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BRADLEY INFANTRY FIGHTING VEHICLE PROCEDURES GUIDES: EVALUATION

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training and as aids during refresher or cross-training. Recommendations for publishing format and distribution are presented.

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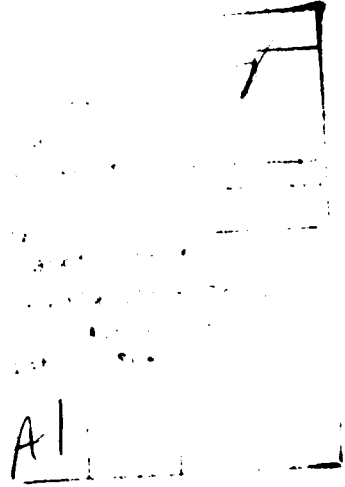
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BRADLEY INFANTRY FIGHTING VEHICLE  
PROCEDURES GUIDES: EVALUATION

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## INTRODUCTION

For a number of years, the Army Research Institute (ARI) has been involved in efforts related to improving training for soldiers in both collective and individual skills. At the same time, ARI has been associated with the development and field testing of the Bradley Infantry Fighting Vehicle (BIFV) and its associated training devices. In support of the U.S. Army Infantry School and Director of Training Development's attempt to maximize the effectiveness of the Bradley M2 Vehicle, ARI has further expanded BIFV training materials with the construction of a Procedural Guide for each of the three major operator positions; (1) Bradley Commander; (2) Gunner; and, (3) Driver. The Bradley Commander's tasks include overall responsibility for the vehicle, and target and weapon selection. He can take over firing of the turret weapons if necessary, and he insures that preventive maintenance checks and services are performed as needed throughout the vehicle. The gunner is responsible for the turret in general and for the operations and maintenance of the major weapons systems. He coordinates with the commander and supervises ammunition resupply. The driver's tasks focus on the operation of the vehicle itself, and on maintenance checks on the hull and driver's areas. The three position-specific guides cover both operational and maintenance tasks; they do not attempt to address tactics and battle drills. The guides are not intended for use as a substitution for the existing Bradley Technical manual. They do provide a supplementary source of information useful in the operational and training environment.

### Previous Research

The Bradley Procedure Guides are modeled after those created by the Army Research Institute - Fort Knox Field Unit for the M1 Abrams Tank (Vaughan,

Silbernagel, & Goldberg, 1981). The M1 Guides were produced in response to the need to improve performance levels for various M1 tasks. The M1, with its complex set of systems, is similar to the Bradley M2 in that there are some tasks which require a great number of steps. Some steps are very complicated and many tasks require careful sequencing of steps. The major training reference for the M1 is the technical manual (TM 9-2350-225-10) which contains a highly proceduralized set of tasks and detailed pictures of equipment. The manual is complete and accurate, but it presents a number of problems. It is cumbersome because of its size, the index is difficult for the operators to use, and only one manual is issued per vehicle. These problems were seen as possible contributing factors to the relatively poor performance of tank tasks by M1 commanders, gunners, drivers and loaders (Goldberg & Campbell, 1983).

Accordingly, Procedure Guides for each M1 crewman were produced, in an effort to provide an alternative training aid (i.e., a supplement to the TM which would present fewer problems for the individuals who tried to use it). In the M1 Guides, tasks which are not complicated are presented in line-by-line form, with the names of tasks listed in the correct sequence. More complex tasks are presented in a flowchart format with decision trees at choice points. The steps within a procedure are sequenced, and the use of symbols highlights the subtasks. Warnings and cautions are presented, as well as indications as to when vehicle indicator lights are critical. The terminology is identical to that found in the technical manual and a table of contents is provided. Each operator guide also contains a checklist of the preventive maintenance checks and services for which that operator is responsible. The Commander's Guide contains a Master Checklist which enables him to supervise the other crew members.

The M1 Guides were field tested at Fort Knox and Fort Hood and found to be useful and effective (Goldberg & Campbell, 1983). However, general performance on the tasks was still so low that it was felt that perhaps the tasks had not been mastered at the time of testing. This would indicate that additional job aids during training might have been beneficial. Although some persons were found to have difficulty with the format of the guides, it was felt that this problem would probably disappear as trainees became more familiar with the style. Some persons made errors which indicated that they were not thoroughly familiar with the tasks, and did not recognize abbreviations. Also, it seemed that during training the individuals had not been required to perform each substep in an accurate manner. Training focus had been placed on the task as a whole, rather than on the elements.

However, the Procedure Guides were found to be as effective as the Technical Manual and a TM checklist, and they were very well received by the trainees. It was the conclusion of the Fort Knox researchers that the Guides showed definite utility, and could be beneficial if introduced early in training with command emphasis to insure that they were being utilized. Task performance accuracy might then increase and full utilization could be made of the M1 vehicle.

#### Development of BIFV Procedure Guides

Because of the favorable results of the Knox testing, very few changes were made in M2 format during the development of the M2 Bradley Infantry Fighting Vehicle Guides. The required sequence of tasks was identified and the more complex steps or procedures were detailed. The symbols indicating decisions, warnings, and lights employed in the M1 Guides were adopted for use with the Bradley Guides. (See Appendix A for symbols and sample pages from each guide.) Visually, each page is broken by boxes or other attention



getters and, as much as possible, only one task is presented on each page to provide maximum clarity without unduly wasting space. The only abbreviations used are those found in the technical manual or on the driver, gunner, and commander instrument panels. Whenever there seemed to be any doubt as to whether a trainee might understand a procedure, more steps or explanations were included to minimize confusion.

The tasks for inclusion in the guides were identified from the tasks presented in TM 9-2350-250-10-1, Fighting Vehicle, Infantry, M2, Hull, and TM 9-2350-250-10-2, Fighting Vehicle, Infantry, M2, Turret. The tasks were further refined by analysis of Soldier's Manuals, (FM 11M10, -20, -30, -40, Soldier's Manual, Fighting Vehicle Infantryman), by informal discussions with members of the Fort Benning Bradley Task Force, and by consultation with NCOs responsible for training soldiers in operation of the Bradley. (Appendix D contains the entire task list.)

Each BIFV operator task was separately examined for possible proceduralization in light of the following criteria:

1. If the task was judged to be relatively simple with no substeps, or was one which could be performed by trainees using skills typically acquired prior to entry level training, the task was designated a checklist task. Proceduralization was indicated only if the task difficulty exceeded this minimum difficulty level.

2. Some tasks are practiced so many times during training that they are overlearned by trainees. The tasks are taught, reinforced, taught again, and practiced and tested throughout training. Tasks of this nature have lost their complexity, and were thus retained on a checklist of tasks requiring performance, but not proceduralization.

3. If the task was one in which correct performance or sequencing of steps was in any way critical to the safety of personnel, to the integrity

of the vehicle, or to accomplishment of the designated mission, then proceduralization was indicated.

4. Some tasks are performed very rarely by BIFV crews and thus do not acquire sufficient practice to insure long-term retention of the individual task steps. Proceduralization of these tasks helps insure that important steps, if forgotten over time, will be available for quick reference.

5. Some tasks require proceduralization because of their lack of delay tolerance; e.g., misfire procedures. These tasks must be learned so thoroughly that reaction is immediate, and the crew member responsible for performing the task does not have time to look at a proceduralized guide. These tasks are detailed in a proceduralized form for quick refresher training, or in case of emergency conditions when the tasks need to be performed by persons not accustomed to performing them.

Tasks which met the proceduralization criteria were analyzed separately, and substeps presented in the M1 Guide format with terminology and sequencing identical to the Technical Manual. Then the tasks were separated by operator position and presented in a logical order within each guide. The vehicle starting operations and the checks which would be made as a mission begins are included, as well as normal and unusual operations. Procedures are included for loading and firing the weapons systems, for shutting down the vehicle, and performing immediate action when necessary. Also included are lists of preventive maintenance checks and services (PMCS) which each operator is responsible for doing or supervising, before, during, and after operations. (See Appendix A for Tables of Contents for M2 Procedure Guides.)

#### OBJECTIVES

The objective of this testing was to ascertain the usefulness, completeness and effectiveness of the BIFV Procedure Guides. It was designed to

determine whether the soldiers, during their training cycles, could use the Guides, and whether the abbreviated format was sufficiently comprehensive to enable trainees to perform the tasks correctly. The testing was also intended to expose the trainees to the Guides, to see how well they liked them as job and/or training aids.

The Bradley M2, with its 9 or 10 man crew, has three main duty positions, and 6 or 7 crew members who ride in the squad area in the back and are responsible for the firing port weapons. Many of the Gunner and Commander tasks are interchangeable and could allow for cross-training, but the Driver does not learn any of the Gunner or Commander tasks.

#### M1 Abrams Task Procedure Guides Validation

Since the M1 Guides were precursors to the BIFV Guides, the Fort Knox testing will be reviewed. The M1 Guides were tested against the technical manual and a technical manual checklist. Subjects were tank trainees and experienced operators from Fort Knox and Fort Hood.

A series of Driver, Loader, Gunner, and Commander tasks were performed by each subject. The Guides were evaluated on the basis of performance accuracy, time to perform a task, and time to locate a task in the training aid (TM, Procedure Guide or Checklist). The Fort Knox testing found that the Guides were useful, were easier to use than the other aids, and did not decrease performance accuracy.

#### M2 BIFV Procedure Guide Validation Approach

The statistical approach to evaluation which was used for the M1 guides was judged to be inappropriate for the conditions available for testing the soundness of the Bradley guides, for a number of reasons. First, though the M1 analyses were performed on small samples, even smaller numbers of trained Bradley Commanders, Gunners, and Drivers are presently available to try out

each of the three position-specific guides. The lack of position cross-training prevented combining groups to enlarge the sample for each separate guide.

Secondly, since the available subjects were trainees just completing one of the courses designed to teach the tasks assigned to a particular Bradley operator position, the level of performance when using a BIFV Procedure Guide did not appear to be an issue. The past experience of course instructors indicated that there would be little variance from a uniformly high level of task performance by the subjects recently completing training.

Another focus of the Fort Knox testing procedure was the time it took subjects to perform the tasks. It proved difficult to determine if subjects were slow because they were thorough or because they were unfamiliar with the material. Similarly, others could have been finished quickly because they were knowledgeable or because they hurried and did not take the time to complete all the steps. For the Bradley, some tasks are timed for end of course testing, but the method is one where an upper limit is given and all subjects must perform the task within that particular time frame. The actual time is of little importance as long as it falls within the limit. Further, since during training many of the tasks have no time standard, to impose one during testing might inappropriately affect the subjects' performance as they strived to meet or beat an arbitrary standard. Accordingly, the M2 Guides tasks were not tested for time to complete each task.

The Fort Knox testing also compared the time required to locate tasks in the Guides, the Checklist, or in the Technical Manual. Since the number of pages contained in the Bradley Procedure Guides is so much smaller than in the TMs (24 in the Driver's Guide vs. more than 500 in the Hull TM; 85 in the Commander Guide vs. more than 600 in the Turret TM), task location should be easy for anyone who has had the time to read the Table of Contents. Since the

BIFV trainees did not have time to study the Procedure Guides, it was decided that time to locate was not a meaningful measure at this time. Also, the TM might have been dog-eared or otherwise marked after weeks of use; the most frequently used page numbers may have been memorized, giving an artificially fast time-to-locate score.

Accordingly, testing of the BIFV Guides was done on a more informal basis than that of the M1, emphasizing the usefulness and effectiveness of the guides, rather than attempting a statistical comparison of the utility of the guides versus the manual. Since the guides are meant to supplement the manual, rather than supplant it, this choice seems defensible.

Validation of the Bradley Infantry Fighting Vehicle Guides consisted of several separate steps. A sample of the operator and maintenance tasks presented in the Guides was tested in a motor pool setting at Fort Benning. (Practical constraints prevented testing any tasks related to weapons systems or vehicular movement.) Subjects were soldiers who were at different stages in their Bradley training. In each case, a trainee was tested on an individual basis, although the actual testing methods differed for the three Guides.

The trainees were also given a questionnaire designed to measure their perceived abilities to perform Bradley related tasks. The questionnaire does not attempt to measure the trainees' actual abilities to perform the tasks; rather, the intention was to obtain an impression of how well they felt they could perform. (See Appendix C for the questionnaire and results.)

The results of the evaluation approach are presented separately for each of the three Bradley Guides in the following sections. The discussion section presents the results of a final review of the content of the guides by SMEs, and recommendations for implementation of the guides.

## DRIVER'S GUIDE

### Introduction

The BIFV Driver's Course is the introduction to the 11M Bradley MOS. The course is taught by the Infantry Training Group (ITG) as a three week add-on to the regular 12-week One Station Unit Training (OSUT) course offered at Fort Benning. Therefore, the attendees are newly trained recruits with no unit experience. Many of the graduates of the Driver's Course are eventually assigned to Bradley driver duty positions in units; others become members of the dismounted Bradley squad and responsible for the on-board firing port weapons and other squad duties.

### Method

The subjects for the testing of the Driver's Guide were 17 soldiers who had completed all requirements of the 11M OSUT add-on except for the End-of-Course Test. Subjects were gathered in a classroom setting and the purpose of the research was explained, together with the assurance that their performance would in no way impact on their Army careers. They were then given a questionnaire concerning their impressions and perceptions of how well they felt they could perform certain Bradley tasks. (This questionnaire, and the rationale for its administration is discussed in Appendix C.) Copies of the Driver's Guide were then distributed to each student. They were encouraged to look at the guides and the format, and then the instruction or general information page was explained in detail (see Appendix B, Driver's Guide Testing). After each symbol and the Table of Contents had been explained, the trainees were told to turn to a specific page in their guides, and the steps of the task, Slave Start: Start Vehicle with Outside Power Source, were

covered, one at a time, with the use of the symbols and boxes again explained. The testing began after each student had had an opportunity to examine the guide.

The students were then taken individually to vehicles in the motor pool area. They were assigned numbers, and were called in order; each of the five experimenters taking the next person in numerical order, so that the process would not be slowed down by any one trainee. All subjects performed the same sample of tasks, in an order counter-balanced for sequence of task performance, and training aid (Guide or TM) used. The orders of task presentation for each subject and the particular training aid used for each task are presented in Table 1. Total time spent with each subject averaged at least 30 minutes.

Four tasks normally performed by the driver were tested and each of these tasks consisted of many substeps.

Task 1: During Operations Preventive Maintenance Checks and Services (PMCS). During operations, the driver must make a number of checks within his compartment. Performance of these checks was observed. Everyone did PMCS using either the TM or the Procedure Guide. With one exception, each of the tasks required within PMCS was familiar to the subjects. The unfamiliar task, Operate the Personnel Heater, had been mentioned, but never actually performed because of the summertime heat. During testing, subjects were requested to operate the heater (briefly) either with the TM as guide or by following the Procedure Guides steps.

Task 2: Start to Stop. Another element of testing was the Start through Shutdown procedures. This included preparing the driver's station, actually starting the engine, shutting it down at the end, and turning on and off all equipment. The experimenters were aware that all of the subjects were capable of following the techniques described in the TM, and probably did not

Table 1  
Order of Presentation of Tasks  
Driver's Guide Testing

Subject Number	First Task	Second Task	Third Task
1	PMCS - DG	NV - None	S - S - PG
2	PMCS - TM	NV - PG	S - S - PG
3	PMCS - PG	NV - TM	S - S - PG
4	S - S - PG	PMCS - TM	NV - None
5	S - S - PG	PMCS - PG	NV - PG
6	S - S - PG	PMCS - TM	NV - TM
7	NV - None	S - S - PG	PMCS - PG
8	NV - PG	S - S - PG	PMCS - TM
9	NV - TM	S - S - PG	PMCS - PG
10	PMCS - TM	NV - None	S - S - PG
11	PMCS - PG	NV - PG	S - S - PG
12	PMCS - TM	NV - TM	S - S - PG
13	S - S - PG	PMCS - PG	NV - None
14	S - S - PG	PMCS - TM	NV - PG
15	S - S - PG	PMCS - PG	NV - TM
omit	<NV - None>	<S - S - PG>	<PMCS - TM>
16	NV - PG	S - S - PG	PMCS - PG
17	NV - TM	S - S - PG	PMCS - TM

PMCS = Preventive Maintenance Checks and Services  
S - S = Start Through Shutdown Procedure  
NV = Night Viewer Installation  
TM = Technical Manual  
PG = Procedure Guide  
None = No Performance Aid

TOTALS: PMCS - TM = 8  
PMCS - PG = 9  
S - S - PG = 17  
NV - None = 5  
NV - TM = 6  
NV - PG = 6



need any performance aids. However, all subjects were told to use the Procedure Guides for each step, even if they did not want or need to.

Task 3: Install Driver's Night Viewer. Installation of the driver's night viewer involves removing the driver's periscope from the hatch cover, unstowing and connecting the night viewer, and stowing the periscope. Finally, the night viewer is restowed and the periscope reinstalled. Subjects were assigned to one of three groups; to use the TM, the Procedure Guides, or no performance aid at all.

Task 4: Erect/Stow Swim Barrier. The task erect and stow the swim barrier is a group effort, supervised by the driver. Normally, as many crew members as are present will help in installing the barrier; in training, groups of six are used. Accordingly, the students were divided into groups of 6, 6, and 5 and asked to erect the barrier using only the Procedure Guide. A leader was picked at random from the groups and he was given the Guide. When the barrier was erected, one of the cadre NCOs inspected it to insure that no step had been omitted or incorrectly performed. After approval, the barrier was removed and stowed, again following the Procedure Guide.

### Results

In general, performance accuracy was very high and scoreable errors in tasks or subtasks were not systematically distributed. So few problems were experienced that failures appeared to be based on individual differences, rather than on any particular defects within the Procedure Guides. Therefore, the presentation of the results of testing focuses on the kinds of errors made by the few individuals who made any errors.

The trainees were so thoroughly trained in most cases that it was difficult to slow them down long enough to get them to use the guides or the TM. This was countered in some degree by each experimenter's insistence that the

subjects read the steps aloud as they performed them. (The original intent of the reading aloud had been to ascertain if reading ability affected performance.) Even with this method of forcing attention to each step, the subjects kept trying to move ahead quickly since they felt they needed no aids to perform the next steps.

An additional problem concerned serviceability of some of the vehicles. There were several instances of inoperable equipment, or deficiencies that prevented the trainees from performing exactly as required. The constraints of time and the numbers of vehicles available for use precluded changing vehicles when difficulties were found. (One benefit of faulty equipment was noted, however; where problems were found, the students were very quick to state that such failures should be reported on Form 2404 for unavailable equipment. At least one lesson had been very thoroughly learned.) The results of the driver testing are presented by task in the following section.

PMCS. The trainees had no difficulty in understanding the format of the PMCS Procedure Guides Checklist. There was a tendency to perform several steps at one time, such as checking several lights and gages at once, but trainees indicated that they tended to do this while using the TM as well as when using the Procedure Guide. Several lost their places in the list, perhaps due to unfamiliarity with it. When prompted by the experimenters, they had no difficulty in performing the tasks. Each experimenter worked with both the TM and the Procedure Guides checklists, and none noted any particular differences in trainee performance as a function of which text was being used. Within the PMCS, the task Operate the Personnel Heater had not previously been taught to the trainees. When the trainees came to that check, they were instructed to follow the procedures as given in the Guides or in the TM. The actual following of the steps proved to be no problem, but a few subjects had difficulty in locating the personnel heater. Too, several heaters proved

inoperable. The subjects did talk through the steps, however, and were apparently able to understand a task on which they had not previously had training. This indicates that the task could be performed correctly on the basis of the limited information presented within the Procedure Guides.

Start-to-Stop. There was a strong tendency for the trainees to skip ahead of the Guides in the start-to-stop procedures and begin the next step before reading it. Some of the steps in preparing the driver's station do not have to be performed in a set sequence, and trainees wanted to perform them in their own particular sequence. Checking of the driver's instrument panel gages had become so automatic that stopping to read the steps in the guides was obviously an inhibiting and apparently frustrating factor. Several omitted the steps requiring the sounding of the horn at ramp raising and lowering, and at engine start. When questioned, they volunteered that they knew no one was there because the others were inside doing other things. They also stated, correctly, that if they had really been going to move the vehicle, there would have been a ground guide for coordination purposes, and that they would have used the horn as well as hand and verbal signals to communicate with him.

A few of the trainees had difficulty with the decision point where they were told what to do if the engine did not start. Since no engine failed to start, no one should have had to read that section of the step. Several trainees read both the yes and no answers, some apparently because they did not understand the diagram; others said that they wanted to read the alternate answer out of curiosity, although they knew that they did not need to perform that step. Greater familiarity with the guides would certainly eliminate this problem.

Install and Remove the Driver's Night Viewer. The only problems observed had to do with trainee unfamiliarity with the guides and equipment failure.

Several subjects tried to perform both the battery power and vehicle power steps and a few lost their place in the Guides. The TM group had no difficulty. One individual who had missed his training on this task was able to perform it using only the guide. Other problems were equipment related. In one vehicle the protective cover kept falling off of the eyepiece, and the trainee, concerned about the viewing element, tried to stow the equipment at once. In another vehicle, the driver's periscope was stuck, and could not be removed from the hatch cover to make room for the night viewer. Subjects talked the experimenter through the steps with no apparent difficulty.

Erect and Remove the Swim Barrier. In one swim barrier group, the designated leader began the task, but as the task proceeded, another student took the guide and performed in the leadership role. The reason for this was not readily apparent, and the experimenter did not interfere. In another of the three vehicles, there were equipment problems. The trim vane could not be locked into an upright position and the barrier could not be erected. The training cadre worked unsuccessfully to remedy the problem, so only two barriers were actually erected.

Following the procedures presented no problem, and the steps contained sufficient information to permit the task to be performed correctly and completely. The sequencing presented some problems, as a tendency emerged for the group to divide into sections and work on different parts of the vehicle at the same time. Some sequencing is forced by the nature of the task; for other parts of the task sequencing is irrelevant. Several began, for example, to work on the rear corners of the barrier while others were still removing the front of the barrier from stowage. Similarly, both sides were being worked on simultaneously, and some persons were putting finishing touches on them while others were completing the front. There was also some tendency to ignore the guide as the subjects knew the task steps so well.

At no time did anyone refer to the TM for help. Similar results were obtained for removing and stowing the barrier.

In summary, the Driver's Guide was both useful and useable. The drivers seemed comfortable with it, and were able to perform their jobs using it. In many cases they did not need it, and it slowed their performance. Nowhere was performance quality reduced by the guide. Subjects said they liked the guide's size and format, and the convenience of the PMCS checklist. Several commented on the bulkiness of the Hull Technical Manual (nearly 500 pages) and the fact that a pocket size guide could be carried with them. The only comments on the absence of pictures or diagrams were from the students whom the experimenters had perceived as being the least comfortable with the tasks.

Thus, for the drivers, the least skilled and least experienced of all the persons associated with the Bradley Infantry Fighting Vehicle the Procedure Guides proved a useful, complete, and effective means of aiding performance and reinforcing training.

## GUNNER'S GUIDE

### Introduction

The Gunner's Course is a four week course which covers all of the material offered in the Driver's Course, plus turret operations and maintenance, and the loading and firing of the BIFV weapons systems. The students are generally E5s, with a large amount of previous Army experience. The Gunner's Course is taught by the Weapons Gunnery and Maintenance Department (WGMD) cadre.

## Method

The Gunner's Course was in its final week and there was very little time not previously scheduled. The only spare time was that available during the days when the trainees were at the firing range. Subjects were made available during the time when they were not engaged in firing, or in riding with those who were. The length of time required for instructions and safety briefings, and the students' desires to utilize their break periods for resting or lunch made it possible to test only 4 soldiers. However, since each of these individuals was tested for 45 minutes, alone with the experimenter, a great deal of information was gathered.

The results of the drivers' testing had indicated that the guides were useable, so only a few tasks were tested on the gunners using the Procedure Guide and the TM was not tested at all. Again, the testing was limited to non-firing tasks. The gunners were relatively experienced soldiers, and three of the four were National Guardsmen undergoing Bradley training at Fort Benning. Several indicated that the course was moving very fast, and that they were not too sure of themselves on some of the procedures.

After an explanation of the purpose of the testing and a brief introduction to the guides, each of the four trainees was given several gunner tasks. They were asked to use the guides for each step, whether or not they needed them, and were asked to read the steps aloud as they were performing them. They operated the turret in both the manual mode and the power mode, traversing the turret and elevating and depressing the 25mm gun. They were also asked to perform the steps required to start up and shut down the turret. They performed both before operation and during operation PMCS on the turret, although they did not dry fire the weapons. They performed the proceduralized

steps required in checking out the deck clearance system and the operations of the integrated sight unit. At a later time, all 25 gunners were administered the questionnaire on perceived task performance ability.

### Results

The gunner results derived were very similar to those obtained from the drivers. The trainees experienced no difficulty in using the guides, and they commented favorably on their brevity and convenience. Two of the trainees had some difficulty in pronouncing the words while reading aloud, although they showed no difficulty in performing the tasks. One individual who was uncertain about a step asked for the TM diagram, but he immediately withdrew the request. He said that he would gladly sacrifice the pictures for the convenience of the guide. He then went on to perform the task correctly.

The PMCS checklists were useful and each man said he had done as well on PMCS as he would have if he had been using the manual. One asked about the deficiency-reporting system and praised the convenience of the guide, likening it to an aviator's checklist. Again, the Procedure Guides seemed to slow the gunner trainees down for some procedures; they wanted to combine steps in a more convenient sequence or to do several things at the same time. The major complaints about the guides were based on the gunners' feelings that they did not really need to use them at this stage in training.

Some time was spent in conversation with the gunners, on the assumption that their previous Army experience would make them perceptive about different kinds of training aids. The general feeling was that they liked the guides and format, and would appreciate their convenience after they had learned the steps with the TM. They further indicated that since they were learning a great deal of material in their course, and since it was going to be difficult to retain all of it, the guides could be used as refreshers.

## COMMANDER'S GUIDE

### Introduction

The Bradley Commander is generally a squad leader or platoon leader, E6 through O3. At the present time, the commanders are trained in an intensive six-week course taught by the Weapons Gunnery and Maintenance Department at Fort Benning. They are taught the operator tasks for the entire vehicle, including weapons and driving, swimming, special operations, and all the maintenance tasks. Some tactical training, and live fire exercises are included. Since the soldiers training at this level already have considerable Army experience, some of it within armor or mechanized infantry units, training proceeds quickly.

### Method

By the time the Bradley Commander's Guide was ready for testing, a tentative decision had been made to combine the Gunner and Commander Guides into one book. Although the original intent was to have three separate guides, one each for the Bradley Commander, Gunner, and Driver, as work proceeded, it became apparent that the Commander's and Gunner's guides were nearly identical in procedural tasks. This was due to dual controls for the weapons systems, and the fact that the Commander shares the same view through his eyepiece as does the Gunner.

The tasks which could have been tested for the commanders were identical to those of the gunner, because of the limits presented by the motor pool environment and because of the duplication of tasks between the two positions. The training schedule was very tight, and there was little time available for outside testing without interfering with the training schedule. The only time that the instructors felt would be available was during the third week of the course when the students were learning to swim the Bradley. After each group



had erected its swim barrier, some men were made available for work with the guide, but only one group of three could be tested.

After the purpose of the experiment was explained and the general format of the guides explained, the men were given copies of the Commander's Guide and were asked to read through the PMCS Master Checklist pages, describing the activities and the responsibilities of the persons assigned to perform them. This proved to be somewhat unworkable as each of the three tried to be the leader and instruct the others. They developed their own more workable and efficient system. Each man took several of the checks, either on the hull or in the turret area, and announced, for example, "I've got the suspension." He then did all of the tasks in the suspension area, reading from the Guide as he performed them. A second volunteered to do the engine checks, and so on. They organized the tasks in a way similar to that required by a vehicle commander. After they had finished their tasks, the three were administered the questionnaire.

### Results

The Commander Course trainees had no difficulty in conceptualizing the PMCS checklist format, and were able to follow it and comprehend the aspects of delegation of responsibility. No one performed a task which had already been done by another, and they worked in a coordinated manner on items which required two persons, such as checking light operations. It was apparent that they took the effort seriously when they discovered a drip under the vehicle. They spent several minutes making checks to determine the cause of the leak even though it was not "their" vehicle and they were not accountable for it.

Another group of trainees was to be given the PMCS but the students were very eager to get to their own swimming exercises, and to watch the progress

of the other groups; therefore, the plan was changed, and the experimenter talked with 10 trainees on an informal basis and showed them the guides. They looked at all three guides, and noted the different tasks and the format. With only one exception, all of the students indicated that they liked the idea of the guides as memory joggers and thought guides would be useful for soldiers at any level. They also thought the PMCS checklists would be easy to use.

The captain who did not like the guides stated that he expected his men to know the tasks so well that they did not need aids. If they needed help, he would send them back to the back to the TM with its details and diagrams until they had learned. He also indicated that he wanted a TM for PMCS so that performance standards would remain high. Others disagreed with him at once, indicating that the technical manuals are so bulky and have so many words and steps not needed by a trained individual that most trained operators do not even read the words. They also said that the PMCS performance would be more thorough with the Procedure Guides checklists than with the TM. These comments indicate that command emphasis will be the key in determining the ultimate usefulness of the procedure guides. Any training material which has the support of the instructors and the commanders will be utilized to the fullest in whichever place it is presented; one with no support will be discarded.

The commanders particularly expressed satisfaction with the compact size of the guide, and the idea that each man would be issued one. Since presently the TM is taken away at the conclusion of the Commander's Course, several of the students asked if they could get advance or draft copies of the guides, so they could refer to them after course completion.

## DISCUSSION

In summary, the results of the testing support the idea that for most procedures neither the Procedure Guides nor any training aids are necessary at the conclusion of training. The trainees feel that they can perform the tasks to whatever standard has been required of them, and they find that the Procedure Guides slow them down (as would the TM at this point.) The deterioration in performance over time, when the trainees are required to operate in their duty positions, is unknown.

The ease of use supports the suggestion that the guides can be performance aids during initial training. The portions of the guides which were tested on the drivers, gunners, and commanders were found to be useful and effective. Little difficulty was found in adjusting to the format; what there was could easily be remedied by greater familiarity with the guides.

### Revision of the Draft Procedure Guides

After the field testing with M2 trainees, all of the material in the M2 BIFV Guides was again subjected to the intense scrutiny of Subject Matter Experts. The SMEs consisted of two distinct groups. Three former members of the Fort Benning Bradley Infantry Fighting Vehicle Task Force reviewed the guides in detail. These sergeants are very familiar with every aspect of the vehicle, participated in the validation of the Technical Manual itself, and two of the three are Master Gunners. The three also helped train the ITG and WGMD trainers. All three NCOs spoke candidly and offered many suggestions as to improvements in accuracy, clarity and completeness for each of the guides. They offered material which was being updated in the Technical Manual, and the expertise gained from more than five years of dedicated work on the vehicle.

The second set of SMEs were members of the training cadre from ITG and WGMD. The officers and NCOs offered multiple comments on each of the guides, and suggestions for improvement, based on their experiences during training. Their perspective was somewhat different from that of the task force members, and provided a different, but not conflicting, set of inputs.

Both groups of SMEs felt that the guides would be useful in the training cycle, and could be utilized as supplements to the Technical Manual. Also, in an emergency situation, the guide could be used as a quick reference for a person moved from his regular duty position to that of another individual. The SMEs also commented on the form in which the guides might be published, asking that durability be stressed. The comments and suggestions from both sets of SMEs were incorporated into the final editions of the Guides.

Other changes provided clarifications which were suggested by the trainees themselves. Based on the testing, the Driver's Night Viewer procedure was rewritten to reduce user confusion. Other tasks had similar rewriting. An attempt was made to be concise without being so brief as to omit something important. The language was made as simple as possible without departing from the Technical Manual terminology.

A final change was made by the combination of the original Gunner and Commander Guides into one Guide. This change was made because of the overlap of tasks between the two guides, and in an attempt to provide a more useable product.

#### RECOMMENDATIONS

##### Implement the Procedure Guides For BIFV Training

Results of field testing of the Bradley Driver and Gunner/Commander Guides indicate that the guides can serve as a useful adjunct to the training

materials already available for operators of the Bradley Infantry Fighting Vehicle. Each guide offers a position specific and very readable supplement to the Technical Manual. The Technical Manual should remain the major source of information for a trainee, and the major means of reinforcing instructor training, but after the tasks have been somewhat mastered, the Procedure Guides could be useful. They have proven convenient to use, especially for PMCS checks, and performance does not appear to deteriorate as a result of their use. They are useable and complete, and could easily serve as refresher training materials when the soldiers have been assigned to duty positions.

#### Format

Ideally, the Procedure Guides should be published on a latex coated or latex saturated water, grease, and dirt resistant paper. The material should also be resistant to cracking, bending, and tearing. They should be published in a looseleaf format or with a corner binding screw so that pages can be removed or inserted where changes occur in equipment. The Guides should be published in a compact size, approximately 5" x 7", suitable for carrying in the pockets of the battle dress uniform.

#### Distribution

One book should be issued for each of the two major sections of the vehicle, the driver's and turret compartments, and each man who enters training for a particular position should be given a guide to use whenever and wherever he needs it.

#### Command Support

With appropriate command support, the BIFV Procedure Guides can be safely and effectively used as performance guides, training aids, and memory joggers for trained personnel.

## REFERENCES

- Goldberg, S. & Campbell, C. H. (1983). A comparative evaluation of M1 Tank Procedure Guide. ARI Field Unit, Fort Knox, Kentucky. U.S. Army Research Institute for the Behavioral and Social Sciences. Final Draft.
- Salter, M. (1983). Bradley Infantry Fighting Vehicle M2 Procedure Guides, Commander and Gunner. U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. In preparation.
- Salter, M. (1983). Bradley Infantry Fighting Vehicle M2 Procedure Guides, Driver. U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. In preparation.
- Vaughan, J. J., Silbernagel, B. & Goldberg, S. L. (1981). M1 Abrams Tank Procedures Guide, Commander. U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. In preparation.
- Vaughan, J. J., Silbernagel, B. & Goldberg, S. L. (1981). M1 Abrams Tank Procedures Guide, Gunner. U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. In preparation.
- Vaughan, J. J., Silbernagel, B. & Goldberg, S. L. (1981). M1 Abrams Tank Procedures Guide, Driver. U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. In preparation.
- Vaughan, J. J., Silbernagel, B. & Goldberg, S. L. (1981). M1 Abrams Tank Procedures Guide, Loader. U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. In preparation.
- Department of Army Field Manual FM 7-11M10. Soldier's Manual 11M10 Fighting Vehicle Infantryman Skill Level 1. Draft, 1982.
- Department of Army Field Manual FM 7-11M20. Soldier's Manual 11M20 Fighting Vehicle Infantryman Skill Level 2. Draft, 1982.
- Department of Army Field Manual FM 7-11M30/40. Soldier's Manual 11M30/40 Fighting Vehicle Infantryman Skill Level 3/4. Draft, 1982.
- Department of Army Field Manual FM 7-11M/TG. Trainer's Guide, Fighting Vehicle Infantryman. Draft, 1982.
- Department of Army Technical Manual TM 9-2350-225-10. Technical Manual/Operator's Manual, M1 Tank. April 1981.
- Department of Army Technical Manual TM 9-2350-225-10 CL. Technical Manual/Operator's Manual, M1 Tank Checklist. April 1981.
- Department of Army Technical Manual TM 9-2350-10-1. Technical Manual/Operator's Manual, Fighting Vehicle Infantry, M2 - Hull. Draft December 1982, changes July 1983.
- Department of Army Technical Manual TM 9-2350-10-2. Technical Manual/Operator's Manual, Fighting Vehicle Infantry, M2 - Turret. Draft December 1982, changes July 1983.

APPENDIX A

TABLES OF CONTENTS AND SAMPLE PAGES BIFV GUIDES

## GENERAL INFORMATION

This booklet contains BIFV Driver Procedure Guides. Each guide is for a single activity and is matched to TM 9-2350-252-10-1 (Operator's Manual for Fighting Vehicle, Infantry, M2, Hull).

## PURPOSE OF PROCEDURE GUIDES

The guides in this booklet are not intended to take the place of the BIFV TM or training materials. They will help you to remember long or difficult sets of procedures. In short, the guides will help to "jog your memory."

## USE OF THIS BOOKLET

The Table of Contents (on the next page) lists the procedure guides in this booklet. Each guide gives you a step-by-step outline for completing an activity. The following will help you to better use each guide:

1. Some steps within a procedure guide are followed by a page number. On that page within the guide you will find a detailed breakdown of the step.
2. Some of the procedure guides include a question(s). Each question is stated inside a diamond shape. Your "yes" or "no" to the question will show you which path to follow.
3. Some steps within a procedure guide are followed by a box. In the box you will find more information on the step or a caution/warning.
4. Certain steps within a procedure guide require that a knob or switch be turned to a certain position. If that position is written like the symbol to the left, a light should also come on.



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SAMPLE PAGE, DRIVER'S GUIDE

Install, Operate, and Remove Driver's Night Viewer

1. DRIVER'S PERISCOPE . . . . . REMOVE FROM DRIVER'S HATCH COVER
2. DRIVER'S NIGHT VIEWER . . . . . UNSTOW -

IF USING VEHICLE POWER, CHECK TO SEE THAT BATTERY HAS BEEN REMOVED. IF USING BATTERY POWER, INSTALL BATTERY.

3. 2 LATCH HANDLES . . . . . SET IN OPEN POSITION
4. ENTRANCE WINDOW . . . . . REMOVE AND STOW  
COVER & PROTECTIVE CAP
5. DRIVER'S NIGHT VIEWER . . . . . INSTALL AND LOCK
6. OFF/BRIGHT ROTARY SWITCH . . . . . OFF
7. DRIVER'S PERISCOPE. . . . . STOW

IF USING VEHICLE POWER, DO STEPS 8 THRU 13.  
IF USING BATTERY POWER, DO STEPS 10 THRU 13.

8. VEHICLE POWER CABLE . . . . . INSTALL ON NIGHT VIEWER
9. MASTER POWER . . . . . ON
10. OFF/BRIGHT ROTARY SWITCH . . . . . MAXIMUM BRIGHT
11. BRIGHTNESS . . . . . ADJUST
12. NIGHT VIEWER . . . . . POSITION AS NEEDED
- 13 OFF/BRIGHT ROTARY SWITCH . . . . . OFF

IF USING VEHICLE POWER, GO TO STEP 14. IF  
USING BATTERY POWER, GO TO STEP 16.

- 14 MASTER POWER . . . . . OFF
15. VEHICLE POWER CABLE . . . . . REMOVE FROM VIEWER
16. NIGHT VIEWER . . . . . UNLOCK AND REMOVE FROM DRIVER'S  
HATCH COVER -- REMOVE BATTERY  
IF PRESENT.
17. EYEPiece PROTECTIVE CAP . . . . . INSTALL  
AND ENTRANCE WINDOW COVER
18. DRIVER'S PERISCOPE . . . . . UNSTOW
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SAMPLE PAGE, COMMANDER/GUNNER GUIDE

Operate Turret in Power Mode

TRAVERSE TURRET

- 1. DRIVER AND CARGO HATCH COVERS . . . . . CLOSED OR POPUP POSITION

MAKE SURE HATCH INTERLOCK  
OVERRIDE SWITCH IS OFF

- 2. TURRET SHIELD DOOR . . . . . CLOSED AND LATCHED

- 3. TURRET TRAVEL LOCK . . . . . RELEASE

- 4. SEAT BELTS . . . . . FASTEN

BOTH GUN ELEVATION SELECT LEVER AND TURRET TRAVERSE  
SELECT LEVER MUST BE IN POWER MODE.

- 5. TURRET TRAVERSE DRIVE SELECT LEVER . . . MOVE TO POWER POSITION

- 6. TOW ELEVATION DRIVE SELECT LEVER . . . . MOVE TO POWER POSITION

- 7. GUN ELEVATION DRIVE SELECT LEVER . . . . MOVE TO POWER POSITION

- 8. TURRET POWER SWITCH . . . . . ON

- 9. TURRET DRIVE SYSTEM SWITCH . . . . . ON

- 10. TURRET . . . . . TRAVERSE

- 11. TURRET . . . . . TRAVERSE AT HIGH SPEED - USE FAST  
TURRET (SLEW) SWITCHES

CONTROL HANDLES SHOULD BE CENTERED BEFORE RELEASING  
SLEW SWITCHES.

ELEVATE AND DEPRESS GUN ROTOR

- 12. GUN ROTOR . . . . . ELEVATE AND DEPRESS

- 13. GUN ROTOR . . . . . ELEVATE AND DEPRESS AT HIGH SPEED -  
USE FAST TURRET (SLEW) SWITCHES

CONTROL HANDLES SHOULD BE CENTERED BEFORE RELEASING  
SLEW SWITCHES.

APPENDIX B  
DRIVER'S GUIDE TESTING

INTRODUCTION TO PROCEDURE GUIDES  
[read to Driver Course trainees]

For the next portion of our testing, we will be asking you to perform some procedures on the Bradley. In some cases you will use the TM to help you, just as you have been doing during training. In some cases you will not need to use the TM at all. At other times you will be asked to use one of these booklets. [Hold up]. Each of you will be given the opportunity to look at it and use it. [E's pass out Guides]. It is a newly developed Driver's Procedures Guide for the BIFV. It covers the main jobs a driver has to do, and some special ones too. In the back there are some PMCS checklists. The tasks in this book are the same ones as are in the TM. The only differences are that there are no pictures, and that these books are much smaller than the TM because a lot of the words and substeps have been left out. The terms and instructions are similar but the book looks different.

At this time I would like everyone to turn to the page just inside the front cover, the page headed General Information. As you read the first few paragraphs, you see that the Guide is intended as a memory jogger, a way of reminding you about some of the things you have been taught to do.

There are some things in the booklet that may be new to you, and I will explain them to you now. Please look at the "Use of this Booklet" section on the information page. It tells you that the booklet will give you step-by-step outlines for doing things. Number 1 also tells you that some tasks are referred to in more than one place. If a box with the words "see page 17" appears, you know that there is more information on this particular step on page 17.

Number 2 has a diamond shape next to it. The diamond has words inside it. The words might ask you a question like "is the light on?" If your light

is not on, you follow the NO line, and do what it says at the end of the NO line. If your light is on, you would follow the YES line and do what it says there.

The information by Number 3 about the box pretty much explains the boxes. Always read a box. It will either give you a warning about your safety, the safety of the vehicle, or it will tell you what to do if something goes wrong.

Number 4 has a sunburst next to it. On the BIFV Driver's instrument panel there are a lot of lights. This sign just tells you that one should light up when you do something.

If you will look at the next page, you will see that the Guide has a Table of Contents. The Guide is divided into three major sections, main activities, special operations, and PMCS. As you look down the Table of Contents you see many task names that you recognize from the TM. Still looking at the Table of Contents, if you look under special operations, you see that the task, START VEHICLE WITH OUTSIDE POWER (SLAVE START) is found on pages 12 and 13. Let's all turn to page 12 at this time.

On page 12 you see the name of the task at the top of the page. You then see two boxes. Read them now. If you were performing this task, you would read those two boxes, and then go to step 1, and do what it says. In this case, it tells you to turn the Master Power Switch off. After you do that, you go to step 2 and do what it says, and so on until after step 8 when you find another box. After you read the box, you do step 9. For step 10, you see that when you turn the Master Power Switch to ON, the light should go on. The sunburst tells you that. After you do step 11, you see a diamond shape at 12. The diamond shape asks you if both vehicle lights are green. If they are both red, or if one is red and one is green, the answer to the question is NO.



You then follow the NO line until you come to the box that says STOP, and then tells you to notify organizational maintenance. If both lights are green however, everything is going the way it is supposed to and you follow the YES line where it tells you to go to step 13. The box between 12 and 13 reminds you that the light color is very important. You then go on with 13 and so on, thru the end of the procedure. Take a few minutes to read thru steps 14 thru 20 to get a feel for the way the Guide works.

[Es collect Guides]. At this time you will go one at a time to the vehicles, to perform some of the Bradley Driver tasks. You will be called by number. Those who are waiting their turns may stay here, until they are called. When you have finished your turn, you may rejoin the group, but please do not talk about what you have been doing, as the next person may not be doing exactly the same thing.

After everyone has finished the first part, we will divide into groups of six and perform a crew task.

I encourage you to do your best on these tasks, but again assure you that your performance in NO WAY affects your Army career. You are helping us with our research, and will be helping future 11 Mikes.

## INSTRUCTIONS TO EXPERIMENTERS

Introduce yourself, and check with the S to be sure of his number so you will be sure to give him his tasks in the correct order with the correct performance aid. The subjects will each perform the same tasks, but in different orders. When you have finished with one person, call for the next one in numerical order. This will permit us to use the time wisely, without being delayed by one balky or slow subject.

### For PMCS task:

Tell the subject that he is to perform all DURING OPERATIONS PMCS that a driver would normally do by himself. This means that he does not do things that are in the squad area, or that involve the gunner or other crew. In the TM, these tasks are on pages 2-58 thru 2-64, and 2-71 thru 2-72. In the PG they are on page 23. When you tell him to begin, he must find these things by himself in his particular aid, and as he does something, he is to read the step out loud to you as he does it. If he skips a step, leave it blank; if he does it and it looks OK, check it; if it is obviously wrong, mark that. On the TM groups, mark on your copies of the PMCS, using some system to keep your subjects separate; for the PG people, you may mark on a copy of the list, one for each person as long as you put his number on the sheet. Tell him that when he gets to the PMCS on the personnel heater, he needs to do the full procedure and actually turn it on. For the TM this is page 2-193; for the PG this is page 7. They have not actually performed this task before, and we will find out if they can.

### For Install/Operate/Remove Driver's Night Viewer task:

Tell the subject that he is to install, adjust (as if to use), remove and stow the driver's night viewer. He will also have to remove the periscope, but he knows this. He should assume that he will be using vehicle power (as

opposed to battery); if he asks, tell him. In the TM these tasks are on pages 2-207 thru 2-220; in the PG on pages 10 and 11. Have the subject find the tasks on his own and have him read the steps to you as he does them. For the group with neither the TM nor the PG, have them tell you what they're doing as they do it. Make the PG and TM groups use their aids; they may not want to. If anyone in the no aid group gets stuck, give him the PG to use and note whether he can do it with that help. Score in a way similar to PMCS.

For the Prepare/Start/Stop/Shutdown Station task:

Give the PG to the subject and instruct him to do everything it says to do to prepare for a start, start the engine (above 40<sup>o</sup>), stop the engine, and shut down the station. Tell him to read the steps to you as he is doing them; make him use the Guide even if he doesn't want to. If necessary, explain that we want to see if he can use it. The steps are on pages 1 thru 4 of the PG. We will skip steps 16 thru 26 cold start, and will not actually move the vehicles, steps 32 and 33. Tell them this as they come up to 32. To score this task, mark steps that are skipped, etc. or any problems you note.

FOR ALL OF THE PRECEDING TASKS, YOU WILL HAVE TO BE UP ON TOP OF THE VEHICLE, SORT OF TO THE RIGHT AS YOU LOOK OUT OVER THE FRONT OF THE VEHICLE, IN ORDER TO BE ABLE TO SEE ANYTHING.

After all subjects are finished with their individual tasks, we will divide them into three groups to do water barrier related tasks. One of their number from each group will be designated the leader and lead his group on unstowing and erecting the water barrier, using the PG as reference. After the barrier is erected, one of the ITG NCOs or BIFV SGTs will check it out and see if they have made any errors and will tell us. After they have checked it, the crews will, again using the PGs, remove and stow the barrier. Experimenters should be making any relevant notes during all of the above.

APPENDIX C  
BIFV QUESTIONNAIRE

## BIFV QUESTIONNAIRE

### Introduction

A BIFV questionnaire was constructed for each trainee to rate various Bradley operator tasks on a five-point scale. They were asked to guess how well they could perform without help from the TM; the rating scale extended from (1), not very well, to (5), very well. It was stressed that during training a TM or instructor is always available, and probably no one had any experience with unassisted performance. The questionnaire does not attempt to measure the trainees' actual abilities to perform the tasks; as the intention was to obtain an impression of how well they felt they could do the tasks. Originally, a scale to measure confidence in the rating was attempted, but this scale was discarded when it became apparent from looking at the driver's responses that the trainees did not understand that they were being asked to rate their confidence in the performance rating. (This latter scale was not presented to the gunners or commanders, and the data was not analyzed for the drivers.)

### Method

The Questionnaire was administered to each of the 17 OSUT trainees, each of the 25 gunners, and 10 of the 20 Commander's Course trainees (see Table 1). The data from one driver had to be discarded as he answered less than 1/3 of the questions. The first 22 task items were identical for the three groups. The commander's list included three more tasks, and the gunner's list included seven more. The commanders had fewer tasks to rate than the gunners because at the stage they were in the training cycle, they had not yet been exposed to the training represented in the last few tasks.

Table C-1

ON A SCALE FROM 1 TO 5, HOW WELL DO YOU THINK YOU COULD DO THE FOLLOWING BIFV TASKS WITHOUT ANY HELP FROM THE TM OR YOUR INSTRUCTORS? IN TRAINING, THE TM IS ALWAYS AVAILABLE, AND YOU ARE ENCOURAGED TO USE IT TO HELP YOU. BUT IF NO HELP WAS AVAILABLE, TELL HOW WELL YOU COULD DO (OR HOW WELL YOU THINK YOU COULD DO, SINCE YOU HAVE NOT TRIED IT!).

TASK NAME	NOT VERY WELL			VERY WELL	
	1	2	3	4	5
PREPARE DRIVER STATION	1	2	3	4	5
START ENGINE ABOVE 40°	1	2	3	4	5
START ENGINE BELOW 40°	1	2	3	4	5
DRIVE BIFV FORWARD	1	2	3	4	5
DRIVE BIFV REVERSE	1	2	3	4	5
PIVOT TURN	1	2	3	4	5
STOP ENGINE	1	2	3	4	5
SHUTDOWN DRIVE STATION	1	2	3	4	5
IMMEDIATE ACTION/RUNAWAY ENGINE	1	2	3	4	5
DRIVE OVER ROUGH TERRAIN	1	2	3	4	5
OPERATE THE PERSONNEL HEATER	1	2	3	4	5
OPERATE THE WINTERIZATION KIT	1	2	3	4	5
INSTALL/OPERATE NIGHT VIEWER/POWERED	1	2	3	4	5
INSTALL/OPERATE NIGHT VIEWER/BATTERY	1	2	3	4	5
SLAVE START A BIFV	1	2	3	4	5
INSTALL/USE TOW CABLES	1	2	3	4	5
INSTALL/USE TOW BARS	1	2	3	4	5
OPERATE BIFV AT -25°	1	2	3	4	5
DRIVE THE BIFV IN WATER	1	2	3	4	5
PERFORM BEFORE OPS PMCS	1	2	3	4	5
PERFORM DURING OPS PMCS	1	2	3	4	5
PERFORM POST-SWIMMING OPS	1	2	3	4	5
[DRIVER'S FINISH]					
FIRE COAX MACHINEGUN	1	2	3	4	5
REFUEL BIFV	1	2	3	4	5
BORESIGHT THE 25mm GUN	1	2	3	4	5
[COMMANDER'S FINISH]					
FIRE THE 25mm GUN	1	2	3	4	5
IMMEDIATE ACTION/COAX MISFIRE HOT GUN	1	2	3	4	5
OPERATE TOW LAUNCHER	1	2	3	4	5
USE THE RING SIGHT	1	2	3	4	5
[GUNNER'S FINISH]					

## Results

The questionnaire results are shown by operator position and combined, in Table C-2. It is apparent that the trainees discriminated in their answers to the questions, as they gave lower ratings to the tasks which had not been covered during their courses of instruction. Since no identification was received and instructors could not see the papers, there was no particular reason for the trainees to give an untrue picture of their perceived abilities.

Generally, the commanders were less conservative in their ratings than the others. It is assumed that their relatively greater experience made them aware of the kinds of tasks which might be encountered, and made them more knowledgeable about the things that had not yet been taught. The commanders tended to give the highest ratings to their perceived abilities and the gunners, the lowest; but all three groups showed that they perceived their Bradley operating skills to be very high. Since the performance confidence ratings are very transient, and may drop rapidly over time, no real conclusions can be drawn from them. However, apparently the BIFV trainees do feel that they have been well trained, and that they know how to perform the Bradley operational tasks.

Table C-2

## QUESTIONNAIRE RATINGS: MEAN RESPONSES

	DRIVERS	GUNNERS	COMMANDERS	COMBINED
PREPARE DRIVER STATION	4.94	4.52	4.80	4.62
START ENGINE ABOVE 40°	5.00	4.56	5.00	4.78
START ENGINE BELOW 40°	3.06	4.20	4.60	3.92
DRIVE BIFV FORWARD	5.00	5.00	5.00	5.00
DRIVE BIFV REVERSE	4.25	4.76	4.90	4.62
PIVOT TURN	4.81	4.76	4.90	4.80
STOP ENGINE	5.00	5.00	5.00	5.00
SHUTDOWN DRIVE STATION	4.94	4.88	5.00	4.92
IMMEDIATE ACTION/RUNAWAY ENGINE	3.19	3.48	4.10	3.51
DRIVE OVER ROUGH TERRAIN	4.56	4.32	4.70	4.77
OPERATE THE PERSONNEL HEATER	3.69	4.44	4.20	4.16
OPERATE THE WINTERIZATION KIT	1.19	3.16	2.20	2.35
INSTALL/OPERATE NIGHT VIEWER/POWERED	4.75	3.72	4.50	4.20
INSTALL/OPERATE NIGHT VIEWER/BATTERY	4.50	3.12	4.70	3.86
SLAVE START A BIFV	4.56	3.80	4.80	4.24
INSTALL/USE TOW CABLES	4.44	4.40	4.90	4.31
INSTALL/USE TOW BARS	4.19	3.92	4.90	4.20
OPERATE BIFV AT -25°	2.06	3.16	2.70	2.73
DRIVE THE BIFV IN WATER	3.69	3.04	3.70	3.35
PERFORM BEFORE OPS PMCS	4.31	4.80	4.20	4.53
PERFORM DURING OPS PMCS	4.06	4.88	4.10	4.37
PERFORM POST-SWIMMING OPS	3.50	2.80	3.80	3.22



APPENDIX D

MASTER TASK LIST  
BRADLEY INFANTRY FIGHTING VEHICLE

The task lists and descriptions in Appendix D are taken from the tasks presented in the December 1982 draft editions of the Fighting Vehicle, Infantry Technical Manuals, TM 9-2350-252-10-1 (Hull) and TM 9-2350-252-10-2 (Turret).

Tasks presented separately before the listings are those added in the July 1983 revisions of the Technical Manuals. Tasks preceded by an asterisk have been proceduralized within the Bradley Infantry Fighting Vehicle Guides.

#### Tasks Added Since December 1982 TM

##### PMCS During Operations

Check for free movement of firing port balls by hand from inside of vehicle.

##### PMCS Weekly

Check that hatch pin lever on Commander's hatch cover moves freely and is operating correctly.

##### Boresight Backup Sight

1. Boresight 25mm gun.
2. Reposition backup sight to Commander's position.
3. Focus backup sight.
4. Look at aiming point image in backup sight reticle.
5. Perform elevation linkage adjustment.
6. Loosen horizontal adjustment lock screw.
7. Center aiming point image.
8. Lock horizontal adjustment lock screw.
9. Check aiming point image.

##### Reposition Backup Sight Eyepiece

1. Reposition eyepiece.
2. Check that eyepiece is locked in new position.

##### Adjust Eyepiece Diopter

1. Focus eyepiece diopter.
2. Find eyepiece diopter setting.

##### Deflate/Inflate Eyecup

1. Deflate eyecup.
2. Inflate eyecup.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS Before Operations Checks

Suspension system

1. Check road wheel, idler wheel, and support roller oil levels through sight glasses.
2. Check road wheel, idler wheel, and support roller sight glasses for cracks and breaks.
3. Check road wheels, idler wheels, support rollers, shock absorbers, and track shoes for signs of oil leaks.

Vehicle exterior

4. Check outside of vehicle for signs of fuel or oil leaks.

External fire suppression handles

5. Check wires and lead seals on external fire extinguisher handles.

Final drive hull drain plugs

6. Check right and left final drive hull drain plugs.

Driver's hatch

7. Check that driver's hatch can open and close fully and locks in both OPEN and CLOSED positions.
8. Check that safety pin is not missing.

Internal fire suppression handles

9. Check that FIRE SUPPRESSION switch is in AUTO.
10. Check wire and lead seal on internal fire suppression handle.

Hull drain plugs

11. Check for open or missing front hull drain plug.
12. Check for open or missing rear hull drain plug.

Internal fire extinguishers

13. Check seals on portable fire extinguishers.
14. Check that pressure gage on both squad area fire extinguishers read within 50 psig of correct pressure reading.
15. Check pressure gage on engine compartment fire extinguisher.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS During Operations Checks

Driver's seat

16. Check driver's seat adjustment.

Driver's hatch

17. Check that driver's hatch can open and close fully and locks in both OPEN and CLOSED positions.
18. Check that safety pin is not missing.

Driver's instrument panel

19. Check VOLTS gage.
20. Check ENGINE COOLANT TEMP gage.
21. Check ENGINE OIL gage.
22. Check COOLANT LOW LEVEL warning light.
23. Check TRANS OIL PRESS warning light.
24. Check TRANS OIL TEMP warning light.
25. Check AIR CLEANER CLOGGED warning light.

Driver's periscope

26. Check periscope lenses for dust and cracks.
27. Check blackout covers for tears.
28. Check that blackout covers stay in place when closed.

Ramp

29. Check ramp operation.

Personnel heater

30. Check squad area duct outlet for steady heat output.
31. Have gunner check around personnel heater for smoke or strong diesel fumes.
32. Have gunner check fuel lines, fittings, and personnel heater for fuel leaks. Have gunner make check through turret door opening.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS During Operations Checks

Squad seats

- 33. Check that squad seats are secured by locking pins.
- 34. Check that lap safety belts adjust and release easily.

Cargo hatch

- 35. Check that release latch releases cargo hatch cover easily and locks in closed position.
- 36. Check that hinge position handle locks cargo hatch cover in POP-UP, TOW LOAD, UPRIGHT, FULL OPEN positions with latch pin fully inserted into index gear.

Squad area periscopes

- 37. Check periscope lenses for dust and cracks.
- 38. Check blackout cover for tears.
- 39. Check that blackout covers stay in place when closed.

Driver's controls

- 40. Check accelerator pedal operation.
- 41. Check gear selector operation.
- 42. Check steering yoke operation.
- 43. Check vehicle brakes.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS After Operations Checks

Fuel gage

44. Check fuel gage.

Power unit access door

45. Check that door brace holds power unit access door open.

Transmission

46. Check transmission oil level.

47. Check and reset transmission oil filter indicator.

Cooling system

48. Check cooling system hoses for leaks.

49. Check engine coolant level; add as needed.

50. Check bilge area for coolant.

51. Check right angle fan drive for leaks.

Intake screen

52. Check intake screen for debris or damage.

Fuel filter

53. Check that fuel filter is drained until raw fuel come out.

54. Check drained liquid for grit, dust and metal particles.

Final drives

55. Check oil level in left and right final drives.

Engine compartment

56. Check hoses, clamps, fittings for oil and coolant leaks.

57. Check engine oil level.

Suspension

58. Check for missing, broken, or leaking shock absorbers.

59. Check for missing or damaged road wheels, idler wheels, and support rollers.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS After Operations Checks

60. Check for worn mounting holes by looking for shiny area around nuts and washers.
61. Check all hubs for any large temperature differences.
62. Check road wheel, idler wheel, and support roller oil through sight glasses.
63. Check track tension.
64. Check track adjuster, grease fitting, and bleed valve for leaks.
65. Check for missing track pin nuts and cracked, bent, or broken track guides.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS Weekly

Torsion bars

66. Check road wheels 1-6 on both sides of vehicle for broken torsion bars.

Batteries

67. Check batteries.

Ramp hydraulic power unit

68. Check ramp hydraulic power unit.

Trim vane

69. Check trim vane for damaged parts or broken mesh.

70. Check that trim vane latch holds trim vane securely in stored position.

PMCS Monthly

Suspension system

71. Check road wheels and support rollers for loss of rubber, pitting, separation of rubber from metal backing, and chunking.

72. Check for broken or bent road and idler wheel arms.

73. Check for worn or missing track shoe pads.

74. Check drive sprocket teeth for wear.

75. Check drive sprocket teeth for breaks and cracks.

76. Check track shoes for breaks and cracks.

77. Check that track pin nuts are centered.

Right angle fan drive

78. Check right angle fan drive oil level.

79. Check that all exterior vehicle lights operate correctly and are not damaged.

Bilge pumps

80. Check bilge pump operation.



PREVENTIVE MAINTENANCE CHECKS AND SERVICES - HULL  
PMCS Monthly

Cooling system

- 81. Check for worn, cracked, or missing coolant pump belt.
- 82. Check that coolant pump belt does not slip on pulleys.

Firing ports

- 83. Check that firing port plugs are secure when installed.
- 84. Check firing port hoses and brass catcher bags for cracks or severe wear.
- 85. Check that air flows out of firing port hoses and that gun port vent fan indicator lights are on.
- 86. Check that dust covers open and close smoothly when firing port vent lever is pulled up and down.

Portable fire extinguishers

- 87. Check tags on both portable fire extinguishers.

HULL MAINTENANCE PROCEDURES

Raise/inspect/lower intake screen

Patch water barrier

Adjust track tension

Remove/install track

- A. Remove
- B. Install

Remove track shoe from stretched track

Replace track shoe

Break/join track

- A. Break track
- B. Join track

Remove/install track shoe pads

- A. Remove
- B. Install

Replace track adjuster grease fitting

Service final drive

Check vehicle batteries

Service bilge pumps

- A. Right front bilge pump.
- B. Left front bilge pump.
- C. Right rear bilge pump.
- D. Left rear bilge pump.
- E. Bilge pumps power check.

Check/fill radiator

Check/add engine oil

Check/add transmission oil

Check ramp hydraulic power unit

PREVENTIVE MAINTENANCE CHECKS AND SERVICE - TURRET  
PMCS Before Operations

Turret exterior

1. Check area outside of turret for objects that will block traversing turret.
2. Check that front ring sight is clean and not damaged.
3. Check TOW launcher for dents and other external damage.
4. Check for debris and damage inside TOW launcher tubes.
5. Check dust cover for tears.
6. Check antenna amounts for damage to antenna support bases and contact points.
7. Check smoke grenade launcher rubber caps for damage.
8. Check smoke grenade launchers for debris and damage.
9. Check smoke grenade storage bins for debris and damage.

Turrent shield door

10. Check that turret shield door locks in closed position.

Turret interior

11. Check turret interior for objects that should not be there.
12. Check that turret travel lock is not damaged or broken, and make sure that it engages.
13. Have helper check HE ammo can door to see that it opens, closes, latches.
14. Have helper check AP ammo can door to see that it opens, closes, latches.
15. Adjust commander's seat.
16. Check that commander's hatch cover can be locked in open or closed position.
17. Check commander's 8 periscopes and gunner's 2 periscopes for dirty or cracked periscope lenses.
18. Check that blackout covers are not torn and stay in place when fastened.
19. Check that gunner's seat can be moved freely and locked in raised and lowered positions.
20. Check that gunner's hatch cover can be locked in OPEN or CLOSED position.
21. Check that ballistic sight cover doors open and close smoothly.
22. Have helper check to see if ISU windows are dirty or broken.

25mm gun system

23. Check gun can, zippers, and bolt position indicator for dirt and damage.
24. Check gun power cable on 25mm gun for damage.
25. Check cable plug for dirt, corrosion, damage.
26. Check AP and HE feed chutes for damage.
27. Check AP and HE eject chutes for damage.
28. Check 25mm gun for damage.

Coas machinegun

29. Check that handles secure coax machinegun access doors in closed position.
30. Check seals on coax machinegun access doors for damages.
31. Check 7.62 ammo feed chute and two latches for damage.
32. Check rear gun mount.

PREVENTIVE MAINTENANCE CHECKS AND SERVICE - TURRET  
PMCS Before Operations

Turret manual operation

33. Check operation of gun elevation drive select lever and gun elevation hand wheel.
34. Check operation of turret traverse drive select lever and turret traverse hand wheel.

Communications equipment and intercom

35. Check radio system.
36. Check intercom system to make sure commander, gunner, and driver can communicate.

PREVENTIVE MAINTENANCE CHECKS AND SERVICE - TURRET  
PMCS During Operations

\* ISU cool down

37. Check that mirror control knob is in unlocked position and that quick release pin is installed.
38. Check that turret power indicator light goes on.
39. Check that closed cycle cooler is operating and can be heard.  
NIGHT VISION PWR switch is ON.

Indicator lights and gun fans

40. Check that all lights on weapon control box are on.
41. Check that all lights on turret position indicator at gunner's station are on.
42. Check that all lights on TOW control box are on.
43. Check that all lights on turret control box go on.
44. Check that gun fans are operating and can be heard.

Turret power operation

45. Check that turret drive system indicator light is on.

Commander's control handle

46. Check that turret traverses to right and to left.
47. Check that turret traverses at a fast speed to left and then to right.
48. Check that 25mm gun elevates and depresses.

Gunner's control handle

49. Check that turret traverses to right and to left.
50. Check that turret traverses at a fast speed to left and then to right.
51. Check that 25mm gun elevates and depresses.

\* Deck clearance system

52. Check that OPEN HATCH annunciator light on annunciator box is on.
53. Check that 25mm gun elevates and depresses by itself when passing over rear deck.
54. With driver's hatch cover in UPRIGHT position, check that turret does not move when gunner's control handles are used.
55. With cargo hatch cover in UPRIGHT position, check that turret does not move when gunner's control handles are used.
56. Check that NO FIRE ZONE annunciator light is on.
57. Check that NO FIRE ZONE annunciator light is off.

\* ISU operation

58. Check that reticle is present in gunner's eyepiece, and that status indicator reads HE.
59. Check that view through gunner's eyepiece is very much larger than view through unity window.

PREVENTIVE MAINTENANCE CHECKS AND SERVICE - TURRET  
PMCS During Operations

60. Check that reticle view in gunner's eyepiece gets darker in NEUTRAL and brighter in CLEAR.
61. Check that reticle in gunner's eyepiece becomes brighter, and then dimmer.
62. Check that diopter focuses reticle in gunner's eyepiece.
63. Check that diopter focuses reticle in commander's eyepiece.
64. Check that lamp behind RANGE control knob is lit.
65. Check that status indicator shows same range setting as on RANGE control knob.
66. Check that view rises in elevation as range setting increases.
67. Check that reticle is present in gunner's eyepiece and that status indicator reads AP.
68. Check that status indicator shows the same range setting as on RANGE control knob.
69. Check that view lowers in elevation as range setting decreases.
70. Check that reticle is present in gunner's eyepiece and that status indicator reads 7.62.
71. Check that status indicator shows the same range setting as on RANGE control knob.
72. Check that view rises in elevation as range setting increases.
73. Check that night view can be seen through gunner's eyepiece.
74. Check that night view in gunner's eyepiece changes from white-on-red to black-on-red.
75. Check that BRT and CON knobs adjust brightness and control of view in gunner's eyepiece.
76. Check that view comes into focus in gunner's eyepiece.
77. Check that view changes from night to day.

\* Dry fire operation of 25mm gun

78. Check that manual SAFE handle moves to SAFE position.
79. Check that BOLT position indicator is in SEAR position.
80. Check that drive shaft handle turns.
81. Check that SEAR indicator light is on.
82. Check that LO AMMO indicator light flashes.
83. Check that LO AMMO, AP SS, and SEAR indicator lights are on, but not flashing.
84. Check that bolt position indicator is in MISFIRE position.
85. Check that bolt position indicator is in SEAR position, and that SEAR indicator light is on.
86. Check dry fire operation of 25mm gun in HE SS mode by repeating step 81 and pressing HE SS button instead of AP SS button. Repeat steps 82-85.
87. Check dry fire operation of 25mm gun in AP LO mode by repeating steps 81-85 and pressing AP LO button.
88. Check dry fire operation of 25mm gun in AP HI mode by repeating steps 81-85 and pressing AP HI button.
89. Check dry fire operation of 25mm gun in HE LO mode by repeating steps 81-85 and pressing HE LO button.
90. Check dry fire operation of 25mm gun in HE HI mode by repeating steps 81-85 and pressing HE HI button.
91. Repeat steps 79-90. Use commander's handle instead of gunner's control handles.

PREVENTIVE MAINTENANCE CHECKS AND SERVICE - TURRET  
PMCS During Operations

\*Dry fire operation of coax machinegun

92. Check that manual safety moves down into fire position.
93. Check that charger handle moves smoothly and charges coax machinegun.
94. Check that coax machinegun access doors can be closed and latched securely.
95. Check that ARM indicator light comes on.
96. Check that 7.62 indicator light comes on.
97. Check that LO AMMO indicator light flashes.
98. Check that LO AMMO indicator light stays on but stops flashing.
99. Check that coax machinegun has dry fired.
100. Repeat step 99 with commander's handle.

\* Smoke grenade launcher operation

101. Check that GRENADE LAUNCHER indicator light comes on.
102. Check that TRIGGER indicator light comes on when TRIGGER button is pressed.

\* TOW launcher operation

103. Check that TOW indicator light comes on and stays on.
104. Check that TOW test indicator light comes on and then goes off after 12 seconds.
105. Check that TRCKR, CGE, and PWR SUP annunciator lights stay off.
106. Check that annunciator lights on annunciator box stay off.
107. Check that reticle is present in gunner's eyepiece.
108. Check that status indicator reads TOW.
109. Check that MISSILE TUBE 1 and MISSILE TUBE 2 indicator lights flash when MISSILE TUBE 1 and MISSILE TUBE 2 buttons are pressed.
110. Check that TOW indicator light goes off.
111. Check that TOW launcher bangs against side of turret and LAUNCHER UP indicator light goes off.

\*Stabilization controls

112. Check that STAB indicator light is on.
113. Check to see if center ring of reticle moves more than 1 mil away from point aimed at on target within 10 seconds.
114. Repeat step 113 for movement of the center ring of reticle away from aiming point of target.

PREVENTIVE MAINTENANCE CHECKS AND SERVICE - TURRET  
PMCS After Operations

25mm gun

115. Clean, inspect, and lubricate 25mm gun.

Coax machinegun

116. Clean, inspect, and lubricate coax machinegun.

Smoke grenade launcher

117. Clean and inspect smoke grenade launcher.

TOW missile launcher

118. Clean and inspect TOW launcher.

PMCS Weekly

Turret emergency batteries

119. Check turret emergency batteries.

25mm gun

120. Clean, inspect, and lubricate 25mm gun.

Coax machinegun

121. Clean, inspect, and lubricate coax machinegun.

TOW missile launcher

122. Clean and inspect TOW launcher.

Smoke grenade launcher

123. Clean and inspect smoke grenade launcher.

Commander's hatch cover cushioning pad

124. Check cushioning pad on commander's hatch cover for cracks and missing pieces.

Gunner's hatch cover cushioning pad

125. Check cushioning pad on gunner's hatch cover for cracks and missing pieces.



TURRET MAINTENANCE PROCEDURES

Remove 25mm gun feeder

Remove 25mm gun barrel

Remove 25mm gun receiver

Remove track and bolt assembly

Disassemble track and bolt assembly

Clean/inspect/lubricate 25mm gun

- A. Clean 25mm gun feeder
- B. Inspect 25mm gun feeder
- C. Lubricate 25mm gun feeder
- D. Clean 25mm gun barrel
- E. Inspect 25mm gun barrel
- F. Lubricate 25mm gun barrel
- G. Clean 25mm gun receiver
- H. Inspect 25mm gun receiver
- I. Lubricate 25mm gun receiver
- J. Clean track and bolt assembly
- K. Inspect track and bolt assembly
- L. Lubricate track and bolt assembly

Assemble track and bolt assembly

- A. Assemble bolt and bolt carrier
- B. Assemble track and bolt assembly

Install track and bolt assembly

Install 25mm gun receiver

Install 25mm gun barrel

Install 25mm gun feeder

Remove coax machinegun

Clean/lubricate coax machinegun

Install coax machinegun

Clean ISU

Clean/inspect TOW launcher

Clean/inspect smoke grenade launcher

TURRET MAINTENANCE PROCEDURES

Remove ring sight assembly

Clean front ring sight

Install ring sight assembly

Replace antenna mount

Check turret emergency batteries

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - HULL

Stow/unstow squad seats

Operate intercom system

1. Plug in CVC helmet in driver's compartment.
2. Plug in CVC helmet in squad area.
3. Plug in CVC helmet.
4. Select channel on intercom control box.
5. Move helmet switch on left of CVC helmet to rear.
6. Adjust volume knob on intercom control box.
7. Press driver's intercom switch on steering yoke to talk, release switch to listen.

\* Start engine above +40° F (+4° C)

1. Check power unit access panels.
2. Adjust brake pedal to desired height.
3. Fasten lap safety belt.
4. Put on and plug in CVC helmet.
5. Check that FIRE SUPPRESSION switch is in AUTO.
6. Move MASTER POWER switch to ON.
7. Move ENGINE ACCESSORY switch to ON.
8. Check driver's instrument panel.
9. Turn on fuel control.
10. Sound horn.
11. Move gear selector to START and hold until engine starts.
12. Check driver's instrument panel.
22. Release hand brake.

\* Start engine below +40° F (+4° C)

1. Check power unit access panels.
2. Adjust brake pedal to desired height.
3. Fasten lap safety belt.
4. Put on and plug in CVC helmet.
5. Check that FIRE SUPPRESSION switch is in AUTO.
6. Move MASTER POWER switch to ON.
7. Move ENGINE ACCESSORY switch to ON.
8. Check driver's instrument panel.
9. Turn on fuel control.
10. Sound horn.
11. Move gear selector to START and hold until engine starts.
12. Check driver's instrument panel.
13. Move COLD START switch to ON.
14. Sound horn.
15. Move STARTER CUTOUT OVERRIDE switch to ON.
16. Press down accelerator pedal about 1/4 inch.
17. Move gear selector to START and hold until engine starts.
18. Move STARTER CUTOUT OVERRIDE switch to OFF.
19. Move COLDSTART switch to OFF.
20. Check driver's instrument panel.
21. Fast idle engine.
22. Release hand brake.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - HULL

Open/close ramp access door

Open/close driver's hatch cover

1. Open driver's hatch cover from outside vehicle.
2. Stow padlock.
3. Unstow padlock.
4. Close driver's hatch cover from outside vehicle.
5. Open driver's hatch cover from inside vehicle.
6. Close driver's hatch cover from inside vehicle.

Open/close cargo hatch cover

Open/close turret shield door

Open/close power unit access door

Lower/raise ramp

1. Lower ramp.
2. Sound horn.
3. Raise ramp.

Adjust brake pedal height

1. Raise brake pedal to upper position.
2. Lower brake pedal to lower position.

Adjust driver's seat

1. Raise or lower driver's seat.
2. Move driver's seat to front or rear.

Stow/unstow driver's seat

A. Stow driver's seat.

1. Fold seat No. 4 backrest down.
2. Lower driver's seat backrest.
3. Raise driver's seat.
4. Move driver's seat forward.
5. Stow driver's seat.

B. Unstow driver's seat.

6. Lower driver's seat.
7. Raise driver's seat backrest.
8. Adjust driver's seat.
9. Unfold seat No. 4 backrest.

Adjust squad seats

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - HULL

\* Start engine with outside power source

1. Check that MASTER POWER switch is OFF.
2. Check that ENGINE ACCESSORY switch is OFF.
3. Check that FIRE SUPPRESSION switch is in MANUAL.
4. Check that STARTER CUTOFF OVERRIDE switch is OFF.
5. Check that FWD and REAR BILGE pumps switches are OFF.
6. Check that smoke screen generator switch is OFF.
7. Check that COLD START switch is OFF.
8. Install slave cable.
9. Start engine of operational vehicle.
10. Check that MASTER POWER switch is OFF in disabled vehicle.
11. Move ENGINE ACCESSORY switch to ON in disabled vehicle.
12. Check slave receptacle power light in operational vehicle and disabled vehicle.
13. Turn on fuel control in disabled vehicle.
14. Move gear selector to START and hold until engine starts.
15. Remove slave cable.
16. Move MASTER SWITCH to ON in disabled vehicle.
17. When engine starts, check driver's instrument panel.

\* Drive vehicle

1. Set gear selector.
2. Sound horn.
3. Move vehicle and control speed.
4. Steer vehicle in forward range.
5. Steer vehicle in reverse.
6. Pivot steer vehicle.
7. Stop vehicle.

\* Stop engine

1. Set hand brake.
2. Turn off fuel control.
3. Move ENGINE ACCESSORY switch to OFF.
4. Move MASTER POWER switch to OFF.

\* Shut down vehicle

1. Check that fire suppression switch is in AUTO.
2. Remove brass catcher bag.
3. Clear firing port weapon.
4. Remove firing port weapon.
5. Install firing port plug.
6. Close ramp firing port covers.
7. Remove firing port weapons from vehicle.
8. Move MASTER POWER switch to ON.
9. Close cargo hatch cover.
10. Lower ramp.
11. Tell crew to exit vehicle.
12. Sound horn.
13. Raise ramp.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - HULL

14. Move MASTER POWER switch to OFF.
15. Unstow padlock.
16. Close driver's hatch cover from outside vehicle.

Fuel vehicle

1. Ground vehicle.
2. Release fuel filler combat lock from inside vehicle.
3. Open fuel filler cover.
4. Clear fuel filler area.
5. Check fuel filler neck screen.
6. Fuel vehicle.
7. Install fuel filler cap.
8. Close fuel filler cover.
9. Remove fueling vehicle ground wire.
10. Engage fuel filler combat lock.

Install/remove windshield kit

1. Open driver's hatch cover to fully OPEN position.
2. Unstow windshield kit.
3. Install windshield kit.
4. Remove windshield kit.
5. Stow windshield kit.
6. Close driver's hatch cover.

\*Operate personnel heater

1. Turn personnel heater on.
2. Select HI or LO heat.
3. Turn personnel heater off.

Operate vent system

Operate vehicle lights

1. Operate headlights.
2. Operate blackout marker.
3. Operate blackout marker and driving lights.
4. Operate stop light.
5. Operate panel lights.
6. Operate parking lights.
7. Operate right turn signal.
8. Operate right hazard signal.
9. Operate left turn signal.
10. Operate left hazard signal.
11. Cancel turn or hazard signals.
12. Operate white dome lights.
13. Operate black dome lights.

Operate fire suppression system

1. Operate engine compartment fire extinguisher.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - HULL

2. Operate portable fire extinguishers.
3. Operate fixed fire suppression system from inside of vehicle.
4. Operate engine compartment fire extinguisher from outside of vehicle.
5. Operate fixed fire suppression from outside vehicle.

Install/remove driver's night viewer

A. Install

1. Remove driver's periscope from driver's hatch cover.
2. Unstow driver's night viewer.
3. Set two latch handlers in OPEN position.
4. Remove entrance window cover and eyepiece protective cap.
5. Install and lock driver's night viewer.
6. Stow driver's periscope.
7. Check that battery is removed from driver's night viewer.
8. Install vehicle power cable on driver's night viewer.

B. Remove

9. Remove vehicle power cable from driver's night viewer.
10. Unlock and remove driver's night viewer from driver's hatch cover.
11. Install eyepiece protective cap and entrance window cover.
12. Unstow driver's periscope.
13. Install driver's periscope.
14. Stow driver's night viewer.

\*Operate driver's night viewer with vehicle power

1. Check that battery is removed from driver's night viewer.
2. Move MASTER SWITCH to ON.
3. Turn OFF/BRIGHT rotary switch to maximum bright position.
4. Adjust brightness of driver's night viewer.
5. Position driver's night viewer.
6. Turn OFF/BRIGHT rotary switch to OFF.
7. Move MASTER POWER switch to OFF.

\*Operate driver's night viewer with battery

8. Check that MASTER POWER switch is OFF.
9. Remove vehicle power cable from driver's night viewer.
10. Install battery in driver's night viewer.
11. Turn OFF/BRIGHT rotary switch to maximum bright position.
12. Adjust brightness of driver's night viewer.
13. Position driver's night viewer.
14. Turn OFF/BRIGHT rotary switch to OFF.
15. Remove battery from driver's night viewer.

Close/open blackout covers

1. Close blackout covers.
2. Open blackout covers.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - HULL

Stow 25mm ammo

Stow Dragon missiles

Stow TOW missiles

Install firing port weapon

Operate firing port weapon

Remove firing port weapon

Operate smoke screen generator

1. Move smoke screen generator switch to ON.
2. Move smoke screen generator to OFF.

Lower/stow trim vane

Remove/install power unit access panels

1. Stow driver's seat.
2. Fold down seat No. 4 backrest.
3. Remove power unit access panels.
4. Install power unit access panels.
5. Raise seat No. 4 backrest.
6. Unstow driver's seat.

Raise/lower side armor plates

1. Raise side armor plate.
2. Lower side armor plate.



TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

Operate turret shield door

Operate turret travel lock

1. Set turret travel lock in locked position.
2. Move turret traverse lever to manual position.
3. Remove spring from handle.
4. Turn turret traverse hand wheel slowly while pushing on travel lock lever to insure that teeth mesh. Release turret traverse hand wheel.
5. Install spring on handle.
6. Move turret traverse drive select lever to power position.
7. Release travel lock lever.

Adjust gunner's/commander's seats

1. Raise gunner's or commander's seat.
2. Lower gunner's or commander's seat.

Open/close commander's hatch cover

1. Open commander's hatch cover.
2. Move commander's hatch cover to level position.
3. Move commander's hatch cover to upright or full open position.
4. Lock hinge latch handle.
5. Unlock hinge latch handle.
6. Move commander's hatch cover to pop-up position.
7. Close commander's hatch cover.

Open/close gunner's hatch cover

1. Open gunner's hatch cover.
2. Push gunner's hatch cover back to full open position.
3. Lock gunner's hatch cover in full open position.
4. Release gunner's hatch cover from locked position.
5. Close gunner's hatch cover.

\*Operate turret in power mode

A. Traverse turret

1. Check that driver's hatch cover is in closed or pop-up position.
2. Check that cargo hatch cover is in closed or pop-up position.
3. Close and latch turret shield door.
4. Release turret travel lock.
5. Put on lap safety bolts.
6. Move turret traverse drive select lever to power position.
7. Move TOW elevation drive select lever to power position.
8. Move gun elevation drive select lever to power position.
9. Move TURRET POWER switch to ON.
10. Move TURRET DRIVE system switch to ON.
11. Traverse turret.
12. Traverse turret at high speed.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

B. Elevate and depress gun rotor

13. Elevate and depress gun rotor.
14. Elevate and depress gun rotor at high speed.

C. Operate in STAB mode

15. Move STAB switch to ON.
16. Check that drive MALF annunciator lights on turret control and annunciator boxes are not on.
17. Move STAB switch to OFF.
18. Move TURRET DRIVE system to OFF.
19. Move TURRET POWER switch to OFF.
20. Move ARM-SAFE-RESET switch to RESET then to SAFE.
21. Move TURRET POWER switch to ON.
22. Move TURRET DRIVE system switch to ON.
23. Move STAB switch to ON.
24. Check that drive MALF annunciator lights on turret control box and annunciator box are not on.
25. Press HE SS or AP SS button.
26. Select target through gunner's eyepiece.
27. Aline reticle on target.
28. Press drift button and hold for 3 to 5 seconds.
29. Check for stabilization drift.
- (30.) Press drift button and hold for 3 to 5 seconds.
- (31.) Check for stabilization drift.
32. Fire 25mm gun as required.
33. Fire Coax machinegun as required.
34. Move STAB switch to OFF.
35. Traverse TURRET DRIVE system switch to OFF.
36. Move TURRET DRIVE system switch to OFF.
37. Move TURRET POWER switch to OFF.
38. Set travel lock.
39. Release lap safety belts.
40. Open turret shield door.

Operate 25mm gun guard and gun cover

1. Remove 25mm gun guard.
2. Open gun cover.
3. Close gun cover.
4. Install 25mm gun guard.

Operate coax machinegun access doors

1. Open coax machinegun access doors.
2. Close coax machinegun access doors.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

Operate intercom system

1. Plug in CVC helmet.
2. Put on CVC helmet.
3. Select channel on intercom control box.
4. Move helmet switch on left of helmet to rear to talk and listen.
5. Adjust volume knob on intercom control box.
6. Have gunner press floor switch to talk, release floor switch to listen.

Close/open blackout cover

1. Close blackout cover.
2. Open blackout cover.

Operate turret lights

A. Operate service light

1. Remove 25mm gun guard and open gun cover.
2. Pull service light from base.
3. Push service light on to base.
4. Operate service light.
5. Pull service light from base, if installed behind 25mm gun guard.
6. Push service light onto base.
7. Install 25mm gun guard and close gun cover.

B. Operate utility light

8. Remove 25mm gun guard and open gun cover.
9. Pull utility light from base.
10. Push utility light onto base.
11. Operate utility light.
12. Pull utility light from base, if installed behind 25mm gun guard.
13. Push utility light onto base.
14. Install 25mm gun guard and close gun cover.

C. Operate dome lights

15. Operate white dome lights.
16. Operate blackout dome lights.

\*Boresight weapons system

A. Boresight 25mm gun

1. Start engine.
2. Drive vehicle to within 3200 feet (1000 meters) of suitable target and position vehicle facing target.
3. Stop engine.
4. Move TURRET POWER switch to ON.
5. Move NIGHT VISION POWER switch to ON.
6. Raise ballistic sight cover doors.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

7. Move range control knob to 0.
8. Move MAG switch to HIGH.
9. Move SENSOR SELECT switch to CLEAR or NEUTRAL.
10. Press AP SS button.
11. Check that AP appears on status indicator.
12. Move turret traverse drive select lever to manual position.
13. Move gun elevation drive select lever to manual position.
14. Move TOW elevation drive select lever to power position.
15. Center gun reticle on aiming point of target.
16. Install 25mm boresight adapter and boresight telescope.
17. Focus boresight telescope on target.
18. Release turret travel lock.
19. Aline elevation crosshairs in boresight reticle on aiming point of target.
20. Aline azimuth crosshairs in boresight reticle on aiming point of target.
21. Check accuracy of boresight telescope.
22. Turn diopter to focus gun reticle.
23. Check alinement of gun reticle on aiming point of target.
24. Aline gun reticle on aiming point of target.
25. Remove boresight telescope and 25mm boresight adapter from 25mm barrel.

B. Boresight coax machinegun

26. Press 7.62 button.
27. Check that 7.62 appears in status indicator.
28. Check alinement of gun reticle on aiming point of target.
29. Sit in commander's seat.
30. Install boresight adapter and boresight telescope.
31. Focus boresight telescope on target.
32. Open coax machinegun access doors.
33. Aline azimuth crosshairs of boresight reticle on aiming point of target.
34. Aline elevation crosshairs in boresight reticle on aiming point of target.
35. Remove boresight telescope and boresight adapter.
36. Close coax machinegun access doors.

C. Boresight night sight to day sight using convenient target method.

37. Check that NIGHT VISION POWER switch is ON.
38. Move SENSOR SELECT switch to NIGHT.
39. Turn BRT knob to adjust brightness.
40. Turn CON knob to adjust contrast.
41. Turn focus knob to focus gun reticle.
42. Aline elevation crosshairs and azimuth crosshairs in gun reticle on aiming point of target.
43. Move SENSOR SELECT switch to CLEAR or NEUTRAL.
44. Check alinement of gun reticle on aiming point of target.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

D. Boresight night sight to day sight using buddy boresight method

45. Start engines of two vehicles.
46. Drive two vehicles to level ground and position the two vehicles facing each other, no less than 656 feet (200 meters) apart.
47. Stop engines of two vehicles.
48. Move TURRET POWER switches in both vehicles to ON.
49. Move NIGHT VISION PWR switches in both vehicles to ON.
50. Press AP SS button.
51. Check that AP appears on status indicator.
52. Turn diopter to focus gun reticle.
53. Move night vision PWR switch to BRSIT.
54. Aline elevation crosshairs in gun reticle on boresight lamp of other vehicle.
55. Aline azimuth crosshairs in gun reticle on boresight lamp of other vehicle.
56. Move SENSOR SELECT switch to NIGHT.
57. Turn BRT knob to adjust brightness.
58. Turn CON knob to adjust contrast.
59. Turn focus knob to focus reticle.
60. Check alinement of gun reticle on thermal resistor of other vehicle.
61. Aline elevation crosshairs and azimuth crosshairs in gun reticle on thermal resistor of other vehicle.
62. Move SENSOR SELECT switch to CLEAR or NEUTRAL.
63. Check alinement of gun reticle on boresight lamp of other vehicle.
64. Move NIGHT VISION PWR switch to OFF.

E. Boresight TOW launcher

65. Select a suitable target 3280 feet (1000 meters) away from you.  
Repeat steps 1-5.
66. Move MAG switch to HIGH.
67. Move SENSOR SELECT switch to CLEAR or NEUTRAL.
68. Raise TOW launcher.
69. Move TURRET DRIVE system switch to OFF.
70. Press TOW button.
71. Check that TOW indicator light stays on when TOW test indicator light goes out.
72. Check that TOW appears on status indicator.
73. Move TOW elevation drive select lever to manual position.
74. Move gun elevation drive select lever to PWR position.
75. Move turret traverse drive select lever to manual position.
76. Install boresight telescope.
77. Release turret travel lock.
78. Focus boresight telescope on target.
79. Look in eyepiece of boresight telescope and aline azimuth crosshair in boresight reticle on aiming point of target.
80. Aline elevation crosshair in boresight reticle on aiming point of target.
81. Check alinement of TOW vehicle on aiming point of target.
82. Aline elevation crosshair in TOW vehicle on aiming point of target.

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83. Press TOW button.
84. Remove boresight telescope.
85. Lower TOW launcher.
86. Move TURRET DRIVE system switch to OFF.

\*Zero ISU and 25mm gun

1. Select target that is 1000 meters (3280 feet) away from you.
2. Turn range control knob to 10.
3. Move MAG switch to HIGH.
4. Press AP SS button or HE SS button (TP-T only).
5. Traverse turret and elevate or depress 25mm gun to align reticle on target.
6. Move ARM-SAFE-RESET switch to ARM.
7. Fire one round at target.
8. Look at strike of round through gunner's eyepiece.
9. Align reticle on center of strike of round.
10. Traverse turret and elevate or depress 25mm gun to align reticle back on target.
11. Repeat steps 7 and 8 until 25mm gun is zeroed.
12. Notify organizational maintenance if 25mm gun cannot be zeroed.

\*Zero ISU and coax machinegun

1. Choose target 800 meters (2624 feet) from vehicle.
2. Turn range control knob to 8.
3. Move MAG switch to HIGH.
4. Open coax machinegun access doors.
5. Check position of manual safety on coax machinegun.
6. Charge coax machinegun.
7. Close coax machinegun access doors.
8. Press 7.62 button.
9. Traverse turret and elevate or depress gun rotor to align reticle or center of target.
10. Move ARM-SAFE-RESET switch to ARM.
11. Fire short burst from coax machinegun.
12. Examine strike of rounds on target.
13. Open coax machinegun access door.
14. Turn EL knob to adjust elevation.
15. Turn AZ knob to adjust azimuth.
16. Close coax machinegun access doors.
17. Check for proper zero of coax machinegun.
18. Open coax machinegun access doors.
19. Push manual safety up to safe position with "S" showing.
20. Close coax machinegun access door.

\*Time 25mm gun feeder

1. Turn worm shaft nut.
2. Cycle 25mm gun feeder to SEAR position.
3. Check bolt position indicator.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

\* Position 25mm gun bolt in SEAR position

1. Check position of drive shaft handle.
2. Pull out drive shaft handle.
3. Lock bolt in SEAR position.
4. Release SEAR retractor lever.
5. Check that drive shaft handle will not turn.
6. Install 25mm gun feeder.

\* Load 25mm gun feeder

1. Remove 25mm gun guard and open gun cover.
2. Check that bolt position indicator is in SEAR position.
3. Check that manual SAFE handle is in SAFE position.
4. Manually elevate 25mm gun to 200 mils.
5. Pull or feed select solenoid knob to HE position.
6. Forward HE AMMO to 25mm feeder.
7. Load feeder with two rounds of HE AMMO.
8. Push in FWD select solenoid knob to AP position.
9. Forward AP AMMO to 25mm feeder.
10. Load feeder with one round of AP ammo.
11. Close gun cover and install 25mm gun guard.

\* Load/reload 25mm HE AMMO

1. Traverse turret to HE LOAD position (2150 mils)
2. Set turret travel lock.
3. Move TURRET DRIVE system switch to OFF.
4. Move TURRET POWER switch to OFF.
5. Open turret shield door.
6. Turn handle and remove 25mm ammo can door.
7. Turn handle and remove access door.
8. Turn handle and remove HE AMMO can door.
9. Stow squad seats.
10. Unstow HE AMMO boxes from floor.
11. Stack HE AMMO boxes.
12. Unstow HE AMMO boxes from IFV ammo racks if necessary.
13. Stack HE AMMO boxes. (14-15 CV only)
16. Prepare first ammo belt.
17. Prepare second ammo belt.
18. Remove first round from ammo belt.
19. Join second ammo belt to first ammo belt.
20. Check ammo belt for short rounds.
21. Join ammo belts as required.
22. Load first 44 rounds in ammo can.
23. Release upper roller.
24. Forward ammo belt.
25. Lock upper roller.
26. Lock next group of rounds on ammo belt in ammo can.
27. Lift ammo belt loops over baffle.

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28. Lift ammo belt loops over roller.
29. Load ammo belt while ammo can is full.
30. Install HE ammo can door and turn handle.
31. Install access door and turn handle.
32. Install 25mm ammo can door and turn handle.
33. Move HE-AP selector to HE.
34. Stow empty ammo cans.
35. Close turret shield door.
36. Move TURRET POWER switch to ON.
37. Move TURRET DRIVE system switch to ON.
38. Release turret travel lock.
39. Traverse turret to 6400 mils.
40. Tell commander HE AMMO is loaded.

\* Load/reload 25mm AP AMMO

1. Traverse turret to AP load position (4350 mils).
2. Set turret travel lock.
3. Move TURRET DRIVE system switch to OFF.
4. Move TURRET POWER switch to OFF.
5. Open turret shield door.
6. Open and remove AP AMMO can door from AP AMMO can.
7. Stow squad seats.
8. Unstow AP AMMO boxes from floor.
9. Stack AP AMMO boxes.
10. Unstow squad seats if necessary.
11. Unstow HE AMMO boxes from IFV ammo racks if necessary.
12. Stack AP AMMO boxes. (13-14 CFV)
15. Prepare first ammo belt.
16. Prepare second ammo belt.
17. Remove first round from second ammo belt.
18. Join second ammo belt to first ammo belt.
19. Check ammo belt for short rounds.
20. Join ammo belts as required.
21. Load ammo belt onto loading rail.
22. Forward ammo belt.
23. Join ammo belt to round hanging from AP feed chute.
24. Install and close AP AMMO can door.
25. Move HE-AP selector switch to AP.
26. Stow empty ammo cans.
27. Close turret shield door.
28. Move TURRET POWER switch to ON.
29. Move TURRET DRIVE system switch to ON.
30. Release turret travel lock.
31. Traverse turret to 6400 mils.
32. Tell commander AP AMMO is loaded.

\* Fire 25mm gun

1. Move TURRET DRIVE system switch to OFF.
2. Remove 25mm gun guard and open gun cover.
3. Move manual SAFE handle to FIRE position.



TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

4. Close gun cover and install 25mm gun guard.
5. Select ammo as required.
6. Move TURRET DRIVE system switch to ON.
7. Move NIGHT VISION PWR switch to ON.
8. Move SENSOR SELECT switch to NIGHT.
9. Move night vision PLRT switch to W/H or B/H as desired.
10. Turn CON knob to adjust control.
11. Turn BRT knob to adjust brightness.
12. Turn FOCUS knob to focus image in gunner's eyepiece.
13. Move SENSOR SELECT switch to CLEAR or NEUTRAL.
14. Turn RET BRT knob to adjust reticle brightness.
15. Move MAG switch to light.
16. Find range of target using range finder in reticle.
17. Turn range control knob to range estimated in step 16.
18. Center target in reticle.
19. Move ARM-SAFE-RESET switch to ARM.
20. Fire 25mm gun at target.
21. Remove 25mm gun guard.
22. Check bolt position indicator.
23. Move ARM-SAFE-RESET switch to SAFE.
24. Move TURRET DRIVE system switch to OFF.
25. Remove 25mm gun guard and open gun cover.
26. Clear 25mm gun.
27. Move manual SAFE handle to SAFE.
28. Close gun cover and install 25mm gun guard.

\* Unload 25mm gun feeder

A. Prepare 25mm gun feeder for unloading

1. Move ARM-SAFE-RESET switch to RESET, then to SAFE.
2. Set turret travel lock.
3. Remove 25mm gun guard and open gun cover.
4. Move manual SAFE handle to SAFE position.
5. Raise feeder handle.
6. Remove power cable from 25mm gun.
7. Open coax machinegun access doors.
8. Disconnect AP and HE links from links in AP and HE eject chutes.
9. Close coax machinegun access door.
10. Remove AP link eject chute from 25mm gun feeder.
11. Pull out feed select solenoid knob to HE position.

B. Unload AP AMMO from 25mm gun feeder

12. Unload AP AMMO from 25mm gun feeder.
13. Remove 25mm gun feeder.

C. Remove HE link eject chute from 25mm gun feeder.

14. Manually depress 25mm gun to maximum depression.
15. Remove HE eject chute from 25mm gun feeder.
16. Push in feed select solenoid knob to AP position.

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D. Unload HE AMMO from 25mm gun feeder

17. Unload HE AMMO from 25mm gun feeder.
18. Remove 25mm gun feeder.

E. Remove 25mm Ammo from 25mm gun feeder

19. Push in and hold timer release rod.
20. Turn worm shaft nut to left.
21. Release timer release rod.
22. Continue to turn worm shaft nut until round drops into helper's hand.
23. Time 25mm gun feeder.

\*Unload/stow 25mm HE AMMO

1. Remove HE link eject chute from 25mm gun feeder.
2. Unload HE AMMO from 25mm gun feeder.
3. Traverse turret to HE load position (2150 mils).
4. Set turret travel lock.
5. Open turret shield door.
6. Move TURRET DRIVE system switch to OFF.
7. Remove HE AMMO can door.
8. Move TURRET POWER switch to OFF.
9. Unload HE AMMO from HE feed chute.
10. Move HE AMMO onto loading rail.
11. Pull ammo belt from HE AMMO can. Stretch and place ammo belt on vehicle floor.
12. Remove 15th round.
13. Separate links.
14. Place loose round in empty double links.
15. Repeat steps 12-14 until all ammo is separated into 15 round belts.
16. Stow first 15 rounds of ammo in HE AMMO box
17. Stow second 15 rounds of ammo in HE AMMO box.
18. Install HE AMMO can door.
19. Stow HE AMMO.
20. Close turret shield door.
21. Move TURRET POWER switch to ON.
22. Move TURRET DRIVE system switch to ON.
23. Release turret travel lock.
24. Traverse turret to 6400 mils.
25. Set turret travel lock.
26. Open turret shield door.
27. Move TURRET DRIVE system switch to OFF.
28. Move TURRET POWER switch to OFF.

\* Unload/stow 25mm AP AMMO

1. Remove AP link eject chute from 25mm gun feeder.
2. Unload AP AMMO from 25mm gun feeder.
3. Traverse turret to AP load position (4350 mils).

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4. Set turret travel lock.
5. Open turret shield door.
6. Move TURRET DRIVE system switch to OFF.
7. Remove AP AMMO can door.
8. Move TURRET POWER switch to OFF.
9. Unload AP AMMO from AP feed chute.
10. Remove AP AMMO onto loading rail.
11. Pull ammo belt from AP AMMO can. Stretch and place ammo belt on vehicle floor.
12. Remove 15th round.
13. Separate links.
14. Place loose rounds in empty double links.
15. Repeat steps 12 thru 14 until all ammo is separated into 15 round belts.
16. Stow first 15 rounds of ammo in AP AMMO box.
17. Stow second 15 rounds of ammo in AP AMMO box.
18. Install AP AMMO can door.
19. Stow AP AMMO.
20. Close turret shield door.
21. Move TURRET POWER switch to ON.
22. Move TURRET DRIVE system switch to ON.
23. Release turret travel lock.
24. Traverse turret to 6400 mils.
25. Set turret travel lock.
26. Open turret shield door.
27. Move TURRET DRIVE system switch to OFF.
28. Move TURRET POWER switch to OFF.

\* Load/reload coax machinegun ammo

1. Open coax machinegun door.
2. Open coax machinegun access door.
3. Set manual safety on coax machinegun.
4. Open feed cover and feed tray.
5. Inspect chamber for round.
6. Unstow and open four 7.62mm cans.
7. Load ammo belt in first section of coax ammo box.
8. Link ammo belts.
9. Load second and third sections of coax ammo box.
10. Load top area of coax ammo box.
11. Link loaded ammo belt to ammo in chute.
12. Close feed tray.
13. Install ammo belt on feed tray.
14. Close feed cover.
15. Close coax machinegun access doors.
16. Close coax ammo box door.

\* Fire coax machinegun

1. Open coax machinegun access doors.
2. Check position of manual safety on coax machinegun.
3. Charge coax machinegun.

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4. Close coax machinegun access doors.
5. Press 7.62 button.
6. Look into gunner's eyepiece.
7. Find range of target using range finder in reticle.
8. Turn range control knob to range estimated in step 7.
9. Center target in reticle.
10. Move ARM-SAFE-RESET switch to ARM.
11. Fire coax machinegun.
12. Move ARM-SAFE-RESET switch to RESET, then to SAFE.
13. Move TURRET DRIVE system switch to OFF.
14. After firing is completed, clear coax machinegun.

\* Clear coax machinegun

1. Open Coax machinegun access doors.
2. Pull charger handle back firmly.
3. Move manual safety up to SAFE position.
4. Open feed cover.
5. Remove ammo belt from feed tray.
6. Open feed tray.
7. Check that chamber is clear of ammo.
8. Close feed tray.
9. Close feed cover.
10. Move manual safety lever to FIRE position.
11. Dry fire coax machinegun.
12. Pull charger handle back firmly.
13. Repeat step 11.
14. Close coax machinegun access doors.

\* Operate TOW launcher in power mode

1. Raise TOW launcher.
2. Elevate TOW launcher.
3. Depress TOW launcher.
4. Lower TOW launcher.

\* Fire TOW missile

1. Check slope indicator.
2. Move NIGHT VISION PWR switch to ON and wait 10 minutes.
3. Move SENSOR SELECT switch to NIGHT.
4. Turn CON knob to adjust contrast.
5. Turn BRT knob to adjust brightness.
6. Turn FOCUS knob to focus images in gunner's eyepiece.
7. Move NIGHT VISION PLRT switch to W/H or B/H as desired.
8. Move SENSOR SELECT switch to NEUTRAL or CLEAR as required.
9. Move MAG switch to HIGH.
10. Raise TOW launcher.
11. Press TOW button
12. Check TOW and TOW test indicator light.
13. Check TOW controls.

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14. Check that annunciator lights on annunciator box are off.
15. Check that annunciator lights on TOW control box are off.
16. Look into gunner's eyepiece.
17. Press button of missile tube 1 or missile tube 2.
18. Move ARM-SAFE-RESET switch to ARM.
19. Center reticle crosshairs on target.
20. Squeeze and hold trigger and palm switches on gunner's control handles.
21. Track target with gunner's control handles until TOW missile impacts.
22. Abort TOW missile if required.
23. With gunner's control handle, guide TOW missile to safe area until TOW missile impacts.
24. Fire second TOW missile. Repeat steps 17 thru 23.

\* Unload 7.62mm ammo

1. Open coax ammo box door.
2. Clear coax ammo forwarder.
3. Close coax ammo box door.
4. Unstow empty 7.62mm ammo cans.
5. Open empty 7.62mm ammo cans.
6. Remove about 100 rounds of 7.62mm ammo from coax ammo box.
7. Stow 100 round belt in 7.62mm ammo can.
8. Fill and close 7.62mm ammo can.
9. Unload remaining 7.62mm ammo from coax ammo box and stow in 7.62 ammo cans.
10. Stow 7.62mm ammo cans.

\* Load/reload TOW launcher

1. Traverse turret to TOW load position (5950 mils).
2. Raise TOW launcher.
3. Elevate TOW launcher to 500 mils.
4. Move TURRET DRIVE system switch to OFF.
5. Move TURRET POWER switch to OFF.
6. Move MASTER POWER switch to OFF.
7. Set turret travel lock.
8. Open cargo hatch cover to TOW load position.
9. Remove dust cover.
10. Prepare TOW launcher for loading.
11. Remove any obstructions or debris from TOW launcher tubes.
12. Check that umbilical connectors do not extend down into TOW launcher tubes.
- (13.) Withdraw umbilical connectors from TOW launcher tubes.
- (14.) If spent TOW missile casing hangs up in TOW launcher tube, pull down hard on handles to aline lug channels.
- (15.) Pull spent TOW missile casing from TOW launcher tube.
- (16.) Withdraw umbilical connectors from TOW launcher tubes.
- (17.) Discard spent TOW missile casing.
18. Unstow TOW missiles from vertical stowages.
19. Unstow TOW missiles from horizontal stowages (Step 20 CFV only).

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

21. Remove forward handling ring from nose end of TOW missile.
22. Remove electrical connector cover from TOW missile electrical connector. Save cover until TOW missiles are fired.
23. Inspect TOW missile for damages.
24. Lug channels in the TOW launcher can get out of alignment and block TOW missile loading. If TOW missile meets resistance about halfway into TOW launcher, pull down hard on loading handle to realign lug channels.
25. Load TOW missile into TOW launcher.
26. Close cargo hatch cover. Tell gunner that cargo hatch cover is closed.
27. Move MASTER POWER switch to ON.
28. Move TURRET POWER switch to ON.
29. Move TURRET DRIVE system switch to ON.
30. Traverse turret to 6400 mils.
31. Lower TOW launcher.

\*Unload TOW launcher

1. Traverse turret to TOW load position (5950 mils).
2. Raise TOW launcher.
3. Elevate TOW launcher to 500 mils.
4. Move TURRET DRIVE system switch to OFF.
5. Move TURRET POWER switch to OFF.
6. Move MASTER POWER switch to OFF.
7. Set turret travel lock.
8. Open cargo hatch cover to TOW load position.
9. Inspect rear end of TOW missile for damage.
10. Unload TOW missile from TOW launcher.
11. Move MASTER POWER switch to ON.
12. Move TURRET POWER switch to ON.
13. Move ARM-SAFE-RESET switch to RESET, then to SAFE. Wait 10 seconds.
14. Move TURRET POWER switch to OFF.
15. Move MASTER POWER switch to OFF.
16. Unload second TOW missile from TOW launcher. Repeat step 10.
17. Prepare TOW missile for stowage.
18. Stow TOW missiles.
19. Install dust cover on TOW launcher.
20. Close cargo hatch cover and tell gunner that cargo hatch is closed.
21. Move MASTER POWER switch to ON.
22. Move TURRET POWER switch to ON.
23. Move TURRET DRIVE system switch to ON.
24. Traverse turret to 6400 mils.
25. Depress TOW launcher to 0 mils.
26. Power TOW launcher.

\*Load/stow/reload smoke grenades

- A. Load and stow smoke grenades
1. Move TURRET DRIVE system switch to OFF.
  2. Move TURRET POWER switch to OFF.
  3. Move MASTER POWER switch to OFF.

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4. Open right side smoke grenade stowage bin.
5. Remove four rubber caps from right side grenade launcher tubes.
6. Unpack eight smoke grenades from two ammo boxes.
7. Stow four smoke grenades in right side smoke grenade stowage bin.
8. Load four smoke grenades in right side grenade launcher tubes.
9. Install four rubber caps on right side grenade launcher tubes.
10. Stow four smoke grenades in left side smoke grenade stowage bins.  
Load four smoke grenades in left side grenade launcher tubes. Repeat steps 4-9.

B. Reload smoke grenades

11. Prepare vehicle for reloading smoke grenades. Repeat steps 1-3.
12. Remove four smoke grenades from right side smoke grenade stowage bin.
13. Reload four smoke grenades in right side grenade launcher tubes.  
Repeat steps 8 and 9.
14. Unstow and reload four smoke grenades in left side grenade launcher tubes. Repeat steps 12, 8, and 9.

\* Launch smoke grenades

1. Close gunner's hatch cover.
2. Close commander's hatch cover.
3. Close cargo hatch cover.
4. Close driver's hatch cover.
5. Move GRENADE LAUNCHER switch to ON.
6. Press trigger button to fire smoke grenades.
7. Take immediate action if smoke grenades fail to fire.
8. Move GRENADE LAUNCHER switch to OFF.
9. As soon as tactical situation permits, check that all smoke grenades have fired.

\* Unload/stow smoke grenades

1. Move TURRET DRIVE system switch to OFF.
2. Move TURRET POWER switch to OFF.
3. Unlatch and open right side smoke grenade stowage bin.
4. Remove four rubber caps from right side grenade launcher tubes.
5. Remove four smoke grenades from right side grenade launcher tubes.
6. Stow four smoke grenades in right side smoke grenade stowage bin.
7. Install four rubber caps on right side grenade launcher tubes.
8. Repeat steps 3 thru 7 to unload and stow smoke grenades on left side of turret.

\* Shut down turret

1. Elevate and depress gun rotor to 0 mils.
2. Traverse turret to 6400 mils.
3. Set turret travel lock in locked position.
4. Move turret traverse select lever to manual position.
5. Turn turret traverse hand wheel slowly while pushing on travel lock lever to insure that teeth mesh.

TASK INDEX: OPERATION UNDER USUAL CONDITIONS - TURRET

6. Move STAB switch to off.
7. Move TURRET DRIVE system switch to OFF.
8. Move TURRET POWER switch to OFF.
9. Close both ballistic sight cover doors.
10. Unlock hinge latch handle.
11. Move commander's hatch cover to POP-UP position.
12. Close commander's hatch cover.
13. Release gunner's hatch cover from locked position.
14. Close gunner's hatch cover.
15. Move power switch on commander's radio to OFF.
16. Move power switch on gunner's radio to OFF.
17. Move power CKT BKR switch on intercom amplifier to OFF.
18. Open turret shield door.
19. Turn two white dome lights off.
20. Turn two blackout dome lights off.



TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - HULL

\*Operate in extreme cold: below -25° F (-10° C)

A. Prepare to operate vehicle in extreme cold.

1. Check that gunner's hatch cover is closed.
2. Check that commander's hatch cover is closed.
3. Check that cargo hatch cover is closed.
4. Check that ramp is raised.
5. Check that ramp access door is closed.
6. Check that driver's hatch cover is closed.
7. Open turret shield door.
8. Install grille cover.
9. Manually depress 25mm gun.
10. Place tarpaulin over vehicle.

B. Operate vehicle in extreme cold.

11. Fold tarpaulin back over turret to uncover exhaust/intake grills.
12. Operate winterization kit.
13. Cold start engine.
14. Release hand brake.
15. Press down brake pedal and hold through step 16.
16. Move gear selector to PIVOT STEER and hold for 5 minutes while slowly raising engine idle. Raise idle while engine runs smoothly.
17. Manually elevate 25mm gun.
18. Check engine coolant gauge. Go to steps 19 or 22.
19. Lower engine idle to slow and move gear selector to NEUTRAL.
20. Set hand brake.
21. Fold grille cover to partly uncover intake grille.
22. Remove tarpaulin from vehicle.
23. Repeat steps 14-16.
24. Perform mission. Then park vehicle on high ground in sheltered area, faced away from wind if possible.
25. Fold grille cover to uncover intake grille.
26. Stop engine.
27. Lower trim vane.
28. Open power unit access door.
29. Drain fuel filter of water.
30. Close power unit access door.
31. Stow trim vane.
32. Install grille cover.
33. Manually depress 25mm gun.
24. Place tarpaulin over vehicle.
25. Repeat steps 1- 6.

\*Operate winterization kit

1. Fold exhaust grille cover to uncover exhaust grille.
2. Move MASTER SWITCH to ON.
3. Start and operate winterization kit heater.
4. Start personnel heater.
5. Shut down winterization kit heater.
6. Turn personnel heater off.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - HULL

\* Prepare to enter water

1. Open driver's hatch cover.
2. Open commander's hatch cover.
3. Open gunner's hatch cover.
4. Elevate 25mm gun to 550 mils.
5. Open cargo hatch cover to UPRIGHT position.
6. Lower ramp.
7. Close firing port vents.
8. Check drain plugs.
9. Close front hull drain plug.
10. Close rear hull drain plug.
11. Remove firing port weapons.
12. Remove two front upper hull drain plugs.
13. Remove two rear upper hull drain plugs.
14. Raise ramp.
15. Check ramp for good seal.
16. Check ramp for access door for good seal.
17. Raise exhaust shroud.
18. Erect water barrier.

\* Ford water less than 3 1/2 feet deep

1. Close front hull drain plug.
2. Close rear hull drain plug.
3. Check that two final drive hull drain plugs are in place and secured.
4. Check that four upper hull drain plugs are in place and secured.
5. Raise ramp.
6. Start engine.
7. Move FWD and REAR BILGE pumps to ON.
8. Ford water.
9. After bilges empty, move FWD and REAR BILGE pump switches to OFF.

\* Erect water barrier

A. Erect tripods

1. Erect left side tripod.
2. Unstow right side tripod.
3. Erect right side tripod.

B. Unstow water barrier

4. Unstow water barrier.

C. Erect rear of water barrier

5. Erect rear of water barrier.
6. Adjust "T" end of tripod.

D. Erect trim vane

7. Erect trim vane.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - HULL

E. Erect sides of water barrier

8. Attach two cable eyelets to trim vane.
9. Pull water barrier over top of trim vane.
10. Raise and lock upper trim vane.
11. Lock trim vane in place.
12. Remove two blocks from right and left brackets.
13. Install two blocks in right and left slides.
14. Install outside elastic cords to grommets on left and right sides of water barrier.
15. Tie inside elastic cord to lifting eye.
16. Snap end of release lanyard to footman loop.
17. Install bilge pump exhaust pipes in front bilge pump outlets.
18. Put struts into caps on left and right sides of hull.
19. Move MASTER POWER switch to ON.
20. Move FWD and REAR bilge pump switches to ON.
21. Check that air flows out of bilge pump exhaust pipes and rear bilge pump outlets.
22. Move FWD and REAR bilge pump switches to OFF.
23. Move MASTER POWER switch to OFF.

F. Raise ramp

24. Raise metal cover.
25. Raise ramp.

\*Drive in water

1. Move FWD and REAR bilge pump switches to ON.
2. Choose spot to enter and exit water.
3. Tell driver where to steer vehicle via intercom.
4. Enter water.
5. Drive vehicle in water.
6. Turn vehicle in water.
7. Stop vehicle quickly in water.
8. Reverse vehicle quickly in water.
9. Drive vehicle forward in water after reversing.
10. Turn vehicle quickly in water.
11. Drive vehicle forward in water after turning quickly.
12. Exit water.
13. Perform post-swimming operations.

\*Stow water barrier

A. Stow trim vane.

1. Lower ramp.
2. Untie elastic cord from lifting eye.
3. Remove outside elastic cords from left and right sides of water barrier.
4. Remove two bilge pump exhaust pipes from two front bilge pump outlets.
5. Remove wire struts from wire cups on left and right sides of hull.
6. Stow lanyard.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - HULL

7. Pull water barrier release lever (under driver's instrument panel) back to raise trim vane to vertical position.
8. Push water barrier off upper trim vane. Have helper assist.
9. Remove two cable eyelets from upper trim vane.
10. Fold upper trim vane into locked position.
11. Unfold snaps on water barrier from trim vane.
12. Fold trim vane against hull. Have helper assist.

B. Stow tripods

13. Remove four cable ends of water barrier from two tripods.
14. Stow left side tripod.
15. Remove right side tripod.
16. Stow right side tripod.

C. Stow front of water barrier

17. Stow front of water barrier.

D. Stow rear of water barrier

18. Stow rear corners of water barrier.
19. Stow rear of water barrier.

E. Stow sides of water barrier

20. Stow right side of water barrier.
21. Stow left side of water barrier.
22. Close cargo hatch cover.
23. Raise ramp.

\*Perform post-swimming operations

1. Release upper trim vane.
2. Drive vehicle to trim level ground.
3. Set hand brake and let engine idle.
4. Turn off fuel control.
5. Move ENGINE ACCESSORY switch to OFF.
6. Move FWD and REAR bilge pump switches to OFF after water is out of vehicle.
7. Move MASTER POWER switch to OFF.
8. Stow water barrier.
9. Drain water from front bilge.
10. Drain water from rear bilge.
11. Open firing port vents.
12. Install upper hull drain plugs.
13. Check for water in hubcap oil.
14. Check for water in final drive oil.

\*Operate vehicle over rough terrain

1. Drive vehicle over trenches.
2. Drive vehicle over obstacle.
3. Drive vehicle on hills.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - HULL

4. Drive vehicle on side slopes.
5. Drive vehicle on snow, ice, or mud.
6. Park vehicle on snow, ice, or mud.

\*Tow disabled vehicle

A. Install

1. Align rear of towing vehicle with front of disabled vehicle.

B. Connect vehicles with tow bar

2. Remove two pins and shackles from two towing eyes on disabled vehicle.
3. Install tow bar on front of disabled vehicle.
4. Install tow bar on pintle of towing vehicle.

C. Connect vehicle with tow vehicle

5. Remove tow cable from disabled vehicle.
6. Remove tow cable from towing vehicle.
7. Remove four pins and shackles from rear of towing vehicle and front of disabled vehicle.
8. Install two towing cables on front of disabled vehicle and rear of towing vehicle in an "X" pattern.

D. Prepare to tow disabled vehicle

9. Move disabled vehicle gear selector to TOW and push down to lock.
10. Release disabled vehicle hand brake.
11. Start engine in towing vehicle.

E. Tow disabled vehicle

12. Set towing vehicle gear selector.
13. Operate headlights.
14. Sound horn.
15. Move vehicle and control speed.
16. Steer vehicle.
17. Stop vehicles.
18. Stop engine in towing vehicle.

F. Disconnect vehicles when using tow bar

19. Disconnect tow bar from pintle of towing vehicle.
20. Disconnect tow bar from towing eyes of disabled vehicle.

G. Disconnect vehicles when using tow cables

21. Remove tow cables from towing eyes.

TASK INDEX: OPERATION UNDER EMERGENCY CONDITIONS - BULL

\*Tow start disabled vehicle

- A. Connect vehicles with tow bar
  - 1. Align rear of towing vehicle with front of disabled vehicle.
  - 2. Remove two pins and shackles from two towing eyes on disabled vehicle.
  - 3. Install tow bar on front of disabled vehicle.
  - 4. Install tow bar on pintle of towing pin.
  
- B. Tow start disabled vehicle
  - 5. Do before (B) preventive maintenance checks and services.
  - 6. Move MASTER POWER switch in disabled vehicle to ON.
  - 7. Move ENGINE ACCESSORY switch in disabled vehicle to ON.
  - 8. Move fuel control handle in disabled vehicle to ON.
  - 9. Release hand brake.
  - 10. Start towing engine.
  - 11. Drive towing vehicle.
  - 12. Tow start vehicle.
  - 13. When disabled vehicle starts, move vehicle gear selector to DRIVE, bring both vehicles to a stop, move gear selector to N (NEUTRAL).
  - 14. Set hand brake on both vehicles.
  - 15. Check disabled vehicle instrument panel for normal gauge reading and light indications.
  - 16. If engine fails to start within 10 seconds of towing at 10-15 mph (15-25 km/hr), wait one minute, then repeat steps 9 and 10.
  - 17. Stop towing vehicle engine.
  
- C. Disconnect vehicles when using a tow bar
  - 18. Remove tow bar from pintle of towing vehicle.
  - 19. Remove tow bar from towing eyes of disabled vehicle.
  - 20. Install two pins and shackles in two towing eyes on disabled vehicle.

Gain access to turned turret in an emergency

\*Immediate action to stop runaway engine

- 1. Move gear selector to N (NEUTRAL).
- 2. Turn off fuel control.
- 3. Stop vehicle.
- 4. Set hand brake.
- 5. Traverse turret to 4100 mils.
- 6. Turn off main fuel manual shut-off valve.
- 7. Traverse turret to 6400 mils.
- 8. Notify organizational maintenance.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - HULL

Engine cooling system

1. Engine coolant temp gage is in red zone.
2. Coolant HI TEMP warning light is on.

Exhaust system

3. Excessive smoke from exhaust system.

Transmission system

4. Transmission overheats during normal operation.
5. TRANS OIL PRESS warning light is on.

Track and suspension system

6. Vehicle pulls to one side on level ground.
7. Track thumps while driving.
8. Vehicle leans or bottoms while driving.
9. Road wheel and support roller hubs are hot.
10. Track adjuster leaks grease.
11. Track is loose.

Bilge pump system

12. Bilge pumps discharge little or no water.

Personnel heater system

13. Personnel heater will not start, or starts but shuts off.

Ramp system

14. Ramp does not work properly.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - TURRET

Operate ring sight

1. Raise front ring sight.
2. Raise aperture ring.
3. Locate target using front ring sight.
4. Track target from outermost ring to center crosshairs on front ring sight and pointer post in aperture ring.
5. Lower aperture ring.
6. Lower front ring sight.

Operate vane sight

1. Traverse turret to align target with vane sight.
2. Determine elevation of target.

\*Operate turret manually

A. Traverse turret manually

1. Move turret traverse drive select lever to manual position.
2. Release turret lock.
3. Remove spring from handle.
4. Traverse turret manually.
5. Install spring on handle.
6. Move turret traverse drive select lever to power position.

B. Operate 25mm gun manual elevation

7. Move gun elevation drive select lever to manual position.
8. Remove spring from handle.
9. Manually elevate and depress 25mm gun.
10. Install spring on handle.
11. Move gun elevation drive select lever to power position.

C. Operate TOW manual lift, raise TOW launcher

12. Move TOW elevation drive select lever to manual position.
13. Remove spring from handle.
14. Manually depress TOW launcher to clear stow pin from saddle.
15. Manually raise TOW launcher to firing position.

D. Operate TOW manual elevation

16. Manually elevate TOW launcher.
17. Manually depress TOW launcher.

E. Operate TOW manual lift, lower TOW launcher

18. Lower TOW launcher to stowed position.
19. Elevate TOW launcher to move stow pin into saddle.
20. Install spring on handle.
21. Move TOW elevation drive select lever to power position.



TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - TURRET

\* Fire 25mm gun manually

1. Remove 25mm gun guard and open gun cover.
2. Remove power cable from 25mm gun.
3. Move manual safe handle to fire position.
4. Lock rear retractor lever.
5. Select AP or HE AMMO as required.
6. Install handcrank assembly or manual drive gear hub.
7. Open commander's hatch cover.
8. Use ring sight to engage target.
9. Fire 25mm gun.
10. Dry fire 25mm gun.
11. Cycle bolt out of misfire position.
12. Cycle 25mm gun until 25mm gun fires.
13. When firing is completed, cycle bolt position indicator to clear position and remove handcrank assembly.

\* Fire coax machinegun manually

1. Open coax machinegun access doors.
2. Charge coax machinegun.
3. Open commander's hatch cover.
4. Use ring sight to engage target.
5. Fire coax machinegun.
6. After firing is completed, clear coax machinegun.

\* Operation in extreme cold

1. Operate turret manually when engine is not running.
2. Perform preventive maintenance checks and services on a regular basis.
3. Manually depress 25mm gun to -150 mils when not in use.
4. Keep ballistic sight cover door closed when ISU is not in use.
5. Keep tarpaulin on vehicle when vehicle is not in use.
6. Keep rubber caps on commander's and gunner's eyepiece when ISU is not in use.
7. Set sensor select switch to NEUTRAL position when using ISU on bright, snowy days.
8. Check that both ISU windows are free of ice, snow, and frost.
9. Use fan defogger switch if ISU fogs up.
10. Fire TOW missile only when temperature is greater than  $-25^{\circ}$  F ( $-31^{\circ}$  C) and target can be seen or tracked through ISU.
11. Replace electrical connector wire after unloading TOW launcher.
12. Check grenade launcher tubes for ice build-up. Keep rubber caps on grenade launcher tubes.

\* Operation in extreme heat

1. Perform preventive maintenance checks and services on a regular basis.
2. Keep ballistic sight cover doors closed when ISU is not in use.
3. Keep tarpaulin on vehicle when vehicle is not in use.
4. Keep rubber cap on commander's and gunner's eyepieces when ISU is not in use.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - TURRET

5. Check position of sun through ISU unity window before using ISU.
6. Set sensor select switch to NEUTRAL position when using ISU on bright, snowy days.
7. Fire TOW missile only when temperature is less than 140<sup>o</sup> F (60<sup>o</sup> C) and target can be seen or tracked through ISU.
8. Replace electrical connector wire after unloading TOW launcher.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - TURRET

\* Immediate action to stop runaway turret

1. Move TURRET DRIVE system switch to OFF.
2. Move TURRET POWER switch to OFF.
3. Using intercom, tell driver to move MASTER POWER switch to OFF.
4. Set turret travel lock.
5. Do not operate turret in power mode. Notify organizational maintenance.

\* Immediate action when 25mm gun misfires

1. Install 25mm gun guard.
2. Move ARM-SAFE-RESET switch to ARM.
3. Release trigger switches on gunner's control handles and wait 5 seconds.
4. Press misfire button.
5. Squeeze trigger and palm switches on gunner's control handles.
6. Check that SEAR indicator light is on.
7. Remove 25mm gun guard.
8. Check bolt position indicator.
9. Tell crew and driver there is cookoff danger. Tell them they must exit vehicle immediately.
10. Open gunner's hatch cover.
11. Open commander's hatch cover.
12. Exit vehicle. Stay clear of 25mm gun barrel and climb down from vehicle.
13. Squeeze trigger switches on gunner's control handles and continue firing.

\* Immediate action when 25mm gun is in cookoff zone (but not in misfire)

1. Tell crew and driver there is cookoff danger. Tell crew and driver they must exit vehicle immediately.
2. Install 25mm gun guard.
3. Move TURRET DRIVE system switch to OFF.
4. Move TURRET POWER switch to OFF.
5. Open gunner's hatch cover.
6. Open commander's hatch cover.
7. Exit vehicle. Stay clear of 25mm gun barrel and climb down from vehicle.

\* Immediate action when Coax machinegun fails to fire

1. Move ARM-SAFE-RESET switch to SAFE.
2. Open coax machinegun access door.
3. Pull charger handle back until bolt locks to reset.
4. Close coax machinegun access door.
5. Tell crew and driver there is cookoff danger. Tell them they must exit vehicle immediately.
6. Move TURRET DRIVE system switch to OFF.
7. Move TURRET POWER switch to OFF.
8. Open gunner's hatch cover.
9. Open commander's hatch cover.
10. Exit vehicle. Stay clear of 25mm gun barrel and coax machinegun barrel and climb down from vehicle.
11. Close coax machinegun access doors.
12. Move ARM-SAFE-RESET switch to ARM.
13. Squeeze palm switch and trigger switch on commander's handle.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - TURRET

\* Immediate action to stop runaway coax machinegun

1. Keep coax machinegun pointed downrange and tell driver to stop vehicle.
2. Move TURRET DRIVE system switch to OFF.
3. Stop coax machinegun from firing.
4. Clear coax machinegun.
5. Unload 7.62 ammo.
6. Notify organizational maintenance.

\* Immediate action when TOW missile misfires

1. Tell crew over intercom TOW missile has misfired and another attempt will be made to fire TOW missile.
2. Move ARM-SAFE-RESET switch to RESET, then to SAFE.
3. Press TOW button.
4. Move TURRET DRIVE system switch to OFF.
5. Move TURRET POWER switch to OFF.
6. Open turret shield door.
7. Exit turret for 30 minutes.
8. Close turret shield door.
9. Notify organizational maintenance of TOW misfire condition.
10. Re-select misfired TOW missile.
11. Move ARM-SAFE-RESET switch to ARM.
12. Squeeze and hold palm switches, then squeeze and hold trigger switches.
13. Move ARM-SAFE-RESET switch to RESET, then SAFE.
14. Move TURRET DRIVE system switch to OFF.
15. Move TURRET POWER switch to OFF.
16. Move MASTER POWER switch to OFF.
17. Open cargo hatch cover to full OPEN position.
18. Exit vehicle through ramp access door.
19. Open turret shield door.
20. Exit turret for 30 minutes.
21. Close turret shield door.
22. Re-enter turret.
23. After 30 minutes, open turret shield door.
24. Traverse turret to TOW load position (5950 mils).
25. Elevate TOW launcher to maximum elevation.
26. Remove misfired TOW missile from TOW launcher.
27. Move misfired TOW missile to safe place.
28. Put clearly visible stake and flag at misfired TOW missile location.
29. Notify explosive ordnance disposal of existence and location of misfired TOW missile.

\* Immediate action when smoke grenade fails to launch

1. Using intercom, tell driver to drive vehicle to a safe area. Vehicle must be at least 410 feet (125 meters) from nearest vehicle, building, personnel or equipment.
2. Move grenade launcher switch to ON.
3. Fire smoke grenades.
4. Open commander's hatch cover.
5. Lower ramp and have helper leave vehicle.
6. Check smoke grenade launchers for misfired smoke grenades.

TASK INDEX: OPERATION UNDER UNUSUAL CONDITIONS - TURRET

7. Move TURRET POWER switch to OFF.
8. Move MASTER POWER switch to OFF.
9. Remove misfired smoke grenades from right side smoke grenade launcher.
10. Remove misfired smoke grenades from left side smoke grenade launcher.
11. Tell gunner that smoke grenade launchers are clear of misfired smoke grenades and that helper is clear of turret.
12. Move smoke grenades to a well-marked spot at least 650 feet (200 meters) from nearest vehicle, building, personnel, or equipment.
13. Notify ordnance disposal of exact location, type, and number of smoke grenades left at safe location.
14. Notify organizational maintenance that smoke grenade launchers on the vehicle have malfunctioned.

\* Immediate action to override hatch switches

1. Remove HATCH INTERLOCK OVERRIDE switch guard.
2. Turn on HATCH INTERLOCK OVERRIDE switch.
3. Report faulty HATCH INTERLOCK OVERRIDE switch to organizational maintenance.
4. When faulty HATCH INTERLOCK OVERRIDE switch is repaired, move it to OFF.
5. Install HATCH INTERLOCK OVERRIDE switch guard.

Gain access to turned turret in an emergency

\* Immediate action to stop runaway engine

1. Move gear selector to NEUTRAL.
2. Turn off fuel control.
3. Stop vehicle.
4. Set hand brake.
5. Traverse turret to 4100 mils.
6. Turn off main fuel manual shut-off valve.
7. Traverse turret to 6400 mils.
8. Notify organizational maintenance.