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**Preliminary Training Requirements
Analysis for the Commander's
Independent Thermal Viewer (CITV)**

**ARI Field Unit at Fort Knox, Kentucky
Training Research Laboratory**

May 1987



U. S. Army Research Institute for the Behavioral and Social Sciences

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Research Product 87-19

**Preliminary Training Requirements
Analysis for the Commander's
Independent Thermal Viewer (CITV)**

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*Office, Deputy Chief of Staff for Personnel
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May 1987

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**Human Performance
Effectiveness and Simulation**

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PRELIMINARY TRAINING REQUIREMENTS ANALYSIS FOR THE COMMANDER'S INDEPENDENT THERMAL VIEWER (CITV)

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FOREWORD

The U.S. Army Research Institute (ARI) provides research, development, and applications support to ensure that soldier-related issues are integrated into the acquisition process for weapon systems. The Future Battlefield Conditions Team at the ARI Field Unit at Fort Knox conducts applied research in the early phases of system development to address pertinent soldier issues such as training and soldier-machine interface.

This report was prepared by the ARI Fort Knox Field Unit under Science and Technology Task 3.5.1, "Training Requirements of NBC and the Future Integrated Battlefield," upon request of the TRADOC System Manager (TSM) for the MIAI Block II. This proactive examination of required training for new equipment is supported by the Memorandum of Understanding (MOU) between ARI and the U.S. Army Armor Center and School (USAARMC) on Land Battle Test Bed research, signed 9 January 1986. The results of this effort were briefed to COL Burgess (TSM-TANK) on 23 February 1987 and the report was provided to the TSM office in response to questions addressed in Tab D of the System MANPRINT Management Plan (SMMP) for the MIAI Block II. This information has been used in subsequent rewrites of the system requirement documentation.



EDGAR M. JOHNSON
Technical Director

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PRELIMINARY TRAINING REQUIREMENTS ANALYSES FOR THE
PROPOSED COMMANDER'S INDEPENDENT THERMAL VIEWER (CITV)

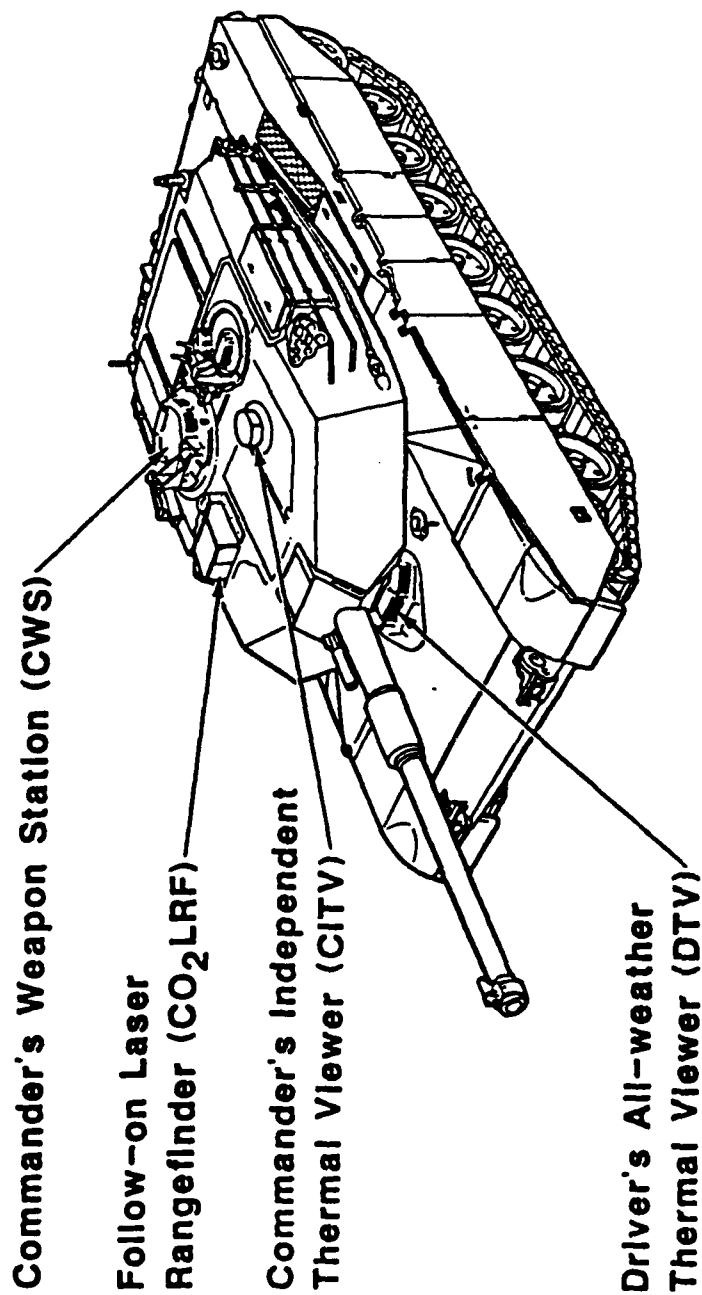
OVERVIEW

Although the M1A1 tank is currently an effective force on the battlefield, several technological advancements are under consideration as enhancements or product improvements to the original design. These enhancements are formally referred to as the M1A1 Block II and consist of a Commander's Independent Thermal Viewer (CITV), an improved Commander's Weapon Station (CWS), a CO₂ Laser Rangefinder (CO₂ LRF), a Battlefield Management System (BMS) to include position location and heading (POS NAV), a Driver's Independent Thermal Viewer (DITV), and a Survivability Enhancement package. These components are shown in relation to an external view of the M1A1 tank in Figure 1. An internal view of a subset of these components is shown in Figure 2.

The potential capability of the M1A1 is greatly enhanced with the addition of the Block II components, but the achieved capability will depend in large measure on the performance of the soldiers who operate, maintain, and support it. In the past, little attention was given to these soldiers during materiel development phases. Often, operator and maintainer performance problems were not identified until the new equipment was fielded. As a result, there are numerous examples of systems used at only 50-75% of their potential and in even more extreme cases systems that were never operationalized. The reasons for such problems include poor soldier-machine interface (SMI), improper anthropometric design, little consideration of training requirements, and little or no consideration for the cognitive capability of the operator and maintainer. The problem is an expensive one, both in terms of wasted dollars and lost combat effectiveness.

MANPRINT

The Army's initiative to obviate or at least reduce future discrepancies between perceived and achieved weapon system capability is called MANPRINT. MANPRINT is formally defined as Manpower and Personnel Integration (Elton, 1986). One of its major goals is to consider the soldier in the design loop early in the life cycle of the new system. Theoretically, this would allow the design to be affected by soldier-based concerns and would move equipment design in the direction of total system performance enhancement. The MANPRINT program attempts to integrate information from six major domains: Manpower, Personnel, Training, Human Factors Engineering, System Safety, and Health Hazard Assessment. MANPRINT efforts should produce systems designed for the soldier in lieu of past approaches which forced the redesign of soldiers (e.g., through training or selection) or the existing equipment (retrofit) for the new system. The MANPRINT approach emphasizes the use of front-end analysis (FEA), modeling and prediction tools. Logically, more quality time and effort spent up front should alleviate the need for resource intensive retrofits after fielding.



- Inter-Vehicular Information System (IVIS)
- Position/Navigation Equipment (P/NE)
- Enhanced Survivability

Figure 1. External view of the M1A1 depicting the M1A1 Block II enhancements.

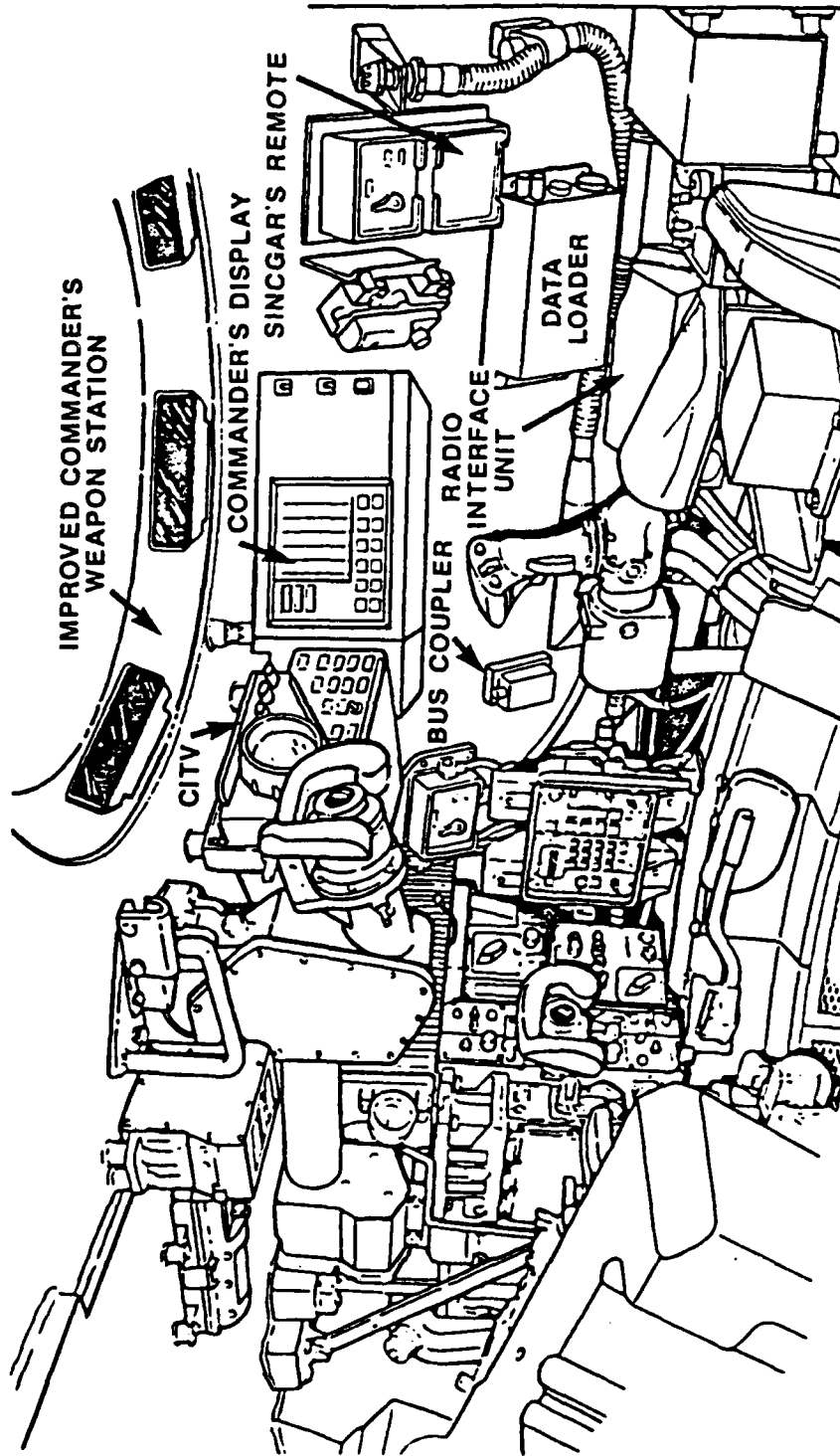


Figure 2. Internal view of the MIAI depicting selected components of the MIAI Block II Product Improvement Program.

Achieving full soldier-in-the-loop system capability necessitates a closely knit integration of all MANPRINT areas and a clear audit trail to maintain information continuity during the life cycle change. A major tool for this integration and audit trail is the System MANPRINT Management Plan (SMMP), that is generated at the early stages of the life cycle to address major issues, goals, milestones, and associated questions. It is a living document, changing periodically to record the events of the system throughout its life. The Army Research Institute (ARI) is currently involved in the development and resolution of SMMP issues for several new systems.

From a time-line perspective, the M1A1 Block II product improvement program preceded the formal introduction of the Army's MANPRINT initiative. As a result, complete FEAs suggested by MANPRINT were not accomplished and the ability to affect total system design can not be fully realized. However, because Block II was comprised of several components which were still in the design stage, it was subjected to a MANPRINT effort and a SMMP was composed to organize and manage the remainder of major events. As an outgrowth of ARI's work with the Block II SMMP construction, the Training and Doctrine Command (TRADOC) System Manager for M1A1 (TSM) requested ARI provide a preliminary training requirements analysis for one of the major components of the Block II, the CITV.

CITV CHARACTERISTICS

The CITV is proposed as a real time thermal viewer to be utilized by the TC in a closed or open hatch mode for target acquisition and surveillance. Components of the proposed system are shown in Figures 3 and 4. These include the CITV display and the TC handle, respectively. The CITV will function as an integral component of the M1A1 fire control system and provide a backup capability for firing the main gun. The CITV is a passive infrared (IR) imaging system designed to operate within the 8-14 micron range of the electromagnetic spectrum. It will allow a TC to effectively survey the battlefield and acquire targets otherwise lost due to one or more of the following: nuclear, biological or chemical (NBC) agents in the area, adverse environmental conditions, lighting conditions (night), dust, smoke, or other man-made obscuration material.

The CITV is a stand alone imaging system in that it is in no way integrated with the Gunner's Thermal Imaging System (TIS). It provides the individual TC with a greatly expanded view of the battlefield which should enable him to move and shoot more efficiently and effectively. The CITV, however, was designed as an integral component of the proposed BMS. As such, its worth is best realized as an enhancement to unit performance rather than to individual tank crew performance. With the capability of seeing more and disseminating that additional information faster, armor units should better detect the enemy and prepare for battle.

The proposed CITV will have three modes of operation: Independent Surveillance, Acquisition (turret and gun slaved to CITV), and Monitor (CITV slaved to turret and gun). These are to be controlled with switches on the CITV display panel and the commander's control handle. Each is briefly explained below.

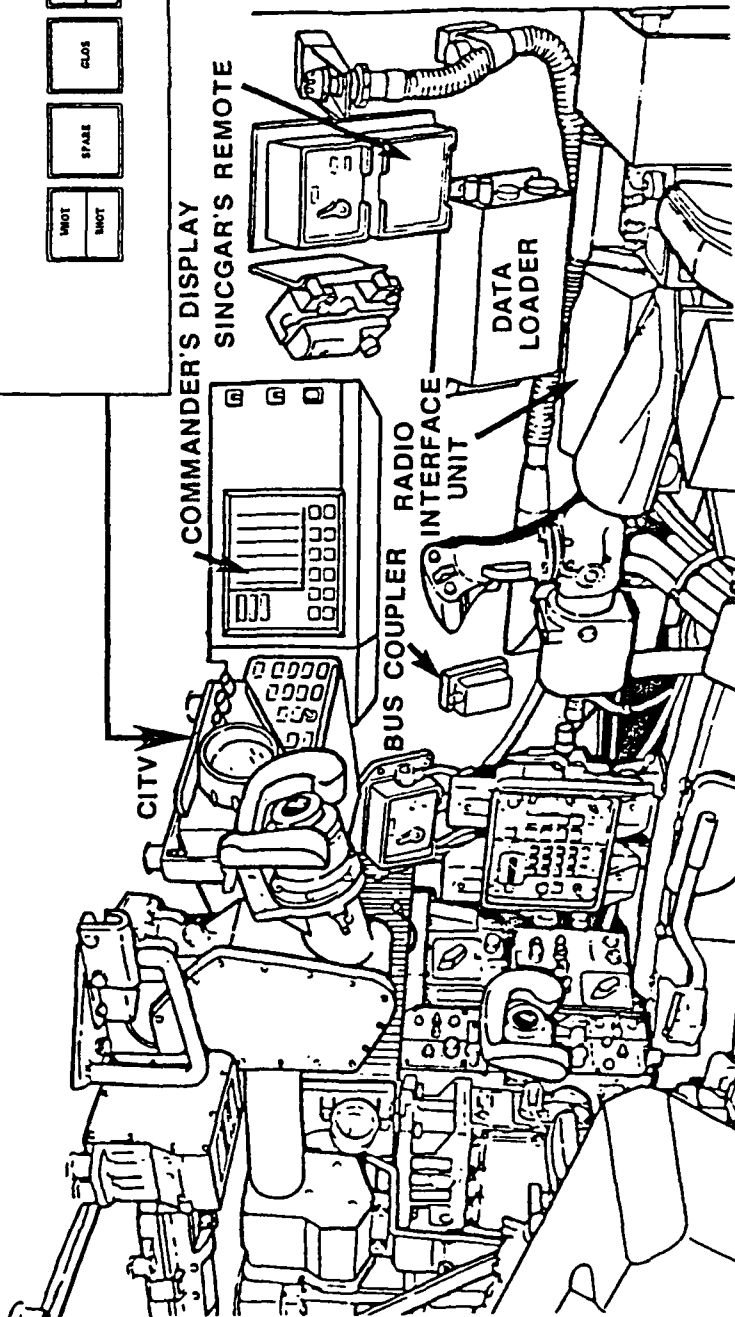
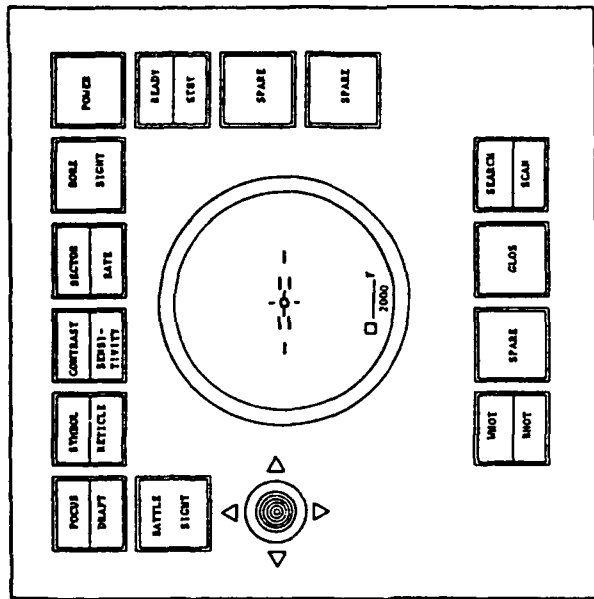


Figure 3. Proposed CITV display and associated panel controls.

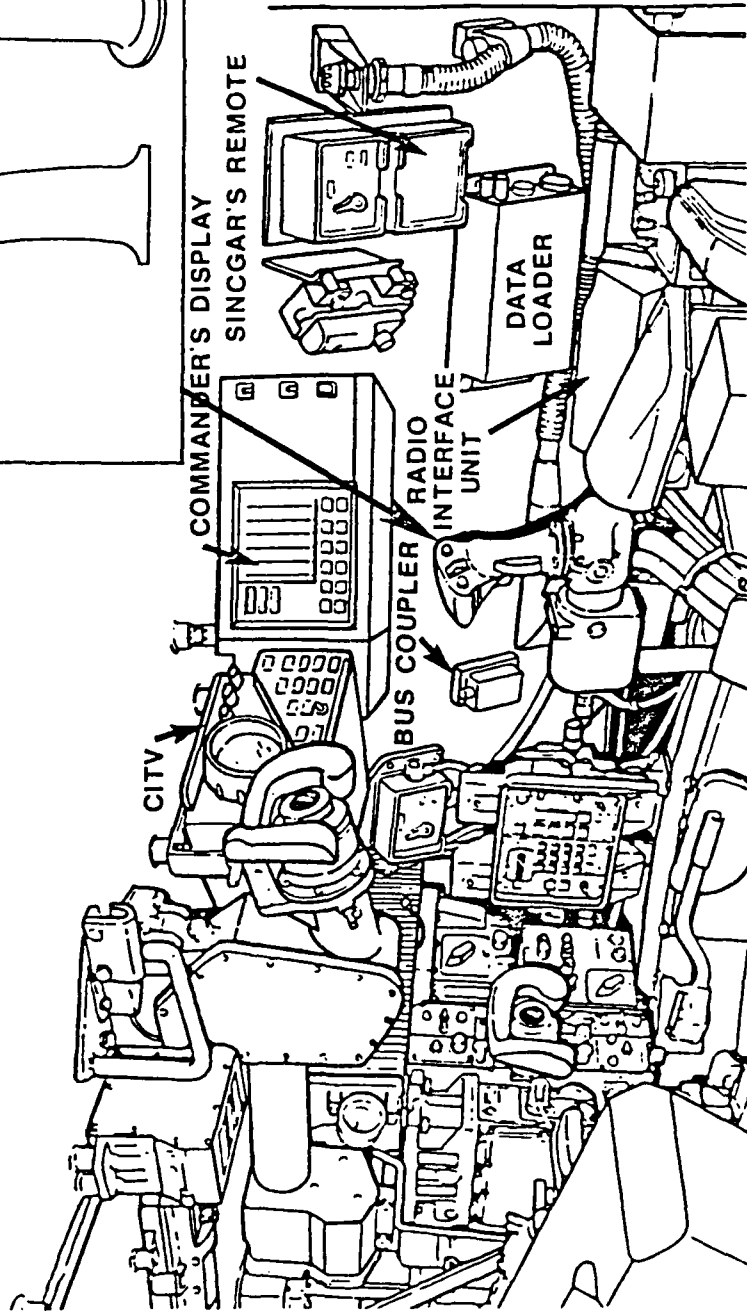
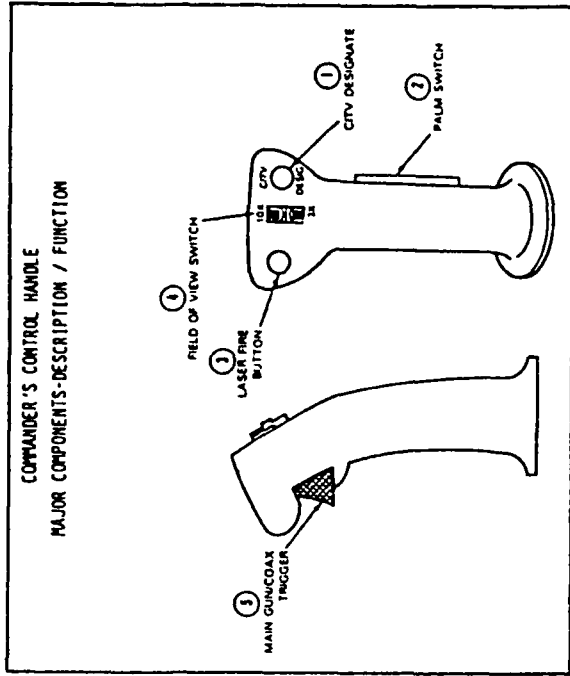


Figure 4. Design Concept of CTV control handle currently under consideration (General Dynamics Land System Human Factors Engineering).

Independent Surveillance. In this mode, the CITV will provide, at a minimum of 270° , an independent surveillance capability to the TC. Coverage will be controlled either by the commander's control handle when it is functioning in CITV status (manual mode) or by the pre-set sector scan which is located on the display panel (auto mode). The auto sector scan can be set at less than 270° and adjusted for angle, position, and rate.

Acquisition: Turret and Gun Slaved to CITV. This mode is referred to as the "Hunter-Killer" capability. At the discretion of the TC, the turret and main gun are slaved to the CITV and respond to the TC's control. The CITV remains on target and the main gun is aligned parallel to the CITV line of sight to within ± 0.15 mil.

Monitor: CITV Slaved to Turret and Gun. This mode is the operational inversion of the override mode. At the discretion of the TC, the CITV is slaved to the turret and gun while the TC assumes the role of a monitor. The CITV line of sight and the main gun are aligned in parallel to within ± 0.15 mil.

In summary, the CITV provides the TC with several new capabilities. These include an expanded view of the battlefield and a view completely independent (if desired) from the gunner's. These capabilities should enable more efficient detection, identification, realistic determination of the most lethal target, and target destruction. Additionally, when integrated with BMS, information such as target location and identification can be gathered and disseminated to other crews or units enabling the total force to be better prepared to meet and fight the enemy.

TRAINING REQUIREMENTS

Training requirements are statements of training obligations the system must fulfill in order to effect its mission (DeGreene, 1970). Simply stated, training requirements analyses, based on solid task and training analyses, provide the system manager and the training manager with indications of possible training concerns and issues associated with the proposed system. These documents should detail: a) who will be trained and to what level, b) what duties and tasks will require training, c) where the proposed training will occur, d) at what stage in the soldier's career progression the training will take place, and e) what materials and devices the training will require.

Training requirement documents should become embedded in the progressive design of the new system. They are based upon information provided in task and training analyses. As such, their worth is completely dependent upon the quality of those analyses and the providers' perceptions of what the training analyst needs. Within the Army's Materiel Acquisition Process (MAP), the initial task analysis should be provided by the contractor of the component/-system, while the training analysis should be conducted by the Directorate of Training and Doctrine (DOTD). These data may be supplemented by subject matter experts (SME) opinions and/or subjective ratings of the user (soldier) on mock-up displays or demonstrators.

The accuracy, but not the value, of the task analysis is dependent upon the maturation of the system. In the early phases of the life cycle, exact system specifications are not completely established. The analysis must therefore be based on the system design concept rather than the actual equipment. Analysis at this level is considered proactive, but it also requires the consideration of an important tradeoff. On the negative side, the analyst is forced to work from a blueprint, an assumed design, or subject matter expert's (SME's) best guess. On the positive side, it may provide preliminary specifications of the duties required in the operational system, early detection of an undesirable human factors design, and potential training problems. In these cases, the proposed design can be changed to bring it more in line with operator and systems performance expectations. Lastly, the predictions made in these analyses can be utilized in the determination of appropriate training programs, simulation for training and/or job aid development. Development of training resources might then occur concurrently with the proposed design allowing the fielding of an operational system with the appropriate mature training strategy and devices.

Given the available data, the analyst systematically steps through the operator tasks searching for specific patterns and/or reoccurring themes. These may include: increases in cognitive requirements, changes in psychomotor responses, potential information overload requiring inefficient attention splits or time sharing, and duties which may ultimately place the soldier's health in jeopardy. When these patterns, trends and problems are identified they can provide the system manager and/or the training manager with insights into potential problematic training areas associated with the proposed system. These may include essential information pertaining to the need of additional resources, such as trainers, training time, training areas and the need for devices and simulators. Additionally they should highlight personnel-related issues to include necessary changes in mental and physical requirements.

In summary, training requirements are the bases for establishing portions of the system performance criteria. Assuming the proper information has been gathered, preliminary analyses of a system in the concept phase can be of great value. In the present analysis, for example, to determine how the soldier interacts with the CITV, what changes in the current training programs are required to facilitate CITV use, and what additional problems may occur as the result of CITV use, should provide the system manager with the insight necessary to affect the subsequent design of the system. Further, training managers should be aided through a better understanding of the training resources required for the CITV.

SOLDIER-IN-THE-LOOP WITH CITV

In order to focus on the duties, tasks, and subtasks involved in the system's use, it is important to view the soldier as he interacts with the system. Therefore, an example of a conduct of fire procedure using the CITV is outlined below. The proposed sequence of crew behaviors includes: target acquisition, ranging, firing, sensing and reengagement.

Target Acquisition/Handoff. With the exception of the TC, crew behaviors in the CITV enhanced MIAI are similar to those in the MIAI version. In both versions, crewmen search assigned sectors and report target sightings to the TC. Unlike the MIAI, the CITV enhanced version provides the TC with the capability to independently search with 3 or 10 power sight magnification. This search may be over a wide arc (as much as 270°) or narrowed to a specific sector or a portion of a sector. Target identification remains a primary responsibility of the TC. Gunners in both systems search to the tank's front using either the Gunners Primary Sight (GPS) daylight or thermal channels in a three power setting. Loaders in both systems search an assigned sector using the 360° swivel mounted angle unity periscope, while the drivers search forward, between the front fenders, looking through vision blocks.

When a target is detected by the TC or reported to him by other crew members, he issues a fire command and lays the main gun for direction with the commander's control handle. When the gunner sees the target he announces "IDENTIFIED." The TC at this point hands-off the target to the gunner and releasing his override. The gunner responds by engaging the palm switches on the control handles, switching the GPS to 10 power whether he is using daylight or thermal channels, and beginning the ranging procedure. With the CITV version the TC has alternatives to this procedure. First he can use the CITV for a direction lay, thus leaving the main gun and the gunner's eyes in another sector. Second, he has the option of handing-off the target to the gunner or engaging the target himself. If he decides to engage, or he simply announces "FROM MY POSITION" and begins the ranging procedure.

Ranging. When the control of the turret/main gun is passed to the gunner he lays the GPS reticle on target center-of-mass and lases to input the range into the fire control system. The laser rangefinder controls and displays are similar in both versions. Range information can be provided on the face of the CITV display (Figure 3), but that capability is slaved to the existing systems. Similarly, the commander's control handle modified for CITV use (see Figure 4) allows the TC to lase to the target, but range determination is dependent upon the already existing rangefinder system.

When a range determination has been made, both the gunner and the TC evaluate the displayed range. If the range does not appear correct, the TC orders "RELEASE" and the procedure (gunner lases to target center-of-mass or TC lases to center-of-mass using CITV) is repeated. If the TC determines the range is still wrong, he can press the battle range button on his control panel. This automatically feeds a preset ammunition dependent range figure into the fire control system. The TC has the additional capability for correction using the MANUAL RANGE ADD/DROP switch. This allows him to add to or subtract from the battle range figure to the estimated target range. The system is now ready for fire.

Fire, Sense, and Reengagement. In a normal hand-off situation, when the TC is satisfied with the range data input, he announces "FIRE." The gunner re-aims onto the center-of-mass and announces "ON THE WAY," and activates either or both firing triggers. The TC and gunner attempt to observe (sense) the effect of the round. If the round misses, reengagement procedures begin. These procedures are dependent upon the type of round. For kinetic energy

rounds (SABOT) the gunner reports the results of the engagement, such as "OVER" "SHORT", etc. based on round location in relation to the target. He then states "REENGAGING." He relays, releases, and announces the new range. After allowing time for the TC to evaluate the range and on TC command, he announces "ON THE WAY" and fires. High explosive anti-tank (HEAT) rounds require a different procedure. Because the speed of the ammo is slower, there is a higher probability of TC or gunner accuracy in sensing round strike relative to the target. After the gunner makes the observation he announces his correction, e.g., "RIGHT ONE-DROP ONE." The "ONE" indicates a one mil adjustment in both range and azimuth. If the TC disagrees with the adjustment he can countermand with a subsequent fire command. The engagement ends when the TC commands "TARGET CEASE FIRE" (indicating target destruction) or until "CEASE FIRE" (for any other reason) is given.

The CITV version allows the TC several alternatives to the above procedure. In the normal target hand-off situation, once the command "FIRE" has been given, the TC may choose to remain as a monitor of the gunner's performance as before or stop monitoring the gunner and resume search for other targets. To do this he must disengage the CITV from the main gun lock. Additionally, and at any point during the procedure, the TC has the capability of comparing target criticality. For example, if a gunner is occupied with a target and the TC detects a new target he suspects as more lethal, he can quickly move the CITV to the gunner's target and make a quick decision. If the new target is determined to be a greater threat, the TC can move the CITV back to the new target, activate the designate button causing main gun alignment with the CITV. At this point the TC is again faced with an option. He can engage the target himself or he can hand-off the target to the gunner, remain until the "FIRE" command is given, disengage the CITV from main gun lock, and reactivate the CITV search.

DESIGN ASSUMPTIONS/CAVEATS

While the desired effect of adding CITV capability to the M1A1 tank is clear, namely increased speed in acquiring and engaging targets, the design specifications have not been so clearly defined. Thus, using a system design concept for the purpose of training requirements analyses requires assumptions and caveats. Those used for the present analyses are shown below.

1. At the time of writing, agreed upon design specifications for the CITV display panel and the TC control handle did not exist. Therefore, a proposed candidate for each was chosen and their functions and capabilities were assumed. Duties requiring integrated operations of these may not be reflected in the task list.

2. Decisions pertaining to the replacement of the GPSE with CITV had not been finalized. Therefore, it was assumed either configuration was possible (i.e. CITV with a GPSE or CITV without a GPSE) and a separate analysis was conducted for each.

3. For the purpose of these analyses, the CITV is considered as a stand alone component added to the original MIAI system. Therefore, integration with other Block II components (especially BMS) is not assumed. This effort may be considered subsequently in an interactive simulator or a crew display demonstration.

4. It was assumed that manual control of the CITV was to be made on either the CITV display panel or with the TC control handle. Other control devices are not involved.

5. It was assumed that CITV does not include an independent LRF capability. The only LRF available will be the existing component.

6. It was assumed that tasks 1-216 in Appendix D and 1-147 in Appendix E pertain only to single tank target engagements.

As indicated, these assumptions range from system integration to the type of function and control manipulanda under consideration. The reader is cautioned that these are preliminary training requirements, but reminded that within the MANPRINT process they are constructed to assist in the determination of the best soldier-in-the-loop performance.

INSTRUMENT CONSTRUCTION

A training requirements analysis requires knowledge of the functional and operational characteristics of the system under consideration. It also requires the necessary background in training devices and development to make judgments concerning the relative difficulty of performing and/or training specific tasks. In response to the TSM's request for such an analysis for CITV, data on proposed CITV characteristics were obtained from the Improved MIAI Tank Program document (General Dynamics, 1985) and judgement categories were based on task and training analyses conducted for the XM1 by Black and Kraemer (1981). Revisions were made to include new tasks specific to the MIAI conduct-of-fire, maintenance, and command, control, and communication (C³) requirements. Duties, tasks, and subtasks that constitute the TC's job description were prepared for alternative CITV configurations. One configuration where the Gunners Primary Sight Extension (GPSE) was retained and one in which the GPSE was removed were examined. The analyses were established and verified with the assistance of SMEs from the Weapons Systems Department of the US Army Armor School (USAARMS).

The order in which the various tasks appear in the task inventory was based on a chronological sequence of events that occurs in an operational Armor unit preparing for and conducting combat missions. Tasks functionally related were grouped and listed in a duty category classification and designated with Roman numerals). Tasks were defined as requiring the performance of one or more individual behaviors and are denoted by Arabic numerals. These in turn were broken down to behaviors with definite beginnings and endings are assigned lower case letters which were defined as subtasks.

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | | PROBLEM | | CAUSE | | | TENTATIVE SOLUTION | | |
|---|------------------|--------------|------|-----|---------|------|--------|-------|----|--------------------|------------|-------------|
| | | MORE EFF | SAME | NEW | INST | UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNC DEV |
| | | | | | | | | | | | | |
| XXV. TARGET ENGAGEMENT WITH MAIN GUN (MANUAL) (GAS) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 116. Establish Weapon System Operating Conditions For MANUAL Mode | S | | X | | | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | | | |

Figure 5. Sample entry in task inventory.

The categories or informational divisions which constitute the subjective MIAI CITV comparability analysis include Commonality, Task Performance, Problem, Cause and Tentative Training Solution (see Appendix C). The results of the training analyses are presented in Appendixes D and E. Appendix D presents the analysis of CITV and GPSE, and Appendix E presents the analysis of training requirements where the GPSE has been removed. To facilitate the use of these analyses, a brief explanation of the informational divisions and the analysis' coding system is provided in the following paragraphs.

The first division, **COMMONALITY**, contains a task by task classification which notes whether performance of a task was unique ("UNIQUE" or "U") to the CITV version of the MIAI task, different ("DIFFRNT" or "D") in some aspect from the MIAI, or essentially the same ("SAME" or "S") as the MIAI counterpart.

The second division is a task by task subjective evaluation of the performance assessment of the MIAI (CITV version) with reference to the MIAI (see example above and Appendix C for further explanation). For example, an "X" or "(X)" appearing under the heading labeled **TASK PERFORM: MORE EFPEC** indicates that performance of the task/subtask appears to be more effective with the addition of the CITV. An "X" or "(X)" under the heading labeled **TASK PERFORM: SAME** denotes no difference in the task or effectiveness of the performance. An "X" or "(X)" under the label **TASK PERFORM: NEW** indicates the task/subtask is new and performance assessment is not possible at this stage.

The third division evaluates duties according to their potential for precipitating a training problem. These are further analyzed according to location (Institution or Unit) where the problem is most likely to occur (see Appendix C for further explanation). For example, a task that is identified as problematic and requires a change in institutional training resources is noted with an "X" or "(X)" under the heading **PROBLEM: INSTITUTION**. Similarly, if the problem requires a change in Unit training resources an "X" or "(X)" is indicated under the heading **PROBLEM: UNIT**.

A fourth division identifies a possible cause for the potential problems. These may be the result of a mental or physical loading and are labeled **MENTAL** and **MOTOR**. The cognitive classification includes problems associated

with memory, procedures, cognitive overload (both quantitative and qualitative). Motor problems are physical (psychomotor) in nature. Duties having potential problems were identified by placing "Yes" under the appropriate column heading, CAUSE: MENTAL MOTOR. Problematic tasks and subtasks were identified by an "X" or (X)" under the appropriate column heading.

The final division was for the proposed training solutions. Solutions considered included embedded training (ET), more hands-on training (More HO), job aids, and training devices (Trng Dev). If incorporating a particular type of training appeared to be the appropriate solution for that duty then "YES" was placed under the corresponding column. If not, a "NO" was entered. Similarly, when a task/subtask received an affirmative evaluation, an "X" or (X)" was entered under that heading. If a task/subtask received a negative evaluation or there was insufficient data to propose a solution, the space was left blank. Appendix C provides a more detailed explanation.

FINDINGS

The findings are organized using the major table headings used in the analyses. These are: (1) Effectiveness; (2) Problem location; (3) Cause; and (4) Tentative Solution. The issues generated by these analyses and general concerns follow in the closing text.

Effectiveness. If designed according to the Army's guide for the CITV specifications, there is no doubt that the CITV will provide the TC with a unique fighting capability. This should allow for more effective performance by the TC, crew, platoon, etc., especially in the areas of target acquisition, simultaneous engagements, and C³. The effectiveness may be limited, however, by the type of training (isolated component vs integrated system), the types of training devices used, and the availability of those devices and other training facilities. For example, if the CITV capability is integrated with BMS, then a form of embedded training which allows inter-vehicular communication and target acquisition practice would be required to maximize training effectiveness.

Additional limitations include efforts toward integration. At the component (CITV) operational level there is the potential for at least "unfriendly" if not greatly hampered interfaces among the use of the sensor, the TC control handle, and the CITV display panel if they are not properly integrated. At the design level, the potential for a "new widget" attitude is highly likely. This attitude occurs when individual components (widgets) are assessed on their positive individual capabilities without consideration of the integration problems that will most certainly occur. This problem may be precluded by efforts of both the training designer and the equipment designer to integrate CITV with already existing and also expected components (GPSE (if maintained) and BMS) of the system.

Problem Location. A change in training resources is expected with the addition of CITV. Because it is a unique addition and does not directly replace another component its training will demand previously unallocated time. Introducing a major component, like CITV, into an existing system

requires acquisition and assimilation of a substantial amount of new information. In this case there is no basis for direct transfer of old skills training. Additional limitations will likely be evidenced in the choice of training devices and facilities as well as their availability. For example, UCFT devices will need to be retrofitted for CITV capability. In addition, the advent of CITV will place renewed emphasis on the need for effective and reliable thermal targets for live fire and laser engagements.

Cause: Mental/Motor. The majority of the problems anticipated with CITV training are cognitive in nature. The potential for cognitive overload appears to be the main concern. This overload is defined as the quantity of information to be processed (e.g., memory for characteristics, capability, procedures for usage, plus quick fixes) versus the quality (components designed for M.I.T. graduates). Simply stated, the use of CITV produces more duties, each loaded with additional memory requirements that are critical for the operation of the total system. Type of training, training devices and facilities, and availability will again be limiting factors.

Potential psychomotor problems are also anticipated in the operation of the CITV control handle. Specifically, the proposed dual mode of the commander's control handle may result in operational problems. The first concern is the differential in the rate of movement control for the CITV and main gun. At the present time, TCs have a built in motor memory for movement control of the turret and gun. Imposing a second movement control on the same handle, especially when the differential is assumed to be extreme, lends itself to confusion and potential for serious flaws in operational usage. To build a new motor memory for acquiring the necessary "touch" associated with the fine tuned control of the CITV requires additional training time and practice for the TC. To accomplish this "touch" while retaining the previously learned main gun control movement memory will be extremely difficult. This soldier-in-the-loop problem is compounded by an equipment design that requires the TC be cognizant at all times of the operational mode (CITV versus turret/main gun control). From the design concepts provided, there appears to be no redundant sensory information to aid the TC in this respect. For example, apparently no provision has been made for signal lights on the display to note the control handle's status (CITV vs. turret).

Perhaps a more serious problem can be attributed to proactive interference. This interference occurs when old motor memories block or interfere with the complete learning of new motor patterns. The effects of this type of interference are generally seen during fatiguing and or stressful situations. In the case of the CITV, function switches are to be located on the control handle in close proximity of the existing function switches. A concern is that under stressful situations the probability of proactive interference effects will increase and temporary loss of an operational system will become more likely. The problem will be more evident in the "well seasoned" TC who is very familiar with the control handle. However, the TC who has not been completely trained and practiced may also fall victim to the interference. It should follow then that the probability of occurrence should be lowered substantially by quality training and practice as well as careful attention to the development and final design of the control handle.

Tentative Solutions. Embedded training may be partial solution for the training of CITV. The degree of its effectiveness however, is dependent upon the level of embedding. If the embedded training is designed for close interactions with other crew members, many of the new tasks would be appropriately addressed. More hands on training is a desirable solution though perhaps not achievable given the restraints which already exist for field training. The probable solution is the use of some type of training device preferably, but not limited to, an interactive simulator. A quality simulation would allow the TC not only to develop the necessary motor memory, but also to assimilate the acquired information through practice. This occurring in the midst of interactive crew training is second only to the "real thing". One of the more obvious trends in the data is the non-use of job aids. It would appear that job aids cannot replace practice with the CITV.

CONCERNS

The reported findings are based on the subjective analyses of data recorded in Appendixes D and E. As with most preliminary analyses, the statements made herein are limited to broad generalizations and/or obvious trends found in the data. Within these parameters, however, the findings should assist members of the Armor community in making some proactive decisions regarding the training associated with the addition of CITV. Additionally, they may serve to highlight research issues for consideration in research efforts such as those using man-in-the-loop simulation capabilities like SIMNET.

In addition to the training problems expected with the use of the CITV, other soldier-related problems surfaced during this analysis. These include physiological problems and hardware design considerations which are reflected in soldier-machine interface (SMI) problems.

Physiological. There are at least three major physiological concerns: visual accommodation and adjustment; disorientation; and motion sickness. The visual accommodation and adjustment concern centers on the need for a TC to make periodic checks from the CITV to the real world through the vision blocks. While CITV provides the TC with a novel viewing capability, this view will be limited at any point in time by a number of variables. Problems with accommodating and adjusting from a screen to the real world through the vision blocks will never be completely eliminated through design, but design considerations may provide the ease in transfer necessary for timely responses by the TC. Some type of sensory augmentation in the form of signal lights, for example, located in the area of the vision blocks, may be useful.

Disorientation is sure to be a major concern with the CITV. At any point in time the TC can experience movement in three directions - movement of the CITV, movement of the turret and main gun, and movement of the chassis. This makes it difficult for the TC to ascertain where he is in relation to his tank and the rest of the world. This problem has been researched by the Germans with the Leopard II and more recently by Hyman (1987). The issue is essential to the effective use of the CITV and to date remains unresolved.

Motion sickness is a catch-all malady which may be the result of several physiological occurrences. Additionally, it has been shown that its probability may be increased by equipment design. The Human Factors Engineering group at General Dynamics Land Systems Division recently published research which addresses motion sickness (1986) with different display models of the CITV. They found two and one-half times more reports of motion sickness when a biocular display was used instead of the preferred direct view display panel. Their results should be considered for subsequent research before the final decisions of the CITV design are completed.

Hardware design. The hardware designs which prove to be sources for concern for the SMI, center on the display presentation, the display panel, and the CITV commander's control handle. With the display, the concern is how the information is presented and how many of the additional responsibilities of the TC will be partially sacrificed when the CITV is used. These concerns stem from the different types of CITV displays proposed. Early versions of the CITV were represented by a "heads-in" design which left little possibility for time sharing between TC duties. Later versions incorporate either the direct view version (flat and rectangular) or the biocular view design (slightly outset from the panel and circular). A complete examination of the advantages and disadvantages of these has yet to be undertaken. This leaves the question of the best soldier fit unresolved. An additional concern on the display panel is the number of switches necessary to operate and control the CITV. Given the time and accuracy constraints within which the TC must work, introducing a system with this many control switches may also increase probability of error.

There are several concerns which focus on the commander's control handle that is modified for CITV use. As mentioned in the training analysis section, the dual mode of operation regarding CITV rotation and main gun rotation may be a potential training problem. Additionally, this dual mode has the potential for operational problems. In this light, several questions immediately surface. These are focused on handle-display integration, sensory augmentation necessary for the TC to be cognizant of a) the operational mode of the systems, b) built redundancy in the control of the CITV, and c) the operational capability of one system when the other is rendered inoperable.

These are MANPRINT concerns which should be addressed before final decisions on the CITV design are formalized. If properly researched they should provide information that contributes to enhanced system performance.

SUMMARY

The findings and concerns as presented contain a common theme. Whether considered separately or in combination, they can be classified as system integration concerns. This is obvious given that subjective assessments made under virtually every major heading of the analysis could have been "it depends". It depends on other existing components in the system (e.g., GPSE) as well as anticipated components (BMS). It depends on the resources (time,

money, energy, facilities) and support. It depends on the upkeep and maintenance. Each of these "it depends" will in some way affect the usage and effectiveness of the CITV, moreover the requirements for training.

From a systems perspective this isolated component analysis begs for integration, the "it depends" questions cannot be addressed from a vacuum. If the preliminary analyses do nothing more than issue red flags of concern to be followed by research efforts in the field or at a simulation site, they have served a purpose. Only in these locations can the quality of integration and interface of the operator, maintainer, and supporter with the component and the total system can be tested and ultimately determined.

Neglecting this type of research effort will lead to the practices of the past where a new "widget" is dropped into a system, forcing some type of integration and interface with the existing components of the system while still expecting designer promised performance. There are too many examples where this practice has failed. Maximum system performance is never achieved and the soldier is left picking up pieces of what should have been. The alternative is to become proactive in applying the necessary resources to address MANPRINT issues during the system design and development phases. This will ensure that the equipment fielded by the Army can achieve its full capability when operated and maintained by available personnel.

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APPENDIX A

PROPOSED SWITCHES AND CONTROLS LOCATED ON CITV CONTROL PANEL

The necessary switches and controls for the operation of the proposed CITV are located on the display panel and consist of the following:

1. Power. Labeled Power and correspond to ON/OFF.
2. Operate/Standby. Labeled READY/STBY, allows operational or standby mode. In the standby mode, detectors will be in a cooled down state with only a minimum of other CITV systems operational.
3. Search/Scan. Labeled SEARCH/SCAN, the search mode permits automatic viewing of imagery produced by CITV rotation. The scan mode permits viewing of selected angular sectors.
4. Gun Line of Sight. Labeled GLOS, the CITV is slaved to the turret and main weapon with a parallel relationship to within 0.15 mil. The gunner maintains control with the TC in monitor mode.
5. Polarity. Labeled WHOT/BHOT, allows the display representation of hot or cold targets as either bright or dark.
6. Battlesight. Labeled BATTLESIGHT, allows for manual range functions by the TC.
7. Focus/Drift. Labeled FOCUS/DRIFT, allows fine tuning of the sensor. Drift control nulls drift of reference gyros in both the elevation and azimuth loops.
8. Reticule and Symbology Brightness. Labeled SYMBOL/RETICLE, allows illumination to be varied for all symbols and reticles. Range includes full bright to full black.
9. Contrast/Sensitivity. Labeled CONTRAST/SENSITIVITY, image contrast is self explanatory and sensitivity provides simultaneous control of all channel gains.
10. Sector/Rate. Labeled SECTOR/RATE, allows TC to establish parameters of the areas to be scanned. Rate controls the angular displacement using scan and search.
11. Boresight adjustment. Labeled BORESIGHT, allows the adjustment of the NFOV scene to boresight coincidence with main gun in azimuth and elevation.
12. Others. This proposed control panel includes three space control switches. One suggested switch is the Built in Test (BIT). The BIT allows fault isolation and diagnostics to major replaceables of the system.

APPENDIX E

PROPOSED SWITCHES LOCATED ON CITV CONTROL HANDLE

1. CITV Designate. Slews main gun to the CITV Line of Sight.
2. Palm Switch. Provides power to the handle to enable all handle switches and CITV modes.
3. Laser Fire Button. Fires laser to target.
4. Field of View. Changes between 10X (narrow) and 3X (wide) Field of View.
5. Trigger. Fires either coax or main gun dependent upon which is selected.

APPENDIX C

GLOSSARY OF TERMS

| Major Category | Level | | | Explanation |
|-------------------------------|--------|------|---------|--|
| | Duty | Task | Subtask | |
| <u>Commonality</u> | Dfrnt | D | (d) | MIAI with CITV different than MIAI |
| | Same | S | (s) | |
| | Unique | U | (u) | |
| <u>Task Perform</u> | Yes | X | (x) | Is task performance changed with CITV? If so, how? (UND-UNDETERMINED) |
| <u>More Same New</u> | No | X | (x) | |
| <u>Effec</u> | N/A | X | (x) | |
| | UND | | | |
| <u>Problem</u> | Yes | X | (x) | Is there a potential training problem for the institution and/or unit related to performance in the MIAI with CITV? If so, where? |
| <u>Instit Unit</u> | No | X | (x) | |
| <u>Cause</u> | Yes | X | (x) | The cause of the potential problem is primarily mental (memory, procedural, cognitive overload) or motor (physical or psychomotor) |
| <u>Cognitive Motor</u> | No | X | (x) | |
| <u>Proposed Trng Solution</u> | Yes | X | (x) | Proposed training solutions include: Embedded Training (ET); More Hands On Training (More HO); Job Aids; and Training Devices (Trng Dev) |
| <u>More Job Trng</u> | No | X | (x) | |
| <u>ET HO Aid Dev</u> | | | | |

*An asterisk appearing next to an S or X indicates dependence on final design. Especially relevant is the ability to fire from CITV, and the parallax problem associated with the LRF-CITV relationship.

APPENDIX D

MIA1 WITH CITY AND GPSE TASK COMPARISON ANALYSIS

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|------------------|--------------|-------------|--------------|-----------------|-------|----|--------------------|-------------|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG DEV | |
| I. PERFORM BEFORE OPERATION PMCS (EXTERIOR) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 1. Supervise PMCS | S | X | | | | | | | | |
| II. PREPARE STATION FOR OPER- ATION (Tasks #2 thru 25) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 2. Enter the Cdr's Station | S | X | | | | | | | | |
| 3. Power-Up Cdr's Station & Turret | S | X | | | | | | | | |
| a. Master Power Switch | (S) | (X) | | | | | | | | |
| b. Turret Power/Engine ON | (S) | (X) | | | | | | | | |
| c. Aux Power/Engine OFF | (S) | (X) | | | | | | | | |
| 4. Check Operation of Cdr's Panel Switches and Lights | S | X | | | | | | | | |
| 5. Replace Panel Lamps | S | X | | | | | | | | |
| 6. Adjust Cdr's Panel Lamp Brightness | S | X | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|--|------------------|--------------------------------------|---------|-------|--------------------|----|--------------------|
| | | | | | ET | HO | TRNG AID DEV |
| 7. Operate Cdr's Hatch (3 Positions) | S | X | | | | | |
| a. Raise/Lower CMS Hatch to Protected Open | (S) | (X) | | | | | |
| b. Raise CMS Hatch to Full Open | (S) | (X) | | | | | |
| c. Close CMS Hatch | (S) | (X) | | | | | |
| 8. Adjust Cdr's Seat | S | X | | | | | |
| a. Raise/Lower Cdr's Seat | (S) | (X) | | | | | |
| 9. Adjust Cdr's Platform | S | X | | | | | |
| a. Raise/Lower Cdr's Lower Platform | (S) | (X) | | | | | |
| b. Raise/Lower Cdr's Middle Platform | (S) | (X) | | | | | |
| 10. Adjust Cdr's Knee Guard | S | X | | | | | |
| a. Stow/Unstow Cdr's Knee Guard | (S) | (X) | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | CAUSE | | TENTATIVE SOLUTION | | | |
|--|------------------|--------------|----------|---------|-----------|--------------|--------------------|------------|------------|-------------|
| | | MORE EFF | SAME NEW | | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| 11. Operate Domelight | S | X | | | | | | | | |
| a. Select Domelight Filters (Red/White) | (S) | (X) | | | | | | | | |
| b. Turn Domelight ON/ OFF | (S) | (X) | | | | | | | | |
| c. Adjust Domelight Brightness | (S) | (X) | | | | | | | | |
| III. PERFORM BEFORE OPERATIONS PMCS (INTERIOR) | SAME | NO YES | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| 12. Operate Radio Set With Intercom System | S | X | | | | | | | | |
| a. Connect/Disconnect CVC Helmet to Inter- com | (S) | (X) | | | | | | | | |
| b. Intercom Without Re- mote Control | (S) | (X) | | | | | | | | |
| c. Intercom Using Thumb Control Switch | (S) | (X) | | | | | | | | |
| d. Set Tactical Radio | (S) | (X) | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|--------------|--------------|----------|-----------|--------------|-------|-----|--------------------|-----|----------|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HIO | AID | NO | TRNG DEV | |
| IV. ADJUST CDR'S GPS EXTENSIVE (GPSE) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 13. Operate Ballistic Doors | S | | X | | | | | | | | |
| a. Open/Close Ballistic Doors | (S) | | (X) | | | | | | | | |
| 14. Adjust GPSE Brow Pad | S | | X | | | | | | | | |
| 15. Adjust GPSE Focus Using Diopter Ring | S | | X | | | | | | | | |
| 16. Check GPSE for Moisture, Fungus, Scratches and Clean GPSE Optics | S | | X | | | | | | | | |
| V. PERFORM CITY CHECKOUT | UNIQUE | N/A | NO | YES | YES | YES | YES | YES | YES | YES | YES |
| 17. Prepare For Operation | U | | X | X | X | X | X | X | X | X | X |
| 18. Perform CITY Pre-Operational Check | U | | X | X | X | X | X | X | X | X | X |
| 19. Adjust CITY Picture | D | | X | X | X | X | X | X | X | X | X |
| a. Adjust Contrast | (D) | | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| b. Adjust Sensitivity | (D) | | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| c. Adjust Focus | (D) | | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|--------------|--------------|---------------|-----------|--------------|-------|----|--------------------|------|-----|
| | | MORE EFF | MORE SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV |
| 20. Adjust CITV Symbol Brightness | D | | X | X | X | X | X | X | X | X |
| 21. Test CITV Power Traverse and Elevation/Depression | U | | X | X | X | X | X | X | X | X |
| VI. INSTALL CDR'S WEAPON | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 22. Install Cal.50 Receiver | S | | X | | | | | | | |
| 23. Install Cal .50 Barrel | S | | X | | | | | | | |
| 24. Set Cal .50 Headspace and Timing | S | | X | | | | | | | |
| 25. Test Cal .50 Firing Mechanism | S | | X | | | | | | | |
| VII. OPERATE COMMANDER'S MANUAL RANGE CONTROLS | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 26. Set Indexed Battlerange into Computer | S | | X | | | | | | | |
| 27. Adjust Battlerange Using Toggle Switch | S | | X | | | | | | | |
| a. Make Small Range Adjustments | (S) | | (X) | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | CAUSE | TENTATIVE SOLUTION | | | | | | |
|---|------------------|--------------|-------------|---------|-------|--------------------|--------------|----|------------|------------|-------------|----|
| | | MORE EFF | SAME NEW | | | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| b. Make Large Range Adjustments | (S) | (X) | | | | | | | | | | |
| c. Return to Original Range | (S) | (X) | | | | | | | | | | |
| VIII. OPERATE TC TURRET POWER CONTROL HANDLE | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 28. Test Turret Power Traverse Operation | S | X | | | | | | | | | | |
| 29. Check Turret Override Capability | S | X | | | | | | | | | | |
| IX. OPERATE COMMANDER'S WEAPON STATION (CWS) IN MANUAL MODE | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 30. Place CWS in Manual Mode | S | X | | | | | | | | | | |
| 31. Traverse the CWS Manually | S | X | | | | | | | | | | |
| X. OPERATE THE COMMANDER'S WEAPON/STATION/SIGHT | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 32. Load Cal .50 Machinegun | S | X | | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------|-------------|--------------|-----------------|-------|----|--------------------|-----|-------------|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | JOB | TRNG DEV | |
| 33. Lock/Unlock Cal .50 Machinegun | S | X | | | | | | | | | |
| 34. Fire Cal .50 Machinegun Using Trigger on Cal .50 | S | X | | | | | | | | | |
| 35. Clear Cal .50 Machinegun | S | X | | | | | | | | | |
| 36. Apply Immediate Action to Cal .50 Machinegun | S | X | | | | | | | | | |
| a. Fail to Fire | (S) | (X) | | | | | | | | | |
| b. Runaway Gun | (S) | (X) | | | | | | | | | |
| 37. Unload Cal .50 Machine- gun | S | X | | | | | | | | | |
| XI. OPERATE M250 GRENADE LAUNCHER | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 38. Fire M250 Grenade Launcher | S | X | | | | | | | | | |
| a. Fire SALVO 1 | (S) | (X) | | | | | | | | | |
| b. Fire SALVO 2 | (S) | (X) | | | | | | | | | |
| c. Fire Both SALVOS | (S) | (X) | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|------------------|----------------------|-----------|--------------|-------|------------|--------------------|-------------|-------|
| | COMMON- ALITY | MORE SAME NEW EFF | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 39. Apply Immediate Action to M250 Grenade Launcher | S | X | | | | | | | |
| a. Misfire | (S) | (X) | | | | | | | |
| b. Fail to Burn/Burst | (S) | (X) | | | | | | | |
| XII. PREPARE WEAPONS FOR TRAVEL | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| 40. Prepare Cal .50 Machinegun For Travel | S | X | | | | | | | |
| XIII. OPERATE OVERPRESSURE SYSTEM | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| XIV. OPERATE GAS PARTICULATE FILTER SYSTEM | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| 41. Clear & Seal Protective Mask (M25) | S | X | | | | | | | |
| 42. Check Filter, Hose and Connections | S | X | | | | | | | |
| 43. Check Intercom Connections | S | X | | | | | | | |
| 44. Check Heater Lamp Light | S | X | | | | | | | |
| 45. Adjust Heater Temperature | S | X | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | | TENTATIVE SOLUTION | | | |
|---|--------------|--------------|----------|---------|------|--------|-------|----|--------------------|---------|----------|----|
| | | MORE EFF | SAME NEW | INST | UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 46. Stow/Unstow Mask | S | X | | | | | | | | | | |
| XV. OPERATE FIRE EXTINGUISHERS | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 47. Operate External Fire Extinguisher Handle | S | X | | | | | | | | | | |
| 48. Operate Portable Fire Extinguishers | S | X | | | | | | | | | | |
| 49. Check Fire Extinguisher Pressure Gauges (Reference Ambient Temperature) | S | X | | | | | | | | | | |
| 50. Maintain Fire Sensor Lenses | S | X | | | | | | | | | | |
| XVI. OPERATE NIGHT VISION GOGGLES (AN/PVS-5) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 51. Stow/Unstow AN/PVS-5 Goggles | S | X | | | | | | | | | | |
| 52. Place AN/PVS-5 Goggles Into Operation | S | X | | | | | | | | | | |
| 53. Maintain AN/PVS-5 Goggles | S | X | | | | | | | | | | |
| XVII. PREPARE COMMANDER'S STATION FOR ALTERNATE WEAPON | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | CAUSE | | | TENTATIVE SOLUTION | | | | |
|---|------------------|--------------|-------------|---------|--------------|--------|-------|--------------------|------------|------------|-------------|----|
| | | MORE EFF | SAME NEW | | INST UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 54. Install M240 Machinegun | S | X | | | | | | | | | | |
| 55. Load M240 Machinegun | S | X | | | | | | | | | | |
| 56. Fire M240 Machinegun | S | X | | | | | | | | | | |
| 57. Remove M240 Machinegun | S | X | | | | | | | | | | |
| XVIII. PERFORM "DURING" OPERATIONS PMCS (REPEAT TASK #1) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 58. Check Cdr's Panel Mounting Lights, and Controls | S | X | | | | | | | | | | |
| 59. Monitor Cdr's Panel Warning Lights | S | X | | | | | | | | | | |
| 60. Check Operation of Cal .50 | S | X | | | | | | | | | | |
| XIX. PERFORM "AFTER" OPERATION PMCS (REPEAT TASK #1) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| XX. POWER DOWN AND SECURE COM- MANDER'S STATION | UNIQUE | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 61. Remove Cal .50 Machinegun | S | X | | | | | | | | | | |
| 62. Power Down CWS and Turret | S | X | | | | | | | | | | |
| 63. Power Down CITY | U | | | X | X | X | X | X | X | X | X | X |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------|-------------|--------------|--------|-------|----|--------------------|------------|-------------|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 64. Secure Station | S | | X | | | | | | | | |
| a. Lock Cdr's Hatch | (S) | | (X) | | | | | | | | |
| b. Exit Tank | (S) | | (X) | | | | | | | | |
| XXI. PERFORM PRE-FIRE PMCSS (REPEAT TASKS #24, 33) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 65. Check Cal .50 Mounting | S | | X | | | | | | | | |
| 66. Check Cal .50 Ammo Stowed in Ready Box | S | | X | | | | | | | | |
| XXII. PERFORM PREPARE TO FIRE CHECKS | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 67. Prepare to Fire Main Gun (7 Tasks) | S | | X | | | | | | | | |
| a. Normal | (S) | | (X) | | | | | | | | |
| b. Degraded | (S) | | (X) | | | | | | | | |
| 68. Prepare to Fire Coax (6 Tasks) | S | | X | | | | | | | | |
| a. Normal | (S) | | (X) | | | | | | | | |
| b. Degraded | (S) | | (X) | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|------------------|-------------------------------|-----|---------|-----------|--------------|-----|--------------------|---------|----------|-----|
| | | EFF | YES | YES | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| XXIII. TARGET ACQUISITION | UNIQUE | YES | YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 69. Acquire Targets From Full Open Hatch Using Naked Eye | S | | X | | | | | | | | |
| 70. Acquire Targets Using CITV From Close Hatch In Automatic Mode | D | X | X | X | X | X | X | X | X | X | X |
| a. Set Sector For Automatic Scan | (U) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| b. Set Rate For Automatic Scan | (U) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| 71. Acquire Targets Using CITV From Closed Hatch in Manual Mode | D | X | X | X | X | X | X | X | X | X | X |
| 72. Acquire Targets From Full Open Hatch Using Binoculars | S | | X | | | | | | | | |
| 73. Acquire Targets From Protected Open (Popped) Hatch Using Naked Eye | S | | X | | | | | | | | |
| 74. Acquire Targets From Popped Hatch Using Binoculars | S | | X | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|--------------|--------------|----------|-----------|--------------|----------|----------|--------------------|----------|----------|----------|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | | |
| 75. Acquire Targets From Closed Hatch Using Unity Windows | S | X | | | | | | | | | |
| 76. Acquire Targets From Closed Hatch Using Binoculars | S | X | | | | | | | | | |
| 77. Acquire Targets at Night using Night Vision Goggles | S | X | | | | | | | | | |
| 78. Acquire Targets From Turret Defillade | D | X | X | X | X | X | X | X | X | X | X |
| 79. Acquire Targets From Hull Defillade | D | X | X | X | X | X | X | X | X | X | X |
| 80. Acquire Targets While Stationary | S | X | | | | | | | | | |
| 81. Acquire Targets While Moving | S | X | | | | | | | | | |
| XXIV. TARGET ENGAGEMENT WITH MAIN GUN (NORMAL) (GPSE) | SAME | NO YES NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO |
| 82. Establish Weapon System Operating Conditions For NORMAL Mode | S | X | | | | | | | | | |
| a. Designate Gun Select Mode | (S) | (X) | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|--|------------------|--------------------------------------|---------|-------|--------------------|----|-----------------|
| | | | | | ET | HO | AID TRNG DEV |
| b. Designate Ammo Select Mode | (S) | (X) | | | | | |
| c. Designate LRFD Mode | (S) | (X) | | | | | |
| 83. Issue Main Gun Precision Fire Commands | S | X | | | | | |
| <u>Lay Main Gun For Direction:</u> | | | | | | | |
| 84. Stat/Stat | S | X | | | | | |
| 85. Stat/Moving (Track) | S | X | | | | | |
| 86. Moving/Stat (Track) | S | X | | | | | |
| 87. Moving/Moving (Track) | S | X | | | | | |
| <u>Decide to Hand-Off Target to GNR or Engage:</u> | | | | | | | |
| 88. Release Turret Control (Override) | S | X | | | | | |
| 89. Announce "From My Position" and Engage | S | X | | | | | |
| <u>Lay On Target To Be Engaged (GPSE):</u> | | | | | | | |
| 90. Stat/Stat | S | X | | | | | |
| 91. Stat/Moving (Track) | S | X | | | | | |

TASK LIST

(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|---------|-------|--------------------|----------|--------------------------|
| | | | | | INST UNIT | MOTOR ET | MORE JOB TRNG HO AID DEV |
| 92. Moving/Stat (Track) | S | X | | | | | |
| 93. Moving/Moving (Track) | S | X | | | | | |
| 94. Determine Range to Target Using LRF/GPSE (Lase on Center-of-Mass) | S | X | | | | | |
| 95. Verify Main Gun Firing Status | S | X | | | | | |
| a. Check/Respond to Multiple Return | (S) | (X) | | | | | |
| b. Check/Respond to Fault Symbol | (S) | (X) | | | | | |
| 96. Fire Main Gun | S | X | | | | | |
| 97. Respond to Main Gun Misfire | S | X | | | | | |
| <u>Round Sense</u> (GPSE) | | | | | | | |
| 98. Stat/Stat | S | X | | | | | |
| 99. Stat/Moving (Track) | S | X | | | | | |
| 100. Moving/Stat (Track) | S | X | | | | | |
| 101. Moving/Moving (Track) | S | X | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------|-------------|--------------|-----------------|-------|----|--------------------|------------|-------------|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | HO | JOB AID | TRNG DEV | |
| <u>Adjust Fire (GPSE):</u> | | | | | | | | | | | |
| 102. Apply Reengage Method | S | X | | | | | | | | | |
| 103. Correct Range Using Toggle Switch | S | X | | | | | | | | | |
| XXV. TARGET ENGAGEMENTS WITH MAIN GUN (NORMAL AND EMERGENCY (TIS) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 104. Establish Weapon System Operating Conditions For NORMAL MODE | S | X | | | | | | | | | |
| a. Designate Gun Select Mode | (S) | (X) | | | | | | | | | |
| b. Designate Ammo Select Mode | (S) | (X) | | | | | | | | | |
| c. Designate LRF Mode | (S) | (X) | | | | | | | | | |
| 105. Issue Main Gun Precision Fire Commands | S | X | | | | | | | | | |
| <u>Lay On Target (TIS)</u> | | | | | | | | | | | |
| 106. Stat/Stat | S | X | | | | | | | | | |
| 107. Stat/Moving (Track) | S | X | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM INST UNIT MENTAL MOTOR ET | CAUSE | TENTATIVE SOLUTION | | |
|---|------------------|--------------------------------------|--------------------------------------|----------|--------------------|----------|----------|
| | | | | | MORE | JOB | TRNG |
| 108. Brief Halt | S | X | | | HO | AID | NO |
| 109. Moving/Stat (Track) | S | X | | | HO | AID | NO |
| 110. Moving/Moving (Track) | S | X | | | HO | AID | NO |
| 111. Determining Range to Target using LRF/TIS (Lase on Center-of-Mass) | S | X | | | HO | AID | NO |
| <u>Round Sense (TIS):</u> | | | | | | | |
| 112. Stat/Stat | S | X | | | HO | AID | NO |
| 113. Stat/Moving | S | X | | | HO | AID | NO |
| 114. Brief Halt | S | X | | | HO | AID | NO |
| 115. Moving/Stat | S | X | | | HO | AID | NO |
| 116. Moving/Moving | S | X | | | HO | AID | NO |
| <u>Adjust Fire (TIS):</u> | | | | | | | |
| 117. Apply Reengage Method | S | X | | | HO | AID | NO |
| 118. Correct Range Using Toggle Switch | S | X | | | HO | AID | NO |
| XXVI. TARGET ENGAGEMENTS WITH MAIN GUN (EMERGENCY) (GPSE) | SAME | NO YES NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|--|------------------|--------------|----------|---------|-------|--------------------|------------|-------------|
| | | MORE EFF | SAME NEW | | | MORE HO | JOB AID | TRNG DEV |
| 119. Establish Weapon System Operating Conditions For EMERGENCY Mode | S | | X | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | |
| b. Designate Ammo Select Mode | (S) | | (X) | | | | | |
| c. Designate LRF Mode | (S) | | (X) | | | | | |
| <u>Lay Main Gun For Direction:</u> | | | | | | | | |
| 120. Stat/Stat | S | | X | | | | | |
| 121. Stat/Moving | S | | X | | | | | |
| 122. Brief Halt | S | | X | | | | | |
| <u>Decide to Hand-Off Target to GNR or Engage</u> | | | | | | | | |
| 123. Release Turret Control (Override) | S | | X | | | | | |
| 124. Announce "From My Posi- tion" and Engage | S | | X | | | | | |
| <u>Lay On Target:</u> | | | | | | | | |
| 125. Stat/Stat | S | | X | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|--|------------------|--------------------------------------|---------|-------|--------------------|-------|-----------------|
| | | | | | MENTAL MOTOR | ET HO | AID TRNG DEV |
| 126. Stat/Moving | S | X | | | | | |
| 127. Brief Halt | S | X | | | | | |
| 128. Apply Manual Leads | S | X | | | | | |
| 129. Determine Range to Target Using LRF/GPSE (Lase to Center-of-Mass) | S | X | | | | | |
| 130. Verify Main Gun Firing Status | S | X | | | | | |
| a. Check/Respond to Multiple Return | (S) | (X) | | | | | |
| b. Check/Respond to Fault Symbol | (S) | (X) | | | | | |
| 131. Fire Main Gun | S | X | | | | | |
| 132. Respond to Main Gun Misfire | S | X | | | | | |
| <u>Round Sense (GPSE)</u> | | | | | | | |
| 133. Stat/Stat | S | X | | | | | |
| 134. Stat/Moving | S | X | | | | | |
| 135. Moving/Stat | S | X | | | | | |
| 136. Moving/Moving | S | X | | | | | |

| TASK LIST (TANK COMMANDER) | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|----------------------|---------|------|--------|-------|--------------------|------------|------------|-------------|
| | COMMON- ALITY | MORE SAME NEW EFF | INST | UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| <u>Adjust Fire (GPSE)</u> | | | | | | | | | | |
| 137. Apply Reengage Method | S | X | | | | | | | | |
| 138. Correct Range Using Toggle Switch | S | X | | | | | | | | |
| XXVII. TARGET ENGAGEMENT WITH MAIN GUN (NORMAL) (CITV) | UNIQUE | UND YES YES YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 139. Establish Weapon System Operating Conditions for NORMAL Mode | S | X | | | | | | | | |
| a. Designate Gun Select Mode | (S) | (X) | | | | | | | | |
| b. Designate Ammo Select Mode | (S) | (X) | | | | | | | | |
| c. Designate LRF Mode | (S) | (X) | | | | | | | | |
| 140. Issue Main Gun Precision Fire Commands | S | X | | | | | | | | |
| <u>Lay CITV For Direction:</u> | | | | | | | | | | |
| 141. Stat/Stat | D | X | X | X | X | X | X | X | X | X |
| 142. Stat/Moving (Track) | D | X | X | X | X | X | X | X | X | X |
| 143. Moving/Stat (Track) | D | X | X | X | X | X | X | X | X | X |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|--|--------------|--------------|---------------|-----------|--------------|-------|----|--------------------|------|-----|
| | | MORE EFF | MORE SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV |
| 144. Moving/Moving (Track) | D | | X | X | X | X | X | X | X | X |
| 145. Activate target designate button (align Main Gun with CITV) | D | | X | X | X | X | X | X | X | X |
| Decide to <u>Hand-Off Target to GNR or Engage:</u> | | | | | | | | | | |
| 146. Release Turret Control to GNR (Override) | S | | X | | | | | | | |
| 147. Announce "From My Position" and Engage | S | | X | | | | | | | |
| <u>Lay On Target To Be Engaged (CITV)</u> | | | | | | | | | | |
| 148. Stat/Stat | S | | X | | | | | | | |
| 149. Stat/Moving (Track) | S | | X | | | | | | | |
| 150. Moving/Stat (Track) | S | | X | | | | | | | |
| 151. Moving/Moving (Track) | S | | X | | | | | | | |
| 152. Determine Range to Target using LRF/CITV (TC lases on Center-of-Mass) | S* | | X* | | | | | | | |
| 153. Verify Main Gun Firing Status | S | | X | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------------------------------|-----------|--------------|-------|-----|--------------------|------|-----|-----|
| | | | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV | |
| a. Check/Respond to Multiple Return | (S) | (X) | | | | | | | | |
| b. Check/Respond to Fault Symbol | (S) | (X) | | | | | | | | |
| 154. Fire Main Gun | S* | X* | | | | | X | | | |
| 155. Respond to Main Gun Misfire | S | X | | | | | | | | |
| <u>Round Sense (CITV):</u> | | | | | | | | | | |
| 156. Stat/Stat | D | X | X | | | | X | | X | |
| 157. Stat/Moving (Track) | D | X | X | | | | X | | X | |
| 158. Moving/Stat (Track) | D | X | X | | | | X | | X | |
| 159. Moving/Moving (Track) | D | X | X | | | | X | | X | |
| <u>Adjust Fire (CITV):</u> | | | | | | | | | | |
| 160. Apply Reengage Method | S | X | | | | | | | | |
| 161. Correct Range Using Toggle Switch | S | X | | | | | | | | |
| XXVIII. TARGET ENGAGEMENTS WITH MAIN GUN (EMERGENCY) (CITV) | DFRNT | UND | YES | YES | YES | YES | YES | YES | YES | NO |
| | | | | | | | | | | YES |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | | |
|---|------------------|--------------------------------------|---------|-------|--------------------|--------------|----|-----------------------------|
| | | | | | INST UNIT | MENTAL MOTOR | ET | MORE JOB TRNG HO AID DEV |
| 162. Establish Weapon System Operating Conditions for Normal Mode | S | X | | | | | | |
| a. Designate Gun Select Mode | (S) | (X) | | | | | | |
| b. Designate Ammo Select Mode | (S) | (X) | | | | | | |
| c. Designate LRF Mode | (S) | (X) | | | | | | |
| 163. Issue Main Gun Precision Fire Commands | S | X | | | | | | |
| <u>Lay On Target (CITY):</u> | | | | | | | | |
| 164. Stat/Stat | D | X | X | X | X | X | X | X |
| 165. Stat/Moving (Track) | D | X | X | X | X | X | X | X |
| 166. Moving/Stat | D | X | X | X | X | X | X | X |
| 167. Moving/Moving | D | X | X | X | X | X | X | X |
| 168. Determine Range to Target using LRF/CITY (Lase on Center-of- Mass) | S* | X* | | | | | | |
| 169. Verify Main Gun Firing Status | S | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|------------------|--------------------------------------|-----------|--------------|-------|-------|--------------------|-------|-------|-------|
| | | | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV | |
| a. Check/Respond to Multiple Return | (S) | (X) | | | | | | | | |
| b. Check/Respond to Fault Symbol | (S) | (X) | | | | | | | | |
| 170. Fire Main Gun | S* | X* | | | | | X* | | | |
| 171. Respond to Main Gun Misfire | S | X | | | | | | | | |
| <u>Round Sense (CITV):</u> | | | | | | | | | | |
| 172. Stat/Stat | D | X | X | X | X | | | X | X | |
| 173. Stat/Moving | D | X | X | X | X | | | X | X | |
| 174. Moving/Stat | D | X | X | X | X | | | X | X | |
| 175. Moving/Moving | D | X | X | X | X | | | X | X | |
| <u>Adjust Fire (CITV):</u> | | | | | | | | | | |
| 176. Apply Reengage Method | S | X | | | | | | | | |
| 177. Correct Range Using Toggle Switch | S | X | | | | | | | | |
| XXIX. TARGET ENGAGEMENT WITH MAIN GUN (MANUAL) (GAS) | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |

TASK LIST
(TANK COMMANDER)

| | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | | | | | | | |
|---|------------------|--------------|-------------|--------------|-----------------|------------|------------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | MORE HO | JOB AID | TRNG DEV | ET | HO | NO | YES | YES | NO | YES | | |
| 178. Establish Weapon System Operating Conditions For MANUAL Mode | S | | X | | | | | | | | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | | | | | | | | |
| b. Designate Ammo Select Mode | (S) | | (X) | | | | | | | | | | | | | | |
| Lay Main Gun For <u>Direction:</u> | | | | | | | | | | | | | | | | | |
| 179. Direct Gunner Onto Target | S | | X | | | | | | | | | | | | | | |
| 180. Estimate/Announce Direction | S | | X | | | | | | | | | | | | | | |
| XXX. ENGAGE TARGETS USING BATTLE- SIGHT GUNNERY (GPSE/CITV) | DFRNT | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | NO | YES | |
| 181. Issue Battlesight Fire Command "From My Position" | S | | X | | | | | | | | | | | | | | |
| 182. Depress Battlesight Button | S | | X | | | | | | | | | | | | | | |
| 183. Apply Battlesight Gunnery Technique | S | | X | | | | | | | | | | | | | | |
| 184. Modify Battlesight Aim | S | | X | | | | | | | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| TASK LIST (TANK COMMANDER) | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | |
|---|--------------|--------------|---------|-----------|--------------|-------|--------|--------------------|-----|
| | | MORE SAME | NEW EFF | INST UNIT | MENTAL MOTOR | ET | HO AID | TRNG DEV | |
| <u>Adjust Fire:</u> | | | | | | | | | |
| 185. Apply Target Form Technique | S | X | | | | | | | |
| 186. Toggle Range Correction | S | X | | | | | | | |
| XXXI. ENGAGE TARGETS USING SKETCH CARD DATA | SAME | NO | YES | NO | NO | NO | NO | NO | NO |
| 187. Prepare Sketch Card | S | X | | | | | | | |
| 188. Issue Sketch Card Fire Command | S | X | | | | | | | |
| XXXII. RESPOND TO SPECIFIC FIRE CONTROL SYSTEM FAILURES | DFRNT | YES | YES | YES | YES | YES | YES | YES | YES |
| 189. Respond to GPSE Failure | S | X | | | | | | | |
| a. Use CITY | (D) | (X) | | | | | | | (X) |
| b. Use TIS(E) | (S) | | (X) | | | | | | |
| 190. Respond to TIS(E) Failure | S | X | | | | | | | |
| a. Use CITY | (D) | (X) | | | | | | | (X) |
| b. Use GPSE | (S) | | (X) | | | | | | |
| 191. Respond to CITY Failure | D | X | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM INST UNIT | CAUSE MENTAL MOTOR ET | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|-------------------|-----------------------|--------------------|---------|----------|
| | | | | | MORE HO | JOB AID | TRNG DEV |
| a. Use GPSE | (S) | (X) | | | | | |
| b. Use TIS | (S) | (X) | | | | | |
| 192. Respond to Laser Range-finder Failure | S | X | | | | | |
| a. Employ Battlesight Gunnery | (S) | (X) | | | | | |
| b. Estimate Range and Announce | (S) | (X) | | | | | |
| c. Estimate Range and Toggle | (S) | (X) | | | | | |
| d. Determine Range Using Non-Ballistic Reticule | (S) | (X) | | | | | |
| 193. Respond To Crosswind Sensor Failure | S | X | | | | | |
| a. Cancel Crosswind Input | (S) | (X) | | | | | |
| 194. Respond to Cant Sensor Failure | S | X | | | | | |
| a. Cancel Cant Input | (S) | (X) | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|--|------------------|--------------|-------------|--------------|-----------------|-------|------------|--------------------|-------------|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| b. Aim High/Opposite Direction | (S) | (X) | | | | | | | | |
| 195. Respond to Lead Angle Sensor Failure | S | X | | | | | | | | |
| a. Cancel Lead Angle Input | (S) | (X) | | | | | | | | |
| b. Apply Manual Lead | (S) | (X) | | | | | | | | |
| 196. Respond to Combined Failures | S | X | | | | | | | | |
| XXXIII. TARGET ENGAGEMENTS WITH COAX (NORMAL/EMER). (CITV) | DFRNT | NO | YES | YES | YES | YES | YES | YES | YES | NO |
| 197. Determine Range to Target Using LRF (Lase on Target Center-of-Mass) | S* | X* | | | | | | X* | | |
| 198. Adjust Coax Fire (CITV) | D | X | X | X | X | X | X | X | X | X |
| a. Apply a Walk-In Technique | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| b. Apply Z-Pattern | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| XXXIV. TARGET ENGAGEMENTS WITH COAX (EMER) (GPSE) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |

TASK LIST

(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|---------|---------|--------------------|----------|--------------------------|
| | | | | | INST UNIT | MOTOR ET | MORE JOB TRNG HO AID DEV |
| 199. Establish Weapon System Operating Conditions for EMERGENCY Mode | S | X | | | | | |
| a. Designate Gun Select Mode | (S) | (X) | | | | | |
| b. Designate Ammo Select Mode | (S) | (X) | | | | | |
| c. Designate LRF Mode | (S) | (X) | | | | | |
| 200. Issue Coax Fire Command | S | X | | | | | |
| 201. Determine Range to Coax Targets Using LRF/GPSE (Lase on Target Center-of-Mass) | S | X | | | | | |
| 202. Fire Coax In 20-30 Round Bursts | S | X | | | | | |
| 203. Adjust Coax Fire (GPSE) | S | X | | | | | |
| a. Apply a Walk-In Technique (Moving) | (S) | (X) | | | | | |
| b. Apply Z-Pattern (Moving) | (S) | (X) | | | | | |
| XXXV. TARGET ENGAGEMENTS WITH COAX (EMER) (CITV) | DFRNT | NO YES | YES YES | YES YES | YES YES | NO YES | YES YES |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|--------------|--------------|---------------|-----------|--------------|-------|---------|--------------------|----------|----|----|
| | | MORE EFF | MORE SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | | |
| 204. Establish Weapon System Operating Conditions For Emergency Mode | S | | X | | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | | |
| b. Designate Ammo Select Mode | (S) | | (X) | | | | | | | | |
| c. Designate LRF Mode | (S) | | (X) | | | | | | | | |
| 205. Issue Coax Fire Command | S | | X | | | | | | | | |
| 206. Determine Range to Coax Targets using (Lase on Target Center-of-Mass) (CITV) | S* | | X* | | | | | | | | |
| 207. Fire Coax In 20-30 Round Bursts | S | | X | | | | | | | | |
| 208. Adjust Coax Fire (CITV) | D | | X | X | X | X | X | | | | |
| a. Apply a Walk-In Technique (Moving) | (D) | | (X) | (X) | (X) | (X) | (X) | | | | |
| b. Apply Z-Pattern (Moving) | (D) | | (X) | (X) | (X) | (X) | (X) | | | | |
| XXXXVI. TARGET ENGAGEMENTS WITH CAL .50 (NORMAL) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM INST UNIT | CAUSE MENTAL MOTOR | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|-------------------|--------------------|--------------------|----|-----|
| | | | | | ET | HO | AID |
| <u>Traverse to Target:</u> | | | | | | | |
| 209. Power Traverse Turret To Target | S | X | | | | | |
| <u>Range On Target:</u> | | | | | | | |
| 210. Range To Cal .50 Targets Using LRF (Lase on Center-of-Mass Target) | S | X | | | | | |
| 211. Estimate Range To Cal .50 Target | S | X | | | | | |
| <u>Lay On Target Using CWS</u> | | | | | | | |
| 212. Stat/Stat | S | X | | | | | |
| 213. Stat/Moving | S | X | | | | | |
| 214. Moving/Stat | S | X | | | | | |
| 215. Moving/Moving | S | X | | | | | |
| 216. Adjust Cal .50 Fire | S | X | | | | | |
| a. Apply Walk-In Technique | (S) | (X) | | | | | |
| b. Apply Z-Pattern | (S) | (X) | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | | |
|---|--------------|--------------|----------|-----------|--------------|-------|-----|--------------------|------|-----|-----|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV | | |
| c. Apply Turret-Carry Method (With Gunner) | (S) | | (X) | | | | | | | | | |
| XXXVII. ENGAGE MULTIPLE/SIMULTANEOUS TARGETS | DFRNT | YES | YES | YES | YES | YES | YES | YES | YES | NO | YES | YES |
| 217. Determine Most Dangerous | D | X | X | X | X | X | X | X | X | X | X | X |
| 218. Issue Multiple Target Fire Command | S | | X | | | | | | | | | |
| 219. Issue Simultaneous Target Fire Command | S | | X | | | | | | | | | |
| 220. Dump Automatic Lead | S | | X | | | | | | | | | |
| XXXVIII. ENGAGE TARGETS USING SMOKE | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 221. Engage Targets Using Engine Smoke Generator | S | | X | | | | | | | | | |
| 222. Engage Targets Using Grenade Launcher System | S | | X | | | | | | | | | |
| XXXIX. TROUBLESHOOT TURRET | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 223. Troubleshoot TC Indicator/Warning Lights (7 Tasks) | S | | X | | | | | | | | | |
| a. Cdr's CKT BKR Light Fails | (S) | | (X) | | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | | | TENTATIVE SOLUTION | | |
|---|------------------|--------------------------------------|---------|-----------|--------|-------|--------------------|---------|---------|
| | | | | INST UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID |
| b. CKT BKR Open Light | (S) | (X) | | | | | | | |
| c. Fire Control MALF Light | (S) | (X) | | | | | | | |
| d. Cdr's LOW BAT CHG Light | (S) | (X) | | | | | | | |
| e. Vehicle Master Power Light Fails | (S) | (X) | | | | | | | |
| f. Turret Power Light Fails | (S) | (X) | | | | | | | |
| g. Aux Hydr Power Light Fails | (S) | (X) | | | | | | | |
| 224. Troubleshoot CITY | U | X | X | X | X | | | | X |
| 225. Troubleshoot Fire Control System (5 Tasks) | S | X | | | | | | | |
| a. Unable to Power Traverse | (S) | (X) | | | | | | | |
| b. Unable to Power Elevate | (S) | (X) | | | | | | | |
| c. Unable to Fire Main Gun | (S) | (X) | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM INST UNIT | CAUSE MENTAL MOTOR ET | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|-------------------|-----------------------|--------------------|---------|----------|
| | | | | | MORE | JOB AID | TRNG DEV |
| d. Unable to Power Traverse CWS | (S) | (X) | | | | | |
| e. Unable to Lase | (S) | (X) | | | | | |
| 226. Troubleshoot Cal .50 Machinegun | S | X | | | | | |
| a. Unable to Fire Cal .50 | (S) | (X) | | | | | |
| 227. Troubleshoot Auxiliary Systems | S | X | | | | | |
| a. Cdr's Gas Particulate Heater Fails to Heat | (S) | (X) | | | | | |
| b. M250 Grenades Do Not Fire | (S) | (X) | | | | | |
| 228. Troubleshoot Tank Electrical System | S | X | | | | | |
| a. No Vehicle Master Power | (S) | (X) | | | | | |
| b. No Hull Power | (S) | (X) | | | | | |
| c. No Turret Power | (S) | (X) | | | | | |
| XXXX. PERFORM DURING-FIRE PMCS | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|------------------|--------------|-------------|--------------|-----------------|-------|-----|--------------------|-------------|----|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG DEV | | |
| XXXXI. PERFORM POST-FIRE PMCS (REPEAT TASKS #14, 15, 16, 20, 21, 25, 28, 29, 30, 31) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 229. Field Strip Cal .50 and Check parts | S | X | | | | | | | | | |
| 230. Clean and Lubricate Cal .50 | S | X | | | | | | | | | |
| XXXXII. LUBRICATE M1A1 ACCORDING TO LUBRICATION ORDER (LO) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| XXXXIII COMMAND, CONTROL, AND COMMUNICATIONS | DFRNT | YES | YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 231. Identify Combat Vehicles as Friend or Foe | D | X | | X | X | X | X | X | X | X | X |
| 232. Identify Combat Aircraft as Friend or Foe | D | X | | X | X | X | X | X | X | X | X |
| 233. Report Bombing, Shelling, and Mortar, Rocket and Aircraft Fire (Spot Report) | D | X | | X | X | X | X | X | X | X | X |
| 234. Cross on Area Contaminated By A Persistent Chemical Agent | D | X | | X | X | X | X | X | X | X | X |
| 235. Control Fire Support | D | X | | X | X | X | X | X | X | X | X |

TASK LIST
(TANK COMMANDER)

| | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | | TENTATIVE SOLUTION | | |
|---|------------------|--------------------------------------|---------|------|--------|-------|----|--------------------|------------|-------------|
| | | | INST | UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| 236. Control Unit Maneuver | D | X | X | X | X | | | X | X | X |
| 237. Conduct Physical Recon- naissance | D | X | X | X | X | | | X | X | X |
| 238. Plan Maneuver Control Measures | D | X | X | X | X | | | X | X | X |
| 239. Plan Direct Fires | D | X | X | X | X | | | X | X | X |
| 240. Plan Fire Support | D | X | X | X | X | | | X | X | X |

APPENDIX E

MIAI WITH CITY TASK COMPARISON ANALYSIS

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|------------------|--------------|-------------|--------------|-----------------|-------|------------|--------------------|-------------|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| I. PERFORM BEFORE OPERATION PMCS (EXTERIOR) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 1. Supervise PMCS | S | | X | | | | | | | |
| II. PREPARE STATION FOR OPER- ATION (Tasks #2 thru 21) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 2. Enter the Cdr's Station | S | | X | | | | | | | |
| 3. Power-Up Cdr's Station & Turret | S | | X | | | | | | | |
| a. Master Power Switch | (S) | | (X) | | | | | | | |
| b. Turret Power/Engine ON | (S) | | (X) | | | | | | | |
| c. Aux Power/Engine OFF | (S) | | (X) | | | | | | | |
| 4. Check Operation of Cdr's Panel Switches and Lights | S | | X | | | | | | | |
| 5. Replace Panel Lamps | S | | X | | | | | | | |
| 6. Adjust Cdr's Panel Lamp Brightness | S | | X | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|--|--------------|--------------------------------|---------|-------|--------------------|--------------|--------------------|
| | | | | | INST UNIT | MENTAL MOTOR | ET HO AID TRNG DEV |
| 7. Operate Cdr's Hatch (3 Positions) | S | X | | | | | |
| a. Raise/Lower CWS Hatch to Protected Open | (S) | (X) | | | | | |
| b. Raise CWS Hatch to Full Open | (S) | (X) | | | | | |
| c. Close CWS Hatch | (S) | (X) | | | | | |
| 8. Adjust Cdr's Seat | S | X | | | | | |
| a. Raise/Lower Cdr's Seat | (S) | (X) | | | | | |
| 9. Adjust Cdr's Platform | S | X | | | | | |
| a. Raise/Lower Cdr's Lower Platform | (S) | (X) | | | | | |
| b. Raise/Lower Cdr's Middle Platform | (S) | (X) | | | | | |
| 10. Adjust Cdr's Knee Guard | S | X | | | | | |
| a. Stow/Unstow Cdr's Knee Guard | (S) | (X) | | | | | |
| 11. Operate Domelight | S | X | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | | |
|--|------------------|--------------|-------------|--------------|-----------------|-------|-----|--------------------|-----|------|-----|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | AID | DEV | TRNG | | |
| a. Select Domelight Filters (Red/White) | (S) | (X) | | | | | | | | | | |
| b. Turn Domelight ON/ OFF | (S) | (X) | | | | | | | | | | |
| c. Adjust Domelight Brightness | (S) | (X) | | | | | | | | | | |
| III. PERFORM BEFORE OPERATIONS PMCS (INTERIOR) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 12. Operate Radio Set With Intercom System | S | X | | | | | | | | | | |
| a. Connect/Disconnect CVC Helmet to Inter- com | (S) | (X) | | | | | | | | | | |
| b. Intercom Without Re- mote Control | (S) | (X) | | | | | | | | | | |
| c. Intercom Using Thumb Control Switch | (S) | (X) | | | | | | | | | | |
| d. Set Tactical Radio | (S) | (X) | | | | | | | | | | |
| IV. PERFORM CITY CHECKOUT | UNIQUE | N/A | NO | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| 13. Prepare For Operation | U | | X | X | X | X | X | X | X | X | X | X |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|--------------|--------------|----------|-----------|--------------|-------|---------|--------------------|----------|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 14. Perform CITY Pre Operational Check | U | X | X | X | X | X | X | X | X | X |
| 15. Adjust CITY Picture | D | X | X | X | X | X | X | X | X | X |
| a. Adjust Contrast | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| b. Adjust Sensitivity | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| c. Adjust Focus | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| 16. Adjust CITY Symbol Brightness | D | X | X | X | X | X | X | X | X | X |
| 17. Test CITY Power Traverse and Elevation/Depression | U | X | X | X | X | X | X | X | X | X |
| V. INSTALL CDR'S WEAPON | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 18. Install Cal.50 Receiver | S | X | | | | | | | | |
| 19. Install Cal .50 Barrel | S | X | | | | | | | | |
| 20. Set Cal .50 Headspace and Timing | S | X | | | | | | | | |
| 21. Test Cal .50 Firing Mechanism | S | X | | | | | | | | |
| VI. OPERATE COMMANDER'S MANUAL RANGE CONTROLS | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | CAUSE | TENTATIVE SOLUTION | | | | | | |
|---|--------------|--------------|----------|---------|-------|--------------------|----------|---------|---------|----------|----|----|
| | | MORE EFF | SAME NEW | | | INST UNIT | MOTOR ET | MORE HO | JOB AID | TRNG DEV | | |
| 22. Set Indexed Battlerange into Computer | S | | X | | | | | | | | | |
| 23. Adjust Battlerange Using Toggle Switch | S | | X | | | | | | | | | |
| a. Make Small Range Adjustments | (S) | | (X) | | | | | | | | | |
| b. Make Large Range Adjustments | (S) | | (X) | | | | | | | | | |
| c. Return to Original Range | (S) | | (X) | | | | | | | | | |
| VII. OPERATE TC TURRET POWER CONTROL HANDLE | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 24. Test Turret Power Traverse Operation | S | | X | | | | | | | | | |
| 25. Check Turret Override Capability | S | | X | | | | | | | | | |
| VIII. OPERATE COMMANDER'S WEAPON STATION (CWS) IN MANUAL MODE | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 26. Place CWS in Manual Mode | S | | X | | | | | | | | | |
| 27. Traverse the CWS Manually | S | | X | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | CAUSE | TENTATIVE SOLUTION | | | | | |
|---|------------------|--------------|-------------|---------|-------|--------------------|--------------|----|------------|------------|-------------|
| | | MORE EFF | SAME NEW | | | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| IX. OPERATE THE COMMANDER'S WEAPON/STATION/SIGHT | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 28. Load Cal .50 Machinegun | S | | X | | | | | | | | |
| 29. Lock/Unlock Cal .50 Machinegun | S | | X | | | | | | | | |
| 30. Fire Cal .50 Machinegun Using Trigger on Cal .50 | S | | X | | | | | | | | |
| 31. Clear Cal .50 Machinegun | S | | X | | | | | | | | |
| 32. Apply Immediate Action to Cal .50 Machinegun | S | | X | | | | | | | | |
| a. Fail to Fire | (S) | | (X) | | | | | | | | |
| b. Runaway Gun | (S) | | (X) | | | | | | | | |
| 33. Unload Cal .50 Machine- gun | S | | X | | | | | | | | |
| X. OPERATE M250 GRENADE LAUNCHER | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 34. Fire M250 Grenade Launcher | S | | X | | | | | | | | |
| a. Fire SALVO 1 | (S) | | (X) | | | | | | | | |
| b. Fire SALVO 2 | (S) | | (X) | | | | | | | | |

| TASK LIST (TANK COMMANDER) | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|------------------|-------------|-------------|--------------|-----------------|----|--------------------|------------|-------------|
| | COMMON- ALITY | MORE EFF | MORE NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| c. Fire Both SALVOS | (S) | (X) | | | | | | | |
| 35. Apply Immediate Action to M250 Grenade Launcher | S | X | | | | | | | |
| a. Misfire | (S) | (X) | | | | | | | |
| b. Fail to Burn/Burst | (S) | (X) | | | | | | | |
| XI. PREPARE WEAPONS FOR TRAVEL | SAME | NO YES | NO | NO | NO | NO | NO | NO | NO |
| 36. Prepare Cal .50 Machinegun For Travel | S | X | | | | | | | |
| XII. OPERATE OVERPRESSURE SYSTEM | S | X | | | | | | | |
| XIII. OPERATE GAS PARTICULATE FILTER SYSTEM | SAME | NO YES | NO | NO | NO | NO | NO | NO | NO |
| 37. Clear & Seal Protective Mask (M25) | S | X | | | | | | | |
| 38. Check Filter, Hose and Connections | S | X | | | | | | | |
| 39. Check Intercom Connections | S | X | | | | | | | |
| 40. Check Heater Lamp Light | S | X | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | CAUSE | TENTATIVE SOLUTION | | | | | | |
|---|--------------|--------------|---------|---------|-------|--------------------|-----------------|----|-----|----------|----|----|
| | | MORE SAME | NEW EFF | | | INST UNIT | MENTAL MOTOR ET | HO | AID | TRNG DEV | | |
| 41. Adjust Heater Temperature | S | X | | | | | | | | | | |
| 42. Stow/Unstow Mask | S | X | | | | | | | | | | |
| XIV. OPERATE FIRE EXTINGUISHERS | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 43. Operate External Fire Extinguisher Handle | S | X | | | | | | | | | | |
| 44. Operate Portable Fire Extinguishers | S | X | | | | | | | | | | |
| 45. Check Fire Extinguisher Pressure Gauges (Reference Ambient Temperature) | S | X | | | | | | | | | | |
| 46. Maintain Fire Sensor Lenses | S | X | | | | | | | | | | |
| XV. OPERATE NIGHT VISION GOGGLES (AN/PVS-5) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 47. Stow/Unstow AN/PVS-5 Goggles | S | X | | | | | | | | | | |
| 48. Place AN/PVS-5 Goggles Into Operation | S | X | | | | | | | | | | |
| 49. Maintain AN/PVS-5 Goggles | S | X | | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|------------------|--------------|-------------|--------------|-----------------|-------|----|--------------------|-----|-------------|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HO | HO | AID | TRNG DEV | |
| XVI. PREPARE COMMANDER'S STATION FOR ALTERNATE WEAPON | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 50. Install M240 Machinegun | S | | X | | | | | | | | |
| 51. Load M240 Machinegun | S | | X | | | | | | | | |
| 52. Fire M240 Machinegun | S | | X | | | | | | | | |
| 53. Remove M240 Machinegun | S | | X | | | | | | | | |
| XVII. PERFORM "DURING" OPERATIONS PMCS (REPEAT TASK #1) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 54. Check Cdr's Panel Mounting Lights, and Controls | S | | X | | | | | | | | |
| 55. Monitor Cdr's Panel Warning Lights | S | | X | | | | | | | | |
| 56. Check Operation of Cal .50 | S | | X | | | | | | | | |
| XVIII. PERFORM "AFTER" OPERATION PMCS (REPEAT TASKS #1) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| XIX. POWER DOWN AND SECURE COM- MANDER'S STATION | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 57. Remove Cal .50 Machinegun | S | | X | | | | | | | | |
| 58. Power Down CWS and Turret | S | | X | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | | TENTATIVE SOLUTION | | | |
|--|------------------|--------------|-------------|--------------|-------|-------|----|-----|--------------------|-----|----|----|
| | | MORE EFF | SAME NEW | INST UNIT | MOTOR | ET | HO | AID | TRNG | DEV | | |
| 59. Secure Station | S | | X | | | | | | | | | |
| a. Lock Cdr's Hatch | (S) | | (X) | | | | | | | | | |
| b. Exit Tank | (S) | | (X) | | | | | | | | | |
| XX. PERFORM PRE-FIRE PMCSs (REPEAT TASKS #20, 29) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 60. Check Cal .50 Mounting | S | | X | | | | | | | | | |
| 61. Check Cal .50 Ammo Stowed in Ready Box | S | | X | | | | | | | | | |
| XXI. PERFORM PREPARE TO FIRE CHECKS | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 62. Prepare to Fire Main Gun (7 Tasks) | S | | X | | | | | | | | | |
| a. Normal | (S) | | (X) | | | | | | | | | |
| b. Degraded | (S) | | (X) | | | | | | | | | |
| 63. Prepare to Fire Coax (6 Tasks) | S | | X | | | | | | | | | |
| a. Normal | (S) | | (X) | | | | | | | | | |
| b. Degraded | (S) | | (X) | | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | | | |
|--|--------------|--------------|----|---------|-----|--------|-------|--------------------|-----|-----|-----|------|-----|
| | | YES | NO | YES | YES | MENTAL | MOTOR | ET | HO | YES | NO | TRNG | DEV |
| XXII. TARGET ACQUISITION | DFRNT | | | | | | | | | | | | |
| 64. Acquire Targets From Full Open Hatch Using Naked Eye | S | | X | | | | | | | | | | |
| 65. Acquire Targets Using CITY From Close Hatch In Automatic Mode | D | X | | X | X | X | X | X | X | X | X | X | X |
| a. Set Sector For Automatic Scan | (D) | (X) | | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| b. Set Rate For Automatic Scan | (D) | (X) | | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| 66. Acquire Targets Using CITY From Closed Hatch in Manual Mode | D | X | | X | X | X | X | X | X | X | X | X | X |
| 67. Acquire Targets From Full Open Hatch Using Binoculars | S | | X | | | | | | | | | | |
| 68. Acquire Targets From Protected Open (Popped) Hatch Using Naked Eye | S | | X | | | | | | | | | | |
| 69. Acquire Targets From Popped Hatch Using Binoculars | S | | X | | | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | | |
|--|------------------|--------------|-------------|---------|------|--------|-------|--------------------|------------|------------|-------------|-----|
| | | MORE EFF | SAME NEW | INST | UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 70. Acquire Targets From Closed Hatch Using Unity Windows | S | | X | | | | | | | | | |
| 71. Acquire Targets From Closed Hatch Using Binoculars | S | | X | | | | | | | | | |
| 72. Acquire Targets at Night using Night Vision Goggles | S | | X | | | | | | | | | |
| 73. Acquire Targets From Turret Defilade | D | | X | X | X | X | X | X | X | X | X | X |
| 74. Acquire Targets From Hull Defilade | D | | X | X | X | X | X | X | X | X | X | X |
| 75. Acquire Targets While Stationary | S | | X | | | | | | | | | |
| 76. Acquire Targets While Moving | S | | X | | | | | | | | | |
| XXIII. TARGET ENGAGEMENT WITH MAIN GUN (NORMAL) (CITV) | UNIQUE | UND | YES | YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 77. Establish Weapon System Operating Conditions for NORMAL Mode | S | | X | | | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|--------------|--------------------------------|-----------|--------------|-------|----|--------------------|------|-----|---|
| | | | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV | |
| b. Designate Ammo Select Mode | (S) | (X) | | | | | | | | |
| c. Designate LRF Mode | (S) | (X) | | | | | | | | |
| 78. Issue Main Gun Precision Fire Commands | S | X | | | | | | | | |
| <u>Lay CITY For Direction:</u> | | | | | | | | | | |
| 79. Stat/Stat | D | X | X | X | X | X | X | X | X | X |
| 80. Stat/Moving (Track) | D | X | X | X | X | X | X | X | X | X |
| 81. Moving/Stat (Track) | D | X | X | X | X | X | X | X | X | X |
| 82. Moving/Moving (Track) | D | X | X | X | X | X | X | X | X | X |
| 83. Activate target designate button (align Main Gun with CITY) | D | X | X | X | X | X | X | X | X | X |
| <u>Decide to Hand-Off Target to GNR or Engage:</u> | | | | | | | | | | |
| 84. Release Turret Control to GNR (Override) | S | X | | | | | | | | |
| 85. Announce "From My Position" and Engage | S | X | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|-----------|--------------|-------|----|--------------------|------|-----|
| | | | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV |
| <u>Lay On Target To Be Engaged (CITY)</u> | | | | | | | | | |
| 86. Stat/Stat | D | X | X | X | X | X | X | X | X |
| 87. Stat/Moving (Track) | D | X | X | X | X | X | X | X | X |
| 88. Moving/Stat (Track) | D | X | X | X | X | X | X | X | X |
| 89. Moving/Moving (Track) | D | X | X | X | X | X | X | X | X |
| 90. Determine Range to Target using LRF/CITY (TC lases on Center-of-Mass) | S* | X* | | | X | | | | |
| 91. Verify Main Gun Firing Status | S | X | | | | | | | |
| a. Check/Respond to Multiple Return | (S) | (X) | | | | | | | |
| b. Check/Respond to Fault Symbol | (S) | (X) | | | | | | | |
| 92. Fire Main Gun | S* | X* | | | | | | X | |
| 93. Respond to Main Gun Misfire | S | X | | | | | | | |
| <u>Round Sense (CITY):</u> | | | | | | | | | |
| 94. Stat/Stat | D | X | X | X | X | X | X | X | X |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|------------------|--------------|-------------|--------------|-----------------|-------|-----|--------------------|----|------|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | HG | AID | NO | YFS. |
| 95. Stat/Moving (Track) | D | | X | X | X | X | X | X | X | X |
| 96. Moving/Stat (Track) | D | | X | X | X | X | X | X | X | X |
| 97. Moving/Moving (Track) | D | | X | X | X | X | X | X | X | X |
| <u>Adjust Fire (CITV):</u> | | | | | | | | | | |
| 98. Apply Reengage Method | S | | X | | | | | | | |
| 99. Correct Range Using Toggle Switch | S | | X | | | | | | | |
| XXIV. TARGET ENGAGEMENTS WITH MAIN GUN (EMERGENCY) (CITV) | DFRNT | NO | YES | YES | YES | NO | YES | YES | NO | YFS. |
| 100. Establish Weapon System Operating Conditions for Normal Mode | S | | X | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | |
| b. Designate Ammo Select Mode | (S) | | (X) | | | | | | | |
| c. Designate LRF Mode | (S) | | (X) | | | | | | | |
| 101. Issue Main Gun Precision Fire Commands | S | | X | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TALK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|--|--------------|--------------------------------|-----------|--------------|-------|----|--------------------|------|-----|
| | | | INST UNIT | MENTAL MOTOR | ET | HO | AID | TRNG | DEV |
| <u>Lay On Target (CITY):</u> | | | | | | | | | |
| 102. Stat/Stat | D | X | X | X | X | X | X | X | X |
| 103. Stat/Moving (Track) | D | X | X | X | X | X | X | X | X |
| 104. Brief Halt | D | X | X | X | X | X | X | X | X |
| 105. Apply Manual Leads | S | X | | | | | | | |
| 106. Determining Range to Target using LRF/CITY (Lase on Center-of-Mass) | S* | X* | | | X | | | | |
| 107. Verify Main Gun Firing Status | S | X | | | | | | | |
| a. Check/Respond to Multiple Return | (S) | (X) | | | | | | | |
| b. Check/Respond to Fault Symbol | (S) | (X) | | | | | | | |
| 108. Fire Main Gun | S* | X* | | | | | X | | |
| 109. Respond to Main Gun Misfire | S | X | | | | | | | |
| <u>Round Sense (CITY):</u> | | | | | | | | | |
| 110. Stat/Stat | D | X | X | X | X | X | X | X | X |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|------------------|--------------|---------------|-----------|--------------|-------|------------|--------------------|-------------|----|
| | | MORE EFF | MORE SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 111. Stat/Moving | D | X | X | X | X | X | X | X | X | X |
| 112. Moving/Stat | D | X | X | X | X | X | X | X | X | X |
| 113. Moving/Moving | D | X | X | X | X | X | X | X | X | X |
| <u>Adjust Fire (CITV):</u> | | | | | | | | | | |
| 114. Apply Reengage Method | S | | X | | | | | | | |
| 115. Correct Range Using Toggle Switch | S | | X | | | | | | | |
| XXV. TARGET ENGAGEMENT WITH MAIN GUN (MANUAL) (GAS) | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO |
| 116. Establish Weapon System Operating Conditions For MANUAL Mode | S | | X | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | |
| b. Designate Ammo Select Mode | (S) | | (X) | | | | | | | |
| <u>Lay Main Gun For Direction:</u> | | | | | | | | | | |
| 117. Direct Gunner Onto Target | S | | X | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|--|------------------|--------------|-------------|--------------|-----------------|-------|------------|--------------------|-------------|----|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | | |
| 118. Estimate/Announce Direction | S | | X | | | | | | | | |
| XXVI. ENGAGE TARGETS USING BATTLE- SIGHT GUNNERY (CITV) | DFRNT | YES | YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 119. Issue Battlesight Fire Command "From My Position" | S | | X | | | | | | | | |
| 120. Depress Battlesight Button | S | | X | | | | | | | | |
| 121. Apply Battlesight Gunnery Technique | S | | X | | | | | | | | |
| 122. Modify Battlesight Aim <u>Adjust Fire:</u> | S | | X | | | | | | | | X |
| 123. Apply Target Form Technique | S | | X | | | | | | | | |
| 124. Toggle Range Correction | S | | X | | | | | | | | |
| XXVII. ENGAGE TARGETS USING SKETCH CARD DATA | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 125. Prepare Sketch Card | S | | X | | | | | | | | |
| 126. Issue Sketch Card Fire Command | S | | X | | | | | | | | |

| TASK LIST (TANK COMMANDER) | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | | |
|--|--------------|----------|---------|-----|-----------|--------|--------------------|-----|---------|---------|----------|
| | COMMON-ALITY | MORE EFF | SAME | NEW | INST UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| XXVIII. RESPOND TO SPECIFIC FIRE CONTROL SYSTEM FAILURES | UNIQUE | UND | YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 127. Respond to CITY Failure | U | | X | X | X | X | X | X | X | | |
| a. Use Binoculars | (D) | | (X) | (X) | (X) | | (X) | | (X) | | |
| b. Use Vision Blocks | (D) | | (X) | (X) | (X) | | (X) | | (X) | | (X) |
| c. Gunner Takes over Using GPS (3x & 10x) | (D) | | (X) | (X) | (X) | | (X) | | (X) | | (X) |
| 128. Respond to Laser Range-finder Failure | S | | X | | | | | | | | |
| a. Employ Battlesight Gunnery | (S) | | (X) | | | | | | | | |
| b. Estimate Range and Announce | (S) | | (X) | | | | | | | | |
| c. Estimate Range and Toggle | (S) | | (X) | | | | | | | | |
| d. Determine Range Using Non-Ballistic Reticle | (S) | | (X) | | | | | | | | |
| 129. Respond To Crosswind Sensor Failure | S | | X | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM INST UNIT | CAUSE MENTAL MOTOR | TENTATIVE SOLUTION | | |
|--------------|--------------------------------|-------------------|--------------------|--------------------|---------|----------|
| | | | | MORE HO | JOB AID | TRNG DEV |
| (S) | (X) | | | | | |
| S | X | | | | | |
| (S) | (X) | | | | | |
| (S) | (X) | | | | | |
| S | X | | | | | |
| (S) | (X) | | | | | |
| (S) | (X) | | | | | |
| S | X | | | | | |
| DFRNT | NO YES YES YES | YES YES | NO YES | YES YES | NO YES | YES YES |
| S* | X* | X | X* | X | X | X |

a. Cancel Crosswind Input

130. Respond to Cant Sensor Failure

a. Cancel Cant Input

b. Aim High/Opposite Direction

131. Respond to Lead Angle Sensor Failure

a. Cancel Lead Angle Input

b. Apply Manual Lead

132. Respond to Combined Failures

XIX. TARGET ENGAGEMENTS WITH COAX (NORMAL/EMER) (CITV)

133. Determine Range to Target Using LRF/CITV (Lase on Target Center-of-Mass)

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------|------------|---------|------|--------|-------|--------------------|------------|------------|-------------|
| | | MORE SAME | NEW EFF | INST | UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| 134. Adjust Coax Fire (CITV) | D | | X | X | X | | X | X | X | | X |
| a. Apply a Walk-In Technique | (D) | | (X) | (X) | (X) | | (X) | (X) | (X) | | (X) |
| b. Apply Z-Pattern | (D) | | (X) | (X) | (X) | | (X) | (X) | (X) | | (X) |
| XXX. TARGET ENGAGEMENTS WITH COAX (EMER) (CITV) | DFRNT | NO | YES | YES | YES | YES | YES | YES | YES | NO | YES |
| 135. Establish Weapon System Operating Conditions For Emergency Mode | S | | X | | | | | | | | |
| a. Designate Gun Select Mode | (S) | | (X) | | | | | | | | |
| b. Designate Ammo Select Mode | (S) | | (X) | | | | | | | | |
| c. Designate LRF Mode | (S) | | (X) | | | | | | | | |
| 136. Issue Coax Fire Command | S | | X | | | | | | | | |
| 137. Determine Range to Coax Targets using (Lase on Tar- get Center-of-Mass) (CITV) | S* | | X* | | | | | | | | |
| 138. Fire Coax In 20-30 Round Bursts | S | | X | | | | | | | | |

| TASK LIST (TANK COMMANDER) | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | |
|---|--------------|-------------------|-----------|-----------|--------------|----------|--------------------|----------|----------|
| | COMMON-ALITY | MORE SAME NEW EFF | NO YES NO | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV |
| 139. Adjust Coax Fire (CITV) | D | X | X | X | X | X | X | X | X |
| a. Apply a Walk-In Technique (Moving) | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| b. Apply Z-Pattern (Moving) | (D) | (X) | (X) | (X) | (X) | (X) | (X) | (X) | (X) |
| XXXI. TARGET ENGAGEMENTS WITH CAL .50 (NORMAL) | SAME | NO YES NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO | NO NO NO |
| <u>Traverse to Target:</u> | | | | | | | | | |
| 140. Power Traverse Turret To Target | S | X | X | | | | | | |
| <u>Range On Target:</u> | | | | | | | | | |
| 141. Range To Cal .50 Targets Using LRF (Lase on Center-of-Mass Target) | S | X | X | | | | | | |
| 142. Estimate Range To Cal .50 Target | S | X | X | | | | | | |
| <u>Lay On Target Using CWS</u> | | | | | | | | | |
| 143. Stat/Stat | S | X | X | | | | | | |
| 144. Stat/Moving | S | X | X | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------|-------------|--------------|--------|-------|-----|--------------------|------------|-------------|-----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL | MOTOR | ET | MORE HO | JOB AID | TRNG DEV | |
| 145. Moving/Stat | S | | X | | | | | | | | |
| 146. Moving/Moving | S | | X | | | | | | | | |
| 147. Adjust Cal .50 Fire | S | | X | | | | | | | | |
| a. Apply Walk-In Technique | (S) | | (X) | | | | | | | | |
| b. Apply Z-Pattern | (S) | | (X) | | | | | | | | |
| c. Apply Turret-Carry Method (With Gunner) | (S) | | (X) | | | | | | | | |
| XXXII. ENGAGE MULTIPLE/ SIMULTANEOUS TARGETS | DFRNT | YES | NO | YES | YES | YES | YES | YES | YES | NO | YES |
| 148. Determine Most Dangerous | D | X | X | X | X | X | X | X | X | X | X |
| 149. Issue Multiple Target Fire Command | S | | X | | | | | | | | |
| 150. Issue Simultaneous Tar- get Fire Command | S | | X | | | | | | | | |
| 151. Dump Automatic Lead | S | | X | | | | | | | | |
| XXXIII. ENGAGE TARGETS USING SMOKE | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 152. Engage Targets Using Engine Smoke Generator | S | | X | | | | | | | | |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM | | PROBLEM | | CAUSE | | TENTATIVE SOLUTION | | | |
|---|------------------|--------------|-------------|--------------|-----------------|-------|------------|--------------------|-------------|----|----|
| | | MORE EFF | SAME NEW | INST UNIT | MENTAL MOTOR | ET | MORE HO | JOB AID | TRNG DEV | | |
| 153. Engage Targets Using Grenade Launcher System | S | | X | | | | | | | | |
| XXXIV. TROUBLESHOOT TURRET | SAME | NO | YES | NO | NO | NO | NO | NO | NO | NO | NO |
| 154. Troubleshoot TC Indica- tor/Warning Lights (7 Tasks) | S | | X | | | | | | | | |
| a. Cdr's CKT BKR Light Fails | (S) | | (X) | | | | | | | | |
| b. CKT BKR Open Light | (S) | | (X) | | | | | | | | |
| c. Fire Control MALF Light | (S) | | (X) | | | | | | | | |
| d. Cdr's LOW BAT CHG Light | (S) | | (X) | | | | | | | | |
| e. Vehicle Master Power Light Fails | (S) | | (X) | | | | | | | | |
| f. Turret Power Light Fails | (S) | | (X) | | | | | | | | |
| g. Aux Hydr Power Light Fails | (S) | | (X) | | | | | | | | |
| 155. Troubleshoot Fire Con- trol System (5 Tasks) | S | | X | | | | | | | | |

TASK LIST
(TANK COMMANDER)

| | COMMON-ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | TENTATIVE SOLUTION | | |
|---|--------------|--------------------------------|---------|-------|--------------------|-----------------|--------------------------|
| | | | | | INST UNIT | MENTAL MOTOR ET | MORE JOB TRNG HO AID DEV |
| a. Unable to Power Traverse | (S) | (X) | | | | | |
| b. Unable to Power Elevate | (S) | (X) | | | | | |
| c. Unable to Fire Main Gun | (S) | (X) | | | | | |
| d. Unable to Power Traverse CWS | (S) | (X) | | | | | |
| e. Unable to Lase | (S) | (X) | | | | | |
| 156. Troubleshoot Cal .50 Machinegun | S | X | | | | | |
| a. Unable to Fire Cal .50 | (S) | (X) | | | | | |
| 157. Troubleshoot CITV | U | X | X | X | X | X | X |
| 158. Troubleshoot Auxiliary Systems (2 Tasks) | S | X | | | | | |
| a. Cdr's Gas Particulate Heater Fails to Heat | (S) | (X) | | | | | |
| b. M250 Grenades Do Not Fire | (S) | (X) | | | | | |

TASK LIST
(TANK COMMANDER)

| TASK LIST (TANK COMMANDER) | COM- PLTY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | CAUSE | | | TENTATIVE SOLUTION | | | | | | |
|--|--------------|--------------------------------------|---------|-----------|--------|---------|--------------------|---------|-------|---------|-------|---------|---------|
| | | | | INST UNIT | MENTAL | MOTOR | ET | HO | AID | TRNG | DEV | | |
| 159. Troubleshoot Tank Elec- trical System | S | X | | | | | | | | | | | |
| a. No Vehicle Master Power | (S) | (X) | | | | | | | | | | | |
| b. No Hull Power | (S) | (X) | | | | | | | | | | | |
| c. No Turret Power | (S) | (X) | | | | | | | | | | | |
| XXXV. PERFORM DURING-FIRE PMCS | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| XXXVI. PERFORM POST-FIRE PMCS (REPEAT TASKS #15, 16, 17, 21, 24, 25, 26, 27) | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| 160. Field Strip Cal .50 and Check parts | S | X | | | | | | | | | | | |
| 161. Clean and Lubricate Cal .50 | S | X | | | | | | | | | | | |
| XXXVII. LUBRICATE MIAI ACCORDING TO LUBRICATION ORDER (LO) | SAME | NO YES NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO | NO NO |
| XXXVIII. COMMAND, CONTROL, AND COMMUNICATIONS | DFRNT | YES NO | NO YES | YES YES | NO NO | YES YES | NO NO | YES YES | NO NO | YES YES | NO NO | YES YES | YES YES |
| 162. Identify Combat Vehicles as Friend or Foe | D | X | X | X | X | X | X | X | X | X | X | X | X |

| TASK LIST (TANK COMMANDER) | COMMON- ALITY | TASK PERFORM MORE SAME NEW EFF | PROBLEM | | CAUSE | | | TENTATIVE SOLUTION | | |
|---|------------------|--------------------------------------|-----------|--------|-------|----|----|--------------------|------|-----|
| | | | INST UNIT | MENTAL | MOTOR | ET | HO | AID | TRNG | DEV |
| 163. Identify Combat Aircraft as Friend or Foe | D | X | X | X | X | | X | X | X | X |
| 164. Report Bombing, Shelling, and Mortar, Rocket and Aircraft Fire (Spot Report) | D | X | X | X | X | | X | X | X | X |
| 165. Cross on Area Contaminated By A Persistent Chemical Agent | D | X | X | X | X | | X | X | X | X |
| 166. Control Fire Support | D | X | X | X | X | | X | X | X | X |
| 167. Control Unit Maneuver | D | X | X | X | X | | X | X | X | X |
| 168. Conduct Physical Recon- naissance | D | X | X | X | X | | X | X | X | X |
| 169. Plan Maneuver Control Measures | D | X | X | X | X | | X | X | X | X |
| 170. Plan Direct Fires | D | X | X | X | X | | X | X | X | X |
| 171. Plan Fire Support | D | X | X | X | X | | X | X | X | X |