCT and retested six weeks later by the same test team. Results showed that the probability of passing the overall test was .81 at the end of BCT, was .63 six weeks later, and was .55 for passing both. Depending on the measure used, the average decrease was 18 to 26 percent. Individual tasks showed decrements from 5 to 44 percent, and Category II personnel were superior to Categories III and IV, who performed alike.

Leonard, Wheaton, and Cohen examined transfer and retention performance over periods of six and seventeen weeks for hand grenade subtasks of selecting, maintaining, arming, throwing positions, and identifying components.[15] One hundred fifty enlisted personnel showed no significant retention loss in hands-on performance, but performance on written subtests was lower upon retest than upon initial testing,

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[13]E. L. Grimsley, Acquistion, Retention, and Retraining: Training Category IV Personnel with Low Fidelity Devices. HumRRO Tech Report 69-12. (Alexandria, VA: Human Resources Research Organization, June, 1969).

[14]Vineberg and Taylor, Performance in Four Army Jobs.

[15]Leonard, Wheaton, and Cohen, Transfer of Training.

with an indication that the longer the retest interval was, the greater the decrease became. The authors point out that the tasks studied did not require a great deal of cognitive processing or complex procedure following, and that relatively short time periods were employed.

Germas trained operators of a tactical data system using lectures and computer-assisted instruction.[16] The mean error rate for eighteen trainees immediately after training was 6.8 (on a performance-based pencil and paper test), and the mean error rate on a retest one month later was 11.9. This study provides an indication of rapid retention loss on a complex procedural task, although results on a performance test would have been more relevant to skill retention than would results on a pencil and paper test.

Another retention research area in a military context is studies of flying skills. Wright found that visual flying rules (VFR) skills remained acceptable for up to three years without any flying, but that instrument flying rules (IFR) skills became less than acceptable after one year for nearly one-half the Army aviators surveyed, even if minimum flight practice was obtained.[17] The loss rate was greatest soon after training and experience, and decreased to near zero after one year. Roscoe concludes that perceptual-motor skills (landing a

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[16] J. E. Germas, "Embedded Training: Utilization of Tactical Computers to Train Computer Operators," Unpublished memorandum, US Army Research Institute, Alexandria, VA; November, 1976.

[17] R. H. Wright, <u>Retention of Flying Skills and Refresher Training Requirements: Effects of Nonflying and Proficiency Flying.</u> HumRRO Tech Report 73-32. (Alexandria, VA: Human Resources Research Organization, December, 1973).

plane) are not quickly forgotten, but that procedural skills (starting a plane) are forgotten more rapidly.[18] Prophet reviews the flight retention literature and concludes that basic flight skills can be retained fairly well for extended periods of non-flying, but some decrement of concern does occur, particularly for instrument and procedural skills.[19] Little is known about the retention and retraining of higher level pilot skills within tactical units. Baldwin, Cliborn, and Foskett looked at the area of visual aircraft recognition skills and found a 14 percent decrease in accuracy over a period of ten weeks.[20]

SUMMARY

Studies of military skill retention have shown significant retention loss over relatively short periods of time. Although the data are limited, it appears that retention loss in more severe for complex procedural tasks than for basic military skills. Problems in drawing final conclusions in this area are summarized below.

A common conclusion that can be drawn from both the general and military skill retention literature is that research has concentrated

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[18] S. N. Roscoe, "Incremental Transfer and Cost-Effectiveness of Flight Training Simulators" in Proceedings of NTEC/Industry Conference (7th). (Orlando, FL: Naval Training Equipment Center, November. 1976), pp 3-9.

[19] W. W. Prophet, Long-Term Retention of Flying Skills: A Review of the Literature. HumRRO Tech Report 76-35. (Alexandria, VA: Human Resources Research Organization, October, 1976).

[20] R. D. Baldwin, R. E. Cliborn, and R. J. Foskett, The Acquisition and Retention of Visual Aircraft Recognition Skills. ARI Tech Report 76-A4. (Alexandria, VA: US Army Research Institute, November, 1976).

on simple, non-procedural, primarily discrete skills. Practically nothing is known about the retention of complex tactical skills used in the military, such as engaging the enemy in tank warfare. Another general conclusion is that most studies have employed relatively short time intervals and have looked only at end-points or ar a few points on the retention curve. Further analysis of skill retention curves over long periods of time is needed. Such an analysis is important for determining that optimal distribution of retraining over time for various types of tasks. With adequate retention data, a program could be designed to retest personnel at times when they are likely to have experienced retention loss and to provide retraining to those who fail to meet the criterion. A third area of concern relates to retention measures and the conditions under which retention is tested. First trial recall and retraining savings measures have both been used in the retention research summarized, and they do not necessarily lead to the same results and conclusions. Much of the military retention data is in terms of pass-fail measures, which may not be adequate to provide precise retention curves. Also, the gathering of skill retention data by use of pencil and paper tests may not be as adequate as the hands-on tests. A final point here is that test and retest conditions need to be carefully controlled, in order to distinguish performance decrements related to transfer from those related to retention loss.

RELEVANCE OF PRESENT RESEARCH

Numerous criticisms of previous studies of military skill retention have appeared in the literature review. The research described in this paper was not designed to answer all these criticisms, but rather was designed as a pilot study to initiate further research in the right direction. The review of the literature indicates that retention of basic military skills has not been studied extensively and that retention of specific armor skills has not been systematically studied at all. The present paper provides initial data on armor skill retention; some of these skills are comparable to basic military skills studied previously, and some are more complex procedural ones. In order to answer some of the criticisms and meet some of the objectives brought out in the review, it is necessary to refine retention test procedures and to standardize test conditions. The present study is of relevance here in providing a look at the usefulness of hands-on institutional tests as retention tests, in providing a consideration of the adequacy of pass-fail measures for retention testing, and in providing a pilot study of retention testing procedures and analysis. The present paper will serve as a model for the future, relatively long-term retention testing in the armor community.

CHAPTER IV

TEST METHODOLOGY/TEST DESIGN

PERFORMANCE TESTING AND EVALUATION

The objective of performance testing and evaluation is to insure that each soldier attains the specified levels of performance in prescribed subject areas and possesses the discipline, skills, and spirit required to progress to the next phase of training.

Performance testing and subjective appraisal are integral parts of the overall program. The trainee is not tested on all of the skills he has learned. The performance tests administered in Basic Armor Training (BAT) measure certain designated critical basic skills. The subjective appraisal, conducted primarily by the drill sergeant, examines the trainee's state of discipline and spirit and provides a GO/NO GO assessment of his overall performance during BAT and determines the trainee's potential for continued service. Specific testing methods are criterion-referenced and selected based on the subject matter, the training objectives, and the likely environment in which the trainee will apply his skills. All tests require 100 percent completion of tasks based on a GO/NO GO criterion.

Under the five-phased concept of BAT, testing is conducted at the end of selected blocks of instruction (Figure 1). The incremental Phase I test, is administered by company cadre. The mid-cycle and end-of-cycle Tanker Skills Qualification Test (TSQT) performance tests, administered by Brigade Test and Evaluation Group, are BAT skill tests which require demonstration of important skills in a

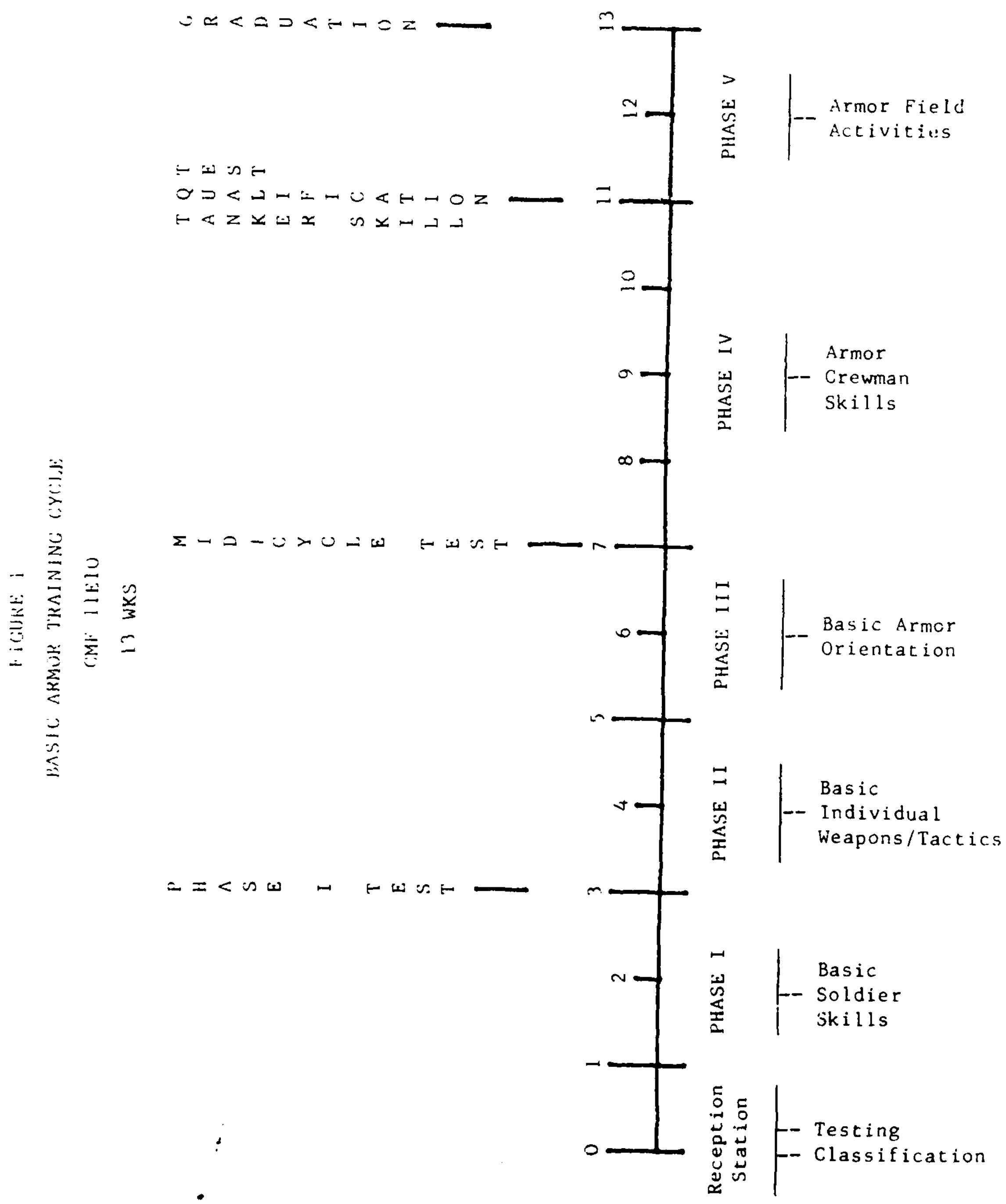
FIGURE 1
BASIC ARMOR TRAINING CYCLE
CMF 11E10
13 WKS
GRADUATION
TANKER SKILL QUALIFICATION TEST
MIDICYCLE TEST
PHASE I TEST
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Reception Station
-- Testing
-- Classification
PHASE I
-- Basic Soldier Skills
PHASE II
-- Basic Individual Weapons/Tactics
PHASE III
-- Basic Armor Orientation
PHASE IV
-- Armor Crewman Skills
PHASE V
-- Armor Field Activities

Figure 1.

realistic setting. Feedback from test results was made available to the trainee so he knew his strengths and weaknesses as compared to the specific standards of BAT.

LIMITATIONS

In the proposed retention testing study certain factors limit the results from the outset. These limitations, which were taken into consideration when the desired results were outlined, can be grouped into the categories of time, funding, and resources.

The available data sources for this proposed retention study were reviewed within First Training Brigade. It was found that records would be inadequate for anyone graduating prior to 16 December 1977. The Basic Armor Training (BAT) course was redesigned and changed drastically for all classes beginning in January 1978, resulting in a new fourteen week course that did not reach the first end of cycle until April 1978. Because of the July 1978 suspense for this report, the evaluation will be limited to approximately a four-month period, from 16 December 1977 to 17 March 1978, and the number of personnel available to be evaluated will also be limited. This number of personnel, when coupled with other factors discussed later, limits the results that can justifiably be expected to provide insights.

A small-scale investigation conducted within the First Training Brigade indicated that the educational level and previous employment status of trainees entering the BAT program may differ from one training cycle to another. The time frame from December to March in any year may tend to include a higher proportion of non-high school graduates, although not the case for this sample, and the unemployed or unemployables than other time frames. The full implications of these factors must be considered when generalizing from the results obtained.

It was deemed cost effective to limit data acquisition instruments to the evaluation instruments that were already set up and being used in the First Training Brigade. These evaluation instruments test many tasks that the Commanding General has identified as critical and provide "GO/NO GO" measures which indicate whether or not a trainee meets the established standard. Exact level of individual proficiency is not recorded. Because of the time involved in developing a new test and the problems that would be encountered in getting evaluators, equipment, and trainees together to take the test, the existing instruments would be used.

The retention testing will limit the results that can be expected. Only forty-three armor skills will be tracked, and these tasks will be tracked for a four-month period of the BAT program, from 16 December 1977 until 17 March 1978. Only limited insights into the decay curves and factors effecting the curves can be obtained. The test program is intended to provide a basis for future studies and to point out areas of special interest and pitfalls to be avoided.

SUBJECTS

The sample for this study consisted of male, entry level, US Army personnel who completed basic armor training during the period 16 December 1977 through 17 March 1978 at the First Training Brigade, Fort Knox, Kentucky. A total of 436 personnel were tested and later retested, 286 on the mid-cycle test and 150 on the end-of-cycle test. A detailed breakdown of sample sizes by test stations and test-retest intervals is provided in Chapter V and in Appendix A, Table A-3. The approximate distribution of examinees across mental categories was Category I-3.1%, II-13.4%, III-75.1%, and IV-8.3%. Approximately two-thirds of the sample were high school graduates. These demographic characteristics are generally typical of those for personnel entering the Army during the winter months (see discussion on limitations above). A more detailed discussion of demographics of the sample is contained in Chapter V.

TEST INSTRUMENTS/APPARATUS

The instruments used to test and retest the examinees were the mid-cycle test and the end-of-cycle Tanker Skills Qualification Test (TSQT).

At the time of this study, these were the standard instruments used by the First Training Brigade to measure the progress of trainees. These were criterion-referenced instruments which for the most part provided performance-oriented testing. The particular skills tested were ones judged as critical armor crewman skills by First Training Brigade and senior Army personnel. The performance test items were selected as representative samples of critical basic armor crewman skill level one performance requirements. Stations on the mid-cycle test were: basic driving, maintenance, first aid, communications, general subjects, caliber .45 and M3A1 submachinegun, and tactical driving. Stations on the TSQT were: loader's duties, breechblock, M219 machinegun, M85 machinegun, tank gunnery, general subjects, communications, maintenance, and advanced driving. A detailed listing of specific test performance measures within each of these stations can be found in Apendix A, Tables A-1 and A-2. Detailed descriptions of performance measures, test standards, conditions, and associated appartus are included in the lesson plans in Appendix E. For the purpose of this study, the term performance measure equates to a specific task identified as an item/subject area on which the trainee is to be evaluated.

Examination of Tables A-1 and A-2 indicates that there were 43 performance measures recorded on the mid-cycle test and 52 on the TSCT. The number of performance measures was not equally divided across stations; e.g., there were 18 measures on the mid-cycle basic driving station and 3 measures on the mid-cycle maintenance station. Stations were also not completely comparable in terms of test conditions, some measures were obtained by a slide test or other classroom exercises, some were obtained on training devices, and some were obtained on actual tanks. Scoring on both tests was in terms of GO/NO GO categories: if an examinee performed all critical sub-tasks on a performance measure properly, he received a GO (pass); if he performed any sub-task improperly, he received a NO GO (fail) for that performance measure. The number of sub-tasks within performance measures was not constant on these tests, some measures involving two sub-tasks which had to be performed properly, and some involving seven or more. These test design factors impact on comparability of test results across stations and performance measures, and will be discussed further in the next chapter. The purpose of the present study was to examine overall failure rates within the existing testing system, and not to redesign the testing system for statistical purposes.

TEST PROCEDURES

A test-retest methodology was adopted in the study to avoid the selective biases associated with dropout and turnover in the sample. How this was accomplished is briefly described below.

During this study randomly selected trainees were retested on the mid-cycle test and the TSCT. The samples were drawn from the First Training Brigade without replacement; i.e., once an individual had been selected and retested on one of the tests he was not retested again on that test. By-name lists of those chosen for retesting were sent to the unit on the day of retesting.

The retention of ability to perform the tested tasks was measured after time periods of seven, fourteen, and twenty-one days from the date of original testing. The mid-cycle test adminstered during the seventh week of training was re-administered during the eighth, ninth, and tenth weeks. Trainees continued in the training cycle during the test-retest interval, so both intervening and remedial training were occurring during this interval. The TSCT adminstered in the eleventh week was re-adminstered only in the twelfth week, since one week was the maximum time period for which trainees were available after this test. The retest (one-, two-, and three-week) groups were in general selected from different training companies; thus slight inter-company training differences were not controlled (counterbalanced) and may have affected the results.

Standardization of test conditions is critical to the success of a retention study. Although somewhat different teams of evaluators conducted the testing and retesting, possible standardization problems were minimized by providing the test teams with training and standardization on the test procedures. Training procedures insured that evaluators had experience in following test procedures prior to testing, and the need for accurate, consistent, standardized scoring was highly emphasized. Identical test conditions, standards, and apparatus were used for the initial tests and retests. Scoring procedures were also identical for tests and retests; GO/NO GO results were recorded by evaluators on standard score sheets.

CHAPTER V

TEST RESULTS/DATA ANALYSIS

INTRODUCTION

In this and the following chapter learning and retention results are presented and briefly discussed for the overall test sample and for demographic subgroups. General test results are discussed first, and data summaries are then presented by test (mid-cycle or TSQT), test station, and individual performance measures.

Institutional learning results are presented in terms of the GO/NO GO measures obtained. If an examinee received a GO on a performance measure the first time he was formally tested on it in the institution, this indicates that he had learned the task and was able to perform it properly. If he received a NO GO on initial testing, this indicates that he had not learned the task and further training was needed. Initial GO/NO GO results for performance measures are presented in terms of the percentages of examinees who passed or failed the task on initial testing. Learning results for test stations and total tests were obtained by averaging across examinees the percentages of performance measures passed. For example, if one man passed 90 percent of his performance measures and another man passed 80 percent, average total test performance for these men was 85 percent GO.

Retention results are presented in terms of dependent measures for examinees who were tested and later retested. The primary index of retention is labelled G-G; this indicates that an examinee received a GO when initially tested on a performance measure and also received a GO when later retested, i.e., he learned the task and remembered how to do it. The primary index of retention loss is labelled G-N; this indicates that an examinee received an initial GO on a task but received a NO GO when retested, i.e., he had learned the task but forgot how to do it. These indices were averaged across examinees to obtain station and total test percentages as described above.

Retraining results are also briefly discussed in this and the following chapter as an index of the effects of remedial training. If an examinee initially received a NO GO on as task and received a GO when retention tested (N-G), it is assumed that remedial training was given and proved effective in teaching him the task. If a man received an initial NO GO and a NO GO during retention testing (N-N), he never learned the task (or, he learned it after initial testing and quickly forgot it before retesting). These retraining indices are summarized for total tests as described above.

The demographic analysis was limited since demographic data were not available for the total test sample. General data summaries for the important demographic variables of mental category and educational level are presented in this chapter. These provide an initial indication of the effects of demographic variables upon institutional learning and retention.

It should be pointed out that the type of data obtained limited the analysis and conclusions that could be accomplished. GO/NO GO measurement provides only an ordinal measurement of learning or retention; it does not allow distinction between a man who barely met the standards and a man who exceeded the standards. A man may have received a G-G on a task, indicating that he learned and retained it. However, on the first test he may have performed the task in two minutes and on retest in four minutes (still under the standard). GC/NC GC measures do not detect this type of skill retention loss.

The reader should also be cautioned that there are problems in comparing learning and retention results across performance measures differing in the number of critical subtasks. One measure may involve seven subtasks which must be performed correctly to receive an overall GO, while another may involve only two. If the former measure appears to be more difficult, this may be because it involves more subtasks, not because the subtasks themselves are inherently more cognitively difficult. Examples of this point are discussed in following paragraphs. Results in this paper are in terms of pass and fail rates within the existing testing system; subtask analysis and test design factors are touched upon for consideration in future retention research.

GENERAL TEST RESULTS

Due to the volume of the overall data, the general test results for the total population are presented in Appendix A. Table A-1 shows retention test results for the mid-cycle test, Table A-2 shows retention test results for the end-of-cycle (TSCT) test, and Table A-3 summarizes test sample sizes for each test. All results are presented in percentages due to the differing sample sizes involved. All test data are categorized in terms of the dependent data measures described above (G-G, G-N, N-G and N-N).

In Table A-1 mid-cycle retention test results are presented by week of retesting (1, 2, or 3) and performance category for each performance measure in the test, for each station in the test, and for the total test. One can thus use this table to isolate retention (G-G versus G-N) or retraining (N-G versus N-N) results for any part of the test over three retesting periods. Performance results on the initial administration (an indicator of initial learning level) can be obtained for any test group by summing the appropriate column entries. For example, for the one-week retest group, initial test performance on the total test was 96.9 (91.5 + 5.4) percent GC and 3.1 (2.7 + .4) percent NC GC. Relevant summaries of the data in this table are presented in the following paragraphs of this section.

In Table A-2 TSQT test results are presented for the only retest period used (one week) and by performance category for each performance measure, for each station, and for the total test. Retention, retraining, and initial learning measures can be isolated in this table in the same way as in Table A-1. Relevant data summaries and comparisons with mid-cycle results are presented below.

Sample sizes for each retest group by test and station are presented in Table A-3. The mid-cycle test sample sizes were 111 trainees for most stations for the one-week group, 69 for each station for the two-week group, and 106 for each station for the three-week group. The TSQT sample sizes were 150 trainees for eight stations and 97 for the other one. These sample sizes are considered sufficient for providing at least preliminary retention trends.

CHAPTER VI

DISCUSSION

INITIAL LEARNING BY STATION

More specific discussion of data analysis is presented in this chapter, data tables referenced appear in Appendix C. Before analyzing retention data, it is necessary to examine initial learning levels, since these levels may affect retention.

GO/NO GO performance on the initial test administration is summarized by station in Table 1 for the mid-cycle test and in Table 2 for the TSCT. These percentage measures provide an indication of the amount of learning in the institution before initial testing. The most striking result is the high degree of learning indicated; on the average 96.7 percent of mid-cycle performance results and 96.1 percent of TSCT performance results were GO. Previous First Training [illegible] experience indicates that these GO rates are not atyp[illegible] performance results on these tests. These results [illegible] possible conclusions: (1) learning in the instit[illegible] extremely high level; (2) the tests were [illegible] measure of learning; or (3) test admi[illegible] controlled and GO's were literally [illegible] the present project to determine [illegible] the primary result of [illegible] the measures, [illegible] subject [illegible]

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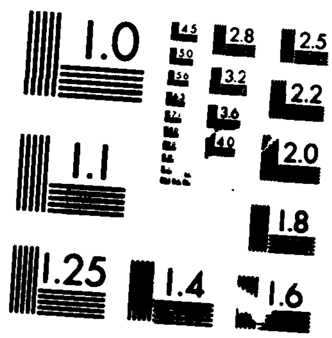

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU [illegible] STANDARDS [illegible]

3-weeks) groups. For the group later retested after one week, initial performance overall was 96.9 percent GC; for the two-week group it was 95.8 percent GC; and for the three-week group it was 97.4 percent GC. These figures agree closely enough to make safe the assumption that the three retest groups were approximately equivalent on initial learning measures for the total test (although the two-week group had learned slightly less). Institutional learning on TSQT tasks was also in close agreement with these figures (96.1 percent).

Examining the data in Tables 1 and 2 by station indicates that communications tasks were the least well learned before the mid-cycle test; 76.9 percent of results (averaged across weeks) were GC on this station while all other stations showed greater than 94 percent GC's. On the remaining mid-cycle stations, caliber .45 pistol and submachinegun and first aid showed the lowest learning levels and tactical training and basic driving showed the highest. On TSQT stations, M219 machinegun showed the lowest level of initial learning (13.1 percent NO GO) while loader's duties showed the highest (only 1.9 percent NO GO). Breechblock, communications, and M85 machinegun stations also showed intial NO GO rates greater than 5 percent. Overall, it appears that tasks least well trained in the institution (but still well trained, in terms of the performance measures obtained) include communications, machinegun, breechblock, small weapons, and first aid. These are primarily procedural tasks, requiring the performance of several steps in proper sequence. These tasks may be more difficult to learn because of the number of subtasks involved or because sequential skills are inherently more difficult (as indicated in the literature review).

INITIAL LEARNING BY PERFORMANCE MEASURES

In the preceding section initial learning levels were examined for individual test stations. A more precise summary of learning by individual tasks or performance measures is presented in Tables 3 and 4. Examination of the performance measures listed in Appendix A indicates that tasks within stations seem to "go together" to various degrees, e.g., first aid tasks seem more related to each other than general subjects tasks do. Thus, a more precise analysis of specific learning difficulties is obtained by looking at individual performance measures. Measures which show an initial NO GO rate of 5 percent or more are listed in Tables 3 and 4 as possible areas of learning difficulty.

Table 3 shows that mid-cycle tasks learned least well by far in the institution are related to communications, a finding in agreement with the station results above. Other individual tasks with a NO GO rate of 5 percent or higher primarily involve first aid or small weapons operations. These results indicate a need for increased emphasis on training in these tasks in the institution.

Table 4 shows that TSQT tasks learned least well in the institution are primarily related to COAX machinegun, communcations, and breechblock; these tasks occur in stations on which performance was relatively low (see preceding section). Another task not isolated in the station analysis which shows relatively low performance is threat vehicle recognition. Again, these results indicate a need for modifying emphasis in training (e.g., a 20 percent NO GO rate on handling COAX stoppage indicates a potentially serious problem).

Again, the results indicate learning difficulty primarily with procedural or sequential tasks. The primary exception is threat vehicle recognition, which is a relatively cognitive task, involving recognition memory rather than motor skills.

OVERALL RETENTION DATA

Retention data are displayed in terms of the dependent measures discussed in the section above. The primary index of retention is labelled G-G; this indicates that an examinee received an initial GO on the performance measures (i.e., he had learned it) and also received a GO during retest (i.e., he remembered how to do it). The primary index of retention loss is labelled G-N, indicating that an examinee received an initial GO but received a NO GO during retest (i.e., he forgot how to do it)..

In Figure 2 the G-G and G-N rates are plotted across weeks tested for the overall mid-cycle test. For each retest group (1-, 2-, and 3-weeks), the overall (total test) percentages of tasks falling into G-G and G-N performance categories are shown. The first obvious result is that retention performance is high for three weeks in the institution. If a soldier initially learned a task (received a GO on it), the probability was high that he remembered how to perform the task over a three week period; only about 5 percent of performance measures fell into the G-N category, indicating retention loss.

Any model predicting retention loss over time would predict that the G-G line in Figure 2 would show a consistent downward trend over weeks, and that the G-N line would show a consistent upward trend. Visual examination of Figure 2 indicates that this was not the case here; the two-week retest group shows a slight decrement in performance, but the three-week group performed at a level equal to

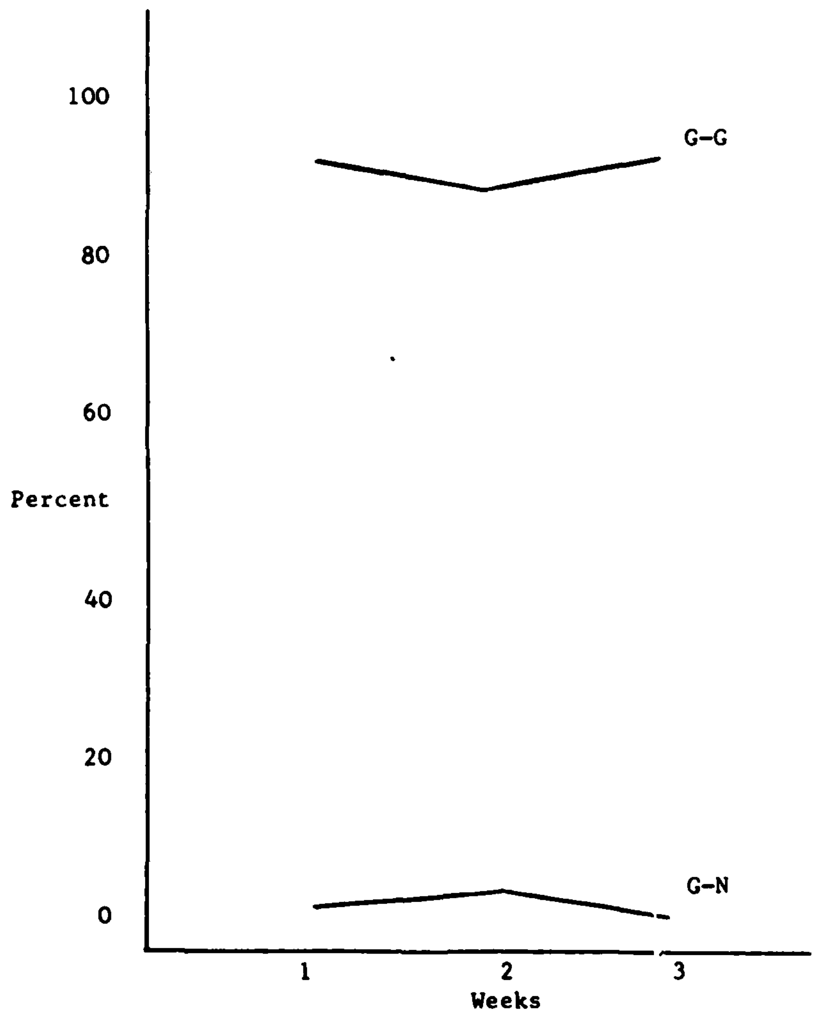

Figure 2. Mid-cycle Retention Test Overall Performance Percentages for 3 Weeks of Testing.

the one-week group. A parametric (chi-square) statistical analysis of the data trend is not possible here because of interdependencies in the data, but a non-parametric Friedman analysis of ranks was performed and yielded a highly significant result (chi-square = 16.30, degrees of freedom = 2).[1] This results indicates that the two-week retest group consistently performed more poorly across tasks in the test. However, this finding has little practical significance, since the overall performance difference was consistent but not large (the two-week results showed a 7.0 percent G-N rate, whereas the one-and three-week results showed 5.4 percent and 5.0 percent G-N rates, respectively). Also, the two-week performance decrement does not indicate a retention loss trend, since there was no decrement after three weeks. These three retest groups primarily consisted of different training companies, so the two-week decrement is thus more appropriately attributed to training or retest conditions differences, rather than to retention loss. There was an indication in the learning results that the two-week group learned slightly less during training.

TSQT retention results were not graphed, since there was only one retest time period (one week). For those trainees tested on the TSQT and later retested after one week, 93.0 percent of performance measures fell in the G-G category and 3.1 percent fell in the G-N category. High retention similar to that found on the mid-cycle test was thus demonstrated here. Findings with both tests indicate that, at a general level, retention in terms of pass-fail measures is

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[1] W. L. Hays, Statistics. (New York: Holt, Rinehart, and Winston, 1963), pp. 640-641.

maintained at a high level in the training institution environment, with no consistent retention loss shown over a period of three weeks.

RETENTION BY STATION

In the previous section it was indicated that retention performance was high on the overall tests examined. In this paragraph retention results are reviewed by test station to see if any particular types of tasks produce more retention difficulties than others do.

In Table 5 the retention results for the mid-cycle test are broken down by test station. Stations which show the greatest retention loss (in terms of G-N percentages across retest groups) are first aid and communications. (Inter-groups differences are apparent and can probably be attributed to different training emphasis or differing retest conditions; e.g., the two-week group retained communications skills well, while the other two groups did not). Other stations show potentially important retention losses for particular groups; e.g., the small weapons station shows retention loss greater than 8 percent for two groups.

In Table 6 the retention results for the TSCT are broken down by test station. Specific stations showing the greatest retention loss here are those having to do with machinegun tasks. Communications tasks on this test do not show a retention loss as severe as that demonstrated on the mid-cycle test.

In general, types of tasks which were difficult to learn also appear to be the ones which were difficult to retain. For mid-cycle stations, communications, small weapons, and first aid tasks were the most difficult to learn (received the lowest percentages of GC's) and retention data indicate that, once learned, these tasks were the most difficult to retain. For TSCT stations, machinegun tasks were the most difficult to learn and were also the most difficult to retain. TSCT communications and breechblock results provide exceptions to this general finding; they were relatively difficult to learn, but showed no particular retention problems. Types of tasks which are both difficult to learn and to retain indicate areas in which increased training emphasis or perhaps over-training, is needed in the institution. Types of tasks which are difficult to retain for three weeks in the institution also are candidate areas for training in the field rather than in the institution. Again, the types of tasks showing learning and retention difficulties appear to be procedural ones, requiring the performance of several steps in precise order.

RETENTION BY PERFORMANCE MEASURES

As argued above, a more precise analysis of specific retention problems can be obtained by looking at results on individual performance measures. A criterion similar to that used there is used here; measures which show a retention loss rate of 5 percent or more are addressed.

In Table 7 mid-cycle performance measures showing over 5 percent average retention loss are listed. Again, there is considerable between-group variability in the data, and tasks which show a consistently large retention loss are emphasized. Many of the between-group differences were found to be significantly different on statistical tests (chi-squares), but none of the measures showed differences in the order that would be predicted by a retention model (one-week retention best, two-week next best, and three-week worst);

thus there are retention differences on specific tasks, but the expected consistent trend was perhaps obliterated by uncontrolled within-group factors (training and testing differences). The most generally forgotten task was control of bleeding, with over one-quarter of trainees having learned and then forgotten this operation (almost one-half the three-week group forgot how to perform this task). A related first aid task (treat for shock) also showed large retention loss. Other consistently forgotten tasks were assume the prone, NBC markers, stopping tank engine, and cal .45 operations. Table 7 shows other specific tasks which were not well retained by at least two of the retest groups.

In Table 8 TSQT performance measures showing over 5 percent retention loss are listed. The most generally forgotten task was threat vehicle recognition, followed by communication and machinegun tasks. The threat vehicle recognition results provide a good example of the problem of comparing performance measures involving different numbers of subtasks. All other results on the TSQT tank gunnery station represent responses to one slide on a slide test; the vehicle recognition result is based on six slides. Thus threat vehicle recognition may appear to be more difficult than other slide test items because of the way the test was designed and the way the data was tabulated. Performance on any individual vehicle recognition slide may have been as high as performance on the other slides, but performance was lower on six slides grouped together, with correct responses required for all six. Learning and retention results for threat vehicle recognition remain unresolved; care must be exercised in future retention research to define performance measures equivalently.

While overall retention was found to be high in the institution, specific tasks showed large retention loss over a period of one to three weeks. Analysis by station and by specific performance measure indicated generally the same results; tasks which were most rapidly forgotten were procedural and cognitive ones involving first aid, communications, machineguns, and perhaps threat vehicle recognition. These findings indicate potentially serious problems in particular situations, e.g., if a tank crew member is bleeding or if multiple friendly and hostile targets appear during a battle. These problems can be solved by two methods: overtraining in the institution or consistent training in the field rather than in the institution.

RETRAINING

Thus far the analysis has concentrated on retention data, e.g., retest performance given an initial GO. Another segment of the data relates to retraining effects; i.e., later performance after an initial NO GO. Such data in the present study are limited, since few NO GO's were received on the initial tests (see Tables 1 and 2). The total test N-G and N-N data in Tables A-1 and A-2 indicate that the vast majority of trainees who had not learned how to perform a task before the initial test had learned to do so by the time of retesting. This is most likely due to remedial training which was given for tasks on which an initial NO GO was received. While First Training Brigade does not have a systematic remedial training program, retraining is provided at unit level. Mid-cycle retest groups may also have received beneficial related training before the retest, due to the fact that they were continuing in the training cycle during the test-retest interval. Specific tasks (e.g., communications and COAX) which were not well learned originally show considerable performance improvement following remedial training. This indicates that remedial training given by the unit is generally successful. It also indicates that additional training or over-training might improve retention performance on tasks for which retention is relatively poor. Further study in which retraining is recorded and more tightly controlled is needed before the relationship of retraining to learning and retention can be more precisely specified.

DEMOGRAPHIC ANALYSIS

The demographic analysis was limited since demographic data were available on only approximately half of the test sample. The bulk of examinees for whom demographics were not available were reservists and national guardsmen; the data reported in this section are based upon Regular Army (RA) trainees.

The demographic results are presented in terms of overall test results broken down by two primary variables: mental category and eductional level. Mental categories are determined by performance on written entrance examinations, with Category 1 representing the highest performance category and Category 4 representing the lowest. Educational level has been divided into two categories, high school graduates and non-high school graduates, since very few of the examinees had received education beyond the high school level.

Overall training and retention performance by mental categories is presented in Tables 9 and 10. Mental Category 1 and 2 results have been combined since there were few Category 1 examinees. Table 9 shows that lower category personnel learned slightly less than Category 1 and 2 personnel; i.e., the initial NC GC rate increased slightly for lower categories. Table 10 shows that lower category personnel also retained slightly less; i.e., the G-N rate increased slightly for lower category personnel. The overall NC GC and G-N rates (total columns) for the demographic sub-sample are close to those for the total sample (comparing with tables 1, 2, 5 and 6), indicating that these results are similar to those that would have been obtained from the total sample, if the data were available. The data obtained here indicate that lower category personnel neither learn nor retain as well as higher category personnel. This is not in complete agreement with previous findings; Grimsley found that lower category personnel took longer to learn a task but retained the task as well as higher category personnel.[2] The data here are general and preliminary and indicate a trend which should be further analyzed in future retention research. Simple non-parametric tests, the Mann-Whitney U and the Kruskal-Wallace K, were conducted and trends noted were not statistically significant.[3]

Overall learning and retention performance by educational level is presented in Tables 11 and 12. Table 11 shows that non-high school graduates learned slightly less than high school graduates (they had a slightly higher initial NO GO rate), but Table 12 shows no consistent trend in retention results. It may be that high school graduates learn slightly more easily because of their previous successful experience in a learning environment (high school), but that high school graduation is not related to retention of tasks, once they are learned. Again, these are preliminary data and the indicated trends need to be more precisely examined in future retention research. The same non-parametric tests as above were conducted, and the education level data were not statistically significant.[4]

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[2] D. L. Grimsley, Acquisition, Retention, and Retraining: Training Category IV Personnel with Low Fidelity Devices. HumRRO Tech Report 69-12. (Alexandria, VA: Human Resources Research Organization, June, 1969).

[3] Sidney Siegel, Nonparametric Statistics for the Behavorial Sciences. (New York: McGraw-Hill, 1956).

[4] Ibid.

CHAPTER VII

CONCLUSIONS

The major conclusions of the institutional retention testing program are as follows:

The overall level of instititutional learning as measured by the GO/NO GO mid-cycle test and TSQT in this study was extremely high. Overall, approximately 96 percent of performance measures were evaluated as a GO. First Training Brigade experience indicates that this result is not atypical. Performance on institutional qualification tests is generally very high.

While overall learning was high, there were specific tasks on which performance was relatively low. These included procedural and cognitive tasks such as communications, first aid, individual weapons, breechblock, machinegun (primarily COAX), and threat vehicle recognition. A more preceise analysis of potential learning difficulties and increased institutional training emphasis should be considered in these areas.

In general, retention was maintained at a high level in the institution, with no consistent retention loss demonstrated over a period of up to three weeks. Overall, only about 5 percent of personnel who had learned how to perform a task showed retention loss in three weeks or less. This conclusion must be tempered by the fact that general GO/NO GO measures were used and some retention loss (e.g., in speed of task completion) may not have been detected by these measures.

While overall retention was high, there were specific tasks on which retention was relatively low. These included procedural tasks, such as first aid, machineguns, and communications, and perhaps relatively cognitive tasks, such as threat vehicle recognition.

In general, types of tasks which were relatively difficult to learn were also relatively difficult to retain, and these tasks were primarily procedural in nature, requiring a sequence of steps to achieve a GO. Included here are communications, individual weapons, first aid, and machinegun tasks. There may be a need for over-training in the institution for these tasks, or, alternatively, for training in the unit rather than in the institution.

Remedial training given in the institution for tasks which were not initially learned appeared to be highly successful. This training was not provided in a formal program, but was informally provided at the training unit level. This finding supports the speculation that additional training on difficult tasks will alleviate learning problems.

The limited demographic data available indicated that lower mental category personnel learn and retain less than higher category personnel do, and that non-high school graduates learn less but, having once learned, retain as much as high school graduates do. These general findings are not in complete agreement with the previous literature on this subject; further, more precise data are needed to determine the relationship of demographics to training variables.

A number of differences between the retest groups which could not be attributed to retention effects were noted in the data. The testing in this study was conducted in an operational environment, and initial training, remedial training, and retest conditions could not be completely controlled and equalized across retest groups. Examinees in this study had entered the Army during the winter months, and they may not have been representative of trainees at other times of the year. In future retention research, a random assignment of individuals within training companies to retest conditions should be accomplished, and testing should proceed over an entire year. A static team of testers would also be desirable, if resources are sufficient. The data summarized here present an initial picture of retention in the institution, but the stability and generalizability of the results could be questioned.

Further research is needed to establish the validity of measures to be used in future retention tests. While the GO/NO GO measures used here are sufficient for operational qualification testing, they are not sensitive enough to establish precise retention trends and to provide the properties necessary for parametric statistical tests. Diagnostic retention testing will also require tighter test administration than resources allow for qualification testing. Completely adequate retention testing would require commitment of considerable resources to allow one-on-one testing with a stable test team and test environment.

The majority of tasks showing learning and/or retention difficulties appear to be procedural ones, involving a sequence of steps to be performed in precise order. This finding is in general agreement with the previous literature. However, one should not jump to the conclusion that procedural tasks are generally forgotten more rapidly than others, for at least two reasons. First, there were many procedural tasks in this study on which learning and retention difficulties were not evidenced. Secondly, procedural tasks must be further analyzed to determine where the difficulties lie. If procedural tasks are defined as ones involving multiple steps or subtasks, the fact that a task involving seven steps is more difficult than a task involving one or two steps is not very startling or interesting. The more important issue for training diagnosis relates to which individual steps are inherently more difficult. Future task analysis and retention testing should examine the relative difficulty of individual steps or subtasks, the response alternatives available at each step, and the cognitive sequencing of steps required. The present paper provides an initial overview of the retention of armor skills; more precise testing and analysis techniques and commitment of extensive resources would be necessary to provide diagnostic data and models having impact on the training system.

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APPENDIX A

GENERAL DATA TABLES

TABLE A-1 MID-CYCLE RETENTION TEST RESULTS (%'s)
FOR TOTAL TEST, STATIONS, AND PERFORMANCE MEASURES

PERFORMANCE MEASURES	PERFORMANCE RESULTS IN PERCENTAGES											
	G-G			G-N			N-C			N-N		
	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk
TOTAL TEST	91.5	88.8	92.4	5.4	7.0	5.8	2.7	3.5	1.8	.4	.8	.6
STATION 1 Basic Driving	98.8	98.3	97.8	1.0	6.2	1.9	.3	1.1	.2	0	.3	.2
PM 1 Starting Tank Engine	95.5	78.3	96.6	2.7	21.7	8.5	1.8	0	0	0	0	.9
PM 2 Stopping Tank Engine	93.7	75.4	89.6	5.4	15.9	9.4	.9	2.9	0	0	1.5	.9
PM 3 H/A Start Engine	100	98.6	99.1	0	1.4	.9	0	0	0	0	0	0
PM 4 H/A Stop Tank	100	97.1	100	0	1.5	0	0	1.5	0	0	0	0
PM 5 H/A Move Forward	100	98.6	100	0	1.4	0	0	0	0	0	0	0
PM 6 H/A Turn Left	100	92.8	96.2	0	5.8	2.8	0	1.4	.9	0	0	0
PM 7 H/A Turn Right	99.1	94.2	97.2	.9	4.4	1.9	0	1.4	.9	0	0	0
PM 8 H/A Move in Reverse	99.1	97.1	99.1	.9	1.5	.9	0	1.5	0	0	0	0
PM 9 H/A Reverse to Left	100	92.7	97.2	0	4.3	.9	0	1.5	.9	0	1.5	.9
PM 10 H/A Reverse to Right	98.2	92.7	97.2	1.8	4.3	1.9	0	1.5	0	0	1.5	.9
PM 11 H/A Neutral Steer	99.1	89.9	99.1	.9	5.8	.9	0	4.3	0	0	0	0
PM 12 H/A Stop Engine	100	89.9	100	0	10.1	0	0	0	0	0	0	0
PM 13 HI Start Engine	98.2	97.1	98.1	1.8	2.9	1.9	0	0	0	0	0	0

PERFORMANCE MEASURES	PERFORMANCE RESULTS IN PERCENTAGES											
	G-G			C-N			N-G			N-N		
	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk
STATION 1 (CONTINUED)												
PM 14 FL Turn Left	99.1	89.9	99.1	.9	10.1	.9	0	0	0	0	0	0
PM 15 FL Turn Right	98.2	89.9	99.1	.9	10.1	.9	.9	0	0	0	0	0
PM 16 FL Move in Reverse	99.1	79.7	100	.9	20.3	0	0	0	0	0	0	0
PM 17 FL Stop Tank	100	82.6	99.1	0	15.9	.9	0	1.5	0	0	0	0
PM 18 FL Move Forward	99.1	88.4	99.1	0	10.1	.9	.9	1.5	0	0	0	0
STATION 2 Maintenance	94.6	92.3	95.3	2.4	3.9	2.5	3.0	3.8	2.2	0	0	0
PM 1 Track & Suspension	93.7	87.0	93.4	2.7	7.2	5.7	3.6	5.8	.9	0	0	0
PM 2 Air Cleaners	96.4	94.2	98.1	.9	1.5	.9	2.7	4.3	.9	0	0	0
PM 3 TM's & LO's	93.7	95.7	94.3	3.6	2.9	.9	2.7	1.4	4.7	0	0	0
STATION 3 First Aid	75.1	83.1	70.8	19.8	9.6	23.9	4.2	5.3	3.5	.9	2.0	1.9
PM 1 Mouth to Mouth	67.6	88.4	76.4	26.1	2.9	17.9	6.3	4.4	3.8	0	4.4	1.9
PM 2 Control Bleeding	70.3	78.3	43.4	22.5	10.1	47.2	5.4	10.1	5.7	1.8	1.5	3.8
PM 3 Treat for Shock	87.4	82.6	92.5	10.8	15.9	6.6	.9	1.5	.9	.9	0	0
STATION 4 Communications	61.7	73.2	68.4	16.3	3.0	15.6	17.9	21.6	17.5	4.2	2.2	6.7
PM 1 Field Phone TA-312	68.3	73.9	54.7	10.0	4.4	19.8	20.8	20.3	17.9	.8	1.5	7.6
PM 2 AN/VRC-64 Into Operation	55.0	72.5	66.0	22.5	1.5	11.3	15.0	23.2	17.0	7.5	2.9	5.7

PERFORMANCE MEASURES	PERFORMANCE RESULTS IN PERCENTAGES											
	G-G			G-N			N-G			N-N		
	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk
STATION 5 General Subjects	93.4	92.3	95.0	3.6	5.6	3.0	2.7	1.7	1.9	.3	1.6	.2
PM 1 Map Colors	96.4	97.1	98.1	1.8	2.9	0	1.8	0	1.9	0	0	0
PM 2 Map Elevation	99.1	98.6	100	0	1.4	0	.9	0	0	0	0	0
PM 3 Map 6 Digit Coordination	98.2	97.1	100	0	2.9	0	1.8	0	0	0	0	0
PM 4 Map Marginal Information	89.2	92.8	97.2	6.3	5.8	.9	3.6	0	1.9	.9	1.4	0
PM 5 NBC Markers	89.2	73.9	83.0	6.3	15.9	14.2	3.6	5.8	2.8	.9	4.4	0
PM 6 Masking	88.3	94.2	91.5	7.2	4.4	2.8	4.5	4.4	4.7	0	0	.9
STATION 6 Caliber .45 & SMC	85.8	82.6	92.4	8.4	8.4	3.6	5.4	7.5	3.4	.4	1.5	.6
PM 1 Clear Caliber .45	85.7	84.1	93.4	8.0	5.8	.9	6.3	10.1	5.7	0	0	0
PM 2 Disassembly, Assembly & Function Check Cal .45	86.5	75.4	87.7	7.2	13.0	8.5	5.4	10.1	3.8	.9	1.5	0
PM 3 Clear M3A1 Submachinegun	91.9	95.7	94.3	4.5	2.9	3.8	3.6	1.5	1.9	0	0	0
PM 4 Disassembly, Assembly & Function Check SMC	85.5	81.2	91.5	8.1	10.1	2.8	5.4	5.8	2.8	.9	2.9	2.8
PM 5 Immediate Action	79.3	76.8	95.3	14.4	10.1	1.9	6.3	10.1	2.8	0	2.9	0
STATION 7 Tactical Training	89.1	93.4	94.0	9.7	4.6	5.7	.5	2.0	.4	.7	0	0
PM 1 Assume the Prone	81.4	81.2	84.9	18.6	15.9	15.1	0	2.9	0	0	0	0
PM 2 Rush	93.0	95.7	93.4	5.8	0	5.7	0	4.3	.9	1.2	0	0

PERFORMANCE MEASURES	PERFORMANCE RESULTS IN PERCENTAGES											
	C-C			C-N			N-C			N-N		
	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk	1wk	2wk	3wk
STATION 7 (CONTINUED)												
PM 3 Tactical High Point	95.4	100	99.1	2.3	0	.9	2.3	0	0	0	0	0
PM 4 High Crawl	95.4	95.7	95.3	4.6	1.4	3.8	0	2.9	.9	0	0	0
PM 5 Low Crawl	80.2	94.2	97.2	17.4	5.8	2.8	0	0	0	2.3	0	0

TABLE A-2. TSQ1 RETENTION TEST RESULTS (%'s) FOR

TOTAL TEST, STATIONS, AND PERFORMANCE MEASURES

PERFORMANCE MEASURES	PERFORMANCE RESULTS IN PERCENTAGES G-G	G-N	N-G	N-N
TOTAL TEST	93.0	3.1	3.3	.5
STATION 1 LOADER'S DUTIES	96.5	1.6	1.7	.2
PM 1 Stow Main Gun Ammo	99.3	0	.7	0
PM 2 Load Banana Box	97.3	.7	2.0	0
PM 3 Load COAX	99.3	.7	0	0
PM 4 COAX Fire Command	98.7	.7	.7	0
PM 5 Main Gun Fire Command	94.7	2.7	2.0	.7
PM 6 Main Gun Misfire	90.0	5.3	4.0	.7
PM 7 Unload Main Gun Misfire	96.0	1.3	2.7	0
STATION 2 BREECHBLOCK	85.7	3.4	10.3	.7
PM 1 Remove & Disassemble	87.3	2.7	9.3	.7
PM 2 Assemble & Install	84.0	4.0	11.3	.7
STATION 3 M219 MACHINEGUN	80.4	6.5	11.6	1.6
PM 1 COAX Stoppage	66.0	14.0	15.3	4.7
PM 2 Clear	82.9	5.5	11.6	0
PM 3 Disassemble/Assemble	92.2	0	7.8	0
STATION 4 M85 MACHINEGUN	86.7	7.0	5.4	1.0
PM 1 Clear	86.0	8.7	4.0	1.3
PM 2 Disassemble/Assemble	87.3	5.3	6.7	.7

	PERFORMANCE RESULTS IN PERCENTAGES			
PERFORMANCE MEASURES	C-G	G-N	N-G	N-N
STATION 5 TANK GUNNERY	95.7	2.2	1.5	.5
PM 1 Replenisher Tape 1 Rough and Smooth	94.7	4.0	1.3	0
2 Two Rough	98.0	2.0	0	0
3 Two Smooth	97.3	.7	1.3	.7
4 Two Long Notches	95.3	3.3	.7	.7
PM 2 Range Flags				
5 Green	96.0	1.3	1.3	1.3
6 Red	97.3	0	2.0	.7
7 Red and Green	98.0	0	2.0	0
8 Red and Orange	96.0	1.3	2.0	.7
9 Green and Orange	96.0	.7	2.7	.7
PM 3 Ammunition				
10 HEAT	97.3	1.3	1.3	0
11 APDS	99.3	.7	0	0
12 HEP	98.7	0	.7	.7
13 APHERS	96.7	1.3	2.0	0
14 WP	99.3	0	.7	0
15 HEAT-TPT	98.0	.7	1.3	0
16 CCAX Ammunition	100	0	0	0
PM 4 Mounting Tanks				
17 Moving Tank Range	94.7	3.3	1.3	.7
18 Stationary Tank Range	96.0	2.7	1.3	0
PM 5 Threat Vehicles	69.3	19.3	7.3	4.0

PERFORMANCE MEASURES	PERFORMANCE RESULTS IN PERCENTAGES			
	G-G	G-N	N-G	N-N
STATION 6 GENERAL SUBJECTS	93.0	3.2	3.7	.2
PM 1 Burns	92.7	4.0	3.3	0
PM 2 Broken Bones	99.3	0	.7	0
PM 3 Masking M25A1	91.3	4.0	4.0	.7
PM 4 NBC Knowledge	88.7	4.7	6.7	0
STATION 7 COMMUNICATION	88.9	4.3	6.0	.8
PM 1 CVC Helmet	96.9	0	3.1	0
PM 2 Audio Amp into Opns	94.9	5.1	0	0
PM 3 RT into Opns	87.6	4.1	5.2	3.1
PM 4 Radio Check	88.7	3.1	8.2	0
PM 5 Transmit Message	76.3	9.3	13.4	1.0
STATION 8 MAINTENANCE	95.9	1.9	2.1	.1
PM 1 Maint Checks	100	0	0	0
PM 2 Operators Maint Checks	100	0	0	0
PM 3 DA Form 2404	92.0	4.0	3.3	.7
PM 4 DA Form 2408-1	92.0	2.0	6.0	0
PM 5 Read Lub Chart	95.3	3.3	1.3	0
STATION 9 ADVANCE DRIVING	92.7	4.9	2.4	0
PM 1 Prepare to Fire Checks	92.0	6.0	2.0	0
PM 2 Starting Procedures	93.3	4.7	2.0	0
PM 3 Emergency Situations	88.7	8.0	3.3	0
PM 4 Stopping Procedures	94.7	4.0	1.3	0
PM 5 Respond to Ground Guide	94.7	2.0	3.3	0

TABLE A-3 SAMPLE SIZES BY STATION FOR MID-CYCLE

AND TSQT RETENTION TESTS

STATIONS	SAMPLE SIZES			
	MID-CYCLE			TSQT
	1wk	2wk	3wk	1wk
1	111	69	106	150
2	111	69	106	150
3	111	69	106	150
4	120	69	106	150
5	111	69	106	150
6	111	69	106	150
7	86	69	106	97
8	-	-	-	150
9	-	-	-	150

APPENDIX B

FIRST TRAINING BRIGADE LESSON PLANS

DEPARTMENT OF THE ARMY
HEADQUARTERS, 1ST TRAINING BRIGADE
US ARMY ARMOR CENTER AND FORT KNOX
Fort Knox, Kentucky 40121

ATZK-TC-TBA-POI
LESSON PLAN 11E10 BAT
T-1

A. ADMINISTRATIVE INSTRUCTIONS:

1. Training conducted: Mid-cycle Examination

2. Time: Eight (8) hours

3. Presented to: BAT trainees

4. Instructors: Twenty-four (24) POI and test & eval, One (1) drill sergeant per station

5. Training aids: See Annex F

6. Location: Holder Complex

B. ORGANIZATION FOR TRAINING:

1. Arrangement and breakout of trainees: See Annex A.

2. Use of company cadre: As test coordinators and scorecard data collectors and on Frazier Range per Annex D.

3. Motivation: Individual level.

4. Expected time each trainee participates in primary training: Two hundred and forty (240) minutes.

5. Expected time each trainee participates in concurrent training: N/A

6. Expected time spent moving, cleaning the training site, or on trainee break: One hundred (100) minutes.

C. INTRODUCTION: Five (5) minutes.

1. Reason: To evaluate the level of proficiency attained in first aid, the caliber .45 pistol, M3A1 submachinegun, communications,

THIS LESSON PLAN SUPERSEDES LESSON PLAN T-1 DATED 29 SEPTEMBER 76.

maintenance procedures, general subjects, basic driving techniques, and tactical subject.

2. Objectives:

a. Task: Each trainee will perform all performance measures.

b. Condition: See conditions for each station.

c. Standards: The trainee must perform all performance measures satisfactorily.

D. TEACHING POINTS: Ten (10) minutes.

Chief tester will briefly explain the conduct and requirement for each of the seven (7) stations to the trainees.

E. APPLICATION: N/A

F. EVALUATION: Two hundred forty (240) minutes.

G. REVIEW AND CRITIQUE: (As required)

Trainees will be critiqued at the completion of each station by the tester.

H. ANNEXES:

A - Procedures.

B - Trainee performance requirements.

C - Scorecard. (Removed from this study report).

D - Personnel/training aids requirements.

E - Strip map. (Removed from this study report).

F - Safety.

PROCEDURES

1. SPECIAL INSTRUCTIONS:

a. Units will insure that each trainee is issued a scorecard prior to their arrival at the testing site, and that the scorecard has the heading completed. Scorecards must be issued by number alphabetically with an annotated company roster. The trainees should be on site by 0745 hours the day of the test for their test briefing.

b. The unit will be divided into groups upon arrival at the testing site by the Chief Tester.

c. Groups will be assigned initial station locations by the Chief Tester.

d. Individuals will rotate through all stations, by group under the direction of the Chief Tester. Cadre or DI will be used to supervise each group to insure prompt completion of the exam.

e. The examiners at each station will critique each trainee prior to sending him to the next station.

f. The tested unit will correlate all test sheets, add up the totals for SATS and UNSATS and annotate the numbered company roster with the station and performance measure number for each UNSAT received. The trainee must pass all stations in order to satisfactorily pass the test. Once the test has been completed the tested unit will turn over one (1) copy of the annotated company roster, and all scorecards to the Chief Tester.

g. Brigade Training Eval, through Bde S-3 will notify the tested unit of the disposition of those failing the test, whether it be retesting academic recycle or other. Scorecards will be returned to the unit for entry on the individual training records and for use by the company cadre as a guide to assist in training.

h. The tested unit will have all required equipment on site and ready for testing by 0750 hours the day of the test.

i. Trainee uniform will be steel pot, pistol belt, canteen, first aid packet, poncho, suspenders, and field pack.

2. GENERAL INSTRUCTIONS: The Chief Tester will briefly explain what will be required of the trainees at each of the eight (8) stations, the layout of the stations, and the method of rotation that will be used.

a. Station #1 - Basic Driving.

b. Station #2 - Maintenance.

c. Station #3 - First Aid.

d. Station #4 - Communications.

e. Station #5 - General Subjects.

f. Station #6 - Caliber .45 and submachinegun.

g. Station #7 - Tactical training.

TRAINEE PERFORMANCE REQUIREMENTS

1. Station #1 - Basic driving.

a. (PM #1) The trainee will have to properly and safety start a tank engine in the M-34 drivers simulator.

b. (PM #2) The trainee will have to properly and safely stop a tank engine in the M-34 drivers simulator.

c. (PM #3) The trainee will have to demonstrate the hand and arm signal to start a tank engine in a classroom.

d. (PM #4) The trainee will have to demonstrate the hand and arm signal to stop a tank in a classroom.

e. (PM #5) The trainee will have to demonstrate the hand and arm signal to move a tank forward in a classroom.

f. (PM #6) The trainee will have to demonstrate the hand and arm signal to turn a tank left in a classroom.

g. (PM #7) The trainee will have to demonstrate the hand and arm signal to turn a tank right in a classroom.

h. (PM #8) The trainee will have to demonstrate the hand and arm signal to move a tank in reverse in a classroom.

i. (PM #9) The trainee will have to demonstrate the hand and arm signal to move a tank in reverse to the left in a classroom.

j. (PM #10) The trainee will have to demonstrate the hand and arm signal to move a tank in reverse to the right in a classroom.

k. (PM #11) The trainee will have to demonstrate the hand and arm signal to neutral steer a tank in a classroom.

l. (PM #12) The trainee will have to demonstrate the hand and arm signal to stop the tank engine in a classroom.

m. (PM #13) The trainee will have to demonstrate the flashlight signal to start a tank engine with a flashlight in a classroom.

n. (PM #14) The trainee will have to demonstrate the flashlight signal to turn a tank left with a flashlight in a classroom.

o. (PM #15) The trainee will have to demonstrate the flashlight signal to turn a tank right with a flashlight in a classroom.

p. (PM #16) The trainee will have to demonstrate the flashlight signal to move a tank in reverse with a flashlight in a classroom.

q. (PM #17) The trainee will have to demonstrate the flashlight signal to stop a tank with a flashlight in classroom.

r. (PM #18) The trainee will have to demonstrate the flashlight signal to move a tank forward with a flashlight in a classroom.

2. Station #2 - Maintenance.

a. (PM #1) The trainee will have to either perform measuring track tension or disconnecting track up to removal of outer end connector, on a tank hull, in a maintenance bay.

b. (PM #2) The trainee will have to perform checking and servicing the air cleaners of a tank on a tank hull.

c. (PM #3) The trainee will have to extract data from the lubrication order (such as lubrication intervals and type of lubricants) for tank components, and demonstrate where and how to lube or check that item on a tank in a maintenance bay.

3. Station #3 First Aid.

a. (PM #1) The trainee must perform mouth to mouth resuscitation on a simulated victim.

b. (PM #2) The trainee must perform the first aid measures to control bleeding for an arm or leg wound without broken bones.

c. (PM #3) The trainee must treat a victim, who has already been treated for an arm or leg wound, for shock.

4. Station #4 - Communications

a. (PM #1) The trainee must take a CVC helmet and a quick disconnect cord and hook them to a control box, and place them into operation, then demonstrate knowledge of the CVC helmet three (3) position switch by placing switch in position to perform functions stated by tester in a communications classroom.

b. (PM #2) The trainee must place the AM-1780 audio amplifier into operation in a communications classroom.

c. (PM #3) The trainee must place RT-841, radio transmitter into operation, in a communications classroom.

d. (PM #4) The trainee must perform a radio check on a complete and operational AN/VRC-64 radio, in a communications classroom.

e. (PM #5) The trainee must transmit a prepared message, using proper radio telephone procedures on a complete and operational AN/VRC-64 radio in a communications classroom.

5. Station #5 - General subjects.

a. (PM #1) The trainee must demonstrate knowledge of the basic map colors, by naming the five main colors and their basic meaning.

b. (PM #2) The trainee must determine elevation on a map.

c. (PM #3) The trainee must locate positions on a map using six (6) digit coordinates.

d. (PM #4) The trainee must identify in writing objects or types of roads using the marginal information tables on the map from a given point on a map.

e. (PM #5) The trainee must demonstrate knowledge of NBC mine and contamination markers, by identifying the markers when shown by the tester.

f. (PM #6) The trainee must demonstrate proper M17A1 masking procedures, within nine (9) seconds.

6. Station #6 - Caliber .45 pistol and M3A1 submachinegun.

a. (PM #1) The trainee within fifteen (15) seconds must properly clear the caliber .45 pistol.

b. (PM #2) The trainee within four (4) minutes must properly disassemble, assemble, and perform a functions check of the caliber .45 pistol.

c. (PM #3) The trainee within fifteen (15) seconds must properly clear the M3A1 submachinegun.

d. (PM #4) The trainee within five (5) minutes must properly disassemble, assemble, and perform a functions check of the M3A1 submachinegun.

e. (PM #5) The trainee must engage targets with a caliber .45 pistol, and successfully hit at least one target out of his three (3) live rounds, on a firing line.

f. (PM #6) The trainee must perform proper immediate action on a caliber .45 pistol when a dummy round chambers while engaging targets during performance test six (6) of this station, on a firing line.

7. Station #7 - Tactical training.

a. (PM #1) the trainee must on the command "assume the prone", demonstrate the proper procedure to assume the prone with an M16A1 rifle in a field location.

b. (PM #2) The trainee must on command "prepare to rush" and "rush" demonstrate proficiency on the prepare to rush and rushing movements with an M16A1 rifle, in a field location.

c. (PM #3) The trainee must demonstrate proficiency in performing the tactical highport. This objective will be evaluated when he is rushing in performance measure two (2) above, in a field location, tester will inform trainee of this prior to PM 2.

d. (PM #4) The trainee must demonstrate proficiency by performing the high crawl with an M16A1 rifle, in a field location.

e. (PM #5) The trainee must demonstrate proficiency by performing the low crawl with an M16A1 rifle, in a field location.

PERSONNEL AND TRAINING AIDS REQUIREMENTS

1. One (1) numbered scorecard per trainee (unit).

2. Station #1 - six (6) examiners (POI).

   a. Four (4) operational M-34 drivers simulators (POI)

   b. Two (2) visual signal tank charts (POI).

   c. Four (4) flashlights (POI).

3. Station #2 - Five (5) examiners (POI).

   a. Three (3) M60A1 hulls (POI).

   b. Twenty (20) M60A1 TMs and LOs (POI).

   c. Twenty (20) TM and LO test boards (POI).

   d. Two (2) flashlights (POI).

   e. Two (2) 12" crescent wrenches (unit).

   f. Three (3) sets of track breaking equipment to include three (3) each, track adjustment link wrenches (Little Joe's), 9/16" wrench "T" slides, 15/16" socket, end connector puller, two (2) pound hammers, track jacks (prs) (unit).

   g. Three (3) sets of track measurement equipment to include three (3) each, tankers bars, 6" x 6" x 1" track adjustment blocks with string (unit).

4. Station #3 - Three (3) testers (POI).

   a. One (1) respirator training aid (POI).

   b. Two (2) dummies (POI).

   c. Four (4) combat dressings (POI).

   d. Six (6) blankets (unit).

   e. Four (4) simulated wounds (POI).

5. Station #4 - Three (3) testers (POI)

   a. One (1) AN/VRC-64 classroom with equipment (POI).

   b. Twelve (12) sets of prepared messages (POI).

6. Station #5 - Two (2) testers (POI).

   a. Twelve (12) prepared map boards (POI).

   b. Eight (8) M17A1 protective masks (unit).

7. Station #6 - Four (4) testers (POI).

   a. Four (4) tables (POI).

   b. Ten (10) caliber .45 pistols (unit).

   c. Ten (10) M3A1 submachineguns w/ magazines (unit).

   d. Twelve (12) caliber .45 magazines (unit).

   e. Twenty-four (24) caliber .45 dummy rounds (unit)

   f. Three (3) live caliber .45 rounds per trainee tested (unit).

   g. One (1) bull horn (unit).

   h. One (1) ambulance, and aid equipment (unit).

   i. Four (4) stopwatches (unit)

   j. Two (2) safety paddles (unit).

   k. Six (6) steel pots (unit).

   l. Eight (8) ear muffs or ear plugs (unit).

   m. <u>Unit personnel requirements</u>

      (1) One (1) aidman (unit).

      (2) One (1) E-7 or above to pull targets and assist in the conduct of the range (unit).

NOTE: THE UNIT E-7 OR ABOVE WILL OPEN THE RANGE AND ASSIST IN ITS OPERATION IN CONJUNCTION WITH THE CHIEF TESTER. THE UNIT WILL CLEAN THE RANGE AND TURN IT BACK OVER TO RANGE CONTROL

LT T-1 ANNEX D (Cont'd)

AFTER THE EXAMINATION.

8. Station #7 - Two (2) testers (POI).

Four (4) M16A1 rifles (rubber) (unit).

SAFETY

1. No smoking within fifty (50) feet of tanks.
2. Extreme care should be taken when traveling the course to prevent accidents.
3. During the Caliber .45 pistol firing, all weapons will be kept up and down range except when engaging targets or performing immediate action.
4. During weapons disassembly testing, extreme care must be taken to prevent live ammunition from accidentally being chambered.

DEPARTMENT OF THE ARMY
HEADQUARTERS, 1ST TRAINING BRIGADE
US ARMY ARMOR CENTER AND FORT KNOX
Fort Knox, Kentucky 40121

ATZK-TC-TBA-PCI
LESSON PLAN 17-11E10 BAT/AITA
T-2

A. ADMINISTRATIVE INSTRUCTIONS

1. Training conducted: Tankers Skills Qualification Test

2. Time: Eight (8) hours

3. Presented to: 11E10 BAT/AITA trainees

4. Instructors: One (1) test supervisor

5. Traiing aids: See Annex D

6. Location: Holder Training Facility

7. References: Appropriate Brigade Lesson plans

B. ORGANIZATION FOR TRAINING

1. Arrangement, information, or breakout of trainees: See Annex A.

2. Use of troop cadre: As test coordinators and scorecard date collectors.

3. Motivation or competition: Individual level.

4. Expected time each trainee participates in primary training: Three hundred (300) minutes.

5. Expected time each trainee participates in concurrent training: One hundred (100) minutes.

6. Expected time spent moving, cleaning the training site or on trainee break: Eighty (80) minutes.

C. INTRODUCTION Five (5) minutes.

a. Reason: To test the proficiency of the 11E10 trainees in the area of gunnery, weapons, safety, general subjects, communications, maintenance, and advanced driving at the loaders level, prior to the gun range practical exercise.

THIS LP SUPERCEDES LP G-8, DATED 17 SEP 76 AND LP T-2, DATED 5 NOV 76

2. Objectives:

a. Task: Each trainee will perform all performance measures.

b. Conditions: See conditions for each station.

c. Standards: The trainee must perform all performance measures satisfactorily. (Station #10 is not included, see Annex B for standards for each performance measure).

D. TEACHING POINTS: Ten (10) minutes.

Test supervisor will briefly explain conduct and requirements for the ten (10) stations.

E. APPLICATION: N/A

F. EVALUATION: Three hundred (300) minutes

G. REVIEW AND CRITIQUE: (As required).

Trainee will be critiqued at the completion of each station.

H. ANNEXES

A - Procedures

B - Trainee Performance Requirements

C - Scorecard (Removed from this study report).

D - Personnel/Training Aids Requirements

E - Safety

ANNEX A

PROCEDURES

a. SPECIAL INSTRUCTIONS:

a. Units will insure that trainees are issued a scorecard prior to their arrival at the testing site, and that the scorecord will have the heading completed, also the scorecards will be issued by number alphabetically with an annotated company roster. The trainees will be on site by 0730 hours the day of the test for their briefing.

b. The unit will maintain group integrity.

c. The testing unit will receive their briefing from the chief tester and then will be administered station #5 immediately afterwards. As personnel finish station #5, they will be broken down into groups by the chief tester.

d. Groups will be assigned initial station locations by the test supervisor and move in a clockwise manner.

e. Groups will rotate through all stations under the direction of the group cadre or DI.

f. The examiners at each station will critique the individual prior to sending him to the next station. Initial retests will not be administered until the unit has been tested completely at all stations or if there is time available.

g. The unit will correlate all test scoresheets, add up the total for SATS and UNSATS, annotate the specific UNSATS by station and performance measure (blue for GO, red for NO-GO) on the company roster and turn the annotated scoresheets and roster to Chief Tester at the completion of the test.

h. Bde S-3 will notify the unit of those trainees who failed the test and will send the scorecards to the unit for entry on the individual training records. A decision will be made for the... failing the retest as to academic recycle or retesting.

i. The tested unit will have all required equipment on site and ready for testing by 0730 hours the day of the test.

j. Trainees should bring their notes, manuals and handouts, which can be used to study between the test stations.

2. GENERAL INSTRUCTIONS: The test supervisor will briefly explain what will be required of the trainees at each of the ten (10) stations, the layout of the station, and the method of rotation that will be used.

a. Station 1 - Loaders tank duties (PM 1-8)

b. Station 2 - Breechblock. (Assembly/Disassembly)

c. Station 3 - M219 machinegun.

d. Station 4 - M85 machinegun.

e. Station 5 - PM #1 Replenisher tape. (Slides)

f. Station 5 - PM #2 Range flags. (Slides)

g. Station 5 - PM #3 Ammunition. (Slides)

h. Station 5 - PM #4 Mounting tank. (Slides)

i. Station 5 - PM #5 Threat vehicle. (Slides)

j. Station 6 - General Subjects.

k. Station 7 - Communications.

l. Station 8 - Maintenance.

m. Station 9 - Advanced driving.

n. Station 10 - Initial sight picture.

NOTE: STATION 10 WILL NOT BE COUNTED TOWARD THE OVERALL GO/NO-GO, BUT WILL BE ADMINISTERED AS A RANGE SAFETY TYPE TEST.

ANNEX B

TRAINEE PERFORMANCE REQUIREMENTS

1. Station #1 - Tank loaders duties.

a. (PM #1) The trainee, within one (1) minutes, will have to stow a main gun round passed to him through the loaders hatch in the ready rack, on a tank.

b. (PM #2) The trainee within three (3) minutes, will have to stow a belt of 200 (7.62) rounds in the banana storage box, on a tank.

c. (PM #3) Thre trainee within one (1) minute, will have to load an M219 Coax machinegun with ammunition previously loaded in the banana storage box, on a tank.

d. (PM #4) The trainee will have to respond to a Coax fire command on a previously loaded Coax machinegun, on a tank.

e. (PM #5) The trainee will have to respond to a main gun fire command, using the main gun round previously stowed in the ready rack on a tank.

f. (PM #6) The trainee, within fifteen (15) seconds, will have to respond to a main gun misfire on a previously loaded main gun round, on a tank.

g. (PM #7) The trainee within one (1) minute, will have to unload and hand to a simulated range safety officer through the loaders hatch a previously loaded misfired main gun round, on a tank.

Station #2 - Breechblock.

a. (PM #1) The trainee within six (6) minutes, will have to remove and disassemble completely the breechblock, on a tank.

b. (PM #2) The trainee, within six (6) minutes will have to assemble completely and replace the breechblock, on a tank.

3. Station #3 - M219 Machinegun.

a. (PM #1) The trainee will, within one (1) minutes reduce a coax stoppage on an already loaded M219 machinegun.

b. (PM #2) The trainee within thirty (30) seconds will have to clear an already loaded M219 machinegun in a classroom.

c. (PM #3) The trainee within four (4) minutes will have to completely disassemble, assemble, and perform a functions check on an M219 machinegun in a classroom.

4. Station #4 - M85 Machinegun.

a. (PM #1) The trainee, within thirty (30) seconds, will have to clear an already loaded M85 machinegun in a classroom.

b. (PM #2) The trainee within seven (7) minutes will have to completely disassemble, assemble, perform a funcitons check on the M85 machinegun in a classroom.

5. Station #5 - Tank Gunnery Subjects.

a. (PM #1) Replenisher Indicator Tape.

(1) The trainee will have to explain the meaning and corrective action for a rough and a smooth reading, in a classroom.

(2) The trainee will have to explain the meaninig and corrective action for two (2) rough's in a classroom.

(3) The trainee will have to explain the meaning and corrective action for two (2) smooth's in a classroom.

(4) The trainee will have to explain the meaning and corrective action for two (2) long notches, in a classroom.

b. (PM #2) Range flags.

(1) The trainee will have to know the meaning of a green flag in a classroom.

(2) The trainee will have to know the meaning of a red flag in a classroom.

(3) The trainee will have to know the meaning of a red and green flag display in a classroom.

(4) The trainee will have to know the meaning of a red and orange flag display in a classroom.

(5) The trainee will have to know the meaning of a green and orange flag display in a classroom.

c. (PM #3) Ammunition

(1) The trainee will have to identify a HEAT round from a fire command, and state its primary use and state its full name in a classroom.

(2) The trainee will have to identify a APDS round from a fire command, and state its full name in a classroom.

(3) The trainee will have to identify a HEP round from a fire command and state its primary use and state its full name in a classroom.

(4) The trainee will have to identify a APHERS round from a fire command and state its primary use and state its full name in a classroom.

(5) The trainee will have to identify a WP round in the fire command and state its primary use and state its full name in a classroom.

(6) The trainee will have to identify a HEAT-TPI round in the fire command and state it is primary use and state its full name in a classroom.

(7) The trainee will have to identify 7.62 mm linked ammunition from a fire command, and state its primary use and state its full name in a classroom.

d. (PM #4) Mounting tanks

(1) The trainee will be asked where to mount a tank on a moving tank range, in a classroom.

(2) The trainee will be asked where to mount a tank on a stationary tank range, in a classroom.

a. (PM #5) Threat vehicles.

The trainee will have one (1) minute to determine if six (6) various NATO and WARSAW PACT vehicles are kill or no kill.

6. Station #6 - General Subjects.

a. (PM #1) The trainee, given a simulated victim, will have to perform the first aid treatment for severe burns to include treatment for shock.

b. (PM #2) The trainee, given a simulated victim, will have to perform first aid treatment for broken bones in either arm or leg.

c. (PM #3) The trainee, within nine (9) seconds, will have to

... (cont'd)
properly don the M25A1 protective mask and give the alarm for a CS gas attack.

d. (PM #4) The trainee will be required to demonstrate proficiency in preparing a tank for nuclear attack and responding to two (2) NBC first aid questions.

7. Station #7 - Communications.

a. (PM #1) The trainee, within two (2) minutes, will be required to place the field telephone TA-312, into operation and conduct a telephone check.

b. (PM #2) The trainee, within two (2) minutes, will be required to place the AN/VRC -64 into operation, given an assigned frequency.

8. Station #8 - Maintenance.

a. (PM #1) The trainee, utilizing an operator's manual, will be required to perform two (2) maintenance checks or tasks on the M60A1 tank.

b. (PM #2) The trainee, utilizing an operator's manual, will perform either before, during, or after operations checks and services on the M60A1 tank.

c. (PM #3) The trainee will be required to properly fill out the heading of a DA Form 2404 and list all shortcomings and deficiencies found during his checks on PM #2 above.

d. (PM #4) The trainee will be required to properly complete the daily entry on the DA Form 2408-1 from the information he has already completed on his DA Form 2404 (PM #3) above).

e. (PM #5) The trainee, will be required to use the lubrication chart and identify type of lubricants, intervals, and location of item to be lubricated.

9. Station #9 - Advanced driving

a. (PM #1) The trainee, will be required to perform the drivers prepare to fire checks in the drivers trainer.

b. (PM #2) The trainee, will be required to start the tank and identify any deficiencies or equipment malfunctions.

c. (PM #3) The trainee will be required to respond to two (2) malfunctions or emergency procedures in the tank drivers trainer while he is operating the tank.

d. (PM #4) The trainee will be required to properly stop the tank engine in the drivers trainer.

e. (PM #5) The trainee, will be required to respond to hand and arm signals in the drivers trainer.

10. Station #10 - Initial sight picture

a. (PM #1) Utilizing the M32, the trainee will be given a fire command for a stationary target, and will be required to take up an initial sight picture.

b. (PM #2) Utilizing the M32, the trainee will be given a fire command for a moving target, and will be required to take up an initial sight picture.

c. (PM #3) Utilizing the M105-D the trainee will be given a fire command, for a stationary target, and he will be required to take up an initial sight picture.

Annex E (cont'd)

NOTE: PARAGRAPH 12, STATION #10, INITIAL SIGHT PICTURE, IS A 20 LEVEL SKILL, AND IS NOT COUNTED IN THE TOTAL SCORING OF THE TEST, IT IS ADMINISTERED AS A SAFETY CHECK PRIOR TO FIRING THE MAIN GUN.

ANNEX D

PERSONNEL AND TRAINING AIDS REQUIREMENTS

1. One (1) numbered scorecard per trainee. (unit)

2. Station #1 - Five (5) examiners. (test & eval)

   a. Five (5) operational M60A1 tanks with five M219 machineguns and cartridge bags installed. (unit)

   b. Five (5) 200 round (7.62mm) belts of dummy ammunition. (test & eval)

   c. Five (5) 105 mm dummy main gun rounds. (unit)

   d. Five (5) stopwatches. (unit)

3. Station #2 - Five (5) examiners. (test & eval)

   a. Five (5) operational M60A1 tanks with operational breechblocks. (unit)

   b. All necessary equipment to remove, disassemble, assemble, and replace the breechblock. (unit)

   c. Five (5) stopwatches. (unit)

4. Station #3 - Two (2) examiners. (test & eval)

   a. Eleven (11) ten (10) round belts of dummy 7.62 mm link ammunition (test & eval)

   b. Eleven (11) M219 COAX machineguns. (unit)

   c. One (1) stopwatch. (unit)

   d. Eight (8) screwdrivers. (unit)

5. Station #4 - Two (2) examiners. (test & eval)

   a. Eleven (11) M85 machinegun. (unit)

b. Eleven (11) ten (10) round belts of dummy 50 cal ammunition. (test & eval)

c. One (1) stopwatch. (unit)

6. Station #5 - Five (5) examiners. (test and eval)

a. PM #1 Replenisher cape slide. (test & eval)

b. PM #2 Range flag slide. (test & eval)

c. PM #3 Tank ammunition slide. (test & eval)

d. PM #4 Mounting of tank slide. (test & eval)

e. PM #5 Threat vehicles slides. (test & eval)

f. Slide projector and screen. (Holder complex)

g. Answer sheets for Station #5. (test and eval)

h. Grease pencils and master scoresheet. (test & eval)

7. Station #6 - Three (3) examiners. (test & eval)

a. Two (2) simulated victims. (test & eval)

b. Ten (10) M25A1 gas masks. (unit)

c. One (1) stopwatch. (unit)

8. Station #7 - Four (4) examiners. (test & eval)

a. Six (6) TA-312s batteries, and WD 1 wire. (test & eval)

b. Ten (10) operational AN/VRC-64s with CVC helmets. (test & eval)

9. Station #8 - Four (4) examiners. (test & eval)

a. Twenty (20) prepared DA Forms 2404s and 2408-1s. (test & eval)

b. Four (4) lubrications charts. (test & eval)

10. Station #9 - Four (4) examiners. (test & eval)

a. Four (4) M-34 drivers trainers. (test & eval)

b. Eight (8) charts on starting and stopping procedures. (test & eval)

c. Five (5) flashlights. (test & eval)

ANNEX E

SAFETY

1. No smoking within fifty (50) feet of tanks.

2. Extreme care will be taken when mounting and dismounting tanks.

3. When conducting the breechblock position of this test, extreme caution will be taken to insure the safety of the trainee and tester.

4. When entering and leaving the M-34 drivers trainers, extreme caution will be taken to prevent falls.

APPENDIX C

TEST RESULTS TABLES

Table

TABLE 1. INITIAL MID-CYCLE TEST RESULTS (%'s) BY STATION AND OVERALL

	PERFORMANCE RESULTS IN PERCENTAGES							
	1 Wk Gp		2 Wk Gp		3 Wk Gp		AVERAGE	
	GO	NO GO	GO	NO GO	GO	NO GO	GO	NO GO
1 - Basic Driving	99.8	.2	98.5	1.5	99.7	.3	99.4	.6
2 - Maintenance	97.0	3.0	96.2	3.8	97.8	2.2	97.0	3.0
3 - First Aid	94.9	5.1	92.7	7.3	94.7	5.3	94.3	5.7
4 - Communications	78.0	22.0	76.2	23.8	76.0	24.0	76.9	23.1
5 - General Subjects	97.0	3.0	97.9	2.1	98.0	2.0	97.6	2.4
6 - Cal .45 and SMG	94.2	5.8	91.0	9.0	96.0	4.0	94.1	5.9
7 - Tactical Training	98.8	1.2	98.0	2.0	99.7	.3	99.0	1.0
Station Average	96.9	3.1	95.8	4.2	97.4	2.6	96.7	3.3

TABLE 2. INITIAL TSQT TEST RESULTS (%'s) BY STATION AND OVERALL

STATIONS	PERFORMANCE RESULTS IN PERCENTAGES GO	NO GO
1 - Loader's Duties	98.1	1.9
2 - Breechblock	89.1	10.9
3 - M219 Machinegun	86.9	13.1
4 - M85 Machinegun	93.7	6.3
5 - Tank Gunnery	97.9	2.1
6 - General Subjects	96.2	3.8
7 - Communications	93.2	6.8
8 - Maintenance	97.8	2.2
9 - Advanced Driving	97.6	2.4
Station Average	96.1	3.9

TABLE 3. INITIAL MID-CYCLE TEST PERFORMANCE MEASURES WITH OVER 5 PERCENT "NO GO" RATE

PERFORMANCE MEASURES	NO GO %
AN/VRC-64 into Operations	23.8
Field Phone TA-312	23.0
Control Bleeding	9.4
Clear Cal .45	7.4
Immediate Action (SMG)	7.4
Disassembly, Assembly and Function Check (Cal .45)	7.2
Disassembly, Assembly and Function Check (SMG)	6.9
Mouth to Mouth	6.9
NBC Markers	5.8

TABLE 4. INITIAL ISCT TEST PERFORMANCE MEASURES WITH OVER 5 PERCENT "NO GO" RATE

PERFORMANCE MEASURES	NO GO %
COAX Stoppage	20.0
Transmit Message	14.4
Assemble & Install Breechblock	12.0
Clear COAX	11.6
Threat Vehicles	11.3
Remove & Disassemble Breechblock	10.0
RT into Operation	8.3
Radio Check	8.2
Disassemble/Assemble COAX	7.8
Disassemble/Assemble M85	7.4
NBC Knowledge	6.7
DA Form 2408-1	6.0
Clear M85	5.3

TABLE 5. MID-CYCLE RETENTION TEST RESULTS (%'s) BY STATION AND OVERALL

STATIONS	PERFORMANCE RESULTS IN PERCENTAGES					
	1 Wk		2 Wk		3 Wk	
	G-G	G-N	G-G	G-N	G-G	G-N
1 - Basic Driving	98.8	1.0	90.3	8.2	97.8	1.9
2 - Maintenance	94.6	2.4	92.3	3.9	95.3	2.5
3 - First Aid	75.1	19.6	83.1	9.6	70.8	23.9
4 - Communications	61.7	16.3	73.2	3.0	60.4	15.6
5 - General Subjects	93.4	3.6	92.3	5.6	95.0	3.0
6 - Cal .45 and SMG	85.8	8.4	82.6	8.4	92.4	3.6
7 - Tactical Training	89.1	9.7	93.4	4.6	94.0	5.7
Station Average	91.5	5.4	88.8	7.0	92.4	5.0

TABLE 6. TSQT RETENTION RESULTS (%'s) BY STATION AND OVERALL

	PERFORMANCE RESULTS IN PERCENTAGES	
	G-G	G-N
1 - Loader's Duties	96.5	1.6
2 - Breechblock	85.7	3.4
3 - M219 Machinegun	80.4	6.5
4 - M85 Machinegun	86.7	7.0
5 - Tank Gunnery	95.7	2.2
6 - General Subjects	93.0	3.2
7 - Communications	88.9	4.3
8 - Maintenance	95.9	1.9
9 - Advanced Driving	92.7	4.9
Station Average	93.0	3.1

TABLE 7. MID-CYCLE RETENTION TEST PERFORMANCE MEASURES WITH OVER 5 PERCENT RETENTION LOSS

PERFORMANCE MEASURES	1 Wk	2 Wk	3 Wk	AVERAGE
Control Bleeding	22.5	10.1	47.2	26.6*
Assume the Prone	18.6	15.9	15.1	16.5*
Mouth to Mouth	26.1	2.9	17.9	15.6
NBC Markers	6.3	15.9	14.2	12.1*
AN/VRC-64 into Operation	22.5	1.5	11.3	11.8
Field Phone TA-312	10.0	4.4	19.8	11.4
Treat for Shock	10.8	15.9	6.6	11.1*
Starting Tank Engine	2.7	21.7	8.5	11.0
Stopping Tank Engine	5.4	15.9	9.4	10.2*
Disassembly, Assembly and Function Check (Cal .45)	7.2	13.0	8.5	9.6*
Immediate Action (SMG)	14.4	10.1	1.9	8.8
Low Crawl	17.4	5.8	2.8	8.7
FL Move in Reverse	.9	20.3	0	7.1
Disassembly, Assembly and Function Check (SMG)	8.1	10.1	2.8	7.0
FL Stop Tank	0	15.9	.9	5.9

*For these tasks retention loss is consistently above 5% for each group.

TABLE 8. TSQT RETENTION TEST PERFORMANCE MEASURES WITH OVER 5 PERCENT RETENTION LOSS

PERFORMANCE MEASURES	G-M%
Threat Vehicles	19.3
COAX Stoppage	14.0
Transmit Message	9.3
Clear M85	8.7
Emergency Situations (Advanced Driving)	8.0
Prepare to Fire Checks	6.0
Clear COAX	5.5
Disassemble, Assemble M85	5.3
Main Gun Misfire	5.3
Audio Amp into Operation	5.1

TABLE 9. INITIAL OVERALL MID-CYCLE AND TSQT "NO GO" PERCENTAGES BY MENTAL CATEGORY

TEST	MENTAL CATEGORY			
	1-2	3	4	OVERALL
Mid-Cycle	2.2	3.3	3.5	3.2
TSQT	3.3	3.9	6.6	4.1
Total	2.4	3.5	5.3	3.5

TABLE 16. MID-CYCLE and TSQT OVERALL RETENTION RESULTS (GO-NO GO PERCENTAGES) BY MENTAL CATEGORY

RETEST	MENTAL CATEGORY			
	1-2	3	4	OVERALL
Mid-Cycle 1 Wk	3.3	4.5	12.4	4.2
Mid-Cycle 2 Wk	3.1	5.1	9.5	5.1
Mid-Cycle 3 Wk	2.1	4.8	6.7	4.5
TSQT	3.5	4.4	4.5	4.3
TOTAL	3.8	4.7	5.9	4.5

TABLE 11. INITIAL OVERALL MID-CYCLE AND TSQT "NO GO" PERCENTAGES BY EDUCATIONAL LEVEL

TEST	EDUCATIONAL LEVEL		
	HS GRAD	NON-HS GRAD	TOTAL
Mid-Cycle	2.8	3.7	3.1
TSQT	4.3	4.9	4.5
TOTAL	3.3	4.0	3.5

TABLE 12. MID-CYCLE AND TSQT OVERALL RETENTION RESULTS (GO-NO GO PERCENTAGES) BY EDUCATION LEVEL

RETEST	EDUCATIONAL LEVEL		
	HS GRAD	NON-HS GRAD	TOTAL
Mid-Cycle 1 Wk	4.3	4.2	4.3
Mid-Cycle 2 Wk	5.6	4.4	5.1
Mid-Cycle 3 Wk	4.5	5.4	4.7
TSQT	3.9	4.3	4.0
TOTAL	4.5	4.5	4.5

PART III

TRIAL IMPLEMENTATION OF THE TANK CREWMAN SKILLS TRAINING PROGRAM

ARI TECHNICAL REPORT

TR-78-A29

TRIAL IMPLEMENTATIONS OF THE TANK CREWMAN SKILLS TRAINING PROGRAM (TCST)

by

Richard E. O'Brien, William J. Crum, Richard D. Healy, James H. Harris, and William C. Osborn

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

This report describes the adaptation of a modular, performance based, individually-paced tank crewman skills training program (TCST) for trial implementation in five different tank crew train-up situations: (1) mobilization train-up of active and reserve crewmen in a training center environment, (2) mobilization train-up of training center crews,

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(3) individual readiness training of armor crewmen preparing for unit gunnery training, (4) accelerated training of tank crew replacements, and (5) accelerated refresher training of experienced crews deprived of regular gunnery training.

The procedure typically involved: (a) adapting TCST to the training situation, (b) planning training implementation, (c) pre-testing, (d) delivering training, (e) administering a crew gunnery criterion test, and (f) post-testing individual skills. The training was administered by unit trainers under supervision of the project staff. Data was collected on individual skill proficiency, crew gunnery performance, and trainee opinions of the program.

Two of the five studies produced positive results. In one, the training center active and reserve mobilization train-up, TCST produced trainee skill levels and opinions superior to those resulting from two alternative programs. In the other, the accelerated tank crew replacement training, TCST was used successfully in rapidly preparing non-11E soldiers to fill in as gunners and loaders on a gunnery qualification test--a Table VIII test in which the crews with replacements performed as well as experienced intact crews. Results of the other three trial implementations were inconclusive.

A need exists for some kind of TCST to be used in preparing combat ready crews. The TCST program has a number of promising features, but needs further development. Of particular importance is the need for detailed trainer guidance on how to plan, schedule and deliver training.

BRIEF

REQUIREMENT

The requirement to be met by the work reported here was to adapt a modular, performance-based, individually-paced tank crewman skills training program (TCST)--originally developed for use with reserve components--for evaluation in a variety of tank crew train-up situations.

PROCEDURE

The program was implemented on a trial basis in five settings: (1) mobilization train-up of active and reserve crewmen in a training center environment, (2) mobilization train-up of training center crews, (3) individual readiness training of armor crewmen preparing for unit gunnery training, (4) accelerated training of tank crew replacements, and (5) accelerated refresher training of experienced crews deprived of regular gunnery training. Each study was intended to represent a different set of training conditions under which tank crewmen would be preparing for combat. In each instance the basic program was modified to accomodate: (a) crewman task requirements dictated by the gunnery criterion test to be used, (b) trainee background, (c) available training time, and (d) training conditions, such as the availability of ranges, subcaliber devices, and service ammunition.

In most cases the procedure involved: (a) adapting TCST to the training situation, (b) planning training implementation, (c) pre-testing, (d) delivering training, (e) administering a crew gunnery criterion test, and (f) post-testing individual skills. The training was typically administered by unit trainers under supervision of the project staff. Data was collected on indiviiual skill proficiency, crew gunnery performance, and trainee opinions of the program.

FINDINGS

Success of TCST in the five trial settings was modest. Two of the five studies produced what could be considered positive results. In one, the training center active and reserve mobilization train-up, TCST produced trainee skill levels and opinions superior to those resulting from two alternative programs. In the other, the accelerated tank crew replacement training, TCST was used successfully in rapidly preparing non-11E soldiers to fill in as gunners and loaders on a gunnery qualification test--a Table VIII test in which the crews with replacements performed as well as experienced intact crews. Results of the remaining three trial runs were inconclusive.

A need exists for some kind of TCST to be used in preparing combat ready crews. Results of the training trials indicate that, despite the supplementary training given, no group of crews--experienced or inexperienced, with or without recent gunnery training--demonstrated a level of crew gunnery proficiency that could be considered combat ready.

The TCST program has a number of promising features, but needs further development. Of particular importance is the need for implementation procedures. Detailed guidance on how to plan, schedule and deliver individual training at the unit level must be developed and validated. Without such guidance and without a commitment to the training by commanders, trainers and trainees alike, no training program of any level of excellence can hope to succeed.

USE OF FINDINGS

The TCST program, with further development, has promise as a flexible program of tank crew training, adaptable in length to a variety of training conditions and trainee experience.

PREFACE

This is the Final Report for Task 4 of a four-task project entitled, "Continuation of Tank Systems Skills and Training Structure." The report describes the trial implementation of a Tank Crewman Skills Training Program in five different training settings.

The work reported here was performed at the Fort Knox Office of the Human Resources Research Organization (HumRRO), under Contract No. DAHC 19-76-C-0001 with the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). The training studies conducted were in support of the Army Training Studies Group work program.

Donald F. Haggard was the Contracting Officer's Technical Representative. He provided administrative assistance, valuable criticism, and substantive suggestions for conceptualizing problems and solutions throughout the project.

HumRRO employees who worked on the project were Richard E. O'Brien, William J. Crum, Richard D. Healy, James H. Harris, and William C. Osborn.

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TRIAL IMPLEMENTATIONS OF THE TANK
CREWMAN SKILLS TRAINING PROGRAM (TCST)

INTRODUCTION

The Tank Crewman Skills Training Program (TCST) originated in response to a need for new Reserve Component training. Armor and Cavalry National Guard units have, since the wind-down of Vietnam and the advent of the volunteer Army, been undergoing change in the areas of equipment, training resources, and personnel. Older tanks are being replaced with newer models; costs of fuel, ammunition and real estate are increasing; and the background of reservists has become more varied, with relatively fewer new recruits and relatively more experienced soldiers shifting from active duty to reserve or National Guard status. Results of a survey of Armor and Cavalry National Guard units[1] led to development of training plans for operating and maintaining the M48A5 tank. The major factors that guided training development were: (a) minimal dependence on skills learned outside the program; (b) being deliverable, as much as possible, at armories; (c) increased use of subcaliber devices; and (d) use of pre-tests to diagnose areas of performance deficiency. The program consisted of performance tests and training modules addressing functional groups of 105 crewman tasks identified as critical to gunnery performance on Table VIII and related crew drills and skills deemed important by the Armor School. Tests and training modules are divided into five packages, one for each crew position and one for the crew. The program was designed around the time, terrain and resource constraints that typify Reserve Component training. It is performance-based, criterion-referenced and individually managed. Training Extension Course (TEC) lessons and existing training devices, along with specifications for other devices and material, are designated for use. The program uses individual diagnostic pretesting to determine training needs, and proceeds from individual skills to

[1]O'Brien, R.E., Ford, J.P., and Boldovici, J.A. Armor and Cavalry National Guard Training Constraints. Alexandria, Virginia: U.S. Army Research Institute for the Behavioral and Social Sciences, 1977.

crew skills. The complete training program is reported elsewhere.[1] A synopsis is given in Appendix A.

An evaluation of the Reserve Component Training Program is currently underway in a National Guard Armored Division. Early in its development, however, the program was identified by the Army Training Studies Group (ARTS) as potentially useful in settings other than the Reserve Component environment. These potential applications included:

- Mobilization train-up of active and reserve tank crews in a training center environment.
- Individual readiness training of armor crewmen preparing for unit gunnery training.
- Accelerated training of tank crew replacements.
- Accelerated refresher training of experienced crews deprived of annual gunnery exercises.

The modular-structure and performance-based features of the original program enable its adaptation to a variety of training conditions and trainee backgrounds. This report describes five such trial implementations of the program, currently termed "Tank Crewman Skills Training" or TCST.

OBJECTIVE

The overall purpose of the work reported here was to develop and evaluate variations of TCST in terms of training effectiveness and trainee acceptance. Specific objectives included determining if:

- TCST led to improved performance on crew live-fire exercises.
- Individual skills trained in TCST are relevant to crew live-fire skills.

[1]Harris, J.H., Osborn, W.C., and Boldovici, J.A. Reserve Component Training for Operating and Maintaining the M48A5 Tank. Alexandria, Virginia: U.S. Army Research Institute for the Behavioral and Social Sciences, 1977.

- TCST can be delivered effectively in different training environments; where training time, trainee background and training resources vary.
- TCST is viewed favorably by trainees and trainers.
- The cost of delivering TCST is reasonable.[1]

APPROACH

Five training studies were carried out in an attempt to meet these objectives. Each of the studies was intended to represent a different set of training conditions under which tank crewmen would be preparing for combat. The studies were:

1. Training Center Active and Reserve Mobilization Trainup. A mixture of active duty and reserve crewmen assigned to the Armor Training Center received approximately one week of individual skills training, in TCST or one of two other mobilization training programs.

2. *Training Center Crew Mobilization Training.* Twenty M60A1 tank crews assigned to the Armor Training Center received one week of the individual skills portion of TCST in preparation for a two-week period of crew training.

3. Field Unit Annual Gunnery Training. Tank crewmen in a divisional FORSCOM battalion received the individual skills portion of TCST in preparation for their annual gunnery training.

4. Accelerated Tank Crew Replacement Training. Soldiers that were not tank crewmen received three days of TCST in preparation for them to serve as replacement gunners and loaders in regular tank crews.

5. Accelerated Tank Crew Refresher Training. Crews in an experienced tank company that had not recently participated in annual gunnery training received either one or three days of TCST as refresher training.

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[1]Training cost estimates for three of the programs are given in Appendix O.

Modification of TCST was necessary for each of the trial implementation. Adaptation of the original program to the M60A1 tank was required for all applications, which entailed relatively minor changes in content to accomodate task relevant equipment differences. Other changes were made to adapt to trainee background, available training time, and training conditions, such as the availability of ranges, subcaliber devices and service ammunition for gunnery training.

The reader should note at the outset that the assorted training trials reported here in no way represent systematic variations of training conditions relevant to the design of TCST. In most cases, limited planning time and resources and the urgency of on-going training schedules precluded the kind of controlled intervention one strives for in program evaluation. Live-fire criterion tests were not comparable from study to study; those who delivered the training differed in background and familiarity with TCST; of those who scored the hands-on readiness tests, some were trained in test administration and some were not, and some were more closely involved with the performance of trainees than others. In short, study objectives, training procedures and evaluation criteria were adapted to the physical and personnel resources available in each case.

THE TRIAL IMPLEMENTATIONS

1. Training Center Active and Reserve Mobilization

This study involved the tryout of three training programs assembled for the purposes of armor crew mobilization and transition training. The programs are summarized as follows:

- Tank Crewman Skills Training (TCST). As described above, this program represented a modification of that designed for armor reserve components to use in training operation and maintenance of the M48A5 tank. The individual training portion of the program covered 105 crewman tasks identified as "critical" in terms of their relevance to Table VIII exercises and other crew skills designated as important by the Armor School. The tasks were divided into four training packages, one for each crew position. A package consisted of readiness tests and training modules addressing functional groups of job tasks. The training is performance-based and individually managed, though some of the knowledge training (TEC Lessons) was group paced. With the minor modifications in task procedures necessary to adapt to the M60A1 tank, and to accomodate three principal tracks (Driver, Loader/Gunner, and Tank Commander), the program was implemented. A trainee took only one of the three tracks.

- Expanded Basic NCO Course (EBNCOC). This program consisted of lesson plans from the Armor Basic NCO Course supplemented by selected TCST modules. The training covered essentially the same tasks as TCST, was similarly divided into three tracks, and included both knowledge and hands-on training. This program differed chiefly from TCST in two respects: 1) knowledge training (TEC lessons) was self-paced, and 2) the Readiness Tests were given on a post-training basis only.

- Self-Managed Mobilization Training Program (SMMT). This program enlarged the scope of armor tasks covered, and featured a self-management approach to training. Approximately 30 tasks were included which were not covered in the two other programs. Many of the additional tasks represented areas of tank crew performance emphasized in the Armor Tank Force Management Study: NBC, recovery operations, communications, extinguishing fires, and camouflage, cover and concealment. The program consisted of a set of training objectives, hands-on criterion tests, resource materials (FMs, TMs, TEC Lessons, etc.), and a course map designating a recommended order for taking the modules. A trainee selected one of ten module clusters, read the objectives for the first module, studied whatever available resource material he wished, and reported for testing when he thought he was ready. In contrast to the other programs, this training was not tracked; trainees were responsible for tasks pertaining to all four crew positions.

Trainee Groups. Trainee groups were comprised of active duty soldiers from the USATCA's 1st and 4th Training Brigades and the 194th Armored Brigade, and reservists from the 100th Training Division. Group background characteristics are summarized in Table 1.

The three groups of trainees appeared dissimilar in important respects. From the standpoint of experience, TCST trainees seemed to have an edge over the other two groups: they tended to be predominantly active duty soldiers with more years in service and of slightly higher average rank; over 40% held the primary MOS of 11-E. The group receiving the Expanded BNCO training, while comparable in terms of the relative number of active duty soldiers, were proportionately under represented by men with the 11-E MOS (14%). Soldiers undergoing the SMMT program were typically reservists (82%) with fewer years service, although nearly half (46%) held the Armor Crewman's primary MOS.

To the extent that one associates trainability in this context with a background of active duty experience as an 11-E, the TCST group appeared to have an edge on the other groups going into the training. Such differences in composition of the three trainee groups are pertinent to interpreting results of the training evaluation.

TABLE 1

BACKGROUND CHARACTERISTICS OF TRAINEES
BY CREW POSITION AND TRAINING PROGRAM

TRAINING PROGRAM	TRAINING CREW	TRAINEE CHARACTERISTICS					
		NUMBER OF TRAINEES	GRADE (MEDIAN)	PMOS (% 11E)	COMPONENT (% ACTIVE)	AGE (MEAN)	YEARS SERVICE (MEAN)
TCST	Driver	10	E-7	0 %	100 %	32	14.2
	Gunner/ Loader	10	E-6	10 %	60 %	30.6	6.3
	Tank Cmdr.	14	E-5	93 %	93 %	27.5	6.4
	All	34	E-6	41 %	85 %	29.7	8.3
EBNCOC	Driver	16	E-5	31 %	81 %	27.6	3.5
	Gunner/ Loader	13	E-6	8 %	100 %	30.8	10.4
	Tank Cmdr.	17	E-5	0 %	88 %	26.1	5.1
	All	46	E-5	14 %	89 %	27.9	6.0
SMMT	All	24	E-5	46 %	18 %	29.4	3.4

Training Delivery. Training was administered by training center cadre who, depending on the particular program involved, administered diagnostic pre-tests, supervised remedial training, and conducted all readiness (criterion) testing. Soldiers assigned to TCST or EBNCOC spent up to a week preparing for post-test evaluation; those participating in SMMT were alloted two weeks for preparation.

Results

Hands-On Test Performance. Principal training results are given in terms of hands-on post-test comparisons among the three groups. TCST and EBNCOC groups received the same hands-on post-tests, and to enable comparison with SMMT trainees the latter were administered a sample of the same hands-on tests. Comparisons involving SMMT trainees were possible for tasks in the loader and driver areas only.

Results of the hands-on testing are shown in Table 2. With exception of loader tasks in the Mission Preparation area, performance of TCST trainees was uniformly high, ranging from 81% to 100% "GO." Overall performance of EBNCOC trainees was moderately high. Of the 12 possible test compairsons between TSCT and EBNCOC, the former group scored higher on eight and lower on three; performance was at a maximum for both groups on the remaining test. Only two of these apparent differences were found to be statistically reliable, however, both in favor of TCST trainees. Areas of significant difference were Weapons Maintenance (loader) and M85 Operation and Maintenance (TC): All TCST trainees passed these two tests, whereas "GO" rates for EBNCOC trainees were 57% and 71%, respectively.

Hands-on performance of the SMMT group was low, and significantly so, in the three areas tested (Combat Loading, Replenisher Tape Reading, and the driver's Before Operation Checks). The combined pass rate of TCST and EBNCOC groups was approximately 95% on these tests, where only about half of the SMMT trainees scored "GO."

TABLE 2

PERCENT "GO" FOR HANDS-ON POST-TESTS
FOR THE THREE TRAINING PROGRAMS

HANDS-ON TEST	TRAINING PROGRAM					
	TCST		EBNCOC		SMMT	
	N	% "GO"	N	% "GO"	N	% "GO"
Loader/Gunner	11		14		24	
Mission Prep.		54		--[1]		--
Cmbt. Loading		100		93		50[3]
Wpns. Mtn.		100		57[2]		--
Replen. Tape		100		93		50[3]
Opnl. Checks		91		100		--
Wpn. Prep.		100		100		--
Tact. Opns.		91		86		--
Driver	9		15		24	
Before Opns.		100		93		58[3]
Tact. Driving		100		80		--
Tank Commander	16		17			
M85		100		71[2]		--
Prep. to Fire		81		88		--
Wpns. Prep.		94		100		--
Tact. Opns.		94		88		--

[1]Not tested.
[2]Significantly smaller than corresponding percentage for TCST ($p < .05$).
[3]Significantly smaller than corresponding combined percentage for TCST and EBNCOC ($p < .05$).

Written Test Performance

A total of 29 TEC lessons with written criterion tests were available for use in the three training programs. Post tests were taken on these lessons by virtually all TCST trainees, and on a sample of 10 lessons by the SMMT group. TEC post tests, with one exception, were either not taken or not recorded for EBNCOC trainees. Data for the 9 lessons on which between-group comparisons could be made is shown in Table 3. Performance by TCST trainees on these 9 lessons depicts reasonably well the pass rate pattern over all lessons. The trend was toward higher performance by those in the Loader/Gunner Track than those in the Driver and TC Tracks, although the 35% on Vehicle Identification was the lowest percent "GO" on all TC lessons.

Noticeable in Table 3 is the uniformly low performance of the SMMT group. Few if any of the trainees passed the post-tests for those TEC lessons sampled, which indicates they knew substantially less about how to perform tasks--at least in the eight areas tested--than did the TCST group.

Trainee Opinion

To supplement performance data, trainee opinions were measured using an 18 item questionnaire (Appendix B). The questionnaire was given to each group of trainees before training began and again after it was completed. Questions pertained to the quality, pace, and accomplishments of both audio-visual and hands-on training. The substance of the questions was the same in both pre-training and post-training versions of the questionnaire. Only the verb tense changed, with the pre-training version designed to elicit expectations (e.g., "Will you like....") and the post-training version to elicit opinions (e.g., "Did you like....").

TABLE 3

PER CENT "GO" ON SELECTED WRITTEN (TEC) POSTTEST
FOR THE THREE TRAINING PROGRAMS

Written Test	TRAINING PROGRAM: TCST N	TCST %"GO"	EBNCOC N	EBNCOC %"GO"	SMMT N	SMMT %"GO"
Loader/Gunner						
Coax Maint.	11	73		--[1]	24	0[2]
Coax Trblsht.	11	100		--	24	4[2]
Brsgt. I	10	70		--	24	25[2]
Brsgt. II	11	73		--	24	0[2]
Prep. for Opns.	11	91		--	24	0[2]
Aux. Fire Con.	11	91		--	24	0[2]
Xenon Slt.	11	64		--	24	42
Driver						
Op. Checks	10	40		--	24	0[2]
Tank Commander						
Veh. Ident.	11	35	17	41		--

[1] - indicates test results not available.

[2] Significantly smaller than corresponding percentage for TCST ($p < .05$).

Unfortunately, because of administrative difficulties, not all trainees completed both forms of the questionnaire. Data for those that did (Table 4) were analyzed in terms of shifts in opinion from what they expected before training to what they concluded after training. Responses were coded as favorable or unfavorable and tabulated by question for each trainee group. These data are summarized in Table 5. Post-training opinions of the EBNCOC group were slightly higher overall than those of TCST (81% and 75%, and both groups held substantially more favorable views of training than did SMMT (46%). But these results should be viewed in light of trainee expectations. Notice from pre-training responses that EBNCOC trainees were much more optimistic, with 81% on the average holding favorable expectations about the forthcoming training, whereas the TCST and SMMT groups averaged 57% and 61% respectively. Since the pre-training questionnaire was given before trainees had any knowledge of the instruction they were to receive, differences in expectations probably reflect differences in group characteristics; and since the EBNCOC group was distinguished by having relatively few 11-E (14% as compared to over 40% in each of the other groups), this difference in training background may have produced the difference in expectations. In any event, it is the shifts in favorability from before to after training that are notewothy in Table 5. The TCST group showed an average increase in response favorability of nearly 20 percentage points, indicating that they thought the training was much better than expected. SMMT trainees, on the other hand, showed an average decrease of 15 percentage points, indicating they thought their training was poorer than expected. No change was found for the EBNCOC group who apparently found their training to be about what they had expected.

TABLE 4

RELATIVE NUMBER OF TRAINEES RESPONDING TO
THE TWO FORMS OF THE OPINION QUESTIONNAIRE

TRAINING PROGRAM	NUMBER OF TRAINEES	NUMBER COMPLETING BOTH FORMS	PERCENT COMPLETING BOTH FORMS
TCST	34	19	56
EBNCOC	46	13	28
SMMT	24	21	88

TABLE 5

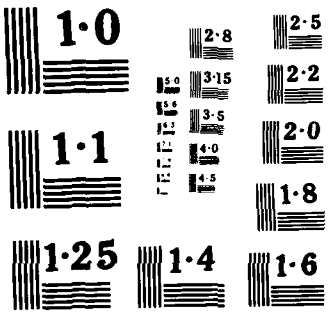
AVERAGE PERCENT OF FAVORABLE QUESTIONNAIRE
RESPONSES FOR PRE- VERSUS POST-TRAINING ADMINISTRATION

TRAINEE GROUP	PRE-TRAINING	POST-TRAINING
TCST	57.0	75.4[1]
EBNCOC	81.3	80.8
SMMT	60.8	45.8[1]

[1]Statistically significant shift in response favorability

AD-A186 323 ARMY TRAINING STUDY: TRAINING EFFECTIVENESS ANALYSIS (TEA) SUMMARY VOLUME 1 ARMOR(U) ARMY TRAINING AND DOCTRINE COMMAND FORT MONROE VA F J BROWN 08 AUG 78 4/5

UNCLASSIFIED SBI-AD-F000 107 F/G 15/1 NL


1·0
2·8
2·5
3·15
2·2
3·5
2·0
1·1
4·0
4·5
1·8
1·25
1·4
1·6

Discussion

Test Performance. "Hard" comparisons among the three programs are difficult if not impossible given differences in composition of the three groups, scope of the programs, training time, and methods of instruction. No one of these factors was systematically varied relative to the others, so post-training performance data is hopelessly confounded between the three programs. The best that can be done is to highlight the similarities and differences among the programs relative to training results observed.

The TCST and EBNCOC programs were similar in scope and in training time, only moderately different in training methods, but dissimilar in background characteristics of the trainees. Both groups consisted of over 80% active duty soldiers, but were quite different in MOS mix. The TCST group consisted of 41% 11-E, which by track subdivided as follows: 0%, Driver; 10%, Loader/Gunner; 93%, Tank Commander. Only 14% of the EBNCOC trainees held the 11-E MOS: 31% of the Drivers, 8% of the Loader/Gunners, and 0% of the Tank Commanders. Is the slightly superior overall hands-on performance by the TCST group (Table 2) attributable, therefore, to variation in instructional method or to the fact the EBNCOC program had more people to put through transition training? It is difficult to say conclusively, but reference to Table 2 indicates no dramatic reversals in pattern of performance between groups from track to track despite substantial shifts in MOS composition of subgroups. That is, taking the liberty of averaging hands-on performance by track for the two groups and comparing this with the MOS breakdown by track, as shown in Table 6, reveals no noticeable association between differences in performance under the two programs and shifts in MOS composition by track. This suggests that differences in test performance are probably not attributable to MOS characteristics of the two groups. But the reader should

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TABLE 6

AVERAGE HANDS-ON TEST PERFORMANCE AND MOS COMPOSITION BY TRACK FOR TCST AND EBNCOC

	TRAINING PROGRAM			
	TCST		EBNCOC	
TRACK	%11-E	AVG.%"GO"	%11-E	AVG.%"GO"
Loader/Gunner	11	97	8	88
Driver	0	100	42	87
Tank Commander	93	92	0	87
Total Group	41	96	14	87

bear in mind that this cannot be held conclusively, particularly in light of the relatively small differences in test results.

Even less can be concluded from a comparison of SMMT with the other two programs. Although differences were large in the few areas of performance measured, SMMT was dissimilar in scope, training time, training method, as well as in background characteristics of the trainees. SMMT attempted to train a group (predominantly reservists with less than half the years of service averaged by TCST trainees) in all four duty positions (plus several additional job tasks) in no more than twice the time available for training in the other programs. Indications are that this was simply too ambitious an undertaking, since the percentage of trainees who completed SMMT averaged 66% over all task clusters. A completion rate of 52% was reported for the Gunnery cluster and for the Maintenance cluster--the two SMMT areas which covered those tasks later tested in the post-training hands-on comparison. The 52% corresponds well with the 50% - 58% SMMT "GO" rate on the three hands-on tests sampled for comparative evaluation (Table 2). Thus, completion percentages for SMMT may offer reasonable estimates of hands-on proficiency in other areas as well.

Although SMMT performance shortfall cannot be attributed to a particular cause, a word about the self-management approach to training is called for. The advantages of self-instruction or self-pacing are well recognized. But it is only as effective as the quality of instructional materials and the management of the learning situation. Developing a self-instructional/self-managed training program requires much more time, effort and expertise than do instructor mediated training programs. In the case of the SMMT program, the developer's effort and competence could not possibly offset the severely limited time for development that was available. Indeed, it would have been remarkable if even one of the fifty-plus modules could have been designed, tested and revised in the time and with the resources allotted for all.

Results of the trainee opinion questionnaire generally supported the foregoing discussion of performance outcomes. Soldiers completing TCST found the training to be significantly better than they had expected, and those completing SMMT found theirs to be significantly worse than anticipated, even though both groups began with about the same overall level of expectation. Opinion data for EBNCOC trainees were less conclusive, since for some reason they began training with much higher expectations than the other groups.

Reasons for the poor reactions to SMMT training are probably much the same as those mentioned in connection with the lower performance of this group. SMMT trainees were responsible for learning more tasks and were given a minimum of instructional guidance. That many failed to complete training is sufficient cause for their unfavorable reaction to the program.

2. Training Center Crew Mobilization Trainup

Following tryout of the three programs of individual skills training, TCST was selected for evaluation in conjunction with a crew training program. Twenty M60A1 tank crews from the 194th Armored Brigade participated in this trial run of a complete mobilization training package. Background characteristics of the trainees are shown in Table 7.

The training was conducted over a three week period, with the first week spent in diagnostic testing and remedial training of individual skills, TCST, and the last two weeks devoted to

TABLE 7

BACKGROUND CHARACTERISTICS OF TRAINEES
IN TCST(2)/CREW TRAINING

CHARACTERISTICS	CREW POSITION: LOADER	DRIVER	GUNNER	TANK CDR.
Number of men	24	21	21	22
Grade (Median)	E4	E4	E4	E6
PMOS (% 11E)	88%	90%	86%	73%
Age (Mean)	20.4	22.1	24.1	30.3
Years Service (Mean)	1.8	1.8	4.5	12.1

crew training. Though the crew training was not the crew module contained in the original TCST program, it did consist of practical exercises in maintenance, fire fighting, refueling, ammunition, reloading, evacuation, tactical movement, pregunnery and firing position drills, plus various dry and live fire gunnery exercises. The two major criterion measures were a tank crew qualification test and gunnery performance on Table VIIC. Training was conducted by cadre from the U.S. Army Training Center Armor.

Results and Discussion

Individual Skills. Performance in TCST was measured in terms of knowledge (TEC) test and hands-on readiness test results as with all previous individual training. Post-test results on the TEC exercises were recorded and compared with those obtained in the previous study [TCST(1)]. These data are summarized in Table 8. Performance on completion of the TEC lessons was uniformly high. The group means by crew position were over 90 indicating the crew members were well prepared from the standpoint of knowledge of their individual skills. It is also worth noting that they scored as high or higher than TCST(1) trainees on 23 of the 29 written post-tests taken by both groups, though in most cases these differences were not large enough to be statistically reliable.

Pre-test performance on the hands-on portion of training is shown in Table 9 along with comparable data for the cadre. This comparison was made because the cadre group was more similar in background to TCST(2) trainees than was the TCST(1) group. Pre-test performance was low for all but the Loaders. The overall indication was that at the start of training the trainees needed considerable work on their individual skills. The extent to which this work was accomplished is not known, however, since post-test results of hands-on training were not available.

TABLE 8

MEAN SCORE BY CREW POSITION ON
WRITTEN (TEC) POST-TESTS FOR TCST GROUPS

	TCST (1)		TCST (2)	
CREW POSITION	NUMBER OF TESTS	GROUP MEAN	NUMBER OF TESTS	GROUP MEAN
Tank Commander	8	89.0	8	90.5
Gunner	9	91.6	10	96.1
Loader	12	92.7	10	97.1
Driver	2	77.5	4	98.2

TABLE 9

PER CENT "GO" ON HANDS-ON PRETEST FOR CADRE AND TCST(2) TRAINEES

TEST	CADRE	TCST(2)
Tank Commander		
A Before Operations Procedures	64	10[1]
C Weapons System Preparation	71	40
E Tactical Operations	50	30
Gunner		
A Before Operations Procedures	50	0[1]
C Weapons System Preparation	62	0[1]
E Tactical Operations	85	68
Loader		
A Mission Preparation	65	60
B Combat Loading	54	85
C Weapons Maintenance	73	80
D Replenisher Tape	96	100
Driver		
B Before Operations Procedures	58	40
D Tactical Driving	62	40

[1]Significantly smaller than percentage in cadre column ($p < .01$).

In terms of their reactions to the individual readiness training, TCST(2) trainees rated the program about the same as the earlier TCST(1) group. Pre-training questionnaire responses averaged about 53% favorable, and rose to 67% after training, indicating they thought that overall the program was better than expected.

Crew Training. Achievement in crew training was measured chiefly by day and night versions of the Tank Crew Qualification Test (TCQT). Performance on the TCQT is summarized in Table 10. As measured in terms of the percentage of task standards met, Table 10 shows that on the whole crew proficiency ranged from 81% to 88% on non-firing duties and from 55% to 66% on the firing exercises.

Further gunnery data were available on five crews who fired Table VIIC both before and after crew training. Engagement times, accuracy, and point scores which were averaged over engagements and crews are listed in Table 11. Substantial improvement from before to after training was evident on all measures, though, because of the few crews involved, only the improvement in time scores was found statistically significant.

It is apparent from the available data that crew training was successful in improving crew performance. The question remains as to whether that improvement was sufficient. Crew proficiency levels of over 80%, as were reported for non-gunnery skills, may be satisfactory when judged against the objectives of mobilization training. Gunnery proficiency only marginally above 50%, however, probably is not.

TABLE 10

TANK CREW QUALIFICATION PERFORMANCE ON TASK STANDARDS

STANDARD	SATISFACTORY
Day Engagements	
Main Gun	
Crew Duties	85%
Time and Hits	66%
Machinegun	
Crew Duties	81%
Time	65%
Coverage	58%
Situation Reports	88%
Night Engagements	
Crew Duties	86%
Time and Hits	55%

TABLE 11

CREW GUNNER PERFORMANCE ON TABLE VIIC

MEASURE OF PERFORMANCE	BEFORE TRAINING	AFTER TRAINING
Opening Times[1]	16.6 sec	8.4 sec[2]
Closing Times[1]	31.3 sec	19.0 sec[3]
Area Coverage	27%	60%[4]
Main Gun Hits	20%	55%[4]
Scores[1]	295 pts	653 pts[4]

[1]Least square estimates for three missing values were obtained by Yates method (Cochran and Cox, 1957). Means were computed including the estimated values.

[2]Significant decrease from Before to After ($p < .05$).

[3]Significant decrease from Before to After ($p < .01$).

[4]No significant change.

3. Field Unit Annual Gunnery Training

This trial run of TCST was conducted in an active Army tank battalion preparing for annual gunnery qualification. During the pre-test phase of the implementation, the readiness tests were administered to the battalions' tank crewmen, and appropriate remedial instruction recommended for each based on readiness test results. A post-test was administered approximately five weeks later as each crew finished firing the gunnery tables.

Before the training was implemented, however, revisions in content and delivery procedures were made. Some changes pertaining to differences in the M60A1 and M48A5 tanks had been made on-the-spot during the two previous trial runs, but time had not been available to formally revise TCST for use with the M60A1 in an active Army setting. Content changes included: replacing M2 machinegun tasks with M85 machinegun tasks; changing references to support rollers in tasks concerned with track tension checks and adjustment; and, appropriately modifying nomenclature and descriptions of gages and warning lights in the driver's compartment. Readiness tests and training module outlines were prepared for additional tasks recommended for inclusion in the program by the Armor Center. In all, the tasks added to TCST are listed in Table 12.

Modifications in guidelines for test administration and training delivery were made to take advantage of differences between active and reserve units in time and resources available for training. The bulk of these changes pertained to guidance for testing, and included: instructions for administering and scoring the written portions of the readiness tests; instructions for the officer-in-charge of conducting the hands-on readiness tests; and instructions for scorers at each hands-on test station. These guidelines are presented in Appendix C.

TABLE 12

TASKS ADDED TO TEST

CREW POSITION	TASK
Driver	. Use camouflage, cover and concealment . Prepare tank for towing
Loader	. Operate tactical FM radio
Gunner	. Charge manual elevation system
Tank Commander	. Load an M85 machinegun . Clear an M85 machinegun
All crewmen	. Check operation of M3 heater (gas particulate unit)

Trainees. A total of 54 tank crews, or 216 soldiers, from an Armored Battalion at Fort Carson participated in the training study. Pre-testing and training proceeded from a Battalion Battle Roster designating the crew and crew position of soldiers for crew gunnery qualification (Table VIII). For the most part, crews normally manning a given tank were kept intact, with crewmen serving in their normal crew position; vacant slots, created by reassignment, impending separation from service, sickness, etc., were filled by drawing additional troops from the battalion on an as needed basis--an approach that in some cases led to crewmen being assigned to positions other than they normally held. Background characteristics of the trainee group are summarized in Table 13.

Scorers. Division demands for support depleted the ranks of those experienced personnel who had originally been singled out to administer the readiness tests during the pre-test phase of the study. As the only practicable alternative, each line company was asked to detail seven soldiers to serve as scorers. The 21 individuals chosen for this role were among those assigned to gunner and tank commander positions for the training and gunnery qualification study, so they served in both roles. Their experience in armor was generally typical of other gunners and tank commanders in the battalion.

Since these scorers were not available for the post-testing phase of the study, four new scorers were provided by the Armor School and trained by the study team. These four NCOs, under direction of the research and development coordinator of USARI-Fort Knox, conducted the post-testing phase in which readiness tests were administered to crewmen on completion of Table VIII firing.

TABLE 13

BACKGROUND CHARACTERISTICS OF
TCST ANNUAL GUNNERY TRAINEES

POSITION	NUMBER OF TRAINEES	GRADE (MEDIAN)	MO. SERVICE (MEAN)	AGE (MEAN) YRS.
Driver	46	E-4	25.9	21.3
Loader	43	E-4	34.9	21.6
Gunner	54	E-4	35.8	22.4
Tank Commander	58	E-6	83.2	27.3
ALL	201	E-4	47.0	23.4

Pre-test Procedures. Pre-testing and remedial training was conducted during two one-week periods. In general, the procedure involved the study team establishing liaison with the battalion, coordinating plans for data collection, training scorers, supervising collection of the written and hands-on test data, identifying appropriate remedial instruction for each soldier, and administering background and opinion questionnaires.

Two days were spent setting up the testing site[1] and training scorers. Scorers were briefed on the purpose of the training study and the kinds of hands-on performance tests to be administered, and instructed in the general scoring procedures to be followed (Appendix C). On completion of these familiarization activities and before further intensive scorer training, all scorers were administered the written and hands-on readiness tests for the positions (i.e., gunner or tank commander) to which they had been assigned in the study proper. All then completed their scorer preparation by alternately performing and scoring the hands-on tests that they would be administering during the pre-testing phase.

Each testing day began with a group of approximately 36 soldiers receiving a briefing on the nature and purpose of the study, completing a background and training expectations questionnaire,[2] and taking the written portions of the readiness tests. On completion of this first session, they reported to the hands-on testing site where they were identified by crew position and organized into four groups. Each group was then briefed on the testing procedure, told

[1]Test site layout and corresponding test components are given in Appendix D.

[2]This training expectations questionnaire, along with its counterpart post-training opinion questionnaire, was a revised version of that shown in Appendix B. Revisions entailed shortening it from 18 to 11 questions, and changing the response array from five scaled alternatives to a seven-point scale of agreement.

how they would progress through the testing stations, and informed of the first station to which they were to report. At a given station the scorer read a standard set of instructions to each soldier who was to be tested at that station. An example of the instructions given for a portion of the driver's hands-on readiness tests is provided in Appendix E. Also presented in this example are the tasks on which drivers were to be examined, the conditions under which testing was to occur, and a series of notes to remind test adminstrators about specifics of the testing procedure. The test then began and continued until performance on all of the relevant tasks had been evaluated. As each task was performed, the test administrator recorded in an answer booklet whether each required step performed satisfactorily (GO), unsatisfactorily (NO GO), or whether the step was not required and not performed (NA). Items not required and therefore marked NA were those for which the appropriate test conditions could not be met, either because of lack of equipment or terrain specifics. Approximately one and a half hours were required to test loaders, gunners, and tank commanders. Driver testing required about one hour. After testing, scorers returned all test booklets to a central collection point where they were reviewed and used to identify needs for refresher training for each soldier.

It is important to note that departures from prescribed testing procedure were detected during the pre-testing phase. For example, on parts A and C of the gunner and tank commander readiness tests. the tasks were frequently "talked through" by the soldier rather than actually performed. Although scorers were constantly discouraged from using this approach, it did in fact occur frequently.

Remedial Training. A soldier's performance on both the written and hands-on portion of the readiness test determines the instructional modules he will take. The remedial training for both the written and hands-on portions of the readiness tests was to be conducted by each line company based on the needs of each soldier as determined by his test results. Then, the soldier would take the post-test for the appropriate TEC lessons and return to the hands-on test site to be retested only on those portions on which he received remedial training.

For a variety of reasons, the most compelling of which was continued division demands for support, the line companies were not able to conduct the remedial training for the hands-on portions. After the second day of testing, therefore, the testing procedure was modified. The scorers were instructed to remediate the hands-on tasks on the spot using one-on-one performance training and then retest the soldier immediately. The remedial training for the written tests was conducted as planned.

Following pre-testing and remedial training, soldiers returned from one to three days later to Battalion Headquarters where they reassembled for the purpose of completing a post-training opinion questionnaire.

Post-test Procedure. Approximately five weeks following pre-test and remedial training--a period in which the battalion fired the gunnery tables, to include a second experimental firing of Table VIII--the readiness tests were readministered to all available crewmen. The procedure followed in conducting the post-test was much the same as for the pre-test, except that fewer soldiers were tested at a time, and the four scorers conducting the testing were better trained and better supervised.

Results

Results of the training study are given in terms of individual readiness test performance, crew performance on Table VIII and trainee reactions.

Readiness Test Performance. Of those trainees designated for the training, a total of 208 took at least one portion of the readiness test appropriate to their crew position; 196 usable hands-on test and 115 written test scores resulted. The pre-test data are summarized in Tables 14 and 15. Results are tabulated in terms of the average proportion of steps in task performance (performance measures) correctly executed (Table 14), and in terms of the average proportion of tasks passed--that is, tasks in which all steps were performed correctly--(Table 15). Scores on the hands-on portion of the test were moderate to high, with the relative number of performance measures passed ranging from .76 for the loaders, to .95 for the tank commanders; mean proportion of hands-on tasks passed was slightly lower, ranging from .60 for loaders, to .87 for tank commanders. Substantially lower was overall performance on the written portion, where, as shown in Table 15, on no more than 10% of the tasks could soldiers typically answer all questions ("performance measures") about task performance. The pattern of scores over crew positions remained much the same regardless of the subtest or measure used, with loaders scoring the lowest, tank commanders the highest, and drivers and gunners in between.

A total of 130 soldiers took part in the post-test, and of these only 63 had taken the pre-test for the duty position in which they served during Table VIII qualification and post-testing. The

TABLE 14

AVERAGE TASK PROFICIENCY[1]
BEFORE GUNNERY TRAINING

POSITION	N	PRE-OP CHECKS	WPNS MTN	TAC OPNS	TOTAL H-O	N	TOTAL WRTN	N	TOTAL TEST
Tk Cmdr	57	.95	.92	.96	.95	28	.70	60	.81
Gunner	51	.86	.86	.93	.88	38	.36	54	.68
Driver	46	.79	N/A	.94	.87	30	.48	49	.73
Loader	42	.72	.75	.79	.76	19	.29	45	.68

[1]Mean proportion of performance measures passed by task, averaged over soldiers and task areas.

TABLE 15

MEAN PROPORTION OF TASKS
PASSED BEFORE GUNNERY TRAINING

POSITION	N	PRE-OP CHECKS	WPNS MTN	TAC OPNS	TOTAL H-O	N	TOTAL WRTN	N	TOTAL TEST
Tk Cmdr	57	.86	.90	.85	.87	28	.10	60	.49
Gunner	51	.63	.69	.78	.70	38	.05	54	.37
Driver	46	.63	N/A	.81	.72	30	.07	49	.39
Loader	36	.54	.56	.69	.60	19	.03	45	.31

remaining 67 occupied other positions during the pre-test, or were new to the battalion, or were newly assigned to tanks. Post-test scores, shown in Tables 16 and 17, indicate lower overall performance than for pre-testing. With exception of loaders, whose hands-on test performance remained about the same from pre- to post-testing, hands-on scores after gunnery training fell from 10 percentage points (tank commander) to 30 percentage points (gunner) below what they were before training. That individual skill proficiency would be lower after training than before makes little sense. Such a drop in proficiency might reasonably result from any of three conditions: (a) changes in crew personnel from pre-test to post-test periods, (b) more stringent scoring of the post-test, or (c) lower motivation of soldiers during post-testing when their formal qualification firing had been completed. The first of these can be evaluated by looking at the pre-post performance of the 63 crewmen tested both times. Shifts in post-test scores for these crewmen, as shown in Tables 18 and 19, generally parallel those for the groups at large, indicating that the skill level of new crewmen (or crewmen serving in different duty positions from those in which they were originally tested) were not substantially different from that of crewmen serving in the pre-test phase only. The possibility that lower post-test scores are attributed to lower motivation following gunnery qualification is not appealing, since there was no observable evidence of reluctance or apathy on the part of soldiers tested as reported by the test administrators. The more likely explanation is that post-testing was conducted more rigorously than the pre-testing. As mentioned earlier, the NCOs who scored the post-test were from outside the test battalion and were carefully trained and supervised in administering the readiness tests, whereas, those who administered the pre-test belonged to the test battalion, also participated as trainees, and were less well trained and supervised in their role as testers. The readiness test results, however rationalized, certainly do not indicate that any

TABLE 16

AVERAGE TASK PROFICIENCY[1]
AFTER GUNNERY TRAINING

POSITION	N	PRE-OP CHECKS	WPNS MTN	TAC OPNS	TOTAL H-O	N	TOTAL WRTN	N	TOTAL TEST
Tk Cmdr	30	.86	.88	.83	.85	31	.45	31	.65
Gunner	41	.45	.43	.80	.56	41	.32	41	.44
Driver	26	.61	N/A	.64	.62	26	.48	26	.55
Loader	32	.67	.90	.79	.78	32	.26	32	.52

[1]Mean proportion of performance measures passed by task, averaged over soldiers and task areas.

TABLE 17

MEAN PROPORTION OF TASKS
PASSED AFTER GUNNERY TRAINING

POSITION	N	PRE-OP CHECKS	WPNS MTN	TAC OPNS	TOTAL H-O	N	TOTAL WRTN	N	TOTAL TEST
Tk Cmdr	30	.62	.74	.69	.68	31	.11	31	.40
Gunner	41	.22	.20	.63	.35	41	.02	41	.19
Driver	26	.36	N/A	.45	.41	26	.09	26	.25
Loader	32	.49	.59	.70	.59	32	.02	32	.31

TABLE 18

AVERAGE TASK PROFICIENCY[1] BEFORE AND AFTER
GUNNERY TRAINING FOR CREWMEN TESTED BOTH TIMES

POSITION	TEST PERIOD	N	PRE-OP CHECKS	WPNS MTN	TAC OPNS	TOTAL H-O	N	TOTAL WRTN	N	TOTAL TEST
Tk Cmdr	Before	27	.96	.97	.96	.96	15	.39	28	.80
	After		.88	.91	.85	.87		.46		.66
Gunner	Before	18	.83	.80	.90	.85	12	.37	18	.70
	After		.57	.51	.84	.64		.40		.52
Driver	Before	11	.85	N/A	.97	.91	7	.38	11	.74
	After		.63	N/A	.63	.63		.50		.56
Loader	Before	6	.68	.91	.90	.84	3	.40	6	.72
	After		.83	.90	.97	.90		.37		.62

[1]Mean proportion of performance measures passed by task, averaged over soldiers and task areas.

TABLE 19

MEAN PROPORTION OF TASKS PASSED BEFORE
AND AFTER GUNNERY TRAINING FOR CREWMEN TESTED BOTH TIMES

POSITION	TEST PERIOD	N	PRE-OP CHECKS	WPNS MTN	TAC OPNS	TOTAL H-O	N	TOTAL WRTN	N	TOTAL TEST
Tk Cmdr	Before	27	.88	.93	.84	.88	15	.10	28	.49
	After		.64	.77	.71	.71		.11		.41
Gunner	Before	18	.67	.61	.70	.66	12	.06	18	.36
	After		.29	.23	.71	.41		.04		.23
Driver	Before	11	.72	N/A	.87	.79	7	.04	11	.41
	After		.39	N/A	.43	.41		.05		.23
Loader	Before	6	.51	.81	.82	.71	3	.07	6	.39
	After		.62	.57	.82	.67		.05		.36

useful individual skills training took place in the two-week pre-test and training period that preceded regular gunnery training.

Crew Gunnery Performance. Performance of crews in gunnery qualification (Table VIII) comprises the best available criterion of the effectiveness of TCST and subsequent crew gunnery training. Data on Table VIII qualification for the test battalion was less than firm, since the battalion's objective was to continue remedial runs of the table until all crews qualified. Scores available for this report, which include some of the initial reruns of the qualification table, indicate that 22 of 54 tanks, or about 40%, achieved the 1400 points necessary for qualification. The 40% figure may be viewed as a generous estimate of first run Table VIII qualification.

Though the overall levels of both individual (hands-on post-test) and crew (Table VIII) skill suggest less than adequate training, it was assumed that the two would correlate positively; that is, crews with greater individual skill would tend to score higher on Table VIII. Thus, correlations were computed between hands-on subtest performance and Table VIII scores. This was done for tank commanders and gunners only, since they are the more critical crew positions and since so few drivers and loaders took the post-test. The correlations, presented in Table 20, offer no support of a relationship between individual skill proficiency and crew gunnery. In fact, if the coefficients could be considered statistically reliable, they would indicate a general negative relationship between individual skill and crew gunnery proficiency. Worth noting, perhaps, is the row of low positive correlations for gunner target-engagement test performance and Table VIII scores, an array which stands in contrast to the predominance of low negative coefficients. The three "significant" negative correlations are not particularly meaningful since 5% or three of the 60 correlations computed might reasonably be expected to achieve statistical

TABLE 20

CORRELATION OF TANK COMMANDER, GUNNER AND CREW READINESS TEST SCORES WITH TABLE VIII PERFORMANCE

		TABLE VIII				
POSITION	READINESS TEST	MACH. GUN	MAIN GUN	DAY	NIGHT	TOTAL
Tk Cmdr (N=28)	Pre-Op H-O	.06	-.16	-.15	-.02	-.12
	Wpns Prep H-O	-.15	-.28	-.22	-.40[1]	-.36
	Tgt Eng H-O	.11	-.28	-.44[1]	.12	-.22
	Total H-O	.01	-.31	-.37	-.12	-.30
	Total Wrtn	-.01	-.12	-.21	.09	-.09
	Total Test	.00	-.26	-.34	-.02	-.24
Gunner (N=24)	Pre-Op H-O	-.16	.06	-.03	-.13	-.11
	Wpn Prep H-O	.01	-.02	.01	-.23	-.13
	Tgt Eng H-O	.09	.18	.06	.13	.12
	Total H-O	-.02	.09	.01	-.10	-.05
	Total Wrtn	-.15	-.25	-.08	-.43[1]	-.33
	Total Test	-.09	-.04	-.02	-.27	-.19

[1]Statistically significant at the .05 level.

significance by chance. About all that can be said, on balance, is that tank commander and gunner skills, as measured by TCST readiness tests did not reliably correlate with crew gunnery proficiency on Table VIII. It cannot be determined whether this is a result of readiness test or Table VIII unreliability, or of the calculations being based on a biased sample of the battalion's crews; or whether the skills tested in TCST are in fact of no relevance to crew gunnery performance.

Trainee Opinions. The opinions of trainees involved in the pre-test and remedial training phase of the study offer another source of information regarding the merit of TCST as implemented. An 11-item training expectation/opinion (before/after) questionnaire, similar to that used in the previous studies, was administered to trainees. Because of an administrative error, only 93 of the trainees completed both the Training Expectation and Training Opinion questionnaires. The mean expectation response, when taken over the 11 items and 93 respondents, was 3.86, indicating that trainees generally expected the training to be neither particularly good nor particularly bad (3.5 being the middle of the 7-point unfavorable-favorable scale.) Though after training the average opinion of trainees rose to 4.04, the shift in favorability was not significant. Moreover, when averaged over the 11 items, the number of trainees who reported various aspects of the training to be poorer than they expected was greater than the number who shifted in the positive direction (Table 21), although this difference also was statistically unreliable. Taken item by item, only two shifts were statistically significant: one positive, indicating that trainees found that less training time than expected was spent on things they already knew; and, one negative, indicating that more time than expected was spent in the classroom. Overall, the opinion data suggests that trainees found the training to be about what they expected--ordinary.

TABLE 21

MEAN NUMBER OF SHIFTS[1] IN OPINION FROM BEFORE TO AFTER TRAINING

POSITIVE SHIFTS	NEGATIVE SHIFTS	NO CHANGE
31.4	38.0	23.6

[1]Number of trainees, averaged over the 11 items.

Discussion

The outcome of this study suggests that TCST, as conducted, contributed nothing either to the individual proficiency of crewmen or to their ability to function effectively in a crew gunnery exercise. The best overall estimate of crewman proficiency is probably the per cent of hands-on tasks passed in the post-test, a figure averaging about 50%, and ranging from 35% for the gunners tested to 68% for the tank commanders. Such results are not inconsistent with the 40% gunnery qualification observed for the battalion.

That little useful training was conducted is not surprising in light of the trainer, training, and trainee turbulence that existed over the course of the study. The original group of tester/trainers earmarked to conduct TCST were replaced at the last minute by less experienced line-company crewmen because of preemptory battalion support requirements. For similar reasons, apparently, plans for conducting remedial training in the company areas had to be changed during pre-testing, with testers taking on the additional responsibilities of providing on-the-spot remediation. Fluctuations in the trainee sample from one phase of the study to the next severely constrained efforts to collect useful longitudinal data. These difficulties simply aggravated attempts to draw meaningful conclusions from what was, at best, a weak study design for evaluating TCST as an augmentation to battalion gunnery training.

4. Accelerated Tank Crew Replacement Training

In support of the ARTs Group study program, the Fort Knox Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences planned a field experiment to investigate the effects on combat readiness of turbulence among tank crewmen. One of the experimental conditions of the study involved a group of tank crews in which regular gunner and loaders were replaced by non-11E MOS soldiers who were to receive a short accelerated tank gunnery training program. The training of replacement gunners and loaders was to be accomplished using TCST, modified to accomodate constraints implicit in the following scenario:

> NATO and Warsaw Pact forces are engaged in a general war with major land battles being conducted in Western Europe. NATO tank losses have been excessive and the U.S. Army's replacement system for 11E MOS personnel is inadequate. The USAREUR Commander in Chief has established a small armor cadre in the communications zone to train available personnel as tank gunners and loaders. He also directed the divisions to provide for a short "shakedown" training period for incoming replacements prior to commitment to battle. Tank gunnery firing training devices are not available in the theatre of operations.

The constraints governing the modification and delivery of TCST were as follows:

- Tank commanders and drivers would be 11E MOS qualified personnel who had recently completed annual tank gunnery training.
- Non-11E soldiers would meet the physical and mental aptitude requirements of 11Es.
- The non-11E replacements would receive a two-day tank gunnery training program in the communication zone and a one-day training program in the combat zone.
- Tank commanders and drivers would represent an armor cadre in the communications zone and unit personnel in the combat zone.

- Limited tank gunnery training facilities would be available in both the communications and combat zones.
- Tank gunnery Table VIII would be used as the criterion of combat readiness.

These conditions were to guide the trial implementation of TCST, the purpose being to evaluate the modified program in terms of its usefulness in rapidly preparing non-11E soldiers to function effectively in a tank crew.

Approach

Conduct of the study entailed adapting TCST to the training constraints, identifying the trainee group, delivering the training, conducting a Table VIII gunnery qualification run, and administering individual readiness tests.

TCST Modification. Considering the entry level skills of the trainees and the limited training time and resources, it was necessary to limit the scope of TCST to the bare minimum gunner and loader skills essential to successful participation in Table VIII. This was accomplished by first analyzing the content of the Fort Carson Table VIII (Appendix F) and then checking gunner and loader task requirements against the tabulated gunnery engagements (Appendix G). Areas in which the Fort Carson Table VIII differed from that prescribed in FM 17-12 enabled the deletion of some tasks, since the Carson Table VIII did not include: simultaneous engagements, firing from a moving tank, range-card-lay-to-direct-fire, NBC engagements, tank commander main gun firing, IR or flare engagements.

Critical gunner and loader tasks were then organized into functional groups (Appendix H), and the groups or training modules structured to accomodate available assets. Training assets

(Appendix I), the most constrained of which were time and ammunition, dictated that the training be sequenced in terms of task complexity so that simple procedural tasks were learned first, the more skilled tasks next, the interactive aspects of crew tasks last. Also, skill development was to progress from hands-on nonfiring, through "dry" and sub-caliber firing, to live firing. The acquisition of crew gunnery skill was based on intensive practice on the sub-caliber gunnery tables plus one "dry" and one live-fire run of a modified Table VII (See Appendix J). TCST training techniques were to be followed, except that no pre-testing was necessary since the trainees were known to have no previous armor experience; one-on-one performance training was the predominant method, though the loader's track began with some self-paced audio-visual knowledge training (TEC lessons). An overview of the three-day program is given in Figure 1.

Trainees. Twenty-two soldiers with Primary MOS other than 11E were identified at Fort Carson for participation in the study as replacement tank gunners and loaders. The range of MOS represented is shown in Table 22. The trainees were typically E-3s and E-4s with slightly less than 2 1/2 years of service and an average age of about 21 years (Table 23).

Trainers. Eleven experienced tank commander-driver pairs were designated as trainers of the gunner and loader replacements. All had just completed their annual gunnery training and were selected for participation in this part of the turbulence experiment because they had since lost their gunner or loader (or both) for various administrative reasons. No time was provided for training the tank commanders and drivers in how to conduct the training, so they proceeded, under supervision of the three-man research team, using the prepared materials, procedures and schedules the best they could.

GUNNER TRACK

DAY 1

HANDS-ON PROCEDURES TRNG

TASK	HOURS DAY	HOURS NGT
. Operate turret	2	1/2
. Prepare-to-fire procedures	3	1
. Misfire procedures	1	1/2

LOADER TRACK

TEC & HANDS-ON PROCEDURES TRNG

TASK	HOURS DAY	HOURS NGT
. Ammo handling	2 1/2	1/2
. Prepare for Opns	1/2	0
. Coaxial machinegun	2	1/2
. Prepare-to-fire procedures	1/2	1/2
. Misfire procedures	1/2	1/2

COMBINED TRACK

DAY 1

DAY AND LIVE FIRE TABLES I & II

TASK	HOURS DAY	HOURS NGT
. Respond to fire commands	1	1
. Respond to subsequent fire commands	1	1

DAY 2

DRY AND LIVE FIRE TABLES III, VI & COAX

TASK	HOURS DAY	HOURS NGT
. Respond to fire commands	6	3
. Respond to subsequent fire commands	2	1

DAY 3

ZERO WEAPONS AND DRY AND LIVE FIRE TABLES VII

TASK	HOURS DAY	HOURS NGT
. Respond to fire commands	6	3
. Respond to subsequent fire commands	2	1

Figure 1. Overview of three-day TCST accelerated gunner/loader replacement training.

TABLE 22

DISTRIBUTION OF MOS
FOR TCST REPLACEMENT TRAINEES

PMOS	TITLE	FREQUENCY GUNNER	LOADER
00U	Race Relations Specialist	1	
05E	Voice Radio Operator	1	1
11B	Infantryman	2	1
36K	Tactical Wire Opns Specialist	1	1
63B	Wheel Vehicle Mechanic	1	
63C	Track Vehicle Mechanic		1
71L	Administrative Specialist	1	1
72E	Telecommo. Center Specialist		1
76Y	Unit Organization Surveyman	1	
94B	Food Service Specialist	1	2
95B	Military Policeman	2	2
95C	Corrections Specialist		1

TABLE 23

BACKGROUND CHARACTERISTICS
OF TCST REPLACEMENT TRAINEES

POSITION	NUMBER OF TRAINEES	GRADE (MEDIAN)	MONTHS SERVICE (MEAN)	AGE (MEAN)
Loader	11	E-3	22.8	21.4
Gunner	11	E-4	31.6	20.9

Training Procedure. Three replications of the three-day program were conducted, with eight replacements trained to fill out four crews in each of the first two replications, and the remaining six to fill out three crews in the final run of the program. The training thus spanned nine days in preparing 11 crews for qualification firing. At the beginning of the first day, the replacement trainees were assembled and two were assigned to each tank commander. After providing a brief orientation on the M60A1 tank, the tank commander designated which trainee would be the gunner and which the loader. Individual training then began, with the tank commander working with gunner, and the driver with the loader. Non-firing procedure training for the gunners was done on the tanks; for loaders some was done on the tanks and some in a weapons storage shed using TEC lessons for ammunition handling and dismounted coaxial machineguns for assembly/disassembly. After approximately six hours of procedures training, each pair of trainers brought their trainees together to begin coordinated crew practice in "dry" fire responses to fire commands. Training progressed as outlined in Figure 1 through the second day. At the end of the second day gunner and loader trainees were told that they had completed the two-day "communications zone" training program and would now be sent to a tank unit in the "combat zone." The tank commanders and drivers were commended for their efforts as a "rear area" armor training cadre. They were then redesignated as tank commanders and drivers of a tank company in the "combat zone" and alerted to receive gunner and loader replacements. Upon receiving replacements, they would have one day for "shakedown" training before being committed to "combat." At this time gunner and loader trainee teams were restructured and assigned to a new tank commander-driver team. The third day of "combat zone" training consisted of zeroing weapons and then firing Table VII, first "dry" and then live.

This training procedure was followed in each of the three replications of the three-day program.

Qualification Firing and Readiness Testing. On completing accelerated replacement training the crews fired Table VIII for qualification, after which replacement gunners and loaders were given the TCST readiness tests appropriate to their position. Readiness testing was done as part of the post-testing described in the previous study.

Results

Results of the training study are given in terms of crew performance on Table VIII, individual skill acquisition as measured by the readiness tests, and trainee reaction to the program.

Table VIII Performance. Ten of the 11 crews completed Table VIII. Scores ranged from a low of 481 to a high of 1480, with an average of 1145. Three crews fired above the 1400 minimum for qualification. Table VIII performance is summarized in Table 24 along with comparable scores from a group of intact crews who fired the same Table VIII in the same time period and under the same conditions.[1] The 11 intact crews averaged 1135 points which is essentially the same as that achieved by the crews with non-11E replacement gunners and loaders. Though both groups qualified the same number of crews (three), it should be noted that all of the intact crews completed the gunnery table, whereas one of the crews with replacements did not. An interesting trend shown in Table 24 was that the crews with replacements fired better during the day than at night. According to gunnery lore, apparently, it is considered easier to hit targets at night, at least under conditions of white light. The intact crews did fire better at night than during the day, though the difference was not statistically significant. The

[1]A more detailed account of the comparitive performance of crews involved in the turbulence study is given in: Eaton, Newell K. and Neff, Janet F. The Effects of Tank Crew Turbulence on Tank Gunnery Performance, Army Research Institute, Draft Technical Paper, June 1978.

TABLE 24

AVERAGE TABLE VIII SCORES FOR CREWS
WITH NON-11E REPLACEMENTS AND FOR INTACT CREWS

TYPE CREWS	NUMBER	DAY MNGN	DAY MHGN	DAY TOTAL[1]	NIGHT MNGN	NIGHT MHGN	NIGHT TOTAL[1]	TOTAL MNGN	TOTAL MHGN	TOTAL[1]
Replacements	10	401	166	582	388	153	563	788	319	1145
Intact	11	329	156	510	435	165	625	764	321	1135

[1]Includes additional points for driving.

relative difference in day versus night performance for the two types of crews was not statistically significant either.

Readiness Test Performance. Performance of the replacement crewmen on the post-Table VIII readiness tests is shown in Tables 25 and 26 along with corresponding scores for regular gunners and loaders who had participated in the annual battalion gunnery training program. Using hands-on performance as the best overall indication of individual skill achievement, replacement gunners averaged 16% of the tasks and 30% of all performance measures, or slightly less than half the proficiency of regular tank gunners; loader replacements averaged 52% "GO" on the tasks and 65% of the performance measures, or about 75% - 80% as proficient as regular loaders. Individual proficiency was, as expected, even lower in areas where little or no training was given. Gunners, especially, were immersed in gunnery or target engagement training (Tactical Operations) from the start, and thus were given little practice on tasks in the areas of Pre-Operations Checks or Weapons Preparation. Loaders, who received relatively more training in the Pre-Operations and Weapons Maintenance, tended to do better in these areas on the readiness tests.

Readiness test sub-totals, when correlated with crew Table VIII scores, reveal little in the way of systematic data regarding the contribution of gunner or loader skill attainment to crew gunnery proficiency. Individual proficiency and crew gunnery tended to correlate positively for gunners and negatively for loaders (Table 27). When gunner and loader readiness test scores were combined, an overall low positive correlation with crew gunnery resulted (Table 28). Because of the small number of crewmen involved, none of these correlations--either positive or negative--were

TABLE 25

AVERAGE TASK PROFICIENCY[1] OF REPLACEMENT VERSUS REGULAR GUNNER AND LOADER TRAINEES

POSITION	GROUP (N)	PRE-OP	WPNS	TAC-OP	H-O TOT	WRT TOT	TEST TOT
		READINESS TEST					
Gunner	Rep (11)	.20	.14	.63	.30	.18	.24
	Reg (30)	.54	.52	.81	.64	.36	.50
Loader	Rep (11)	.52	.55	.88	.65	.17	.41
	Reg (21)	.74	.91	.91	.86	.30	.58

[1]Mean proportion of performance measures passed by task, averaged over soldiers and task areas.

TABLE 26

PROPORTION OF TASKS PASSED BY REPLACEMENT VERSUS REGULAR GUNNER AND LOADER TRAINEES

POSITION	GROUP (N)	PRE-OP	WPNS	TAC-OP	H-O TOT	WRT TOT	TEST TOT
		READINESS TEST					
Gunner	Rep (11)	.10	.05	.35	.16	.00	.08
	Reg (30)	.27	.25	.71	.41	.03	.22
Loader	Rep (11)	.40	.52	.65	.52	.02	.27
	Reg (21)	.56	.56	.79	.64	.03	.33

TABLE 27

CORRELATION OF READINESS TEST SCORES AND
TABLE VIII SCORES[1] FOR GUNNER AND LOADER REPLACEMENTS

POSITION	READINESS TEST	TABLE VIII MACH GUN ENGMTS	MAIN GUN ENGMTS	DAY TOTAL	NIGHT TOTAL	TABLE VIII TOTAL
Gunner (N = 10)	H-O Total	.47	.25	.10	.42	.34
	WRT Total	-.26	.14	-.03	.06	.03
	Test Total	.31	.26	.08	.39	.31
Loader (N = 9)	H-O Total	-.27	-.40	-.44	-.26	-.39
	WRT Total	.18	-.56	-.25	-.38	-.39
	Test Total	-.13	-.54	-.44	-.36	-.47

[1]Table VIII scores for the crews in which the replacements served.

TABLE 28

CORRELATION OF READINESS TEST SCORES[1] AND
TABLE VIII SCORES FOR CREWS (N=10) CONTAINING
REPLACEMENT GUNNERS AND LOADERS

READINESS TEST		DAY TOTAL	NIGHT TOTAL	TABLE VIII TOTAL
Total H-O		.01	.36	.26
Total WRT		.08	-.13	-.06
Total Test		.05	.25	.20

[1]Gunner and loader scores averaged.

statistically significant. The reason for the difference in the trend of the correlation for gunners and loaders is not clear. Certainly gunner skills are more critical than loader in firing a gunnery table, but this does not explain the tendency toward a negative relationship for the loader. Moreover, the fact that the combined scored (Table 28) produced on balance, a positive relationship reflects only the greater variance in gunner test scores and not the relative importance of the two positions to crew gunnery.

Trainee Opinions. The pre-post training opinion questionnaire used in the previous study was not used here since those questions were couched in terms of comparisons of TCST and other armor training programs--comparisons the non-11E soldiers could not make validly. Thus, in an effort to get some indication of trainee reactions to the program without taking much time, a brief three-item questionnaire was administered before and after training. The pre [post] questions, each of which presented a five-point response scale, pertained to: (1) Whether they thought [found] that learning to fire a tank would be very easy ... very difficult, (2) whether they thought they would be able to [can] fire a tank very well ... not very well, (3) whether they thought [found] that learning to fire a tank would be [was] very interesting ... boring. Shifts in response from before to after training were generally favorable, though not significantly so. Trainees found that firing a tank was somewhat easier (mean of 2.5 on a five-point scale) than they thought it would be (3.1) before training. They also reported that they thought they were slightly better at it (2.1) than they thought they would be (2.6). Overall, they expected it to be very interesting (1.4) from the outset and, indeed, found it to be (1.4) when they had completed the program.

Discussion

The outcome of this trial run of a modified TCST program for replacement gunners and loaders was successful. The training was well received by the participants and, though individual skill attainment was only moderate, achievement in critical tasks apparently was sufficient to enable trainees to function effectively in crew gunnery exercises. When viewed relatively, crew performance was quite good overall; in terms of average score on Table VIII and number of tanks qualified, crews with replacement gunners and loaders did as well as experienced intact crews. On an absolute basis, however, neither group can be considered really well trained. A qualification figure of 27% falls considerably short of what would be termed combat ready for either group.

Two additional points relevant to the outcome of this study should be mentioned. The first pertains to the intensive schedule with which training was conducted. No more than four pairs of replacement trainees were handled during a three-day training period, each spending 12 hours a day under the tutelage of a two-man team of trainers (tank commander and driver) who in turn had nearly full-time access to a member of the training research staff. The second point pertains to the high level of motivation that prevailed throughout the course of the training. All personnel--trainees, trainers, and supervising research staff alike--were quite obviously committed to success of the experimental program. This was due in part to the novelty and challenge of the task before them, and in part to a very real concern for the danger inherent in allowing novice crewmen to participate in a live fire gunner exercise. It is likely that the intensity and commitment with which the program was carried out had as much to do with its success as did its substance and design.

5. Accelerated Tank Crew Refresher Training

This trial application of TCST involved extending the accelerated version of the program, as described in the previous study, to the refresher training of experienced tank crews who had had no recent gunnery training. The training evaluation study was modeled from the following scenario:

> A tank company, which is assigned to a tank battalion in the 2nd Armored Division, has been involved in mission support duties for an extended period and has been unable to conduct other than mandatory training. The battalion has just been alerted for emergency deployment in ten days to USAEUR. The company commander has been instructed to prepare his tank crews for deployment. He has 72 hours for refresher training. [In another situation he has 24 hours for refresher training.] The company is limited to three rounds of 105mm HEAT TP-T per crew, but had unlimited access to .50 caliber TELFARE subcaliber devices with appropriate ammunition.

A tank company assigned to support field test activities of the U.S. Army Combat Developments Experimental Command (USACDEC) at Fort Hunter-Liggett, California was available to participate in the gunnery train-up study. One-day and three-day accelerated training programs were tried out, with a newly developed Table VIII serving as the gunnery criterion test. The purpose was to compare the two programs in terms of the relative gunnery proficiency of participating crews. The priority of the one- and three-day training conditions and small number of crews available unfortunately precluded the use of a control condition.

Approach

The study was executed in five phases. First, the gunnery criterion test (Table VIII) was developed and set-up at the study site; then the one- and three-day training programs were prepared; next the trainee groups were established; training was then delivered; and, finally, the crews fired Table VIII.

Gunnery Criterion Test. Since no Table VIII gunnery range was available within reasonable distance of Hunter-Liggett, it was necessary to construct one. Consideration was given to patterning the gunnery table after the one at Fort Carson. But since it was concluded that a comparison of study results from the two sites could not be made validly anyway, a Table VIII was constructed which reflected current changes being incorporated in Armor School revisions to FM 17-12. The principal features of the new table, which grew out of the "Worldwide Tank Gunnery Conference"(WWTGC), differed from that used at Carson, with an increased emphasis on: multiple targets, simultaneous engagements, firing on the move, firing in an NBC environment, and conservation of ammunition. In addition, the scoring standards were more stringent than those for the old Table VIII.

TCST Modification. The approach taken in adapting TCST to the conditions and constraints of the training situation was much the same as that described earlier for the replacement training adaptation, except in this case analysis and revision was done for all four crew positions. First the content of the new Table VIII was analyzed (Appendix K) and crewman task requirements were checked against the tabulated gunnery engagements. This led to the addition of tasks pertaining to those new features of the WWTGC Table VIII mentioned above. Also a few basic tasks such as "Operate Intercom" or "Place Turret Into Power Operation" were deleted, since the training was targeted on experienced crewmen. The resulting tasks were organized into functional groups (Appendix L) and the groups or training modules structured to accomodate available assets (Appendix M). The principles followed in doing this were the same as described in the previous study: training progressed from individual to crew, from simple to complex, and from hands-on non-firing through "dry" sub-caliber firing, to live firing. The individual readiness tests were used as pre-tests to diagnose each crewman's training needs. Pre-testing, individual remedial training, and crew exercises were much the same in form and content for both one- and three-day programs, the former being chiefly a condensed version of the latter. The two programs are summarized in Appendix N.

Trainees. Sixteen crews from an Armor Company assigned to USACDEC at Fort Hunter-Liggett participated in the training study. In their continuing support of field experiments, the company had not been involved in tank crew gunnery operations for the previous three years. Participation in Table IV a year ago was the only gunnery training the company had received. The crews were divided into two "equivalent" groups of eight on the basis of the tank commanders' scores on the written portion of their readiness test. One group of eight crews was then assigned to the three-day program, and the other group to the one-day program.

Training Procedure. The training and testing was conducted in two replications over two weeks. The company commander selected four of the one-day and four of the three-day crews for training and qualification firing the first week; the remaining two sub-groups of four completed the program the second week. Within each week crews in the one-day group received their day of training on the last day of the three-day program, so that the time from completion of training to Table VIII firing was the same for all crews.

Training was carried out (at least during the second week) as outlined in Appendix N. Members of the research team, including three experienced and trained armor NCOs from Fort Knox, pre-tested and provided remedial training for the tank commanders. The remaining pre-testing and training within the crews was conducted by the tank commanders under supervision of the research staff.

Training went as scheduled during the second week. The first week, however, was plagued with delays caused by difficulty in getting TELFARE devices to operate, equipment breakdowns, and recurring range fires caused by tracer ammunition. The delays were so extreme that little if any training was completed in the three-day group before their third and last day. During the third day of the first week, training proceeded reasonably well for the one-day group, with all four tank commanders being certified on their individual tasks and their crews completing Table VIIC and firing the three service rounds; crews in the three-day group also managed to complete Table VIIC and fire their service rounds. As mentioned, the training went smoothly for the two groups in the second replication.

Qualification Firing. In each week, on the day following completion of training, crews from the one- and three-day programs alternated in firing Table VIII qualification. All runs of the qualification table were carried out using separate set of tanks that had been zeroed by company personnel not participating in the study. Table VIII firing was hampered throughout by range fires and dust which made it difficult for crews to sense rounds. Moreover, night firing in the second week was carried out with severely restricted visibility caused by weather conditions retaining the smoke from the day's firing, which diffused illumination and made targets difficult to detect.

Following Table VIII it was intended that each crewman be administered an individual skills post-test. Scheduling mix-ups and loss of equipment to preemptive support activities prevented post-testing both weeks.

Results

Crew Gunnery Performance. Table VIII results for the 16 crews are given in Tables 29-31. Overall, only three of the 16 crews achieved the 70% (seven of ten "engagements"[1] successfully fired) minimum score for qualification. Of the three qualifying crews, one was from the three-day group and two were from the one-day; all were from the first week of training (Table 29). When scored in terms of the percent of total engagements successfully fired (Table 31), the average for all crews was 37%. Crews in the one-day group averaged 40%, as compared to 35% for those in the three-day group. Those participating in the first replication (Week 1) averaged 44%, and those in the second week, 31%. The one-day group did better than the three-day in the first week, but the three-day group did better than the one-day in the second week. None of these differences in performance are statistically significant, chiefly because of the few crews involved.

Trainee Opinions. Most of the trainee opinion data was lost, since the post-training questionnaire was to be given along with the readiness tests. Some of the trainees from the first week did, however, complete both the expectation and opinion (before and after) questionnaires. The nine trainees from the one-day group began with training expectations that were slightly more positive than neutral (4.6), but indicated afterwards (4.1) that the training was not quite as good as anticipated. A similar negative but statistically insignificant shift (4.9 to 4.4) occurred among the nine trainees responding in the three-day group.

Discussion

As if the small number of crews and limited time frame were not sufficiently constraining, the study was troubled throughout with

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[1]Nine actual engagements plus ammunition conservation.

TABLE 29

RELATIVE NUMBER OF CREWS QUALIFYING ON
TABLE VIII BY TRAINING GROUP AND TRAINING WEEK

TRAINING WEEK	TRAINING GROUP 3-DAY	1-DAY	TOTAL
1	1/4	2/4	3/8
2	0/4	0/4	0/8
TOTAL	1/8	2/8	3/16

TABLE 30

AVERAGE NUMBER OF TABLE VIII ENGAGEMENTS[1] SUCCESSFULLY
FIRED BY TRAINING GROUP AND TRAINING WEEK

TRAINING WEEK	TRAINING GROUP (N)[2]	3-DAY	(N)	1-DAY	(N)	TOTAL
1	(4)	3.25	(4)	4.75	(8)	4.0
2	(4)	3.0	(4)	2.5	(8)	2.75
TOTAL	(8)	3.125	(8)	3.625	(16)	3.375

[1]A total of nine engagements, six day and three night, were contained in Table VIII.

[2](N) = number of crews.

TABLE 31

PROPORTION OF TABLE VIII ENGAGEMENTS[1] SUCCESSFULLY FIRED DURING THE DAY AND NIGHT BY TRAINING GROUP AND WEEK

TRAINING GROUP	TRAINING WEEK	TABLE VIII DAY	NIGHT	TOTAL
3-DAY	1	.333	.417	.361
	2	.458	.083	.333
1-DAY	1	.583	.417	.528
	2	.333	.167	.278
	TOTAL	.427	.271	.375

[1]A total of nine engagements, six day and three night, were contained in Table VIII.

problems of equipment, weather, and scheduling. To begin with, there was some question as to whether the matching of groups in terms of tank commander knowledge test scores actually produced two sets of crews equivalent in experience and training readiness. Informally, the company commander revealed that the one-day training group probably had better crews to start with; and across both groups, those assigned to the first week were probably better than those in the second. Background data offered some support for those speculations, in that the three-day group had slightly fewer months of tank experience than the one-day group (12 versus 14), and crews in the second week fewer than crews in the first week (9 versus 15). The extent of this effect, unfortunately, cannot even be estimated, since very little training was accomplished the first week in the three-day program, and night firing criterion scores, expecially during the second week, were severely degraded by prevailing weather and smoke conditions. With these confounded effects, it is difficult if not impossible to draw conclusions about the merit of the training or the relative merit of the one- and three-day programs. Looking just at performance of the second week's crews, where training went as planned, the three-day group did better than the one-day, but no crews qualified and the difference in per cent of engagements successfully fired is too small to warrant serious interpretation.

In the face of these considerations no conclusion can be drawn or even intelligent speculation made regarding the adequacy of one day or three days of TCST for refresher training of experienced tank crews.

CONCLUSIONS AND IMPLICATIONS

Design and conduct of the five trial applications of TCST reported here were fraught with shortcomings. Limited planning time and resources and the urgency of on-going training schedules precluded the kind of controlled intervention one strives for in program evaluation. The forms of training being studied were not designed as systematic variants of TCST; trainees were often identified on the basis of availability rather than suitability; those who delivered the training differed from study to study in background, motivation, and familiarity with the program; of those who administered the readiness tests, some were well trained and some were not, and some were more closely involved with the performance of trainees than others; live-fire criterion tests were not comparable from study to study. In short, study objectives, training procedures, and evaluation criteria accomodated the physical and personnel resources available in each case. Moreover, some data were not collected that should have been, other data were incomplete, missing, or unusable. That is much the nature of field studies.

Despite these shortcomings, some conclusions and implications are warranted. Some are based on data collected and others on informal observations or "lessons learned." They are presented under the headings of training need, training results, the training program, and training implementation.

Training Need. There is no doubt about the need for some kind of TCST to be used in preparing combat ready tank crews. Results of the training trials reported here indicate that despite the training no group of crews--experienced or inexperienced, with or without recent gunnery training--demonstrated a level of crew gunnery proficiency that could be interpreted as combat ready. Qualification rates were from about 20% to 40%; even using the more liberal measure of percent of engagements successfully fired, group performance did not range beyond 60%. The need for training to rapidly produce and maintain tank gunnery proficiency is clear.

Training Results. The success of TCST in the five trial settings was modest. Two of the five studies produced what could be considered positive results. In one, the Training Center Active and Reserve Mobilization Train-up, TCST in comparison with two other programs produced reasonable evidence of its superiority, though no gunnery criterion test was included. In the other, the Accelerated Tank Crew Replacement Training study, TCST was used successfully in quickly preparing non-11E soldiers to fill in as gunners and loaders in a gunnery qualification test, a test in which their crews performed as well as experienced intact crews. Results of the remaining three trial implementations were inconclusive at best.

The Training Program. TCST is still in need of further development and evaluation. But it's principal design features are sound and are to be recommended for any such tank crewman skills training program:

- Individual readiness training should be individualized. Since there is considerable variation in the entry level skills of trainees, it is important that each block of training be adapted to the needs of the individual. This should be diagnosed by pretesting on all skills unless trainees are known to be totally naive.
- Individual readiness training should be performance based. All training, whether knowledge or hands-on, individual or crew, should begin with a pretest to determine what the individual or crew can and can't do. Even more importantly, an individual/crew should not be advanced from a module or block of instruction until proficiency has been demonstrated in a post-test.

- <u>Individual readiness training should be instructor managed</u>. Self-instruction to the point of self-management is not recommended. This does not imply the need for complete one-on-one training, but it does imply at a minimum that individual entry skill-level be tested by an instructor, who then assigns trainee learning activities, periodically monitors progress, assists as necessary, and signs-off on criterion performance.

- <u>Individual readiness training should be closely tied to crew training requirements</u>. Individual skill requirements should be carefully derived from crew skill requirements which, in turn, should be derived from unit performance criteria, <u>viz</u>., Tables VIII and IX and ARTEP.

- <u>Individual readiness training should rapidly progress to crew readiness training</u>. Trainees should begin team exercises (two-man, three-man and full crew) just as soon as minimum qualification on individual skills is achieved. This is especially important when training time is short.

- <u>Maximum use should be made of dry and sub-caliber firing exercises</u>. Though the adequacy of substitutes for service firing is not yet well documented, ammunition costs discourage frequent live-fire exercises. And since repeated intensive gunnery drills are necessary to achieve proficiency, the use of dry, sub-caliber, or other simulated forms of gunnery training are recommended.

Additional work on TCST is necessary. Except for the readiness tests, the program in its present form is little more than a detailed outline for training. Many of the training aids, devices and materials recommended have not been developed. Also, variations of the program necessary to accomodate different training conditions and resources need to be more systematically planned and evaluated.

<u>Training Implementation</u>. The most significant implication of the work done to date with TCST pertains to strategies for implementation. The quality of a training program is probably much less

important than the care with which it is implemented or the motivation of the trainers and trainees. This was vividly illustrated in the trial run of TCST as part of an armored battalion's annual gunnery training. A new training package or program simply cannot be handed to trainers and be expected to work. Detailed guidance on how to plan, schedule and deliver this training must be documented, validated and provided along with the program. Training of trainers in both the content of the program and procedures for conducting it is absolutely imperative. And, finally, the undiluted commitment of the commander to the program must be secured. The need for training implementation strategies simply cannot be overemphasized.

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APPENDIXES

APPENDIX A

SYNOPSIS OF THE "RESERVE COMPONENT
TRAINING FOR OPERATING AND MAINTAINING THE M48A5 TANK"

This training was developed in an effort to help meet the needs of Armor and Cavalry National Guard units. Development proceeded in four phases as follows:

1. Priority individual and crew tasks were selected for inclusion in the program by reviewing Army literature and reports of recent research on the criticality, comprehensiveness, and representativeness of Armor tasks.

2. A Crew Interaction Performance Test was developed. It consists of functional groupings of tasks identified as noted in 1, above, and has three modules:

   . Preoperations checks.

   . Weapon systems preparation.

   . Tactical operations.

   Since the Crew Interaction Performance Test contains tasks from Gunnery Table VIII, from the crew drills in TC 17-15-5, and from the Gunnery Skills Test, successful completion of the crew test was expected to be highly predictive of performance on the other tests.

3. Readiness tests were developed for each of the four M48A5 duty positions (Driver, Loader, Gunner, Tank Commander). The individual readiness tests are used in three ways:

   . As pre-tests, they are administered to prospective trainees (AIT graduates) before training begins. The soldier then follows a particular instructional sequence, depending on results of the pre-test.

   . As end-of-course mastery tests, after soldiers complete the instructional sequence dictated by the results of the first administration.

   . Diagnostically throughout training, to identify needs for refresher instruction.

4. Outlines for training modules were written for each duty position. Each module outline contains sections on:

   - Pretraining Conditions: the conditions leading to the need for mastering the contents of the modules; for example, failure to meet the standard on part of a readiness test.
   - Objective: a global statement of the desired behavior and the conditions under which the behavior is to be demonstrated.
   - Method: a brief statement of the stimulus materials and response modes appropriate for mastery of the module.
   - Equipment and materials.
   - Estimated time.
   - Procedure: an outline of a sequence of instructional events leading to mastery of the module.
   - Notes: answers to questions that might arise on reading the outlines.

The content of the individual training portion of the program is summarized in the module and unit listing in Table A.1. Readiness tests and the crew exercise were designed around these same task areas.

TABLE A.1

MODULES AND UNITS FOR INDIVIDUAL CREWMAN TRAINING

DRIVER	LOADER
OPERATIONAL CHECKS AND SERVICES	MISSION PREPARATION (KNOWLEDGE)
TANK PREPARATION AND START-UP	Operational Checks and Services
TARGET ACQUISITION	Ammunition Handling
Target Scanning	Boresighting M219 Machinegun
Locating and Reporting Targets	MISSION PREPARATION (SKILL)
Target Range Determination (Knowledge)	COMBAT LOADING (KNOWLEDGE)
Target Range Determination (Skill)	Selecting Ammunition
Target Recognition	Loading Ammunition
TACTICAL DRIVING I	Misfire and Unloading Procedures
Varied Terrain Driving (Knowledge)	COMBAT LOADING (SKILL)
Varied Terrain Driving (Skill)	Main Gun Loading
TACTICAL DRIVING II	Misfire and Stoppage Procedures
Evasive Driving (Knowledge)	M219 MACHINEGUN MAINTENANCE (KNOWLEDGE)
Target Engagement Driving	Mounting, Loading, Dismounting the Coax
	Clearing, Disassembly and Assembly of Coax
	WEAPONS MAINTENANCE
	REPLENISHER TAPE READING
	TARGET ACQUISITION
	Target Scanning
	Locating and Reporting Targets
	Target Range Determination (Knowledge)
	Target Range Determination (Skill)
	Target Recognition

[continued]

TABLE A.1 (cont'd.)

MODULES AND UNITS FOR INDIVIDUAL CREWMAN TRAINING

GUNNER	TANK COMMANDER
BEFORE OPERATIONS PROCEDURES	BEFORE OPERATIONS PROCEDURES
WEAPON SYSTEMS PREPARATION I	M2 Machinegun Headspace and Timing (Knowledge)
Boresight Weapon Systems (Knowledge)	Before Operations Procedures (Skill)
Boresight Weapon Systems (Skill)	WEAPON SYSTEMS PREPARATION I
WEAPON SYSTEMS PREPARATION II	Boresight Weapon Systems (Knowledge)
Zero Weapon Systems (Knowledge)	Ranging Test
Zero Weapon Systems (Skill)	Boresight Weapon Systems (Skill)
TARGET ACQUISITION	WEAPON SYSTEMS PREPARATION II
Target Scanning	Zero Weapon Systems (Knowledge)
Locating and Reporting Targets	Zero Weapon Systems (Skill)
Target Range Determination (Knowledge)	TARGET ACQUISITION
Target Range Determination (Skill)	Target Scanning
Target Recognition	Locating and Reporting Targets
TACTICAL OPERATIONS	Target Range Determination (Knowledge)
Misfire Procedures (Knowledge)	Target Range Determination (Skill)
Coaxial Machinegun Engagements (Knowledge)	Target Recognition
Target Engagements (Conduct-of-Fire Devices)	TACTICAL OPERATIONS
Target Engagements (Skill)	Initial Fire Commands (Knowledge)
	Machinegun Engagements (Knowledge)
	Target Engagements (Conduct-of-Fire Devices)
	Target Engagements (Skill)

APPENDIX B

TRAINEE ATTITUDE QUESTIONNAIRE

NAME ________________ UNIT ________________ SSN ________________

Training Expectation Questionnaire

INSTRUCTIONS: In the next few days, you will be learning to perform the duties of a tank commander, gunner, driver, or loader. The following have to do with what you expect this training to be like. Please select the one answer that is closest to what you think the training will be like, and circle the letter for that answer. The answers will not be examined individually, therefore please answer each question truthfully.

I. Audio-visual (TEC) lessons.

1. Will the audio-visual lessons be interesting?

   a. Almost always
   b. Usually
   c. Some of the time
   d. Not usually
   e. Almost never

2. Will the audio-visual lessons have any mistakes in how the duties should be performed?

   a. Almost no mistakes
   b. Few mistakes
   c. Some mistakes
   d. Many mistakes
   e. Very many mistakes

3. Will the audio-visual lessons move along at the right pace for you to learn?

   a. Much too fast
   b. Somewhat too fast
   c. About right
   d. Somewhat too slow
   e. Much too slow

4. Will you get a chance to repeat a lesson if you need it?

   a. Almost never
   b. Not very often
   c. Sometimes
   d. Usually
   e. Almost always

5. Will the objective of the lesson (what you are supposed to learn) be explained in advance?

   a. Almost never
   b. Not very often
   c. Sometimes
   d. Usually
   e. Almost always

6. Can you learn from audio-visual lessons just as well as from hands-on practice?

   a. Usually better
   b. Sometimes better
   c. About the same
   d. Sometimes worse
   e. Usually worse

7. Will the lesson post-test give a good picture of what you have learned?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Not very often
   e. Almost never

8. How much will you like the audio-visual lessons?

   a. Very much
   b. Somewhat
   c. A little
   d. Not very much
   e. Not at all

II. Hands-on practice.

1. Will the instructor do a lot of useless talking before you get a chance to try each task?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Not usually
   e. Almost never

2. Will the instructor clearly explain and demonstrate what you are supposed to do to perform each task?

   a. Almost never
   b. Not usually
   c. Sometimes
   d. Usually
   e. Almost always

3. Will the instructor make mistakes in showing you how to perform the tasks?

   a. Almost never
   b. Not usually
   c. Sometimes
   d. Usually
   e. Almost always

4. Will you get enough chances and time to practice each task?

   a. Almost never
   b. Usually not
   c. Sometimes
   d. Usually
   e. Almost always

5. Will the instructor help you out when you need help?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Usually not
   e. Almost never

6. Will you be tested or checked out on a task before you are ready?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Not usually
   e. Almost never

7. Will the performance test show what you have really learned?

   a. Almost never
   b. Not usually
   c. Sometimes
   d. Usually
   e. Almost always

8. Will your instructor be a real expert on tanks?

   a. Very much so
   b. To some extent
   c. A little bit
   d. Not very much
   e. Not at all

9. How well will you know your job on tanks when you are done?

   a. Extremely well
   b. Very well
   c. Somewhat
   d. Not very well
   e. Very poorly

10. How much will you like hands-on training and practice?

   a. Very much
   b. Somewhat
   c. A little
   d. Not very much
   e. Not at all

Training Preference: What tank duty position would you like to train for most?

   a. Tank Commander
   b. Driver
   c. Gunner
   d. Loader

NAME____________________________ UNIT_____________________ SSN________________

Training Opinion Questionnaire

INSTRUCTIONS: In the last few days, you learned to perform the duties of a tank commander, gunner, driver, or loader. The following questions have to do with what you think this training was like. Please select the one answer that is closest to what you think the training was like, and circle the letter for that answer. The answers will not be examined individually, therefore please answer each question truthfully.

I. Audio-visual (TEC) lessons.

1. Were the audio-visual lessons interesting?

   a. Almost always
   b. Usually
   c. Some of the time
   d. Not usually
   e. Almost never

2. Did the audio-visual lessons have any mistakes in how the duties should be performed?

   a. Almost no mistakes
   b. Few mistakes
   c. Some mistakes
   d. Many mistakes
   e. Very many mistakes

3. Did the audio-visual lessons move along at the right pace for you to learn?

   a. Much too fast
   b. Somewhat too fast
   c. About right
   d. Somewhat too slow
   e. Much too slow

4. Did you get a chance to repeat a lesson if you needed it?

   a. Almost never
   b. Not very often
   c. Sometimes
   d. Usually
   e. Almost always

5. Was the objective of the lesson (what you are supposed to learn) explained in advance?

   a. Almost never
   b. Not very often
   c. Sometimes
   d. Usually
   e. Almost always

6. Did you learn from audio-visual lessons just as well as from hands-on practice?

   a. Usually better
   b. Sometimes better
   c. About the same
   d. Sometimes worse
   e. Usually worse

7. Did the lesson post-tests give a good picture of what you learned?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Not very often
   e. Almost never

8. How much did you like the audio-visual lessons?

   a. Very much
   b. Somewhat
   c. A little
   d. Not very much
   e. Not at all

II. Hands-on practice.

1. Did the instructor do a lot of useless talking before you had a chance to try each task?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Not usually
   e. Almost never

2. Did the instructor clearly explain and demonstrate what you are supposed to do to perform each task?

   a. Almost never
   b. Not usually
   c. Sometimes
   d. Usually
   e. Almost always

3. Did the instructor make mistakes in showing you how to perform the tasks?

   a. Almost never
   b. Not usually
   c. Sometimes
   d. Usually
   e. Almost always

4. Did you get enough chances and time to practice each task?

   a. Almost never
   b. Usually not
   c. Sometimes
   d. Usually
   e. Almost always

5. Did the instructor help you out when you needed help?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Usually not
   e. Almost never

6. Were you tested or checked out on a task before you were ready?

   a. Almost always
   b. Usually
   c. Sometimes
   d. Not usually
   e. Almost never

7. Did the performance test show what you really learned?

   a. Almost never
   b. Not usually
   c. Sometimes
   d. Usually
   e. Almost always

8. Was your instructor a real expert on tanks?

   a. Very much so
   b. To some extent
   c. A little bit
   d. Not very much
   e. Not at all

9. How well do you know your job on tanks after this training?

   a. Extremely well
   b. Very well
   c. Somewhat
   d. Not very well
   e. Very poorly

10. How much did you like hands-on training and practice?

   a. Very much
   b. Somewhat
   c. A little
   d. Not very much
   e. Not at all

APPENDIX C

GUIDANCE FOR ADMINISTERING READINESS TESTS

OIC Instructions for
Hands-On Readiness Testing

SET-UP OF TEST SITE

1. Equipment and Scorer Allocation (Requirements for each readiness test are listed in the scorer instructions attached.)

Station A - Gunner's and TC's Readiness Tests A.
Gunner's and TC's Readiness Test C.
Gunner's and TC's Readiness Tests E.
Driver's Readiness Test D.

. 9 tanks and 14 scorers.
. Station A waiting point.

Station B - Driver's Readiness Test B.
Loader's Readiness Test A.2.
Loader's Readiness Test B.2.
Loader's Readiness Test C.2.

. 6 tanks and 9 scorers
. Station B waiting point.

2. Station Set-Up.

Station A -

. 5 tanks with one scorer each positioned close to the starting point of the moving course (tanks and scorers A1 through 5)*

. 4 tanks with two scorers each positioned close to tanks A1 through A5; on level ground and in a location which affords a good field of vision to a boresight target at a range of 1200 meters and ranging targets at various distances from the vehicles. (tanks and scorers A6 through A9)

. Waiting station A with fire barrels located between the groups of tanks.

*Tank A5 should be assigned two scorers.

Station B -

. 3 tanks with two scorers each positioned close to tanks A1 through A5, on level ground and in a location which affords a good field of vision to a boresight target at a range of 1200 meters. (Tanks and scorers B1 through B3).

. 3 tanks with one scorer each positioned near tanks B1 through B3. (Tanks and scorers B4 through B6).

. Waiting station B with fire barrels located between the groups of tanks.

Tanks A1 through A4.

. Prepared for testing in accordance with scorer instructions for Gunner's and TC's Readiness Tests E and Driver's Readiness Test D.

Tank A5.

. Prepared for testing in accordance with scorer instructions for Gunner's and TC's Readiness Tests A, C and F and Driver's Readiness Test D.

Tanks A6 through A9.

. Prepared for testing in accordance with scorer instructions for Gunner's and TC's Readiness Tests A and C.

Tanks B1 through B3.

. Prepared for testing in accordance with scorer instructions for Driver's Readiness Test B, Loader's Readiness Test A.2 and Loader's Readiness Test C.2.

Tanks B4 through B6.

. Prepared for testing in accordance with scorer instructions for Loader's Readiness Tests B.2 and C.2.

CONDUCT OF TESTING

1. Special Instructions for Scorers.

. Instruct the scorers that, although there may be crewmen at their station waiting to be tested, they must conduct the tests according to the following schedule:

. Station A

	Run	Crewmen	Tests
Tank A1	1	Driver 4	Driver's Readiness Test D
		Gunner 1	Gunner's Readiness Test E
	4	Driver 4	None
		Gunner 5	Gunner's Readiness Test E
	7	Driver 3	Driver's Readiness Test D
		Gunner 8	Gunner's Readiness Test E
	10	Driver 3	None
		Gunner 3	Gunner's Readiness Test E

	Run	Crewmen	Tests
Tank A2	2	Driver 6	Driver's Readiness Test D
		Gunner 2	Gunner's Readiness Test E
	5	Driver 6	None
		Gunner 6	Gunner's Readiness Test E
	8	Driver 9	Driver's Readiness Test D
		Gunner 9	Gunner's Readiness Test E
	10	Driver 9	None
		Gunner 4	Gunner's Readiness Test E
Tank A3	2	Driver 7	Driver's Readiness Test D
		TC 2	TC's Readiness Test E
	5	Driver 1	Driver's Readiness Test D
		TC 6	TC's Readiness Test E
	8	Driver 1	None
		TC 8	TC's Readiness Test E
	11	Driver 8	None
		TC 4	TC's Readiness Test E
Tank A4	3	Driver 8	Driver's Readiness Test D
		Gunner 7	Gunner's Readiness Test E
	6	Driver 2	Driver's Readiness Test D
		TC 5	TC's Readiness Test E
	9	Driver 2	None
		TC 9	TC's Readiness Test E
	11	Driver 7	None
		TC 3	TC's Readiness Test E
Tank A5	1	Driver 5	Driver's Readiness Test D
		TC 1	TC's Readiness Test E
	4	Driver 5	None
		TC 7	TC's Readiness Test E

At the completion of this run, move the tank to a position near tanks A6 through A9.

Two tanks will conduct each 45 minute run through the course according to the following time schedule:

Run	From (Minutes after testing started)	To	Tank Numbers
1	0	45	A1&A5
2	10	55	A2&A3
3	20	65	A4
4	70	115	A1&A5
5	80	125	A2&A3
6	90	135	A4
7	120	165	A1
8	130	175	A2&A3
9	140	185	A4
10	190	235	A1&A2
11	200	245	A3&A4

	Hour	Crewmen	Tests
Tank A6	1	Gunner & TC 3	Gunner's & TC's Readiness Tests A
	2	Gunner & TC 3	Gunner's & TC's Readiness Tests C
	3	Gunner & TC 1	Gunner's & TC's Readiness Tests A
	4	Gunner & TC 1	Gunner's & TC's Readiness Tests C
Tank A7	1	Gunner & TC 4	Gunner's & TC's Readiness Tests A
	2	Gunner & TC 4	Gunner's & TC's Readiness Tests C
	3	Gunner & TC 6	Gunner's & TC's Readiness Tests A
	4	Gunner & TC 6	Gunner's & TC's Readiness Tests C
Tank A8	1	Gunner & TC 8	Gunner's & TC's Readiness Tests A
	2	Gunner & TC 8	Gunner's & TC's Readiness Tests C
	3	Gunner & TC 7	Gunner's & TC's Readiness Tests A
	4	Gunner & TC 7	Gunner's & TC's Readiness Tests C
Tank A9	1	Gunner & TC 9	Gunner's & TC's Readiness Tests A
	2	Gunner & TC 9	Gunner's & TC's Readiness Tests C
	3	Gunner & TC 2	Gunner's & TC's Readiness Tests A
	4	Gunner & TC 2	Gunner's & TC's Readiness Tests C
Tank A5	1	Run 1	
	2	Run 4	
	3	Gunner & TC 5	Gunner's & TC's Readiness Tests A
	4	Gunner & TC 5	Gunner's & TC's Readiness Tests C

. Station B

	Hour	Crewmen	Tests
Tank B1	1	Driver & Loader 1	Driver's Readiness Test B & Loader's Readiness Test A.2
	2	Driver & Loader 7	Driver's Readiness Test B & Loader's Readiness Test A.2
	3	Driver & Loader 4	Driver's Readiness Test B & Loader's Readiness Test A.2
	4	Loader 4	Loader's Readiness Test C.2
Tank B2	1	Driver & Loader 2	Driver's Readiness Test B & Loader's Readiness Test A.2
	2	Driver & Loader 8	Driver's Readiness Test B & Loader's Readiness Test A.2
	3	Driver & Loader 5	Driver's Readiness Test B & Loader's Readiness Test A.2
	4	Loader 5	Loader's Readiness Test C.2

	Hour	Crewmen	Tests
Tank B3	1	Driver & Loader 3	Driver's Readiness Test B & Loader's Readiness Test A.2
	2	Driver & Loader 9	Driver's Readiness Test B & Loader's Readiness Test A.2
	3	Driver & Loader 6	Driver's Readiness Test B & Loader's Readiness Test A.2
	4	Loader 6	Loader's Readiness Test C.2
Tank B4	1	Loaders 4 & 7	Loader's Readiness Test B.2
	2	Loader 1	Loader's Readiness Tests B.2 and C.2
	4	Loader 7	Loader's Readiness Test C.2
Tank B5	1	Loader's 5 & 8	Loader's Readiness Test B.2
	2	Loader 2	Loader's Readiness Tests B.2 and C.2
	4	Loader 8	Loader's Readiness Test C.2
Tank B6	1	Loaders 6 & 9	Loader's Readiness Test B.2
	2	Loader 3	Loader's Readiness Tests B.2 & C.2
	4	Loader 9	Loader's Readiness Test C.2

. Scorers will call for crewmembers by number at the waiting point for their station for each rotation.

2. Instructions to Crewmen.

. Brief and number the crews 1 through 9.

. Instruct the crewmembers to report to the stations listed below to begin the test and to rotate as indicated:

		First Station	When Released Rotate to
Driver	1	Tank B1	Waiting point Station A
	2	Tank B2	Waiting point Station A
	3	Tank B3	Waiting point Station A
	4	Tank A1	Waiting point Station B
	5	Tank A5	Waiting point Station B
	6	Tank A2	Waiting point Station B
	7	Tank A3	Waiting point Station B
	8	Tank A4	Waiting point Station B
	9	Waiting Point Station B	

All Drivers return to the waiting point for Station A when released from Station B testing to await a scorer's call for further testing.

		First Station	When Released Rotate to
Loader	1	Tank B1	Tank B4
	2	Tank B2	Tank B5
	3	Tank B3	Tank B6
	4	Tank B4	Waiting point Station B
	5	Tank B5	Waiting point Station B
	6	Tank B6	Waiting point Station B
	7	Waiting point Station B	Tank B4
	8	Waiting point Station B	Tank B5
	9	Waiting point Station B	Tank B6

All Loaders return to the waiting point for Station B when released from testing to await a scorer's call for further testing.

		First Station
Gunner	1	Tank A1
	2	Tank A2
	3	Tank A6
	4	Tank A7
	5	Waiting point Station A
	6	Waiting point Station A
	7	Tank A4
	8	Tank A8
	9	Tank A9

All Gunners return to the waiting point for Station A when released from testing to await a scorer's call for further testing.

		First Station
TC	1	Tank A5
	2	Tank A3
	3	Tank A6
	4	Tank A7
	5	Waiting point Station A
	6	Waiting point Station A
	7	Waiting point Station A
	8	Tank A8
	9	Tank A9

All Tank Commanders return to the waiting point for Station A when released from testing to await a scorer's call for further testing.

3. At the completion of the test, collect all score sheets from the scorers and give them to a representative of the tested company.

GENERAL INSTRUCTION TO SCORER

You have been selected to be a training manager during your unit's annual tank gunnery training program. Your task will be two-fold. Initially, you will score individual crewmembers on a readiness test designed to measure their knowledge and skill in the basic tasks for operation of a tank and its fire control systems. The results of these readiness tests will enable you to diagnose accurately the training status of each crewmember you test and to identify the tasks on which he will need instruction.

Based on your diagnosis of each crewmember's knowledge and skill, you will then select the training modules to use to fulfill the second part of your task, which is to manage his training. The objective of this program is to allow each crewmember to progress to the level of training where he can successfully perform all of the tasks in the readiness tests for his crew position.

As you can see from the job description above, your effectiveness in this program depends on how you score the readiness tests. Attached are scorer guides to assist you to set up and administer the hands-on readiness tests. These alone, however, are not enough to insure your success. The critical nature of these tests demands that all training managers have a clear understanding of the purpose of and the procedures to be used in scoring the tests.

- The readiness tests are <u>diagnostic tests</u>. Therefore, the scorer's role is <u>not</u> to determine if the crewmember passes or fails a given task. The scorer's role in the administration of the readiness tests is to determine which tasks the crewmember absolutely knows and can perform, so that valuable training time is not wasted, and on which tasks the crewmember must train. When the readiness tests are viewed in this manner, the phrase, "close enough for government work," cannot apply. The crewmember either knows and can perform the task in an absolutely correct manner, as opposed to well enough to get by, or he needs additional training in the task. The skill of the training manager is revealed in the accuracy of his detection of training needs.

. The steps in each task in the readiness tests are taken directly from the M60A1 operator's manual. Although some of the tasks can be performed in a different manner, i.e., "shortcuts," it is necessary to require the crewmember to perform each task exactly as given in order to determine if he has absolute mastery of the skill. (This is also an excellent refresher for SQT.)

. In order to fulfill your diagnostic function, you must score the process as well as the product of each readiness task. The difference between process and product scoring is best described by considering the scoring of a tank main gun engagement. If we score the product, result, of the engagement we would determine that a target hit indicates that the crew has mastered the skills required to fire that type of an engagement. If the round missed the target, however, we would determine that the crew needs additional training to fire that type of an engagement, but we would not know which crewmember or members need the training or what training is required. By evaluating the process, i.e., the individual tasks and task steps, of the engagement, we are able to determine which crewmembers need additional training and to prescribe the training required to gain a target hit.

. The readiness tests are designed to allow the crewmember to demonstrate the ability to perform each task correctly rather than tell the scorer how the task is performed. If an individual can tell you how to lift 400 lbs. correctly, you should not be convinced that he can actually lift that weight.

All your actions as a scorer should be guided by two principles:

1. Be sure the test conditions are the same for every soldier.

2. Be sure the standard is applied evenly to every soldier.

If you administer the readiness tests in the manner described above, you will not have any difficulty in determining the training needs of each crewmember. You can then use the training modules to satisfy these needs. The result of your efforts will be reflected in your unit's high qualification scores on Table VIII.

GENERAL TEST PROCEDURES

1. Insure that the test site is properly set up and you have all the conditions and equipment specified in the scorer's instructions for the test you are going to administer.

2. Record the name, tank number, and crew position of the person you are testing on the scoresheet.

3. Read the test requirement to the crewmember and have him restate the requirement to you.

4. Evaluate and mark every task step as it is completed.

5. Assist the crewmember ONLY if (a) assistance is specified in the scorer's instructions or (b) he is doing something that endangers the equipment or himself.

6. DO NOT answer any questions about how to perform a task.

7. Answer questions about which tasks to perform by rereading the instructions or an appropriate portion of them.

8. If a crewmember stops during the test because he forgets what to do, tell him to do the best he can and do not stop the test or time.

9. If a distraction occurs during the test, record the point where it occurs and continue to score the test as if there had been no distraction. If the crewmember fails the test, determine if the distraction was the cause of his failure and decide whether to retest him.

10. At the completion of the test, record in the COMMENTS section all information which will help to determine the remedial training required.

11. Conduct or schedule remedial training.

12. Set up the station for the next test.

SCORER INSTRUCTIONS

TANK COMMANDER'S AND GUNNER'S READINESS TESTS, PART A

PERSONNEL.

Two scorers, one gunner and one tank commander.

PREPARATION.

Insure that the following equipment and conditions are present at the test site.

1. M60A1 with BII.
   - On level ground.
   - Master Battery switch ON.
   - M85 mounted.
   - Gas Particulate Filter switch ON.
   - Turret power OFF.
2. Protective mask for each crew member (may be specified as part of the uniform).
3. One belt of dummy caliber .50 ammunition.
4. Cleaning and lubricating equipment, small arms.
5. Stop watch.

SEQUENCE OF TASKS.

The tasks should be performed in the sequence listed below:

1. Gunner - 1, 2, 3
2. Tank Commander - 1, 3, 2, 4, 5, 6, 7, 8

SCENARIO.

1. The tank commander and gunner will be tested simultaneously.
2. The gunner will perform task 2 while waiting for his M3 heater to warm.
3. The tank commander will perform task 3 while waiting for his M3 heater to warm.
4. The tank commander and gunner will perform the prepare-to-fire checks together at the tank commander's command.

SCORER POSITIONS AND INSTRUCTIONS.

1. Gunner's Scorer.

   . Position - loader's station.

   . Instructions:

      a. Check the tank and surrounding area for the gunner's traverse on his request.

      b. Check the replenisher tape at the beginning of task 2.

      c. Insert the firing circuit tester at the appropriate time in task 2.

      d. Report "DRIVER READY" and "LOADER READY" on the TC's command to REPORT.

      e. Conduct remedial training according to module G1 as required.

2. Tank Commander's Scorer.

   . Positions:

Task Number	Position
1, 3, 2	Top of Turret
4, 5, 6, 7, 8	Loader's Station

   . Instructions:

      a. Insure that the tank commander disassembles and assembles the M85 within 10 minutes each.

SCORER INSTRUCTIONS

GUNNER'S AND TANK COMMANDER'S READINESS TESTS, PART C

PERSONNEL.

Two scorers, one gunner and one tank commander (if live zeroing is not conducted, an assistant instructor is required down range to place shot group discs over the zero panels.)

PREPARATION.

Insure that the following equipment and conditions are present at the test site:

1. M60A1 with BII.
   - . On level ground.
   - . Firing mechanism removed.
   - . Black thread over witness lines on muzzle of main gun.
   - . Binoculars.
   - . Master Battery switch ON.

2. Targets
   - . Boresight and zero panel (main gun) 1200 meters.
   - . Zero panel M219 800 meters.
   - . Boresight and zero panel (M85) 500 meters.
   - . Ranging target, greater than 1200 meters range.

3. Ammunition
   - . Dummy 105mm ammunition, APDS (if live firing is not conducted.)

4. Shot group discs to represent target hits if live fire is not used.

5. Opaque material with a 3/4 inch hole in line with infrared body.

SEQUENCE OF TASKS.

The gunner and tank commander will be tested simultaneously. Tasks which require interaction between crewmen are indicated by an asterisk (*). Tasks houls be performed in the sequence indicated below:

1. Gunner - 4*, 1, 2, 3, 5, 6*, 7, 8, 12*, 13*

   Tank Commander - 1*, 2, 3*, 4, 7, 8*, 9*, 10

   Interaction - Gunner - 4, 6, 12, 13,
   Tank Commander - 1, 3, 8, 9

SCENARIO.

TC - Performs task 1.

GUNNER - At the completion of TC task 1, performs tasks 4, 1, 2, 3 and 5 in order

TC - At the completion of Gunner task 4, performs task 2.

TC - Performs task 3 and informs Gunner that computer switch is OFF.

GUNNER - Performs tasks 6, 7 and 8.

TC - While gunner is performing tasks 6, 7 and 8, performs tasks 4 and 7.

GUNNER/TC - When both crewmen have completed the tasks above, Gunner and Tank Commander perform Gunner task 12 and Tank Commander task 8 together.

GUNNER/TC - Perform Gunner task 13 and Tank Commander task 9 together.

TC - Perform task 10.

SCORER POSITIONS AND INSTRUCTIONS.

1. Gunner's scorer.

. Positions:

Task Number	Position
1,2,3,4,5,6,7,8, 11,12,13	Loader's station

. Instructions:

a. Stand behind main gun as required to observe task 4 (check azimuth indicator).

b. Perform the role of the loader as requested in task 1.

c. Check appropriate sight picture at the completion of tasks 2, 6, 7, and 8.

d. Ask the gunner the elevation quadrant reading during task 5 and check the quadrant to verify the accuracy of his response.

e. Check lay of gun in task 12 prior to the Gunner traversing back to the target aiming point.

f. Act as the Loader in tasks 11 and 13.

g. Check the infinity sight lay prior to the Gunner firing a check burst.

h. Load main gun in task 12 if required.

2. Tank Commander's scorer.

. Positions:

Task Number	Position
1,2,3,4,7,8,9,10	Top of turret

. Instructions:

a. At the completion of task 2, check the coincidence reticle.

b. Check target range in task 3.

c. Check rangefinder reticle at the completion of task 4.

d. Check M85 and sight reticle alinement on boresight target at the appropriate time in task 7.

e. If required, control the assistant instructor at the appropriate times to place simulated shot group panels on the zero targets for main gun, coax and M85 zero firing simulations.

SCORER INSTRUCTIONS

DRIVER'S READINESS TEST, PART D AND GUNNER'S READINESS TEST, PART E

PERSONNEL.

One scorer, one driver and one gunner. Take the loader, if he has passed Loader's Readiness Test Parts B.1 and B.2. He can practice loading the main gun and acquiring targets.

PREPARATION.

These tests require the following equipment and conditions:

1. Fully operational M60A1 with BII.
2. Tactical driving course including:
   - . Vertical Obstacle - Approximately 30" high, but no higher than 36".
   - . Ditch - Six to eight feet wide, but no wider than eight feet.
   - . Steep Grade - Ideally 50% to 60%, but no more than 60%. (If a 50% to 60% grade is not available, a grade steep enough to allow the tank to descend forward with the transmission in reverse at idle speed can be used to simulate.)
   - . Water Obstacle - Three to four feet deep, but no deeper than four feet.
3. Targets:
   - . 2 SABOT Targets, one of which is moving.
   - . 1 HEP Target.
   - . 1 set of coax targets (silhouettes).
   - . Moving target for driver to observe during misfire procedure.
4. Stop watch.
5. One dummy 105mm round (If loader is included, 2 SABOT and 2 HEP).

SEQUENCE OF TASKS.

The course should be arranged so that the obstacles are encountered between target engagements.

SCENARIO.

A specific scenario should be developed to suit the terrain available. A sample scenario is given below:

- . Tank moves out on course.
- . Driver ascends a steep grade.
- . TC (scorer) instructs driver to assume a hull defilade overwatch position in the vicinity of the hill top.
- . Gunner detects a stationary tank within battlesight range.
- . TC issues fire command.
- . Driver descends a steep grade.
- . Driver drives through a water obstacle.
- . Driver detects a group of troops in the open.
- . TC issues fire command.
- . Driver drives through a ditch.
- . TC issues a fire command to engage a moving tank.
- . Driver crosses a vertical obstacle.
- . Crewmember (Driver or Gunner) detects anti-tank target.
- . TC issues fire command.
- . TC informs gunner of misfire.

SCORER POSITIONS AND INSTRUCTIONS.

1. The scorer will conduct the readiness test from the TC's position.

2. Instructions:

   a. At some point, have the driver conduct missle evasion driving.

   b. If no loader is present, scorer assumes loader's duties.

   c. Announce misfire during one of the main gun engagements.

   d. Verify sight picture through the rangefinder each time the gunner announces ON THE WAY.

   e. Evaluate gunner's area coverage of coax target. Issue directions as required to gain full area coverage.

   f. Time each engagement from announcement of target descriptions until a correct sight picture is obtained. Gunner must obtain a correct sight picture within 10 seconds

g. Control which crewmember detects targets by turret orientation.

h. If the loader is present, instruct him to indicate target detection by pointing, and to perform all other loader duties in the normal manner.

i. Score driver and gunner in accordance with standards in "SCORING" portion of readiness tests.

j. Conduct remedial training as required according to modules D-4.1, D-4.2, G-5.1, G-5.2, G-5.3, and G-5.4.

SCORER INSTRUCTIONS

DRIVER'S READINESS TEST, PART B
AND LOADER'S READINESS TEST, PART A.2

PERSONNEL.

Two scorers, one driver and one loader.

PREPARATION.

Insure that the following equipment and conditions are present at the test site.

1. M60A1 with BII.

   . On level ground.
   . One track loose.
   . M27 periscope dirty.
   . Driver's and Loader's protective masks. (May be prescribed as part of the uniform.)
   . All ammunition storage areas blocked except:

      7 slots in ready rack.
      1 slot in tubular storage rack.
      1 slot in bustle.

   Empty slots should correspond to ammunition stowage plan and types of dummy rounds.
   . Tools necessary for track adjustment.
   . Binoculars.
   . Coax mounted.
   . Ammunition stowage plan.
   . Tanker bar.
   . Intercom operational and 3 operational CVC helmets.
   . DA Form 2404.

2. Boresight target. (1200 meters.)

3. Dummy 105mm rounds: (Same configuration, color, markings, weight and weight distribution as an actual round.)

   . 3 APDS
   . 3 HEP
   . 2 HEAT
   . 1 APERS

4. Block of wood, 1" thick by 6" square.

5. Ruler.

6. Black thread.

7. Tape.

SEQUENCE OF TASKS.

The driver and loader will be tested simultaneously. Tasks which require interaction between crewmen are indicated below by an asterisk (*). Tasks should be performed in the sequence indicated below:

1. Driver - 1, 2, 6*, 7*, 8*, 9*, 3, 4, 5*, 10*
2. Loader - 1*, 2*, 3, 4*, 9*, 5, 6, 7, 8
3. Interaction - Driver 6 & 7   8 & 9   5   10
   Loader   1   2   4   9

SCENARIO.

DRIVER - Enters driver's station and performs tasks 1 and 2.

LOADER - Begins task 1. Tells driver to start engine at the appropriate point in task 1.

DRIVER - When requested by loader, performs tasks 6 and 7.

LOADER - Performs task 2.

DRIVER - Upon instructions from loader, performs tasks 8 and 9.

LOADER - Performs task 3.

DRIVER - When loader is finished positioning tank, performs task 3 and 4.

LOADER - At the completion of task 3, enters loader's station, turns on radio and connects CVC.

DRIVER - When completed task 4, connects CVC and performs task 5.

LOADER - When instructed by driver on intercom, performs task 4.

DRIVER/
LOADER - Performs tasks Driver 10 and Loader 9 on the TC's (scorer's) command, "PREPARE-TO-FIRE."

LOADER - Performs tasks 5, 6, 7 and 8 in order.

DRIVER - Assists in Loader task 8 by handing dummy rounds from the ground to his scorer on the tank as requested.

SCORER POSITIONS AND INSTRUCTIONS.

1. Driver's Scorer

. Positions:

Task Number	Position
1, 2	Front slope (driver's hatch open).
3 through 10	Behind breech (gun over rear deck).

. Instructions:

a. After driver requests that gun tube be rotated forward in step 3 of task 3, traverse tube forward. Then, administratively traverse back over rear deck to allow observation of driver's actions.

b. During loader's task 8, act as an assistant instructor. Receive dummy rounds from the driver's on the ground and pass them through the loader's hatch to the loader. Pass one round through the hatch primer down.

c. Score driver in accordance with standards in "SCORING" portion of readiness test.

d. Conduct remedial training according to module D-2 as required without interferring with the completion of the loader's test.

2. Loader's Scorer

. Positions:

Task Number	Position
1	Rear deck
2, 3	Ground next to track
4	Top of turret (observing through loader's hatch)
5	TC's seat and main gun bore
6, 7, 8, 9	TC's seat

. Instructions:

a. Measure track tension for loader in task 3 after being told where to measure and what clearance to attain.

b. Lay main gun close to alinement with boresight target aiming point prior to task 6 and adjust final lay as directed by loader.

c. Determine if ammunition is stowed according to ammunition storage plan.

d. Command "PREPARE-TO-FIRE" over intercom.

e. Score loader in accordance with standards in "SCORING" portion of readiness test.

f. Conduct remedial training according to module L-2 as required.

SCORER INSTRUCTIONS

LOADER'S READINESS TEST, PART B.2

PERSONNEL.

One scorer and one loader.

PREPARATION.

Insure that the following equipment and conditions are present at the test site.

1. M60A1 with BII

   . On level ground.
   . Intercom operational.
   . Coax mounted.

2. Dummy ammunition which has the same configuration, color, markings, weight and weight distribution as service ammunition:

   . 3 APDS
   . 3 HEP
   . 2 HEAT
   . 1 APERS (Range selector fuze must be operable.)
   . Belt of dummy 7.62mm rounds (single round loaded in chamber of coax and belt loaded on top so that chambered round won't extract when weapon is charged.)
   . 105mm ammunition stowed in ready rack according to unit ammunition storage plan.

3. Stop watch.

4. Two operational CVC helmets.

SEQUENCE OF TASKS.

Fire commands which require loading the available types of dummy rounds interspersed with two or three coax commands can be given in any order at about 15 second intervals.

SCENARIO.

A suggested sequence of fire commands is:

1. Battlesight (SABOT), HEP, HEAT, COAX, HEP, MISFIRE. (Misfire provides a break in the sequence.)

2. (Reload for battlesight); APERS, SABOT (NO "CEASE FIRE"), SABOT, HEAT, COAX, STOPFALL.

SCORER POSITION AND INSTRUCTIONS.

1. The scorer will conduct the readiness test from the TC's position.

2. Instructions:

   a. Begin each fire command with the loader standing in the loader's hatch.

   b. Traverse the turret and elevate or depress the main gun slightly (no more than 15 degrees in azimuth and 5 degrees in elevation) at the beginning of each fire command to simulate laying gun for direction.

   c. Assist the loader in misfire procedures.

   d. Score the loader according to the standards in the "SCORING" portion of the readiness test.

   e. Announce "ON THE WAY" after each "UP" and check to see if loader turns on the Vent Blower.

   f. Conduct remedial training according to module L-4.1 or L-4.2, or both as required.

SCORER INSTRUCTIONS

LOADER'S READINESS TEST, PART C.2

PERSONNEL.

One scorer and one loader.

PREPARATION.

Insure that the following equipment and conditions are present at the test site:

1. M60A1 with BII

   . Coax mounted with safety in F position.
   . Gun tube level and out of travel lock.
   . Main gun safety switch in the FIRE position.

2. Complete gun tool roll stowed according to unit loading plan.

3. Belt of dummy 7.62mm ammunition loaded in coax.

4. Cleaning equipment and lubricating oil.

5. Stop watch.

6. Wooden block (to close breech block).

SEQUENCE OF TASKS.

The readiness test should be administered in the order given.

SCENARIO.

The readiness test secenario is described in the "INSTRUCTIONS TO LOADER" portion of the readiness test.

SCORER POSITION AND INSTRUCTIONS.

1. The scorer will conduct the readiness test from the TC's position.

2. Instructions:

   a. Inform loader when time begins for each phase of the test.

   b. Do not assist loader during the test.

c. Score the loader according to the standards in the "SCORING" portion of the readiness test.

d. Conduct remedial training according to module L-6 as required.

INSTRUCTIONS FOR SCORING
TEC PRETESTS

1. These instructions apply to scoring the following Readiness Test Parts:

   . Driver's Readiness Test Parts A, C, E and F.

   . Loader's Readiness Test Parts A.1, B.1, C.1, E and F.

   . Gunner's Readiness Test Parts B and D.

   . Tank Commander's Readiness Test Parts B and D.

2. Station Set-Up: Insure you have the following items at the test site:

   . One copy of appropriate pretest (see TAB 2) per crewmember.

   . One pencil per crewmember.

   . Answer sheet for each pre-test.

   . One answer key for each pretest.

   . Sufficient seats and writing space to accomodate crew-members being tested.

   . Stop watch.

3. Test Procedure:

   . Issue pretests.

   . Instruct the crewmember not to make any marks on the test sheet.

   . Instruct crewmembers to place their name, tank number and TEC Lesson Number in the upper right corner of the sheet of paper they will use to record their answers.

   . Instruct the crewmembers to begin answering the questions on the pretest.

   . Do not provide any assistance to the person taking the pretest.

   . Stop the test when the allotted time is reached.

   . Collect the pretests and answer sheets.

   . Score the answer sheets.

   . Determine which crewmembers met or exceeded the standard of the readiness test and which crewmembers should take TEC lessons.

4. Scoring Standards:

- Use the answer provided on the answer sheet.
- Do not assume that the crewmember knows anything that he does not write on his answer sheet.
- Do not give partial credit for any answer.

APPENDIX D

HANDS-ON TEST COMPONENTS AND
TEST STATION LAYOUT FOR TCST BATTALION TRAINING STUDY

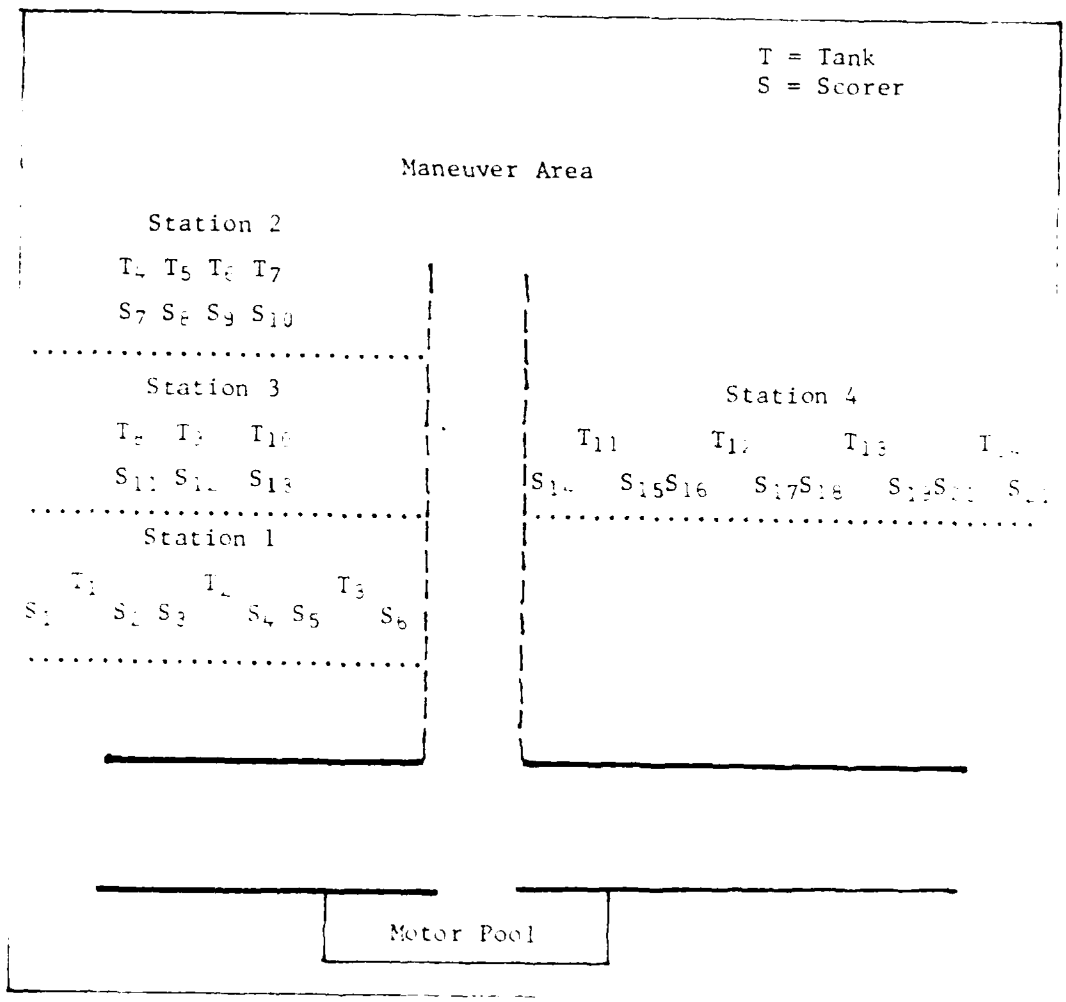

Figure D-1. Layout of [illegible]

AD-A186 323 ARMY TRAINING STUDY: TRAINING EFFECTIVENESS ANALYSIS (TEA) SUMMARY VOLUME 1 ARMOR(U) ARMY TRAINING AND DOCTRINE COMMAND FORT MONROE VA F J BROWN 08 AUG 78 5/5

UNCLASSIFIED SBI-AD-F000 107 F/G 15/1 NL

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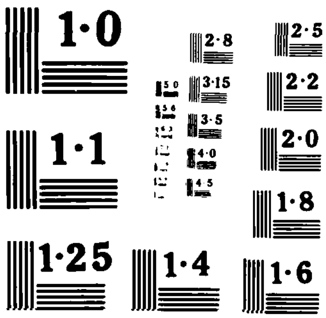
1·0
2·8
2·5
3·15
2·2
3·5
2·0
1·1
4·0
4·5
1·8
1·25
1·4
1·6

TABLE D-1.

Hands-On Performance Test Components Administered at Four Test Stations

Station	Number of Tanks	Number of Scorers	Hands-On Performance Test Components			
			Driver	Loader	Gunner	Tank Commander
1	3	6	Part B Tank Preparation and Start-Up	Part A.2 Mission Preparation Part C.2 Weapon Maintenance		
2	4	4	Part D Tactical Driving		Part E Tactical Operations	Part E Tactical Operations
3	3	3		Part B.2 Combat Loading Part C.2 Weapon Maintenance		
4	4	8			Part A Before Operations Procedures Part C Weapons System Preparation	Part A Before Operations Procedures Part C Weapons System Preparation

APPENDIX E

SAMPLE HANDS-ON TEST
(FROM THE DRIVER'S READINESS TEST)

DRIVER'S READINESS TEST

PART B. TANK PREPARATION AND START-UP (GARRISON/HANDS-ON).

CONDITIONS. Fully operational M60A1 situated on level ground with main gun over rear deck and drain valves open. Tank has following deficiencies: track tension loose; M24 periscope dirty and/or parts missing.

INSTRUCTIONS TO DRIVER. "Prepare the tank for driving on a night mission in an NBC environment. Your activities will include Driver requirements in checking engine/transmission oil and checking track tension. You will be scored on what you do as well as how well you do it. I will observe your performance and serve as the TC and Loader as needed."

TASKS.

Remove M27 periscope.
Perform before-operation checks and services on M24 (IR) and M27 periscopes.
Install M24 (IR) periscope.
Place M24 (IR) periscope into operation.
Start tank engine.
Perform before-operations checks and services on engine and transmission oil levels.
Place tank in motion.
Check track tension.
Perform main gun prepare-to-fire procedures from Driver's station.
Perform before operation checks and services on the gas particulate unit.

NOTES.

a. Soldier should not be given this part of the test until he has passed PART A.

b. Remedial training on tasks failed should be provided on-the-spot, but after soldier has completed all of PART B. [See MODULE D-2.]

c. Tasks in parentheses, though not priority tasks for training, must be performed as part of the test procedure. Test administrator may therefore wish to check out and provide on-the-spot remedial training on them.

d. It is not necessary to perform the tasks in the order given; however, the steps within each task must be performed in order.

PERFORMANCE MEASURES

	Yes	No	NA
1. REMOVE THE M27 PERISCOPE			
. Loosened wing nuts on both sides of the periscope.	___	___	___
. Rotated retainers until clear of the periscope mounting lugs.	___	___	___
. Removed periscope from the bracket.	___	___	___
2. PERFORM BEFORE-OPERATIONS MAINTENANCE CHECKS AND SERVICES ON THE M24 (IR) PERISCOPE AND M27 PERISCOPE			
a. M24 (IR) Periscope			
. Inspected the M24 (IR) periscope and spare head for cracked or dirty lenses and completeness.	___	___	___
. Recorded on DA Form 2404 any damaged or unserviceable parts detected.	___	___	___
b. M27 Periscope			
. Inspected M27 periscope and spare for cracks and dirty lenses.	___	___	___
. Cleaned dirty lenses.	___	___	___
. Recorded on DA Form 2404 any damaged lenses on the M27 periscope.	___	___	___
3. INSTALL THE M24 (IR) PERISCOPE			
. Closed the Driver's hatch.	___	___	___
. Placed the Master Battery switch in the OFF position.	___	___	___
. Instructed crew member to rotate the turret so the gun tube is forward.	___	___	___
. Pulled periscope holder lid handle down with fingers of the left hand while pushing up on the lid latch with the thumb.	___	___	___
. Pushed upward and opened lid.	___	___	___
. Reached to rear of the seat and unlatched both catches on IR periscope stowage box.	___	___	___
. Removed the periscope from stowage box.	___	___	___
. Pulled up (rearward) on the elevation adjustment lever insuring bind (tension) has been released on elevation clamp and elevation clamp pivots.	___	___	___
. Loosened the jam nut on the front (forward) inside of the elevation clamp.	___	___	___
. Using both hands, position the periscope in the periscope holder.	___	___	___

	Yes	No	NA
. Pushed up on periscope until it locked in the holder. (Insured the periscope was locked in the holder before released.)	___	___	___
. Insured the elevation clamp is positioned in the periscope holder detent.	___	___	___
. Tightened the adjustment screw on front right hand inside of the elevation clamp until the elevation clamp was firmly seated in the periscope holder detent.	___	___	___
. Tightened the elevation clamp adjustment screw jam nut.	___	___	___
. Pushed elevation adjustment lever downward (forward) and locked periscope.	___	___	___
. Unscrewed dust cap from power receptable (center) location.	___	___	___
. Unscrewed power cable connecting plug from stowage receptacle on right-hand side of compartment.	___	___	___
. Threaded power cable connecting plug into periscope receptacle and hand tightened.	___	___	___
. Installed the periscope without exposing it to direct sunlight.	___	___	___

4. PLACE THE M24 (IR) PERISCOPE INTO OPERATION

	Yes	No	NA
. Turned the Master Battery switch ON.	___	___	___
. Placed the Blackout Selector switch in BO DRIVE.	___	___	___
. Turned the IR switch ON.	___	___	___
. Visually checked to insure IR Indicator lamp is lit.	___	___	___
. Turned the Lighting Control switch handle to the left.	___	___	___
. Pulled the elevation adjustment lever up.	___	___	___
. Adjusted periscope elevation angle to a comfortable position by moving periscope with both hands.	___	___	___
. Pushed elevation adjustment lever down to lock the periscope in position.	___	___	___
. As necessary, loosened the two inner wingnuts on the headrest until the proper eye distance is obtained, then retightened (handtight) both wingnuts.	___	___	___
. As necessary, bent headrest to fit head contour by pulling, pushing or twisting on each side of the headrest.	___	___	___
. Allowed periscope to warm up for 5 minutes before adjusting focus.	___	___	___
. Unscrewed left and right dust caps from bottom focus controls.	___	___	___
. Rotated left and right focus control knobs until the view through each eyepiece appears with maximum sharpness.	___	___	___
. Screwed left and right dust covers back over focus control knobs and tightened finger tight.	___	___	___

5. PERFORM BEFORE OPERATIONS CHECKS AND SERVICES ON THE GAS PARTICULATE UNIT.

	Yes	No	NA
. Inspected precleaner, particulate filter unit housing, gas filter cannisters and air heater for dents, missing or loose control knob and/or pinched or blocked air hose.	___	___	___
. Wiped precleaner, particulate filter unit housing, gas filter cannisters and airheater clean with a damp rag.	___	___	___
. Ensured hose assemblies and electrical cables are tight and serviceable.	___	___	___
. Removed spring clip from air inlet openings.	___	___	___
. Placed Gas Particulate switch ON.	___	___	___
. Disconnected air duct hose from Driver's orifice connector and checked for air flow.	___	___	___
. Rotated air heater knob to ON and checked for indicator lamp operation.	___	___	___
. Checked air flow through the hose.	___	___	___
. Allowed air to warm up at least five minutes.	___	___	___
. Checked air temperature.	___	___	___
. Adjusted protective mask and attached air hose.	___	___	___
. Requested other crew members to check gas particulate operation.	___	___	___
. Removed and stowed air hose and protective mask.	___	___	___
. Rotated air heater knob to OFF and listened for audible click.	___	___	___
. Placed Gas Particulate switch OFF.	___	___	___
. Replaced spring clip to air inlet openings.	___	___	___
. Recorded on DA Form 2404 any damaged or unserviceable components.	___	___	___

6. START TANK ENGINE

. Locked hatches in open or closed position.	___	___	___
. Checked that drain valves are closed.	___	___	___
. Locked parking brakes by depressing the brake pedal and placing the transmission shift lever in PARK.	___	___	___
. Placed steering control in center position.	___	___	___
. Placed fuel shut-off valve handle to ON position.	___	___	___
. Placed fuel pumps switch in the ON position.	___	___	___
. Placed generator switch in the ON position.	___	___	___
. Placed Master Battery switch in ON position.	___	___	___
. Checked that power plant warning lamp and master control switch indicator lamp are lit.	___	___	___
. Checked to insure fuel gages are operating.	___	___	___
. Purged the fuel lines of air, if tank had not been operated within the past week.	___	___	___

	Yes	No	NA
. Depressed accelerator pedal about 2/3 to 3/4 of full displacement and firmly pressed and held starter switch until engine started (but no longer than 15 seconds).	___	___	___
. As soon as engine started, released starter switch and checked that the generator blower is operating.	___	___	___
. Allowed engine to warm up for at least three minutes at 1000 to 1200 RPM.	___	___	___
. Reduced engine RPM to idle speed (700 to 750 RPM) just prior to shifting.	___	___	___
7. PERFORM BEFORE-OPERATIONS CHECKS AND SERVICES ON TANK ENGINE AND TRANSMISSION OIL LEVELS			
. Set parking brake (on "Loader's" command to start engine).	___	___	___
. Started tank engine (on "Loader's" command to start engine).	___	___	___
. Idled engine between 1000-1200 RPM for 5 minutes.	___	___	___
. Reduced engine idle to 700-750 RPM.	___	___	___
8. PLACE TANK IN MOTION			
. Told crew members to secure hatches in the open or closed position.	___	___	___
. Turned on appropriate lights.	___	___	___
. Depressed accelerator to disengage the accelerator lock.	___	___	___
. Released accelerator.	___	___	___
. Depressed brake pedal and moved transmission shift lever to NEUTRAL with engine idle speed at 700-750 RPM.	___	___	___
. Released parking brake.	___	___	___
. Maintained pressure on brake pedal and moved transmission shift lever to LOW.	___	___	___
. Released brake pedal and depressed accelerator slowly.	___	___	___
9. CHECK TRACK TENSION			
. Moved vehicle forward on level hard surface and, when signaled by Loader, coasted to a stop without applying brakes.	___	___	___
. Made final forward adjustments (without applying brakes) in response to Loader signals in order to aline a track link on #2 support roller.	___	___	___

10. PERFORM PREPARE-TO-FIRE PROCEDURES

	Yes	No	NA
. Lowered seat for closed hatch driving.	___	___	___
. Closed and locked Driver's hatch.	___	___	___
. Turned master control switch to ON.	___	___	___
. Started engine on TC's command, "CHECK FIRING SWITCHES."	___	___	___
. Reported "DRIVER READY" on TC's command, "REPORT."	___	___	___

SCORING.

To pass, soldier must have:

a. Removed M27, installed M24, and inspected both without cuing by scoring.

b. Been checked "Yes" or "NA" on each performance measure.

c. Task steps which do not apply to the situation, i.e., DA Form 2404 entries when no deficiencies are found will be scored "NA."

COMMENTS (Recommended remedial training, etc.)

___ PASS ___ FAIL

APPENDIX F

ANALYSIS OF FORT CARSON TABLE VIII ENGAGEMENTS

TABLE F.1

Fort Carson Table VIII Engagements

Table VIII A

ENGE NO	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO
1 D	GN	MG	BS	STA	STA	TK	VIS	12-17	D	GPD	HT
2 D	GN	MG	PRE	STA	STA	TK	VIS	18-25	D	GPD	SB
3 D	GN	MG	BS	STA	STA	TK	VIS	8-11	D	GPD	HT
4 D	GN	MG	PRE	STA	MOV	TK	VIS	12-14	D	GPD	SP
5 D	GN	MG	PRE	STA	STA	AT	VIS	16-18	D	TEL	HEP
6 D	TC	50	NP	STA	STA	TRK	VIS	6-8	D	TPD	50
7 D	GN	CX	NP	STA	STA	TPS	VIS	2-4	D	INF	762
8 D	TC	50	NP	STA	STA	TPS	VIS	12-14	D	TPD	50
9 D	GN	CX	NP	STA	MOV	TRK	VIS	4-6	D	INF	762
10 D	GN	CX	NP	STA	STA	TPS	VIS	4-6	D	INF	762

Table VIII B

ENGE NO	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO
1 N	GN	MG	BS	STA	STA	TK	VAL	12-17	N	GPD	SB
2 N	GN	MG	PRE	STA	STA	TK	VAL	18-25	N	GPD	HT
3 N	GN	MG	BS	STA	STA	TK	VAL	8-11	N	GPD	SP
4 N	GN	MG	BS	STA	MOV	TK	VAL	12-14	N	GPD	HT
5 N	GN	MG	BS	STA	STA	AT	VAL	16-18	N	GPD	HEP
6 N	TC	50	NP	STA	STA	TRK	VAL	4-6	N	TPD	50
7 N	GN	CX	NP	STA	STA	TPS	VAL	4-6	N	INF	762
8 N	TC	50	NP	STA	STA	TPS	VAL	12-14	N	TPD	50
9 N	GN	CX	NP	STA	MOV	TRK	VAL	8-10	N	INF	762
10 N	GN	CX	NP	STA	STA	TPS	VAL	6-8	N	INF	762

APPENDIX G

IDENTIFICATION OF GUNNER AND
LOADER TASKS REQUIRED IN
FORT CARSON TABLE VIII ENGAGEMENTS

TABLE G.1

GUNNER

Critical Tasks Table VIII

	Task	Type Engagements						
		GN-MG-BS-STA-STA-GPD	GN-MG-PRE-STA-STA-GPD	GN-MG-PRE-STA-MOV-GPD	GN-MG-PRE-STA-STA-TEL	GN-MG-BS-STA-MOV-GPD	GN-CX-NP-STA-STA-INF	GN-CX-NP-STA-MOV-INF
1.	Turns on turret power.	x	x	x	x	x	x	x
2.	Turns on main gun switch	x	x	x	x	x		
3.	Turns on coax switch						x	x
4.	Indexes ammunition into ballistic computer	x	x	x	x	x	x	x
5.	Selects HEP reticle.				x			
6.	Announces IDENTIFIED.	x	x	x	x	x	x	x
7.	Announces CANNOT IDENTIFY.							
8.	Lays crosshair at center of target base.	x						
9.	Lays crosshair at center of target vulerability.		x	x				
10.	Lays rangeline at center of target vulnerability				x			
11.	Lays circle reticle at center of target.						x	
12.	Applies leadline in direction of target apparent motion.			x		x		
13.	Lays crosshair leadline at center of base of target.					x		
14.	Lays circle reticle at interpolated leadline of target.							x
15.	Makes final precise lay.	x	x	x	x	x		
16.	Announces ON THE WAY.	x	x	x	x	x	x	x
17.	Fires main gun.	x	x	x	x	x		
18.	Fires coax.						x	x
19.	Adjust coax burst for point target							x
20.	Adjust coax burst for area target.						x	
21.	Lays coax for direction on edge of target.						x	
22.	Locates target in unity window or periscope.	x	x	x	x	x	x	x
23.	Observes target after firing	x	x	x	x	x	x	x
24.	Announces sensing	x	x	x	x	x	x	x
25.	Apply BOT.	x	x	x	x	x		
26.	Apply range change correction.				x			
27.	Apply mil change correction.		x	x				
28.	Apply target form correction.	x				x		
29.	Adjust coax burst on point target.							
30.	Adjust coax burst on area target.							
31.	Adjust coax burst on moving target.							
32.	Operates tank intercom.	x	x	x	x	x	x	x
33.	Manually elevate, depress, and traverse main gun.							
34.	Prepares periscope for operation.	x	x	x		x		

TABLE G.1

GUNNER

Critical Tasks Table VIII (continued)

Task	Type Engagements						
	GN-MG-BS-STA-STA-GPD	GN-MG-PRE-STA-STA-GPD	GN-MG-PRE-STA-MOV-GPD	GN-MG-PRE-STA-STA-TEL	GN-MG-BS-STA-MOV-GPD	GN-CX-NP-STA-STA-INF	GN-CX-NP-STA-MOV-INF
35. Prepares telescope for operation.				x			
36. Places turret into power operation.	x	x	x	x	x	x	x
37. Traverses, elevates, and depresses main gun in power.	x	x	x	x	x	x	x
38. Places ballistic computer into operation.	x	x	x	x	x	x	x
39. Checks firing triggers.	x	x	x	x	x	x	x
40. Boresights periscope and telescope.	x	x	x	x	x		
41. Indexes ammunition in computer for boresight.	x	x	x	x	x		
42. Announces GUNNER READY.	x	x	x	x	x	x	x
43. Apply immediate action in case of main gun failure to fire.	x	x	x	x	x		
44. Apply immediate action in case of coax failure to fire.						x	x

TABLE G.2

LOADER

Critical Tasks Table VIII

	Task	Type Engagements						
		GN-MG-BS-STA-STA-GPD	GN-MG-PRE-STA-STA-GPD	GN-MG-PRE-STA-MOV-GPD	GN-MG-PRE-STA-STA-TPT	GN-MG-BS-STA-MOV-GPD	GN-CX-NP-STA-STA-INF	GN-CX-NP-STA-MOV-INF
1.	Unlock ammo ready rack.	x	x	x	x	x		
2.	Selects correct ammunition.	x	x	x	x	x		
3.	Loads main gun.	x	x	x	x	x		
4.	Places main gun safety in fire position.	x	x	x	x	x		
5.	Places coax safety in fire position.						x	x
6.	Announces UP.	x	x	x	x	x	x	x
7.	Loads coax.						x	x
8.	Stand clear of breech.							
9.	Identifies types of ammunition.	x	x	x	x	x	x	x
10.	Stows ammunition.	x	x	x	x	x	x	x
11.	Operates tank intercom.	x	x	x	x	x	x	x
12.	Reads replenisher tape.	x	x	x	x	x		
13.	Unload coax.							
14.	Remove coax from tank.							
15.	Dissemble coax.							
16.	Assemble coax.							
17.	Check operation of coax.							
18.	Mount coax in tank.							
19.	Disassembles and assembles coax.						x	x
20.	Mounts coax in tank.						x	x
21.	Opens breech and inspects tube and chamber.	x	x	x	x	x		
22.	Checks coax mount and solenoid.						x	x
23.	Inspects stowed ammunition.	x	x	x	x	x	x	x
24.	Positions circuit tester in breech.	x	x	x	x	x		
25.	Cocks coax.						x	x
26.	Unlocks turret.	x	x	x	x	x	x	x
27.	Places boresight threads on muzzle of main gun.	x	x	x	x	x		
28.	Report LOADER READY.	x	x	x	x	x	x	x
29.	Apply immediate action to reduce stoppage of coax.						x	x
30.	Rotates main gun misfired round.	x	x	x	x	x		
31.	Unloads main gun misfired round.	x	x	x	x	x		
32.	Selects second round	x	x	x	x	x		

APPENDIX H

CRITICAL TASK CLUSTERS COMPRISING THE TRAINING CONTENT FOR ACCELERATED GUNNER AND LOADER REPLACEMENT TRAINING

GUNNER

Critical Task Clusters

1. OPERATE TURRET.

    a. Operate tank intercom.
    b. Manually elevate, depress, and traverse main gun.
    c. Prepare gunner's periscope for operation.
    d. Prepare gunner's telescope for operation.
    e. Place turret into power operation.
    f. Elevate, depress, and traverse main gun in power.
    g. Place ballistic computer into operation.

2. PERFORM PREPARE-TO-FIRE PROCEDURES.

    a. Turn main gun switch ON.
    b. Check firing trigger.
    c. Turn coax switch ON.
    d. Check firing trigger.
    e. Elevate and depress main gun in power.
    f. Traverse main gun in power.
    g. Check ballistic computer operation.
    h. Boresight periscope and telescope.
    i. Index ammunition into computer for boresight.
    j. Announce GUNNER READY.
    k. Direct fire procedures (see cluster 4)

3. PERFORM MISFIRE PROCEDURES.

    a. Apply immediate action in case of main gun failure to fire.
    b. Apply immediate action in case of coax failure to fire.

4. RESPOND TO FIRE COMMANDS.

    a. Turn on turret power.
    b. Turn on main gun switch.
    c. Turn on coax firing switch.
    d. Index ammunition into ballistic computer.
    e. Select HEP reticle.
    f. Announce IDENTIFIED.
    g. Announce CANNOT IDENTIFY.
    h. Lay crosshair at center of target face.
    i. Lay crosshair at center of target vulnerability.
    j. Lay rangeline at center of target vulnerability.
    k. Lay circle reticle at center of target.
    l. Applies lead in direction of apparent target motion.
    m. Lay crosshair leadline at center of base of target.
    n. Lay circle reticle at interpolated leadline of target.
    o. Make final precise lay.
    p. Announce ON THE WAY.

GUNNER

Critical task Clusters (continued)

q. Fire main gun.
r. Fire coax.
s. Adjust coax burst for point target.
t. Adjust coax burst for area target.
u. Lay coax for direction at edge of target.
v. Locates target in unity window or periscope.
w. Observes target after firing.
x. Announces BOT.
y. Apply BOT

5. RESPOND TO SUBSEQUENT FIRE COMMANDS.

a. Apply range change correction.
b. Apply mil change correction.
c. Apply target form correction.
d. Adjust coax burst on point target.
e. Adjust coax burst on area target.
f. Adjust coax burst on moving target.

LOADER

Critical Task Clusters

1. AMMUNITION HANDLING.

   a. Identify tank ammunition.
   b. Stow tank ammunition.
   c. Load main gun.
   d. Load coax.

2. PREPARATION FOR OPERATION.

   a. Operate tank intercom.
   b. Read replenisher tape.
   c. Check stowage of ammunition.

3. COAXIAL MACHINEGUN.

   a. Unload coax.
   b. Remove coax from tank.
   c. Disassemble coax.
   d. Assemble coax.
   e. Check operation of coax.
   f. Mount coax in tank.

4. PERFORM PREPARE-TO-FIRE PROCEDURES.

   a. Check replenisher tape.
   b. Open breech and inspect tube and chamber.
   c. Check coax mount and solenoid.
   d. Inspect stowed ammunition.
   e. Place main gun safety switch to FIRE.
   f. Position circuit tester in breech.
   g. Cock coax.
   h. Unlock turret.
   i. Place boresight threads on muzzle.
   j. Report LOADER READY.

5. PERFORM MISFIRE PROCEDURES.

   a. Apply immediate action to reduce stoppage of coax.
   b. Rotate main gun misfired round.
   c. Unload main gun misfired round.

LOADER

Critical Task Clusters (continued)

6. RESPOND TO FIRE COMMANDS.

   a. Unlock ammunition ready rack.
   b. Select correct ammunition.
   c. Load main gun.
   d. Place main gun safety in fire position.
   e. Place coax safety in fire position.
   f. Loads coax.
   g. Announce UP.
   h. Stand clear of breech.
   i. Select second round.

7. RESPOND TO SUBSEQUENT FIRE COMMAND.

   a. Continue to load main gun.

APPENDIX I

TRAINING ASSETS FOR ACCELERATED GUNNER/LOADER REPLACEMENT TRAINING

TRAINING ASSETS

1. Time. Three days, twenty-four hours of daylight and twelve hours of darkness would be available for training four tank crews.

2. Personnel.

   Crew personnel: four qualified TCs and drivers, and four non-11E gunners and loaders for each three-day period.

   Support personnel: One OIC/Safety Officer, two assistant instructors, one target operator, one radio operator, one medic, two truck drivers, small ammo/target detail, and three study team supervisors.

3. Equipment. Four M60A1 tanks, one searchlight tank, one quarter ton and one 5-ton truck, two moving target vehicles, one ambulance, four stop watches, necessary targets, and two radios.

4. Facilities. One Table VII range with capabilities for firing subcaliber Tables I, II, III, VI, VII, and a special coax table.

5. Training Devices and Aids. One Beseler Cue/See, appropriate TEC tapes, six rounds dummy 105-mm ammunition, and short linked belts of empty 7.62 and .50 caliber machinegun ammunition.

6. Ammunition. Each crew was allocated 455 rounds 7.62 tracer, 2100 rounds 7.62 (4-1 linked), 200 rounds .50 caliber (4-1 linked), two rounds 105-mm HEP-TP-T, four rounds 105-mm TPDS-T, and eight rounds 105-mm HEAT-TP-T (four for zeroing) of ammunition.

APPENDIX J

MODIFIED TABLE VII USED IN ACCELERATED GUNNER AND LOADER REPLACEMENT TRAINING

TABLE J.1

Table VII Engagements

NO	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RGN	DAY/ NGT	FC INS	AMMO
1 D	GN	MG	PRE	STA	MOV	TK	VIS	12-14	D	GPD	HT
2 D	GN	MG	PRE	STA	STA	TK	VIS	12-14	D	GPD	SB
3 D	GN	MG	PRE	STA	STA	AT	VIS	14-18	D	TEL	HEP
4 D	TC	50	NP	STA	STA	HEL	VIS	9-10	D	TPD	50
5 D	GN	CX	NP	STA	STA	ST	VIS	4-8	D	INF	762
6 D	TC	50	NP	STA	STA	TPS	VIS	14-16	D	TPD	50
7 D	GN	CX	NP	STA	MOV	TRK	VIS	6-8	D	INF	762
8 D	GN	CX	NP	STA	STA	TPS	VIS	6-8	D	INF	762
1 N	GN	MG	BS	STA	MOV	TK	VAL	12-14	N	GPD	HT
2 N	GN	MG	BS	STA	STA	TK	VAL	8-11	N	GPD	SP
3 N	TC	50	NP	STA	STA	HEL	VAL	9-10	N	TPD	50
4 N	GN	CX	NP	STA	STA	ST	VAL	4-8	N	INF	762
5 N	TC	50	NP	STA	STA	TPS	VAL	14-16	N	TPD	50
6 N	GN	CX	NP	STA	MOV	TRK	VAL	6-8	N	INF	762
7 N	GN	CX	NP	STA	STA	TPS	VAL	6-8	N	INF	762

Table VIII Engagements Not Fired on Table VII (Because of Ammunition Restrictions)

Day	Night
1 HEAT	1 HEAT
1 SABOT	1 SABOT
	1 HEP

Ammunition Allocations

	7.62 (4-1 linked)	.50 cal (4-1 linked)	105mm HEP-TPT	105mm HEAT-TP-T	105mm TPDS-T
Table VII	500	200	2	4	4
Table VIII	520	200	4	8	8

APPENDIX K

ANALYSIS OF WWTGC TABLE VIII ENGAGEMENTS

TABLE K.1

WWTGC TABLE VIII ENGAGEMENTS

TABLE VIII A (Day)

ENGE NO	TASK/CONDITION	RANGE (METERS)	WPN(S)	AMMO	VEH MOT	TGT MOT	ILLUM (NIGHT)
1	Tank (HULLDOWN) Stabilized Mode	1000-1200	MG	TPDS-T	10 MPH	STA	--
2	Two Tanks	1800-2000	MG	TPDS-T	STA	STA	--
	BRDM	1000-1200	Cal.50	Cal.50	STA	STA	--
3	Three Tanks	900-1000	MG	HEAT-TP-T	STA	STA	--
4	RPG Team	200-400	COAX	7.62	STA	STA	--
	ATGM Team	900-1100	Cal.50	Cal.50	STA	STA	--
	Troops	1200-1500	Cal.50	Cal.50	STA	STA	--
5	Moving Tank	1200-1600	MG	TPDS-T	STA	MOV	--
	Stationary Tank	1200-1600	MG	TPDS-T	STA	STA	--
	NBC Environment						
6	Troops	600-800	COAX	7.62	STA	STA	--
	Moving BRDM	800-1100	Cal.50	Cal.50	STA	MOV	--

TABLE VIII B (Night)

ENGE NO	TASK/CONDITION	RANGE (METERS)	WPN(S)	AMMO	VEH MOT	TGT MOT	ILLUM (NIGHT)
7	Two Tanks (1 HULLDOWN)	800-1200	MG	HEAT-TP-T	STA	STA	IR
	Troops	800-1200	Cal.50	Cal.50	STA	STA	IR
	NBC Environment Range-card to Direct Lay						
8	Troops	600-800	COAX	7.62	STA	STA	IR
	BRDM	1200-1400	Cal.50	Cal.50	STA	STA	IR
	NBC Environment						
9	Moving Tank	1200-1600	MG	TPDS-T	STA	MOV	Flare
	Stationary Tank	1200-1600	MG	TPDS-T	STA	STA	Flare
10	Ammo Conservation						

APPENDIX L

CRITICAL TASK CLUSTERS COMPRISING THE TRAINING CONTENT FOR ACCELERATED TANK CREW REFRESHER TRAINING

TANK COMMANDER

Critical Task Clusters

1. OPERATION OF NBC EQUIPMENT AND M85 MACHINEGUN.

    a. Check gas particulate unit.
    b. Perform prepare-to-fire procedures.
    c. Load and clear an M85 machinegun.
    d. Dismount an M85 machinegun.
    e. Disassemble an M85 machinegun.
    f. Maintain, clean and inspect an M85 machinegun.
    g. Assemble an M85 machinegun.
    h. Mount an M85 machinegun.

2. FIRING SKILLS.

    a. Prepare tank rangefinder for operation.
    b. Determine range to target with rangefinder.
    c. Lay the main gun for direction.
    d. Lay the main gun for direction while masked.
    e. Measure mil angle with the reticle of the M17 binoculars.
    f. Measure mil angle with the rangefinder reticle.

3. ADJUSTMENT OF FIRE.

    a. Sense rounds.
    b. Respond to gunner's observation, "LOST."
    c. Respond to gunner's correct sensing and "BOT."
    d. Respond to gunner's incorrect sensing.

4. TARGET ENGAGEMENTS.

    a. Acquire targets.
    b. Preset SABOT battlesight information.
    c. Engage target with main gun (Battlesight Model).
    d. Preset HEAT battlesight information.
    e. Engage target with the main gun (Precision Model).
    f. Engage multiple targets with the main gun.
    g. Simultaneously engage targets with the main gun and caliber .50 machinegun.
    h. Simultaneously engage targets with the coax and caliber .50 machinegun.

GUNNER

Critical Task Clusters

1. BEFORE OPERATIONS PROCEDURES.

   a. Check operation of gas particulate unit.
   b. Charge manual elevation system.
   c. Place turret in power operation.
   d. Prepare azimuth indicator for operation.
   e. Operate elevation quadrant.
   f. Prepare gunner's telescope for operation.
   g. Prepare gunner's periscope for operation.
   h. Perform prepare-to-fire procedures.

2. MANIPULATION.

   a. Manipulate main gun while firing through the periscope.
   b. Manipulate main gun while firing through the telescope.

3. ADJUSTMENT OF FIRE.

   a. Apply BOT method of adjustment.
   b. Apply the mil change method of adjustment.
   c. Apply the range change method of adjustment.
   d. Apply the target form method of adjustment.
   e. Apply the standard adjustment.

4. MOVING TARGETS.

   a. Engage a moving target with main gun.
   b. Apply BOT to a moving target.
   c. Apply the target form method of adjustment to a moving target.

5. TARGET ENGAGEMENTS.

   a. Acquire targets.
   b. Preset SABOT battlesight information.
   c. Engage main gun target using battlesight mode.
   d. Preset HEAT battlesight information.
   e. Engage main gun target using precision mode.
   f. Engage multiple targets with main gun.
   g. Engage target with main gun while .50 cal is firing.
   h. Engage target with coax while .50 cal is firing.

LOADER

Critical Task Clusters

1. MISSION PREPARATION.

   a. Perform before operation checks and services on engine and transmission oil levels.
   b. Stow main gun rounds.
   c. Perform prepare-to-fire procedures.
   d. Check operation of gas particulate unit.

2. COMBAT LOADING.

   a. Load main gun in response to fire commands.
   b. Ready coax in response to fire commands.
   c. Rotate round in misfire procedure.
   d. Unload unfired main gun round.
   e. Apply immediate action to reduct stoppage of an M219 machinegun.

3. WEAPONS MAINTENANCE.

   a. Unload M219 machinegun.
   b. Remove M219 machinegun from tank.
   c. Disassemble M219 machinegun.
   d. Inspect M219 machinegun.
   e. Assemble M219 machinegun.
   f. Check operation of M219 machinegun.
   g. Mount M219 machinegun in tank.
   h. Load an M219 machinegun.
   i. Disassemble breechblock.
   j. Assemble breechblock.

4. REPLENISHER TAPE READING.

   a. Determine corrective action required by replenisher tape.

DRIVER

Critical Task Clusters

1. TANK PREPARATION AND START-UP.

   a. Remove M27 periscope.
   b. Perform before operations check and services on M24 (IR) and M27 periscope.
   c. Install M24 (IR) periscope.
   d. Place M24 (IR) periscope into operation.
   e. Start tank engine.
   f. Perform before operations checks and services on engine and transmission oil levels.
   g. Place tank in motion.
   h. Perform prepare-to-fire checks.
   i. Perform before operations checks and services on the gas particulate unit.

2. TACTICAL DRIVING.

   a. Operate tank in neutral steer.
   b. Drive over varied terrain.
   c. Drive across a water obstacle.
   d. Perform evasive maneuvers upon enemy contact.
   e. Drive to defilade firing position upon enemy contact.
   f. Drive during main gun engagement.
   g. Drive during coax engagement.
   h. Drive during caliber .50 engagement.

CREW

Critical Task Clusters

1. MACHINEGUN FIRING.

   a. Boresight M219 mounted on a tank.
   b. Boresight M85 mounted on a tank.
   c. Zero M219.
   d. Zero M85.
   e. Engage multiple targets with the coax.
   f. Simultaneously engage coax and caliber .50 targets.

2. TARGET ENGAGEMENTS.

   a. Engage a main gun target in an NBC environment.
   b. Engage multiple targets with the main gun.
   c. Engage multiple targets with the coax.
   d. Simultaneously engage main gun multiple targets and a caliber .50 target.
   e. Simultaneously engage a coax target and caliber .50 targets.

3. TANK COMBAT COURSE (Table VII C).

   a. Engage main gun targets.
   b. Engage coax targets.
   c. Engage caliber .50 targets.

4. MAIN GUN FIRING.

   a. Boresight 105mm gun.
   b. Engage multiple targets with the main gun.

APPENDIX M

TRAINING ASSETS FOR ACCELERATED TANK CREW REFRESHER TRAINING

TRAINING ASSETS

1. Time.

Three-day group: Twenty-four hours of daylight and twelve hours of darkness would be available for training eight tank crews.

One-day group: Ten hours of daylight and five hours of darkness would be available for training eight tank crews.

2. Personnel.

Crew personnel: Sixteen tank crews would be available.

Support personnel: One OIC/Safety Officer, two assistant instructors, one target operator, one radio operator, one medic, two truck drivers, small ammo/target detail and one HumRRO researcher would be available to support the training. The majority of the support functions were to be performed by tank crews who were not involved in the training for that day.

3. Equipment. Eight M60A1 tanks, one 105mm Howitzer, one searchlight tank, one 1/4 ton truck, one 5-ton truck, one moving target vehicle (M113), one ambulance, four stop watches, necessary targets, and three radios.

4. Facilities. Since no tank ranges were available at Ft. Hunter-Liggett, a Table VIII course had to be constructed. The same training area was used to conduct all of the firing training. Use of the training area was controlled so as not to prematurely disclose the Table VIII course.

5. Training Devices and Aids. Two Beseler Cue/See, appropriate TEC tapes, three rounds dummy 105mm ammunition, short linked belts of empty 7.62mm and .50 caliber machinegun ammunition, and eight .50 caliber TELFARE subcaliber devices were used.

6. Ammunition. Each crew was allocated 350 rounds of Caliber .50 tracer, 46 rounds of Caliber .50 non-tracer, 1,400 rounds of Caliber .50 linked, 1,100 rounds of 7.62mm linked, 12 rounds of 105mm HEAT-T, and 15 rounds of 105mm Howitzer illuminating.

APPENDIX N

OVERVIEW OF THE ONE-DAY AND THREE-DAY
TCST PROGRAMS FOR TANK CREW REFRESHER TRAINING

DAY 1

Hours	Personnel	Location	Activity	Notes
0800-0850	TC & Driver	Motor Pool	TC Readiness Test Part B-Operation of NBC Equipment and M85 Machinegun	
	Gunner	TBD	View TEC Lessons 020-171-5342 and 020-171-5341	
	Loader	TBD	View TEC Lessons 020-171-5331 and 020-171-5332	
0900-0950	TC & Driver	Motor Pool	TC Readiness Test Part C-Firing Skills TC Readiness Test Part D-Adjustment of Fire	
	Gunner	TBD	View TEC Lessons 020-171-5336 and 020-171-5337	
	Loader	TBD	View TEC Lessons 020-171-5346, 020-171-5347 and 020-171-5348.	
1000-1050	TC & Driver	Motor Pool Area	TC Readiness Test Part E-Target Engagements	
	Gunner	Motor Pool	Practice Gunner's Readiness Test Part A-Before Operations Procedures	2 Gunners per tank
	Loader	Motor Pool	Practice Loader's Readiness Test Part A-Mission Preparation	2 Loaders per tank
1100-1150	TC	Motor Pool	Remedial Training as required	
	Driver	Motor Pool	Driver's Readiness Test Part A-Tank Preparation and Start UP	Driver and Loader are tested simultaneously
	Loader	Motor Pool	Loader's Readiness Test Part A-Mission Preparation	
	Gunner	Motor Pool	Remedial Training as required	
1300-1330	Crew	Enroute	Driver's Readiness Test Part B-Tactical Driving	
1400-1450	TC & Gunner	Stony Valley Range	Gunner's Readiness Test Part B-Manipulation	
	Loader	Stony Valley Range	Loader's Readiness Test Part B-Combat Loading	
	Driver	Stony Valley Range	Range support	TEC Lessons

DAY 1 (cont'd.)

Hours	Personnel	Location	Activity	Notes
1500-1550	TC & Gunner	Stony Valley Range	Gunner's Readiness Test Part C.1-Adjustment of Fire (Principles)	
	Loader	Stony Valley Range	Loader's Readiness Test Part D- Replenisher Tape Reading	
	Driver	Stony Valley Range	Range Support	TEC Lessons
1600-1650	TC & Gunner and Loader	Stony Valley Range	Gunner's Readiness Test Part C.2-Adjustment of Fire (Application)	
	Driver	Stony Valley Range	Range Support	TEC Lessons
1800-1850	All	Stony Valley Range	Gunner's Readiness Test Part E-Target Engagements	Adjust illumination and spot search-light tank.
1900-2030	All	Stony Valley Range	Remedial Training as required.	
2030-2100	All	Stony Valley Range	Preparation for night operations.	
2100-	All	Stony Valley Range	Gunner's Readiness Test Part B-Manipulation Gunner's Readiness Test Part C.2-Adjustment of Fire (Application) Gunner's Readiness Test Part E-Target Engagements	

DAY 2

Hours	Personnel	Location	Activity	Notes
1000-1050	All	Stony Valley Range	Remedial Training as required.	
1100-1150	TC & Gunner	Stony Valley Range	Gunner's Readiness Test Part D-Moving Targets	
	Loader & Driver	Stony Valley Range	Range Support	
1300-1450	All	Stony Valley Range	Crew Readiness Test Part A-Machinegun Firing	
1500-1650	All	Stony Valley Range	Crew Readiness Test Part B-Target Engagement	
1800-1850	All	Stony Valley Range	Main Gun Firing	
1900-2000	All	Stony Valley Range	Remedial Training as required	Adjust illumination and spot search-light tank
2000-2100	All	Stony Valley Range	Preparation for Night Operations	
2100-	All	Stony Valley Range	Gunner's Readiness Test Part D-Moving Target Crew Readiness Test Part A-Machinegun Firing Crew Readiness Test Part B-Target Engagements	

DAY 3

Hours	Personnel	Location	Activity	Notes
0800-1100	All (3 day group)	Stony Valley Range	Crew Readiness Test Part D-Tank Combat Course	
0800-0850	TC & Driver (1 day group)	Motor Pool	TC Readiness Test Part C-Firing Skills TC Readiness Test Part D-Adjustment of Fire	Driver practice Driver's Readiness Test Part A-Tank Preparation and start up
	Gunners (1 day group)	Motor Pool	Practice Gunner's Readiness Test Part A-Before Operations Procedures	2 Gunners per tank
	Loaders (1 day group)	Motor Pool	Practice Loader's Readiness Test Part A-Mission Preparation	2 Loaders per tank
0900-0950	TC (1 day group)	Motor Pool	TC Readiness Test Part E	
	Drivers (1 day group)	Motor Pool	Driver's Readiness Test Part A-Tank Preparation and Start Up	Same tank as TC
	Loaders (1 day group)	Motor Pool	Practice Loader's Readiness Test Part B-Combat Loading	2 Loaders per tank
	Gunners (1 day group)	Motor Pool	Practice Tracking	2 Gunners per tank
1000-1030	All (1 day group)	Enroute	Driver's Readiness Test Part B-Tactical Driving	
1100-1150	All (-)	Stony Valley Range	Gunner's Readiness Test Part C.1-Adjustment of Fire (Principles)	All crews from 3 day group will be included for remedial training as required.
1200-1330	All (-)	Stony Valley Range	Gunner's Readiness Test Part C.2-Adjustment of Fire (Application)	
1330-1430	All (-)	Stony Valley Range	Gunner's Readiness Test Part D-Moving Targets	
1430-1630	All (-)	Stony Valley Range	Crew Readiness Test Part B-Target Engagements	

DAY 3 (cont'd.)

Hours	Personnel	Location	Activity	Notes
1630-1930	All	Stony Valley Range	Crew Readiness Test Part D-Tank Combat Course	
1930-2030	All (1 day group)	Stony Valley Range	Crew Readiness Test Part C-Main Gun Firing	
2100-2200	All (1 day group)	Stony Valley Range	Crew Readiness Test Part B-Target Engagements	
2200-	All	Stony Valley Range	Crew Readiness Test Part D-Tank Combat Course	

DAY 4

Hours	Personnel	Location	Activity	Notes
1000-1900	All	Stony Valley Range	Table VIII A	Firing order: Alternate 3 day group crews and 1 day crews
2100-	All	Stony Valley Range	Table VIII B	

DAY 5

Hours	Personnel	Location	Activity	Notes
0800-1800	All	Motor Pool	Post Test	

APPENDIX O

COST DATA

FIELD UNIT ANNUAL GUNNERY TRAINING

ACCELERATED TANK CREW REPLACEMENT TRAINING

ACCELERATED TANK CREW REFRESHER TRAINING

FIELD UNIT ANNUAL GUNNERY TRAINING
COST DATA FOR 54 CREWS

The cost of the Field Unit Annual Gunnery Training Program including personnel, ammunition, and petroleum was:

Personnel	
Crewmen	$ 36,407.88
Support	126,596.01
Research	1,870.56
TOTAL	$164,874.45
Ammunition	
7.62mm	$ 22,113.00
.50 caliber	60,547.50
105mm HEP-TP-T	107,855.28
105mm HEAT-TP-T	193,058.64
105mm TPDS-T	293,805.36
TOTAL	$677,379.78
Petroleum	
Deisel	$ 9,736.92
Mogas	110.50
TOTAL	$ 9,847.42
TOTAL COST	$852,101.65

FIELD UNIT ANNUAL GUNNERY TRAINING
DETAILED COST DATA

TYPE COST	PRETEST	TABLE V	TABLE VII	TABLE VIII	POST TEST	TOTAL
1. PERSONNEL						
Crewmen	$ 4,314.87	$ 4,692.54	$ 19,930.53	$ 4,692.55	$ 2,777.39	$ 36,407.88
Support	$ 951.56	$ 24,167.11	$ 39,032.47	$ 59,471.71	$ 2,973.16	$126,596.01
Research	$ 1,870.56	$ ---	$ ---	$ ---	$ ---	$ 1,870.56
TOTAL	$ 7,136.99	$ 28,859.65	$ 58,963.00	$ 64,164.26	$ 5,750.55	$164,874.45
2. AMMUNITION						
7.62 (4-1) linked	$ ---	$ 1,134.00	$ 15,309.00	$ 5,670.00	$ ---	$ 22,113.00
.50 cal (4-1) linked	$ ---	$ 3,912.30	$ 45,457.20	$ 11,178.00	$ ---	$ 60,547.50
105mm HEP-TP-T	$ ---	$ 8,296.56	$ 82,965.60	$ 16,593.12	$ ---	$107,855.28
105mm HEAT-TP-T	$ ---	$ 10,725.48	$128,705.76	$ 53,627.40	$ ---	$193,058.64
105mm TPDS-T	$ ---	$ 46,390.32	$170,097.84	$ 77,317.20	$ ---	$293,805.36
TOTAL	$ ---	$ 70,458.66	$442,535.40	$164,385.72	$ ---	$677,379.78
3. PETROLEUM						
Deisel	$ 129.00	$ 2,681.48	$ 5,821.77	$ 1,061.67	$ 43.00	$ 9,736.92
Mogas	$ ---	$ 25.50	$ 42.50	$ 42.50	$ ---	$ 110.50
TOTAL	$ 129.00	$ 2,706.98	$ 5,864.27	$ 1,104.17	$ 43.00	$ 9,847.42
GRAND TOTAL	$ 7,265.99	$102,025.29	$507,362.67	$229,654.15	$ 5,793.55	$852,101.65

ACCELERATED TANK CREW REPLACEMENT TRAINING
COST DATA FOR 11 CREWS

The cost of the Accelerated Tank Crew Replacement Training Program including personnel, ammunition, and petroleum was:

Personnel	
Non-11E (GNs and LDs)	$ 3,738.25
Cadre ((TCs and DVs)	4,581.55
Support	4,243.11
Research	2,421.36
TOTAL	$ 14,984.27
Ammunition	
7.62mm	$ 5,601.75
.50 caliber	1,518.00
105mm HEP-TP-T	1,690.04
105mm HEAT-TP-T	4,369.64
105mm TPDS-T	12,599.84
TOTAL	$ 25,779.27
Petroleum	
Deisel	$ 660.48
Mogas	12.50
TOTAL	$ 672.98
TOTAL COST	$ 41,436.52

ACCELERATED TANK CREW REFRESHER TRAINING
COST DATA FOR 16 CREWS

The cost of the Accelerated Tank Crew Refresher Training Program including personnel, ammunition, and petroleum was:

Personnel	
Crewmen	$ 17,980.37
Support	15,678.25
Research	2,552.64
TOTAL	$ 36,211.26
Ammunition	
7.62mm	$ 2,242.80
.50 caliber	8,473.20
105mm HEAT-TP-T	11,917.20
105mm TPDS-T	25,772.40
105mm Illum.	26,897.92
TOTAL	$ 75,303.52
Petroleum	
Deisel	$ 346.58
Mogas	151.00
TOTAL	$ 497.58
TOTAL COST	$112,012.36

ACCELERATED TANK CREW REFRESHER TRAINING
DETAILED COST DATA

	3 DAY PROGRAM (8 CREWS)	1 DAY PROGRAM (8 CREWS)	TABLE VIII (16 CREWS)	POST TEST (8 CREWS)*	TOTAL
1. PERSONNEL					
Crewmen	$ 8,565.36	$ 3,378.15	$ 5,338.01	$ 698.84	$ 17,980.36
Support	$ 7,208.50	$ 4,543.10	$ 3,561.10	$ 465.56	$ 15,778.26
Research	$ 1,059.04	$ 724.40	$ 579.52	$ 89.68	$ 2,452.64
TOTAL	$ 16,832.90	$ 8,645.65	$ 9,478.63	$ 1,254.08	$ 36,211.26
2. AMMUNITION					
7.62 (4-1) linked	$ 924.00	$ 310.80	$ 1,008.00	$ ---	$ 2,242.80
.50 cal (4-1) linked	$ 3,864.00	$ 1,297.20	$ 3,312.00	$ ---	$ 8,473.20
105mm HEAT-TP-T	$ 2,383.44	$ ---	$ 9,533.76	$ ---	$ 11,917.20
105mm TPDS-T	$ ---	$ 3,436.32	$ 22,336.08	$ ---	$ 25,772.40
105mm Illum.	$ 10,086.72	$ 10,086.72	$ 6,724.48	$ ---	$ 26,897.92
TOTAL	$ 17,258.16	$ 15,131.04	$ 42,914.32	$ ---	$ 75,303.52
3. PETROLEUM					
Deisel	$ 151.36	$ 50.74	$ 101.48	$ 43.00	$ 346.58
Mogas	$ 74.00	$ 25.00	$ 50.00	$ 2.00	$ 151.00
TOTAL	$ 225.36	$ 75.74	$ 151.48	$ 45.00	$ 497.58
GRAND TOTAL	$ 34,316.42	$ 23,852.43	$ 52,544.43	$ 1,299.08	$112,012.36

* Scheduling mix-ups and preemptive support requirements prevented post-testing the second week.

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