ARI TECHNICAL REPORT
TR-77-A14

Reserve Component Training for Operating and Maintaining the M48A5 Tank

by

James H. Harris, William C. Osborn, and John A. Boldovici

HUMAN RESOURCES RESEARCH ORGANIZATION
300 North Washington Street
Alexandria, Virginia 22314

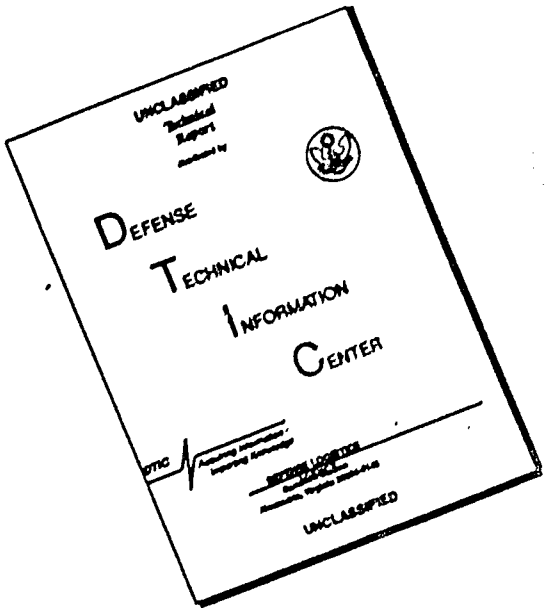
AUGUST 1977

Contract DAHC-19-76-C-0001
ARI Field Unit, Fort Knox, Kentucky

Prepared for

U.S. ARMY RESEARCH INSTITUTE
for the BEHAVIORAL and SOCIAL SCIENCES
5001 Eisenhower Avenue
Alexandria, Virginia 22333

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

U. S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the Deputy Chief of Staff for Personnel

J. E. UHLANER
Technical Director

W. C. MAUS
COL, GS
Commander

Research accomplished
under contract to the Department of the Army

Human Resources Research Organization

NOTICES

DISTRIBUTION: Primary distribution of this report has been made by ARI. Please address correspondence concerning distribution of reports to: U. S. Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-P, 5001 Eisenhower Avenue, Alexandria, Virginia 22333.

FINAL DISPOSITION: This report may be destroyed when it is no longer needed. Please do not return it to the U. S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

(18) ARI

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER (19) TR-77-A14 — Technical Report
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER (9)

4. TITLE (and Subtitle) (6)
RESERVE COMPONENT TRAINING FOR OPERATING AND MAINTAINING THE M48A5 TANK.

5. TYPE OF REPORT & PERIOD COVERED
Final Report. Task 2 of 2
15 Feb 1977 - 11 May 1977

(14) HumRRO
6. PERFORMING ORG. REPORT NUMBER
FR-WD-(KY)-77-10

7. AUTHOR(s) (1)
James H. Harris, William C. Osborn, and John A. Boldovici

(15)
8. CONTRACT OR GRANT NUMBER(s)
DAHC 19-76-C-0001

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Human Resources Research Organization (HumRRO)
300 North Washington Street
Alexandria, Virginia 22314

(16)
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
2Q762722A764

11. CONTROLLING OFFICE NAME AND ADDRESS
U.S. Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue
Alexandria, Virginia 22333

(11)
12. REPORT DATE
August 1977

13. NUMBER OF PAGES
292

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)
(12) 306 p.

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DDC AUG 18 1977 DISTRIBUTED C

18. SUPPLEMENTARY NOTES
Research performed by HumRRO, Western Division, Fort Knox Office, P.O. Box 293, Fort Knox, Kentucky 40121, and monitored technically by Donald F. Haggard, Chief of the ARI Field Unit at Fort Knox.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Armor	Training
Tanks	Testing
M48A5	National Guard

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

Existing training for Armor and Cavalry Reserve Components needs to be updated. The M48A5 tank is replacing the M48A1 in the National Guard, and new equipment requires different operation and maintenance training. Less experienced men need more training in basic skills. Increased costs encourage training that can be performed in armories or that require less ammunition, practice firing, and travel. A survey of training constraints indicated that new training for Armor National Guard units should depend

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

405 260

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. primarily on skills learned within the program, be deliverable as much as possible at armories, increase the use of subcaliber devices, and use pre-tests to determine areas of mastery and deficiency.

The present report presents a coherent plan and outline for a crew-level Reserve Component training program to be developed for the M48A5 tank. The plan is designed to use existing training materials such as the Training Extension Course (TEC) as much as possible. Soldiers are assumed to have been through Advanced Individual Training (AIT).

In developing the training plans, tasks were selected for inclusion in training, a Crew Interaction Performance Test developed, a readiness test developed for each of the four tank duty positions, module outlines written for each position, and an evaluation plan developed.

Selection of priority tasks for inclusion was based on previous research and Army training literature. These tasks were grouped functionally and incorporated in the Crew Interaction Performance Test, the crew-level proficiency criterion (~~reproduced in Appendix A~~). The Test consists of three modules - preoperations checks, weapon systems preparation, and tactical operations. As it contains tasks from Gunnery Table VIII, tank crew drills, and the Gunnery Skills Test, successful completion should predict performance on other tests.

Readiness tests were developed for the duty positions of Driver, Loader, Gunner, and Tank Commander, (~~Appendixes B-E~~), to be used (1) as pre-tests to determine level of existing mastery, (2) as end-of-course mastery tests, and (3) diagnostically throughout training. Outlines for training modules comprised functional groupings of tasks for each duty position (~~Appendixes F-I~~), and contain sections on pretraining conditions, objective, method, equipment, estimated time, and procedure. The evaluation plan (~~Appendix J~~) for training programs to be developed from the module outlines focuses on the decisions necessary in the three stages of program development: planning decisions, operating decisions (formative evaluation), and concluding decisions (summative evaluation).

Considerations that will affect use of the plans include time requirements, prerequisites and sequencing, instructor roles, other training and testing requirements, and test security. The estimated time required for the longest sequence of individual instruction (30-35 hours) plus 16 hours of crew exercises, doubled to allow for travel, set-up, and maintenance, is still sufficiently within the 280 hours available to National Guardsmen each year to be practical. No test security is required for the readiness tests.

SUMMARY

The training needs of Armor and Cavalry Reserve Components are changing. Old equipment is being replaced with new. Personnel turbulence promises to increase with expiring commitments of soldiers who entered service during the Vietnam build-up, and with elimination of the draft. And the costs of ammunition, real estate, range and hardware maintenance, targets, fuel, transportation, and replacement equipment continue to increase. The work reported here was done in an effort to help meet new Reserve Component training needs by designing training plans for operating and maintaining the M48A5 tank.

A survey was conducted which indicated that new training for Armor and Cavalry National Guard units should be characterized by:

1. Minimal dependence on skills learned outside the program.
2. Being deliverable, as much as possible, at armories.
3. Increased use of subcaliber devices at armories.
4. Use of pre-tests to determine areas of mastery and deficiency.

In light of results of the survey, and of other considerations, a series of five training- and test-development activities was undertaken:

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:
   A. Preoperations checks.
   B. Weapon systems preparation.
   C. 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 is hypothesized 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 to be used in three ways:

   A. 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.

   B. As end-of-course mastery tests, after soldiers complete the instructional sequence dictated by the results of the first administration.

   C. 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:

   A. 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.

   B. Objective: a global statement of the desired behavior and the conditions under which the behavior is to be demonstrated.

   C. Method: a brief statement of the stimulus materials and response modes appropriate for mastery of the module.

   D. Equipment and materials.

   E. Estimated time.

   F. Procedure: an outline of a sequence of instructional events leading to mastery of the module.

   G. Notes: answers to questions that the writers expected might arise on reading the outlines.

5. An Evaluation Plan was prepared, which focuses on decisions that must be made in three stages of program development: planning, operating (or formative), and concluding (or summative).

The longest sequence of instruction, for a Driver who fails to meet the standards for every part of his readiness test and therefore must take all of the modules for his duty position, is estimated to require from 30 to 35 hours. This estimate includes the time required to take the readiness test twice (first as a pre-test, later as an end-of-course test). Adding another 16 hours of crew exercises (three dry- and one live-fire of the Crew Interaction Performance Test) totals 51 hours. If doubled to allow for travel, set-up and maintenance time, the estimated total time is about 100 hours. Theoretically at least, a total of 280 hours per year is available for training a Guardsman (48 four-hour drills, and 88 hours of ADT). Completing the proposed program of instruction would thus seem to leave ample time for conducting other activities in which Guardsmen are expected to participate.

PREFACE

This is the Final Report for Task 2 of a two-task project entitled, "Tank Systems Skills and Training Structure." The report presents a Crew Interaction Performance Test, readiness tests, and Reserve Component training outlines for operating and maintaining the M48A5 tank.

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).

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 John A. Boldovici, Charlotte H. Campbell, Roy C. Campbell, J. Patrick Ford, James H. Harris, Richard E. O'Brien, and William C. Osborn.

George R. Wheaton and Andrew M. Rose wrote the Evaluation Plan appended to this report, under a HumRRO subcontract to the American Institutes for Research.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF TABLES AND FIGURES (CONT'D.)

RESERVE COMPONENT TRAINING FOR OPERATING AND MAINTAINING THE M48A5 TANK

INTRODUCTION

The training needs of Reserve Components are changing. The M48A1 tank, which is the second most prevalent in the National Guard inventory, is being replaced by the M48A5. Personnel turbulence, always a problem in Reserve Components, promises to become even greater with the elimination of the draft, and as the result of expiration of the eight-year commitments of Guardsmen who entered service during the Vietnam build-up. In addition to problems associated with equipment and personnel turbulence, the costs of ammunition, real estate, range and hardware maintenance, targets, fuel, transportation, and replacement equipment continue to increase.

One effect of the trends noted above is that existing training for Armor and Cavalry Reserve Components is becoming increasingly inappropriate and obsolete. As old equipment is replaced with new, the training for operation and maintenance of the old equipment becomes inappropriate, and the need for new training becomes more compelling. As experienced Guardsmen are replaced with inexperienced personnel, training that focuses on higher level skills becomes insufficient, and training on basic skills becomes necessary. And as costs increase, training that depends on large quantities of ammunition, on frequent service practice firing, and on travel to and from training sites becomes less acceptable, and the need for training that can be delivered at armories becomes more obvious.

Recognizing the forthcoming need for new Reserve Component training, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) initiated research to design training plans for operating and maintaining the M48A5 tank. The present project was part of that research program.

The project began[1] by exploring new techniques for addressing two central issues in training design:

1. How to group tasks for optimal efficiency of presentation in training.
2. How to establish with acceptable reliability the criticality of tasks that are candidates for inclusion in training.

Two approaches to grouping tasks were explored. One involved estimating the difficulty of learning and evaluating performance of the tasks. The estimates were only marginally reliable, so were not used in further training development work. The other approach used cluster analyses[2] to group tasks on the basis of similarities in terms of the stimuli, mediating processes, responses, and equipment required for task performance. The results of this approach were promising; unfortunately, time did not permit exploring the feasibility of designing training around the task clusters.

The criticality of armor crew members' tasks was examined using a paired-comparison technique. The results were highly reliable. The method deserves consideration in any training development effort where choices among tasks for inclusion in training cannot readily be made. The results of the criticality study were used in the present training development work, as will be described later.

OBJECTIVE

The project had several intermediate objectives, which can be inferred from the foregoing discussion. The ultimate goal, however -- the one addressed by this report -- was to develop plans and outlines for Reserve Component training for the M48A5 tank.

[1]For details of earlier project work, see Boldovici, J.A., Harris, J.H., Osborn, W.C., and Heinecke, C.L. Tank Systems Skills and Training Structure: Comparative Skill Analysis. Draft Final Report, HumRRO: Alexandria, Virginia, 1977.

[2]Hartigan, J.A. Direct Clustering of a Data Matrix, Journal of the American Statistical Association, 67, 1972.

DEVELOPMENT CONSIDERATIONS

Developing training plans for Reserve Components using the M48A5 tank began with a survey of constraints on Armor and Cavalry National Guard training.[1] The results indicated that new training for Armor and Cavalry National Guard units should be characterized by:

1. Minimal dependence on skills learned outside the program.
2. Being deliverable, as much as possible, at armories.
3. Increased use of subcaliber devices at armories.
4. Use of pre-tests to determine areas of mastery and deficiency.

Other considerations in the development of the plans were:

1. Scope.
2. Use of existing materials.
3. Soldier characteristics and remediation methods.

Scope

The highest level of organization addressed by the training plans is the crew. The plans do not address section, platoon, or larger unit training, which was outside the scope of the project.

Notice also that what has been prepared is by no means a "training program," the development of which also was outside the scope of the project. What is presented may best be regarded as a training plan or a training outline. Transforming the plan or outline into a training program will require considerable developmental work.

[1] O'Brien, R.E., Ford, J.P., and Boldovici, J.A. Armor and Cavalry National Guard Training Constraints. Research Memorandum. HumRRO: Alexandria, Virginia, 1977.

Use of Existing Materials

An effort was made in designing the training to use existing programs, devices, and materials as much as possible. This was especially true for the use of Training Extension Course (TEC) lessons. Where existing programs, materials, and devices were apparently absent or obviously deficient, the absence or deficiency was noted, and recommendations for new designs were made.

Soldier Characteristics and Remediation Methods

The training plans were developed on the assumption that entering soldiers have been through AIT. Few assumptions were made, however, about what was learned in AIT. The results of pre-tests, and not the content of previous training, dictate the soldier's instructional track.

One aspect of the training structure does reflect a concession to the assumption that soldiers have completed AIT: If a soldier fails to meet the standard on part of a readiness pre-test that assesses mastery of tasks addressed in AIT, then the recommendation is to remediate on the spot using one-on-one performance training. The assumptions here are that the tasks addressed in AIT were at one time mastered by the soldier, that soldiers will come close to passing parts of the pre-test addressing these tasks, and that failure to demonstrate mastery can be remedied with minimal refresher training. The same method of remediation is recommended for tasks that are largely procedural (for example, driver installing M24 IR periscope).

For tasks that are not addressed in AIT, that are not highly procedural, or both, the method of remediation is to direct the soldier through a track of selected instructional modules that is tailored by results of the pre-test.

DEVELOPING THE TRAINING PLANS

In light of the findings and considerations noted above, a series of training and test-development activities was undertaken:

1. Selecting tasks for inclusion in training.
2. Developing a Crew Interaction Performance Test.
3. Developing a readiness test for each duty position.
4. Writing module outlines.
5. Preparing an Evaluation Plan.

Selecting Tasks

Priority individual and crew tasks were selected by reviewing several sources. A task base was first formed which consisted of all tasks comprising the Tank Crew Gunnery Skills Test as described in FM 17-12-5.[1] The task base was supplemented by high-criticality tasks identified in task analysis and criticality studies conducted earlier in the project.[2] The tank gunnery tasks selected for inclusion in the program were an amalgam of those identified in an earlier study[3] as most comprehensive and representative of the gunnery domain; of tasks described in FM 17-12-2[4]; and tasks encompassed by the crew drills in TC 17-15-5 CD.[5] The tasks selected for inclusion in the program are shown by duty position in Figure 1.

[1]U.S. Army. Tank Gunnery Training, FM 17-12-5. Author, 1975.

[2]Boldovici et al., 1977. Op cit.

[3]Boldovici, J.A., Wheaton, G.R., and Boycan, G.G. Selecting Items for a Tank Gunnery Test. HumRRO: Fort Knox, Kentucky 1976.

[4]U.S. Army. M60, M60A1, M60A1AOS, and M48A5 Tanks. FM 17-12-2. Author, 1976.

[5]U.S. Army Armor School. Crew Drill M60A1 Tank. TC 17-15-5 CD. Author, 1977.

	DRIVER	LOADER	GUNNER	TC
AA104, A5202 Perform before-operations maintenance checks and services on engine and transmission oil levels.	✓	✓		
AB101 Perform before-operations maintenance checks and services on the M24 (IR) and M27 periscopes.	✓			
AA105, AA210, A5302, A5401 Perform main gun prepare-to-fire procedures.	✓	✓	✓	✓
A5114 Place a tank in motion.	✓			
A5124, AA230 Check track tension.	✓	✓		
A5125 Adjust track tension.		✓		
A5108 Install the M24 (IR) periscope.	✓			
A5109 Place the M24 (IR) periscope into operation.	✓			
A5116 Drive the tank over varied terrain -- hatch open/close.	✓			
A5118 Operate a tank across a water obstacle.	✓	✓	✓	
AA108 Perform during-operations maintenance checks and services on steering, accelerator shift, and brake controls.	✓			
A5117 Perform during-operations checks on instruments, gages, and warning lights.	✓			
AA112 Acquire targets.	✓	✓	✓	✓
AA109 Perform evasive maneuvers upon enemy contact.	✓			✓
AL105, AL205, AL305, AL405 Coax engagement, moving tank, stationary target, Gunner fires.	✓	✓	✓	✓
AL104, AL204, AL304, AL404 Coax engagement, moving tank, moving target, TC fires.	✓	✓	✓	✓
AL103, AL203, AL303, AL403 Main gun engagement, moving to a halt, stationary target, Gunner fires.	✓	✓	✓	✓
AL106, AL206, AL306, AL406 Caliber .50 engagement, moving to a halt, moving target, TC fires.	✓	✓	✓	✓
AL101, AL201, AL301, AL401 Main gun engagement-moving to a halt-stationary target-TC fires.	✓	✓	✓	✓

[continued)

Figure 1. Priority tasks for training.[1]

[1]Code numbers are from earlier project work, and indicate tasks whose performance is common to the M48A5 and other tanks. AA= M48A5, M60A1, M60A3, and M60A1(AOS); AB= M48A5, M60A1, and M60A1(AOS); AL= M48A5 and M60A1; A5= M48A5 only.

	DRIVER	LOADER	GUNNER	TC
AL116, AL216, AL316, AL416 Main gun engagement, moving to a halt, moving target, Gunner fires.	✓	✓	✓	✓
AL102, AL202, AL302, AL402 Main gun engagement, stationary tank, stationary target, Gunner fires.	✓	✓	✓	✓
A5115 Operate a tank in neutral steer.	✓			
AA110 Move vehicle into defilade firing position upon enemy contact.	✓			
AA213 Stow main gun rounds in the tank.		✓		
AB203 Disassemble an M219 machinegun.		✓		
AB207 Assemble an M219 machinegun.		✓		
AB208 Check operation of an M219 machinegun.		✓		
AA204 Disassemble the breechblock.		✓		
AA205 Assemble the breechblock.		✓		
AB213, AB308 Boresight an M219 machinegun.		✓	✓	
AB210 Load an M219 machinegun.		✓		
AB209 Clear an M219 machinegun.		✓		
AB214 Apply immediate action to reduce a stoppage of an M219 machinegun.		✓		
AA211 Determine corrective action required by replenisher tape.		✓		
AB211 Unload an M219 machinegun.		✓		
A5201 Unload misfired main gun.		✓	✓	
A5301 Place turret into power operation.			✓	
AB301, AA401 Prepare tank for boresighting.	✓	✓	✓	✓
AA302 Prepare Gunner's telescope for operation.			✓	
AB302 Prepare Gunner's periscope for operation.			✓	
AA303 Boresight Gunner's telescope.		✓	✓	
AB303 Boresight daylight sight of Gunner's periscope.		✓	✓	
AB304 Boresight IR sight of Gunner's periscope during daylight.		✓	✓	
A5305 Zero an M219 machinegun.		✓	✓	✓
AA309 Prepare azimuth indicator for operation.			✓	
AA307 Operate elevation quadrant.			✓	
AB307, AB404 Zero tank main gun.		✓	✓	✓

[continued]

Figure 1 (Cont'd). Priority tasks for training.

	DRIVER	LOADER	GUNNER	TC
AB401 Prepare tank rangefinder for operation.				✓
AB402 Boresight rangefinder with the main gun bore axis alined on an aiming point at 1200 meters.				✓
AB403 Determine range to target with rangefinder (coincidence).				✓
A5307, AB407 Boresight tank searchlight using primary method.			✓	✓
A5306, AB406 Boresight tank searchlight using alternate method.			✓	✓
A5411 Boresight M2 machinegun mounted on a tank.				✓
A5405 Disassemble an M2 machinegun.				✓
A5406 Assemble an M2 machinegun.				✓
A5409 Adjust headspace on the M2 machinegun.				✓
A5410 Adjust timing on the M2 machinegun.				✓
A5304 Apply immediate action in case of main gun failure to fire.		✓	✓	

Figure 1 (Cont'd). Priority tasks for training.

The Crew Interaction Performance Test

The tasks shown in Figure 1 were grouped functionally and incorporated into a Crew Interaction Performance Test, which consists of three modules:

1. Preoperations checks.
2. Weapon systems preparation.
3. Tactical operations.

The test, associated equipment lists, and administration guidance are attached as Appendix A.

The Crew Interaction Performance Test represents a crew-level proficiency criterion to which Armor reserve training is targeted. It permits assessing a soldier's mastery of skills and knowledge, and his ability to recognize and react to conditions which initiate task performance. The test assesses mastery of each task by the use of modules in which several tasks are imbedded, with instructions given only for performance of the first task in the module. Completion of one task then serves as the stimulus for initiation of the next task. This approach is distinguished from the conventional method of testing each task as a discrete incident, in that each task is tested in a functional context which maintains the normal order of performing the tasks.

The test provides a method for evaluating the proficiency of individuals in the crew environment. Many of the tasks included in the test are team tasks; that is, two or more crew members must work together to complete the task. Unloading a misfired main gun, for example, requires the coordination of the Loader and Gunner, as follows:

Gunner: Turn MAIN GUN and TURRET power switches OFF.
Loader: Place safety in SAFE.
Loader: Open breech.

Gunner: Insert ramming and extracting tool between the face of the breech and rim of the cartridge.

Loader: Hold breech operating handle down.

Gunner: Pry round out of chamber.

Loader: Return breech operating handle to latched position.

As noted earlier, the crew interaction test contains tasks from Table VIII, from the crew drills in TC 17-15-5, from the gunnery skills test, and from a pool of engagements identified as most comprehensive and representative of the gunnery domain. One would hypothesize then, that successful completion of the crew interaction test would be highly predictive of performance on Table VIII, the skills test, and crew drills.

Duty Position Readiness Tests

Readiness tests were developed for each of the four duty positions. Each test assesses a crew member's ability to perform the tasks for his duty position as shown in Figure 1. The individual readiness tests address tasks in addition to the ones shown in Figure 1. The additional tasks are ones whose performance is necessary for initiating performance of one or more of the tasks in Figure 1. "Remove M27 periscope," for example, does not appear on the master list in Figure 1. It is included in the Driver's Readiness Test, however, as a task that precedes the task, "Perform before-operation checks and services on the M24 (IR) and M27 periscopes."

The readiness tests have three purposes. The first purpose is to identify an appropriate instructional sequence for each soldier: The readiness tests serve as "pre-tests" before training begins, and the soldier follows an instructional sequence that is dictated by the pre-test results. The second purpose is to assess end-of-course mastery, after the soldier completes his instructional sequence. Depending on the results of his "post-tests," the soldier either receives remedial instruction, or proceeds to crew training. The third and final purpose

of the readiness tests is to identify needs for refresher training. Administered periodically throughout the year, the readiness tests point up areas of individuals' strengths and weaknesses, and direct troops to appropriate remedial instruction.

The readiness tests are presented in Appendixes B, C, D and E.

Module Outlines

Outlines for training modules comprised of functional groupings of the tasks shown in Figure 1 were written for each duty position. A sample module outline is presented in Figure 2. The sample, and the other module outlines (see Appendixes F, G, H and I) contain sections on:

1. 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.
2. Objective: a global statement of the desired behavior and the conditions under which the behavior is to be demonstrated.
3. Method: a brief statement of the stimulus materials and response modes appropriate for mastery of the module.
4. Equipment and Materials.
5. Estimated Time.
6. Procedure: an outline of a sequence of instructional events leading to mastery of the module.
7. Notes: answers to questions that the writers expected might arise on reading the outlines.

Evaluation Plan

A plan was developed for evaluating training that may be developed based on the module outlines appended to this report. The Evaluation

MODULE D-1. OPERATIONAL CHECKS AND SERVICES

PRETRAINING CONDITIONS:

Soldier failed to meet standard on Part A, Driver's Readiness Test.

OBJECTIVE:

Given pictures or descriptions of tank components, soldier will recognize unserviceable parts and describe actions necessary to service them.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Five filmstrip cartridges and five audio cassettes (TEC lessons 020-171-5366-F through 020-121-5370-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-60 minutes for each of five lessons

PROCEDURE:

a. Select lesson(s) corresponding to pre-tests failed on Part A of the Driver's Readiness Test.

b. Soldier completes assigned lessons and takes post-tests.

c. Soldier reviews those lessons keyed on the post-test for items missed.

d. Soldier has satisfactorily completed the lesson(s) when he can complete the post-test with no more than one error.

NOTE: Some of the maintenance tasks covered in these lessons are not considered here to be priority training tasks. But since they are integrated with priority tasks, and since the lessons are not very long, the soldier should be required to master the knowledge aspects of them as represented in the post-tests.

Figure 2. Sample module outline.

of the readiness tests is to identify needs for refresher training. Administered periodically throughout the year, the readiness tests point up areas of individuals' strengths and weaknesses, and direct troops to appropriate remedial instruction.

The readiness tests are presented in Appendixes B, C, D and E.

Module Outlines

Outlines for training modules comprised of functional groupings of the tasks shown in Figure 1 were written for each duty position. A sample module outline is presented in Figure 2. The sample, and the other module outlines (see Appendixes F, G, H and I) contain sections on:

1. 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.
2. Objective: a global statement of the desired behavior and the conditions under which the behavior is to be demonstrated.
3. Method: a brief statement of the stimulus materials and response modes appropriate for mastery of the module.
4. Equipment and Materials.
5. Estimated Time.
6. Procedure: an outline of a sequence of instructional events leading to mastery of the module.
7. Notes: answers to questions that the writers expected might arise on reading the outlines.

Evaluation Plan

A plan was developed for evaluating training that may be developed based on the module outlines appended to this report. The Evaluation

MODULE D-1. OPERATIONAL CHECKS AND SERVICES

PRETRAINING CONDITIONS:

Soldier failed to meet standard on Part A, Driver's Readiness Test.

OBJECTIVE:

Given pictures or descriptions of tank components, soldier will recognize unserviceable parts and describe actions necessary to service them.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Five filmstrip cartridges and five audio cassettes (TEC lessons 020-171-5366-F through 020-121-5370-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-60 minutes for each of five lessons

PROCEDURE:

a. Select lesson(s) corresponding to pre-tests failed on Part A of the Driver's Readiness Test.

b. Soldier completes assigned lessons and takes post-tests.

c. Soldier reviews t' ..se lessons keyed on the post-test for items missed.

d. Soldier has satisfactorily completed the lesson(s) when he can complete the post-test with no more than one error.

NOTE: Some of the maintenance tasks covered in these lessons are not considered here to be priority training tasks. But since they are integrated with priority tasks, and since the lessons are not very long, the soldier should be required to master the knowledge aspects of them as represented in the post-tests.

Figure 2. Sample module outline.

Plan follows the lead of Klaus,[1] focusing on decisions that must be made at three stages of program development: planning, operating (or formative), and concluding (or summative). It is attached as Appendix J.

USE CONSIDERATIONS

Among the considerations that will affect use of the plans are:

1. Time requirements.
2. Prerequisites and sequencing.
3. Instructor roles.
4. Other training and testing requirements.
5. Test security.

Time Requirements

Tables 1 through 4 contain the titles of the modules and units, along with estimates of the time required for soldiers to complete each. The time estimates should be regarded as tentative for several reasons:

1. The training plans have never been implemented and administered as a whole (although the TEC lessons have been tried out individually).
2. The modules are, for the most part, self-paced. Considerable variations in training time can therefore be expected from soldier to soldier.
3. No allowance has been made for unforeseen circumstances (equipment failures, for example), for travel to and from training sites, and for equipment set-up and maintenance time.

[1]Klaus, D.J. Evaluation Plan for the DEIDS and Related Projects. American Institutes for Research: Washington, D.C., 1974.

TABLE 1. TIME ESTIMATES FOR DRIVER'S MODULES AND UNITS

MODULES AND UNITS		UNIT TIME IN HOURS	MODULE TIME IN HOURS
NO.	TITLE		
D-1.	OPERATIONAL CHECKS AND SERVICES		3.5 to 5.0
D-2.	TANK PREPARATION AND START-UP		1.0
D-3.	TARGET ACQUISITION		5.0 to 6.0
D-3.1.	Target Scanning	1.0	
D-3.2.	Locating And Reporting Targets	1.0	
D-3.3.	Target Range Determination (Knowledge)	1.0	
D-3.4.	Target Range Determination (Skill)	1.0	
D-3.5.	Target Recognition	1.0 to 2.0	
D-4.	TACTICAL DRIVING I		9.5 to 10.0
D-4.1.	Varied Terrain Driving (Knowledge)	1.5 to 2.0	
D-4.2.	Varied Terrain Driving (Skill)	8.0	
D-5.	TACTICAL DRIVING II		3.0 to 5.0
D-5.1.	Evasive Driving (Knowledge)	2.0 to 4.0	
D-5.2.	Target Engagement Driving	1.0	
	Readiness Test (before and after instruction)		8.0
	Total Training and Testing Time		30.0 to 35.0

TABLE 2. TIME ESTIMATES FOR LOADER'S MODULES AND UNITS

MODULES AND UNITS		UNIT TIME IN HOURS	MODULE TIME IN HOURS
NO.	TITLE		
L-1.	MISSION PREPARATION (KNOWLEDGE)		3.0
L-1.1.	Operational Checks and Services	1.0	
L-1.2.	Ammunition Handling	1.0	
L-1.3.	Boresighting M219 Machinegun	1.0	
L-2.	MISSION PREPARATION (SKILL)		2.0
L-3.	COMBAT LOADING (KNOWLEDGE)		3.0
L-3.1.	Selecting Ammunition	1.0	
L-3.2.	Loading Ammunition	0.5	
L-3.3.	Misfire and Unloading Procedures	1.5	
L-4.	COMBAT LOADING (SKILL)		3.0
L-4.1.	Main Gun Loading	2.0	
L-4.2.	Misfire and Stoppage Procedures	1.0	
L-5.	M219 MACHINEGUN MAINTENANCE (KNOWLEDGE)		1.5
L-5.1.	Mounting, Loading, Dismounting the Coax	0.5	
L-5.2.	Clearing, Disassembly and Assembly of Coax	1.0	
L-6.	WEAPONS MAINTENANCE		3.0
L-7.	REPLENISHER TAPE READING		0.5
D-3.	TARGET ACQUISITION		5.0 to 6.0
D-3.1.	Target Scanning	1.0	
D-3.2.	Locating and Reporting Targets	1.0	
D-3.3.	Target Range Determination (Knowledge)	1.0	
D-3.4.	Target Range Determination (Skill)	1.0	
D-3.5.	Target Recognition	1.0 to 2.0	
	Readiness Test (before and after instruction)		10.0
	Total Training and Testing Time		31.0 to 32.0

TABLE 3. TIME ESTIMATES FOR GUNNER'S MODULES AND UNITS

MODULES AND UNITS		UNIT TIME IN HOURS	MODULE TIME IN HOURS
NO.	TITLE		
G-1.	BEFORE OPERATIONS PROCEDURES		1.0
G-2.	WEAPON SYSTEMS PREPARATION I		1.5 to 2.0
G-2.1.	Boresight Weapon Systems (Knowledge)	0.5 to 1.0	
G-2.2.	Boresight Weapon Systems (Skill)	1.0	
G-3.	WEAPON SYSTEMS PREPARATION II		1.5
G-3.1.	Zero Weapon Systems (Knowledge)	1.0	
G-3.2.	Zero Weapon Systems (Skill)	0.5	
D-3.	TARGET ACQUISITION		5.0 to 6.0
D-3.1.	Target Scanning	1.0	
D-3.2.	Locating and Reporting Targets	1.0	
D-3.3.	Target Range Determination (Knowledge)	1.0	
D-3.4.	Target Range Determination (Skill)	1.0	
D-3.5.	Target Recognition	1.0 to 2.0	
G-5.	TACTICAL OPERATIONS		7.5
G-5.1.	Misfire Procedures (Knowledge)	0.75	
G-5.2.	Coaxial Machinegun Engagements (Knowledge)	0.75	
G-5.3.	Target Engagements (Conduct-of-Fire Devices)	4.0	
G-5.4.	Target Engagements (Skill)	2.0	
	Readiness Test (before and after instruction)		12.0
	Total Training and Testing Time		28.5 to 30.0

TABLE 4. TIME ESTIMATES FOR TANK COMMANDER MODULES AND UNITS

MODULES AND UNITS		UNIT TIME IN HOURS	MODULE TIME IN HOURS
NO.	TITLE		
TC-1.	BEFORE OPERATIONS PROCEDURES		1.5
TC-1.1.	M2 Machinegun Headspace and Timing (Knowledge)	0.5	
TC-1.2.	Before Operations Procedures (Skill)	1.0	
TC-2.	WEAPON SYSTEMS PREPARATION I		3.0
TC-2.1.	Boresight Weapon Systems (Knowledge)	1.0	
TC-2.2.	Ranging Test	1.0	
TC-2.3.	Boresight Weapon Systems (Skill)	1.0	
TC-3.	WEAPON SYSTEMS PREPARATION II		1.5
TC-3.1.	Zero Weapon Systems (Knowledge)	1.0	
TC-3.2.	Zero Weapon Systems (Skill)	0.5	
D-3.	TARGET ACQUISITION		5.0 to 6.0
D-3.1.	Target Scanning	1.0	
D-3.2.	Locating and Reporting Targets	1.0	
D-3.3.	Target Range Determination (Knowledge)	1.0	
D-3.4.	Target Range Determination (Skill)	1.0	
D-3.5.	Target Recognition	1.0 to 2.0	
TC-5.	TACTICAL OPERATIONS		7.75
TC-5.1.	Initial Fire Commands (Knowledge)	1.0	
TC-5.2.	Machinegun Engagements (Knowledge)	0.75	
TC-5.3.	Target Engagements (Conduct-of-Fire Devices)	4.0	
TC-5.4.	Target Engagements (Skill)	2.0	

Readiness Test (before and after instruction)	12.0
Total Training and Testing Time	31.0 to 32.0

Users should, for the reasons noted above, revise the time estimates based on experience in administering the program, and modify scheduling procedures accordingly.

The longest sequence of instruction, for a Driver who fails to meet the standards for every part of his readiness test and therefore must take all of the modules for his duty position, is estimated to require from 30 to 35 hours. This estimate includes the time required to take the readiness test twice (first as a pre-test, later as an end-of-course test). Adding another 16 hours of crew exercises (three dry- and one live-run of the Crew Interaction Performance Test) totals 51 hours. If doubled to allow for travel, set-up and maintenance time, the estimated total time is about 100 hours. Theoretically at least, a total of 280 hours per year is available for training a Guardsman (48 four-hour drills, and 88 hours of ADT). Completing the proposed program of instruction would thus seem to leave ample time for the conduct of other instructional activities in which Guardsmen must participate.

Prerequisites and Sequencing

Module sequences for each duty position are shown in Figures 3 through 6. Modules that are nearest the bottom of the page should be taken before modules nearer the top. The lines connecting two modules indicate prerequisites. In Figure 3, for example, Varied Terrain Driving (K) (Module D-4.1.) is a prerequisite to varied Terrain Driving (S) (Module D-4.2.): Soldiers must pass the part of the Driver's Readiness Test corresponding to Module D-4.1. before taking Module D-4.2. The sequence of any two modules connected by a line should not be altered.

Where modules are not connected by lines, sequences are suggested by vertical position in the diagrams. It is suggested, for example, that Operational Checks and Services (D-1.) precede Target Scanning (D-3.1.). The suggested sequences can and should be modified in light of practical considerations.

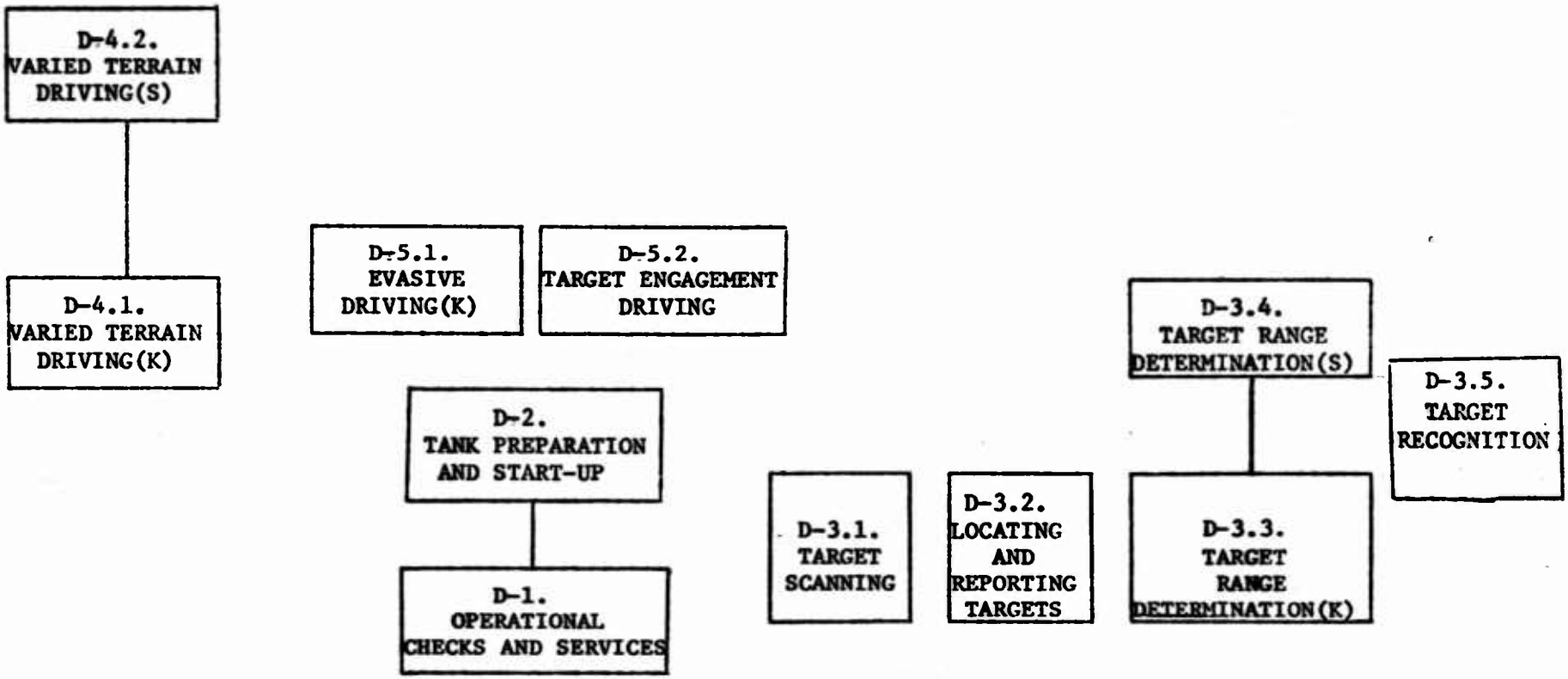


Figure 3. Prerequisites and suggested sequence for Driver's modules.

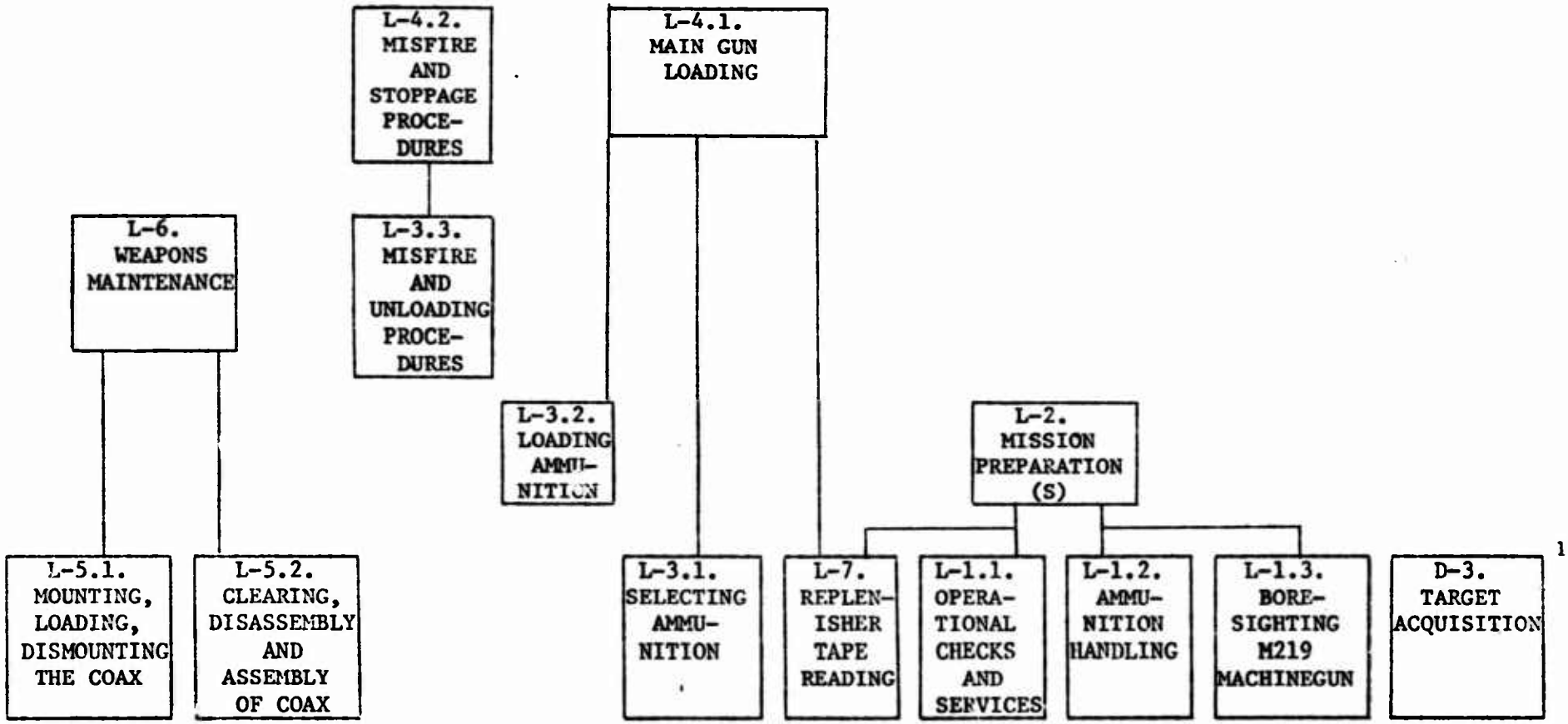


Figure 4. Prerequisites and suggested sequence for Loader's modules.

[1]Unit sequence for Target Acquisition as in Figures 5 and 6.

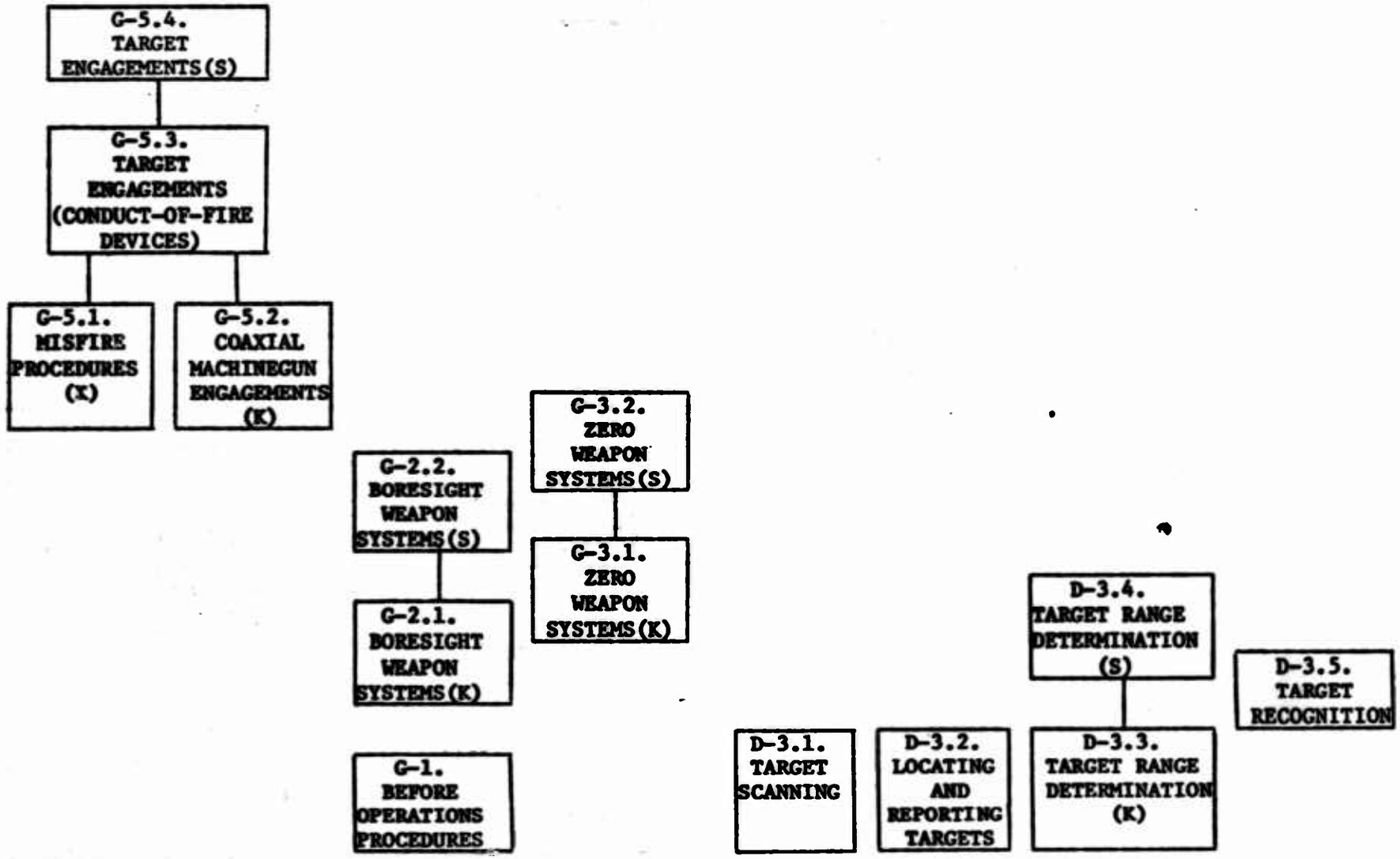


Figure 5. Prerequisites and suggested sequence for Gunner's modules.

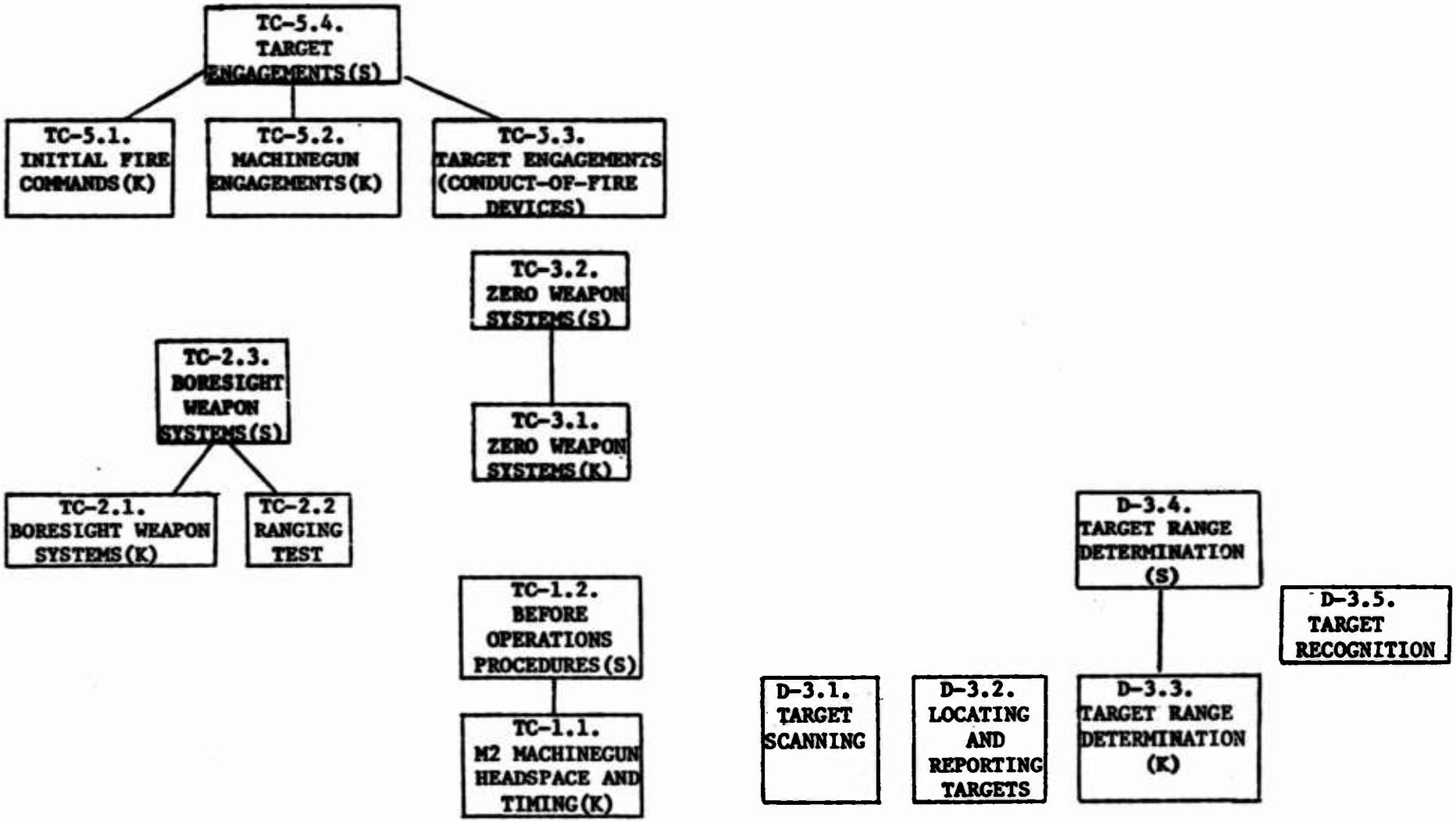


Figure 6. Prerequisites and suggested sequence for Tank Commander's modules.

Instructor Roles

Administering programs of instruction such as those suggested by the module outlines may require new roles for instructors. Since many of the modules will be self-paced and "canned," instructors will not play central roles in presenting information. They should, therefore, have more than the usual amount of time to devote to such important functions as:

1. Checking the responses of trainees in test exercises.
2. Answering questions on an individual basis.
3. Maintaining interest and motivation.
4. Providing remedial help.
5. Record-keeping and scheduling.

Other Training and Testing Requirements

As noted earlier, implementing the training and testing outlined in this report would seem to leave considerable time for other Reserve Component instructional activities. This is not to say that all Armor and Cavalry units should adopt the plans outlined here. Our scant knowledge of the unique training needs of individual units would make such a recommendation presumptuous. If, however, the plans were adopted by some units, integration with other training and testing requirements could be accomplished as outlined in Figure 7. Here it can be seen that the training cycle begins with administering pre-tests to recent AIT graduates.[1] The pre-test results not only indicate appropriate tracks through the instructional modules, but also can provide clues about soldiers' strengths and weaknesses as related to, say, MOS qualification and readiness for SQT. Once individual training

[1]Many of the pre-tests, especially those associated with the TEC lessons, are written and short. As a matter of administrative convenience therefore, the written tests may all be given at once; as opposed to, say, alternating from a brief written component to a "hands-on" component, back to another brief written component, and so forth.

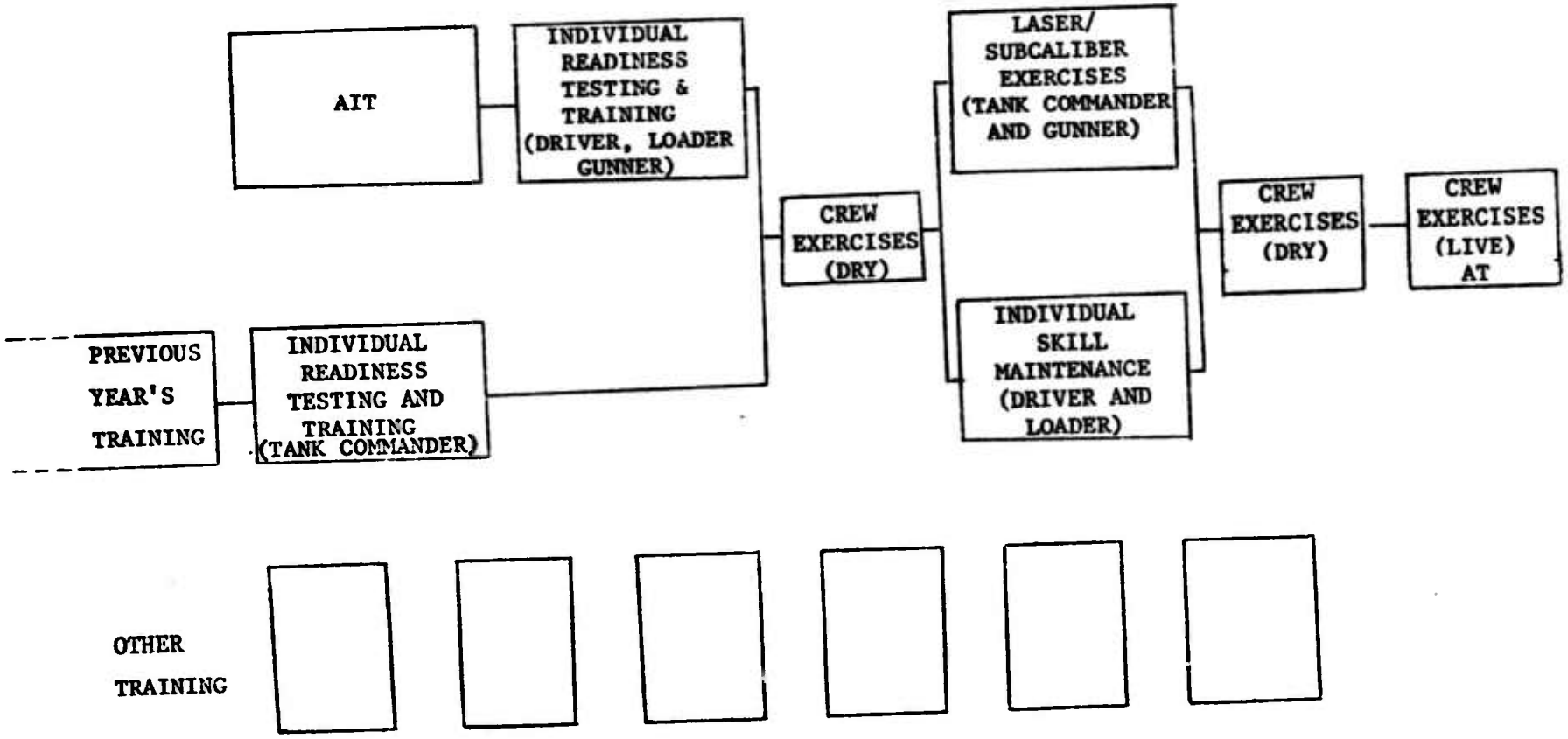


Figure 7. Integration of training and testing components.

is complete, exercising individual skills in a crew setting becomes the immediate objective. This is best accomplished through a mixture of dry-run crew exercises and laser/subcaliber firing drills for Gunners and Tank Commanders. Should available resources curtail the frequency and extent of crew exercises, the maintenance of some individual skills may have to be accomplished by refresher training tailored to the results of periodically administered readiness tests. In any case, the entire instructional program should be targeted on the crew live-fire exercises during AT.

Test Security

Test security frequently becomes an issue where tests are used to assess ability to acquire and neutralize targets. Showing the examinees the Crew Interaction Performance Test would have the same effect as telling them the locations of the targets. This would invalidate the test, because no generalizations could be made about crews' abilities to neutralize targets of kinds and at ranges other than those used in the test. The recommendation to keep the contents of the Crew Interaction Performance Test secret is, however, contra-indicated by practical constraints. There is simply no practicable way to keep the contents of a full field performance test secret. Efforts to do so undoubtedly would prove futile, and therefore are not recommended. Rather, the use of alternative forms is suggested, in which target locations are systematically or randomly varied from one crew to the next.

The readiness tests are a different matter. There is no need to keep their contents secret, since the tests are intended only to assess mastery of the tasks addressed, and not as a means for making generalizations about ability to perform a larger domain of tasks. Trainees should, in fact, be given copies of the readiness tests at the outset of training, for use as study guides.

REFERENCES

Boldovici, J.A., Harris, J.H., Osborn, W.C., and Heinecke, C.L. Tank Systems Skills and Training Structure: Comparative Skill Analysis. Fort Knox, Kentucky: Human Resources Research Organization (HumRRO), 1977.

Boldovici, J.A., Wheaton, G.R., and Boycan, G.G. Selecting Items for a Tank Gunnery Test. Fort Knox, Kentucky: Human Resources Research Organization (HumRRO), 1976.

Fitzpatrick, R. The selection of measures for evaluating programs. In Evaluative Research Strategies and Methods. American Institutes for Research: Washington, D.C., 1970.

Hartigan, J.A. Direct clustering of a data matrix, Journal of the American Statistical Association, 67, 1972.

Johnson, G.H. The purpose of evaluation and the role of the evaluator. In Evaluative Research Strategies and Methods. American Institutes for Research: Washington, D.C., 1970.

Klaus, D.J. Evaluation Plan for the DEIDS and Related Projects. American Institutes for Research: Washington, D.C., 1974.

O'Brien, R.E., Ford, J.P., and Boldovici, J.A. Armor and Cavalry National Guard Training Constraints. Research Memorandum. HumRRO: Alexandria, Virginia, 1977.

U.S. Army Armor School. Crew Drill M60A1 Tank. TC 17-15-5 CD. Author, 1977.

U.S. Army. M60, M60A1, M60A1AOS, and M48A5 Tanks. FM 17-12-2. Author, 1976.

U.S. Army. Tank Gunnery Training. FM 17-12-5. Author, 1975.

APPENDIXES

APPENDIX A

CREW INTERACTION PERFORMANCE TEST, EQUIPMENT LISTS, AND ADMINISTRATIVE GUIDANCE

GUIDELINES FOR TEST ADMINISTRATOR

This section provides guidelines for administering the full-crew interaction performance test. Specific items covered are:

1. Standardized conditions
2. Time requirements and control measures
3. Rater preparation
4. Test interruptions
5. Tank gunnery engagements
6. Test site requirements

Standardized Conditions. Accurate assessment of tank crew combat readiness requires standardized test conditions. All personnel tested must be presented identical stimulus conditions. The test conditions described for each module of the test must be strictly adhered to. Events must occur as prescribed in the directions for establishing and administering each module.

Time Requirements and Control Measures. Time requirements listed in the module descriptions are approximations. The time required to conduct the test, particularly Module III, will vary with the terrain. A dry run of the course to determine a realistic maximum time to conduct the Tactical Operations Module is necessary before the test is administered. Each crew must be allowed the maximum time to complete each module. Some crews may complete a module in less than the maximum time; however, no crew may take more than the maximum time. The maximum time for the modules is:

1. Module I 1 hour
2. Module II 1 hour
3. Module III 2 hours

Control measures for Tactical Operations in the form of identifiable phase line, boundaries and check points must be inserted as required to aid adherence to a time schedule. The control measures must be equally applied to all crews.

Rater Preparation. The raters are the key to a successful test. Rater responses must not be left to chance and every effort must be made to minimize rater subjectivity. The key to good rating lies in rater motivation and familiarity of raters with the test as conducted "on the ground." It is necessary that raters have at least one walk through and one actual run prior to their first scored run. The test administrator must frequently spot check the raters to insure objectivity and continuity.

The raters must know tank crew requirements, the procedure for each test item, the purpose of the test and the mechanics of evaluation. Raters must be prepared in advance and given a briefing on the subject matter they are to rate. Impress upon them the importance of their duty, the need for objectivity and the requirement for test security. Raters must be provided reference materials such as FMs, TMs, job aids and copies of pertinent unit SOPs.

Uncontrolled Test Interruptions. It is recognized that certain events will occur that are not listed as test items. These may include minor equipment failures and reaction to events not planned for testing. These interruptions must not be treated administratively. If a serious event such as equipment breakdown occurs, the test should be terminated until the situation is corrected. A new order should be given starting the test where it stopped.

Tank Gunnery Engagements. There are seven live-fire gunnery engagements during the test. Four are main gun engagements, two are coaxial machinegun engagements and one is a .50 caliber engagement. The motion of the firing vehicle and the target is given for each engagement as well as the crew member who fires. Ranges are not given, as they will depend on the terrain used for the test.

Test Site Requirements. Sufficient terrain must be available to provide a 4-6 KM course. The course must have several natural or man-made obstacles of each of the following types: vertical obstacles (fallen trees, rocks, etc.), ditches, hills, water obstacles. Obstacles should represent a range of difficulty including some that cannot be negotiated. Terrain should also provide features such as ridge lines suitable for tank defilade. Simulated targets should be provided which meet the conditions of the firing engagements.

The test administrator of a full-crew interaction performance test will encounter requirements for control and test standardization that are not present in other crew test situations. Adherence to these guidelines during preparation and conduct of the test will prevent uncontrolled conditions from developing and increase the reliability of combat readiness assessment.

EQUIPMENT LISTS

The equipment lists which follow are the minimum equipment, materials, supplies and personnel specifically required to conduct the test. Local conditions may require more or different support material. Basic issue items (BII) are those items listed in the vehicle TM. Medical, administrative, clerical, mess and control support will be determined by unit field SOP and are not listed here.

EQUIPMENT

Tested Crew

M48A5 with BII, radio coaxial and M2 machinegun
Individual weapons
Ammunition
- 300 rd. per M2 machinegun
- 500 rd. per M219 coaxial machinegun
- 10 rds. main gun, practice

Binoculars
Flashlight with filter
Map 1:50,000
Unit SOP
Protective mask
CEOI Extract
Uniform, seasonal combat

Raters

Binoculars
Protective mask
CEOI Extract
Rating sheets, Modules I through III
Script for operation order
M48A5 Technical Manual
Map 1:50,000
Unit SOP

Other Support

Boresight panels (Module II)
Zeroing panels (Module II)
Main gun engagement targets (Module III)
Machinegun engagement targets (Module III)
Noise devices (empty shell casings, artillery simulator) (Module III)

MODULE I

PREOPERATIONS

MODULE I: PREOPERATIONS

OBJECTIVE: To determine whether the tank crew can perform tactical preoperations maintenance on the vehicle and weapons.

PROCEDURE: The rater will initiate activities by issuing an oral order to the Tank Commander. The oral order will be such that each crew is part of a platoon attacking a threat force. The Tank Commander will formulate his plan for accomplishing the mission and issue an operation order to his crew covering:

1. The actions necessary for preparing for the mission.
2. The planned conduct of the mission.

The crew will then prepare the vehicle, themselves, weapons, radios, and other equipment for the mission. The Tank Commander should spot-check performance of preoperations in which he does not assist, and will make a final determination that the crew is ready.

CONDITIONS: 1. The module can be administered during daylight or darkness, in a motor pool or assembly area.

2. All equipment and ammunition will be issued and the vehicle will be in tactical configuration as required by SOP.

3. Uniform will be combat, as required by SOP.

RATER ACTIVITIES: The rater will also function as the platoon leader through the test. He must observe each of the operations on the attached checklist. The rater must not question crew members, indicate the ratings that are being given, or prompt crew members in any way.

PERFORMANCE ASSESSMENT:

1. Crew members must follow the TM in performing preoperation maintenance checks and services.
2. Operational checks must be performed on all weapons. The weapons must be clean and lubricated, with bores clean and dry.
3. A ground guide must be used when moving the vehicle within the assembly area.
4. Activities must be completed within one hour of issue of the oral order.

ATTACHMENTS:

Schematic diagram, Module I

Initial Oral Order

Rating sheets, Module I

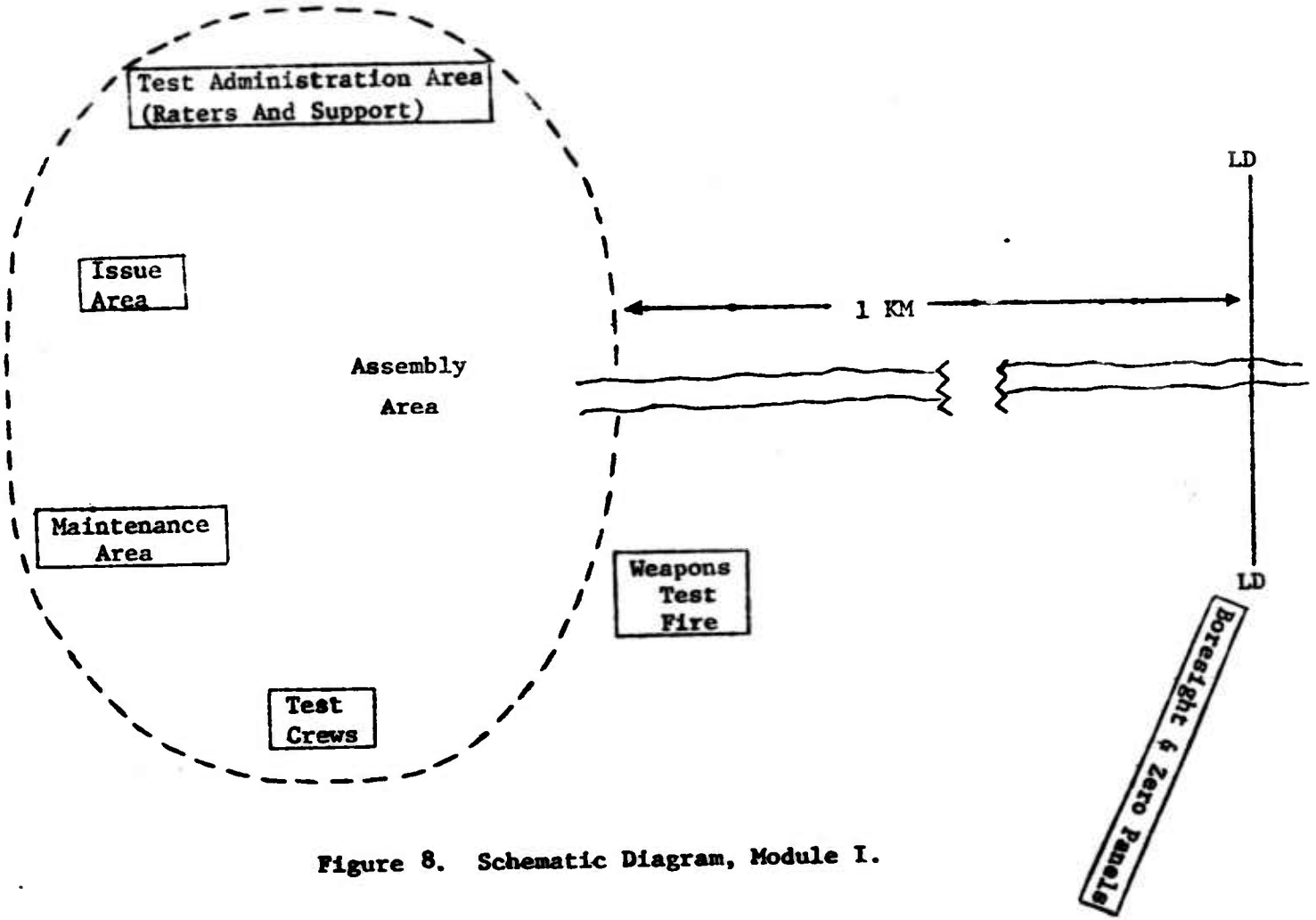


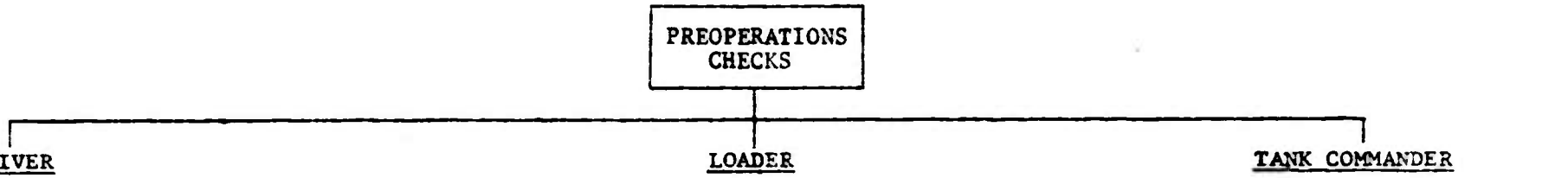
Figure 8. Schematic Diagram, Module I.

INITIAL ORAL ORDER

"The platoon has been ordered to resume the offensive by attacking to secure an objective defended by a small force in hasty defensive positions. Intelligence reports that enemy forces are using T54 and T62 tanks, motorized infantry armed with SAGGER missiles, RPGs, and other armor-defeating weapons. Your mission is to pass through friendly positions and attack the area shown as PL ZULU on your sketch map.

Be prepared to continue the operation on order. Make sure you complete preoperations on your vehicle and weapons before you move out. Move to the weapons test fire area to boresight and zero.

Submit all reports directly to me. Current CEOI remains in effect. I want you to cross the LD at _____; time is now _____ . Any questions concerning your mission?"



DRIVER

1. Perform before-operations maintenance checks and services on engine and transmission oil levels.
2. Perform before-operations maintenance checks and services on the M24 (IR) and M27 periscopes.
3. Place a tank in motion.
4. Check track tension.

LOADER

1. Perform before-operations maintenance checks and services on engine and transmission oil levels.
2. Check track tension.
3. Adjust track tension.
4. Stow maingun rounds in the tank.
5. Disassemble an M219 machinegun.
6. Assemble an M219 machinegun.
7. Check operation of an M219 machinegun.
8. Disassemble the breechblock.
9. Assemble the breechblock.

TANK COMMANDER

1. Disassemble an M2 machinegun.
2. Assemble an M2 machinegun.
3. Adjust headspace on the M2 machinegun.
4. Adjust timing on the M2 machinegun.

Figure 9. Tasks performed by each crew member during Module I: Preoperations check.

PERFORM BEFORE-OPERATIONS MAINTENANCE CHECKS AND SERVICES ON TANK ENGINE AND TRANSMISSION OIL LEVELS [DRIVER/LOADER].

		Yes	No
Loader	. Check engine and transmission oil levels.	___	___
Loader	. Add engine oil until level indicated on gage is to the ADD mark.	___	___
Loader	. Add transmission oil until level indicated on gage is to the ADD mark.	___	___
Loader	. Tell Driver to start engine.	___	___
Driver	. Set parking brake and start tank engine.	___	___
Driver	. Idle engine between 1000-1200 RPM for 5 minutes.	___	___
Driver	. Reduce engine idle to 700-750 RPM.	___	___
Loader	. Add or drain engine oil until level indicated on gage is to the FULL mark.	___	___
Loader	. Add or drain transmission oil until level indicated on gage is to the FULL mark.	___	___

PERFORM BEFORE-OPERATIONS MAINTENANCE CHECKS AND SERVICES ON THE M24 (IR) PERISCOPE AND M27 PERISCOPE [DRIVER].

	Yes	No
. Inspect the M24 IR periscope and spare head for cracked or dirty lenses and completeness.	___	___
. Install the periscope without exposing it to direct sunlight.	___	___
. Energize the IR power.	___	___
. Allow 5 minutes for the system to warm-up and then focus on an image using the focus controls.	___	___
. Record on DA Form 2404 any damaged or unserviceable parts detected or the inability to focus the M24 (IR) periscope.	___	___
. Inspect M27 periscope and spare for cracks and dirty lenses.	___	___
. Clean dirty lenses.	___	___
. Record on DA Form 2404 any damaged lenses on the M27 periscope.	___	___

PLACE A TANK IN MOTION [DRIVER].

	Yes	No
. Lock the Driver's hatch in either the open or closed position.	___	___
. Tell crew members to secure hatches in the open or closed position.	___	___
. Turn on appropriate lights.	___	___
. Depress accelerator to disengage the accelerator lock.	___	___
. Release accelerator.	___	___
. Depress brake pedal and move transmission shift lever to NEUTRAL when the engine idle speed is 700-750 RPM.	___	___
. Release parking brake.	___	___
. Maintain pressure on brake pedal and move transmission shift lever to LOW.	___	___
. Release brake pedal and depress accelerator slowly.	___	___

CHECK TRACK TENSION [DRIVER/LOADER].	Yes	No
Loader . Direct Driver to coast to a stop so that a track link is continued on the #3 support roller.	___	___
Driver . Move vehicle forward on a level hard surface and when directed, coast to a stop without applying brakes.	___	___
Loader . Raise the track with a crowbar, at the number three support roller and place a block (1" thick by 6" square) between the number three support roller and the track link.	___	___
Loader . Measure the clearance between the bottom of the track and the top of the number two support roller: Acceptable clearance is 1/4 to 1/2 inch.	___	___

ADJUST TRACK TENSION [LOADER]

	Yes	No
. Remove the track and adjusting link screw and washer from the top of the track adjusting link.	___	___
. Use the track adjusting wrench on the track adjusting link and pull up to increase track tension (right side) and push down to decrease track tension (right side). (Reverse directions for the left side). [Track adjusting link must not be extended beyond the red painted groove.]	___	___
. Adjust track tension to 1/4-1/2 inch in tolerance.	___	___
. Install lockwasher and lockscrew and tighten with wrench. Lockscrew must tighten until it is fully seated on the shoulder.	___	___

	Yes	No
STOW MAIN GUN ROUNDS IN THE TANK [LOADER].[1]		
. Stow in ready rack.		
- Place round into ready rack.	___	___
- Swing hinge of the holder up and to the left.	___	___
- Pull out spring-loaded knob on the rod of holder, slide hinge slot over the rod behind the knob, and release the knob.	___	___
. Stow in tubular stowage rack.		
- Push round into tubular rack nose first.	___	___
- Swing handle lock over primer end of round.	___	___
- Rotate handle lock securely in place.	___	___
. Stow in turret bustle.		
- Seat round with nose toward inside of the turret.	___	___
- Swing hinge up and to the left.	___	___
- Pull up clamp and fit slot in hinge in place below the clamp.	___	___
- Push clamp down.	___	___

[1]The unit SOP supersedes the specifications detailed for this task.

	Yes	No
DISASSEMBLE AN M219 MACHINEGUN [LOADER].		
. Remove barrel and jacket assembly from receiver.	___	___
. Separate barrel from jacket assembly.	___	___
. Remove cover assembly.	___	___
. Remove feed tray.	___	___
. Remove guide rod springs while holding barrel extension forward.	___	___
. Separate guide rods from guide rod springs.	___	___
. Remove backplate assembly.	___	___
. Retract barrel assembly.	___	___
. Depress buffer support lever and remove barrel extension.	___	___
. Remove breechblock from barrel extension assembly.	___	___
. Remove retainer clip and charger assembly from projecting stud.	___	___

ASSEMBLE AN M219 MACHINEGUN [LOADER].	Yes	No
. Install charger assembly.	___	___
. Place breechblock assembly in barrel extension.	___	___
. Install barrel extension.	___	___
. Install backplate assembly.	___	___
. Join guide rods and guide rod springs.	___	___
. Install guide rod springs.	___	___
. Install feed tray.	___	___
. Install cover assembly.	___	___
. Join barrel to the jacket assembly.	___	___
. Join barrel and jacket assembly with the receiver.	___	___

	Yes	No
CHECK OPERATION OF AN M219 MACHINEGUN [LOADER].		
. Place safety in FIRE position.	___	___
. Charge weapon to lock moving parts to the rear.	___	___
. Allow barrel extension to ease forward by keeping tension on the charging handle and depressing the manual firing trigger.	___	___

DISASSEMBLE MAINGUN BREECHBLOCK [LOADER].

	Yes	No
A. REMOVE		
. Insure that the main gun safety switch is in the SAFE position.	___	___
. Insure that the breechblock crank stop is in the REAR position.	___	___
. Open the breech.	___	___
. Insure chamber is empty.	___	___
. Close the breech manually by tripping the extractors with an empty cartridge case or a wooden block.	___	___
. Remove firing pin spring by depressing plunger, moving plunger to the right, twisting firing pin spring retainer counter-clockwise until the lug alines with the groove in the breech-block, and removing the retainer and spring.	___	___
. Remove firing pin and retractor guide with firing pin retractor by inserting screwdriver blade into retractor guide slot and prying outward.	___	___
. Screw eye bolt into the top of the breechblock.	___	___
. Suspend chain hoist from hook on the turret ceiling and connect chain hoist to eye bolt.	___	___
. Take up slack with the chain hoist to support the breechblock.	___	___
. Apply tension on closing spring by turning adjuster clockwise with spanner wrench.	___	___
. Remove tension from the closing spring by depressing plunger from its notch with a screwdriver and allowing adjuster to turn counter-clockwise under control of the spanner wrench.	___	___
. Insert small screwdriver into hole in breechblock crank stop and slide stop forward.	___	___
. Start breechblock downward by rotating operating handle rearward and down, and with the chain hoist let the breechblock begin descending.	___	___
. Return the operating handle to the latched position.	___	___
. Lower the breechblock until breechblock crank pivot is free of the T-slot and remove pivot.	___	___
. Lower breechblock until breechblock is on the turret floor.	___	___
. Release chain hoist from the eye bolt.	___	___
. Remove right and left extractors from the breech ring.	___	___

	Yes	No
DISASSEMBLE MAINGUN BREECHBLOCK [LOADER]. (Cont'd.)		
B. DISASSEMBLE THE BREECHBLOCK		
. Depress firing contact plate plunger and turn firing contact plate, counterclockwise until arrows on plate and breechblock are alined with each other..	___	___
. Remove firing contact plate, firing contact plate plunger, and spring.	___	___
. Remove plastic washer, firing contact, and firing contact sleeve.	___	___
. Remove retractor pivot pin and firing pin retractor from retractor guide.	___	___
. Remove screw, washers, and clamp securing the retractor driver to the bottom of the breechblock. (Use Allen wrench to remove screws.)	___	___
. Remove retractor driver, retractor driver shaft, and spring.	___	___

ASSEMBLE MAIN GUN BREECHBLOCK [LOADER].

	Yes	No
A. ASSEMBLE		
. Install retractor driver spring, shaft, and retractor driver into the bottom of the breechblock.	___	___
. Affix the retractor group to the bottom of the breechblock by installing securing clamp, washers, and screw with the Allen wrench.	___	___
. Insert firing contact sleeve, firing contact, plastic washer, spring, and firing contact plate plunger into the breechblock.	___	___
. Install firing pin retractor into retractor guide and secure it with the retractor pivot pin.	___	___
. Replace firing contact plate by alining the arrow and depressing and rotating the plate clockwise until firing contact plate plunger engages locking notch in plate.	___	___
B. INSTALL		
. Install right and left extractors into extractor pivots in the breech ring.	___	___
. Insert chain hoist into eye bolt on breechblock.	___	___
. Raise breechblock and guide it into breech ring until breechblock comes in contact with extractor plungers.	___	___
. Depress plungers and move breechblock upward.	___	___
. Install breechblock crank pivot in breechblock crank.	___	___
. Insert pivot in breechblock T-slot.	___	___
. Trip extractors with the screwdriver and raise the breechblock to the closed position.	___	___
. Insert small screwdriver or rod into the hold in breechblock crank stop and slide stop to the rear position.	___	___
. Jiggle the crank stop back and forth to assure that the plunger is seated in its recess.	___	___
. Release the tension on the chain hoist.	___	___
. Turn adjuster clockwise until plunger enters the first recess.	___	___
. Remove chain hoist and eye bolt.	___	___
. Install retractor guide with firing pin retractor and firing pin in its well by pushing guide forward until it is flush with inner surface of the well.	___	___
. Install firing pin spring and firing pin spring retainer.	___	___

ASSEMBLE MAIN GUN BREECHBLOCK [LOADER]. (Cont'd.)

	Yes	No
B. INSTALL (Cont'd.)		
. Depress plunger, and twist retainer clockwise until plunger is seated in its recess.	___	___
. Open and close breech several times. (The action of breech should be smooth without binding or shock. If it closes either too slow or too fast, increase or decrease the tension on the closing spring.)	___	___

DISASSEMBLE AN M2 MACHINEGUN [TANK COMMANDER].

	Yes	No
. Remove the barrel by pushing in on the barrel latch while depressing the barrel latch lock, rotating the barrel 90° and pulling the barrel out of the barrel jacket.	___	___
. Remove link chute adapter.	___	___
. Remove belt holding pawl pin.	___	___
. Remove the backplate by pushing in on the backplate latch lock while raising the backplate latch and sliding the backplate up and out of the receiver.	___	___
. Remove the bolt buffer group and separate by:		
- Pushing in on the rear of the driving spring guide rod and rotating it left or right until it can slide rearward.	___	___
- Grasping the bolt buffer and sliding rearward until clear of receiver.	___	___
- Sliding the driving spring rod off the drive rod.	___	___
- Sliding the drive rod out of the buffer spring.	___	___
- Sliding the buffer spring out of the buffer sleeve.	___	___
. Remove charger cover.	___	___
. Retract manual charger to aline bolt stud with disassembly holes in left side of side plate.	___	___
. Remove bolt stud.	___	___
. Remove bolt assembly.	___	___
. Remove extractor and bolt switch.	___	___
. Release firing pin.	___	___
. Disengage cocking lever and cocking lever pin.	___	___
. Remove cocking lever and cocking lever pin.	___	___
. Release accelerator stop lock.	___	___
. Remove accelerator stop lock.	___	___
. Depress accelerator stop.	___	___
. Remove accelerator stop.	___	___
. Remove sear slide and sear spring.	___	___
. Remove firing pin extension.	___	___
. Disengage firing pin from firing pin extension.	___	___
. Depress buffer body spring and push barrel extension to the rear.	___	___
. Remove buffer assembly and barrel extension assembly.	___	___
. Push forward on tips of accelerator and disconnect buffer from barrel extension.	___	___

DISASSEMBLE AN M2 MACHINEGUN [TANK COMMANDER]. (Cont'd.)

	Yes	No
. Remove barrel buffer body from buffer assembly.	___	___
. Remove accelerator pin and accelerator from barrel buffer body.	___	___
. Remove breech lock-pin and breech lock from barrel extension.	___	___
. Remove belt feed lever lock-pin.	___	___
. Push belt feed lever to the right until toe is in line with slot in cover.	___	___
. Remove belt feed lever.	___	___
. Remove belt feed slide group.	___	___
. Remove belt feed pawl pin.	___	___
. Disassemble belt feed slide group.	___	___
. Remove trigger bar.	___	___

ASSEMBLE AN M2 MACHINEGUN [TANK COMMANDER].

	Yes	No
. Clean and lubricate components.	___	___
. Install trigger box.	___	___
. Assemble belt feed group.	___	___
. Install belt feed pawl pin.	___	___
. Install belt feed slide group.	___	___
. Insert compression helical spring and headless shoulder pin into belt feed lever for right hand feed.	___	___
. Position belt feed lever on pivot stud, press in headless shoulder pin and install lever.	___	___
. Install belt feed lever lock-pin.	___	___
. Install breech lock and secure with pins; insure that breech lock double beveled edge is in position.	___	___
. Position accelerator in barrel buffer body and secure pins.	___	___
. Assemble barrel buffer body and buffer assembly.	___	___
. Hold buffer assembly with accelerator up and engage notch on shank of barrel extension with crossgroove in piston rod of buffer. Aline depressors in grooves of barrel extension and push buffer forward.	___	___
. Install buffer assembly and barrel extension assembly; push barrel extension forward.	___	___
. Assemble firing pin and firing pin extensions.	___	___
. Install sear spring and sear.	___	___
. Press downward on sear and install sear slide.	___	___
. Insert accelerator stop and press in place.	___	___
. Install accelerator stop lock, swing stop into groove in bolt.	___	___
. Install cocking lever and cocking lever spring; press in sear slide.	___	___
. Install bolt switch and extractor so that grooves in switch aline with grooves of bolt for right hand feed.	___	___
. Install bolt assembly.	___	___
. Install bolt stud.	___	___
. Install charger cover.	___	___
. Insert driving spring rod assembly into its hole in bolt, push rod forward and when pin on rod is alined with hole, seat pin in hole.	___	___

ASSEMBLE AN M2 MACHINEGUN [TANK COMMANDER]. (Cont'd.)

	Yes	No
. Start backplate into grooves in rear of receiver, disengage latch lock and push backplate down until latch is engaged.	___	___
. Install belt holding pawl.	___	___
. Install chute link adapter.	___	___
. Install barrel.	___	___
. Close cover.	___	___

ADJUST HEADSPACE ON THE M2 MACHINEGUN [TANK COMMANDER].

	Yes	No
. Raise cover assembly.	___	___
. Retract recoiling parts approximately 5/8" by pulling on the charging handle until lug on the barrel locking spring alines with the hole in the right sideplate of the receiver.	___	___
. Screw barrel fully into extension.	___	___
. Unscrew barrel two notches.	___	___
. Release charger handle.	___	___
. Cock machinegun to withdraw firing pin from face of bolt.	___	___
. Allow bolt to return manually to battery position.	___	___
. Retract recoiling parts approximately 1/16".	___	___
. Raise extractor.	___	___
. Insert GO end of headspace gage into T-slot between face of bolt and barrel.	___	___
. If GO end of gage enters T-slot to center ring of gage and the NO GO end will not enter, headspace is correct.	___	___
. If GO end of gage will not enter T-slot freely, headspace is too tight.	___	___
. To adjust:		
- Retract bolt.	___	___
- Unscrew barrel one notch.	___	___
- Return parts to battery position.	___	___
- Retract recoiling parts.	___	___
- Check headspace.	___	___
- Repeat until headspace is correct.	___	___
. If NO GO end of gage enters T-slot, headspace is too loose.	___	___
. To adjust:		
- Retract bolt.	___	___
- Screw barrel into barrel extension one notch.	___	___
- Return parts to battery position.	___	___
- Retract recoiling parts.	___	___
- Check headspace.	___	___
- Repeat until headspace is correct.	___	___

ADJUST TIMING ON THE M2 MACHINEGUN [TANK COMMANDER].

	Yes	No
. Raise cover.	___	___
. Cock machinegun to withdraw firing pin from face of bolt.	___	___
. Raise extractor.	___	___
. Retract bolt sufficiently to insert the NO FIRE gage (0.116 inch) between barrel extension and trunnion block.	___	___
. Release handle.	___	___
. Depress trigger (Gun should not fire).	___	___
. If firing pin is released with NO FIRE gage installed, timing is early.	___	___
. To adjust:		
- Move recoiling parts rearward enough to remove NO FIRE gage.	___	___
- Cock machinegun.	___	___
- Remove backplate.	___	___
- Retract bolt sufficiently rearward to install NO FIRE gage.	___	___
- Turn trigger bar stop adjusting nut to the left one notch.	___	___
- Attempt to fire gun by pushing up on rear of trigger bar (Gun should not fire).	___	___
- When gun does not fire, insert the FIRE gage and push up on rear of trigger bar. (If firing pin is not released, timing is correct).	___	___
. If firing pin is not released with the NO FIRE gage installed, retract bolt sufficiently to remove NO FIRE gage and install the FIRE gage (0.020 inch) between barrel extension and trunnion block.	___	___
. Release charger handle.	___	___
. Depress manual firing device on solenoid (The gun should fire).	___	___
. If firing pin is not released with FIRE gage installed, timing is early.	___	___
. To adjust:		
- Remove backplate.	___	___
- Turn trigger bar stop adjusting nut to the right one notch.	___	___
- Attempt to fire gun by pushing up on rear of trigger bar.	___	___
- If trigger pin does not release, continue to turn trigger bar stop adjusting nut one notch at a time to the right and attempt to fire at each turn until firing pin does not release.	___	___
- When gun fires, install backplate.	___	___
- Remove FIRE gage and cock gun.	___	___
- Retract bolt sufficiently rearward to install NO FIRE gage.	___	___
- Depress manual firing device on solenoid.	___	___
- Timing is correct if firing pin does not release.	___	___

MODULE II

WEAPON SYSTEM PREPARATION

MODULE II: WEAPON SYSTEMS PREPARATION

OBJECTIVE: To determine whether the tank crew can prepare the weapon systems for a tactical operation, including boresighting and zeroing.

PROCEDURE: The Tank Commander should direct his crew to proceed to the weapons test fire area to prepare the weapon systems.

CONDITIONS: 1. The module can be administered during daylight or darkness.

2. A live-fire area will be provided for zeroing.

RATER ACTIVITIES: The rater must observe each of the operations on the attached checklist. He must not question crew members, indicate the ratings that are being given, or prompt crew members in any way.

RATER EQUIPMENT:

Rating sheets, Module II, attached

M48A5 Technical Manual

Binoculars

PERFORMANCE ASSESSMENT:

1. A ground guide must be used when moving the vehicle to the weapons test fire area.

2. Weapons must be properly boresighted and zeroed.

3. Activities must be completed within one hour.

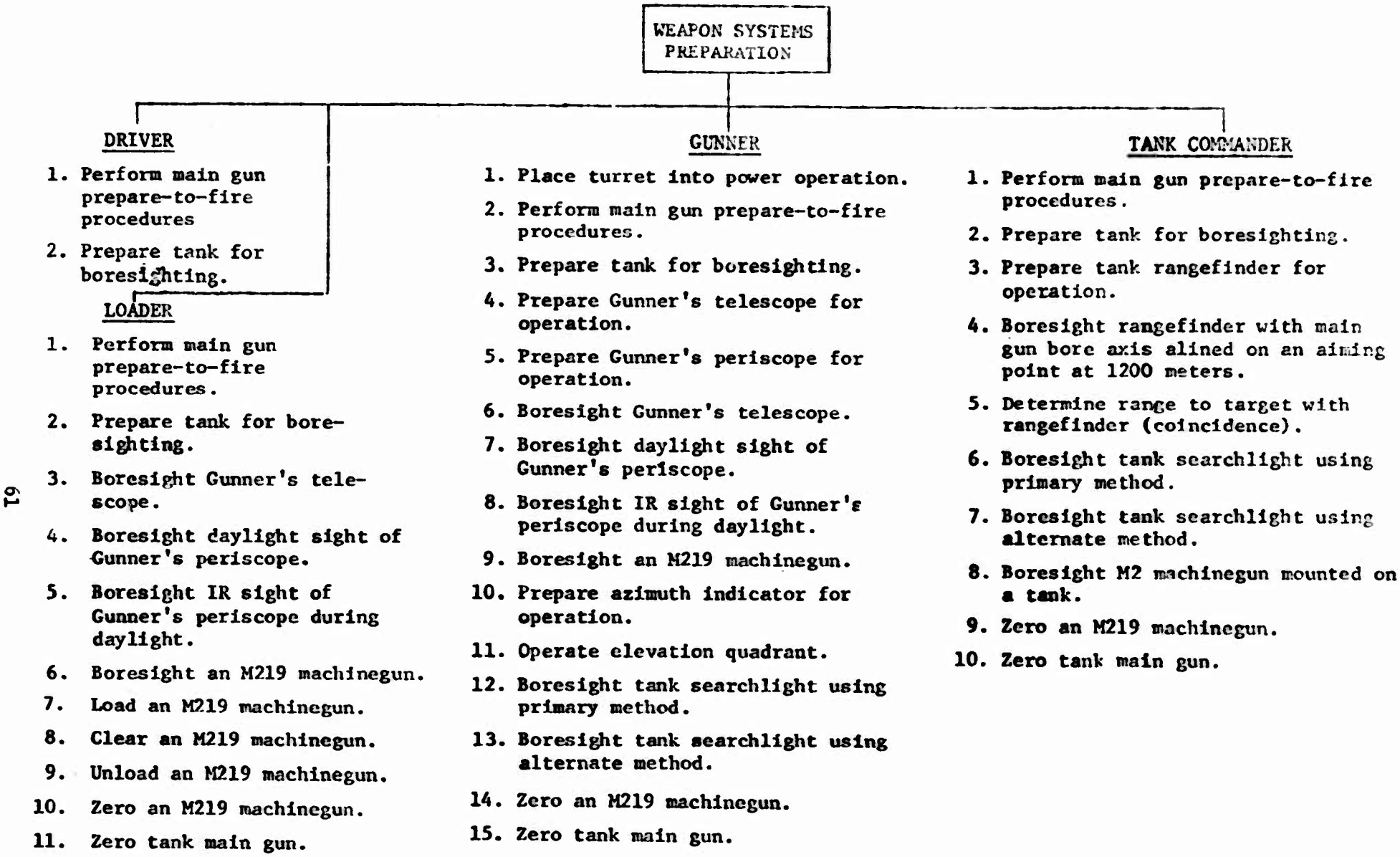


Figure 10. Tasks performed by each crew member during Module II: Weapon Systems Preparation

PLACE TURRET INTO POWER OPERATION [GUNNER]

	Yes	No
. Insure that the tank and surrounding area are clear of obstructions.	___	___
. Insure that crew is in safe position and Driver has lowered his seat and has his head down.	___	___
. Tell Loader to release gun tube from travel lock.	___	___
. Unlock turret lock.	___	___
. Announce POWER to alert the crew.	___	___
. Check that engine has been started and set at 800 to 900 RPM.	___	___
. Insure manual traversing handle locking lever is in the detent position.	___	___
. Place TURRET POWER switch in the ON position.	___	___
. Squeeze magnetic brake switch and rotate Gunner's control handle to traverse turret.	___	___
. Rotate handles rearward and forward to elevate and depress gun.	___	___

PERFORM PREPARE TO FIRE PROCEDURES [DRIVER/LOADER/GUNNER/TANK COMMANDER]

		Yes	No
Tank Commander	. Command PREPARE TO FIRE.	___	___
Tank Commander	. Disconnect breakaway plug.	___	___
Tank Commander	. Clean exterior lens and vision devices on turret.	___	___
Tank Commander	. Check operation of shield on M36 periscope.	___	___
Tank Commander	. Check instrument lights.	___	___
Gunner	. Clean and inspect Gunner's direct fire sights (interior).	___	___
Gunner	. Check operation of ballistic shield.	___	___
Gunner	. Check instrument lights.	___	___
Loader	. Check recoil oil.	___	___
Loader	. Check breechblock crank stop.	___	___
Loader	. Inspect gun tube and chamber.	___	___
Loader	. Check coaxial machinegun mount and adjust solenoid.	___	___
Loader	. Inspect turret stowed ammunition.	___	___
Driver	. Lower seat and close hatch.	___	___
Driver	. Turn master control switch ON.	___	___
Tank Commander	. Command CHECK FIRING SWITCHES.	___	___
Tank Commander	. Check firing trigger on power controlhandle when main gun switch is ON and when coaxial machinegun switch is ON.	___	___
Gunner	. Turn main gun switch ON.	___	___
Gunner	. Check firing trigger on power control handle and trigger on manual control handle.	___	___
Gunner	. Check main gun manual firing device.	___	___
Gunner	. Announce ON THE WAY each time a trigger is pressed.	___	___
Loader	. Move gun safety switch to FIRE and insert circuit tester. (Insert cover at night to protect nigh vision.)	___	___
Loader	. Observe for lighting in bulb each time trigger is pressed.	___	___
Loader	. Announce NO FIRE if light fails to come on.	___	___

PERFORM PREPARE TO FIRE PROCEDURES [DRIVER/LOADER/GUNNER/TANK COMMANDER] (Continued)

		Yes	No
Loader	. Close cover and cock coaxial machinegun and listen for the action of the barrel and barrel extension going forward when TC and Gunner check triggers.	___	___
Loader	. Remove and stow circuit tester.	___	___
Driver	. Start engine.	___	___
Tank Commander	. Command CHECK GUN CONTROLS.	___	___
Tank Commander	. Check power control handle for power elevation and power traverse.	___	___
Loader	. Check hull stowed ammunition.	___	___
Tank Commander	. Command CHECK FIRE CONTROLS.	___	___
Tank Commander	. Turn cupola power switch ON.	___	___
Tank Commander	. Check operation of caliber .50 machinegun mount and controls.	___	___
Tank Commander	. Check for binding on rangefinder.	___	___
Tank Commander	. Turn ballistic computer ON.	___	___
Tank Commander	. Index various ranges on range finder and tell Gunner to ensure they are indexed on ballistic computer.	___	___
Gunner	. Set range correction knob of ballistic computer at zero.	___	___
Gunner	. Check manual operation of computer.	___	___
Gunner	. Push RESET button on computer.	___	___
Gunner	. Check that pointers on computers synchronize at various indexed ranges.	___	___
Gunner	. Check that superelevation counter indicates correct superelevation for various ammunition and ranges.	___	___
Gunner	. Turn range correction knob of ballistic computer to proper setting.	___	___
Tank Commander	. Command REPORT.	___	___
Gunner	. Report GUNNER READY.	___	___
Loader	. Report LOADER READY.	___	___
Driver	. Report DRIVER READY.	___	___

PREPARE TANK FOR BORESIGHTING [TANK COMMANDER/GUNNER/LOADER/DRIVER]

		Yes	No
Tank Commander	. Direct positioning of the tank on level ground.	___	___
Driver	. Position vehicle on level ground.	___	___
Gunner	. Set superelevation on the ballistic computer to ZERO.	___	___
Gunner	. Center right telescope of binocular M17A1 over firing pin hole.	___	___
Gunner	. Aline axis of 105mm gun bore on right angle of aiming point by operating the manual traversing and elevating handles while using firing pin hole as rear sight and cross threads on the muzzle as front sight.	___	___
Tank Commander	. Range to the boresight target.	___	___
Tank Commander	. Set the known tank-to-boresight target range on the range scale of the rangefinder.	___	___
Tank Commander	. Place the computer switch on the rangefinder in the OFF position.	___	___
Loader	. Place black thread over witness lines.	___	___
Loader	. Secure thread on muzzle end of main gun.	___	___
Loader	. Remove firing mechanism from breechblock.	___	___

PREPARE GUNNER'S TELESCOPE FOR OPERATION [GUNNER]

	Yes	No
. Inspect eyepiece hanger and screws for presence and tightness.	___	___
. Inspect the hanger assembly and quick disconnect pin for presence, proper fit, and swivel movement.	___	___
. Inspect the holder assembly to ensure that the pin on the telescope and the slot on the holder assembly are seated.	___	___
. Adjust headrest by loosening adjusting nut and sliding headrest to desired position and tightening nut.	___	___
. Clean lenses.	___	___
. Focus eyepiece by rotating diopter to the maximum plus reading and then rotating the diopter back until the view through the eyepiece appears with the maximum sharpness.	___	___
. Set reticle illumination by rotating the rheostat knob on instrument light M50.	___	___
. Remove filters from filter box.	___	___
. Clean if required, and inspect for cracks.	___	___
. If conditions warrant use of filters, select proper filter.	___	___
. Attach filter to telescope eyepiece.	___	___
. View through eyepiece and move reticle selector to each position checking to see that both reticles are visible.	___	___

BORESIGHT GUNNER'S TELESCOPE [GUNNER/LOADER]

		Yes	No
Gunner .	Move reticle selector switch until reticle corresponding to type of ammunition that will be used to zero can be seen through the eyepiece.	___	___
Gunner .	Unlock telescope mount elevation and deflection boresight knobs.	___	___
Gunner .	Rotate the boresight knobs until the boresight aiming cross of the reticle is on the same aiming point as the muzzle cross threads.	___	___
Gunner .	Move elevation and deflection knob locking levers to the lock position.	___	___
Gunner .	Rotate slip scales on the elevation and deflection knobs to read 3 and 3.	___	___
Gunner .	Tell Loader to confirm that the muzzle cross threads are on the aiming point.	___	___
Loader .	Check the lay of the main gun to assure it is on the aiming point by sighting through firing pin hole using the M17A1 binoculars.	___	___

PREPARE GUNNER'S PERISCOPE FOR OPERATION [GUNNER]

	Yes	No
• Inspect the M118 mount for general condition.	___	___
• Report any damage to the vehicle commander.	___	___
• Adjust the day light and IR headrest for proper fit.	___	___
• Open ballistic shield.	___	___
• Adjust diopter on the daylight sight by rotating the diopter to the maximum-plus reading and then back until the image seen through the eyepiece appears with the maximum sharpness.	___	___
• Set the reticle illumination by rotating the light source control knob until reticle appears with desired brightness.	___	___

BORESIGHT DAYLIGHT SIGHT OF GUNNER'S PERISCOPE [GUNNER/LOADER]

	Yes	No
Gunner . Sight through the eyepiece, disengage the elevation and deflection boresight knobs, and rotate the knobs until the aiming cross is on the same aiming point as the muzzle cross threads.	___	___
Gunner . Rotate slip scale on the elevation and deflection boresight knobs to read 4 and 4.	___	___
Gunner . Confirm that the daylight sight reticle is on the aiming point.	___	___
Gunner . Tell Loader to confirm that the muzzle cross threads are on the aiming point.	___	___
Loader . Check the lay of the main gun to identify the aiming point by sighting through the firing pin hole with the M17A1 binoculars.	___	___

BORESIGHT IR SIGHT OF GUNNER'S PERISCOPE DURING DAYLIGHT [GUNNER/LOADER]

		Yes	No
Gunner ·	Open the ballistic shield.	___	___
Gunner ·	Place opaque material over the periscope head assembly with a 3/4 inch hole in line with the IR body.	___	___
Gunner ·	Place the IR switch in the 1.5 volt position.	___	___
Gunner ·	View through the IR eyepiece and rotate the IR diopter to the maximum plus reading then back until the grain on the converter tube surface as seen through the eyepiece appears clear and sharp.	___	___
Gunner ·	Rotate the light source control until the reticle illumination has the desired brightness.	___	___
Gunner ·	Sight through the eyepiece and rotate focusing ring until the target appears with the maximum sharpness.	___	___
Gunner ·	Disengage and rotate the elevation and deflection boresight knobs until the aiming cross of the reticle is alined on the same aiming point as the muzzle cross threads.	___	___
Gunner ·	Rotate slip scale on the elevation and deflection boresight knobs to read 4 and 4.	___	___
Gunner ·	Confirm that aiming cross on the reticle of the daylight scope is on the aiming point.	___	___
Gunner ·	Tell Loader to confirm that the muzzle cross threads are on the aiming point.	___	___
Loader ·	Check the lay of the main gun to identify the aiming point by sighting through the firing pin hole using the M17A1 binoculars.	___	___

BORESIGHT AN M219 MACHINEGUN MOUNTED ON A TANK [LOADER/GUNNER]

		Yes	No
Loader	· Remove the solenoid electrical lead from the machinegun backplate assembly by grasping the solenoid plug and apply a downward force.	—	—
Loader	· Pull the right disconnector ring rearward with sufficient force to disengage the disconnector pin from the disconnector hole.	—	—
Loader	· Rotate the receiver downward and pull rearward until disengaged from mounting block.	—	—
Loader	· Loosen support setscrews located in the gun mount cover shield collar approximately 1 1/2 turns.	—	—
Loader	· Select the target employed to boresight the main gun with a clearly defined right angle at a distance of 1200 meters.	—	—
Loader	· Aline the machinegun bore vertically on target while viewing the aiming point through the right binocular M17A1 so as to adjust the machinegun elevation alinement with the bore of the main gun by loosening or tightening the adjusting screws.	—	—
Loader	· Physically inspect both vertical screws to insure they are tightened securely.	—	—
Loader	· Tighten lock and jam nuts.	—	—
Loader	· Tighten mounting screws.	—	—
Loader	· Loosen bracket assembly mounting screws.	—	—
Loader	Loosen lock and jam nuts on both front and rear horizontal adjusting set screws.	—	—
Loader	· Aline machinegun bore horizontally on target by loosening or tightening front and rear horizontal adjusting screws while viewing the aiming point through the right binocular M17A1 thereby adjusting machinegun azimuth with the bore of the 105mm gun.	—	—
Loader	· Inspect visually and mechanically, both horizontal adjusting screws and insure they are tightened securely.	—	—
Gunner	· Rotate, either to the left or right, the rheostat knob on the infinity sight M44C for periscope M31 or the rheostat knob of the light source control for periscope M30 in order to adjust brightness of reticle.	—	—

BORESIGHT AN M219 MACHINEGUN MOUNTED ON A TANK [LOADER/GUNNER] (Continued)

		Yes	No
Loader .	Adjust, by rotating support set screws in collar on gun mount cover until they contact the flash suppressor body, then back off setscrews 1/4 to 1/2 turn.	___	___
Gunner .	Rotate both the elevation and deflection boresight knobs on the infinity sight so as to aline the center of reticle on aiming point of target.	___	___
Loader .	Replace receiver assembly by positioning left disconnector pin through left disconnector hole in mounting block.	___	___
Loader .	Pull rearward on right disconnector ring to allow the disconnector pin to clear the mounting block and rotate the receiver counter-clockwise until the disconnector pin is alined with the disconnector hole.	___	___
Loader .	Release disconnector ring allowing the disconnector pin to seat itself in the disconnector hole of the mounting block.	___	___
Loader .	Grasp receiver group and apply rotational force to insure that the disconnector pins are securely seated.	___	___
Loader .	Connect the solenoid electrical lead to the back plate assembly and insure that it is seated.	___	___

PREPARE AZIMUTH INDICATOR FOR OPERATION [GUNNER]

	Yes	No
· Rotate rheostat knob until desired brightness is obtained.	___	___
· Place the aiming cross of the periscope on the reference point.	___	___
· Perform accuracy test by traversing turret 360 degrees to return to original reference point. (Do not go beyond reference point)	___	___
· Set the micrometer and azimuth pointers on zero.	___	___
· Perform slippage test by traversing the turret rapidly in power and stop suddenly.	___	___
· Repeat this operation two or more times in same direction.	___	___
· Manually traverse turret in opposite direction to return to original reference point.	___	___
· Insure that both the micrometer and azimuth pointers are on zero.	___	___

OPERATE ELEVATION QUADRANT [GUNNER]

	Yes	No
· Place aiming point on the center of the target and establish a line of sight.	___	___
· Measure the position of the gun tube by rotating the micrometer knob until the bubble is centered in the level vial.	___	___
· Read elevation from the elevation and micrometer scales.	___	___

PREPARE TANK RANGEFINDER FOR OPERATION [TANK COMMANDER]

	Yes	No
. Adjust headrest to fit the contour of the head.	___	___
. Rotate occluder knob to the R position.	___	___
. Rotate the diopter scale to the maximum plus reading.	___	___
. Rotate the diopter scale until the view through the eyepiece appears with the maximum sharpness.	___	___
. If necessary move the filter switch to the left to place the filters into the optical system.	___	___
. Rotate the range scale rheostat to determine if range scale lamp is illuminated.	___	___
. Set rheostat until desired brightness has been obtained.	___	___
. Rotate the occluder to the L position.	___	___
. Move the reticle switch to the aux-gunsight position.	___	___
. Sight through the eyepiece and set red illuminated reticle for brightness by rotating reticle rheostat.	___	___
. Rotate occluder knob to the center position and move reticle switch to the coincidence position.	___	___
. Sight through the eyepiece and set coincidence reticle brightness by rotating the coincidence reticle rheostat.	___	___
. Move reticle switch to the OFF position.	___	___
. Rotate the occluder knob to the R position.	___	___
. Set the known tank-to-target range on the range scale by rotating the range knob.	___	___
. Rotate the occluder knob to the center position.	___	___
. Sight through eyepiece and rotate the horizontal adjustment knob until the ghost image is positioned to the left of the actual image.	___	___
. Rotate the vertical adjustment knob to bring the ghost image into vertical alinement with the actual image.	___	___
. Rotate the horizontal adjustment knob to bring the ghost image into alinement with the actual image from the left to the right -- stop the instant coincidence has been obtained.	___	___

PREPARE TANK RANGEFINDER FOR OPERATION [TANK COMMANDER] - Continued

	Yes	No
. Check target image coincidence by ranging on a known distance target.	___	___
. Move reticle switch to coincidence position.	___	___
. Loosen the wing nut and swing the red ICS knob cover aside.	___	___
. Rotate the ICS knob until vertical lines of the upper right half and lower left portions of the coincidence reticle are alined.	___	___
. Loosen the wing nut and swing the red halving knob cover aside.	___	___
. Rotate halving knob until horizontal lines of the upper right half and the lower left portions of the coincidence reticle are alined to form a cross.	___	___
. Swing the ICS and halving knob covers into place and secure with wing nuts.	___	___
. Move reticle switch to the OFF position.	___	___

BORESIGHT RANGEFINDER WITH THE MAIN GUN BORE AXIS ALINED ON AN AIMING POINT AT 1200 METERS [TANK COMMANDER]

	Yes	No
. Check coincidence reticle for alinement and if necessary, aline reticle using horizontal and vertical adjustment.	___	___
. Place the occluder knob on the rangefinder in the R position.	___	___
. Move the locking levers of the main elevation and deflection boresight knobs to the unlocked position.	___	___
. Sight through rangefinder eyepiece and aline the blacketched cross on the sight reticle with the same aiming point as the main gun bore axis.	___	___
. Move the boresight knob locking levers to the lock position.	___	___
. Rotate slip scale to read 2 on elevation boresight knob and 3 on deflection boresight knob.	___	___
. Place the occluder knob in the L position.	___	___
. Place the reticle switch on the rangefinder in the aux-gunsight position.	___	___
. Unlock auxiliary elevation and deflection knobs.	___	___
. Rotate the knobs to aline the red illuminated cross on the same aiming point as the main gun bore axis.	___	___
. Lock aux-gunsight elevation and deflection knobs.	___	___
. Rotate slip scale on auxiliary elevation boresight knob to read 2 and the auxiliary deflection boresight knob to read 3.	___	___
. Check main gun bore axis, main gun laying reticle of the rangefinder, and the aux-gunsight to assure that each is alined on the same aiming point.	___	___

DETERMINE RANGE TO TARGET WITH RANGEFINDER (COINCIDENCE) [TANK COMMANDER]

	Yes	No
. Place OCCLUDER knob in center position.	___	___
. Concentrate on a vertical or near vertical part of the target and rotate the range knob until the two target images merge.	___	___
. Read range to target on range scale.	___	___

BORESIGHT TANK SEARCHLIGHT USING PRIMARY METHOD [TANK COMMANDER/GUNNER]

		Yes	No
Tank Commander	. Select a target as near 1200 meters as possible.	___	___
Tank Commander	. Tell Driver to idle tank engine at 1000-1200 RPM.	___	___
Tank Commander	. Turn searchlight main power switch to the ON position and turn searchlight control to VIS FOCUS mode.	___	___
Gunner	. Remove all superelevation from the fire control system using the computer's superelevation handcrank.	___	___
Gunner	. Lay aiming cross of primary sight on the center of the boresight panel or target chosen.	___	___
Gunner	. Center the bubble on the elevation quadrant using the micrometer knob.	___	___
Gunner	. Apply plus 5 mils on elevation quadrant using the micrometer knob.	___	___
Gunner	. Manually elevate the gun until the bubble is centered.	___	___

BORESIGHT TANK SEARCHLIGHT USING THE ALTERNATE METHOD (XENON)
[TANK COMMANDER/GUNNER]

		Yes	No
Tank Commander	. Direct Driver to position tank so the searchlight is approximately 10 meters from a wall.	___	___
Tank Commander	. Draw a cross on the wall approximately 7 feet from the ground.	___	___
Tank Commander	. Draw a second cross 16 1/2 inches directly above the first cross and vertically in line with the first cross.	___	___
Tank Commander	. Tell Driver to insure that the tank engine is run at a fast idle speed.	___	___
Tank Commander	. Turn searchlight main power switch to ON position and turn searchlight control to VIS FOCUS mode.	___	___
Tank Commander	. Adjust horizontal and vertical adjustment screws until the searchlight beam is centered on the upper cross.	___	___
Tank Commander	. Tell Loader to draw reference mark at the bottom edge of the searchlight beam.	___	___
Tank Commander	. Adjust vertical and horizontal adjustment screws until the bottom of the searchlight beam is above and just touching the reference mark.	___	___
Gunner	. Remove superelevation from fire control system using computer's handcrank.	___	___
Gunner	. Boresight main gun on lower cross.	___	___
Gunner	. Center the bubble on the elevation quadrant using the micrometer knob.	___	___
Gunner	. Apply plus 5 mils to elevation quadrant using the micrometer knob.	___	___
Gunner	. Manually elevate the gun until the bubble is centered.	___	___

BORESIGHT M2 MACHINEGUN MOUNTED ON A TANK [TANK COMMANDER]

	Yes	No
. Disconnect solenoid lead connector.	___	___
. Remove backplate group and open cover.	___	___
. Remove driving spring rod.	___	___
. Remove charger cover.	___	___
. Remove bolt stud.	___	___
. Remove bolt and close cover.	___	___
. Sight through machinegun barrel and aline axis of gun bore on defined target approximately 500 meters in range.	___	___
. Lock azimuth lock.	___	___
. Adjust deflection without moving the gun or cupola.	___	___
. Adjust elevation.	___	___
. Install bolt.	___	___
. Install bolt stud.	___	___
. Install charger cover.	___	___
. Install driving spring rod.	___	___
. Install backplate group.	___	___
. Connect solenoid lead connector.	___	___

LOAD AN M219 MACHINEGUN [LOADER]

	Yes	No
. Push forward on the rear of the left cover latch rod assembly and raise the cover.	___	___
. Raise the feed tray.	___	___
. Place the machinegun safety in the FIRE position.	___	___
. Charge (cock) the machinegun by pulling the charger handle to the rear.	___	___
. Inspect the chamber for obstructions by looking and feeling in the chamber.	___	___
. Place safety in SAFE.	___	___
. Lower feed tray.	___	___
. Feed ammunition belt through chute of ammunition box.	___	___
. Place first round of ammunition belt in feed tray slot with the open side of ammunition link loops facing down.	___	___
. Close machinegun cover assuring that lock rod is engaged.	___	___

CLEAR AN M219 MACHINEGUN [LOADER]

	Yes	No
. Charge weapon to lock moving parts to the rear.	___	___
. Instruct Gunner to turn electrical machinegun switch OFF.	___	___
. Place machinegun safety in SAFE.	___	___
. Push left cover latch rod forward and raise cover.	___	___
. Remove ammunition from feed tray.	___	___
. Lift feed tray.	___	___
. Look and feel in receiver and chamber to insure they are clear of ammunition.	___	___
. Place machinegun safety in FIRE.	___	___
. Charge (cock) machinegun by pulling the charge handle to the rear.	___	___
. Allow barrel extension to close slowly by maintaining tension on the charging handle and depressing manual firing trigger.	___	___
. Place safety in SAFE.	___	___
. Close the cover assembly.	___	___

UNLOAD AN M219 MACHINEGUN [LOADER]

	Yes	No
. Direct Gunner to turn machinegun switch OFF.	___	___
. Place safety in SAFE.	___	___
. Open cover assembly.	___	___
. Remove ammunition belt from the machinegun.	___	___

ZERO AN M219 MACHINEGUN [GUNNER/TANK COMMANDER/LOADER]		Yes	No
Gunner	. Select a target with a clearly defined aiming point at a known range as near 800 meters as possible.	—	—
Tank Commander	. Rotate the range knob of the rangefinder to range the target.	—	—
Gunner	. Index the lowest velocity tank main gun ammunition in the ballistic computer.	—	—
Gunner	. Sight through the unity power window of the Gunner's periscope (M31) and lay the target in the center of the aiming circle by operating the manual elevation and traversing handles.	—	—
Loader	. Load weapon.	—	—
Loader	. Announce UP.	—	—
Gunner	. Place the electrical machinegun switch on the Gunner's panel in the ON position.	—	—
Gunner	. Depress the electrical firing trigger and fire a 20-25 round burst.	—	—
Gunner	. Observe the strike of the rounds in relation to the target.	—	—
Gunner	. Rotate the infinity sight boresight knobs to move the sight reticle so that the strike area is in the center of the field of view.	—	—
Gunner	. Fire an additional 20-25 round burst to check the accuracy of adjustment.	—	—
Gunner	. Rotate the infinity sight boresight knobs, if necessary, to readjust the field of view in relation to the strike of the rounds.	—	—

ZERO TANK MAIN GUN [TANK COMMANDER/GUNNER/LOADER]		Yes	No
Tank Commander	. Turn computer switch ON.	___	___
Gunner	. Index ammunition element into ballistic computer.	___	___
Tank Commander	. Index range into rangefinder.	___	___
Loader	. Load main gun.	___	___
Loader	. Announce UP.	___	___
Gunner	. Lay sight reticle on center of mass of target by operating the manual elevation and traversing handles.	___	___
Gunner/ Loader	. Fire a three round shot group.	___	___
Gunner	. Unlock boresight knobs and move sight reticle to center of shot group, without disturbing the lay of the gun.	___	___
Gunner	. Re-lay main gun back to center of mass by operating the manual elevation and traversing handles.	___	___
Gunner/ Loader	. Fire a check round.	___	___
Gunner	. Re-lay main gun back to center of mass by operating the manual elevation and traversing handles.	___	___
Gunner	. Record elevation and deflection readings on all sights.	___	___

MODULE III

TACTICAL OPERATIONS

MODULE III: TACTICAL OPERATIONS

OBJECTIVE: To determine whether the tank crew can move, shoot and communicate in a tactical combat environment.

PROCEDURE: The Tank Commander should insure that his tank crosses the LD at the appropriate time. The crew will move through friendly forces and attack the area shown as PL ZULU on the sketch map. During the operations phase, they will encounter enemy personnel, wheeled vehicles and tanks. All targets of opportunity must be engaged.

CONDITIONS: 1. The module can be administered during daylight or darkness along a tactical route capable of supporting tank traffic.
2. The route will not exceed 5 KM nor have more then four lateral routes or key terrain features.

RATER ACTIVITIES: The rater will respond to all tested vehicle radio traffic and initiate or respond to radio traffic to insure the test situations, boundaries and time limits are being followed. The rater must observe each of the operations on the attached checklist. He must not question crew members, indicate the ratings that are being given or prompt crew members in any way.

RATER EQUIPMENT:

Rating sheets, Module III, attached

Map 1:50,000

Binoculars

Protective mask

CEOI Extract

PERFORMANCE ASSESSMENT:

1. Activities must be completed within 2 hours of crossing the LD.

2. When operating the tank, the Driver must:

- . Operate with minimum guidance from the Tank Commander.
- . Select course of movement by viewing and analyzing terrain prior to movement.
- . Position tank, when moving and at the halt, to take advantage of terrain and vegetation.
- . Evaluate soil condition by color and vegetation to avoid impassable ground.
- . Maintain steady speed during movement.
- . Traverse open areas rapidly.
- . Traverse areas slowly when visibility is restricted.

3. Radio traffic must be kept to a minimum. Reports not required by SOP or immediately by the situation are not submitted by radio.

- Reports required are submitted by:

- - SOP format or,
- - Who.
- - What.
- - Where.
- - When.
- - Activity.

4. Radio security must be maintained:

- . Friendly information not sent in the clear.
- . Correct radio telephone procedure used.
- . Codes and clear text not interchanged.

5. Activities must be completed within one hour of crossing the LD.

ATTACHMENTS:

Schematic diagram, Module III

Rating sheets, Module III

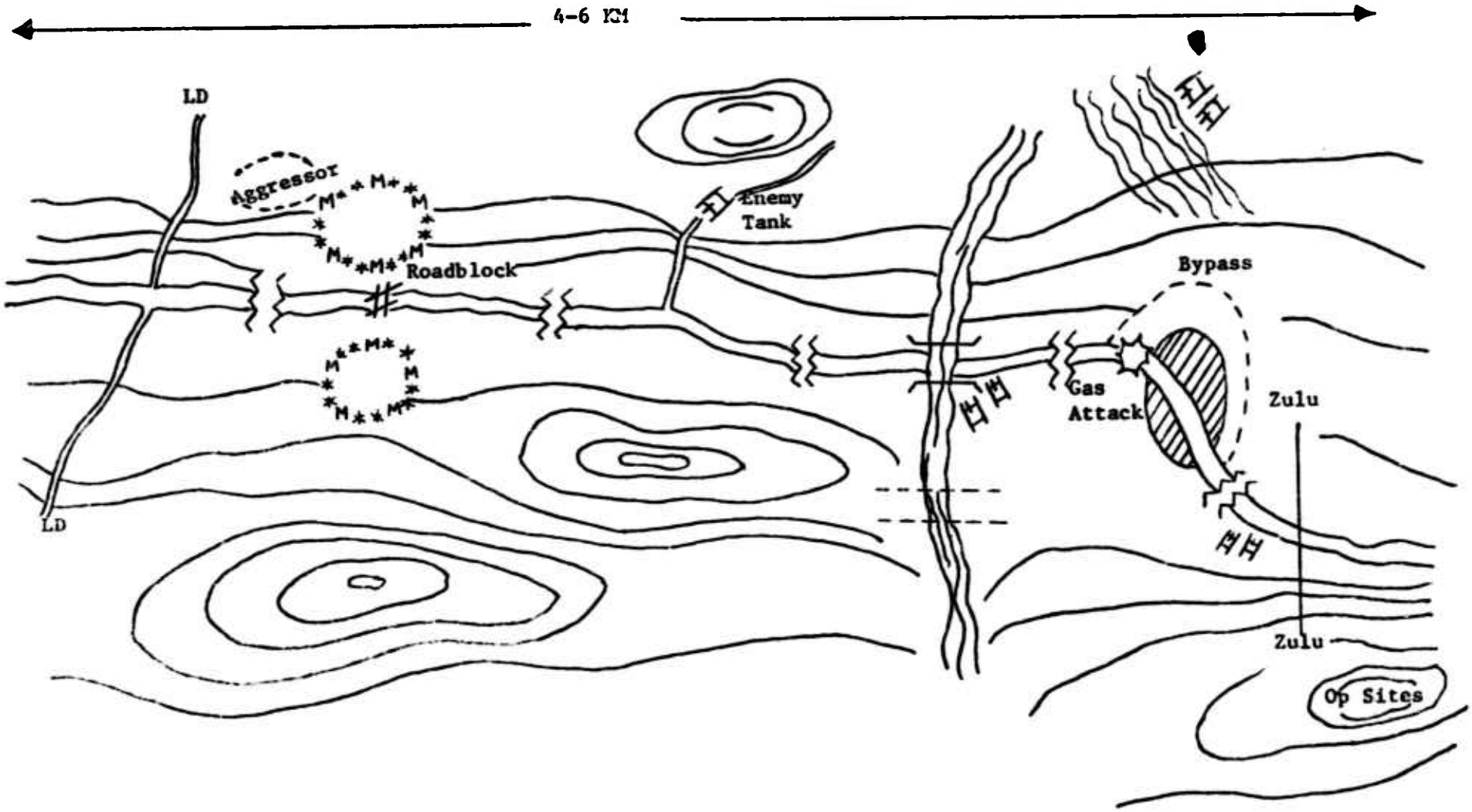
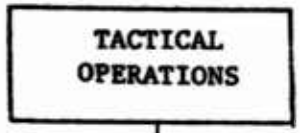


Figure 11. Schematic Diagram, Module III



DRIVER

1. Drive the tank over varied terrain - hatch open/close.
2. Operate a tank across a water obstacle.
3. Install the M24 (IR) periscope.
4. Place the M24 (IR) periscope into operation.
5. Acquire targets.
6. Perform evasive maneuvers upon enemy contact.
7. Coax engagement - moving tank - stationary target - Gunner fires.
8. Coax engagement - moving tank - moving target - TC fires.
9. Main gun engagement - moving to a halt - stationary target - Gunner fires.
10. Caliber .50 engagement - moving to a halt - moving target - TC fires.
11. Main gun engagement - moving to a halt - stationary target - TC fires.
12. Main gun engagement - moving to a halt - moving target - Gunner fires.
13. Main gun engagement - stationary tank - stationary target - Gunner fires.

LOADER

1. Operate a tank across a water obstacle.
2. Acquire targets.
3. Coax engagement - moving tank- stationary target - Gunner fires.
4. Coax engagement - moving tank - moving target - TC fires.
5. Main gun engagement - moving to a halt - stationary target - Gunner fires.
6. Caliber .50 engagement - moving to a halt - moving target - TC fires.
7. Main gun engagement - moving to a halt - stationary target - TC fires.
8. Main gun engagement - moving to a halt - moving target - Gunner fires.
9. Main gun engagement - stationary tank - stationary target - Gunner fires.
10. Apply immediate action to reduce stoppage of an M219 machinegun.
11. Determine corrective action required by replenisher tape.
12. Unload misfired main gun.

Figure 12. Tasks performed by each crew member during Module III: Tactical Operations.

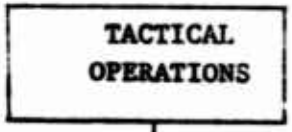
DRIVER

14. Operate a tank in neutral steer.
15. Move vehicle into defilade firing position upon enemy contact.
16. Perform during-operations maintenance checks and services on steering, accelerator, shift and brake controls.
17. Perform during-operations checks on instruments, gages and warning lights.

LOADER

13. Apply immediate action in case of main gun failure to fire.

Figure 12. (Cont'd.). Tasks performed by each crew member during Module III: Tactical Operations.



GUNNER

1. Operate a tank across a water obstacle.
2. Acquire targets.
3. Coax engagement - moving tank - stationary target - Gunner fires.
4. Coax engagement - moving tank - moving target - TC fires.
5. Main gun engagement - moving to a halt - stationary target - Gunner fires.
6. Caliber .50 engagement - moving to a halt - moving target - TC fires.
7. Main gun engagement - moving to a halt - stationary target - TC fires.
8. Main gun engagement - moving to a halt - moving target - Gunner fires.
9. Main gun engagement - station tank - stationary target - Gunner fires.
10. Unload misfired main gun.
11. Apply immediate action in case of main gun failure to fire.

TANK COMMANDER

1. Acquire targets.
2. Perform evasive maneuvers upon enemy contact.
3. Coax engagement - moving tank - stationary target - Gunner fires.
4. Coax engagement - moving tank - moving target - TC fires.
5. Main gun engagement - moving to a halt - stationary target - Gunner fires.
6. Caliber .50 engagement - moving to a halt - moving target - TC fires.
7. Main gun engagement - moving to a halt - stationary target - TC fires.
8. Main gun engagement - moving to a halt - moving target - Gunner fires.
9. Main gun engagement - stationary tank - stationary target - Gunner fires.

Figure 12.(Cont'd.). Tasks performed by each crew member during Module III: Tactical Operations .

DRIVE THE TANK OVER VARIED TERRAIN WITH DRIVER HATCH IN THE OPEN/CLOSE POSITION [DRIVER]

	Yes	No
. Vertical obstacle.		
- Warn crew members of the obstacle.	___	___
- Push transmission shift lever up in L when speed reaches 9 MPH or less.	___	___
- Meet the obstacle with both tracks simultaneously.	___	___
- Apply sufficient acceleration to climb the obstacle.	___	___
- Continue to accelerate until the tank starts to counter balance.	___	___
- Decelerate as the tank counter balances forward.	___	___
- Do not attempt to steer while climbing the obstacle.	___	___
. Cross a ditch.		
- Warn the crew of the approaching ditch.	___	___
- Push the transmission shift lever up to L when the speed reaches 9 MPH or less.	___	___
- Decelerate as the tank begins to counter balance forward into the ditch.	___	___
- Ease tank to the bottom by braking and releasing the brake.	___	___
- Insure that both tracks strike bottom of ditch simultaneously	___	___
- Accelerate tank as tracks strike bottom.	___	___
- Decelerate tank as it pitches over the top.	___	___
. Ascend a steep grade.		
- Push the transmission shift lever up to L position when the speed reaches 9 MPH or less.	___	___
- Apply acceleration to climb the incline.	___	___
- On steep grades (50% - 60%) ascend backwards using Reverse.	___	___
. Descend a steep grade.		
- Push transmission shift lever up to L when speed is at 9 MPH or less.	___	___
- Use brakes to maintain engine speed at less than 2400 RPM.	___	___
- For extremely steep grades (50% - 60%) stop the tank and pull the transmission shift lever to Reverse and allow the tank to move forward.	___	___
- Accelerate to slow the tanks descent. Maintain sufficient engine speed to keep the engine above stall.	___	___
- Pull the steering wheel down counterclockwise to turn right; pull the steering wheel down clockwise to turn left.	___	___
- If engine stalls, stop tank.	___	___
- If the engine starts to run backwards, stop the engine and restart the engine.	___	___
- If the engine starts to run backwards and the brakes will not stop the tank, push the transmission shift lever up to neutral, maintain brake pressure and allow the tank to slide down the incline without steering.	___	___

OPERATE A TANK ACROSS A WATER OBSTACLE [DRIVER/LOADER/GUNNER]	Yes	No
Loader . Remove the three screws and washers from the turret platform door.	___	___
Loader . Raise the turret platform door.	___	___
Gunner . Rotate the turret until the platform door opening is over the batteries.	___	___
Loader . Tighten all 36 cell vent plugs finger tight.	___	___
Loader . Close the turret platform door and reinstall the three washers and screws.	___	___
Loader . Insert a plug into the opening of the personnel heater exhaust pipe on the right hand fender and tape if necessary.	___	___
Driver . Close and lock the Driver's hatch.	___	___
Loader . Insure turret is pointed at the front or rear and turret power is OFF.	___	___
Driver . Close the hull-turret seal air valve by rotating the wing valve (located below the air seal gage on the right hand side of the Driver's compartment) clockwise finger tight.	___	___
Driver . Pump the "T" handle of the hull-turret seal pump up and down to inflate the seal.	___	___
Driver . Continue pumping until the hull-turret seal gage reads 25 PSI.	___	___
Driver . Turn wing valve counterclockwise (open) and relieve air pressure. Air pressure must drop to zero PSI.	___	___
Driver . Close the wing valve finger tight.	___	___
Driver . Pump the "T" handle up and down to inflate the seal.	___	___
Driver . Continue pumping until the reading on the hull-turret seal gage indicates 12-14 PSI.	___	___
Driver . Inspect air cleaner intake to insure air is being drawn from crew compartment (vented air intake screen will be visible).	___	___
Driver . Push to left and release crew compartment drain valve handle (left rear) and engine compartment drain valve handle (right rear).	___	___
Driver . Raise the EMER HEATER cover and turn the EMER HEATER switch OFF.	___	___

OPERATE A TANK ACROSS A WATER OBSTACLE [DRIVER/LOADER/GUNNER] (Continued)

		Yes	No
Driver	. Move transmission shift lever to L.	___	___
Driver	. Increase engine speed to a minimum of 1000 RPM. Maintain minimum of 1000 RPM while crossing water.	___	___
Driver	. Enter water slowly to avoid water surge.	___	___
Driver	. Cross water obstacle maintaining vehicle speed of 3-4 MPH.	___	___
Driver	. Maintain 3-4 MPH speed and minimum of 1000 RPM by braking as necessary.	___	___
Driver	. Open (counterclockwise) the air valve located below the hull-turret seal gage after emerging from the water.	___	___
Driver	. Observe the gage and insure it drops to zero PSI.	___	___
Driver	. Open crew compartment drain valve (to Driver's left rear) by pulling lever up and pushing it to the right into the OPEN position detent and releasing the handle.	___	___
Driver	. Open engine compartment drain valve by pushing the lever handle down and to the right into the OPEN position detent and releasing the handle.	___	___

INSTALL THE M24 (IR) PERISCOPE [DRIVER].	Yes	No
. Close the Driver's hatch.	___	___
. Place the MASTER BATTERY switch in the OFF position.	___	___
. Instruct crew member to rotate the turret so the gun tube is forward.	___	___
. Pull periscope holder lid handle down with fingers of the left hand while pushing up on the lid latch with the thumb.	___	___
. Push upward and open lid.	___	___
. Reach to the rear of the seat and unlatch both catches on the IR Periscope stowage box.	___	___
. Remove the periscope.	___	___
. Pull up (rearward) on the elevation adjustment lever insuring bind (tension) has been released on elevation clamp and elevation clamp pivots.	___	___
. Loosen the jam nut on the front (forward) inside of the elevation clamp.	___	___
. Position the periscope in the periscope holder.	___	___
. Push up on periscope until it locks in the holder.	___	___
. Insure the elevation clamp is positioned in the periscope holder detent.	___	___
. Tighten the adjustment screw on front right hand inside of the elevation clamp until the elevation clamp is firmly seated in the periscope holder detent.	___	___
. Tighten the elevation clamp adjustment screw jam nut.	___	___
. Push elevation adjustment lever downward (forward) and lock periscope.	___	___
. Unscrew dust cap from power receptacle (center) location.	___	___
. Unscrew power cable connecting plug from stowage receptacle on right-hand side of compartment.	___	___
. Thread power cable connecting plug into periscope receptacle and hand tighten.	___	___

PLACE THE M24 (IR) PERISCOPE INTO OPERATION [DRIVER].	Yes	No
. Turn the Master Battery switch ON.	___	___
. Place the Blackout selector switch in BO DRIVE.	___	___
. Turn the IR Switch ON. (Visually inspect to insure IR Indicator lamp is lit.)	___	___
. Turn the Lighting Control switch handle to the left.	___	___
. Pull the elevation adjustment lever up.	___	___
. Adjust periscope elevation angle to a comfortable position by moving periscope with both hands.	___	___
. Push elevation adjustment lever down to lock the periscope in position.	___	___
. If necessary, loosen the two inner wingnuts on the headrest until the proper eye distance is obtained. Retighten (handtight) both wingnuts.	___	___
. If necessary, bend headrest to fit head contour by pulling, pushing or twisting on each side of the headrest.	___	___
. Allow periscope to warm up for 5 minutes before adjusting focus.	___	___
. Unscrew left and right dust caps from bottom focus controls.	___	___
. Rotate left and right focus control knobs until the view through each eyepiece appears with maximum sharpness.	___	___
. Screw left and right dust covers back over focus control knobs and tighten finger tight.	___	___

ACQUIRE TARGETS [DRIVER/LOADER/GUNNER/TANK COMMANDER].	Yes	No
. Observe assigned sector for potential enemy targets.		
- Search sector for ground targets by scanning from left to right beginning near own location and working out to the horizon.	___	___
. Describe target.	___	___
. Estimate range to target by:		
- mil relation technique	___	___
- approximation in 100 meter increments	___	___
. Determine direction to target:		
- in mils	___	___
- by the clock method	___	___

PERFORM EVASIVE MANEUVERS UPON ENEMY CONTACT [DRIVER/TANK COMMANDER].

		Yes	No
Tank Commander	. Direct Driver to appropriate covered and concealed hull-down routes and positions.	___	___
Driver	. Begin evasive maneuvers on own initiative when necessary.		
	- Look for hull defilade position.	___	___
	- Orient hull toward target.	___	___
	- Stop on command of TC.	___	___
	- Attempt to sense rounds.	___	___

MOVE VEHICLE INTO DEFILADE FIRING POSITION UPON ENEMY CONTACT [DRIVER].

	Yes	No
. Receive initial defilade firing position location orders from the Tank Commander.	___	___
. Receive final positioning instructions from the Gunner.	___	___
. Move the vehicle into the defilade position with front portion of the vehicle toward target (ideal position).	___	___
. Drive the vehicle into the position slowly and be prepared to move if necessary.	___	___
. Coordinate with the Tank Commander and the Gunner and position the vehicle as level as the terrain will permit.	___	___
. Bring the vehicle to a smooth and gradual halt.	___	___

OPERATE A TANK IN NEUTRAL STEER [DRIVER].

	Yes	No
. Move the transmission shift lever to N.	___	___
. Pull the left side of the steering wheel down to the maximum for a left pivot, pull the right side of the steering wheel down to the maximum for a right pivot.	___	___
. Depress the accelerator slowly while holding the steering wheel in the desired direction.	___	___

COAX ENGAGEMENT - MOVING TANK - STATIONARY TARGET - GUNNER FIRES.

TC	GUNNER	LOADER	DRIVER
Announce GUNNER			
Announce COAX	Turn COAX switch ON	Place COAX SAFETY in FIRE	Maintain steady rate of speed
Announce target description			Maneuver tank for firing
Lay gun for direction	Announce IDENTIFIED	Announce UP	
Estimate range			
Announce range	Lay rangeline at center of target vulnerability		
Announce FIRE	Announce ON THE WAY		Announce adverse terrain conditions
	Fire COAX		

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

COAX ENGAGEMENT - MOVING TANK - MOVING TARGET - TC FIRES.

TC	GUNNER	LOADER	DRIVER
Announce GUNNER			
Announce COAX	Turn COAX switch ON	Place COAX SAFETY in FIRE	Maintain steady rate of speed
Announce MOVING			
Announce target description			
Lay gun for direction			Maneuver tank for firing
Estimate range			
Announce range	Announce CANNOT IDENTIFY	Announce UP	
Apply lead in direction of target apparent motion			
Announce FROM MY POSITION			
Lay crosshair leadline at center of target vulnerability			
Announce ON THE WAY			Announce adverse terrain conditions
Fire COAX			

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

MAIN GUN ENGAGEMENT - MOVING TO A HALT - STATIONARY TARGET - GUNNER FIRES.

Announce GUNNER	Turn main gun switch ON		Maintain steady rate of speed
Announce HEP	Index HEP	Unlock ammo ready rack	Maneuver tank for firing
Announce target description		Unload main gun	Announce adverse terrain conditions
Lay gun for direction	Announce IDENTIFIED	Select HEP	Move to hull down firing position
Announce DRIVER STOP		Load main gun	Bring tank to smooth gradual halt
Announce Range	Lay crosshair at center of target vulnerability		
Announce FIRE	Apply aim-off (when range > 1800 meters)	Announce HEP, UP	
	Make final precise lay	Stow round	
	Announce ON THE WAY		
	Fire Main gun		

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

CALIBER .50 ENGAGEMENT - MOVING TO A HALT - MOVING - TC FIRES.

TC	GUNNER	LOADER	DRIVER
Announce CALIBER FIFTY			Maintain steady rate of speed
Place caliber .50 safety in FIRE			Maneuver tank for firing
	Observe sector	Observe sector	Announce adverse terrain conditions
			Move to hull down firing position
Announce DRIVER, STOP			Bring tank to smooth gradual halt
Apply lead in direction of target apparent motion			Lock brakes
Lay crosshair leadline at center of target vulnerability			
Fire caliber .50			

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

MAIN GUN ENGAGEMENT - MOVING TO A HALT - STATIONARY TARGET - TC FIRES.

TC	GUNNER	LOADER	DRIVER
Announce GUNNER	Turn main gun switch ON		Maintain steady rate of speed
Announce BATTLESIGHT		Unlock ammo ready rack	Maneuver tank for firing
Announce target description		Select SABOT or HEAT	Announce adverse terrain conditions
Lay gun for direction		Place main gun safety in FIRE	
Apply lead in direction of own gun traverse	Announce CANNOT IDENTIFY		
Lay crosshair leadline at center of base of target		Announce UP	Move to hull down firing position
Announce FROM MY POSITION			Bring tank to smooth gradual halt
Time shot			Lock brakes
Announce ON THE WAY			
Fire main gun			

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

MAIN GUN ENGAGEMENT - MOVING TO A HALT - MOVING TARGET - GUNNER FIRES.

TC	GUNNER	LOADER	DRIVER
Announce GUNNER	Turn main gun switch ON		Maintain steady rate of speed
Announce BATTLESIGHT		Unlock ammo ready rack	Maneuver tank for firing
Announce MOVING		Select SABOT or HEAT	Announce adverse terrain conditions
Announce target description			
Lay gun for direction	Announce IDENTIFIED	Place main gun safety in FIRE	
	Apply lead in direction of target apparent motion		
	Lay crosshair leadline at center of base of target	Announce UP	Move to hull down firing position
Announce FIRE	Time shot		Bring tank to smooth gradual halt
	Announce ON THE WAY		Lock brakes
	Fire main gun		

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

MAIN GUN ENGAGEMENT - STATIONARY TANK - STATIONARY TARGET - GUNNER FIRES.

TC	GUNNER	LOADER	DRIVER
Announce GUNNER	Turn main gun switch ON		Lock brakes
Announce BATTLESIGHT		Unlock ammo ready rack	
Announce target description		Select SABOT or HEAT	
Lay gun for direction	Announce IDENTIFIED	Place main gun safety in FIRE	
	Lay crosshair at center of base of target		
	Make final precise lay	Announce UP	
Announce FIRE	Announce ON THE WAY		
	Fire main gun		

	Yes	No
TC	___	___
GUNNER	___	___
LOADER	___	___
DRIVER	___	___

NOTES: Indicate errors made by each crew member (if any):

APPLY IMMEDIATE ACTION TO REDUCE A STOPPAGE OF THE M219 MACHINEGUN [LOADER].

	Yes	No
. Wait 5 seconds to allow for a hangfire.	___	___
. Charge the machinegun, locking the recoiling parts to the rear.	___	___
. Check to insure that the ammunition is feeding into the weapon.	___	___
. Announce UP.	___	___
. Allow the Gunner to turn on the machinegun switch and attempt to fire. (If the machinegun fails to fire, the Gunner will turn off the machinegun switch and announce: STOPPAGE.)	___	___
. Wait 5 seconds from the time the Gunner announces STOPPAGE.	___	___
. Remove the round from the chamber (within 5 additional seconds if the gun is hot) by:		
- Pulling the barrel extension to the rear;	___	___
- Placing the safety in SAFE;	___	___
- Raising the cover and removing the ammunition.	___	___
. Lift the feed tray.	___	___
. Look and feel in the chamber to insure that it is clear.	___	___
. Remove any obstructions which may be present (including a possible ruptured cartridge) case by:		
- Removing the receiver group;	___	___
- Removing the barrel;	___	___
- Inserting ruptured cartridge case extractor into the ruptured cartridge case from the receiver end;	___	___
- Inserting assembled, jointed cleaning rod through muzzle end of barrel; and	___	___
- Driving extractor and case from chamber.	___	___
. Place the safety in FIRE and hand function the weapon one cycle.	___	___
. Reload the weapon.	___	___
. Tell Gunner to attempt to fire the weapon.	___	___

DETERMINE CORRECTIVE ACTION REQUIRED BY REPLENISHER TAPE [LOADER].	Yes	No
. Check replenisher assembly indicator tape before and during main gun engagements.	___	___
. Take the appropriate corrective action given any of the following conditions of the tape:		
- One rough edge and one smooth edge -- normal condition.	___	___
- Rough edges on both sides -- add oil to replenisher before and during firing.	___	___
- Smooth edges on both sides -- drain oil from the replenisher before firing; level is satisfactory during firing but observe tape closely.	___	___
- Two long notches -- drain oil from replenisher before and during firing.	___	___

APPLY IMMEDIATE ACTION IN CASE OF MAIN GUN FAILURE TO FIRE [GUNNER/LOADER]

	Yes	No
Gunner . Announce MISFIRE upon failure to fire.	___	___
Gunner . Announce ON THE WAY and attempt to fire by depressing a firing trigger on the Gunner's power control handle that was NOT used to fire the round initially.	___	___
Gunner . Announce MISFIRE if gun again fails to fire.	___	___
Gunner . Announce ON THE WAY and attempt to fire by depressing the firing trigger on the Gunner's manual control handle.	___	___
Gunner . Announce MISFIRE if gun again fails to fire.	___	___
Gunner . Turn main gun switch OFF.	___	___
Gunner . Announce ON THE WAY and attempt to fire with the EMERGENCY FIRING DEVICE.	___	___
Gunner . Announce MISFIRE if gun again fails to fire.	___	___
Gunner . Wait two minutes and direct Loader to rotate the round 1/2 turn.	___	___
Loader . Open breech.	___	___
Loader . Rotate round 1/2 turn.	___	___
Loader . Close breech.	___	___
Loader . Announce UP.	___	___
Gunner . Turn main gun switch ON.	___	___
Gunner . Announce ON THE WAY and attempt to fire by depressing one of the electrical firing triggers.	___	___
Gunner . Announce MISFIRE if gun again fails to fire and wait two minutes for a hangfire.	___	___

UNLOAD MISFIRED MAIN GUN [LOADER/GUNNER].	Yes	No
Gunner . Turn MAIN GUN and TURRET power switches OFF.	___	___
Loader . Place safety in SAFE.	___	___
Loader . Open breech.	___	___
Gunner . Insert ramming and extracting tool between the face of the breech and rim of the cartridge.	___	___
Loader . Hold breech operating handle down.	___	___
Gunner . Pry round out of chamber.	___	___
Loader . Return breech operating handle to latched position.	___	___

PERFORM DURING-OPERATIONS MAINTENANCE CHECKS AND SERVICES ON STEERING, ACCELERATOR, SHIFT AND BRAKE CONTROLS [DRIVER].	Yes	No
. Check for binding or excessive play in the linkage or any unusual characteristics in the controls.	___	___
. Note deficiencies as faults on DA Form 2404.	___	___

PERFORM DURING OPERATION CHECKS ON INSTRUMENTS, GAGES AND WARNING LIGHT [DRIVER].

	Yes	No
. Check to insure Engine Oil Pressure gage is at a minimum of 15 PSI at 750 RPM.	___	___
. Check the Engine Oil Temperature gage for a reading of 180° to 225° F.	___	___
. Check Transmission Oil Temperature gage for a reading of 200°F to 280°F.	___	___
. Check Transmission Oil Pressure gage for a reading of 8 PSI to 40 PSI (2 PSI at 750 RPM).	___	___
. Check BATTERY/GENERATOR indicator for a reading in the green band.	___	___
. Check the Power Plant Warning Lamp to insure it is OFF.	___	___
. Check the Master Battery indicator light to insure it is lit.	___	___
. Check the tachometer to insure it gives a steady indication.	___	___

APPENDIX B

DRIVER'S READINESS TEST

DRIVER'S READINESS TEST
(4 HOURS)

PART A. OPERATIONAL CHECKS AND SERVICES

Type: Written pre-tests for TEC lessons 020-171-5366-F through 020-171-5370-F

Time: 1/2 hour

Location: Armory

Scoring: 90% correct

PART B. BEFORE-OPERATIONS PROCEDURES AND TANK START-UP

Type: Hands-On (attached)

Time: 3/4 hour

Location: Armory

Support: Tank and TC scorer

Scoring: 100% correct

PART C. TARGET ACQUISITION

Type: Written pre-tests for TEC Lessons 020-171-1611-F, 020-171-1612-F and 020-171-1614-F, and oral post-test 935-171-0203-F.

Time: 1 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

PART D. TACTICAL DRIVING

Type: Hands-On (attached)

Time: 2 hours

Location: Weekend Training Site

Support: Tank and TC scorer

Scoring: 100% correct

DRIVER'S READINESS TEST

PART B. TANK PREPARATION AND START-UP (GARRISON/HANDS-ON)

CONDITIONS. Fully operational M48A5 situated on level ground. 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. 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.

(A5112	Remove M27 periscope)
AB101	Perform before-operation checks and services on M24 (IR) and M27 periscopes.
A5108	Install M24 (IR) periscope.
A5109	Place M24 (IR) periscope into operation.
(A5113	Start tank engine.)
AA104	Perform before-operations checks and services on engine and transmission oil levels.
A5114	Place tank in motion.
A5124	Check track tension.
AA105	Perform main gun prepare-to-fire procedures from Driver's station.

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.

PERFORMANCE MEASURES.

1. REMOVE THE M27 PERISCOPE (A5112)	Yes	No
. 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 (AB101)

	Yes	No
a. M24 (IR) Periscope		
.Inspected the M24 (IR) periscope and spare head for cracked or dirty lenses and completeness.	___	___
.Installed the periscope without exposing it to direct sunlight.	___	___
.Energized the IR power.	___	___
.Allowed 5 minutes for the system to warm-up.	___	___
.Focused on an image using the focus controls.	___	___
.Recorded on DA Form 2404 any damaged or unserviceable parts detected or the inability to focus the M24 (IR) periscope.	___	___
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 (A5108)

. 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.	___	___
. 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 receptacle (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.	___	___

4. PLACE THE M24 (IR) PERISCOPE INTO OPERATION (A5109)	Yes	No
. 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. START TANK ENGINE (A5113)		
. 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.	___	___
. 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.	___	___

6. PERFORM BEFORE-OPERATIONS CHECKS AND SERVICES ON TANK ENGINE AND TRANSMISSION OIL LEVELS (AA104)

	Yes	No
. Set parking brake (on "Loader's" command to start engine).	___	___
. Started tank engine (on "Loader's" command to start engine).	___	___
. Idled engine between 1000-12000 RPM for 5 minutes.	___	___
. Reduced engine idle to 700-750 RPM.	___	___

7. PLACE TANK IN MOTION (A5114)

. 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.	___	___

8. CHECK TRACK TENSION (A5124)

. 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 #3 support roller.	___	___

9. PERFORM PREPARE-TO-FIRE PROCEDURES (AA105)

. Lowered seat for closed hatch driving.	___	___
. Closed and locked Driver's hatch.	___	___
. Turned master control switch to ON.	___	___
. 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 scorer.

b. Been checked "Yes" on each performance measure.

DRIVER'S READINESS TEST

PART D. TACTICAL DRIVING DRIVING (FIELD/HANDS-ON)

CONDITIONS. Fully operational M48A5. Tactical driving course including obstacles (ditch, vertical incline, water) and simulated targets. Scenario of fire commands and driving commands to be given by TC.

INSTRUCTIONS TO DRIVER. "This is a test of your tactical driving ability. We are going on a simulated mission. You should listen and react to my commands when I give them; but you should also react as necessary if I fail to give you a command. Watch for targets and report them as you would normally."

TASKS.

A5115	Operate tank in neutral steer.
A5116	Drive over varied terrain.
A5118	Drive across a water obstacle.
AA109	Perform evasive maneuvers upon enemy contact.
AA110	Drive to defilade firing position upon enemy contact.
AL01	Main gun engagement moving to a halt (TC).
AL02	Main gun engagement stationary (Gunner).
AL03	Main gun engagement moving to a halt (Gunner).
AL04	Coax engagement moving (TC).
AL05	Coax engagement moving (Gunner).
AL06	Caliber .50 engagement moving to a halt (TC).
AA112	Acquire targets.

NOTES.

a. Soldier should complete PARTS A-C before taking this one.

b. Portions of PART B of test that were failed previously can be retested as part of preparation for this test.

PERFORMANCE MEASURES.

1. OPERATE TANK IN NEUTRAL STEER (A5115)	Yes	No
. Given the special command to "PIVOT TANK LEFT IN NEUTRAL STEER":		
. Moved the transmission shift lever to N.	___	___
. Pulled the left side of the steering wheel down to the maximum for a left pivot.	___	___
. Depressed the accelerator slowly while holding the steering wheel in the desired direction.	___	___

	Yes	No
2. DRIVE OVER VARIED TERRAIN (A5116)		
a. Cross a Vertical Obstacle.		
.Warned crew members of the obstacle.	___	___
.Pushed transmission shift lever up in L when speed reached 9 MPH or less.	___	___
.Met the obstacle with both tracks simultaneously.	___	___
.Applied sufficient acceleration to climb the obstacle.	___	___
.Continued to accelerate until the tank started to counter balance.	___	___
.Decelerated as tank counter balanced forward.	___	___
.Did not attempt to steer while climbing the obstacle.	___	___
b. Cross a Ditch.		
.Warned the crew of the approaching ditch.	___	___
.Pushed transmission shift lever up to L when the speed reached 9 MPH or less.	___	___
.Decelerated as the tank counter balanced forward into the ditch.	___	___
.Eased tank to the bottom by braking and releasing the brake.	___	___
.Met bottom of ditch with both tracks simultaneously.	___	___
.Accelerated tank as tracks struck bottom.	___	___
.Decelerated tank as it pitched over the top.	___	___
c. Ascend a Steep Grade.		
.Pushed transmission shift lever up to L position when the speed reached 9 MPH or less.	___	___
.Accelerated to climb the incline.	___	___
.On steep grades (50% - 60%) ascended backwards using Reverse.	___	___
d. Descend a Steep Grade.		
.Pushed transmission shift lever up to L when speed reached 9 MPH or less.	___	___
.Used brakes to maintain engine speed at less than 2400 RPM.	___	___
.On steep grades (50% - 60%) stopped the tank, pulled the transmission shift lever to Reverse and allowed the tank to move forward.	___	___
.Accelerated to slow the tank's descent, maintaining sufficient engine speed to keep the engine above stall.	___	___
.Pulled steering wheel down counterclockwise to turn right; pulled the steering wheel down clockwise to turn left.	___	___
.Stopped tank if engine stalled.	___	___
.Stopped and restarted the engine, if engine started to run backwards.	___	___
.Pushed transmission shift lever up to neutral, maintained brake pressure and allowed the tank to slide down the incline without steering, if the engine started to run backwards and brakes would not stop the tank.	___	___

	Yes	No
3. DRIVE ACROSS A WATER OBSTACLE (A5118)		
.Closed and locked the Driver's hatch.	___	___
.Closed the hull-turret seal air valve by rotating the wind valve clockwise finger tight.	___	___
.Pumped the "T" handle of the hull-turret seal pump up and down to inflate the seal.	___	___
.Continued pumping until the hull-turret seal gage read 25 PSI.	___	___
.Turned wing valve counterclockwise (open) and relieved air pressure to zero PSI.	___	___
.Closed the wing valve finger tight.	___	___
.Pumped the "T" handle up and down to inflate the seal.	___	___
.Continued pumping until the hull-turret seal gage read 12-14 PSI.	___	___
.Inspected air cleaner intake to insure air was drawn from crew compartment.	___	___
.Pushed to left and released crew compartment drain valve handle and engine compartment drain valve handle.	___	___
.Raised the EMER HEATER cover and moved the EMER HEATER switch to the OFF (down) position.	___	___
.Moved transmission shift lever to L.	___	___
.Increased engine speed to a minimum of 1000 RPM.	___	___
.Entered water slowly to avoid water surge.	___	___
.Crossed water obstacle maintaining vehicle speed of 3-4 MPH.	___	___
.Maintained 3-4 MPH speed and minimum of 1000 RPM by braking as necessary.	___	___
.Opened (counterclockwise) the air valve located below the hull-turret seal gage after emerging from the water.	___	___
.Observed the gage to insure it dropped to zero PSI.	___	___
.Opened crew compartment drain valve by pulling lever up and pushing it ot the right into the OPEN position detent and releasing the handle.	___	___
.Opened engine compartment drain valve by pushing the lever handle down and to the right into the OPEN position detent and releasing the handle.	___	___
4. PERFORM EVASIVE MANEUVERS UPON ENEMY CONTACT (AA109)		
a. Follow TC Commands.		
.Took up correct firing position in response to TC's directions.	___	___
.Followed route given by TC.	___	___
b. Begin Evasive Maneuvers on Own Initiative as Necessary.		
.Selected a hull defilade position where available.	___	___
.Oriented hull toward target.	___	___
.Selected a route with cover and concealment.	___	___

	Yes	No
5. DRIVE INTO DEFILADE FIRING POSITION UPON ENEMY CONTACT (AA110)		
·Drove to initial defilade firing position following direction from TC.	___	___
·Moved the vehicle into the defilade position with front portion of the vehicle toward target.	___	___
·Drove vehicle into the position slowly.	___	___
·Coordinated with TC and Gunner in positioning vehicle as level as the terrain permitted.	___	___
·Brought vehicle to a smooth and gradual halt.	___	___
6. DRIVE IN RESPONSE TO FIRE COMMANDS (AL01 - AL06)		
a. Drive During Target Engagement.		
·Continued to drive in response to COAX element of fire command.	___	___
·Maintained steady rate of speed.	___	___
·Maneuvered hull toward target.	___	___
·Announced adverse terrain condition.	___	___
b. Drive to a Halt for Target Engagement..		
·Maintained steady speed during initial part of fire command.	___	___
·Maneuvered hull toward target.	___	___
·Announced adverse terrain condition.	___	___
·Moved to hull-down firing position.	___	___
·Brought tank to a smooth gradual halt.	___	___
·Locked brakes.	___	___
c. Lock Brakes During Stationary Target Engagement.	___	___
7. ACQUIRE TARGETS		
·Detected targets in assigned observation sector.	___	___
·Called out target type.	___	___
·Called out estimated range in 100's of meters.	___	___
·Called out direction to target by clock method or reference point method.	___	___

SCORING.

To pass, soldier must have:

a. Detected and reported all targets. Delay in detection is <u>not</u> cause for failure.

b. Responded without hesitation to each fire command.

c. Been checked "Yes" on all performance measures.

APPENDIX C

LOADER'S READINESS TEST

LOADER'S READINESS TEST
(5 HOURS)

PART A. MISSION PREPARATION

1. KNOWLEDGE

Type: Written pre-tests for TEC Lessons 020-171-5366-F through 020-171-5370-F (exclusive of portions on tank batteries, 020-171-5332-F and 020-171-5352-F (exclusive of portion on M85).

Time: 1/2 hour

Location: Armory

Scoring: 90% correct

2. SKILL

Type: Hands-On (attached)

Time: 1 1/4 hours

Location: Armory

Support: Tank and TC scorer

Scoring: 100% correct

PART B. COMBAT LOADING

1. KNOWLEDGE

Type: Written pre-tests for TEC Lessons 020-171-5331-F, 020-171-5346-F, 020-171-5347-F, and 020-171-5348-F

Time: 1/2 hour

Location: Armory

Scoring: 90% correct

2. SKILL

Type: Hands-On (attached)

Time: 1/2 hour

Location: Armory

Support: Tank and TC scorer

Scoring: 100% correct

PART C. WEAPONS MAINTENANCE

1. KNOWLEDGE

Type: Written pre-tests for TEC Lessons 020-171-1131-F through 020-171-1133-F and 020-171-5241-F

Time: 1/2 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

2. SKILL

Type: Hands-On (attached)

Time: 3/4 hour

Location: Armory

Support: Tank dummy rounds and TC scorer

Scoring: 100% correct

PART D. REPLENISHER TAPE READING

Type: Hands-On (attached)

Time: 1/4 hour

Location: Armory

Support: Replenisher Tape Mock-up and TC Scorer

Scoring: 100% correct

PART E. TARGET ACQUISITION

Type: Written pre-tests for TEC Lessons 020-171-1612-F and 020-171-1614-F and oral post-test for 935-171-0203-F

Time: 3/4 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

LOADER'S READINESS TEST

PART A. 2. MISSION PREPARATION (GARRISON/HANDS-ON)

CONDITIONS. M48A5 tank complete with BII, situated on level ground. Gun tube is aimed at a suitable boresight target, but slightly out of alinement with respect to target. An Ammunition Stowage Plan and dummy rounds (including 3 APDS, 3 HEP, 2 HEAT and 1 APERS) are located next to tank. All ammunition stowage areas are blocked off with exception of 7 slots in the ready rack, 1 slot in the tubular stowage rack and 1 in the turret bustle; empty slots should correspond to stowage plan and types of dummy rounds. Tank has the following deficiencies: engine or transmission oil low; track tension loose; recoil oil low.

INSTRUCTIONS TO LOADER. "Assume we are preparing the tank for a combat mission. You are to perform the following loader tasks [read list of tasks]. I realize you would normally perform some additional tasks as the loader in this situation, but these are the ones you are being tested on today. Perform each task when I instruct you to do so. I will observe and score your performance, and I will serve as driver, gunner or TC as needed."

TASKS.

AA104	Perform before-operation checks and services on engine and transmission oil levels.
A5124	Check track tension.
A5125	Adjust track tension.
AB213	Boresight M219 machinegun.
AB301	Prepare tank for boresighting.
AB303 AA303 AB304	Check boresight alinement of main gun.
AA213	Stow main gun rounds.
AA210	Perform main gun prepare-to-fire procedures from Loader's station.

NOTES.

a. Soldier should not be given this part of the test until he has passed PART A. 1.

b. Remedial training on tasks failed should be provided on-the-spot; but only after soldier has completed all of PART A. 2. See Module L-2.

PERFORMANCE MEASURES

		Yes	No
1.	PERFORM BEFORE-OPERATIONS CHECKS AND SERVICES ON TANK ENGINE AND TRANSMISSION OIL LEVELS (AA104)		
	. Checked engine and transmission oil levels.	___	___
	. Added engine oil until level indicated on gage is to the ADD mark.	___	___
	. Added transmission oil until level indicated on gage is to the ADD mark.	___	___
	. Told Driver to start engine.	___	___
	. Waited until engine was warm and idling at 700-750 RPM.	___	___
	. Added or drained engine oil until level indicated on gage was to the FULL mark.	___	___
	. Added or drained transmission oil until level indicated on gage was to the FULL mark.	___	___
2.	CHECK TRACK TENSION (A5124)		
	. Directed Driver to coast to a stop so that a track link was continued on the #3 support roller.	___	___
	. Coordinated with Driver by arm and hand signals so that tank coasted to a stop with track link in proper position.	___	___
	. Raised the track with a crowbar, at the number three support roller and placed a block (1" thick by 6" square) between the number three support roller and the track link.	___	___
	. Measured the clearance between the bottom of the track and the top of the number two support roller: Acceptable clearance is 1/4 to 5/16 inch.	___	___
3.	ADJUST TRACK TENSION (A5125)		
	. Removed the track and adjusting link screw and washer from the top of the track adjusting link.	___	___
	. Used the track adjusting wrench on the track adjusting link and pulled up to increase track tension (right side) or pushed down to decrease track tension (right side). (Reversed directions for the left side.)	___	___
	. Track adjusting link was not extended beyond the red painted groove.	___	___
	. Adjusted track tension to 1/4-5/16 inch in tolerance.	___	___
	. Installed lockwasher and lockscrew and tightened with wrench. Lockscrew was tightened until fully seated on the shoulder.	___	___
4.	PREPARE TANK FOR BORESIGHTING(AB301)		
	. Placed black thread over witness lines on muzzle end of main gun and secured thread tautly.	___	___
	. Removed firing mechanism from breechblock.	___	___

		Yes	No
5.	CHECK BORESIGHT ALINEMENT OF MAIN GUN (AA303, AB303, AB304)		
	On request from Gunner to confirm that muzzle cross threads are on aiming point:		
	. Checked alinement of main gun by sighting through firing pin hole with M17A1 binocular to see if cross threads lay on aiming point.	—	—
	. Reported gun out of alinement (or reported gun correctly alined).	—	—
6.	BORESIGHT M219 MACHINEGUN MOUNTED ON A TANK (AB213)		
	. Removed the solenoid electrical lead from the machinegun backplate assembly by pulling the solenoid plug down.	—	—
	. Pulled the right disconnector ring rearward to disengage the disconnector pin from the disconnector hole.	—	—
	. Rotated the receiver downward and pulled rearward until disengaged from mounting block.	—	—
	. Loosened support setscrews located in the gun mount cover shield collar approximately 1 1/2 turns.	—	—
	. Selected the target employed to boresight the main gun with a clearly defined right angle at a distance of 1200 meters.	—	—
	. Alined the machinegun bore vertically on target while viewing the aiming point through the right binocular M17A1 so as to adjust the machinegun elevation alinement with the bore of the main gun by loosening or tightening the adjusting screws.	—	—
7.	STOW MAIN GUN ROUNDS IN THE TANK (AA213)		
	. Determined, by reference to Ammunition Stowage Plan and present load, how many of each type of round is needed.	—	—
	. Called out to assisting crewman how many of a given type of round is wanted.	—	—
	. Insisted that round be handed in through turret nose down.	—	—
	. Round stowed in:		
	- Ready rack by placing primer end down, swinging hinge of holder up and to the left, pulling out spring loaded knob on rod of holder, sliding hinge slot over rod behind knob, and releasing the knob.	—	—
	- Tubular stowage rack by pushing round in nose first, swinging handle lock over primer end of round, and rotating handle lock securely in place.	—	—
	- Turret bustle by seating round with nose toward inside of turret, swinging hinge up and to the left, pulling up clamp and slotting hinge in place below clamp, and pulling clamp down.	—	—
	. Completed stowage of rounds one type at a time.	—	—
		—	—

8. PERFORM MAIN GUN PREPARE-TO-TO-FIRE PROCEDURES FROM LOADER'S STATION(AA210)

	Yes	No
On command "PREPARE TO FIRE":		
. Checked recoil oil by feeling replenisher indicator tape for one rough and one smooth edge.	___	___
. Moved breechblock crank stop to the rear.	___	___
. Opened breech and looked in chamber for obstruction and cleanliness.	___	___
. Tightened M219 machinegun mounting bolts.	___	___
. Plugged electrical lead into solenoid.	___	___
. Inspected turret stowed ammunition for completeness, type and serviceability.	___	___
On command "CHECK FIRING SWITCHES":		
. Placed main gun safety switch in FIRE POSITION.	___	___
. Installed circuit tester between breechblock and face of chamber.	___	___
. Observed for lighting of circuit tester bulb each time Gunner or TC announced "ON THE WAY," and announced "NO FIRE" any time bulb failed to light.	___	___
. Closed the cover on the coaxial machinegun, charged it, and listened for forward action of barrel and barrel extension when Gunner and TC activated firing switches (recharging coax before each check).	___	___
. Removed and stowed circuit tester.	___	___
On Gunner's alert, "POWER":		
. Checked for obstruction to turret traverse and unlocked turret.	___	___
. Inspected hull stowed ammunition for completeness, type, and serviceability; coordinating turret traverse with Gunner in order to expose stowage area.	___	___
On command "REPORT":		
. Reported "LOADER READY."	___	___

SCORING

To pass, soldier must have:

a. Detected that engine (or transmission) oil was low, and added correct amount.

b. Detected that track tension was loose and adjusted it.

c. Reported that main gun was not alined with boresight target.

d. Boresighted M219 with primary sight.

e. Stowed dummy rounds according to Ammunition Stowage Plan.

f. Detected that recoil oil was low.

PART B. 2. COMBAT LOADING (GARRISON/HAND-ON)

CONDITIONS. M48A5 tank situated on level ground. Ready rack contains 9 dummy rounds (3 APDS, 3 HEP, 2 HEAT and 1 APERS). Dummy 7.62mm round loaded by hand in chamber of coax with belt of dummy rounds loaded on top so that chambered round won't extract when weapon is charged.

INSTRUCTIONS TO LOADER. "This is a test of your ability to perform the duties of a loader under simulated conditions of an extended fire mission. We will be carrying APDS in the tube for battlesight engagements, so begin by loading a SABOT round. From then on, listen to the fire commands and react accordingly. Since you will be working with dummy rounds, you will have to unload rounds between firings. But wait until I give you the command to unload, then quickly remove the round and be ready for the next command. O.K...Take up your position in the Loader's station and load a round of SABOT."

TASKS.

AL01, AL02, AL03 } Load main gun in response to fire commands.

AL04, AL05, AL06 } Ready coax in response to fire commands.

A5304 Rotate round in main gun misfire procedure.

A5201 Unload misfired main gun round.

AB214 Apply immediate action to reduce stoppage of an M219 machinegun.

NOTES.

a. A soldier should not be given this part of the test until he has passed PART B. 1.

b. For Performance Measures 1 and 2, TC-Scorer gives a series of fire commands, at about 15 second intervals, that require loading the available types of dummy rounds interspersed with two or three coax commands. A suggested sequence is:

(1) Battlesight (SABOT), HEP, HEAT, COAX, HEP, MISFIRE:

(2) (Reload for battlesight); APERS, SABOT (NO "CEASE FIRE") SABOT, HEAT, COAX, STOPPAGE.

c. The MISFIRE command provides a break in the sequence. After TC-Scorer goes through MISFIRE checks, tells Loader to rotate round, and round still fails to fire; he then waits two minutes for a hangfire, tells Loader to unload the round, and assists him in doing so.

d. Loading should be timed with a stop watch. Timing should begin with announcement of ammunition element and end with Loader's announcement of "UP". Time should be cumulated for each series of five commands.

PERFORMANCE MEASURES.

1. LOADS MAIN GUN IN RESPONSE TO FIRE COMMANDS(AL01, AL02, AL03)

	Yes	No
a. Battlesight, SABOT Loaded.		
. Stood clear of path of recoil.	___	___
. Placed firing safety switch in FIRE.	___	___
. Announced "UP".	___	___
. Prepared to load a second round in case no "CEASE FIRE" is given.	___	___
b. Main Gun not Loaded.		
. Placed firing safety switch in SAFE position.	___	___
. [Checked replenisher tape.]	___	___
. Opened breech.	___	___
. Selected announced ammunition.	___	___
. Unlocked ammunition ready rack.	___	___
. [Set range on APERS ammunition fuze when "BEEHIVE TIME" is announded in fire command].		
. Inserted appropriate round into chamber by placing the round 2/3rds into chamber and pushing it the rest of the way with the heel of the fist, swinging arm up and away from closing breech.	___	___
. Stood clear of path of recoil.	___	___
. Placed firing safety switch in FIRE position.	___	___
. Announced "UP."	___	___
. Prepared to load a second round in case no "CEASE FIRE" is given.	___	___
c. SABOT Loaded, Different Ammunition Element Given.		
. Placed firing safety switch in SAFE position.	___	___
. [Checked replenisher tape.]	___	___
. Unloaded SABOT round.	___	___
. Placed and locked SABOT round in ready rack.	___	___
. Selected announced ammunition.	___	___
. Unlocked ammunition ready rack.	___	___
. [Set range on APERS ammunition fuze when "BEEHIVE TIME" is announced in fire command.]	___	___
. Inserted appropriate round into chamber by placing round 2/3rds into chamber, and pushing it the rest of the way with the heel of the fist, swinging arm up and away from closing breech.	___	___

	Yes	No
. Stood clear of path of recoil.	___	___
. Placed firing safety switch in FIRE position.	___	___
. Announced "UP".	___	___
. Prepared to load a second round in case no "CEASE FIRE" is given.	___	___

2. READY COAX IN RESPONSE TO FIRE COMMANDS (AL04, AL05, AL06)

. Placed coax safety in FIRE position.	___	___
. Announced "UP."	___	___

3. ROTATED ROUND IN MAIN GUN MISFIRE PROCEDURE (A5304)

On Gunner's command "ROTATE ROUND":

. Placed firing safety switch in SAFE position	___	___
. Opened breech slowly enough to extract round about 1/2 way.	___	___
. Rotated round 1/2 turn.	___	___
. Pushed round into chamber with heel of the fist, swinging arm up and away from closing breech.	___	___
. Stood clear of path of recoil.	___	___
. Placed firing safety switch in FIRE position.	___	___
. Announced "UP."	___	___

4. UNLOAD MISFIRED MAIN GUN ROUND (A5201)

. Told Gunner to turn main gun and turret power switches OFF.	___	___
. Placed firing safety switch in SAFE POSITION.	___	___
. Opened breech.	___	___
. Held breech operating handle down while TC (Gunner) pried round out of chamber.	___	___
. Returned breech operating handle to latched position.	___	___

5. APPLY IMMEDIATE ACTION TO REDUCE STOPPAGE OF AN M219 MACHINEGUN (AB214)

On command "STOPPAGE":

. Waited 5 seconds to allow for a hangfire.	___	___
. Charged the machinegun, locking the recoiling parts to the rear.	___	___
. Checked to see if the ammunition is feeding into the weapon.	___	___
. Pulled barrel extension to the rear.	___	___
. Placed safety in SAFE.	___	___
. Raised cover and removed the ammunition.	___	___
. Removed "misfired" round from chamber	___	___
. Placed safety in FIRE and hand functioned the weapon one cycle.	___	___
. Reloaded the weapon.	___	___
. Announced "UP."	___	___

SCORING.

To pass, soldier must have:

a. Executed the first five fire commands in a total time of 35 seconds, and the second four commands (five loading reactions) in 1 minute 35 seconds. (See Note d.)

b. Responded to "MISFIRE", including unloading the misfired round, within 2 1/2 minutes.

c. Responded to "STOPPAGE" by removing misfired round within 10 seconds of command, and completed procedure within 15 seconds.

d. Selected the correct round in response to each fire command.

e. Checked replenisher tape at least once during the test.

f. Set correct range on BEEHIVE round.

g. Been checked "YES" on each performance measure.

PART C. 2. WEAPONS MAINTENANCE (GARRISON/HANDS-ON)

CONDITIONS. An M48A5 tank with M219 mounted and loaded with dummy ammunition. Complete gun-tool roll stowed.

INSTRUCTIONS TO LOADER. "This test is in two parts. In the first part you are to remove, disassemble, inspect, assemble, mount, and load the M219 machinegun. In the second part you are to disassemble, inspect, and assemble the breechblock. Some of the tasks will be timed. You will have 3 minutes to disassemble the machinegun, and 3 minutes to assemble it. You will have 10 minutes to remove and disassemble the breechblock, and 10 minutes to assemble and install it. I will alert you before I start timing on each of these tasks. I will not assist you during the test... Do you have any questions? Work quickly, but carefully... Ready... Begin."

TASKS

AB211	Unload M219 machinegun.
(AB216	Remove M219 machinegun from tank.)
AB203	Disassemble M219 machinegun.
(AB204	Inspect M219 machinegun.)
AB207	Assemble M219 machinegun.
AB208	Check operation of an M219 machinegun.
(AB215	Mount M219 machinegun in tank.)
AB210	Load an M219 machinegun.
AA204	Disassemble breechblock.
AA205	Assemble breechblock.

NOTES.

a. Soldier should not be given this part of the test until he has passed PART C. 1.

b. Remedial training on tasks failed should be provided on the spot, but after soldier has completed all of PART C. 2. See Module L-6.

PERFORMANCE MEASURES.

1. UNLOAD AN M219 MACHINEGUN (AB211)	Yes	No
. Charged weapon to lock moving parts to the rear.	___	___
. Directed gunner to place machinegun switch in the OFF position.	___	___
. Placed safety in the SAFE position.	___	___
. Opened cover assembly.	___	___
. Removed ammunition belt from the machinegun.	___	___

		Yes	No
2.	REMOVE M219 MACHINEGUN FROM TANK (AB216)		
	. Disconnected electrical lead from solenoid.	___	___
	. Loosened three support set screws in collar on gun mount cover shield.	___	___
	. Removed machinegun retainer.	___	___
	. Removed the machinegun.	___	___
	. Removed the spent cartridge bag.	___	___
	. Removed the case ejection shield.	___	___
3.	DISASSEMBLE M219 MACHINEGUN (AB203)		
	. Removed barrel and jacket assembly from receiver.	___	___
	. Separated barrel from jacket assembly.	___	___
	. Removed cover assembly.	___	___
	. Removed feed tray.	___	___
	. Removed guide rod springs while holding barrel extension forward.	___	___
	. Separated guide rods from guide rod springs.	___	___
	. Removed backplate assembly.	___	___
	. Retracted barrel assembly.	___	___
	. Depressed buffer support lever and removed barrel extension.	___	___
	. Removed breechblock from barrel extension assembly.	___	___
	. Removed retainer clip and charger assembly from projecting stud.	___	___
4.	INSPECT M219 MACHINEGUN (AB204)		
	. Checked all metal surfaces for bulges, cracks, burrs, corrosion, rust and foreign matter.	___	___
	. Checked all moving parts for looseness, binding, wear, or damage.	___	___
5.	ASSEMBLE M219 MACHINEGUN (AB207)		
	. Installed charger assembly.	___	___
	. Placed breechblock assembly in barrel extension.	___	___
	. Installed barrel extension.	___	___
	. Installed backplate assembly.	___	___
	. Joined guide rods and guided rod springs.	___	___
	. Installed feed tray.	___	___
	. Installed cover assembly.	___	___
	. Joined barrel to the jacket assembly.	___	___
	. Joined barrel and jacket assembly with the receiver.	___	___
6.	CHECK OPERATION OF M219 MACHINEGUN (AB208)		
	. Placed safety in FIRE POSITION.	___	___
	. Charged weapon to lock moving parts to the rear.	___	___
	. Allowed barrel extension to ease forward by keeping tension on the charging handle and depressing the manual firing trigger.	___	___

7. MOUNT M219 MACHINEGUN IN TANK (AB215) Yes No

. Physically examined the gun mount cover shield to see that the three support set screws were backed off flush with the collar of the gun port. ___ ___
. If set screws were not flush with collar of gun port, unscrewed the set screws so that the flash suppressor of the machinegun did not hit the set screws when inserted through the machinegun port. ___ ___
. Had the gunner, if necessary, depress the gun tube so that it was horizontal or slightly below. ___ ___
. Placed the shell ejection shield on the shield support and fastened the six snap fasteners which hold it in place. ___ ___
. Installed the spent cartridge bag on the empty cartridge bag support by fastening the eight snap fasteners which hold it in place. ___ ___
. Slid the machinegun into the machinegun port until the rearmost portion of the jacket assembly (the disconnector holes) were flush with the machinegun bracket assembly. ___ ___
. Placed machinegun retainer over the rear-most position of the jacket assembly, alining it with machinegun bracket assembly. ___ ___
. Inserted the two cap screws and lock washers in their respective holes and tightened them down. ___ ___
. Plugged in the machinegun electrical lead to the solenoid on the machinegun's backplate assembly. ___ ___

8. LOAD M219 MACHINEGUN (AB210)

. Pushed forward on the rear of the left cover latch rod assembly and raised the cover. ___ ___
. Raised the feed tray. ___ ___
. Placed the machinegun safety in the FIRE position. ___ ___
. Charged (cocked) the machinegun by pulling the charger handle to the rear. ___ ___
. Inspected the chamber for obstructions by looking and feeling in the chamber. ___ ___
. Placed safety in the SAFE position. ___ ___
. Lowered feed tray. ___ ___
. Fed ammunition belt through chute of ammunition box. ___ ___
. Placed first round of ammunition belt in feed tray slot with the open side of ammunition link loops facing down. ___ ___
. Closed machinegun cover assuring that lock rod is engaged. ___ ___

9. DISASSEMBLE MAIN GUN BREECHBLOCK (AA204)

A. REMOVAL

. Insured that the main gun safety switch was in the SAFE position. ___ ___
. Insured that the breechblock crank stop was in the REAR position. ___ ___

	Yes	No
. Opened the breech.	___	___
. Insured chamber was empty.	___	___
. Closed the breech manually by tripping the extractors with an empty cartridge case or a wooden block.	___	___
. Removed firing pin spring by depressing plunger, moving plunger to the right, twisting firing pin spring retainer counter-clockwise until the lug alined with the groove in the breechblock, and removing the retainer and spring.	___	___
. Removed firing pin and retractor guide with firing pin retractor by inserting screwdriver blade into retractor guide slot and prying outward.	___	___
. Screwed eye bolt into top of breechblock.	___	___
. Suspended chain hoist from hook on the turret ceiling and connected chain hoist to eye bolt.	___	___
. Took up slack with the chain hoist to support breechblock.	___	___
. Applied tension on closing spring by turning adjuster clockwise with spanner wrench.	___	___
. Removed tension from the closing spring by depressing plunger from its notch with a screwdriver and allowing adjuster to turn counterclockwise under control of the spanner wrench.	___	___
. Inserted small screwdriver into hole in breechblock crank stop and slid stop forward.	___	___
. Started breechblock downward by rotating operating handle rearward and down, and with chain hoist let the breechblock begin descending.	___	___
. Returned the operating handle to the latched position.	___	___
. Lowered the breechblock until breechblock crank pivot was free of the T-slot, and removed pivot.	___	___
. Lowered breechblock until breechblock was on the turret floor.	___	___
. Released chain hoist from the eye bolt.	___	___
. Removed right and left extractors from the breech ring.	___	___

B. DISASSEMBLY

. Depressed firing contact plate plunger and turned firing contact plate counterclockwise until arrows on plate and breechblock were alined with each other.	___	___
. Removed firing contact plate, firing contact plate plunger, and spring.	___	___
. Removed plastic washer, firing contact, and firing contact sleeve.	___	___
. Removed retractor pivot pin and firing pin retractor from retractor guide.	___	___
. Removed screw, washers, and clamp securing the retractor driver to the bottom of the breechblock. (Use Allen wrench to remove screws.)	___	___
. Removed retractor driver, retractor driver shaft, and spring.	___	___

10. ASSEMBLE MAIN GUN BREECHBLOCK (AA205)

A. ASSEMBLY	Yes	No
. Installed retractor driver spring, shaft, and retractor driver into the bottom of the breechblock.	___	___
. Affixed the retractor group to the bottom of breechblock by installing securing clamp, washers, and screw with the Allen wrench.	___	___
. Inserted firing contact sleeve, firing contact, plastic washer, spring, and firing contact plate plunger into the breechblock.	___	___
. Installed firing pin retractor into retractor guide and secured it with the retractor pivot pin.	___	___
. Replaced firing contact plate by alining the arrow and depressing and rotating the plate clockwise until firing contact plate plunger engaged locking notch in plate.	___	___
B. INSTALLATION		
. Installed right and left extractors into extractor pivots in the breech ring.	___	___
. Inserted chain hoist into eye bolt on breechblock.	___	___
. Raised breechblock and guided it into breech ring until breechblock came in contact with extractor plungers.	___	___
. Depressed plungers and moved breechblock upward.	___	___
. Installed breechblock crank pivot in breechblock crank.	___	___
. Inserted pivot in breechblock T-slot.	___	___
. Tripped extractors with the screwdriver and raised the breechblock to the closed position.	___	___
. Inserted small screwdriver or rod into the hole in breechblock crank stop and slid stop to the rear position.	___	___
. Jiggled the crank stop back and forth to assure that the plunger was seated in its recess.	___	___
. Released the tension on the chain hoist.	___	___
. Turned adjuster clockwise until plunger entered the first recess.	___	___
. Removed chain hoist and eye bolt.	___	___
. Installed retractor guide with firing pin retractor and firing pin in its well by pushing guide forward until it was flush with inner surface of the well.	___	___
. Installed firing pin spring and firing pin spring retainer.	___	___
. Depressed plunger, and twisted retainer clockwise until plunger was seated in its recess.	___	___
. Opened and closed breech several times to test for binding or shock.	___	___
. Adjusted tension on the closing spring to contact any binding or shock in breech operation.	___	___

SCORING.

To pass, soldier must have:

a. Unloaded M219 (without being told) before removing it from tank.

b. Checked operation of the M219 (without being told) after assembling it.

c. Completed disassembly and assembly of the M219 and breech-block within the times specified.

d. Been checked "Yes" on all performance measures.

LOADER'S READINESS TEST

PART D. REPLENISHER TAPE READING (GARRISON/HANDS-ON)

CONDITIONS. Replenisher tape mock-up positioned forward of the soldier in the relative position as in the loader's station. The tape can be set in any one of four positions: (1) one rough edge and one smooth (2) two rough edges (3) three smooth edges, and (4) two long notches.

INSTRUCTIONS TO LOADER. "In this part of the test I am going to give you some different settings of the replenisher tape, and you are to feel the tape and tell me what action you would take if you got that reading (a) during firing, and (b) before firing (during mission preparation). I will set the tape and say "Ready," you should then reach up into the mock-up, feel the tape and immediately report what action is called for."

TASK.

AA211 Determine corrective action required by replenisher tape.

NOTES.

a. TC-Scorer should present each of the four settings twice in a series of eight settings presented in random order to soldier.

b. This is the same mock-up described in Module L.7.

PERFORMANCE MEASURES.	Yes	No
. Reached up with left hand behind the rangefinder and to the left end of the replenisher cylinder and felt tape.	___	___
. Took no action if felt one rough edge and one smooth edge.	___	___
. Added oil to replenisher (after announcing "CEASE FIRE," if during firing) if felt rough edges on both sides of tape.	___	___
. Continued to check tape frequently during firing if felt smooth edges on both sides of tape, but drained oil from replenisher at first opportunity.	___	___
. Drained oil from replenisher (after announcing "CEASE FIRE," if during firing) if felt two long notches in tape.	___	___

SCORING.

To pass, soldier must have:

a. Stated the correct action for each of the eight test trials for during-firing and before-firing conditions.

b. Responded in each trial without hesitation, immediately after feeling the tape.

APPENDIX D

GUNNER'S READINESS TEST

GUNNER'S READINESS TEST
(6 HOURS)

PART A. BEFORE OPERATIONS PROCEDURES

Type: Hands-On (attached)

Time: 1 hour

Location: Armory

Support: Tank and TC scorer

SCORING: 100% correct

PART B. WEAPON SYSTEMS PREPARATION (KNOWLEDGE)

Type: Written pre-tests for TEC Lessons
020-171-5351-F
-5355-F
-5342-F
-5337-F
-5354-F
-5352-F
-5353-F

Time: 1 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

PART C. WEAPON SYSTEMS PREPARATION (SKILL)

Type: Hands-On (attached)

Time: 1 hour

Location: Weekend Training Site

Support: Tank and TC scorer

Scoring: 100% correct

PART D. TARGET ACQUISITION

Type: Written pre-tests for TEC Lessons 020-171-1611-F. 020-171-1612-F and 020-171-1614-F, and oral post-test for 935-171-0203-F

Time: 1 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

PART E. TACTICAL OPERATIONS

Type: Hands-on (attached)

Time: 2 hours

Location: Weekend Training Site

Support: Tank and TC scorer

Scoring: 100% correct

GUNNER'S READINESS TEST

PART A: BEFORE-OPERATIONS PROCEDURES (GARRISON/HANDS-ON)

CONDITIONS. Fully operational M48A5 situated on level ground.

INSTRUCTIONS TO GUNNER. "Prepare the tank for a tactical mission. 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 other crew members as needed."

TASKS.

A5301 Place turret into power operation.
A5302 Perform main gun prepare-to-fire procedure from the Gunner's station.

NOTES.

a. Remedial training on tasks failed should be provided on-the-spot, but after soldier has completed all of PART A. See MODULE G-1.

b. The Gunner should not boresight the periscope and telescope or apply established zero.

PERFORMANCE MEASURES.

1. PLACE TURRET INTO POWER OPERATION (A5301)	Yes	No
. Insured the tank and surrounding area are clear of obstruction.	___	___
. Insured crew is in safe position and Driver has lowered his seat and has his head down.	___	___
. Instructed Loader to release gun tube from travel lock.	___	___
. Unlocked turret lock.	___	___
. Announced POWER to alert the crew.	___	___
. Checked that engine is running and set at 800 to 900 RPM.	___	___
. Insured manual traversing handle locking lever is in the detent position.	___	___
. Turned TURRET POWER switch ON.	___	___
. Squeezed magnetic brake switch and rotated Gunner's control handle to traverse turret.	___	___
. Rotated handles rearward and forward to elevate and depress gun.	___	___

2. PERFORM PREPARE-TO-FIRE PROCEDURES (A5302)		
On command PREPARE-TO-FIRE from TC:		
- Observed Loader's action in checking replenisher tape.	___	___
- Cleaned and inspected direct fire sights (interior).	___	___
- Checked operation of ballistic shield.	___	___
- Checked instrument lights.	___	___

On command CHECK FIRING SWITCHES:	Yes	No
• Turned main gun switch ON.	___	___
• Checked firing trigger on power control handle and trigger on manual elevating control handle.	___	___
• Checked main gun manual firing device.	___	___
(NOTE: Announced ON THE WAY each time a trigger is checked for the main gun or the manual firing device is actuated.)		
• Turned main gun switch OFF.	___	___
• Turned coaxial machinegun switch ON.	___	___
• Checked firing trigger on manual elevating control handle.	___	___
• Turned coaxial machinegun switch OFF.	___	___
On command CHECK FIRING CONTROLS:		
• Set range correction knob of ballistic computer at zero.	___	___
• Checked manual operation of computer for bind in computer or linkage.	___	___
• Pushed RESET button on computer.	___	___
• Observed that pointers on computer synchronized at various indexed ranges.	___	___
• Observed that superelevation counter indicated correct superelevation for various ammunition and ranges.	___	___
• Turned range correction knob of ballistic computer to proper setting.	___	___
• Reported GUNNER READY on command REPORT.	___	___

SCORING.

To pass, soldier must have:

a. Placed turret into power operation without cuing by scorer.

b. Been checked "Yes" on each performance measure.

GUNNER'S READINESS TEST

PART C: WEAPON SYSTEMS PREPARATION (SKILL: FIELD/HANDS-ON)

CONDITIONS. Fully operational M48A5 situated on level ground with BII and coaxial machinegun mounted. Boresight and zero panels are at appropriate ranges.

INSTRUCTIONS TO GUNNER. "Prepare the weapon systems on your tank for a night tactical mission. Your activities should include preparing the azimuth indicator for operation and operating the elevation quadrant. If necessary, I will give you the information for your shot groups during zeroing. 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.

AB301	Prepare tank for boresighting.
AA302	Prepare Gunner's telescope for operation.
AB302	Prepare Gunner's periscope for operation.
AA309	Prepare azimuth indicator for operation.
AA307	Operate elevation quadrant.
AA303	Boresight Gunner's telescope.
AB303	Boresight daylight sight of Gunner's periscope.
AB304	Boresight IR sight of Gunner's periscope during daylight.
A5307	Boresight tank searchlight using primary method.
A5306	Boresight tank searchlight using alternate method.
AB308	Boresight an M219 machinegun.
AB307	Zero tank main gun.
A5305	Zero an M219 machinegun.

NOTES:

a. Soldier should not be given this part of the test until he has passed PART A and completed the written TEC Lesson pre-tests for PART B and any remedial training necessary on TEC Lessons failed.

b. Remedial training on tasks failed should be provided on-the-spot but after soldier has completed PART C. [See MODULE G-2 and G-3]

c. Task A5307 (Boresight tank searchlight using primary method) must be performed at night.

d. Task A5306 (Boresight tank searchlight using alternate method) must be performed at a location where a wall is available to reflect the beam.

e. If live-fire cannot be used to zero the weapons, the test administrator must arrange both simulated firing and simulated shot groups. The simulated shot group can be accomplished by having an assistant scorer down range to place discs over the zero panels to represent target hits.

f. In the PERFORMANCE MEASURES section which follows, the role of the scorer as TC or LOADER is indicated by "TC" or "LOADER." For example, PERFORMANCE MEASURE C.1, PREPARE TANK FOR BORESIGHTING begins with the statement: "After 'LOADER' removed firing mechanism from breechblock..." The scorer, acting as LOADER, should remove the firing mechanism.

PERFORMANCE MEASURES.

	Yes	No
1. PREPARE TANK FOR BORESIGHTING (AB301)		
After "LOADER" removed firing mechanism from breechblock:		
. Centered right telescope of binocular M17A1 over firing pinhole.	___	___
. Alined axis of 105mm gun bore on right angle of aiming point by operating the manual traversing and elevating handles.	___	___
2. PREPARE GUNNER'S TELESCOPE FOR OPERATION (AA302)		
. Inspected eyepiece hanger and screws for presence and tightness.	___	___
. Inspected the hanger assembly and quick-disconnect pin for presence, proper fit, and swivel movement.	___	___
. Inspected the holder assembly to ensure that the pin on the telescope and the slot on the holder assembly are seated.	___	___
. Adjusted headrest by loosening adjusting nut and sliding headrest to desired position and tightening nut.	___	___
. Cleaned lenses.	___	___
. Focused eyepiece by rotating diopter to the maximum plus reading and then rotating the diopter back until the view through the eyepiece appears with the maximum sharpness.	___	___
. Set reticle illumination by rotating the rheostat knob on instrument light M50.	___	___
. Removed filters from filter box.	___	___
. Cleaned if required, and inspected for cracks.	___	___
. Selected proper filter if conditions warrant use of filters.	___	___
. Attached filter to telescope eyepiece.	___	___
. Viewed through eyepiece and moved reticle selector to each position checking to see that both reticles are visible.	___	___

		Yes	No
3.	PREPARE GUNNER'S PERISCOPE FOR OPERATION (AB302)		
	. Inspected the M118 mount for general condition.	___	___
	. Reported any damage to mount to the vehicle commander.	___	___
	. Adjusted the daylight and IR headrest for proper fit.	___	___
	. Opened ballistic shield.	___	___
	. Adjusted diopter on the daylight sight by rotating the diopter to the maximum-plus reading and then back until the image seen through the eyepiece appears with the maximum sharpness.	___	___
	. Set the reticle illumination by rotating the light source control knob until reticle appears with desired brightness.	___	___
4.	PREPARE AZIMUTH INDICATOR FOR OPERATION (AA309)		
	. Rotated rheostat knob until desired brightness is obtained.	___	___
	. Placed the aiming cross of the periscope on the reference point.	___	___
	. Performed accuracy test by traversing turret 360 degrees to return to original reference point.	___	___
	. Set the micrometer and azimuth pointers on zero.	___	___
	. Performed slippage test by traversing the turret rapidly in power and stopping suddenly.	___	___
	. Repeated this operation two or more times in same direction.	___	___
	. Traversed turret manually in opposite direction to return to original reference point.	___	___
	. Insured that both the micrometer and azimuth pointers are on zero.	___	___
5.	OPERATE ELEVATION QUADRANT (AA307)		
	. Placed aiming point on the center of the target and established a line of sight.	___	___
	. Measured the position of the gun tube by rotating the micrometer knob until the bubble is centered in the level vial.	___	___
	. Read elevation from the elevation and micrometer scales.	___	___
6.	BORESIGHT GUNNER'S TELESCOPE (AA303)		
	. Moved reticle selector switch until reticle corresponding to type of ammunition that will be used to zero can be seen through the eyepiece.	___	___
	. Unlocked telescope mount elevation and deflection boresight knobs.	___	___
	. Rotated the boresight knobs until the boresight aiming cross of the reticle is on the same aiming point as the muzzle cross threads.	___	___
	. Moved elevation and deflection knob locking levers to the lock position.	___	___
	. Rotated slip scales on the elevation and deflection knobs to read 3 and 3.	___	___
	. Told Loader to confirm that the muzzle cross threads are on the aiming point.	___	___

7. BORESIGHT DAYLIGHT SIGHT OF GUNNER'S PERISCOPE (AB303) Yes No

. Sighted through the eyepiece, disengaged the elevation and deflection boresight knobs, and rotated the knobs until the aiming cross is on the same aiming point as the muzzle cross threads. ___ ___
. Rotated slip scale on the elevation and deflection boresight knobs to read 4 and 4. ___ ___
. Checked to assure that the daylight sight reticle is on the aiming point. ___ ___
. Told Loader to confirm that the muzzle cross threads are on the aiming point. ___ ___

8. BORESIGHT IR SIGHT OF GUNNER'S PERISCOPE DURING DAYLIGHT (AB304)

. Opened the ballistic shield. ___ ___
. Placed opaque material over the periscope head assembly with a 3/4 inch hole in line with the IR body. ___ ___
. Placed the IR switch in the 1.5 volt position. ___ ___
. Viewed through the IR eyepiece and rotated the IR diopter to the maximum plus reading then back until the grain on the converter tube surface as seen through the eyepiece appears clear and sharp. ___ ___
. Rotated the light source control until the reticle illumination has the desired brightness. ___ ___
. Sighted through the eyepiece and rotated focusing ring until the target appears with the maximum sharpness. ___ ___
. Disengaged and rotated the elevation and deflection boresight knobs until the aiming cross of the reticle is alined on the same aiming point as the muzzle cross threads. ___ ___
. Rotated slip scale on the elevation and deflection boresight knobs to read 4 and 4. ___ ___
. Checked to insure that aiming cross on the reticle of the daylight scope is on the aiming point. ___ ___
. Told Loader to confirm that the muzzle cross threads are on the aiming point. ___ ___

9. BORESIGHT TANK SEARCHLIGHT USING PRIMARY METHOD (A5307)

After "TC" turned searchlight ON and control to VIS FOCUS mode:

. Removed all superelevation from the fire control system using the computer's superelevation handcrank. ___ ___
. Laid aiming cross of primary sight on the center of the boresight panel or target chosen. ___ ___
. Centered the bubble on the elevation quadrant using the micrometer knob. ___ ___
. Applied plus 5 mils on elevation quadrant using the micrometer knob. ___ ___
. Manually elevated the gun until the bubble is centered. ___ ___

10. BORESIGHT TANK SEARCHLIGHT USING THE ALTERNATE METHOD (A5306) Yes No

After "TC" laid the bottom of the searchlight beam above and just touching the reference mark:

- Removed superelevation from fire control system using computer's handcrank. ___ ___
- Boresighted main gun on lower cross. ___ ___
- Centered the bubble on the elevation quadrant using the micrometer knob. ___ ___
- Applied plus 5 mils to elevation quadrant using the micrometer knob. ___ ___
- Manually elevated the gun until the bubble is centered. ___ ___

11. BORESIGHT AN M219 MACHINEGUN MOUNTED ON A TANK (AB308)

After "LOADER" tightened both horizontal adjustment screws:

- Rotated, either to the left or right, the rheostat knob on the infinity sight M44C for periscope M31 or the rheostat knob of the light source control for periscope M30 in order to adjust brightness of reticle. ___ ___
- Rotated both the elevation and deflection boresight knobs on the infinity sight so as to aline the center reticle on aiming point of target. ___ ___

12. ZERO TANK MAIN GUN (AB307)

After "TC" turned computer ON:

- Indexed ammunition element into ballistic computer. ___ ___
- Laid sight reticle on center of mass of target by operating the manual elevation and traversing handles. ___ ___

After "LOADER" announced UP:

- Fired a three-round shot group. ___ ___
- Unlocked boresight knobs and moved sight reticle to center of shot group, without disturbing lay of the gun. ___ ___
- Relaid main gun back to center of mass by operating the manual elevation and traversing handles. ___ ___

After "LOADER" announced UP:

- Fired a check round. ___ ___
- Relaid main gun back to center of mass by operating the manual elevation and traversing handles. ___ ___
- Recorded elevation and deflection readings on all sights. ___ ___

13. ZERO AN M219 MACHINEGUN (A5305) Yes No

. Selected a target with a clearly defined aiming point at a known range as near 800 meters as possible. ___ ___
. Indexed the lowest velocity tank main gun ammunition in the ballistic computer. ___ ___
. Sighted through the unity power window of the Gunner's periscope and laid the target in the center of the aiming circle by operating the manual elevation and traversing handles. ___ ___

After "LOADER" announced UP:

. Placed the electrical machinegun switch on the Gunner's panel in the ON position. ___ ___
. Depressed the electrical firing trigger and fired a 20-25 round burst. ___ ___
. Observed the strike of the rounds in relation to the target. ___ ___
. Rotated the infinity sight boresight knobs to move the sight reticle so that the strike area is in the center of the field of view. ___ ___
. Fired additional 20-25 round burst to check the accuracy of adjustment. ___ ___
. Rotated the infinity sight boresight knobs, if necessary, to readjust the field of view in relation to the strike of the rounds. ___ ___

SCORING.

To Pass:

a. The soldier must have been checked "Yes" on each performance measure.

b. The TC (scorer) must verify that optics and weapons are boresighted by confirming that reticle aiming crosses are on same aiming points as muzzle cross threads.

GUNNER'S READINESS TEST

PART E: TACTICAL OPERATIONS (FIELD/HANDS-ON)

CONDITIONS. Fully operational M48A5 tank with BII, coaxial machinegun, dummy main gun round loaded and blank coaxial machinegun rounds (if available). Tactical driving course including obstacles (ditch, vertical, incline, water), terrain conditions suitable for tank defilade and simulated targets (both moving and stationary, main gun and coaxial). Scenario of fire commands to be given by TC.

INSTRUCTIONS TO GUNNER. "This is a test of your ability to engage targets. We are going on a simulated combat mission. You should listen and react to my commands when I give them, but you should also react as necessary if I fail to give you a command. Watch for targets and report them as you would normally. I will serve as the TC and Loader as needed."

TASKS.

AL02 Main gun engagement, stationary tank, stationary target, Gunner fires.
AL03 Main gun engagement, moving to a halt, moving target, Gunner fires.
AL05 Coax engagement, moving tank, stationary target, Gunner fires.
AL16 Main gun engagement, moving to a halt, stationary target, Gunner fires.
A5304 Apply immediate action in case of main gun failure to fire.
A5201 Unload misfired main gun.
AA112 Acquire targets.

NOTES:

a. Soldier should complete PARTS A-D Gunner's Readiness Test, before taking this one.

b. In the PERFORMANCE MEASURES section which follows, the role of the scorer as TC or LOADER is indicated by "TC" or "LOADER." For example, PERFORMANCE MEASURE E-1, MAIN GUN ENGAGEMENT, STATIONARY TANK, STATIONARY TARGET, GUNNER FIRES, begins with the statement, "After "TC" announces Gunner." The scorer, acting as TC, should announce GUNNER.

c. The TC (scorer) must announce "MISFIRE" during one of the main gun engagements.

d. The TC (scorer) must verify sight picture each time GUNNER announces ON THE WAY.

e. Second round adjustments not being tested here, MODULE G-5, UNIT G-5.3 provides extensive conduct-of-fire training.

f. The targets should be appropriate for the engagements provided. However, the order in which the targets appear is not important.

PERFORMANCE MEASURES.

1. MAIN GUN ENGAGEMENT, STATIONARY TANK, STATIONARY TARGET, GUNNER FIRES (AL02)

	Yes	No
After "TC" announced GUNNER:		
. Turned MAIN GUN switch ON.	___	___
After "TC" announced target description:		
. Announced IDENTIFIED.	___	___
. Laid crosshair at center of base of target.	___	___
. Made final precise lay.	___	___
After "TC" announced FIRE:		
. Announced ON THE WAY.	___	___
(NOTE: TC (scorer) VERIFIES SIGHT PICTURE)		
. Fired main gun.	___	___

2. MAIN GUN ENGAGEMENT, MOVING TO A HALT, MOVING TARGET, GUNNER FIRES (AL03)

After "TC" announced GUNNER, BATTLESIGHT:		
. Turned main gun switch ON.	___	___
After "TC" announced target description:		
. Announced IDENTIFIED:	___	___
. Applied lead in direction of target apparent motion.	___	___
. Laid crosshair leadline at center of base of target.	___	___
After "TC" announced FIRE:		
. Timed shot.	___	___
. Announced ON THE WAY.	___	___
(NOTE: TC (scorer) VERIFIES SIGHT PICTURE)		
. Fired main gun.	___	___

3. COAX ENGAGEMENT, MOVING TANK, STATIONARY TARGET, GUNNER FIRES (AL05)

After "TC" announced GUNNER, COAX:		
. Turned COAX switch ON.	___	___
After "TC" announced target description:		
. Announced IDENTIFIED.	___	___
After "TC" announced RANGE:		
. Laid rangeline at center of target vulnerability.	___	___
After "TC" announced FIRE:		
. Announced ON THE WAY.	___	___
(NOTE: TC (scorer) VERIFIES SIGHT PICTURE)		
. Fired COAX.	___	___

4. MAIN GUN ENGAGEMENT, MOVING TO A HALT, STATIONARY TARGET, GUNNER FIRES (AL16)

	Yes	No
After "TC" announced GUNNER, HEP:		
. Turned main gun switch ON.	___	___
. Indexed HEP.	___	___
After "TC" announced target description:		
. Announced IDENTIFIED.	___	___
After "TC" announced RANGE:		
. Laid crosshair at center of target vulnerability.	___	___
After "TC" announced FIRE:		
. Applied aim-off (when range > 1800 meters).	___	___
. Made final precise lay.	___	___
. Announced ON THE WAY.	___	___
(NOTE: TC (scorer) VERIFIES SIGHT PICTURE)		
. Fired main gun.	___	___

5. APPLY IMMEDIATE ACTION IN CASE OF MAIN GUN FAILURE TO FIRE (A5304)

After "TC" tells Gunner that round failed to fire:		
. Announced MISFIRE.	___	___
. Announced ON THE WAY and attempted to fire by depressing a firing trigger on the Gunner's power control handle that was NOT used to fire the round initially.	___	___
(NOTE: "TC" tells Gunner that round failed to fire.)		
. Announced MISFIRE if gun again fails to fire.	___	___
. Announced ON THE WAY and attempted to fire by depressing the firing trigger on the Gunner's manual control handle.	___	___
(NOTE: "TC" tells Gunner that round failed to fire.)		
. Announced MISFIRE if gun again fails to fire.	___	___
. Announced ON THE WAY and attempted to fire with the EMERGENCY FIRING DEVICE.	___	___
(NOTE: "TC" tells Gunner that round failed to fire.)		
. Announced MISFIRE if gun again fails to fire.	___	___
. Waited two minutes and directed Loader to rotate the round 1/2 turn.	___	___
After "LOADER" announced UP:		
. Turned main gun switch ON.	___	___
. Announced ON THE WAY and attempted to fire by depressing one of the electrical firing triggers.	___	___
(NOTE: "TC" tells Gunner that round failed to fire.)		
. Announced MISFIRE if gun again fails to fire and waits two minutes for a hangfire.	___	___

		Yes	No
6.	UNLOAD MISFIRED MAIN GUN (A5201)		
	After "TC" commands UNLOAD MISFIRED MAIN GUN:		
	. Turned MAIN GUN and TURRET POWER switches OFF.	___	___
	After "LOADER" opened breech:		
	. Inserted ramming and extracting tool between face of the breech and rim of the cartridge.	___	___
	. Pried round out of chamber.	___	___
7.	ACQUIRE TARGETS (AA112)		
	. Detected targets in assigned observation sector.	___	___
	. Called out target type.	___	___
	. Called out estimated range in 100s of meters.	___	___
	. Called out direction to target by clock method or reference point method.	___	___

SCORING.

To pass, soldier must have:

a. Detected and reported all targets that the "TC" did not announce. Delay in detection is <u>not</u> cause for failure.

b. Responded without hesitation to each applicable element of each fire command.

c. Taken up correct sight pictures within 10 seconds of announcement of target description.

d. Continued to monitor sight picture after firing.

e. Been checked "yes" on all performance measures.

APPENDIX E

TANK COMMANDER'S READINESS TEST

TANK COMMANDER'S READINESS TEST
(6 HOURS)

PART A. BEFORE OPERATIONS PROCEDURES

Type: Hands-On (attached)

Time: 1 hour

Location: Armory

Support: Tank and TC Scorer

Scoring: 100% correct

PART B: WEAPON SYSTEMS PREPARATION (KNOWLEDGE)

Type: Written pre-tests for TEC Lessons 020-171-5335-E, 020-171-5340-F, 020-171-5355-F, 020-171-5352-F, 020-171-5343-F, 020-171-5354-F, 020-171-5353-F

Time: 1 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

PART C: WEAPON SYSTEMS PREPARATION (SKILL)

Type: Hands-On (attached)

Time: 1 hour

Location: Weekend Training Site

Support: Tank and TC Scorer

Scoring: 100% correct

PART D. TARGET ACQUISITION

Type: Written pre-tests for TEC Lessons 020-171-1611-F and 020-171-1614-F, and oral post-test for 935-171-0203-F

Time: 1 hour

Location: Armory

Support: TC scorer

Scoring: 90% correct

PART E. TACTICAL OPERATIONS

Type: Hands-On (attached)

Time: 2 hours

Location: Weekend Training Site

Support: Tank and TC scorer

Scoring: 100% correct

TC scorer should be a TC from another crew or, if possible, a platoon leader.

TANK COMMANDER'S READINESS TEST

PART A. BEFORE OPERATIONS PROCEDURES (GARRISON HANDS-ON)

CONDITIONS: Fully operational M48A5 with BII, coaxial machinegun and M2 machinegun.

INSTRUCTIONS TO TANK COMMANDER. "Your unit is going on a tactical mission. In one hour your vehicle will move to the firing range to boresight and zero. You will be scored on what you do during this hour as well as how well you do it. Do only those tasks which involve you actively. You do not have to supervise the members of your crew. I will observe your performance and serve as the other crew members as needed. When the hour is over, proceed to the firing range."

TASKS.

A5401	Perform main gun prepare-to-fire procedure from the TC position.
A5405	Disassemble an M2 machinegun.
A5413	Service an M2 machinegun.
A5406	Assemble an M2 machinegun.
A5409	Adjust headspace on the M2 machinegun.
A5410	Adjust timing on the M2 machinegun.

NOTES.

a. The scorer must not give the soldier any more information than he would have on the job. One goal of the Tank Commander's Readiness Test is to determine whether the TC can ready himself and his crew for a combat mission with a minimum of supervision.

b. Remedial training on tasks failed should be provided on-the-spot, but after soldier has completed all of PART A. See MODULE TC-1.

c. In the PERFORMANCE MEASURES section which follows, the role of the scorer as GUNNER or LOADER is indicated by "GUNNER" or "LOADER." The scorer, acting as either, should perform as indicated.

d. The role of the TC as supervisor of the crew is not addressed in this test. To do so, add to the instructions that no before operations checks have been performed by any crew member and that you will perform as the other crew members as directed. Delete remarks concerning supervision.

PERFORMANCE MEASURES.

	Yes	No
1. PERFORM MAIN GUN PREPARE-TO-FIRE PROCEDURES FROM THE TC POSITION (A5401)		
. Commanded PREPARE TO FIRE after "Gunner" placed turret into power operation.	___	___
. Disconnected breakaway plug.	___	___
. Cleaned exterior lens and vision devices on turret.	___	___
. Checked operation of shield on persicope.	___	___
. Checked instrument lights.	___	___
. Commanded CHECK FIRING SWITCHES.	___	___
. Checked firing trigger on power control handle when main gun switch is ON.	___	___
. Checked firing trigger on power control handle when coaxial machinegun switch is ON.	___	___
. Commanded CHECK GUN CONTROLS.	___	___
. Checked commander's power control handle for power elevation and power traverse.	___	___
. Commanded CHECK FIRING CONTROLS.	___	___
. Turned cupola power switch ON.	___	___
. Checked operation of .50 caliber machinegun mount and controls.	___	___
. Checked for binding on rangefinder.	___	___
. Turned ballistic computer ON.	___	___
. Indexed various ranges on rangefinder.	___	___
. Told "GUNNER" to ensure they are indexed on ballistic computer.	___	___
. Commanded REPORT.	___	___
2. DISASSEMBLE AN M2 MACHINEGUN (A5405)		
. Removed the barrel by pushing in on the barrel latch while depressing the barrel latch lock, rotating the barrel 90° and pulling the barrel out of the barrel jacket.	___	___
. Removed link chute adapter.	___	___
. Removed belt holding pawl pin.	___	___
. Removed the backplate by pushing in on the backplate latch lock while raising the backplate latch and sliding the backplate up and out of the receiver.	___	___
Removed the bolt buffer group and separated by:		
. Pushing in on the rear of the driving spring guide rod and rotating it left or right until it can slide rearward.	___	___
. Grasping the bolt buffer and sliding rearward until clear of receiver.	___	___
. Sliding the driving spring rod off the drive rod.	___	___
. Sliding the drive rod out of the buffer spring.	___	___
. Sliding the buffer spring out of the buffer sleeve.	___	___
. Removed charger cover.	___	___
. Retracted manual charger to aline bolt stud with disassembly holes in left side of side plate.	___	___
. Removed bolt stud.	___	___
. Removed bolt assembly.	___	___

	Yes	No
. Removed extractor and bolt switch.	___	___
. Released firing pin.	___	___
. Disengaged cocking lever and cocking lever pin.	___	___
. Removed cocking lever and cocking lever pin.	___	___
. Released accelerator stop lock.	___	___
. Removed accelerator stop lock.	___	___
. Depressed accelerator stop.	___	___
. Removed sear slide and sear spring.	___	___
. Removed firing pin extension.	___	___
. Disengaged firing pin from firing pin extension.	___	___
. Depressed buffer body spring and pushed barrel extension to the rear.	___	___
. Removed buffer assembly and barrel extension assembly.	___	___
. Pushed forward on tips of accelerator and disconnected from barrel extension.	___	___
. Removed barrel buffer body from buffer assembly.	___	___
. Removed accelerator pin and accelerator from barrel buffer body.	___	___
. Removed breech lock-pin and breech lock from barrel extension.	___	___
. Removed belt feed lever lock-pin.	___	___
. Pushed belt feed lever to the right until toe is in line with slot in cover.	___	___
. Removed belt feed lever.	___	___
. Removed belt feed slide group.	___	___
. Removed belt feed pawl pin.	___	___
. Disassembled belt feed slide group.	___	___
. Removed trigger bar.	___	___

3. SERVICE AN M2 MACHINEGUN (A5413)

. Cleaned all powder-fouled surfaces with rifle bore cleaner (CR).	___	___
. Cleaned all components with dry cleaning solvent (SO).	___	___
. Wiped all components dry with clean rag.	___	___
. Oiled all components lightly with General Purpose Lubricating Oil (PL Special).	___	___

4. ASSEMBLE AN M2 MACHINEGUN (A5406)

. Installed trigger box.	___	___
. Assembled belt feed group.	___	___
. Installed belt feed pawl pin.	___	___
. Installed belt feed slide group.	___	___
. Inserted compression helical spring and headless shoulder pin into belt feed lever for right hand feed.	___	___
. Positioned belt feed lever on pivot stud, press in headless shoulder pin and install lever.	___	___
. Installed belt feed lever lock-pin.	___	___
. Installed breech lock and secured with pins: (insured that breech lock double beveled edge is in position).	___	___

	Yes	No
. Positioned accelerator in barrel buffer body and secured pins.	___	___
. Assembled barrel assembly with accelerator up and engaged notch on shank of barrel extension with crossgroove in piston rod of buffer.	___	___
. Alined depressors in grooves of barrel extension and pushed buffer forward.	___	___
. Installed buffer assembly and barrel extension assembly; pushed barrel extension forward.	___	___
. Assembled firing pin and firing pin extensions.	___	___
. Installed sear spring and sear.	___	___
. Pressed downward on sear and installed sear slide.	___	___
. Inserted accelerator stop and pressed in place.	___	___
. Installed accelerator stop lock, swung stop into groove in bolt.	___	___
. Installed cocking lever and cocking lever spring; pressed in sear slide.	___	___
. Installed bolt switch and extractor so that grooves in switch aline with grooves of bolt for right hand feed.	___	___
. Installed bolt assembly.	___	___
. Installed bolt stud.	___	___
. Installed charger cover.	___	___
. Inserted driving spring rod assembly into its hold in bolt, pushed rod forward and when pin on rod is alined with hole, set pin in hole.	___	___
. Started backplate into grooves in rear of receiver, disengaged latch lock and pushed backplate down until latch is engaged.	___	___
. Installed belt holding pawl.	___	___
. Installed chute link adapter.	___	___
. Installed barrel.	___	___
. Closed cover.	___	___

5. ADJUST HEADSPACE ON THE M2 MACHINEGUN (A5409)

. Raised cover assembly.	___	___
. Retracted recoiling parts approximately 5/8" by pulling on the charging handle until lug on the barrel spring alines with the hole in the right sideplate of the receiver.	___	___
. Secured barrel fully into extension.	___	___
. Unscrewed barrel two notches.	___	___
. Released charger handle.	___	___
. Cocked machinegun to withdraw firing pin from face of bolt.	___	___
. Allowed bolt to return manually to battery position.	___	___
. Retracted recoiling parts approximately 1/16."	___	___
. Raised extractor.	___	___
. Inserted GO end of headspace gage into T-slot between face of bolt and barrel.		

	Yes	No
. Removed extractor and bolt switch.	___	___
. Released firing pin.	___	___
. Disengaged cocking lever and cocking lever pin.	___	___
. Removed cocking lever and cocking lever pin.	___	___
. Released accelerator stop lock.	___	___
. Removed accelerator stop lock.	___	___
. Depressed accelerator stop.	___	___
. Removed sear slide and sear spring.	___	___
. Removed firing pin extension.	___	___
. Disengaged firing pin from firing pin extension.	___	___
. Depressed buffer body spring and pushed barrel extension to the rear.	___	___
. Removed buffer assembly and barrel extension assembly.	___	___
. Pushed forward on tips of accelerator and disconnected from barrel extension.	___	___
. Removed barrel buffer body from buffer assembly.	___	___
. Removed accelerator pin and accelerator from barrel buffer body.	___	___
. Removed breech lock-pin and breech lock from barrel extension.	___	___
. Removed belt feed lever lock-pin.	___	___
. Pushed belt feed lever to the right until toe is in line with slot in cover.	___	___
. Removed belt feed lever.	___	___
. Removed belt feed slide group.	___	___
. Removed belt feed pawl pin.	___	___
. Disassembled belt feed slide group.	___	___
. Removed trigger bar.	___	___

3. SERVICE AN M2 MACHINEGUN (A5413)

. Cleaned all powder-fouled surfaces with rifle bore cleaner (CR).	___	___
. Cleaned all components with dry cleaning solvent (SO).	___	___
. Wiped all components dry with clean rag.	___	___
. Oiled all components lightly with General Purpose Lubricating Oil (PL Special).	___	___

4. ASSEMBLE AN M2 MACHINEGUN (A5406)

. Installed trigger box.	___	___
. Assembled belt feed group.	___	___
. Installed belt feed pawl pin.	___	___
. Installed belt feed slide group.	___	___
. Inserted compression helical spring and headless shoulder pin into belt feed lever for right hand feed.	___	___
. Positioned belt feed lever on pivot stud, press in headless shoulder pin and install lever.	___	___
. Installed belt feed lever lock-pin.	___	___
. Installed breech lock and secured with pins: (insured that breech lock double beveled edge is in position).	___	___

	Yes	No
. Positioned accelerator in barrel buffer body and secured pins.	___	___
. Assembled barrel assembly with accelerator up and engaged notch on shank of barrel extension with crossgroove in piston rod of buffer.	___	___
. Alined depressors in grooves of barrel extension and pushed buffer forward.	___	___
. Installed buffer assembly and barrel extension assembly; pushed barrel extension forward.	___	___
. Assembled firing pin and firing pin extensions.	___	___
. Installed sear spring and sear.	___	___
. Pressed downward on sear and installed sear slide.	___	___
. Inserted accelerator stop and pressed in place.	___	___
. Installed accelerator stop lock, swung stop into groove in bolt.	___	___
. Installed cocking lever and cocking lever spring; pressed in sear slide.	___	___
. Installed bolt switch and extractor so that grooves in switch aline with grooves of bolt for right hand feed.	___	___
. Installed bolt assembly.	___	___
. Installed bolt stud.	___	___
. Installed charger cover.	___	___
. Inserted driving spring rod assembly into its hold in bolt, pushed rod forward and when pin on rod is alined with hole, set pin in hole.	___	___
. Started backplate into grooves in rear of receiver, disengaged latch lock and pushed backplate down until latch is engaged.	___	___
. Installed belt holding pawl.	___	___
. Installed chute link adapter.	___	___
. Installed barrel.	___	___
. Closed cover.	___	___
5. ADJUST HEADSPACE ON THE M2 MACHINEGUN (A5409)		
. Raised cover assembly.	___	___
. Retracted recoiling parts approximately 5/8" by pulling on the charging handle until lug on the barrel spring alines with the hole in the right sideplate of the receiver.	___	___
. Secured barrel fully into extension.	___	___
. Unscrewed barrel two notches.	___	___
. Released charger handle.	___	___
. Cocked machinegun to withdraw firing pin from face of bolt.	___	___
. Allowed bolt to return manually to battery position.	___	___
. Retracted recoiling parts approximately 1/16."	___	___
. Raised extractor.	___	___
. Inserted GO end of headspace gage into T-slot between face of bolt and barrel.		

	Yes	No
. Adjusted tight headspace (if appropriate) by:		
- Retracting bolt.	___	___
- Unscrewing barrel one notch.	___	___
- Returning parts to battery position.	___	___
- Retracting recoiling parts.	___	___
- Checking headspace.	___	___
- Repeating until headspace is correct.	___	___
. Adjusted loose headspace (if appropriate) by:		
- Retracting bolt.	___	___
- Screwing barrel into barrel extension one notch.	___	___
- Returning parts to battery position.	___	___
- Retracting recoiling parts.	___	___
- Checking headspace.	___	___

6. ADJUST TIMING ON THE M2 MACHINEGUN (A5410)

. Raised cover.	___	___
. Cocked machinegun to withdraw firing pin from face of bolt.	___	___
. Raised extractor.	___	___
. Retracted bolt sufficiently to insert the NO FIRE gage (0.116 inch) between barrel extension and trunnion block.	___	___
. Released handle.	___	___
. Depressed trigger (gun should not fire).	___	___
. Adjusted early timing (if appropriate) by:		
- Moving recoiling parts rearward enough to remove NO FIRE gage.	___	___
- Cocking machinegun.	___	___
- Removing backplate.	___	___
- Retracting bolt sufficiently rearward to install NO FIRE gage.	___	___
- Turning trigger bar stop adjusting nut to the left one notch.	___	___
- Attempting to fire gun by pushing up on rear of trigger bar (gun should not fire).	___	___
- When gun does not fire, inserting the FIRE gage and pushing up on rear of trigger bar. (If firing pin is not released, timing is correct.)	___	___
. Retracted bolt sufficiently to remove NO FIRE gage and install the FIRE gage (0.020 inch) between barrel extension and trunnion block if firing pin is not released with the NO FIRE gage installed.	___	___
. Released charger handle.	___	___
. Depressed manual firing device on solenoid. (The gun should fire.)	___	___

	Yes	No
. Adjusted early timing (if appropriate) by:		
- Removing backplate.	___	___
- Turning trigger bar stop adjusting nut to the right one notch.	___	___
- Attempting to fire gun by pushing up on rear of trigger bar.	___	___
- (If trigger pin does not release) Continuing to turn trigger bar stop adjusting nut one notch at a time to the right and attempt to fire at each turn until firing pin does not release.	___	___
- (When gun fires) Installing backplate.	___	___
- Removing FIRE GAGE and cocking gun.	___	___
- Retracting bolt sufficiently rearward to install NO FIRE gage.	___	___
- Depressing manual firing device on solenoid.	___	___
- Timing is correct if firing pin does not release.	___	___

SCORING.

To pass, soldier must have:

a. Initiated performance on all tasks without cuing by scorer.

b. Been checked "Yes" on each performance measure.

TANK COMMANDER'S READINESS TEST

PART C: WEAPON SYSTEMS PREPARATION(SKILL: FIELD/HANDS-ON)

CONDITIONS: Fully operational M48A5 with BII, coaxial machinegun, and M2 machinegun. Tank is situated on level ground. Boresight and zero panels are at appropriate ranges.

INSTRUCTIONS TO TANK COMMANDER. "Prepare the weapon systems on your tank for a night tactical mission. If necessary I will give you the information for your shot groups during zeroing. 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 other crew members as needed."

TASKS.

AA401	Prepare tank for boresighting.
AB401	Prepare tank rangefinder for operation.
AB403	Determine range to target with rangefinder.
AB402	Boresight rangefinder with the main gun bore axis alined on an aiming point at 1200 meters.
AB407	Boresight tank searchlight using primary method.
AB406	Boresight tank searchlight using alternate method.
A5411	Boresight M2 machinegun.
AB404	Zero tank main gun.
A5305	Zero an M219 machinegun.
A5407	Zero an M2 machinegun.

NOTES.

a. A soldier should not be given this part of the test until he has passed PART A and completed the written TEC Lesson pretests for PART B and any remedial training necessary on TEC Lessons failed.

b. Remedial training on tasks failed should be provided on-the-spot but after soldier has completed PART C. [See MODULE TC-2 and TC-3.]

c. Task AB407 (Boresight tank searchlight using primary method) must be performed at night.

d. Task AB406 (Boresight tank searchlight using alternate method) must be performed at a location where a wall is available to to reflect the beam.

e. If live-fire cannot be used to zero the weapons, the test administrator must arrange both simulated firing and simulated shot groups. The simulated shot group can be accomplished by having an assistant scorer down range to place discs over the zero panels to represent target hits.

f. In the PERFORMANCE MEASURES section which follows, the role of the scorer as GUNNER, LOADER or DRIVER is indicated by "GUNNER" or "LOADER" or "DRIVER." The scorer, acting as either, should perform as indicated.

g. The scorer must not give the soldier any more information than he would have on the job. One goal of the Tank Commander's Readiness Test is to determine whether the TC can ready himself and his crew for a combat mission w' .u a minimum of supervision.

PERFORMANCE MEASURES.

	Yes	No
1. PREPARE TANK FOR BORESIGHTING (AA401)		
. Directed Driver to position tank on level ground.	___	___
2. PREPARE TANK RANGEFINDER FOR OPERATION (AB401)		
. Adjusted rangefinder headrest to fit the contour of the head.	___	___
. Rotated occluder knob to the R position.	___	___
. Rotated the diopter scale to the maximum plus reading.	___	___
. Rotated the diopter scale until the view through the eyepiece appears with the maximum sharpness.	___	___
. Moved the filter switch to the left to place the filters into the optical system if necessary.	___	___
. Rotated the range scale rheostat to determine if range scale lamp is illuminated.	___	___
. Set rheostat until desired brightness is obtained.	___	___
. Rotated the occluder to the L position.	___	___
. Moved the reticle switch to the AUX-GUNSIGHT position.	___	___
. Sighted through the eyepiece and set red illuminated reticle for brightness by rotating reticle rheostat.	___	___
. Rotated occluder knob to the center position and moved reticle switch to the coincidence position.	___	___
. Sighted through the eyepiece and set coincidence reticle brightness by rotating the coincidence reticle rheostat.	___	___
. Moved reticle switch to the OFF position.	___	___
. Rotated the occluder knob to the R position.	___	___
. Rotated the occluder knob to the center positon.	___	___
. Sighted through eyepiece and rotated the horizontal adjustment knob until the ghost image is positioned to the left of the actual image.	___	___
. Rotated the vertical adjustment knob to bring the ghost image into vertical alinement with the actual image.	___	___
. Rotated the horizontal adjustment knob to bring the ghost image into alinement with the actual image from the left to the right -- stop the instant coincidence has been obtained.	___	___
. Checked target image coincidence by ranging on a known distance target.	___	___

	Yes	No
. Moved reticle switch to coincidence position.	___	___
. Loosened the wing nut and swung the red ICS knob cover aside.	___	___
. Rotated the ICS knob until vertical lines of the upper right half and lower left portions of the coincidence reticle were alined.	___	___
. Loosened the wing nut and swung the red halving knob cover aside.	___	___
. Rotated halving knob until horizontal lines of the upper right half and the lower left portions of the coincidence reticle were alined to form a cross.	___	___
. Swung the ICS and halving knob covers into place and secured with wing nuts.	___	___
. Moved reticle switch to the OFF position.	___	___

3. DETERMINED RANGE TO TARGET WITH RANGE FINDER (AB403)

. Placed occluder knob in center position.	___	___
. Ranged to the boresight target.	___	___
. Rotated range knob until two target images merge.	___	___
. Read range to target on range scale.	___	___

4. BORESIGHT RANGEFINDER WITH THE MAIN GUN BORE AXIS ALINED ON AN AIMING POINT AT 1200 METERS (AB402)

. Checked coincidence reticle for alinement and if necessary, alined reticle using horizontal and vertical adjustment.	___	___
. Placed the occluder knob on the rangefinder in the R position.	___	___
. Moved the locking levers of the main elevation and deflection boresight knobs to the unlocked position.	___	___
. Sighted through rangefinder eyepiece and alined the black-etched cross on the sight reticle with the same aiming point as the main gun bore axis.	___	___
. Moved the boresight knob locking levers to the lock position.	___	___
. Rotated slip scale to read 2 on elevation boresight knob and 3 on deflection boresight knob.	___	___
. Placed the occluder knob in the L position.	___	___
. Placed the reticle switch on the rangefinder in the AUX-GUNSIGHT position.	___	___
. Unlocked auxiliary elevation and deflection knobs..	___	___
. Rotated the knobs to aline the red illuminated cross on the same aiming point as the main gun bore axis.	___	___
. Locked AUX-GUNSIGHT elevation and deflection knobs.	___	___
. Rotated slip scale on auxiliary elevation boresight knob to read 2 and the auxiliary deflection boresight knob to read 3.	___	___
. Checked main gun bore axis, main gun laying reticle of the rangefinder, and the AUX-GUNSIGHT to assure that each is alined on the same aiming point.	___	___

	Yes	No
5. BORESIGHT TANK SEARCHLIGHT USING PRIMARY METHOD (AB407)		
. Selected a target as near 1200 meters as possible.	___	___
. Told Driver to idle tank engine at 1000-1200 RPM.	___	___
. Turned searchlight main power switch to the ON position and turned searchlight control to VIS FOCUS mode.	___	___
6. BORESIGHT TANK SEARCHLIGHT USING THE ALTERNATE METHOD (AB406)		
. Directed Driver to position tank so the searchlight is approximately 10 meters from a wall.	___	___
. Drew a cross on the wall approximately 7 feet from the ground.	___	___
. Drew a second cross 16 1/2 inches directly above the first cross and vertically in line with the first cross.	___	___
. Told Driver to insure that the tank engine is run at a fast idle speed.	___	___
. Turned searchlight main power switch to ON position and turned searchlight control to VIS FOCUS mode.	___	___
. Adjusted horizontal and vertical adjustment screws until the searchlight beam is centered on the upper cross.	___	___
. Told Loader to draw reference mark at the bottom edge of the searchlight beam.	___	___
. Adjusted vertical and horizontal adjustment screws until the bottom of the searchlight beam is above and just touching the reference mark.	___	___
7. BORESIGHT M2 MACHINEGUN (A5411)		
. Disconnected solenoid lead connector.	___	___
. Removed backplate group and open cover.	___	___
. Removed driving spring rod.	___	___
. Removed charger cover.	___	___
. Removed bolt stud.	___	___
. Removed bolt and closed cover.	___	___
. Sighted through machinegun barrel and alined axis of gun bore on defined target approximately 500 meters in range.	___	___
. Locked azimuth lock.	___	___
. Adjusted deflection without moving the gun or cupola.	___	___
. Adjusted elevation.	___	___
. Installed bolt.	___	___
. Installed bolt stud.	___	___
. Installed charger cover.	___	___
. Installed driving spring rod.	___	___
. Installed backplate group.	___	___
. Connected solenoid lead connector.	___	___

	Yes	No
8. ZERO TANK MAIN GUN (AB404)		
. Turned computer switch ON.	___	___
. Indexed ammunition element into ballistic computer.	___	___
. Indexed range into rangefinder.	___	___
9. ZERO AN M219 MACHINEGUN (A5305)		
. Rotated the range knob of the rangefinder to range the target.	___	___
10. ZERO AN M2 MACHINEGUN (A5407)		
. Selected a target with a clearly defined aiming point at a range of 500 meters.	___	___
. Laid the 500 meter aiming point of the Tank Commander's weapon sight on the aiming point of the zeroing targets with the elevating and traversing controls.	___	___
. Fired a 10-20 round burst.	___	___
. Moved the 500-meter reticle to the center of the beaten zone without disturbing the lay of the gun.	___	___
. Fired another 10-20 round burst to verify the zero.	___	___

SCORING.

To pass, a soldier must have:

a. Initiated performance on all tasks without cuing by scorer.

b. Been checked "Yes" on each performance measure.

c. The scorer must verify that optics are boresighted by confirming that aiming crosses are on same aiming points as muzzle crossthreads.

d. Range read to target on range scale (TASK C.3) must be $\pm$ 50 meters of actual range.

TANK COMMANDER'S READINESS TEST

PART E: TACTICAL OPERATIONS (FIELD/HANDS-ON)

CONDITIONS. Fully operational M48A5 tank with BII, skilled Driver, coaxial machinegun, M2 machinegun and blank coaxial machinegun rounds (if available). Tactical driving course, including obstacles (ditch, vertical, incline, water), terrain conditions suitable for tank defilade, and simualted targets (both moving and stationary, main gun, coaxial and M2 machinetgun).

INSTRUCTIONS TO TANK COMMANDER. "This is a test of your ability to supervise your crew during a tactical mission. We are going on a simulated combat mission. Your tank has a basic combat load of ammunition and we expect to encounter enemy vehicles and troops. You will be scored on what you do as well as how well you do it. I will serve as the other crew members (Gunner and Loader) as needed."

TASKS.

AA112	Acquire targets.
AL01	Main gun engagement-moving to a halt-stationary target-TC fires.
AL02	Main gun engagement-stationary tank-stationary target-Gunner fires.
AL03	Main gun engagement-moving to a halt-moving target-Gunner fires.
AL04	Coax engagement-moving tank-moving target-TC fires.
AL05	Coax engagement-moving tank-stationary target-Gunner fires.
AL06	Caliber .50 engagement-moving to a halt-moving target-TC fires.
AL16	Main gun engagement-moving to a halt-stationary target-Gunner fires.

NOTES.

a. Soldier should complete PARTS A-D, Tank Commander's Readiness Test before taking this one.

b. In the PERFORMANCE MEASURES section which follows, the role of the scorer as GUNNER or LOADER is indicated by "GUNNER" or "LOADER." The scorer, acting as either, should perform as indicated.

c. The scorer must verify sight picture each time TC announces ON THE WAY.

d. Second round adjustments not being tested here. MODULE G-5, UNIT G-5.3 provides extensive conduct-of-fire-training. The soldier should perform the duties of the TC when taking UNIT G-5.3.

e. The targets should be appropriate for the engagements provided. However, the order in which the targets appear is not important.

PERFORMANCE MEASURES.	Yes	No
1. ACQUIRE TARGETS (AA112)		
. Detected targets in assigned observation sector.	___	___
. Announced proper ALERT element of fire commands.	___	___
. Announced proper target description.	___	___
2. MAIN GUN ENGAGEMENT-MOVING TO A HALT-STATIONARY TARGET-TC FIRES (AL01)		
. Announced GUNNER, BATTLESIGHT.	___	___
. Announced target description.	___	___
. Laid gun for direction.	___	___
. Applied lead in direction of own gun traverse.	___	___
After "GUNNER" announced CANNOT IDENTIFY:		
. Laid crosshair leadline at center of base of target.	___	___
. Announced FROM MY POSITION.	___	___
After "LOADER" announced UP:		
. Announced ON THE WAY.	___	___
(NOTE: SCORER VERIFIES SIGHT PICTURE)		
. Fired main gun.	___	___
3. MAIN GUN ENGAGEMENT-STATIONARY TANK-STATIONARY TARGET-GUNNER FIRES (AL02)		
. Announced GUNNER, BATTLESIGHT.	___	___
. Announced target description.	___	___
. Laid gun for direction.	___	___
After "GUNNER" announced IDENTIFIED and "LOADER" announced UP:		
. Announced FIRE.	___	___
4. MAIN GUN ENGAGEMENT-MOVING TO A HALT-MOVING TARGET-GUNNER FIRES (AL03)		
. Announced GUNNER, BATTLESIGHT.	___	___
. Announced MOVING.	___	___
. Announced target description.	___	___
. Laid gun for direction.	___	___
After "GUNNER" announced IDENTIFIED and "LOADER" announced UP:		
. Announced FIRE.	___	___

		Yes	No
5.	COAX ENGAGEMENT-MOVING TANK-MOVING TARGET-TC FIRES (AL04)		
	. Announced GUNNER, COAX.	___	___
	. Announced MOVING.	___	___
	. Announced target description.	___	___
	. Laid gun for direction.	___	___
	. Announced estimated range.	___	___
	After "GUNNER" announced CANNOT IDENTIFY and "LOADER" announced UP:		
	. Applied lead in direction of target apparent motion.	___	___
	. Announced FROM MY POSITION.	___	___
	. Laid crosshair leadline at center of target vulnerability.	___	___
	. Announced ON THE WAY.	___	___
	(NOTE: SCORER VERIFIES SIGHT PICTURE)		
	. Fired COAX.	___	___
6.	COAX ENGAGEMENT-MOVING TANK-STATIONARY TARGET-GUNNER FIRES (AL05)		
	. Announced GUNNER, COAX.	___	___
	. Announced target description.	___	___
	. Laid gun for direction.	___	___
	. Announced estimated range.	___	___
	After "GUNNER" announced IDENTIFIED and "LOADER" announced UP:		
	. Announced FIRE.	___	___
7.	CALIBER .50 ENGAGEMENT-MOVING TO A HALT-MOVING TARGET-TC FIRES (AL06)		
	. Announced CALIBER FIFTY.	___	___
	. Placed caliber .50 safety in FIRE.	___	___
	. Announced DRIVER, STOP.	___	___
	. Applied lead in direction of target apparent motion.	___	___
	. Laid crosshair leadline at center of target vulnerability.	___	___
	(NOTE: SCORER VERIFIES SIGHT PICTURE)		
	. Fired caliber .50.	___	___
8.	MAIN GUN ENGAGEMENT-MOVING TO A HALT-STATIONARY TARGET-GUNNER FIRES (AL16)		
	. Announced GUNNER, HEP.	___	___
	. Announced target description.	___	___
	. Laid gun for direction.	___	___
	After "GUNNER" announced IDENTIFIED and "LOADER" HEP, UP:		
	. Announced DRIVER, STOP.	___	___
	. Announced range.	___	___
	. Announced FIRE.	___	___

SCORING.

To pass, soldier must have:

a. Detected all targets and given proper ALERT element of fire command.

b. Given proper element of each fire command at appropriate time for each target.

c. Taken up correct sight picture for each target engaged.

d. Continued to monitor sight picture after firing.

e. Been checked "Yes" on all performance measures.

APPENDIX F

DRIVER'S MODULE OUTLINES

MODULE D-1. OPERATIONAL CHECKS AND SERVICES

PRETRAINING CONDITIONS:

Soldier failed to meet standard on Part A, Driver's Readiness Test.

OBJECTIVE:

Given pictures or descriptions of tank components, soldier will recognize unserviceable parts and describe actions necessary to service them.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Five filmstrip cartridges and five audio cassettes (TEC lessons 020-171-5366-F through 020-121-5370-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-60 minutes for each of five lessons

PROCEDURE:

a. Select lesson(s) corresponding to pre-tests failed on Part A of the Driver's Readiness Test.

b. Soldier completes assigned lessons and takes post-tests.

c. Soldier reviews those lessons keyed on the post-test for items missed.

d. Soldier has satisfactorily completed the lesson(s) when he can complete the post-test with no more than one error.

NOTE: Some of the maintenance tasks covered in these lessons are not considered here to be priority training tasks. But since they are integrated with priority tasks, and since the lessons are not very long, the soldier should be required to master the knowledge aspects of them as represented in the post-tests.

MODULE D-2. TANK PREPARATION AND START-UP

PRETRAINING CONDITIONS:

Soldier passed Part A of Driver's Readiness Test but failed to meet standard on one or more tasks in Part B.

OBJECTIVES:

a. Given an M48A5 tank with M27 periscope installed, an M24(IR) periscope in stowage box and a procedural job aid, soldier will remove M27, install M24 and place it in operation. All steps (see Part B of Driver's Readiness Test) in this three-task objective will be performed within 15 minutes without damage to equipment.

b. Given an M48A5 tank, a procedural job-aid and an indication from the Loader that he wants to check engine and transmission oil levels; soldier will start and idle tank engine according to procedures in Part B.5 and B.6 of Driver's Readiness Test.

c. Given an M48A5 on level ground with engine running, a request to move the vehicle into position for checking track tension, and guidance from the Loader; soldier will drive the tank forward and coast it to a stop with track in proper position (see Part B.8 of Driver's Readiness Test).

d. Given an M48A5 with Driver's hatch open and the command, "PREPARE-TO-FIRE," soldier will perform Driver's prepare-to-fire procedures (see B.9 of Driver's Readiness Test).

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank

b. Pocket-sized job aids listing steps in M27 periscope removal, M24 periscope installation and operational check-out, starting the tank engine and idling the engine for oil checks.

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Instructor makes sure soldier has pocket job aids and urges him to refer to them during task performance.

b. Instructor explains to soldier task elements failed in Readiness Test.

c. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

d. Soldier then practices with instructor available to coach as necessary.

e. Soldier is retested on relevant portion(s) of Part B, Driver's Readiness Test.

NOTES:

a. This module should be conducted as remedial training immediately following administration of Part B of the Driver's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthy lectures on principles of equipment operation, while the trainee is idle, usually slow down the learning process.

c. Checking and servicing the periscopes (AB101) are not covered here because of difficulty in providing a variety of damaged periscopes. Knowledge aspects of the task are covered in Module D-1.

MODULE D-3. TARGET ACQUISITION

UNIT D-3.1. TARGET SCANNING

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-1614-F (Part C, Driver's Readiness Test).

OBJECTIVE:

Soldier will state from memory the correct procedure for: scanning for targets (day or night), acquiring and preserving night vision, and using devices in acquiring targets at night.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. One filmstrip cartridge with audio-cassette TEC Lesson 020-171-1614-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT D-3.2. LOCATING AND REPORTING TARGETS

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-1612-F (Part C, Driver's Readiness Test).

OBJECTIVE:

Given targets depicted in various locations relative to soldier's tank, and targets depicted in various positions on a binocular mil scale, soldier will, in writing, report targets using "the clock method" or "the reference point method."

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Film strip cartridge and audio cassette (TEC Lesson 020-171-1612-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

50 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

Unit D-3.3. TARGET RANGE DETERMINATION (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-1611-F (Part C, Driver's Readiness Test).

OBJECTIVE:

Soldier will describe the: "Flash-to-Bang," "100-meter," and "Appearance of Objects" methods of range estimation; and, how various factors of terrain, clearness of detail, and observer's position will affect range estimates.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. One filmstrip cartridge with audio-cassette (TEC Lesson 020-171-1611-F).

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

50 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT D-3.4. TARGET RANGE DETERMINATION (SKILL)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-1611-F (Part C, Driver's Readiness Test) and completed UNIT D-3.3.

OBJECTIVE:

Given an area containing objects (vehicles, buildings, terrain features) at various distant ranges, soldier will estimate range to each object using both the "100-meter" and "Appearance of Objects" methods. Estimated range will be $\pm$ 25% of actual range.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

Sufficient terrain to provide several natural and man-made objects of each of the following types: vehicles (any type, including non-military), buildings, and terrain features. Objects within each category should be at various distant ranges.

ESTIMATED TIME:

1 hour

PROCEDURE:

a. TC (instructor) identifies various "targets" at known ranges and has soldier estimate range to each.

b. TC (instructor) provides analysis and special cues for any range-to-target soldier estimated incorrectly.

c. Practice should emphasize quickness as well as accuracy in estimating.

d. Practice continues until soldier correctly ($\pm$ 25%) estimates range to about six consecutive targets (two short, two medium and two long range targets).

NOTE:

It might be a good idea to have soldier give type of target and direction along with range. This would give additional practice on target reporting as required on the battlefield.

UNIT D-3.5. TARGET RECOGNITION

PRETRAINING CONDITIONS:

Soldier failed to meet standard on post-test for TEC Lesson 935-171-0203-F.

OBJECTIVE:

Shown pictures of friendly (NATO) and enemy (Warsaw Pact) armored vehicles at various ranges and in various degrees of concealment, soldier will correctly identify each vehicle as to country of origin within 5 seconds.

METHOD:

Self-instructional sound-slide presentation with written and oral response.

EQUIPMENT/MATERIALS:

a. Three filmstrip cartridges and audio cassette (TEC Lessons 935-171-0202-F, 935-171-0202-F, and 935-171-0203-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40 minutes to 2 hours

PROCEDURE:

a. Soldier takes pre-tests for Lessons -0201-F and -0202-F. If he fails, assign appropriate lesson(s), and follow with Lesson -0203-F. If he passes both pre-tests, assign Lesson -0202-F.

b. Soldier completes assigned lesson(s) and takes post-test(s).

c. Instructor administers post-test for Lesson -0203-F since soldier's responses should be oral and are limited by time.

d. Soldier reviews lesson(s) until he can complete post-test(s) with no errors.

NOTE:

This module should include a unit on target detection in which soldiers learn to detect the full range of target types (troops, bunkers, etc., in addition to armored vehicles) when they are barely perceptible whether because of extended range or because of camouflage and concealment. Such training has been omitted since no method of simulation has been found effective. Training under simulated target-terrain-lighting conditions, through high-quality photographs or miniaturization, generally has not transferred to target detection in the field. Field training in target detection, moreover, does not seem feasible unless conducted in conjunction with other field exercises.

MODULE D-4. TACTICAL DRIVING I

UNIT D-4.1. VARIED TERRAIN DRIVING (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on terrain driving portion of Part D, Driver's Readiness Test.

OBJECTIVE:

Given pictures or descriptions of various terrain obstacles and conditions, soldier will a) recognize obstacles that cannot be negotiated, and b) describe the actions necessary to negotiate those that can be.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Two filmstrip cartridges with audio cassettes (TEC Lessons 945-171-0100-F and 945-171-0101-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-60 minutes for each of two lessons

PROCEDURE:

a. Soldier completes assigned lesson and takes post-test.

b. Soldier reviews lessons until he can complete post-test with no errors.

NOTE: These two TEC Lessons are under development. The instructional objective was written on the basis of inferences made from lesson titles.

UNIT D-4.2. VARIED TERRAIN DRIVING (SKILL)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on terrain driving portion of Part D of Driver's Readiness Test and completed UNIT D-4.1.

OBJECTIVE:

Given an operational M48A5 tank and a Driver's course containing terrain obstacles (ditches, grades, vertical obstacles and water) and terrain conditions suitable for tank defilade, soldier will drive the tank along a route given by the TC-instructor; soldier will a) avoid obstacles that cannot be negotiated, b) safely drive over obstacles that can be negotiated, and c) drive tank into defilade on command.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. Operational M48A5 tank

b. Sufficient terrain to provide several natural or man-made obstacles of each of the following types: vertical obstacles (fallen trees, rocks, etc.), ditches, hills, water obstacles. Obstacles within each category should represent a range of difficulty, including at least one that cannot be negotiated. Terrain should also provide features such as ridges suitable for tank defilade.

ESTIMATED TIME:

8 hours

PROCEDURE:

a. TC (instructor) directs Driver trainee to move out to the first (easiest) obstacle. Driver practices negotiating obstacle, with coaching by TC, until he demonstrates the correct technique (in the TC's judgment) for approaching the obstacle, timing acceleration and deceleration over the obstacle.

b. TC directs Driver trainee to move out to an obstacle of the same type but of slightly greater difficulty. TC provides guided practice as in a above.

c. TC takes Driver trainee through all obstacles in this manner, proceeding from easy to difficult and from one type of obstacle to another.

d. Practice in driving to defilade should be handled in the same way.

e. When Driver trainee has mastered the more difficult obstacle of each type, and can drive to defilade under the more difficult terrain condition, he is given additional practice in driving over a variety of types of obstacles, all difficult.

f. When TC thinks driver is ready, he administers a tactical driving test of the type described in Part D of the Driver's Pre-test.

NOTE: This training probably could be mediated more effectively and, in the long run, more inexpensively by a high fidelity Driver trainer. The M34, Tracked Vehicle Driving Trainer, in its present form, is an inadequate simulator for varied terrain driving. It could be used, perhaps, as the basis for an effective simulator, if motion and visual systems were added. One type of simulator that should be effective in training terrain driving is outlined below:

a. The simulator would consist of three major components:
(1) a Driver's station with visual display,
(2) a miniaturized terrain board and mobile video camera, and
(3) a computer to link the two.

b. The Driver's station would consist of a Driver's seat, instrument panel and controls, all with high functional fidelity. Engine noise would be faithfully reproduced as a function of gear, accelerator and engine load. The station should have a motion capability in three dimensions: pitch, yaw and roll. A screen to the front would receive a life-size video projection of the terrain.

c. Inputs to the Driver's station would be provided by a scaled terrain board and mini-tank video system. A motorized miniature "tank" chassis, scaled to the terrain, would carry a video camera. The assembly is driven over the terrain board through linkage with controls in the Driver's station, with the camera transmitting a fixed view of terrain from the Driver's perspective. The attitude of the assembly in relation to terrain obstacles is sensed and transmitted to the motion system in the Driver's station.

d. A computer of some kind would be used to provide the necessary fidelity in translating engine speed, control and vehicle motion from the miniaturized analog to the Driver's station.

The cost-effectiveness of such a simulator for Reserve and National Guard units would have to be compared with the use of actual tanks. But live tank or high-fidelity simulator appears to be the only option in training terrain driving.

MODULE D-5. TACTICAL DRIVING II

UNIT D-5.1. EVASIVE DRIVING (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on evasive driving portion of Part D of Driver's Readiness Test.

OBJECTIVE:

Given photographs of terrain, designated with a point of enemy threat as seen from the tank driver's station, the soldier will indicate the evasive maneuver he would take as tank driver in the absence of driving commands from the TC. Correctness of response is determined in comparison with responses provided by tactical experts.

METHOD:

Programmed text supplemented by flash cards.

EQUIPMENT/MATERIALS:

a. Short programmed text teaching the principles of evasive driving

b. Photographs of terrain with designated enemy threat, as seen from Driver's station. Photographs would represent the range of terrain situations. Each would have the acceptable type and route of evasive driving maneuver for that situation printed on the back.

c. Paper and pencil

ESTIMATED TIME:

2-4 hours

PROCEDURE:

a. Soldier completes self-instructional text.

b. Soldier practices with terrain flash cards until he is ready to be tested.

c. TC-instructor tests soldier on a separate set of terrain cards.

d. TC-instructor explains errors made by the soldier, and retests him on a similar set of terrain cards selected from practice deck.

NOTE:

a. This instructional unit lends itself to a TEC sound-slide medium, and could be so developed.

b. Some practice in applying knowledge of evasive driving following this unit, could be given in conjunction with Unit D-4.2, Varied Terrain Driving.

UNIT D-5.2. TARGET ENGAGEMENT DRIVING

PRETRAINING CONDITIONS:

Soldier failed to meet standard on that portion of Part D of Driver's Readiness Test involving driving in reaction to fire commands.

OBJECTIVE:

Given a series of fire commands, soldier will demonstrate the correct driving response to each by either braking or maintaining vehicle motion.

METHOD:

Audio-tape controlled practice at a Driver's station mock-up.

EQUIPMENT/MATERIALS:

a. Simple mock-up of the Driver's station containing the brake, accelerator, steering control and seat. The brake and accelerator should be similar in response and configuration to those in a tank. The steering control need not be operable. The relative position of the four components should be highly similar to that in a tank.

b. Audio-cassette recording(s) of instructions, fire commands and feedback

c. Cassette player

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Soldier seats himself in the mock-up and starts cassette player. Taped instructions provide explanation of the purpose and procedure for this unit. The correct Driver response to be made to the various types of fire commands is also explained briefly.

b. Soldier practices responding to fire commands. Following each command is a statement of the correct response. Soldier continues to practice until he thinks he is ready for a criterion test.

c. TC-instructor tests soldier by giving an assortment of fire commands and observing the driving responses.

NOTES:

a. Additional practice in target engagement driving, following this unit, could be given in conjunction with Unit D-4.2, Varied Terrain Driving.

b. If the Driver's station of an M48A5 tank is available, the mock-up is not necessary. Soldier can practice at the actual controls; a battery-operated cassette player can be plugged into the tank intercom or used directly with the player's internal speaker.

APPENDIX G

LOADER'S MODULE OUTLINES

MODULE L-1. MISSION PREPARATION (KNOWLEDGE)

UNIT L-1.1. OPERATIONAL CHECKS AND SERVICES

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-tests for TEC Lesson 020-171-5366-F through 020-171-5370-F (Part A.1 of Loader's Readiness Test).

OBJECTIVE:

Given pictures or descriptions of tank components, soldier will recognize unserviceable parts and describe actions necessary to service them.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Five filmstrip cartridges and five audio cassettes (TEC Lessons 020-171-5366-F through 020-171-5370-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-60 minutes for each of five lessons

PROCEDURE:

a. Select lesson(s) corresponding to pre-tests failed on Part A.1 of the Loader's Readiness Test.

b. Soldier completes assigned lessons and takes post-tests.

c. Soldier reviews those lessons keyed on the post-test for items missed.

d. Soldier has satisfactorily completed the lesson(s) when he can complete the post-test with no more than one error.

NOTES:

a. Some of the maintenance tasks covered in these lessons are not considered here to be priority training tasks. But since they are integrated with priority tasks, and since the lessons are not that long, the soldier should be required to master the knowledge aspects of them as represented in the post-tests.

b. These lessons address Driver tasks as well as Loader tasks, and in some cases tasks performed by both. Since the tasks cannot be separated easily, the soldier should be urged to focus his attention on Loader tasks and Loader aspects of Driver-Loader tasks.

UNIT L-1.2. AMMUNITION HANDLING

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-5332-F (Part A.1, Loader's Readiness Test).

OBJECTIVE:

Given pictures of correct and incorrect procedures, soldier will identify correct procedures for unpacking, inspecting, servicing, carrying, handling and stowing main gun ammunition.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio cassette (TEC Lesson 020-171-5332-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-50 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT L-1.3. BORESIGHTING M219 MACHINEGUN

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-5352-F (Part A.1 Loader's Readiness Test).

OBJECTIVE:

Soldier must be able, in writing, to: (a) list the characteristics of a good target for use in boresighting the coax, (b) identify the conditions that must exist before the coax can be boresighted, and (c) describe the procedures for boresighting the coax.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio cassette (TEC LESSON 020-171-5352-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-50 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

NOTE:

Portions of lesson pertaining to M85 machinegun should be skipped.

MODULE L-2. MISSION PREPARATION (SKILL)

PRETRAINING CONDITIONS:

Soldier passed Part A.1 of the Loader's Readiness Test (or completed MODULE L-1) but failed to meet standard on one or more tasks in Part A.2 of Readiness Test.

OBJECTIVES:

a. Given an M48A5 tank with engine or transmission oil low, a skilled Driver, access to engine and transmission oil, and a procedural job aid; soldier will check and adjust engine and transmission oil levels according to procedures in Part A.2.1 of Loader's Readiness Test.

b. Given an M48A5 tank on level ground, with track tension loose, a skilled Driver, BII, a 1"x 6"x 6" block of wood, and a procedural job aid; soldier will check and adjust track tension according to procedures in Part A.2.2 and A.2.3 of Loader's Readiness Test.

c. Given an M48A5 tank with gun tube aimed at a suitable boresight target (but slightly out of alinement with respect to target), heavy black thread, tape and the M17A1 binocular; soldier will prepare tank for boresighting (see Part A.2.4 Loader's Readiness Test) and, on request to check main gun alinement, detect that alinement is off (Part A.2.5 of Loader's Readiness Test).

d. At the Loader's station in an M48A5 tank with M219 out of boresight, a suitable boresight target available, the M17A1 binocular, and a procedural job aid; soldier will boresight the M219 according to procedures in Part A.2.6 of Loader's Readiness Test.

e. At the Loader's station of an M48A5 tank with open slots in the ammunition racks, a supply of several rounds of each type of dummy ammunition, an Ammunition Stowage Plan and a crewman to hand rounds in through the turret; soldier will complete stowage of main gun rounds in accord with Ammunition Stowage Plan (see Part A.2.7 of Loader's Readiness Test).

f. At the Loader's station of an M48A5 tank with BII and a procedural job aid, and given the command "PREPARE TO FIRE"; soldier will carry out Leader's prepare-to-fire procedures as given in Part A.2.8 of Readiness Test.

METHOD:

One-on-one instructor controlled performance training

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII

b. Block of wood 1"x 6"x 6", heavy black thread, tape

c. Pocket-sized job aids listing steps in checking/servicing engine and transmission oil, checking/adjusting track tension, boresighting M219, and performing prepare-to-fire procedures

ESTIMATED TIME:

1-2 hours

PROCEDURE:

a. Instructor makes sure soldier has pocket job-aids and urges him to refer to them during task performance (where applicable).

b. Instructor explains to soldier task elements failed in Readiness Test.

c. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

d. Soldier then practices with instructor available to coach as necessary.

e. Soldier is retested on relevant portion(s) of Part A.2, Loader's Readiness Test.

NOTE:

a. This module should be conducted as remedial training immediately following administration of Part A.2 of the Loader's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthly lectures on principles of equipment operation, while the trainee is idle, usually slows down the learning process.

MODULE L-3. COMBAT LOADING (KNOWLEDGE)

UNIT L-3.1. SELECTING AMMUNITION

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-5331-F (Part B.1, Loader's Readiness Test).

OBJECTIVES:

a. Given pictures of different types of main gun rounds, or different types of targets, or statements of various fire commands; soldier identifies the (correct) round in writing or by selecting a picture of the round.

b. Given pictures of correct and incorrect procedures for setting the fuze on a BEEHIVE round, soldier will identify the correct procedure.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio cassette (TEC Lesson 020-171-5331-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-50 minutes

PROCEDURE:

a. Soldier completes esson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT L-3.2. LOADING AMMUNITION

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-5346-F (Part B.1, Loader's Readiness Test).

OBJECTIVE:

Soldier will list the steps in correct and safe loading, recognize common loading errors, and describe in writing the dangers of incorrect loading procedures.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio-cassette (TEC Lesson 020-171-5346-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

30-35 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT L-3.3. MISFIRE AND UNLOADING PROCEDURES

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lessons 020-171-5347-F or 020-171-5348-F (Part B.1, Loader's Readiness Test).

OBJECTIVE:

Soldier will describe in writing the procedures (announcements, actions and precautions) followed in reacting to a main gun misfire and in unloading a misfired round.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio cassette (TEC Lessons 020-171-5347-F and 020-171-5348-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-50 minutes (misfire procedures 5347-F)

30-40 minutes (unloading 5348-F)

PROCEDURE:

a. Select lesson(s) corresponding to pre-test(s) failed on Part B.1 of Loader's Readiness Test.

b. Soldier completes assigned lesson(s) and takes post-test(s)

c. Soldier reviews lesson(s) until he can complete post-test(s) with no errors.

MODULE L-4. COMBAT LOADING (SKILL)

UNIT L-4.1. MAIN GUN LOADING

PRETRAINING CONDITIONS:

Soldier passed Part B.1 of Loader's Readiness Test (or completed MODULE L-3) but failed to meet time or accuracy standard for main gun loading on Part B.2 of Loader's Readiness Test.

OBJECTIVE:

Positioned in the Loader's station of an M48A5 tank with at least 9 dummy rounds (3 APDS, 3 HEP, 2 HEAT and 1 APERS) in the ready rack, and given a series of five fire commands; soldier selects and loads correct rounds. Soldier must load according to procedures given in Part B.2.1 and B.2.2 of Loader's Readiness Test, and meet the following time standards:

a. 10 seconds (breech open) from time ammunition element is given until announces "UP" (excluding BEEHIVE for other than MA setting).

b. 15 seconds (breech open) from time "BEEHIVE" is given (with range element greater than 100 meters) until announces "UP."

c. 2 seconds (battlesight round loaded) from time "BATTLESIGHT" is given until announces "UP."

d. 55 seconds (battlesight round loaded) from time ammunition element (other than battlesight round) is given until announces "UP."

e. 2 seconds from time "COAX" is given until announces "UP."

f. Total time for five consecutive loadings should be no more than the sum of the individual time standards.

g. Carry out two series of five consecutive loadings within 10 minutes.

METHOD:

Audio-tape controlled practice at Loader's station in M48A5 tank.

EQUIPMENT/MATERIALS:

a. M48A5 tank

b. Main gun dummy ammunition, including at a minimum: 3 APDS, 3 HEP, 2 HEAT and 1 APERS. Dummy rounds may have to be locally fabricated. In any case, each should have the same configuration, color, markings, weight and weight distribution as an actual round. Range selector fuze on dummy APERS round should be operable.

c. Audio-cassette recordings of instructions, fire commands and feedback. Various mixes of fire commands should be recorded in blocks of five, and the blocks should be graded from easy to difficult in terms of the mix of commands and time allowed to execute each.

d. Cassette player that will plug into tank intercom.

ESTIMATED TIME:

2 hours

PROCEDURE:

a. Soldier positions himself in Loader's station and starts cassette player. Taped instructions provide explanation of the purpose and procedure for this unit, including the necessary requirement to unload between rounds.

b. Soldier takes the first exercise (block of 5 commands), which gives the commands at a relatively slow pace. Soldier replaces rounds in ready rack and starts next exercise. When he can complete two of most difficult exercises within the time limit, he is ready for a criterion test.

c. TC (instructor) tests soldier by giving two difficult exercises and observing loading procedures for accuracy, safety and time.

NOTES:

a. Because of the physical conditioning aspect of this training, the Loader should probably be required to practice the module frequently during the training year.

b. This module could be greatly improved if a Loader's simulator were developed to support the exercises. Such a simulator should provide for motion (since the first few steps in loading are often carried out while the tank is still moving), gun recoil (training in safety) and movement of breech into battery, and automatic ejection of dummy round. Noise of the round firing is also desirable, but probably not an essential factor in the simulation.

UNIT L-4.2. MISFIRE AND STOPPAGE PROCEDURES

PRETRAINING CONDITIONS:

Soldier passed Part B.1 of Loader's Readiness Test (or completed MODULE L-3) but failed to meet time or accuracy standards for main gun misfire or coax stoppage portions of Part B.2 of the Readiness Test.

OBJECTIVES:

a. Positioned in the Loader's station of an M48A with a dummy round loaded in the main gun, and given the announcement "MISFIRE"; soldier, on command, rotates the round 1/2 turn and, also on command, unloads the misfired round with assistance from the Gunner. Responding to the MISFIRE, including unloading the misfired round, is completed within 2 1/2 minutes.

b. Positioned in the Loader's station of an M48A5 tank with a dummy 7.62mm round hand loaded in chamber of the coax and a belt of dummy rounds loaded on top so that chambered round won't extract when weapon is charged, and given the announcement "STOPPAGE"; soldier will apply immediate action to reduce stoppage in the coax. Misfired round is removed within 10 seconds, and the entire procedure executed correctly (see B.2.5 of Loader's Readiness Test) through announcement "UP" within 15 seconds.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank with M219 machinegun mounted

b. Dummy round of main gun ammunition and belt of dummy 7.62mm ammunition

ESTIMATED TIME:

1 hour

PROCEDURE:

a. TC (instructor) explains to soldier misfire or stoppage task elements failed in Readiness Test.

b. TC (instructor) "talks soldier through" the task elements to be learned; soldier performs as these oral directions are given.

c. Soldier then practices with instructor available to coach as necessary.

d. Soldier is retested on relevant portion(s) of Part B.2 of the Readiness Test.

NOTES:

a. This unit should be conducted as remedial training immediately following administration of Part B.2 of the Loader's Readiness Test, or following the criterion test for Unit L-4.1, when the tank is already set up and a TC (instructor) is present.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthly lectures on principles of equipment operation, while the trainee is idle, usually slows down the learning process.

MODULE L-5. M219 MACHINEGUN MAINTENANCE (KNOWLEDGE)

UNIT L-5.1. MOUNTING, LOADING, DISMOUNTING THE COAX

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-5241-F (Part C.1, Loader's Readiness Test).

OBJECTIVE:

Soldier describes in writing the procedures for mounting, loading and dismounting the M219 coaxial machinegun.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio cassette (TEC Lesson 020-171-5241-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

30-40 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT L-5.2. CLEARING, DISASSEMBLY AND ASSEMBLY OF COAX

PRETRAINING CONDITIONS:

Soldier failed to meet standard on pre-test for TEC Lesson 020-171-1131-F (Part C.1, Loader's Readiness Test).

OBJECTIVE:

Soldier describes in writing the procedures for clearing, disassembling and assembling the M219 coaxial machinegun.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge and audio cassette (TEC Lesson 020-171-1131-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

40-50 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

NOTES:

a. Objectives and estimated times for Units L-5.1 and L-5.2 were inferred from lesson titles since the lessons are not yet in print.

b. TEC lessons on Cleaning and Lubrication of the Coax (020-171-1132-F) and Troubleshooting the Coax (020-171-1133-F) should also be given as part of this Module, if time is available. They are not prerequisite to MODULE L-6, however.

MODULE L-6. WEAPONS MAINTENANCE

PRETRAINING CONDITIONS:

Soldier passed Part C.1 of Loader's Readiness Test (or completed MODULE L-5) but failed to meet standard on one or more tasks in Part C.2.

OBJECTIVES:

a. In the Loader's station of an M48A5 tank with M219 machinegun mounted and loaded with dummy ammunition; soldier unloads, removes, disassembles, inspects, assembles, checks operation, mounts and loads the M219. Soldier carries out procedures as given in Parts C.2.1 through C.2.8 of Loader's Readiness Test, completing the disassembly and assembly tasks each in 3 minutes.

b. In the Loader's station of an M48A5 tank with complete gun-tool roll stowed and breech closed; soldier removes, disassembles, assembles and installs the breechblock. Soldier carries out procedures as given in Parts C.2.9 and C.2.10 of Loader's Readiness Test, completing the entire operation within 20 minutes.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank

b. Belt of dummy 7.62mm ammunition

c. Gun-tool roll stowed

ESTIMATED TIME:

1-3 hours

PROCEDURE:

a. Instructor explains to soldier task elements failed in Readiness Test.

b. Instructor "talks soldier through" task or task elements to be learned; soldier performs <u>as these oral directions are given</u>.

c. Soldier then practices with instructor available to coach as necessary.

d. Soldier is retested on relevant portion(s) of Part C.2, Loader's Readiness Test.

NOTE:

a. This module should be conducted as remedial training immediately following administration of Part C.2 of the Loader's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthy lectures on principles of equipment operation, while the trainee is idle, usually slows down the learning process.

c. No TEC Lesson(s) exists, apparently, for disassembly/assembly of the breechblock. Some such self-instructional module for acquiring knowledge of breechblock disassembly/assembly procedures should be developed, used, and a proficiency standard met before soldier undertakes hands-on practice. For the time being, it is recommended that the soldier who fails the breechblock portion of the Readiness Test so substantially that he cannot be remediated in two or three hands-on trials, be required to memorize the steps in disassembly/assembly before resuming hands-on practice.

MODULE L-7. REPLENISHER TAPE READING

PRETRAINING CONDITIONS:

Soldier failed to meet standard on Part D of Loader's Readiness Test.

OBJECTIVE:

Stationed at a mock-up of the replenisher tape, and given any one of the four possible settings of the tape; soldier feels the tape and states what remedial action he would take, if any, given that reading, (a) during firing and (b) before firing. Soldier must respond accurately (see performance measures for Part D of the Readiness Test) and immediately upon feeling the tape, and respond so on eight consecutive trials.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

Replenisher tape mock-up. The mock-up, which can be simple and inexpensive, should have the following characteristics:

- A representation of the replenisher cylinder (same general size and configuration)
- A representation of the replenisher tape that is highly accurate with respect to size, opening, feel of edges, and location with respect to replenisher cylinder and rangefinder; tape should be operable so that it can easily be set in one of the four positions.
- A representation of that portion of the rangefinder which blocks the view of the replenisher cylinder and that is accurate with respect to size and position relative to the tape.
- The components should be mounted on some kind of frame at the same general height as in the tank.

ESTIMATED TIME:

30 minutes

PROCEDURE:

a. Instructor explains to soldier aspects of task failed in the Readiness Test, and explains the correct response for each of the four settings.

b. If soldier has trouble remembering the correct responses, instructor might provide the mnemonic:
"Rough and Smooth: in The Groove;
Two Rough: Not Enough;
Two Smooth: Remove."

c. Soldier practices, with instructor varying the setting from trial to trial so that practice is geared to the more troublesome settings for the soldier.

d. When ready, soldier is retested on Part D of Readiness Test.

NOTE:

Since there are no safety requirements involved, practice on the device could be administered by anyone (e.g., the soldier's buddy). The criterion test, though, should probably be administered by the TC (instructor).

MODULE L-8. TARGET ACQUISITION

(Same as Driver's MODULE D-3.)

APPENDIX H

GUNNER' MODULE OUTLINES

MODULE G-1. BEFORE OPERATIONS PROCEDURES

PRETRAINING CONDITIONS:

Soldier failed to meet standard on one of the tasks in PART A of Gunner's Readiness Test.

OBJECTIVES:

a. Given an M48A5 tank and a procedural job-aid, soldier will place turret into power operation. All steps (see PART A of Gunner's Readiness Test) will be performed correctly without damage to equipment.

b. Given an M48A5 tank, a procedural job-aid, and the command PREPARE TO FIRE, soldier will perform Gunner's prepare-to-fire procedures (see A.2 of Gunner's Readiness Test).

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII and coaxial machinegun.

b. Pocket-sized job-aids listing steps in placing the turret into power operation and performing prepare-to-fire procedures from the Gunner's position.

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Instructor makes sure soldier has pocket job-aids and urges him to refer to them during task performance.

b. Instructor explains to soldier task element(s) failed in Readiness Test.

c. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

d. Soldier then practices with instructor available to coach as necessary.

e. Soldier is retested on relevant portion(s) of PART A, Gunner's Readiness Test.

NOTE:

a. This module should be conducted as remedial training immediately following administration of PART A of the Gunner's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthy lectures on principles of equipment operation, while the soldier is idle, usually slows down the learning process.

MODULE G-2. WEAPON SYSTEMS PREPARATION I

UNIT G-2.1. BORESIGHT WEAPON SYSTEMS (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on boresighting weapon systems portion of PART B or PART C, Gunner's Readiness Test.

OBJECTIVES:

a. Given the requirement to prepare the tank weapon systems for boresighting, the soldier will:

- Identify a good target for use in boresighting the main gun and coax machinegun.
- Identify a boresight cross correctly alined with the target aiming point.
- Describe the procedures for placing the Gunner's telescope and periscope into operation.
- Read the elevation quadrant and zero its scales.

b. Given the requirement to boresight the tank weapon systems, the soldier will:

- State the procedures or conditions necessary to complete sight alinement of the reticles of the Gunner's telescope and periscope.
- Identify the correct slip scale settings for boresight knobs of Gunner's telescope and periscope.
- Describe the controls used and adjustments necessary to boresight the xenon searchlight by both the primary and alternate methods.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Six filmstrip cartridges with audio cassettes (TEC Lessons 020-171-5351-F, 020-171-5342-F, 020-171-5337-F, 020-171-5355-F, 020-171-5354-F, 020-171-5352-F).

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

35-65 minutes

PROCEDURE:

a. Select lesson(s) corresponding to pre-tests failed on PART B of the Gunner's Readiness Test or all lessons if failed PART C.

b. Soldier completes assigned lessons and takes post-tests.

c. Soldier reviews those lessons keyed on the post-test for items missed.

d. Soldier reviews appropriate lessons until he can complete post-test with no errors.

UNIT G-2.2. BORESIGHT WEAPON SYSTEMS (SKILL)

PRETRAINING CONDITIONS:

Soldier passed PART B of the Gunner's Readiness Test (or completed UNIT G-2.1) but failed to meet standard on boresighting weapon systems portion of PART C, Gunner's Readiness Test (Tasks C.1 through C.11).

OBJECTIVES:

a. Given an M48A5 tank situated on level ground with boresight panels at range of 1200 meters and an indication from the Tank Commander to prepare the weapon systems for a night tactical mission, soldier will prepare tank for boresighting, prepare Gunner's telescope, periscope and azimuth indicator for operation and operate the elevation quadrant. All steps in this five-task objective will be performed within 20 minutes without damage to equipment (see PART C.1 through C.5 of Gunner's Readiness Test).

b. Given an M48A5 tank situated on level ground with boresight panel at range of 1200 meters and the tank and optics prepared for boresighting, the soldier will boresight the tank main gun, tank searchlight, and coaxial machinegun. All steps in this six-task objective will be performed within 40 minutes without damage to equipment (see PART C.6 through C.11 of Gunner's Readiness Test).

METHOD:

One-on-one instructor controlled performance training

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII and coaxial machinegun.

b. Boresight panels at range of 1200 meters

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Instructor explains to soldier task elements failed in Hands-On portion of Readiness Test.

b. TC (instructor) directs Gunner to insure that Gunner's telescope and periscope headrests are adjusted to desired position.

c. TC (instructor) directs Gunner to take up correct sight pictures through both Gunner's telescope and periscope. TC emphasizes importance of placing head in same position in headrest each time Gunner takes up sight picture. Point out to Gunner that he should be aware of pressure points on the head and face which can serve as cues to insure he has head in correct position in headrest.

d. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

e. Soldier then practices with instructor available to coach as necessary.

f. Soldier is retested on relevant portion(s) of PART C, Gunner's Readiness Test (PART C.1 through C.11).

NOTE:

a. This module should be conducted as remedial training immediately following administration of PART C, Gunner's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthy lectures on principles of equipment operation, while the soldier is idle, usually slows down the learning process.

MODULE G-3. WEAPON SYSTEMS PREPARATION II

UNIT G-3.1. ZERO WEAPON SYSTEMS (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on zeroing weapon systems portions of PART B or PART C, Gunner's Readiness Test.

OBJECTIVE:

Given the requirement to zero the tank main gun and the coaxial machinegun, the soldier will:

. List the desired characteristics of a target used for zeroing the main gun or coaxial machinegun.

. Describe the procedures for zeroing the main gun and coaxial machinegun.

. Identify the sight reticles that must be alined after the main gun and coax machinegun are zeroed.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge with audio cassette (TEC Lesson 020-171-5353-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT G-3.2. ZERO WEAPON SYSTEMS (SKILL)

PRETRAINING CONDITIONS:

Soldier passed PART B of the Gunner's Readiness Test (or completed UNIT G-3.1) but failed to meet standard on zeroing weapon systems portion of PART C, Gunner's Readiness Test (Tasks C.12 through C.13).

OBJECTIVE:

Given an M48A5 tank with a subcaliber device attached, situated on level ground at a subcaliber range, with a main gun zero panel at a scaled range of 1200 meters, a coaxial machinegun zero panel at a scaled range of 800 meters, soldier will zero the tank main gun and the coaxial machinegun.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII and coaxial machinegun

b. Main gun zero panel at scaled range of 1200 meters

c. Coaxial machinegun zero panel at scaled range of 800 meters

d. Subcaliber ammunition

ESTIMATED TIME:

30 minutes

PROCEDURE:

a. Instructor explains to soldier task elements failed in Readiness Test.

b. TC (instructor) directs Gunner to insure that Gunner's telescope and periscope headrests are adjusted to desired position.

c. TC (instructor) directs Gunner to take up correct sight pictures through both Gunner's telescope and periscope. TC emphasizes importance of placing head in same position in headrest each time Gunner takes up sight picture. Point out to Gunner that he should be aware of pressure points on the head and face which can serve as cues to insure he has head in correct position in headrest.

d. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

e. Soldier practices with instructor available to coach as necessary.

f. Soldier is retested on relevant portion(s) of PART C, Gunner's Readiness Test (PART C.12 and C.13).

NOTE:

This training probably could be mediated more effectively and in the long run, less expensively, by a high fidelity Tank Gunnery trainer. One type of simulator that should be effective in training main gun and coaxial machinegun zeroing is outlined in MODULE G-5, UNIT G-5.4, TACTICAL OPERATIONS.

MODULE G-4. TARGET ACQUISITION

See MODULE D-3, Driver's Training Package.

MODULE G-5. TACTICAL OPERATIONS

UNIT G-5.1. MISFIRE PROCEDURES (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on immediate action and unload misfired main gun portions of PART E, Gunner's Readiness Test.

OBJECTIVES:

a. Given an indication that the main gun has failed to fire, the soldier will make the correct announcements, name the switches he must use, and state the actions he must take when misfires occur.

b. Given an indication that the main gun is hot and misfire procedures have been completed, soldier will state the actions he must take.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. One filmstrip cartridge with audio-cassette TEC Lesson 020-171-5347-F

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

45 minutes

PROCEDURE:

a. Soldier completes assigned lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT G-5.2. COAXIAL MACHINEGUN ENGAGEMENTS (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on coaxial machinegun engagement portion of PART E, Gunner's Readiness Test.

OBJECTIVES:

Soldier will:

a. Name the ammunition setting on the ballistic computer that is used for the COAX machinegun.

b. Identify sight pictures that show the proper leads for engaging moving targets with the COAX machinegun.

c. Identify correct methods of firing COAX machinegun engagements from a moving tank at moving personnel targets.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. One filmstrip cartridge with audio cassette (TEC Lesson 020-171-5364-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

45 minutes

PROCEDURE:

a. Soldier completes assigned lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT G-5.3. TARGET ENGAGEMENTS (CONDUCT-OF-FIRE TRAINING DEVICES)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on one or more of the target engagements in PART E of Gunner's Readiness Test and completed UNIT G-5.1 and G-5.2.

OBJECTIVES:

a. On a gunnery trainer (boresighted and zeroed) at the Armory, Subcaliber Range, or weekend training site; and given a series of 10 targets (8 hard and two soft), 4 moving and 6 stationary, at scaled ranges from 500 to 2500 meters, with one near and one far moving target; soldier will engage targets in response to fire commands. Soldier will fire on each target within 10 seconds of the target designation and hit 8 of 10 targets on first round.

b. On a gunnery trainer (out of boresight) at the Armory, Subcaliber Range, or weekend training site; and given a series of 6 targets, 3 moving and 3 stationary at scaled ranges from 500 to 2500 meters (one moving and one stationary at near, medium and far ranges); soldier will engage targets in response to fire commands. Soldier will fire on each target within 10 seconds of target designation and second round within 5 seconds of first, and hit 4 of 6 targets within 2 rounds.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. Any one of the following gunnery trainers:

(1). Laser Gun Firing Trainer (DVC 17-33; Model 3A102B)

(2). Subcaliber Devices:

a. .22 caliber (inbore) (DVC 17-53)
b. Brewster Device (DVC 17-87)
c. Telfare Device (DVC 17-88)

(3). Conduct-of-Fire Trainer (DVC 17-4)

b. Range or terrain board appropriate to trainer

c. Targets and other supporting equipment

ESTIMATED TIME:

4 hours

PROCEDURE:

a. TC (instructor) directs soldier to take up correct sight picture through both Gunner's telescope and periscope, emphasizing importance of placing head in same position in headrest each time he takes up a sight picture, and pointing out that he should be aware of pressure points on the head and face which can serve as cues to correct positioning of head.

b. TC (instructor) starts soldier (boresighted and zeroed) on several close-targets, emphasizing speed and technique of engagement, then gradually increases target difficulty by introducing moving targets and increasing range. Speed of engagement should be emphasized first as a criterion for practice, with accuracy building up within the 10 second limit.

c. Soldier continues to practice under supervision of TC (instructor) until he can meet the training objective for first round engagements.

d. TC (instructor) takes gun out of boresight and gives soldier practice in second round engagements. TC (instructor) helps soldier sense rounds.

e. If soldier is having trouble applying burst-on-target techniques, he is given remedial training on the Burst-on-Target Tank Gunnery Trainer (DVC 17-58; Model 17B4), then resumes practice with laser or subcaliber trainer.

f. Soldier continues to practice under supervision of TC (instructor) until he can meet the training objective for second round engagements.

NOTES:

a. The standards given in the training objectives reflect neither Armor doctrine nor extensive research or experience. The unit training manager is therefore encouraged to experiment with different standards and conditions (ranges and target speeds) to determine what level of proficiency should be attained here by the Gunner trainee in order to qualify in later live-fire exercises.

b. BOT with laser gunnery trainer can be practiced only if a retroflective background is used.

c. The Chrysler Fire Control Simulator (FCCS), a conduct of fire trainer currently undergoing developmental test at the Armor School, offers considerable promise as a relatively low cost gunnery trainer suitable for the early stages of training target engagement and tracking. If some of its shortcomings (e.g., no BOT capability, limited target speed and direction, no coax firing simulation, excessive reliance on an instructor) can be remedied, it will be a more cost-effective device for this stage of gunnery training. If it does not replace laser or subcaliber devices, it should precede them in the training sequence.

UNIT G-5.4. TARGET ENGAGEMENTS (SKILL/FIELD)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on one or more of the target engagements in PART E of Gunner's Readiness Test and completed UNIT G-5.1, G-5.2. and G-5.3.

OBJECTIVE:

Given a fully operational M48A5 tank with a skilled Driver, BII, coaxial machinegun, blank coaxial machinegun rounds, a tactical driving course including obstacles and terrain conditions suitable for tank defilade, and simulated targets (both moving and stationary, main gun and coaxial), soldier will engage targets in response to fire commands, meeting the standards laid out in PART E of Gunner's Readiness Test.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. Operational M48A5 tank with BII, coaxial machinegun, blank coaxial machinegun rounds

b. Sufficient terrain to provide several natural or man-made obstacles and features such as ridges suitable for tank defilade; simulated targets (both moving and stationary, main gun and coaxial).

ESTIMATED TIME:

2 hours

PROCEDURE:

a. TC (instructor) will act as both TC and LOADER and give appropriate fire commands and LOADER responses for each target encountered. Gunner practices appropriate responses for each command with coaching by TC, until he demonstrates the correct techniques for engaging the target.

b. TC coaches Gunner through all the target engagements in this manner, repeating any the TC deems necessary. When TC thinks Gunner is ready, he administers a tactical operations test of the type described in PART E of the Gunner's Readiness Test.

c. TC (instructor) directs Gunner to take up correct sight pictures through both Gunner's telescope and periscope. TC emphasizes importance of placing head in same position in headrest each time Gunner takes up sight picture. Point out to Gunner that he should be aware of pressure points on the head and face which can serve as cues to insure he has head in correct position in headrest.

NOTE:

This training probably could be mediated more effectively and in the long run, less expensively, by a high fidelity Tank Gunnery Trainer. There are many conduct-of-fire training devices in the inventory. [See UNIT G-5.3.] Each device has its own advantages and disadvantages. None appears adequate to conduct the tactical operations described here. Another simulator that could be effective in tactical operations training is outlined below. [NOTE: Some of the characteristics discussed are detailed in Training Device Requirements,[1] and Unified Industries, Incorporated (1976)[2]]:

a. The simulator should provide for training in target acquisition, vehicle identification and target engagements with the tank main gun and coaxial machine-gun using either the primary or alternate fire control and sighting equipment; as well as the .50 caliber machinegun. Provision must be made for moving and stationary targets, single and multiple target arrays in a realistic battlefield environment and day, night and reduced visibility conditions.

b. The instructor's station must provide the capability to: monitor both the Gunner's and Tank Commander's fire control equipment, insert faults to test judgment and reaction, and provide automatic scoring/feedback system for evaluating individual performance.

c. The target scene would provide the normal environmental characteristics in which a tank functions. Day, night and reduced visibility conditions should be simulated along with the apporpriate terrain and vegetation. Targets would appear to be the appropriate size and shape according to the range at which they are simulated. The Tank Commander and Gunner will have the appropriate Scene at their respective station. All types of targets

[1] U.S. Army Armor School, Directorate of Training Developments, "Training Device Requirements for a Unit Conduct of Fire Trainer (U-COFT) for the M60 series (M60A1A0S, M60A1, M60 and M48A5) Tanks," Fort Knox, Ky. (Draft), 1977.

[2] Conduct-of-Fire Trainers Study, Unified Industries Incorporated, Alexandria, Va. Author, 1976.

would be provided, both stationary and moving. Moving targets are variable in their movement direction and both individual and multiple target arrays are provided.

d. Intercommunications and radio would be provided for use in conjunction with the CVC helmet.

e. All fire control equipment used during gunnery would be available, to include the following: weapon selection, ammunition indexing, all sighting equipment with appropriate reticles, headrests, control handles, rangefinder, firing switches and auxiliary fire control equipment. The location, appearance, feel and reaction of each fire control component will be representative of the actual equipment. The headrests would have some kind of sensors internally mounted and pre-exercise adjustable to insure the soldier puts his head in the same position each time.

f. Appropriate obscuration seen in the sights during firing would be provided. Obscuration of the target caused by short rounds is required. Smoke and other reduced visibility conditions would provide training in firing during degraded sighting conditions.

g. The instructor station would permit the instructor to establish and select the initial engagement parameters and sequences. Visual display and monitoring of each station is provided. The instructor would be able to insert faults such as misfires, lost and erratic rounds, machinegun stoppages. A variable three to ten second firing inhibit switch between rounds and a freeze capability to allow immediate corrections would be available.

h. Adjustable boresight knobs and a zero panel that permits generating a shot group would provide for zeroing both the main gun and the machinegun.

i. Firing vehicle motion would permit firing on the move (machinegun) and making initial main gun lay during moving-to-a-halt engagements.

The cost-effectiveness of such a simulator for Reserve and National Guard units would have to be compared with the use of actual tanks. But live tank or high-fidelity simulator appear to be the only option in training tactical gunnery operations.

APPENDIX I

TANK COMMANDER'S MODULE OUTLINES

MODULE TC-1 BEFORE OPERATIONS PROCEDURES

UNIT TC-1.1 M2 MACHINEGUN HEADSPACE AND TIMING (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on either adjust headspace or adjust timing tasks or both, in PART A of Tank Commander's Readiness Test.

OBJECTIVES:

a. Given the requirement to adjust headspace on the M2 machinegun, the soldier will:

- . Identify an M2 machinegun with correct headspace.
- . Describe the procedures to adjust tight headspace.
- . Describe the procedures to adjust loose headspace.

b. Given the requirement to adjust timing on the M2 machinegun, the soldier will:

- . Identify an M2 machinegun with correct timing.
- . Describe the procedure to adjust early timing when NO FIRE gage is installed.
- . Describe the procedure to adjust early timing when FIRE gage is installed.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge with audio cassette (TEC Lesson 941-071-0117-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

30 minutes

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT TC-1.2 BEFORE OPERATIONS PROCEDURES (SKILL)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on one or more tasks in PART A of Tank Commander's Readiness Test, and completed UNIT TC-1.1.

OBJECTIVES:

a. Given an M48A5 tank, with BII, coaxial machinegun, M2 machinegun, and an indication from the GUNNER that he has placed the turret into power operation, and a procedural job-aid, the soldier will perform TCs prepare-to-fire procedures (see A.1 of Tank Commander's Readiness test).

b. Given an M48A5 tank with BII, coaxial machinegun, M2 machinegun, a procedural job-aid and an indication from the Platoon Leader that a tactical mission is imminent, soldier will perform before operations procedures on the M2 machinegun.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII, coaxial machinegun and M2 machinegun.

b. Pocket-sized job-aids listing steps in performing: prepare-to-fire procedures from the TC's position; assembling and disassembling the M2 machinegun; and, adjusting headspace and timing on the M2 machinegun.

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Instructor makes sure soldier has pocket job-aides and urges him to refer to them during task performance.

b. Instructor explains to soldier task element(s) failed in Readiness Test.

c. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

d. Soldier then practices with instructor available to coach as necessary.

e. Soldier is retested on relevant portion(s) of PART A, Tank Commander's Readiness Test.

NOTE:

a. This module should be conducted as remedial training immediately following administration of PART A of the Tank Commander's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstration of performance by the instructor or lengthy lectures on principles of equipment operation, while the soldier is idle, usually slows down the learning process.

MODULE TC-2. WEAPON SYSTEMS PREPARATION I

UNIT TC-2.1 BORESIGHT WEAPON SYSTEMS (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on boresighting weapon systems portion of PART B, or PART C, Tank Commander's Readiness Test.

OBJECTIVES:

Given the requirement to boresight the tank weapon systems, the soldier will:

- Identify a good target for use in boresighting the main gun, coax machinegun and M2 machinegun.
- Locate and use the various parts of the rangefinder.
- State the procedures or conditions necessary to complete sight alinement of the reticles of the rangefinder.
- Identify the correct slip scale settings for the boresight knobs of the rangefinder.
- Describe the operation of the XENON searchlight.
- Describe the controls used and adjustments necessary to boresight the XENON searchlight by both the primary and alternate methods.
- Identify, and list in the correct order of removal, the parts that must be removed from the M2 machinegun before boresighting.
- Describe the procedures for boresighting the M2 machinegun.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS

a. Five filmstrip cartridges and six audio cassettes (TEC Lessons 020-171-5335-E, 020-171-5340-F, 020-171-5355-F, 020-171-5343-F, 020-171-5354-F, 020-171-5352-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Select lesson(s) corresponding to pre-tests failed on PART B of Tank Commander's Readiness Test or all lessons if failed PART C.

b. Soldier completes assigned lessons and takes post-test.

c. Soldier reviews those lessons keyed on post-test for items missed.

d. Soldier reviews appropriate lessons until he can complete post-test with no errors.

NOTE:

These lessons address Gunner as well as TC tasks and in some cases tasks performed by both. Since the tasks cannot be separated easily, the soldier should be urged to focus his attention on TC tasks and TC aspects of Gunner-TC tasks.

UNIT TC-2.2. RANGING TEST

PRETRAINING CONDITIONS:

Soldier failed to determine correct range to target, PART C-3, Tank Commander's Readiness Test and completed UNIT TC-2.1.

OBJECTIVES:

Given an M48A5 Tank with BII, situated on level ground, and a minimum of six 6-by 6-foot target panels placed at varying known ranges from 1,000 to 3,500 meters, soldier will make 20 rangings on each target.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS

a. M48A5 tank with BII

b. Six 6-by 6-foot target panels at varying known ranges from 1,000 to 3,500 meters.

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Each ranging starts from an indexed range of 500 meters in such a sequence that no two rangings on any one target are consecutive.

b. The range scale on the range finder is covered so that the TC cannot read it. The instructor notes and records each reading from the computer and reindexes 500 meters on the rangefinder for the next ranging.

c. At the completion of the test, the readings for all targets are computed. Proficiency is determined as follows:

- Compute average range reading for each target by adding all 20 readings for that target and dividing by 20.
- Obtain range bias for each target by determining the difference between the average range reading and the known range for that target.
- Obtain range spread by subtracting the smallest reading from the largest.
- The standard for qualification is a range bias not greater than ± 50 meters and a range spread not greater than 100 meters.

UNIT TC-2.3. BORESIGHT WEAPON SYSTEMS (SKILL)

PRETRAINING CONDITIONS:

Soldier passed PART B of Tank Commander's Readiness Test (or completed UNIT TC-2.1, and TC-2.2), but failed to meet standard on boresighting weapon systems portion of PART C, Tank Commander's Readiness Test. (Tasks C.1 through C.7).

a. Given an M48A5 tank situated on level ground with boresight panels at ranges of 1200 meters and 500 meters soldier will prepare tank for boresighting and prepare tank rangefinder for operation. All steps in this objective will be performed within 20 minutes. (See PART C 1 and C 2).

b. Given an M48A5 tank situated on level ground with boresight panels at range of 1200 meters and 500 meters and the tank and optics prepared for boresighting, the soldier will boresight the rangefinder, tank searchlight, and M2 machinegun. All steps in this objective will be performed within 40 minutes without damage to equipment. (See PART C.3 through C.7 of Tank Commander's Readiness Test).

METHOD:

One-on-one instructor controlled performance training

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII, coaxial machine gun, and M2 machinegun.

b. Boresight panels at ranges of 1200 meters and 500 meters

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Instructor explains to soldier task elements failed in Hands-On portion of Readiness Test.

b. Instructor directs TC to insure that TC's rangefinder headrest is adjusted to desired position.

c. Instructor directs TC to take up correct sight picture through rangefinder. Instructor emphasizes importance of placing head in same position in headrest each time TC takes up sight picture. Point out to TC that he should be aware of pressure points on the head and face which can serve as cues to insure he has head in correct position in headrest.

d. Instructor "talks soldier through" task or task elements to be learned; soldier performs as these oral directions are given.

e. Soldier then practices with instructor available to coach as necessary.

f. Soldier is retested on relevant portion(s) of PART C, Tank Commander's Readiness Test (PART C.1 through C.7).

NOTE:

a. This module should be conducted as remedial training immediately following administration of PART C, Tank Commander's Readiness Test.

b. Procedures for remedial training should be followed as given. Demonstrations of performance by the instructor or lengthy lectures on principles of equipment operation, while the soldier is idle, usually slows down the learning process.

MODULE TC-3. WEAPON SYSTEMS PREPARATION II

UNIT TC-3.1. ZERO WEAPON SYSTEMS (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on zeroing weapon systems portions of PART B, or PART C, Tank Commander's Readiness Test.

OBJECTIVE:

Given the requirement to zero the tank main gun, coaxial machinegun, and M2 machinegun, the soldier will:

- List the desired characteristics of a target used for zeroing the main gun, coaxial machinegun, and M2 machinegun.
- Describe the procedures for zeroing the main gun, coaxial machinegun, and M2 machinegun.
- Identify the sight reticles that must be alined after the main gun and coax machinegun are zeroed.
- Identify the point on the M2 machinegun sight reticle used for zeroing the machinegun.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. Filmstrip cartridge with audio cassette (TEC Lesson 020-171-5353-F)

b. Beseler Cue/See

c. Paper and Pencil

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Soldier completes lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

NOTE:

This lesson addresses Gunner as well as TC tasks and in some cases tasks performed by both; since the tasks cannot be separated easily, the soldier should be urged to focus his attention on TC tasks and TC aspects of Gunner-TC tasks.

UNIT TC-3.2. ZERO WEAPON SYSTEMS (SKILL)

PRETRAINING CONDITIONS:

Soldier passed PART B of the Tank Commander's Readiness Test (or completed UNIT TC-3.-1.) but failed to meet standard on zeroing weapon systems portion of PART C, Tank Commander's Readiness Test. (Tasks C.8 through C.10).

OBJECTIVE:

Given an M48A5 tank with subcaliber devices attached, situated on level ground at a subcaliber range, with a main gun zero panel at a scaled range of 1200 meters, an M2 machinegun zero panel at a scaled range of 500 meters, a coaxial machinegun zero panel at a scaled range of 800 meters, soldier will zero the tank main gun, the coaxial machinegun, and the M2 machinegun.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. M48A5 tank with BII, coaxial machinegun and M2 machinegun.

b. Main gun zero panel at scaled range of 1200 meters.

c. Coaxial machinegun zero panel at scaled range of 800 meters.

d. M2 machinegun zero panel at scaled range of 500 meters.

e. Subcaliber ammunition.

ESTIMATED TIME:

30 minutes

PROCEDURE:

a. Instructor explains to soldier task elements failed in Readiness Test.

b. Instructor directs TC to insure that TC's rangefinder headrest is adjusted to desired position.

c. Instructor directs TC to take up correct sight pictures through rangefinder. Instructor emphasizes importance of placing head in same position in headrest each time TC takes up sight picture. Point out to TC that he should be aware of pressure points on the head and face which can serve as cues to insure he has head in correct position in headrest.

d. Instructor "talks soldier through" task on task elements to be learned; soldier performs as these oral directions are given.

e. Soldier practices with instructor available to coach as necessary.

f. Soldier is retested on relevant portion(s) of PART C, Tank Commander's Readiness Test (PART C-8 through C-10).

NOTE:

This training probably could be mediated more effectively and in the long run, less expensively, by a high fidelity Tank Gunnery trainer. One type of simulator that should be effective in training main gun and machinegun zeroing is outlined in MODULE G-5, UNIT G-5.4 TACTICAL OPERATIONS.

MODULE TC-4 TARGET ACQUISITION

See MODULE D-3, Driver's Training Package

MODULE TC-5 TACTICAL OPERATIONS

UNIT TC-5.1. INITIAL FIRE COMMANDS (KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to issue correct initial fire command for one of the target engagements in PART E, Tank Commander's Readiness Test.

OBJECTIVE:

Soldier will be able to formulate and issue an initial fire command for main gun and machinegun targets.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. One filmstrip cartridge with audio cassette (TEC Lesson 020-171-5361-F).

b. Beseler Cue/See

c. Paper and Pencil

ESTIMATED TIME:

1 hour

PROCEDURE:

a. Soldier completes assigned lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no errors.

UNIT TC-5.2 MACHINEGUN ENGAGEMENTS(KNOWLEDGE)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on coaxial and M2 machinegun engagements of PART F, Tank Commander's Readiness Test.

OBJECTIVES:

Soldier will:

a. Identify sight pictures that show the proper leads for engaging moving targets with the COAX machinegun.

b. Identify correct methods of giving COAX machinegun engagements from a moving tank at moving personnel targets.

c. Identify correct sight pictures for engaging stationary and moving targets with the caliber .50 machinegun, at various ranges.

METHOD:

Self-instructional sound-slide presentation with written response.

EQUIPMENT/MATERIALS:

a. One film strip cartridge with audio cassette (TEC Lesson 020-171-5364-F)

b. Beseler Cue/See

c. Paper and pencil

ESTIMATED TIME:

45 minutes

PROCEDURE:

a. Soldier completes assigned lesson and takes post-test.

b. Soldier reviews lesson until he can complete post-test with no error.

NOTE:

This lesson addresses Gunner as well as TC tasks and in some cases tasks performed by both. Since the tasks cannot be separated easily, the soldier should be urged to focus his attention on TC tasks and TC aspects of Gunner-TC tasks.

UNIT TC-5.3 TARGET ENGAGEMENTS (CONDUCT-OF-FIRE TRAINERS)

See UNIT G-5.3, Gunner's Training Package: The conduct-of-fire trainers can be used simultaneously by TC and Gunner. The soldier should focus his attention on TC aspects of the trainers.

UNIT TC-5.4 TARGET ENGAGEMENTS (SKILL/FIELD)

PRETRAINING CONDITIONS:

Soldier failed to meet standard on one or more of the target engagements in PART E of Tank Commander's Readiness Test and completed UNIT TC-5.1, TC-5.2, and TC-5.3.

OBJECTIVE:

Given a fully operational M48A5 tank with a skilled Driver, BII, coaxial machinegun, caliber fifty machinegun, blank coaxial machinegun rounds, a tactical driving course including obstacles and terrain conditions suitable for tank defilade, and simulated targets (both moving and stationary, main gun, coaxial and caliber fifty), soldier will give initial and subsequent fire commands to engage each target and engage targets as appropriate, meeting the standards laid out in PART E of Tank Commander's Readiness Test.

METHOD:

One-on-one instructor controlled performance training.

EQUIPMENT/MATERIALS:

a. Operational M48A5 tank with BII, coaxial and caliber fifty machineguns, blank coaxial machinegun rounds.

b. Sufficient terrain to provide several natural or man-made obstacles and features such as ridges suitable for tank defilade; simulated targets (both moving and stationary, main gun and machinegun).

ESTIMATED TIME:

2 hours

PROCEDURE:

a. Instructor will act as both GUNNER and LOADER and give appropriate responses as the TC gives the initial and subsequent fire commands. Instructor should announce CANNOT IDENTIFY for at least one main gun and one coaxial machinegun engagement. He should also give the TC information to make subsequent fire commands.

b. Instructor coaches TC through the initial and subsequent fire commands for each target, and through the target engagement techniques for each target that the GUNNER announces CANNOT IDENTIFY. Instructor repeats any he deems necessary and when he thinks TC is ready, he administers a tactical operations test of the type described in PART E of the Tank Commander's Readiness Test.

c. Instructor directs TC to take up correct sight pictures through rangefinder. Instructor emphasizes importance of placing head in same position in headrest each time TC takes up sight picture. Point out to TC that he should be aware of pressure points on the head and face which can serve as cues to insure he has head in correct position in headrest.

NOTE:

See UNIT G-5.4. for a discussion of simulator that should be effective in training the TC.

APPENDIX J

EVALUATION PLAN FOR M48A5 TRAINING[1]

[1]Prepared by George R. Wheaton and Andrew M. Rose under HumRRO subcontract number SC76-12-32 to the American Institutes for Research.

EVALUATION PLAN FOR M48A5 TRAINING

INTRODUCTION

In the preceding sections of this report a Reserve Component training structure has been designed which addresses the individual and crew skills required for operating and maintaining the M48A5 tank. Based on a modular conceptualization of skills, the training structure provides for multiple entries, tracks, and exits. The assumption underlying such flexibility is that not all personnel in all units will need to master the same sets of skills because of different mobilization categories, entry mastery levels, etc. Accordingly, the structure has been developed to accommodate individual training needs by permitting selection of those portions of the total structure, pinpointed by pre-testing, which are in need of training.

To support this approach the training content has been organized hierarchically. Pyramiding of content occurs in sequencing the training modules, and to enhance the benefit in sequencing, mixes of media and devices have been specified for each instructional segment, which should prove particularly useful for training and testing of achievement.

Given a training program as complex as this, how should one approach its evaluation? Clearly, the intricacies of the training problems generate evaluation requirements that are complex. One approach to evaluation is that it should simply consist of the comparison of terminal outcomes with the stated objectives of training. This one-step approach may, however, miss valuable and significant information. To be sure, comparison of outcomes with objectives is essential. Other evaluative information, however, collected at other points in the training program development cycle, may also be of tremendous value, particularly to those re-

sponsible for modifying the program to improve its operations and products.

Evaluation of the proposed M48A5 training program involves a large number of considerations. Chief among these, in our view, is the requirement that the evaluation be decision-oriented. Determining what decisions will likely be made with respect to the program is essential for specifying the kinds of evaluative data that are needed and when they should be obtained. Failure to focus on decisions which can be made about program design, implementation, and operation can result in an unresponsive evaluation which fails to address key issues and squanders resources on the collection of irrelevant data.

Klaus[1] discusses the general concept of evaluation in terms of the decisions which must be made at three stages of program development. The first are planning decisions made at the start of the effort which define the problem to be solved so the appropriate and realistic goals can be established and needed inputs can be determined and assembled. The RFQ which spawned the current effort, the comparative skill analyses, and the proposed training structure all constitute planning decisions. In the M48A5 program the backbone of these planning decisions is a set of well defined goals, both at intermediate and terminal levels, against which accomplishments can be measured. To the extent that these goals and their derivative decisions are now fixed, the initial program design phase can be excluded from formal evaluation. This is true since further information about how the program is conceptualized will have little influence on the planning decisions themselves.

[1]Klaus, D.J. Evaluation plan for the DEIDS and related projects. Washington, D.C.: American Institutes for Research, 1974.

Once the program is implemented on even a pilot basis, operating decisions will be made about how well the training is working. Made in response to diagnostic information, such decisions will involve appropriate and timely remedial actions to improve program operation. The operating decisions are concerned with two aspects of training program management. One is related to process, and is concerned with whether the training was delivered as originally planned. The other is related to components, and addresses the need to alter or modify specific parts of the program.

In the present context, process is an especially important consideration since it is usually unsafe to assume that a training program has been implemented and operated exactly in accordance with the training plan (or that the prescribed control conditions have been adhered to). Aspects of the environmental context may be unreceptive to or may preclude implementation of portions of the training plan. These can include both physical constraints (availability of instructors, devices, facilities, for example), as well as more subjective factors such as instructor and student acceptance of the training plan.

Program components refer to specific features or aspects of the training program which may not function as originally anticipated. In the present case, for example, pre-tests, media/device mixes for specific modules, sequences of objectives, etc. might not behave in an optimal or even acceptable manner. Evaluation, therefore, must uncover such problems and provide feedback on how program components are functioning during the course of training program development. Assessment in response to operating decisions, which examines both the process and component aspects of training management, is referred to as formative evaluation.

In addition to planning and operating decisions, program personnel are concerned with concluding decisions which determine program

continuation, expansion or replication. Those responsible for such decisions are required, in essence, to predict the success of the same program, more or less, under more or less similar conditions at some future time or other place. This kind of assessment, therefore, focuses on terminal program outcomes, comparing those which were planned to those which were obtained. During the course of these comparisons, consideration also is given to consequences of the training program in addition to those that were planned and intended. This terminal and overall appraisal is often referred to as summative evaluation.

To paraphrase Johnson[1], decision-oriented evaluation can occur at three stages of training program development:

> During planning the principal role of evaluation is to help program planners to define their objectives appropriately, and to formulate criteria for the assessment of the objectives.
>
> During implementation and operation the evaluation provides process and component information to the program operators, on the basis of which the program may be modified. This function constitutes a corrective feedback loop in the evolutionary development of the program. Purposes and objectives may be refined and modified, as may features of the program operation, as a result of the feedback. This form of assessment, while the project is ongoing, represents formative evaluation.
>
> Upon program completion the evaluation compares end-products with the stated goals, to assess degree of success and thus furnish information to decision-makers about what might be ex-

[1]Johnson, G.H. The purpose of evaluation and the role of the evaluator. In Evaluative Research Strategies and Methods. Washington, D.C.: American Institutes for Research, 1970.

pected should the program be continued, expanded or replicated. This activity comprises summative evaluation.

In the M48A5 Reserve Component training program the initial planning decisions are essentially complete, as reflected in the prototypic training structure presented in this report. Consequently, discussion of program evaluation in the following sections will be limited to the latter two stages of development - implementation and post-operation - and organized in terms of formative and summative approaches.

FORMATIVE EVALUATION

Within the context of the present training development effort, the sequence and nature of process and component evaluations must be considered. The first issue involves the kind of strategy to be pursued, including: initial experimental studies of program components; implementation of pilot programs under evaluator control; implementation of pilot programs under unit control; and broad implementation of the full program. The second issue involves the relative emphasis to be given to process and component evaluation within the various strategies.

In many kinds of programs, implementation often proceeds on the basis of planning decisions alone, without benefit of testing and pilot runs. In these instances the two aspects of formative evaluation proceed simultaneously, or with process preceding component evaluation. What distinquishes this approach is the real-time nature of the process evaluation. As soon as departures from planned program functioning are noted, the causes are determined and the deviations are immediately rectified. Against this background of continuous system evolution, component evaluations are conducted when indicated and feasible. However, in the context of the proposed M48A5 program, this strategy cannot be recommended as a feasible approach to evaluation. The importance of a

successful program and the amount of resources required mitigate against initial broad implementation followed by program bootstrapping and trial-and-error improvement.

Alternatively, one could argue that before a totally new program is implemented on a broad scale, feasibility testing and pilot programs should be instituted. As one option, one might want to determine empirically the utility of each individual component prior to its use in even a pilot program. But the complexity of the proposed training system, both in terms of its content and methods of instruction, argues against an interminable series of experiments in which resources are used to test each component and combination of components prior to their implementation in a training setting.

The preferred approach, therefore, is to start at a point between the extremes outlined above. The content and methods of instruction representing a "best bet" would be determined on rational grounds, insofar as possible. All, or more likely a portion of the resultant training program, would then be introduced into selected units on a pilot basis. In preliminary studies the program's designers would be responsible for program implementation and operation, and would concentrate almost exclusively on component evaluation. (Appropriate process and procedures would be ensured by the investigators.) Once components were debugged, the program would be implemented in other units on a pilot basis. This time the units themselves, after suitable familiarization with the operations involved (itself an important aspect of process evaluation), would conduct training during a specified trial period. Process evaluation during the trial period would identify departures from planned operations, and upon completion of the pilot effort, additional process assessment would attempt to isolate the reasons for observed deviations. Based on the findings from these pilot runs, carefully

tailored experimental studies would be undertaken, as needed, to correct features of the implementation and/or to further modify components of the program. Following this final series of pilot studies the program would be widely implemented (and evaluated).

This sequential strategy has the advantages of being readily initiated, and of providing valuable feedback on first the system components and then on the process of implementation. It is, therefore, viewed as a cost-effective alternative to a broad-based study or a series of microanalytic experiments.

The sequential strategy discussed above is recommemded for use during formative evaluations of the M48A5 program. To reduce the effort to a manageable level, it is suggested that this strategy be used for segments or modules of the overall program that are relatively independent and self-contained. For example, each of the four crew position tracks (i.e., driver, loader, gunner, and tank commander) could be examined separately. Within each track, evaluation could be initially focused on individual gunnery or maintenance skills (as embodied in the Tank Crewman Gunnery Skills Test, for example, or on even smaller units of instruction), and subsequently on crew skills and their associated training objectives and standards.

Evaluation of Training Program Components

In assessing program components during formative evaluation two questions are paramount. Have students achieved the training objectives specified for the particular segment of the program under investigation (measured in terms of the level of proficiency or mastery achieved after a fixed amount of practice time, or as the time required to attain a given level of proficiency)? Do students retain their skill during the intervals between successive modules, particularly when one module serves as a prerequisite for a later module? Both questions may also be framed in the relative sense, by contrasting the results obtained with alternative system components.

Studies of program components can be conducted by using students who are drawn from the same reserve unit but who are randomly assigned to different "treatment" groups. Ideally, all troops within the designated unit(s) would first be given the pre-test(s) related to the particular module or segment of training under study.[1] Using these pre-test scores, troops would be categorized into groups differing in skill level (based on quartiles, for example). One-third of the students in each group would be randomly assigned to an experimental group embodying the training component under study; another third would receive conventional or a second experimental type of training; the final third would receive no training on the segment in question.

The treatments indicated for each group would then be applied. For example, different media/device mixes, amounts of practice, sequences of objectives, etc. could be evaluated.[2] Acquisition would be determined by administering appropriate within-module and end-of-module achievement tests.[1] After suitable intervals the achievement tests would again be administered to determine retention levels for content trained under the different "treatment" approaches. The choice of specific retention intervals would be dictated by the training structure and, in particular, the planned interface among training objectives and between adjacent modules.

The general data collection strategy outlined above will support a variety of analyses which are predicated on covariance tech-

[1]Tests would be readministered during this period in parallel or original forms to obtain estimates of reliability. Go/No-Go scores would have to be converted to continous data to permit estimating test reliability.

[2]A series of small-scale studies conducted unsystematically is not being advocated, nor are evaluations where there is little doubt about the outcome. Rather, the evaluations should address major system components whose adequacy is, for some reason, suspect.

niques and related procedures. Correlational analyses within and between tests will generate estimates of score reliability and the predictability of subsequent performance from prior test data. Analyses of covariance and analyses of variance will provide estimates of the significance of any differences observed among treatment effects, and will reveal how such effects may potentially vary as a function of the prior skill levels of students. All of these and similar results could be used to modify the training program in appropriate ways before proceeding to more widespread implementation.

Evaluation of Training Program Process

As described above, evaluation of system components usually depends on empirical studies in which one component is pitted against one or more alternative components in a rigorously controlled setting. The evaluation of process proceeds very differently, being comprised of monitoring and observing activities with active intervention limited to acquiring reactions from those involved in the program.

The pilot program described above would not serve as a rich source of process data. As previously indicated, that program would be under the direct and rigid control of the evaluators who would make every attempt to adhere to planned procedures. Nevertheless, documenting difficulties experienced in implementing the program, and soliciting student, instructor, and command personnel reactions would be warranted. Such data might provide useful insights when planning a subsequent pilot effort in which process variables would be examined.

The Reserve Component units that might eventually receive the M48A5 training program differ in many ways, some of which may influence the nature of the program and its effectiveness. For example, salient unit characteristics include: the kinds of tanks available, the number and experience levels of instructors,

the unit's mobilization status, access to live-fire training areas, unit training schedules, and so forth. Any of these or numerous other factors which comprise the environment into which the M48A5 program will be introduced may have an impact. To examine this possibility and its consequences, process evaluations would be conducted in a small number of units that implemented and ran portions of the program for a trial period. Units would be selected which possessed characteristics likely to impact adversely on the program's implementation and/or operation.

Within the segment of training singled out for evaluation, one would examine the process or procedures actually occurring vis-à-vis those which were originally intended by the program's planners. If instances were uncovered where planned procedures were either missing or modified, the underlying reasons for such departures would be sought and documented. For example, a Reserve Component might exclude a given module from its program because available equipment (an M60A1 tank, for example) did not permit using the module. As another example, a given module might be taught using a media/device mix differing from that originally planned. In this case, the departure might be due to instructors' lack of acceptance of the device.

In conducting these analyses three basic sources of data are required. First, extensive documentation is needed about the composition and manner of conducting the segment of training. This information would include details of pre-testing, scoring, assignment to training, content, method(s) of delivery, achievement testing, interpretation of scores, advancement or remediation, etc. Second, data would have to be obtained on each of these facets to indicate what went on in practice. Such data would be obtained by monitoring the training program and accessing records such as student rosters, logs of device use, repair work orders, equipment inventories, instructor lesson plans and records and numerous other documents. Third, empirical data would be needed which indicated how well

accomplishment and retention of the segment and each of its composite modules and objectives compared with specified standards.

As illustrated in Figure 13, information on training successes and failures would be used to identify departures from planned procedures which may have had a negative impact on the outcomes of training. If results were obtained consistent with cell #1, one would proceed to another segment, module, or objective. In this case training was provided as planned and proved effective. Findings represented by cell #2 also would be viewed favorably. That is,

		Process	
		As planned	Not as planned
Outcome of Training	Satisfactory	1	2
	Unsatisfactory	3	4

Figure 13. Hypothetical results of evaluation of process.

although departures in procedures occurred, they were either so slight or the training was so robust as to preclude adverse impact. An outcome of the type illustrated in cell #4 would be subjected to further study. In this case, for example, reactions to the training program might be obtained by interviewing and obtaining critical incidents from students, instructors, and command personnel in an attempt to determine why the departure occurred and whether it might account for the degraded training which was observed. By limiting such additional effort only to problem cells, the efficiency of data collection would be increased.

Finally, if the outcomes portrayed in cell #3 were obtained, one would proceed to question the utility of the components of training involved. While the program was implemented as planned, some aspect of the implementation was apparently faulty. The outcome

represented by this cell would be unlikely, however, given the prior evaluation of program components.

The final step in the formative evaluation would occur during widespread implementation of the program. Reserve Components adopting the M48A5 training approach would be monitored periodically to evaluate their progress. Particular attention would be given to units during the implementation and early-operation stages to identify and quickly remedy incipient problems. The actual decision to proceed on this broad front would, of course, have been predicated on the results of a summative evaluation.

SUMMATIVE EVALUATION

Summative evaluation is concerned with three principal issues, namely:

- The definition of the goals (or functions) of the training system. This includes determining the behavioral objectives to be measured (assuming that all objectives cannot feasibly be measured), and establishing performance standards for the behavioral objectives (i.e., the selection of measures);
- The development and application of procedures for collecting relevant data for training system evaluation. This includes the resolution of formal experimental design issues (what control groups and training-testing should be used, for example), the selection of samples, and the establishment of measurement and observation schedules; and
- The analysis and interpretation of the data. This includes specification of group comparisons and the hypotheses addressed by each comparison, and determination of the inferences that can be drawn from the types of data collected.

In the sections which follow, aspects of these issues will be addressed which are particularly critical for summative evaluation.

Following this discussion, a summative evaluation plan for the M48A5 training system will be presented. This plan will serve as both an illustrative summary of many of the critical issues, and as a specific and feasible experimental design that could be used to evaluate the training system.

Definition of the Goals of the Training System

The typical resolution of the issue of what to measure is definitional:

> "The people responsible for the delineation of a training program should specify the objectives of the program. In order to specify an objective clearly, one must state the operations by which it can be determined whether or to what extent the objective has been attained. These operations are then the measures which are needed. That is, if objectives are precisely (usually behaviorally) stated, the measurement problem is all but resolved."[1,2]

This view is, however, probably inappropriate from the perspective of a summative evaluation. First and most obviously, in a program of any complexity, the number of potentially important measures that would have to be developed, tested, standardized, and administered would be prohibitively expensive. Less obvious but just as important is that unless the operational specifications for evaluative measures are considered at the time of formalization of the training system, the educational objectives may not be compatible with evaluative measures. This discrepancy may arise from relatively superficial or complex training objectives, or from the imprecision of measurement instruments. Instead of being resolvable by a simple definitional statement, the problem of "what to measure" in summative evaluations must be carefully considered, not only during the design of

[1]Fitzpatrick, R. The selection of measures for evaluating programs. In Evaluation Research Strategies and Methods. Washington, D.C.: American Institutes for Research, 1970.

[2]This quotation is taken out of context; Fitzpatrick goes on to criticize this view of the measurement issue and in fact, presents a far more useful conceptualization of the measurement selection issue than the one implied by the quotation.

the evaluation plan, but also as previously indicated, during the planning and design of the training program.

There are several "standard" criteria for the selection of behavioral indicators that must be applied to any potential summative measurement system. These criteria include validity, comprehensiveness, reliability, and feasibility. In the context of summative evaluation, validity refers to the "strength" of the relationship between the selected performance measure and the training objective, and to the relative importance of the performance for measurement; reliability maintains its normal meaning in an "error of measurement" sense; comprehensiveness refers to the degree to which the domain of training objectives is sampled by the selected set of measures; and feasibility refers to the cost-effectiveness and administrative efficiency of sets of candidate measures.

Decisions regarding specification of evaluative measures cannot be made independently of the experimental design, proposed data analyses, data interpretation, or types of inferences that the evaluation will attempt to provide. The interrelationships among these topics will be addressed after each has been presented.

Development and Application of Procedures for Data Collection

The validity of empirical results obtained from an experimental evaluation depends upon both the validity of the measurement system and the amount of control exercised in the experimental situation. Experimental controls are used to maximize the probability that the training program actually produces the observed behavioral changes in the subject population, while minimizing the probability that some alternative influences could have produced the outcomes. Typical experimental controls are such procedures as standardizing the measurement situation, training observers, controlling for potential biases due to time of day, weather, location, and measurement instrument variability, and so on. Formal experimental designs also aid

in ruling out artifactual sources of group differences, thereby permitting unequivocal tests of hypotheses concerning treatment effects.

The selection of applicable experimental designs depends upon the types of behavioral changes expected to result from the training program. The categories of behavioral changes of most importance are retention of skill, transfer of training, and the interaction between them. These notions represent similar but conceptually different phenomena. Retention is concerned with the extent to which a skill learned at Time 1 is still available at Time 2, given the passage of time, the effect of intervening activity, or both. Transfer may refer to the extent to which experience in one context at Time 1 facilitates performance in another context at some later Time 2.

Information about transfer and retention is important for Army training managers since the operational necessity to have critical tasks performed at the unit level frequently dictates that personnel be assigned to unit duties which differ from those for which they were originally trained. Similarly, the broadening of MOS under the new EPMS increases the likelihood that the use of some skills will be delayed significantly following entry into the unit. At some future point, however, individuals will probably be called upon to perform the tasks for which they were originally trained. Thus, in order to evaluate the benefits derived from any particular training program, it is important not only to know the extent to which the original training facilitates performance on the operational task (transfer), but also the extent to which the passage of time and the performance of other tasks affect both retention and transfer.

Such knowledge can prove useful in a number of specific ways. It can provide a partial basis for determining the nature, timing, and amount of refresher training which might be necessary for personnel who have been performing tasks other that those for which

they were trained. For newcomers to the unit, this understanding can contribute to a number of important decisions, including: selection of tasks for training where equally critical training objectives must be reduced to meet limited resources; and determination of the trade-offs between tasks, conditions and standards to meet available resources. For example, knowledge concerning the retention decay rate for particular tasks and the relationship between retention of training content and transfer to operational tasks at the unit could provide part of the basis for eliminating or deferring tasks from training.

Hypothetical relationships between transfer of training and retention can be conceptualized in the matrix illustrated in Figure 14. The six cells of the matrix represent a number of situations which might develop were a soldier exposed to a training program at Time 1 and called upon to recall the content of his training or perform the operational task for which the training was designed at some later Time 2. Cell 4, for example, depicts a situation in which the soldier shows good retention of the training content, but negative transfer to the operational task. Such a situation might occur, for example, if the training program required the development of highly specific skills, many of which were related only to the specific training situation. Little knowledge of a general type which would facilitate performance on other, similar tasks would be developed, and the highly specific learning might actually impede performance on a new task. On the other hand, if the training program required the development of general skills which might be applicable in a number of situations, then the situation depicted in Cell 3 might occur. In this case there might be relatively poor retention of the training content but good transfer to the operational setting.

		Transfer to Operational Task		
		Negative (-)	Neutral (0)	Positive (+)
Training Content Retention	Low	1	2	3
	High	4	5	6

Figure 14. Transfer Retention Matrix

Thus, the experimental design selected can increase the "power" of the summative evaluation through the consideration of issues not directly incorporated into the design of the training program.

Analysis and Interpretation of the Data

There are several standard issues that must be addressed concerning the analysis and interpretation of data collected in support of summative evaluation. As usual, the statements of the experimental questions and null hypotheses to be tested provide indicators of potential statistical techniques. For example, if the evaluation plan calls for experimental-control-group comparisons, such techniques as t and f tests are implied. Of course, potential violations of statistical test assumptions should be explored and alternative (e.g., nonparametric) data analysis methods considered. This is not the place to go into detail about the relative robustness of tests, impact of test assumption violations, or the misuse of analytic techniques; it will suffice to state that "appropriate" analyses should be carefully judged before implementation of the evaluation plan.

Similar considerations apply to the issues involved in interpretations. For example, a frequent error with regard to interpretation is the confusion of "relative" data with "absolute" data. Especially in a summative training evaluation context, it is usually insufficient to claim that program A resulted in better performance than an alternate program (or an untrained control group); it is typically necessary

to ask some "criterion-referenced" questions: As a result of this training, are the graduates now combat-ready? Is the proportion of the domain of operational performance objectives mastered by a given individual or crew above the minimum specified? What are the specific deficiencies of individuals or crews (as an index of deficiencies in the training program per se)? Again, these issues must be considered in the design of the training program as well as during the specification of a summative evaluation plan.

Summative Evaluation Plan

In order to summarize the issues involved in the development and application of a summative evaluation to a training system, a complex but efficient experimental design will be presented below. Most of the groups depicted in the design represent prototypes of the actual training-and-assignment sequences currently experienced by Army personnel, or prototypes of improved sequences incorporating initial on-the-job training (OJT) or refresher training which is under consideration for future implementation. The design is efficient since it uses groups which are "experimental" for certain kinds of questions, and which are "control" groups for other questions. The design depends on relatively few scientific assumptions, and has been developed with necessary sensitivity to the anticipated practical constraints which always are found in field research. Finally, the design is extremely flexible, since it can be fractionated into sub-designs which address summative issues of specific concern.

Before presenting the details of the experimental design, it will be useful to consider the kinds of issues raised by a training system evaluation and addressed by the proposed design:

1. Transfer from training to the operational task as a function of time since training. Classical transfer studies have examined immediate transfer, while the Army's situation often involves a delay between training and arrival at the initial duty station, or between training and application at Summer Camp. Occasionally

the transfer delay interval may be substantial, as when a soldier's duty station assigns him to duty ancillary to, or entirely different from, his primary MOS because of practical exigencies.

2. Retention of trained skills as a function of time since training. Delayed transfer, as addressed above, is a function of at least two primary components: retention of trained skills, and communality between trained skills and operationally required skills. By comparing retention losses to transfer losses over time, these two components can be separated.

3. Effectiveness of interventions which attempt to compensate for transfer losses over varying delays from training to operational job activities. These interventions include refresher training, which focuses on the previously trained material and therefore impacts on the retention component, and on-the-job training, which includes both refresher material and operational skill practice.

4. Optimal placement of refresher training and/or OJT over the delay from training to operational job activities. In particular, is such supplemental training effective when it is given substantially before transfer actually occurs?

5. The value of refresher training in renewing previously trained skills over longer intervals. In particular, is the retention component of transfer facilitated by refresher training used as a "bridge," as when a man is needed in a job other than in his MOS over a relatively long period, but takes a refresher course to try to "stay sharp" for the ultimate assignment in his MOS?

It must be kept in mind that ultimate program evaluation decisions are dependent upon a constellation of factors. These empirical,

"summative" issues, even if resolved unambiguously for the proposed program, must still be weighed along with other issues (e.g., formative evaluation, cost, etc.). It is the task of the Army planners and decision makers to weigh the importance of each factor before accepting, rejecting, or modifying the training program.

Answers to these issues presuppose the existence of relevant, comprehensive, reliable, and feasible measures of performance. Furthermore, it is assumed that in the context of the proposed training system, retention and transfer are truly distinct in terms of content and behavioral indicators. In other words, two questions can be legitimately asked of troops after they have completed training -- did they master the training content, and can they transfer those skills and that knowledge to a real-world situation? Furthermore, the experimental design assumes the existence of both refresher training modules and on-the-job training modules.

An illustrative experimental design is presented in Table 5 . The general format of the design involves 15 groups of subjects, each available to experimental contact at one or more of three points in time: immediately upon completion of training; approximately five weeks later, and finally, approximately three months after training. Two groups (Groups 2 and 4 in Table 5) are labeled "untrained" and would be tested before training -- or involve soldiers who are in programs unrelated to M48A5 tanks. These two groups are classical control groups for the first two issues discussed above; all other groups are experimental comparisons for one or more of the questions, and may also serve as controls for some of the questions.

Each of the five issues may be addressed by sets of comparisons among these 15 groups. When Group 1 is compared to Group 2, the classical immediate transfer question is answered; comparing Groups 7 and 10 to Group 2 indicates the absolute effect of typical (e.g., five

Table 5

Experimental Design

Group Name	Weeks From End of Training		
	Week 0	Week 5	Week 13
1. Immediate Transfer	T	(T)	(T)
2. Untrained Transfer	T	-	-
3. Immediate Retention	R	(R)	(R)
4. Untrained Retention	R	-	-
5. 5-Week Retention	-	R	-
6. 13-Week Retention	-	-	R
7. 5-Week Transfer	-	T	-
8. 5-Week OJT	-	OJT/T	-
9. 5-Week Refresher	-	REF/T	-
10. 13-Week Transfer	-	-	T
11. 13-Week OJT	-	-	OJT/T
12. 13-Week Refresher	-	-	REF/T
13. OJT before Transfer	-	OJT	T
14. Refresher before Transfer	-	REF	T
15. Refresher before Retention	-	REF	R

T = Transfer Test

R = Retention Test

OJT = On-the-job training module

REF = Refresher training module

weeks) and longer (e.g., 13 weeks) delays on transfer, while comparing Group 7 to Group 1, and Group 10 to Group 7 provides data on the incremental effect of delays on transfer. These comparisons relate primarily to the first issue above. Were this the only issue of concern the design could be restricted to these four groups.

The second issue is addressed by comparisons among Groups 3, 4, 5 and 6. When Groups 3, 5, and 6 are compared to Group 4, they provide information on absolute retention losses over time. By comparing Groups 5 to 3 and 6 to 5, the incremental losses may be estimated.

The effectiveness of refresher training and OJT is evaluated by comparing groups with supplemental training to groups which are transferred at the same delay interval. Thus, Groups 8 and 9 are compared to Group 7 to determine the effectiveness of each of the two kinds of intervention at a five-week transfer delay. Groups 8 and 9 also are compared to each other to test the relative effectiveness of refresher training vs. OJT. Similarly, Groups 10, 11, and 12 are used to consider the effectiveness of supplemental training after a longer delay (e.g., 13 weeks).

Groups 13 and 14 receive supplemental training substantially before transfer, and when compared to Groups 11 and 12, would reveal the relative effectiveness of the timing of such training. When they are compared to Group 10 they indicate the absolute effectiveness of this type of "bridge" training on transfer.

Group 15 is used to examine the impact of refresher training on the retention component of transfer, again where the training is supplied as a bridge. It may be compared to Group 6 to measure its absolute effectiveness; a composite comparison may also be made to consider the difference between Groups 15 and 6 vs. the difference between Groups 14 and 10 to get the relative effectiveness of "bridge" training on the two components of transfer.

Table 6 summarizes the basic comparisons planned in order to address each research issue. The primary technique for performing these comparisons is analysis of covariance. End-of-course scores serve as the covariate data for adjusting for a priori between-group differences. The primary dependent measure is group performance on the transfer or retention test. Where three or more groups are involved in a comparison, planned linear contrasts are used after, or in place of, the overall analysis. In order to describe transfer differences among various groups, any of several transfer formulas could be used. These formulas could also be used in a slightly modified form to describe relative retention losses.

This design has been developed with several considerations in mind, not the least of which are practical problems. For example, it is not reasonable to assume that performance on the retention test is independent of performance on the transfer test. Thus, if troops took the transfer test followed by the retention test, we would expect that the taking of the transfer test would act as a refresher and improve performance on the retention test. Therefore, no single group is ever tested on more than one test of either type. This accounts, in part, for the relatively large number of test groups in the design. Groups 1 and 3 are exceptions; their crucial data comes from the first test they take. Subsequent tests, enclosed in parentheses in Table 6 , are used as additional checks on the reliability of the tests, and as rough indicators of the effects of standard Army procedure on subsequent transfer and retention performance.

Practical problems in implementing the design are apparent. The requirement for field support for training and testing is appreciable and some reduction in optimal group size would probably occur. The trade-off, of course, is that the comparisons have decreasing statistical power, and an increasing burden is placed on the tests, which will have to be more reliable (and therefore probably longer and more difficult to administer) as group size is decreased.

TABLE 6 . SUMMARY OF EXPERIMENTAL COMPARISONS AND ASSOCIATED ISSUES

Groups Compared "Experimental" vs. "Control"		
1	2	Transfer effectiveness of program--using classical transfer for paradigm (Issue 1)
7, 10	2	Transfer effectiveness of program--delayed transfer paradigm (Issue 1)
7 10	1 7	Transfer effectiveness of program (Issue 1) as an incremental function of delay (Issue 1)
3	4	Training gain from program (Issue 2)
5, 6	3	Absolute retention loss as a function of delay (Issue 2)
5 6	3 5	Retention loss as an incremental function of delay (Issue 2)
8	7	Transfer gain from OJT after short delay (Issue 3)
9	7	Transfer gain from refresher training after short delay (Issue 3)
8	9	Relative effectiveness of refresher training and OJT after short delay (Issue 3)
11	10	Transfer gain from OJT after long delay (Issue 3)
12	11	Transfer gain from refresher training after long delay (Issue 3)
11	12	Relative effectiveness of refresher training and OJT after long delay (Issue 3)
13	10	Transfer gain from OJT which substantially precedes transfer (Issue 4)
13	11	Comparative transfer effectiveness when OJT immediately precedes transfer vs. substantially precedes it (Issue 4)
14	10	Transfer gain from refresher training which substantially precedes transfer (Issue 4)
14	12	Comparative transfer effectiveness when refresher training immediately precedes transfer vs. substantially precedes it (Issue 4)
15	6	Absolute effect of "bridge" refresher training on retention (Issue 5)
(15-6)	(14-10)	Estimate retention and non-retention components of transfer with "bridge" training (Issue 5)

Conclusions

The experimental design presented above can be considered as merely illustrative of a summative evaluation study or as an "ideal" design, to be used prescriptively. In the latter usage, the presumptions of the design are the true critical issues - can relevant, comprehensive, reliable, and feasible measures of training and performance objectives be developed? If the group comparisons are statistically significant, do we have confidence that the observed support for the experimental hypotheses have been meaningfully addressed? The design of any training program represents the summative preferences among options at many points in the training structure. The greater the complexity of the behavioral changes desired, the greater the number of choices that must be made during program construction and the smaller the probability that a single test (or set of experimental hypotheses) will be particularly informative or evaluative. Naturally, whenever it is possible to break up a long and involved program into a series of discrete hypotheses, confidence as to the attribution of outcomes is increased when proper experimental controls and designs are employed. If sufficient investments of resources are made in the establishment of "good" tests and measures, summative evaluations of the type illustrated by the above design can be powerful tools for Army planners; if these prior investments have not been made, the use of a sophisticated design would be fruitless.

APPENDIX K

CONSOLIDATED EQUIPMENT LISTS FOR READINESS TESTS AND MODULE OUTLINES

DRIVER'S READINESS TEST

PART A.

. Written pre-tests for TEC Lessons:

020-171-5366-F
020-171-5367-F
020-171-5368-F
020-171-5369-F
020-171-5370-F

. Paper and pencil

PART B.

. M48A5 with BII

PART C.

. Written pre-tests for TEC Lessons:

020-171-1611-F
020-171-1612-F
020-171-1614-F

. Oral post-test for TEC Lesson:

935-171-0203-F

. Paper and pencil

PART D.

. M48A5 with BII

. Tactical driving course with obstacles and simulated targets

. Scenario of driving commands

. Scenario of fire commands

DRIVER'S MODULES AND UNITS

MODULE D-1.

. Five filmstrips and five audio cassettes:

TEC Lessons: 020-171-5366-F
020-171-5367-F
020-171-5368-F
020-171-5369-F
020-171-5370-F

. Beseler Cue/See

. Paper and pencil

MODULE D-2.

. M48A5 with BII

. Pocket-sized job aids listing steps in:

- Removing M27 periscope
- Installing M24 periscope and checking operation
- Starting tank engine
- Idling engine for oil checks

UNIT D-3.1.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-1614-F

. Beseler Cue/See

. Paper and pencil

UNIT D-3.2.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-1612-F

. Beseler Cue/See

. Paper and pencil

UNIT D-3.3.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-1611-F

. Beseler Cue/See

. Paper and pencil

UNIT D-3.4.

. Sufficient terrain to provide several natural and man-made objects of each of the following types:

- vehicles (any type, including non-military)
- buildings
- terrain features

(Objects within each category should be at various distant ranges.)

UNIT D-3.5.

. Three filmstrips and three audio cassettes:

TEC Lessons: 935-171-0201-F
935-171-0202-F
935-171-0203-F

. Beseler Cue/See

. Paper and pencil

UNIT D-4.1.

. Two filmstrips and two audio cassettes:

TEC Lessons: 945-171-0100-F
945-171-0101-F

. Beseler Cue/See

. Paper and pencil

UNIT D-4.2.

. M48A5 with BII

. Sufficient terrain to provide several natural or man-made obstacles of each of the following types:

- vertical obstacles (fallen trees, rocks, etc.)
- ditches
- hills
- water obstacles

(Obstacles within each category should represent a range of difficulty, including at least one that cannot be negotiated. Terrain should also provide features such as ridges, suitable for tank defilade.)

UNIT D-5.1.

. Short programmed text teaching the principles of evasive driving.

. Photographs of terrain with designated enemy threat (as seen from Driver's station). Photographs should represent the range of terrain situations. [Each would have the acceptable type and route of evasive driving maneuver for that situation printed on the back.]

. Paper and pencil

UNIT D-5.2.

- Simple mock-up of the Driver's station containing the brake, accelerator, steering control and seat. The brake and accelerator should be similar in response and configuration to those in a tank. The steering control need not be operable. The relative position of the four components should be highly similar to that in a tank.
- Audio cassette recording(s) of instructions, fire commands and feedback
- Cassette player

LOADER'S READINESS TEST

PART A.1.

. Written pre-tests for TEC Lessons:

020-171-5366-F
020-171-5367-F
020-171-5368-F
020-171-5369-F
020-171-5370-F
(exclusive of portions on tank batteries)
020-171-5332-F
020-171-5352-F
(exclusive of portion on M85)

. Paper and pencil

PART A.2.

. M48A5 with BII

. Boresight target at 1200 meters

. Ammunition stowage plan

. Dummy main gun rounds

- 3 APDS
- 3 HEP
- 2 HEAT
- 1 APERS

PART B.1.

. Written pre-tests for TEC Lessons:

020-171-5331-F
020-171-5346-F
020-171-5347-F
020-171-5348-F

. Paper and pencil

PART B.2.

. M48A5 with BII

. Dummy main gun rounds

- 3 APDS
- 3 HEP
- 2 HEAT
- 1 APERS

. Dummy 7.62mm ammunition

PART C.1.

. Written pre-tests for TEC Lessons:

020-171-1131-F
020-171-1132-F
020-171-1133-F
020-171-5241-F

. Paper and pencil

PART C.2.

. M48A5 with BII (complete gun-tool roll stowed)

. M219 machinegun, mounted

. Dummy 7.62mm ammunition

PART D.

. Replenisher tape mock-up. [See MODULE L-7 for complete description.]

PART E.

. Written pre-tests for TEC Lessons:

020-171-1612-F
020-171-1614-F

. Oral post-test for TEC Lesson:

935-171-0203-F

. Paper and pencil

LOADER'S MODULES AND UNITS

UNIT L-1.1.

. Five filmstrips and five audio cassettes:

TEC Lessons: 020-171-5366-F
020-171-5367-F
020-171-5368-F
020-171-5369-F
020-171-5370-F

. Beseler Cue/See

. Paper and pencil

UNIT L-1.2.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-5332-F

. Beseler Cue/See

. Paper and pencil

UNIT L-1.3.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-5352-F

. Beseler Cue/See

. Paper and pencil

MODULE L-2.

. M48A5 with BII

. Block of wood 1" x 6" x 6"

. Heavy black thread

. Tape

. Pocket-sized job aids listing steps in:

- Checking and servicing engine and transmission oil
- Checking and adjusting track tension
- Boresighting M219 machinegun
- Prepare-to-fire procedures

UNIT L-3.1.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-5331-F

. Beseler Cue/See

. Paper and pencil

UNIT L-3.2.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-5346-F

. Beseler Cue/See

. Paper and pencil

UNIT L-3.3.

. Two filmstrips and two audio cassettes:

TEC Lessons: 020-171-5347-F
020-171-5348-F

. Beseler Cue/See

. Paper and pencil

UNIT L-4.1.

- M48A5 with BII
- Dummy main gun rounds
  - 3 APDS
  - 3 HEP
  - 2 HEAT
  - 1 APERS
- Audio cassette recordings of instructions, fire commands and feedback. [Various mixes of fire commands should be recorded in blocks of five; the blocks should be graded from easy to difficult in terms of the mix of commands and time allowed to execute each.]
- Cassette player

UNIT L-4.2.

- M48A5 with BII
- M219 machinegun, mounted
- Dummy main gun round
- Belt of dummy 7.62mm ammunition

UNIT L-5.1.

- One filmstrip and audio cassette:

  TEC Lesson: 020-171-5241-F
- Beseler Cue/See
- Paper and pencil

UNIT L-5.2.

- Filmstrip and audio cassette:

  TEC Lesson: 020-171-1131-F
- Beseler Cue/See
- Paper and pencil

MODULE L-6.

- M48A5 with BII (complete gun-tool roll stowed)
- Belt of dummy 7.62 ammunition

MODULE L-7.

. Replenisher tape mock-up. [See MODULE L-7 for complete description.]

MODULE L-8.

. Same as UNIT D-3.1.
UNIT D-3.2.
UNIT D-3.3.
UNIT D-3.4.
UNIT D-3.5.

GUNNER'S READINESS TEST

PART A.

. M48A5 with BII

PART B.

. Written pre-tests for TEC Lessons:

020-171-5351-F
020-171-5355-F
020-171-5342-F
020-171-5337-F
020-171-5354-F
020-171-5352-F
020-171-5353-F

. Paper and pencil

PART C.

. M48A5 with BII

. M219 machinegun, mounted

. Main gun boresight and zero panels at 1200 meters

. M219 machinegun boresight panel at 1200 meters

. M219 machinegun zero panel at 800 meters

PART D.

. Written pre-tests for TEC Lessons:

020-171-1611-F
020-171-1612-F
020-171-1614-F

. Oral post-test for TEC Lesson:

935-171-0203-F

. Paper and pencil

PART E.

. M48A5 tank with BII

. M219 machinegun, mounted

. Dummy main gun round (loaded)

. Blank M219 machinegun rounds

.Tactical driving course with obstacles and terrain conditions suitable for tank defilade.

. Simulated targets (both moving and stationary, main gun and coaxial)

. Scenario of fire commands

GUNNER'S MODULES AND UNITS

MODULE G-1.

. M48A5 tank with BII

. M219 machinegun, mounted

. Pocket-sized job aids listing steps in:

- Placing the turret into power operation
- Prepare-to-fire procedures

UNIT G-2.1.

. Six filmstrips and six audio cassettes:

TEC Lessons: 020-171-5351-F
020-171-5342-F
020-171-5337-F
020-171-5355-F
020-171-5354-F
020-171-5352-F

. Beseler Cue/See

. Paper and pencil

UNIT G-2.2.

. M48A5 tank with BII

. M219 machinegun, mounted.

. Main gun and M219 machinegun boresight panel at 1200 meters

UNIT G-3.1.

. One filmstrip and audio cassette:

TEC Lesson: 020-171-5353-F

. Beseler Cue/See

. Paper and pencil

UNIT G-3.2.

. M48A5 with BII and subcaliber device attached

. M219 machinegun, mounted

. Main gun zero panel at scaled range of 1200 meters.

. Subcaliber ammunition

MODULE G-4.

- **Same as** UNIT D-3.1
  UNIT D-3.2
  UNIT D-3.3
  UNIT D-3.4
  UNIT D-3.5

UNIT G-5.1.

- **One filmstrip and audio cassette:**

  TEC Lesson: 020-171-5347-F

- **Beseler Cue/See**
- **Paper and pencil**

UNIT G-5.2.

- **One filmstrip and audio cassette:**

  TEC Lesson: 020-171-5364-F

- **Beseler Cue/See**
- **Paper and pencil**

UNIT G-5.3.

- **One of the following gunnery trainers:**
  - Laser Gun Firing Trainer (DVC 17-33; Model 3A102B)
  - Subcaliber Devices:
    - .22 caliber (inbore) (DVC 17-53)
    - Brewster Device (DVC 17-87)
    - Telfare Device (DVC 17-88)
  - Conduct-of-Fire Trainer (DVC 17-4)
- **Range or terrain board appropriate to the terrain**
- **Targets and other supporting equipment**

UNIT G-5.4.

- **M48A5 with BII**
- **M219 machinegun, mounted**
- **Blank M219 machinegun rounds**
- **Tactical driving course with obstacles and terrain conditions suitable for tank defilade**
- **Simulated targets (both moving and stationary, main gun and coaxial)**
- **Scenario of fire commands**

TANK COMMANDER'S READINESS TEST

PART A.

- M48A5 with BII
- M219 machinegun, mounted
- M2 machinegun, mounted

PART B.

- Written pre-tests for TEC Lessons:

  020-171-5335-E
  020-171-5340-F
  020-171-5355-F
  020-171-5352-F
  020-171-5343-F
  020-171-5354-F
  020-171-5353-F

- Paper and pencil

PART C.

- M48A5 with BII
- M219 machinegun, mounted
- M2 machinegun, mounted
- Main gun and M219 machinegun boresight panel at 1200 meters
- M2 machinegun boresight panel at 500 meters
- Main gun zero panel at 1200 meters
- M219 machinegun zero panel at 800 meters
- M2 machinegun zero panel at 500 meters

PART D.

- Written pre-tests for TEC Lessons:

  020-171-1611-F
  020-171-1614-F

- Oral post-test for TEC Lesson:

  935-171-0203-F

- Paper and pencil

PART E.

- M48A5 tank with BII
- M219 machinegun, mounted
- M2 machinegun, mounted
- Blank coaxial machinegun rounds
- Tactical driving course with obstacles and terrain conditions suitable for tank defilade
- Simulated targets (both moving and stationary, main gun, coaxial, and M2 machinegun)
- Scenario of fire commands

TANK COMMANDER'S MODULES AND UNITS

UNIT TC-1.1.

- One filmstrip and audio cassette:

  TEC Lesson: 941-071-0117-F

- Beseler Cue/See
- Paper and pencil

UNIT TC-1.2.

- M48A5 with BII
- M219 machinegun, mounted
- M2 machinegun, mounted

UNIT TC-2.1.

- Five filmstrips and six audio cassettes:

  TEC Lessons: 020-171-5335-E
  020-171-5340-F
  020-171-5355-F
  020-171-5343-F
  020-171-5354-F
  020-171-5352-F

- Beseler Cue/See
- Paper and pencil

UNIT TC-2.2.

- M48A5 with BII
- Six 6-by-6 foot target panels at varying known ranges from 1,000 to 3,500 meters

UNIT TC-2.3.

- M48A5 with BII
- M219 machinegun, mounted
- M2 machinegun, mounted
- Main gun and M219 machinegun boresight panel at 1200 meters
- M2 machinegun boresight panel at 500 meters

UNIT TC-3.1.

- One filmstrip and audio cassette:

  TEC Lesson: 020-171-5353-F
- Beseler Cue/See
- Paper and pencil

UNIT TC-3.2.

- M48A5 with BII and subcaliber device attached
- M219 machinegun, mounted
- M2 machinegun, mounted
- Main gun zero panel at scaled range of 1200 meters
- M2 machinegun zero panel at scaled range of 500 meters
- Subcaliber ammunition

MODULE TC-4.

- Same as UNIT D-3.1
  UNIT D-3.2
  UNIT D-3.3
  UNIT D-3.4
  UNIT D-3.5

UNIT TC-5.1.

- One filmstrip and audio cassette:

  TEC Lesson: 020-171-5361-F
- Beseler Cue/See
- Paper and pencil

UNIT TC-5.2.

- One filmstrip and audio cassette:

  TEC Lesson: 020-171-5364-F

- Beseler Cue/See
- Paper and pencil

UNIT TC-5.3.

- Same as UNIT G-5.3

UNIT TC-5.4.

- M48A5 with BII
- M219 machinegun, mounted
- M2 machinegun, mounted
- Blank M219 machinegun rounds
- Sufficient terrain to provide several natural and man-made obstacles and features such as ridges suitable for tank defilade
- Simulated targets (both moving and stationary, main gun, coaxial, and M2 machinegun)
- Scenario of fire commands