FM 17-12-7

Tank Gunnery Training Devices and Usage Strategies

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Headquarters, Department of the Army

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TANK GUNNERY TRAINING DEVICES AND USAGE STRATEGIES
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Preface

This manual presents an overview of current, doctrinally approved tank combat training devices. The intent is to familiarize the user with armor-related devices and how they can be used to train and test tank gunnery or tactical skills. This manual is designed for use with FM 17-12-series manuals and the technical manuals or other resource materials for each device.

FM 17-12-7 was developed as a ready reference for tank commanders, platoon sergeants, platoon leaders, master gunners, S3s, and the chain of command of armor units. From this manual, the user can select devices that will best support the type of planned gunnery/tactical training at home station.

The proponent of this publication is HQ TRADOC. Submit changes for improving this publication on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward it to: Commander, United States Army Armor Center and Fort Knox, ATTN: ATZK-TDD-PG, Fort Knox, KY 40121-5200. E-mail: armordoctrine@ftknox5-emh3.army.mil.

PREFACE

This supplement to the FM 17-12-series manuals presents an overview of current and proposed tank combat training devices. It provides users with a working knowledge of armor-related devices and how they are used to train and test tank gunnery or tactical skills. This manual is designed for use with the FM 17-12-series manuals and the technical manuals or other resource materials for each device.

FM 17-12-7 was developed as a ready reference for tank commanders, platoon sergeants, platoon leaders, master gunners, S3s, and the chain of command of armor units. From it, the user can select devices that best support tank gunnery training at his home station. This manual also contains matrices that match tank tables with the proper devices to train specific objectives, skills, or knowledge. The matrices show at a glance the training value of devices for each tank table. Finally, FM 17-12-7 provides detailed procedures for establishing and maintaining a training aids supply account.

The proponent of this publication is HQ TRADOC. Send comments and recommendations on DA Form 2028 directly to Commandant, United States Army Armor School, ATTN: ATSB-WP, Fort Knox, KY 40121-5212.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Chapter 1

Introduction

Crew turbulence and the rising cost of tank main gun ammunition, fuel, and spare parts make it difficult to produce and maintain skilled tank crews, sections, and platoons. Moreover, units' time at range complexes grow shorter and shorter. Therefore, more gunnery sustainment training must be done at the home station using simulators and appended gunnery training devices.

Training devices help fill some of the void caused by lack of resources. They cannot, however, replace or duplicate main gun firing or other vital aspects of gunnery or tactical training. Their purpose is to enhance training. Devices allow the trainer to identify and correct procedural errors. They enable the trainer to spot tank crews or individuals who are having problems with a particular gunnery or tactical task.

This manual contains 11 chapters and 1 appendix. Chapters 3 through 11 cover the current inventory of tank gunnery training devices and usage strategies. The appendix, *Gunnery Event Device Suitability*, shows the devices described in Chapters 3 through 9 by type, with their suitability code for tank-table training.

FM 17-12-7 is like a catalog. Each device is illustrated and has a purpose statement, brief description, and usage strategy. From this information, the user can decide which device best suits his training needs, and refer to the matrix in the appendix to verify his choice. For more specific information on a device, the user should consult the proper technical manual listed in the References.

Some devices have been issued directly to tactical units. Others are available for loan from the local Training Support Center (TSC). Still others can be built from drawings in this manual or from drawings available at the TSC.

Some of the drawings at the TSC are identified as drawings for Army Training Aids (DATA). DATA items are low in cost and can be made by most TSCs. They are designated as DATA devices (DVC-D). Devices that have been centrally produced by the United States Army Training and Doctrine Command (TRADOC) are identified as TRADOC devices (DVC-T).

The TSC may have locally designed devices that are not available Armywide. It is also the source for graphic training aids (GTA) and for training devices produced by the United States Army Materiel Command (AMC). More information on these devices and GTAs can be found in the local TSC catalog, TRADOC Pamphlet 71-9, DA Pamphlet 350-9, and DA Pamphlet 310-32.

The TSC is the main support channel for training devices. It can provide information on what devices are available, how to procure them, and how long it will take to receive them. The TSC can usually offer suggestions for using a particular device in training. In short, the TSC is the main link between devices and a unit's training program.

Many of the devices described in this manual are currently under contract for upgrades and improvements. As these upgraded or reconfigured devices are fielded, this manual will be updated to ensure that the trainer has a publication with the most current information possible.

Chapter 2

Assessing and Developing a Device-Based Gunnery Training Strategy

This chapter discusses issues that the commander, S3, and master gunners should consider when establishing a gunnery program for their unit. The effectiveness of the gunnery training strategy will be a direct result of the amount of planning and effort placed into it during the assessment and development phase.

Assessing the Unit's Training Level

The first step the trainer should take in developing a training strategy is to assess the unit's current level of proficiency. This assessment should not be limited to gunnery-related tasks, but should consider all aspects of the unit's readiness status. Some of the areas that should be reviewed by the trainer are:

- Previous gunnery program strengths or weaknesses.
- Previous Tank Crew Gunnery Skills Test (TCGST) results or whether a diagnostic TCGST should be conducted.
- Age of equipment and current maintenance status.
- The unit's mission and its METL.
- Availability of training days.
- Availability of training areas.
- Availability of training devices.
- Whether training events can be combined to maximize training dollars.
- Crew stability within the unit (loss/gain of personnel).

Developing the Training Strategy

Once the unit's level of training has been determined, the trainer can start to develop his training strategy. At this point, the commander and trainer must work together to make sure the training strategy meets the needs of the unit, achieves the commander's goals and intent, and sustains unit proficiency.

SCHEDULING

Scheduling the training events will be the greatest challenge to developing the training strategy. Issues concerning scheduling will be mandated by the availability of training days, devices, and training sites. Some things the trainer can do to minimize scheduling problems are:

- Schedule early.
- Coordinate with supporting units.
- Develop contingencies for alternate training methods.
- Make sure training does not conflict with other unit commitments.
- Make sure enough time is allotted to complete the scheduled event.
- Maintain a logical training sequence.

The training developer should establish milestones within the training program to make sure the unit has reached the required level of training before progressing to the next training event. Scheduling, using milestones as the framework of the training program, will ensure that the unit has conducted all prerequisite training prior to live fire. Current gunnery training milestones mandated by Army doctrine are:

- Conduct Preparatory Tank Gunnery Training, per FM 17-12-1-2, Chapter 13, page 13-9.
- Record TCGST semi-annually.

- Conduct a gun tube recoil exercise and borescope semi-annually.
- Conduct Conduct-of-Fire Trainer (COFT) and Advanced Gunnery Training System (AGTS) training to achieve prerequisites to live fire.
- Conduct basic gunnery tables prior to intermediate gunnery tables.
- Conduct intermediate gunnery tables prior to advanced gunnery tables.
- Conduct advanced gunnery tables XI and XII annually.
- Conduct platoon field training exercises (FTX) quarterly.

Note. Combining training events, such as platoon FTXs and tactical tables, will maximize training days, sites, and operational tempo (OPTEMPO) available to the unit.

The use of training milestones will also help maintain the logical progression of training. It is recommended that the training cycle be divided into 90-day training periods. Alternating the emphasis of training from gunnery to maneuver will ensure that all combat-critical tasks are trained within the calendar year; however, those skills trained in the previous quarter must be sustained for this concept to be effective. The following is a sample training cycle for a unit:

- First quarter gunnery training emphasis, sustain maneuver skills.
- Second quarter maneuver training emphasis, sustain gunnery skills.
- Third quarter gunnery training emphasis, sustain maneuver skills.
- Fourth quarter maneuver training emphasis, sustain gunnery skills.

DEVICES

Once all training events have been scheduled, the training developer must determine which training devices best support the scheduled training. In a perfect world with unlimited resources, all training would be conducted on the actual system using live ammunition. As OPTEMPO decreases, unit trainers will need to maximize the available simulations and training devices available, to conduct as realistic training as possible.

Certain areas can currently only be trained in simulation, such as firing MPAT at a moving helicopter. If more than one device can support the scheduled training event, the trainer should choose which better supports training, and use the other system as a contingency should the preferred system become unavailable.

IMPLEMENTATION

Implementation of the unit training strategy at the beginning of a new gunnery training cycle will help ensure continuity in the gunnery training program. Ensuring that all scheduled events appear on the unit training schedule will help keep all members of the unit prepared for the upcoming training events.

It is imperative that the trainer delegate as much of the training as possible to qualified personnel to conduct the training event. If the primary trainer becomes totally involved in conducting the training, the program will suffer. The primary trainer should be the central hub from which training is scheduled and evaluated for effectiveness.

SUSTAIN

The training cycle should be continuous and change as the unit's mission and level of proficiency changes. Units that cease to train will experience a gradual loss of the skills learned previously.

Chapter 3

Tank Weapon Gunnery Simulation System (TWGSS)

TWGSS is the primary gunnery training device for the Abrams-series tank. The TWGSS is a tank-mounted training device that aids the crew in gaining and improving proficiency in gunnery skills without the expenditure of live ammunition. Precision gunnery training using TWGSS can be conducted at any training site that eye-safe laser firing is permitted. TWGSS provides the crew with visual and sound effects that accurately simulate real firing conditions. The system simulates the firing of the tank's main gun, the firing of the M240 machine gun, and the effects of a hit on target.

TWGSS Components

The TWGSS system consists of three major subsystems, the firing system, the target system, and the Training Data Retrieval System (TDRS). These major subsystems perform functions within the system as a whole.

FIRING SYSTEM

The firing system simulates the ballistic characteristics for the ammunition being fired and provides the visual and sound effects.

TARGET SYSTEM

The target system receives and processes data from another entity equipped with a laser training device and informs the crew of the results of the attack on own vehicle. The attack could come from another TWGSS-equipped tank, a Precision Gunnery System (PGS)-equipped Bradley, or a Multiple Integrated Laser Engagement System (MILES)-equipped unit. An observer controller can also communicate with the TWGSS target system using a control gun.

TRAINING DATA RETRIEVAL SYSTEM

The TDRS provides real-time analysis for each round fired. This information provides critical data for use in conducting an after-action review for both gunnery-type scenarios, and tactical training environments.

TWGSS Individual Components

The individual components of the TWGSS system and a brief description of the functionality of each component are shown below.

- The *transceiver unit* performs the complete weapon effect simulation, to include point of impact, type of ammunition fired, and identity of firing vehicle to the target.
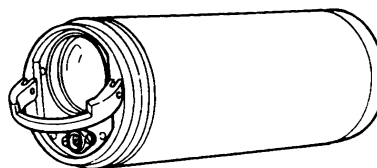
Figure 3-1. Transceiver unit.

- The *tracer, burst, obscuration simulator (TBOS)* projects tracer, burst, and obscuration effects simulation into the gunner's auxiliary sight (GAS).
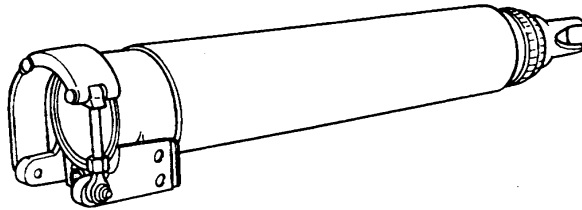
Figure 3-2. Tracer, burst, obscuration simulator.

- The *TBOS driver unit* provides image data for the type of ammunition being fired and, if hit, provides burst image data to the TBOS GAS unit.
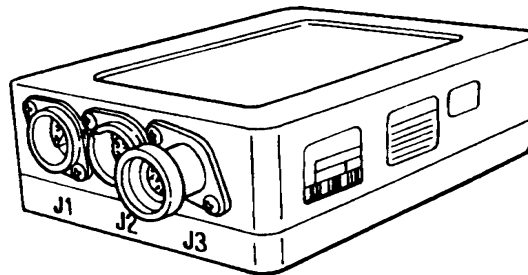
Figure 3-3. TBOS driver unit.

- The *turret position sensor (TPS)* senses the turret position in relation to the hull and sends this information to the vehicle interface unit.
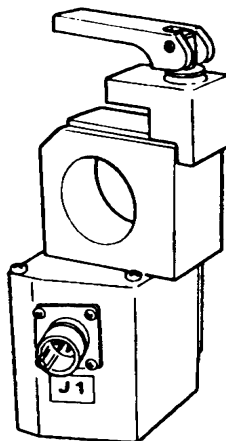
Figure 3-4. Turret position sensor.

- The *vehicle interface unit* receives electrical power from the tank and distributes power to system components.
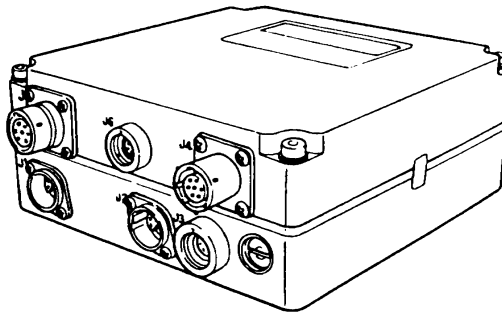
Figure 3-5. Vehicle interface unit.

- The *control panel* is the soldier's TWGSS system interface for inputting data. Entries into the control panel include:

  - Upload ammunition.
  - Select training modes.
  - Operate system during training.
  - Align system prior to training.
  - View results of engagements.
  - View built-in test (BIT) results.
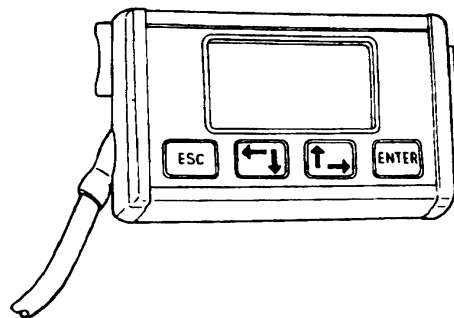
Figure 3-6. Control panel.

- The *TDRS memory card* stores firing and target data for the type of vehicle being used and the type of training being conducted. It collects and stores training events in real time during the TWGSS training for retrieval and use during the AAR using the TDRS computer unit.
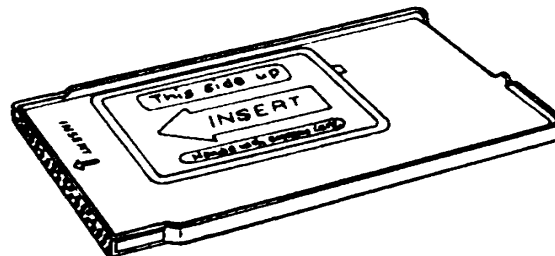
Figure 3-7. TDRS memory card.

- The loader's panel allows the loader to select the type of ammunition being loaded, and provides the aural cues associated with loading the main gun.
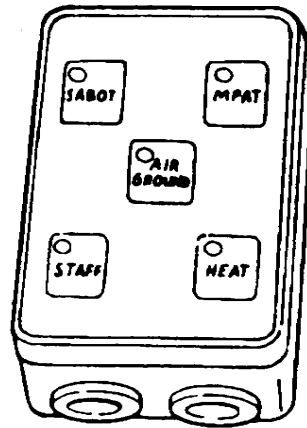
Figure 3-8. Loader's panel.

- The TBOS video-mixer unit provides video-generated obscuration, tracer, and target effects for the gunner's primary sight (GPS) in both daylight and thermal modes.
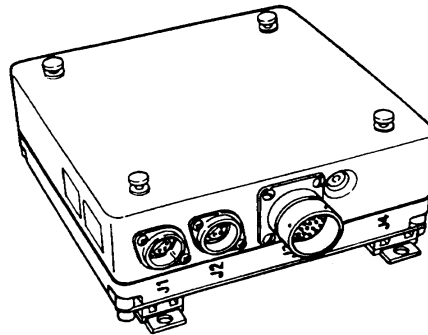
Figure 3-9. TBOS Video-mixer unit.

- The retrodetector unit consists of two reflectors, two laser detectors, and one strobe light. The reflectors reflect laser light to the firing TWGSS or PGS. The laser detectors receive hit information, including type of ammunition, identity of attacker, and hit point on own vehicle. The strobe light flashes when the tank has been hit.

Note.   For placement of target panel retrodetectors, refer to TM 9-6920-703-10.
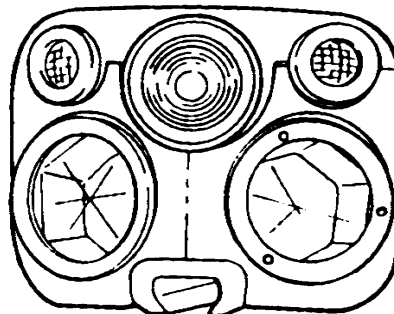
Figure 3-10. Retrodetector unit.

• The hull defilade detector unit detects a hit to the hull of the tank, when exposed.
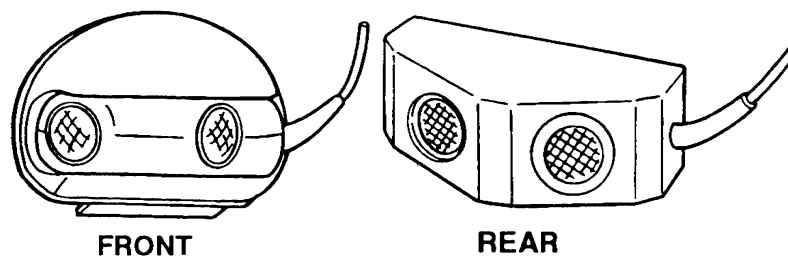
Figure 3-11. Hull defilade detector unit.

• The target computer unit receives the results of a simulated firing, including hit point, type of ammunition, and identity of the firing system. The computer also determines if there was a near miss, hit, mobility kill, weapon kill, catastrophic kill, or no effect.
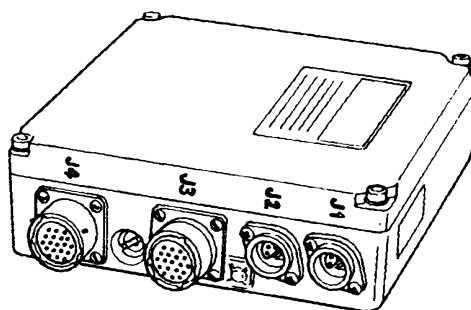
Figure 3-12. Target computer unit.

• The TIS junction box provides a connecting point for the electrical input from the TBOS video-mixer unit to enter the TIS image control panel.
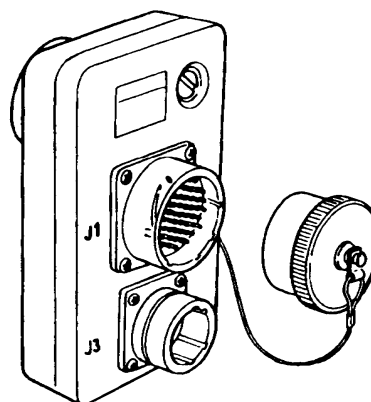
Figure 3-13. TIS junction box.

TWGSS Capabilities and Limitations

CAPABILITIES

The TWGSS provides full-crew interactive training on the actual vehicle utilizing the complete functionality of the fire control system (FCS). The system utilizes the axis of the gun line in conjunction with the firing tables to determine the trajectory and impact point for the type of ammunition being fired. The system is fully interoperable with the PGS, MILES, Laser Target Interface Device (LTID), and the Improved Tank Gunfire Simulator (ITGS).

The system simulates the following visual effects:

- Tracer.
- Burst on target.
- Burst on ground.
- Obscuration.

The system provides the following aural cues to the crew via the intercom:

- Main gun firing.
- M240 machine gun firing.
- Hit indication.
- Ammunition loading.
- System error tone.

TWGSS also provides panel gunnery training, target tracking training, scaled-target training, and realistic force-on-force training with immediate feedback.

Degraded-mode gunnery while using TWGSS requires no additional inputs from the crew. The system has its own embedded sensors that will identify any inoperative portions of the FCS and require the crew to react to the malfunction in the appropriate manner to still hit targets.

SYSTEM LIMITATIONS

In order to conduct manual- and emergency-mode gunnery training, the turret power must remain on to provide power for the TWGSS components.

Note. The main gun can be fired using the manual blasting machine and the hydraulic elevation handle trigger to simulate degraded-mode gunnery engagements.

TWGSS Training

The TWGSS train-up program is a train-the-trainer-type program. The certification course is a 40-hour block of instruction. Once an individual has been certified on TWGSS and has his certificate of training, he is then certified to teach the certification course to others. It is recommended that a certification course be taught quarterly, as a minimum, to ensure that every unit has plenty of personnel trained on the system.

Before conducting a training event using TWGSS, a refresher training block of instruction should be scheduled to ensure all soldiers are still proficient in installation, operation, and AAR. A well-trained tank crew can install TWGSS in about 45 minutes, as well as have fewer instances of lost training time due to crew error and damaged equipment.

Conducting training with TWGSS should be scheduled as often as possible within a unit's gunnery training program. This will ensure that the crew's proficiency level with the FCS will not deteriorate over time and will help guarantee a continuous gunnery training cycle.

HOME-STATION TRAINING

Before conducting training that requires ranges or training areas, TWGSS can be used at home station to conduct target tracking and engagement techniques. If the land available at home station is not large enough to support full-scale target engagement ranges, training can be conducted using half-scale targetry. This training is ideally suited to be conducted in conjunction with the refresher training on utilizing TWGSS.

RANGE TRAINING

In its role as the primary precision gunnery trainer, TWGSS is the resourced device by STRAC for many of the tank gunnery tables and tactical tables. When the system is set up for panel gunnery, it provides the crews with the capability to engage targets on a range complex in the same manner as if they were firing live ammunition and provides immediate feedback for use during an AAR.

The following tank tables should be conducted using TWGSS:

- Tank Table IV.
- Tank Table VI.
- Tank Table VII (dry runs).
- Tank Table XI.

TWGSS has the ability to train using various scaled targets. The trainer has the option to use full-scale, half-scale, or 1/10-scale targets, depending on the resources and ranges available. If a full-size range is available, the trainer can use the full- or half-scale target options. The 1/10-scale target option is used when resources and range constraints exist. The 1/10-scale targets can be used in local training areas.

Note. All tank tables can be trained using TWGSS, but qualification tables must be fired using live ammunition in order for a crew or platoon to be considered qualified.

FORCE-ON-FORCE TRAINING

If the number of TWGSS systems available to a unit is sufficient to support force-on-force training, it should be the preferred device to use. Although MILES is the resourced device, it does not utilize the tank's FCS in a precision-gunnery role. Reinforcing precision gunnery skills at all levels of training should be conducted whenever possible.

AFTER-ACTION REVIEW

The TWGSS TDRS computer provides the means by which the information collected by the TDRS memory card is formatted into an effective AAR. The TDRS computer unit enables the instructor to set up, control, and evaluate training exercises. The system supports AARs for both panel gunnery mode and force-on-force mode. The major event categories captured for use on the TDRS computer for replay during an AAR are:

- Targeting events.
- Firing events.
- Movement events.

The AAR can be prepared and ready to run by a trained operator within 15 minutes.

System Information

For more information about the TWGSS system, to include future upgrades, contractor logistical support (CLS), and general information, contact the Chief, Systems Branch (Armor Training Devices), DTDD, Fort Knox, KY, (DSN) 464-5656, (Commercial) 502-624-5656.

Chapter 4

Conduct-of-Fire Trainer (COFT)

The COFT is an M1/M1A1 tank gunnery training device for TC/gunner teams. Its primary purpose is to sustain basic gunnery skills and increase combat gunnery skills. The COFT places the TC and gunner in a realistically simulated crew station and presents them with a full range of computer-controlled engagement situations. The COFT produces full-color, computer-generated action scenes in which crew members interact with various target situations. Programmed exercises vary in target type and number, range, vehicle and target motion, visibility, and other complex conditions. The crew is in no danger, no fuel is consumed, and no ammunition is expended. The result is challenging, progressive gunnery training. For convenience, the COFT has a mobile unit (MCOFT) that is predominantly used by National Guard units, and provides the same training values as the COFT (see Figure 4-4).

COFT Configurations

There are two different configurations of the COFT general-purpose computer (GPC) system: VAX 11/780 and MICRO VAX II. The VAX 11/780 consists of a double-wide main console with an expansion cabinet side-by-side (see Figure 4-1).
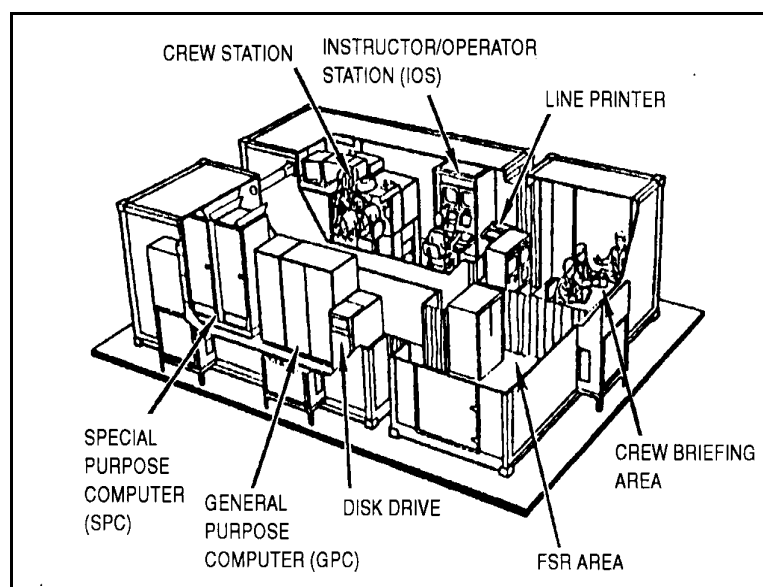
Figure 4-1. COFT with VAX 11/780 GPC components.

The MICRO VAX II consists of a lowboy console containing the mass memory disk drive and a central processing unit (CPU) with the main control panel (see Figure 4-2).
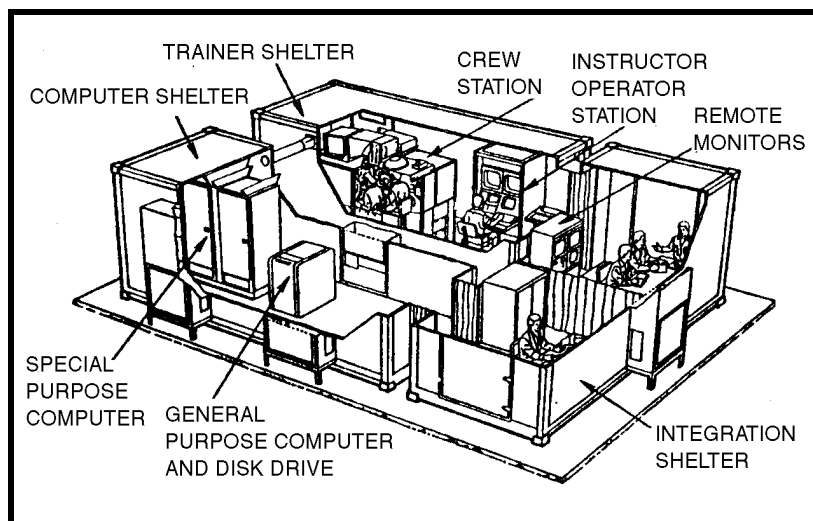
Figure 4-2. COFT with MICRO VAX II GPC components.

COFT Components

The COFT consists of three shelters: integration shelter, computer shelter, and trainer shelter.

- **Integration shelter.** The integration shelter contains the crew briefing area, the remote monitors, and the field service representative (FSR) area.

- **Computer shelter.** The computer shelter includes the GPC, the special-purpose computer (SPC), and the disk drive.

- **Training shelter.** The training shelter contains the crew station and the instructor/operator station (IOS) (see Figure 4-3).
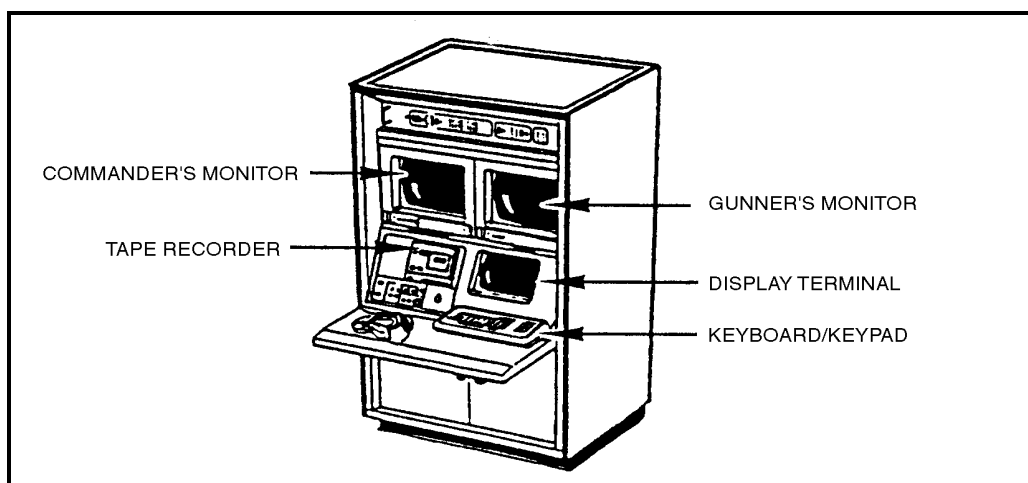
Figure 4-3. COFT instructor/operator station.

The hardware in the IOS includes—

- TC's and gunner's color monitors. These monitors allow the instructor/operator (IO) to see the same scenes (including reticles) as viewed through the TC and gunner sights.

- Tape recorder. The tape recorder allows the IO to record and play fire commands and crew responses.

- Display terminal. Instructions on the display terminal explain what the IO must do to begin the training exercises and run maintenance routines.

- Keyboard/keypad. The keyboard/keypad allows the IO to select and control training exercises, obtain desired displays or printouts, act as driver and loader, and run maintenance routines.

- Printer. The printer enables the IO to print records of crew performance, which he uses to debrief and prebrief the crew and plan future training. At the end of a training session, the IO may print a summary of all exercises fired during that session.

Note. The operator's manual describes the COFT hardware in detail.

MCOFT Components

The MCOFT consists of three shelters: covered walkway/main entrance, computer shelter, and trainer shelter.

- **Covered walkway/main entrance.** The covered walkway/main entrance is the transition point for personnel to enter the training shelter or the FSR/IO to enter the computer shelter.

- **Computer shelter.** The computer shelter for the VAX 11/780 (see Figure 4-4) includes the GPC, SPC, and the disk drive. The computer shelter for the MICRO VAX II (see Figure 4-5) includes the GPC and SPC.

- **Training shelter.** The training shelter contains the crew station and the IOS.

Note. The operator's manual describes the MCOFT hardware in detail.
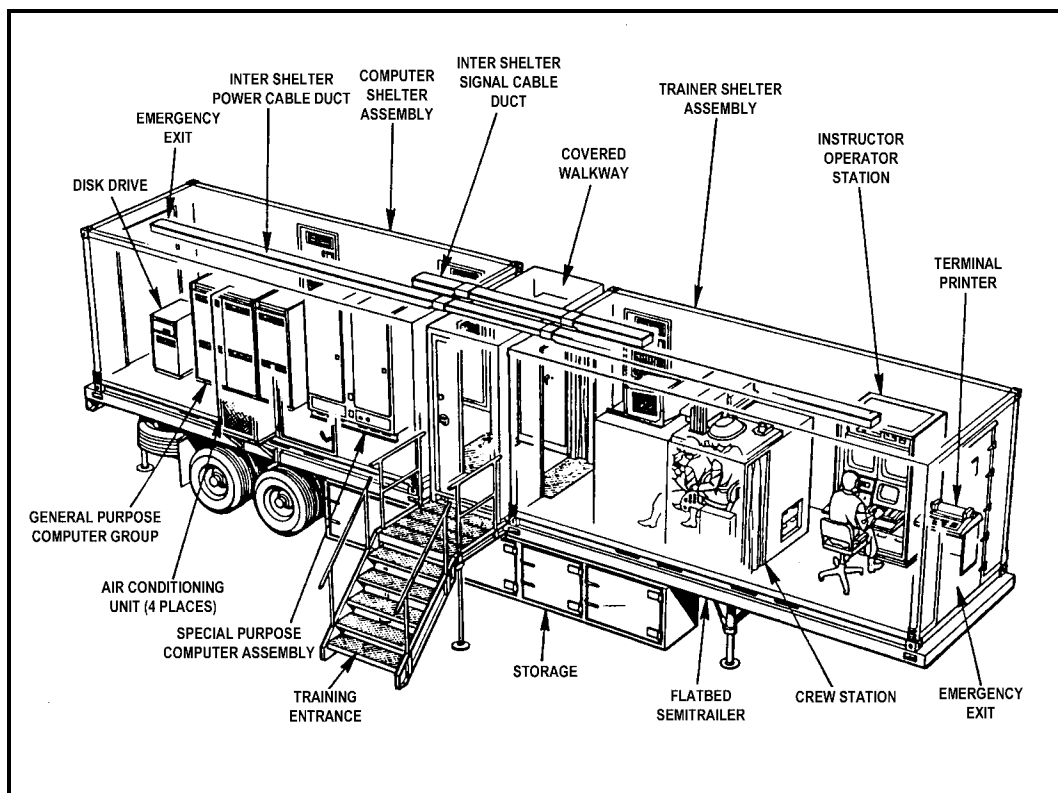
Figure 4-4. MCOFT with VAX 11/780 GPC components.
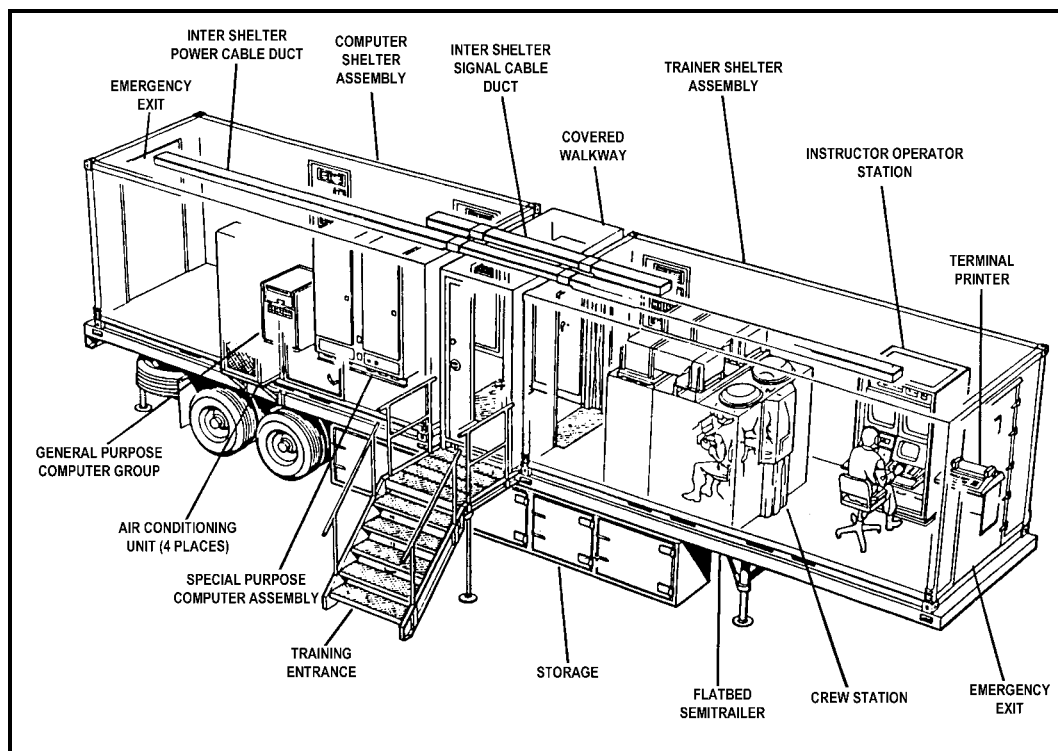
Figure 4-5. MCOFT with MICRO VAX II GPC components.

Capabilities and Limitations

Although the COFT places the TC and gunner in a realistically simulated crew station and presents them with a full range of computer-controlled engagement situations, some functions of the TC and gunner stations are physically simulated and some are not.

CAPABILITIES

The COFT provides initial, refresher, and sustainment training for tank commander/gunner teams. The system utilizes computer-generated visual scenes, targetry, and special effects to simulate the engagement of targets. The majority of the fire control system is replicated in both physical and functional aspects. The system trains both fully operational and degraded-mode gunnery techniques under a wide variety of conditions.

The system simulates the following visual effects:

- Multiple, single, and delayed targets (T-72, BMP, BRDM, ZSU-23-4, HIND-D, truck GAZ-69, MI-8C, rocket-propelled grenade [RPG] team, troops, M1, M2/M3, M60A3, and AH-64).
- Varied ranges, speeds, exposure times, and reactive targets.
- Own-vehicle moving and stationary.
- Round tracer.
- Scene obscuration.
- Round impact and effect on target.
- Round impact on terrain.
- Catastrophic kill.
- Mobility kill (advanced matrix).
- Friendly fire.
- Enemy direct and indirect fire.
- Own vehicle hit and kill.

The system provides the following visibility conditions:

- Day unlimited.
- Day with haze.
- Day with fog.
- Dawn and dusk.
- Night unlimited.
- Night with thermal clutter.
- Mortar illumination (advanced matrix).

The system provides the following aural cues to the crew:

- Enemy direct and indirect fire.
- Round loading and reloading sounds.
- Loader's "UP."
- Main gun, M240, and M2 machine gun firing.
- Track clatter.
- Engine and transmission sounds.
- Gun jump.
- TIS cooling fan.

- Turret blower.
- Own vehicle hit and kill.
- Ammunition transfer sounds.

LIMITATIONS

The following items are not functionally simulated on the COFT:

- TC's periscopes. The forward unity periscope is operational; the other periscopes around the TC's hatch are not operable.
- Caliber .50 (not physically simulated). The commander can fire the caliber .50 only from the closed hatch position. The sights, elevation, firing, and traversing mechanisms are simulated on the COFT. The components of the caliber .50 on the outside of the tank are not simulated on the COFT.
- LOW BAT CHG light, CKT BKR OPEN light, and ENGINE FIRE on the TC's panel on the M1 tank. Air temperature control and NBC alarm mute control for the M1A1 (lamps will light when tested).
- Hydraulic pressure gauge.
- Gunner's unity periscope.
- Ammunition temperature gauge.
- Gunner's TIS focus knob.
- Coax machine gun. The coax machine gun is partially simulated. Manual fire cannot be accomplished. The charging handle can be used to apply immediate action for simulated stoppages.
- Driver's and loader's stations (not simulated).
- Exterior turret components (not simulated).

Note. See TM 55-6920-744-15, Transportability Guidance for Trainer, Mobile Conduct-of-Fire, 12 Apr 94, for set-up and tear-down time that is required of the system.

COFT Training

The key to a successful COFT training program is to make sure there are trained, competent personnel operating and managing the COFT.

COFT INSTRUCTOR/OPERATOR

The IO is critical in COFT training and must be well trained and highly motivated. Operation of the COFT is simple, but quality training requires an IO with an in-depth knowledge of the tank and tank gunnery. COFT IOs perform the following duties:

- Place the COFT in operation.
- Prepare for COFT training (analyze crew records, plan the training session, prepare and conduct briefings).
- Conduct prepare-to-fire and screening exercises.
- Conduct training sessions.
- Conduct AARs.
- Power down the COFT.
- Perform operator maintenance.
- Maintain crew records.

SENIOR INSTRUCTOR/OPERATOR (SIO)

The SIO is the subject matter expert on the COFT; he is the only person who can certify new IOs and make changes in the COFT training management subsystem. SIOs perform the following duties:

- Train new IOs using the exportable training packet (ETP).
- Supervise IOs, to include:
  - Inspect COFT training.
  - Maintain IO proficiency.
  - Evaluate training.
- Recertify IOs annually.
- Help the unit commander set up a COFT training program.
- Serve as training manager, as directed.
- Manage COFT training records.
- Reposition crews in the matrix (as required).
- Train IOs on the advanced matrix.

MASTER GUNNER

The master gunner should be IO certified and should attend the SIO course. He performs the following duties:

- Help the unit commander plan and implement the total gunnery program.
- Make sure gunnery skills are taught to standard (quality control).
- Coordinate with the SIO on matters pertaining to the COFT.

TRAINING MANAGER

The battalion S3 and master gunner manage the COFT training program. The training manager should attend the following training:

- COFT Instructor/Operator Course (new equipment training [NET] or ETP certified).
- Senior Instructor/Operator Course (United States Army Armor School [USAARMS]).
- Advanced Matrix Instructor/Operator Course.

Training with COFT

The COFT training program consists of a suite of software that contains a structured training exercise library designed to train combat-critical TC/gunner gunnery tasks. Training guidelines have been established to ensure proper proficiency levels are achieved before executing these tasks on the actual vehicle. Crews that follow these guidelines should achieve a greater percentage of first-round target hits.

COFT TRAINING PROGRAM SOFTWARE

The COFT software includes two different training program matrixes—the original matrix and the advanced matrix. The IO selects the training program that is appropriate for each crew.

ORIGINAL MATRIX

COFT training in the original matrix is progressive training that develops TC/gunner team skills over an extended period of time. The training subsystem built into the COFT offers four programs with specific minimum skill levels. The minimum skills required to progress through the matrix are based on crew

performance under a variety of conditions. Teams attaining or surpassing minimum requirements progress through the matrix to certification. The original matrix includes 689 training exercises (see Table 4-1).

EXERCISE LIBRARY FOR M1/M1A1 COFT (Original Matrix)	
Orientation	1 Sustainment Orientation 1 Basic, Cross, and Transition Orientation
Preparation	1 Preparation for Operation
Boresight, Calibration, and Zeroing	3 Exercises
Acquisition and Manipulation	5 Gunner Exercises 4 Commander Exercises
Evaluation	4 Training Exercises
Killer Tank	2 Training Exercises (European Environment) 2 Training Exercises (Desert Environment)
TC Only	126 Training Exercises (European Environment) 30 Training Exercises (Desert Environment)
TC/Gunner	390 Training Exercises (European Environment) 120 Training Exercises (Desert Environment)
Total	**689 Training Exercises**

Table 4-1. COFT original matrix.

The original matrix includes training programs for four levels of gunnery training:

- Sustainment—experienced M1 or M1A1 TCs and gunners.
- Transition—qualified tank crewmen with no M1 or M1A1 experience.
- Cross—M1 or M1A1 crewmen who are inexperienced as TCs or gunners.
- Basic—prospective M1 or M1A1 TCs or gunners who have had no previous tank crew experience.

ADVANCED MATRIX

The advanced matrix is designed to train and sustain the TC's and gunner's proficiency in critical combat gunnery skills. Prior to the start of each training session, the crew is required to conduct a prep-to-fire check. The crew must boresight the main gun, zero the coax machine gun, and enter all environmental and ballistic data into the ballistic computer. The crew is then required to conduct the live-fire accuracy screening test (LFAST) as defined in FM 17-12-1-1, Chapter 4. The boresight procedures are also included as an appendix in the Instructor Utilization Handbook (IUH) for the advanced matrix. The advanced matrix contains a total of 126 exercises (see Table 4-2).

Note.   Failure to perform correct boresight procedures will cause crews to be unable to hit targets after entering the training matrix.

EXERCISE LIBRARY FOR M1/M1A1 COFT (Advanced Matrix)	
Prepare-to-Fire	1 Exercise
Practice	4 Optical Improvement Package (OIP) Exercises
Practice	4 Tank Table V Exercises
Practice	42 Practice Gate Exercises
Group 1	16 Training Exercises
Gate	15 Live-Fire Prerequisite Exercises
Group 2	16 Training Exercises
Group 3	16 Training Exercises
Group 4	12 Training Exercises
Note. There are only 60 exercise numbers in Groups 1, 2, 3, and 4; however, each time an exercise is fired it is different. For example, a crew fires Exercise 401 and receives a computer recommendation of No Advance. The crew refires Exercise 401. Even though the exercise number remains the same, the configuration of the exercise (target array, etc.) is different. Because each exercise in Group 4 has an undetermined variety of target arrays, the number of configurations for the exercises in Group 4 is virtually unlimited, even though there are only 12 exercise numbers.	

Table 4-2. COFT advanced matrix.

The advanced matrix is designed for battle-roster (sustainment) crews and includes training for five levels of proficiency:

- Group 1—basic gunnery skills.
- Gate—live-fire prerequisite skills.
- Group 2—combat gunnery skills.
- Group 3—advanced combat gunnery skills.
- Group 4—sustainment gunnery skills.

The advanced matrix contains a selection of exercises designed to train crews on Tank Tables V and VIII tasks. Tank Tables I through III can be trained on the COFT using the guidelines outlined in Table 4-3.

COFT	
Table I	Through Reticle Aim 14.
Table II	Through Reticle Aim 14.
Table III	Tasks 1 through 9, Day. Exercise 312110 with IO announcing degraded conditions to the crew. Tasks 10 through 15, Day and 1 through 8, Night. The IO uses the Advanced Matrix Special-Purpose Exercise Builder.

Table 4-3. COFT tank gunnery tables.

TRAINING GUIDELINES

The TC and gunner should master the preparatory tank gunnery training requirements as outlined in FM 17-12-1-2, Chapter 13, before beginning COFT training. Although the COFT can be used for part of this training, it is more efficient to train to minimum proficiency before training on the COFT.

Crews should be required to complete Group 2 in the original matrix and Group 1 and a gate exercise (live-fire prerequisites) of the advanced matrix during an intense initial training period. For an average TC/gunner combination, this intense initial training phase should take approximately 20 hours of trainer time (10 2-hour training sessions). The goal for completing the intense training phase should be within 60 days of the TC/gunner combination being battle-rostered.

Minimizing crew turbulence is crucial to ensuring all battle-rostered crews receive, as a minimum, four hours of COFT training monthly. The goal of only 20 percent of battle-rostered crews being in the intensive training phase should be used to ensure all crews receive adequate training time.

Training milestones for COFT and the approximate time to achieve them are shown in Table 4-4.

COFT TRAINING MILESTONES		
Milestone	**Description**	**Training Time (approximate)**
Initial Training	Initial training consists of tank combat training before beginning COFT training. The following skills are trained in the initial phase: • Using fire control system. • Issuing and responding to fire commands. • Laying main gun for direction and target hand-off. • Proper engagement techniques and procedures. • Target acquisition and identification.	15 to 20 hours.
Intensive Training	Intensive training on the COFT is used to build skills to a level that can be retained with less frequent training sessions. Intensive training should be used to complete the following: • Through Group 2 (original matrix). Crews must complete Group 2 of the original matrix before entering Group 1 of the advanced matrix. • Group 1 and Gate (advanced matrix). The Gate exercise is the live-fire prerequisite. Note. Groups 3 through 6 of the original matrix are used for remedial training for new crews or crews who have difficulty in the advanced matrix.	Through Group 2 (original matrix)—10 to 15 hours. Group 1 and Gate (advanced matrix)—8 to 12 hours.
Intermediate Gunnery Training	Group 2 (advanced matrix).	12 to 15 hours
Advanced Gunnery Training	Group 3 (advanced matrix). Crew certifies when they successfully complete Group 3 of advanced matrix.	14 to 17 hours
Sustainment Training	Group 4 (advanced matrix, unlimited configurations of exercises).	Unlimited replications.

Table 4-4. COFT training milestones.

Once crews have reached the minimum prerequisites to live fire, they should continue to progress through the matrix using computer recommendations, attempting to reach the sustainment level of group 4. It is not recommended that crews be moved back in the training matrix after completing a gunnery cycle. The advanced matrix is designed to continue to train combat-critical gunnery skills under progressively more difficult conditions.

An example of a COFT training schedule for one training day is shown in Table 4-5.

SAMPLE BATTALION TRAINING SCHEDULE	
DAY 1	

Time	IO 1	IO 2
0600	Arrive at COFT/Power up COFT	
0630	Prepare prebrief	
0650	Crew A arrives at COFT/Prebrief Crew A	
0700	Training Session	
0730	Training Session	Arrive at COFT/Prepare prebrief
0750	Training Session	Crew B arrives at COFT/Prebrief Crew B
0800	Debrief Crew A	Training Session
0810	Break	Training Session
0850	Monitor station	Training Session
0900	Training Session	
0910	Training Session	
0950	Training Session	
1000	AAR Crew A	Training Session
1015	Break/Prepare prebrief	Training Session
1050	Crew C arrives at COFT/Prebrief Crew C	Training Session
1100	Training Session	AAR Crew B
1115	Training Session	Break/Prepare prebrief
1150	Training Session	Crew D arrives at COFT/Prebrief Crew D
1200	Debrief Crew C	Training Session
1210	Break	Training Session
1250	Monitor station	Training Session
1300	Training Session	Debrief Crew D
1350	Training Session	Monitor station
1400	AAR Crew C	Training Session
1415	Off	Training Session
1500		AAR Crew D
1515		Off
	IO 3	**IO 4**
1430	Arrive at COFT/Prebrief	
1450	Crew E arrives at COFT/Prebrief Crew E	
1500	Training session	
1530	Training session	Arrive at COFT/Prepare prebrief
1550	Training session	Crew F arrives at COFT/Prebrief Crew F
1600	Debrief Crew E	Training session
1610	Break	Training session
1650	Monitor station	Training session
1700	Training session	Debrief Crew F
1710	Training session	Break

Time	IO 3	IO 4
1750	Training session	Monitor station
1800	AAR Crew E	Training session
1815	Off	Training session
1900		AAR Crew F
1915		Power down/off

Notes. Day 2 repeats day 1 schedule with:　　IO 3 on at 0600, off at 1415.　　　IO 4 on at 0730, off at 1515.

IO 2 on at 1420, off at 1815.　　　IO 1 on at 1530, off at 1915.

On the advanced matrix, the prepare-to-fire exercise for each crew must be performed; allow 5 to 10 minutes for each crew to perform this exercise. If the crew fails to perform this exercise, the errors in the sight will be magnified during the training session. This exercise will help those crews who are marginal in this area.

Table 4-5. Sample COFT training schedule.

Note.　　The two crews in the Headquarters Tank Section are usually attached to one of the line companies and share in that line company's 60 hours of COFT training time; each of the 16 crews receive 3.75 hours of COFT time. By adding only 2 training sessions on any day during the week, all 16 crews would receive their recommended 4 hours of COFT time per month.

AFTER-ACTION REVIEW

The evaluation software and various page printouts provide an extremely comprehensive data package for an IO to conduct an AAR on the crew's performance. In addition to these page printouts, the IO should utilize handwritten notes, playback of exercise, and a tape recorder to emphasize training strengths and weaknesses. An AAR normally takes no longer than 15 minutes to prepare and conduct. Once the AAR is complete and the training session has been concluded, the various page printouts and the session summary for the crew should be placed with their records. This is particularly important for the next IO to conduct a training session with the crew, as it provides the IO the means to review the strengths and weaknesses of the firing crew, and conduct an effective prebrief.

System Information

For more information about the COFT, to include future upgrades and general information, contact the Senior Instructor Operator Section, Hill Hall, Fort Knox, KY, (DSN) 464-5364, (Commercial) 502-624-5364 or Crew Gunnery Doctrine Branch, DTDD, COFT Subject Matter Expert, Fort Knox, KY, (DSN) 464-5806/3633, (Commercial) 502-624-5806/3633.

Chapter 5

Advanced Gunnery Training System (AGTS)

The AGTS is an M1A2 tank gunnery training device for TC/gunner teams. Its primary purpose is to sustain basic gunnery skills and increase combat gunnery skills. The AGTS places the TC and gunner in a realistically simulated crew station and presents them with a full range of computer-controlled engagement situations. The AGTS produces full-color, computer-generated action scenes in which crew members interact with various target situations. Programmed exercises vary in target type and number, range, vehicle and target motion, visibility, and other complex conditions. The crew is in no danger, no fuel is consumed, and no ammunition is expended. The result is challenging, progressive gunnery training.

AGTS Components

The AGTS, unlike the COFT, is a single-sheltered system. Major components within the training shelter are the crew station, IOS, electronic interface device (EID), SPC, and GPC.
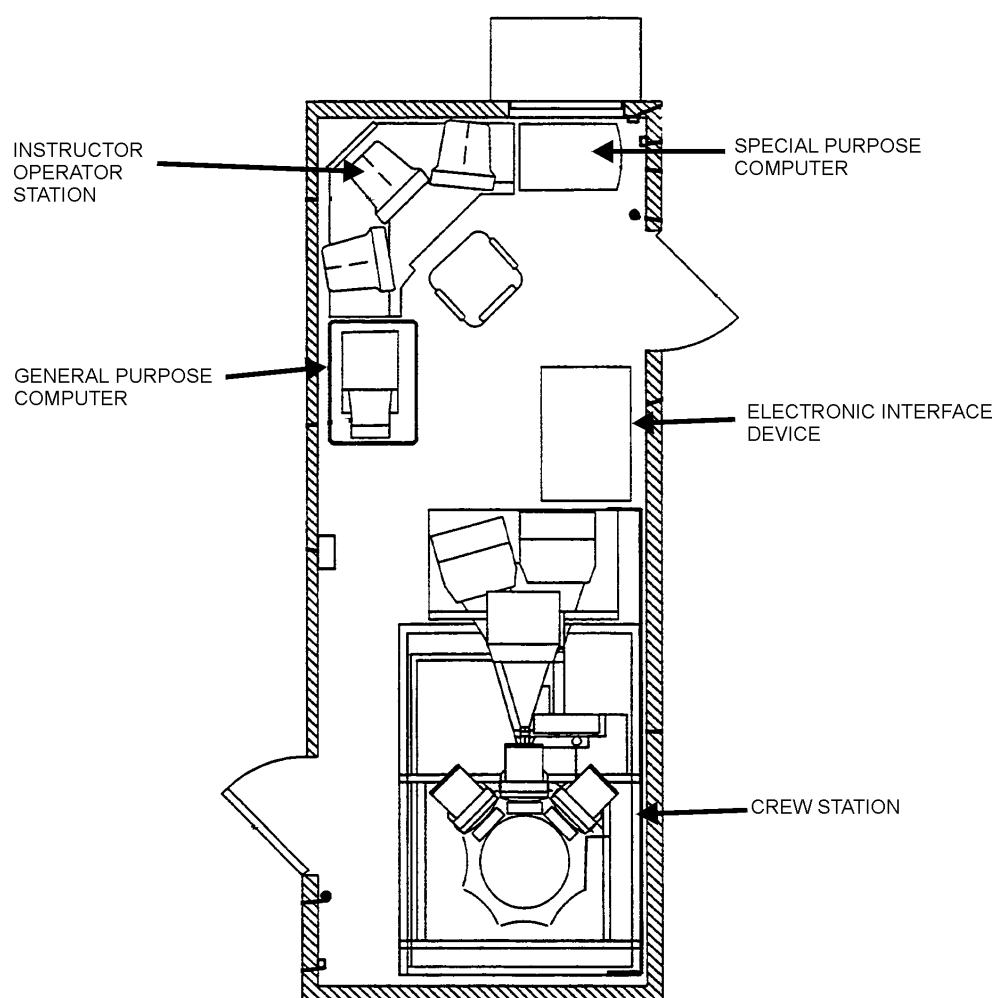
Figure 5-1. Advanced gunnery training system.

CREW STATION

The crew station is designed as a full-size replica of the M1A2 tank commander's and gunner's stations. Controls, indicators, and panels are in the same location as the actual vehicle. The crew station components are designed to provide a high level of form, fit, and fidelity to make sure the tank commander and gunner acquire, identify, and engage targets the same as they would on the actual vehicle. All simulated controls and interface devices of the fire control system accept the same inputs as the actual vehicle.
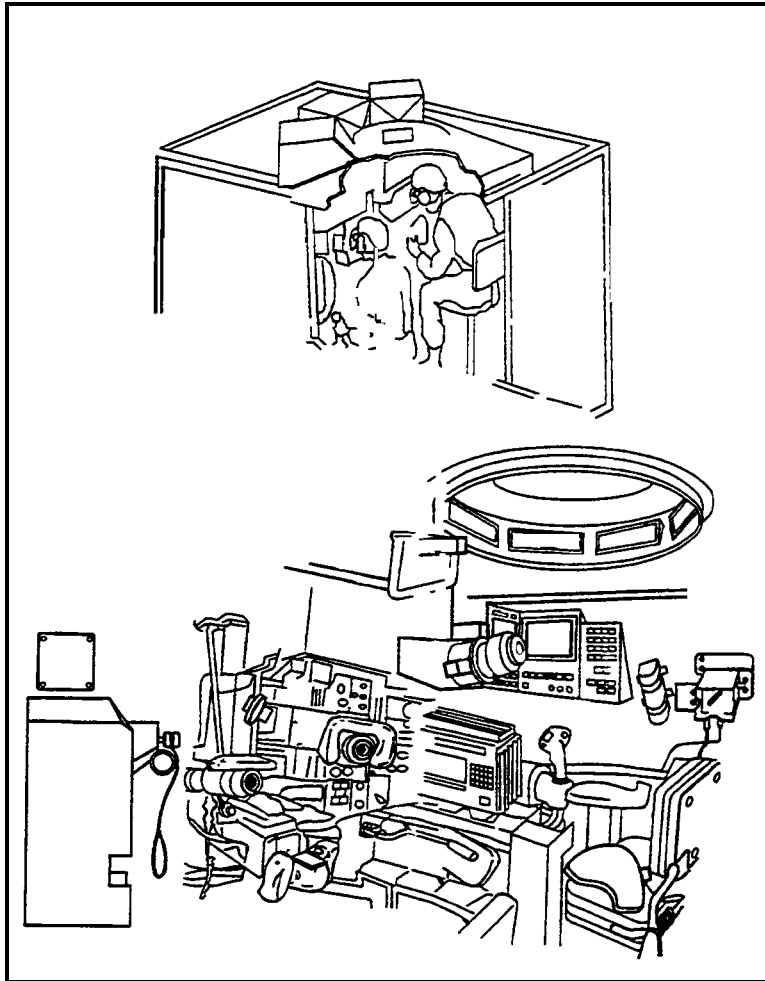
Figure 5-2. AGTS Crew Station.

INSTRUCTOR/OPERATOR STATION

The IOS allows the IO to power up and power down the system, select training modes, perform record management, monitor the crew's performance during a training session, and communicate with the crew.
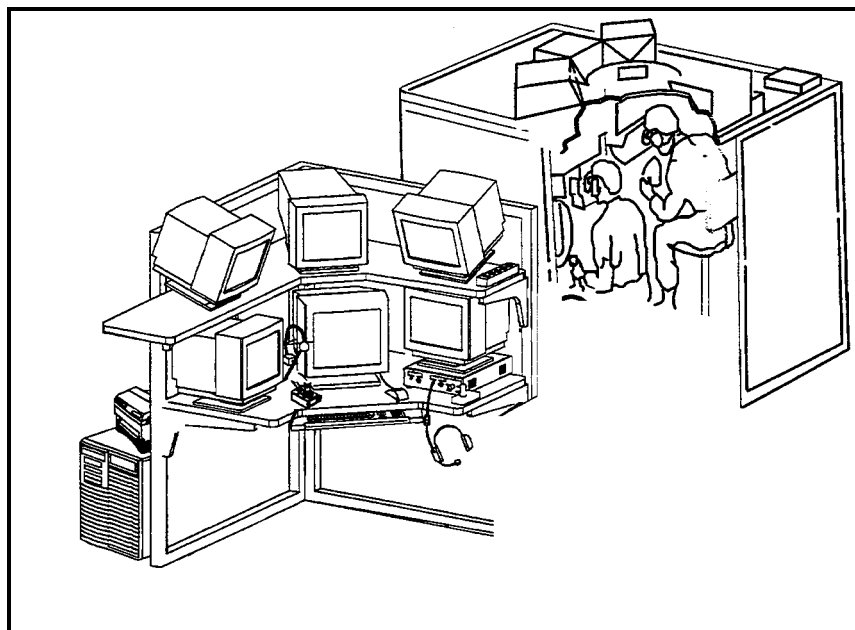
Figure 5-3. AGTS Instructor/Operator Station.

ELECTRONIC INTERFACE DEVICE

The EID provides the interface between the GPC and the crew station switches, controls, and indicators.
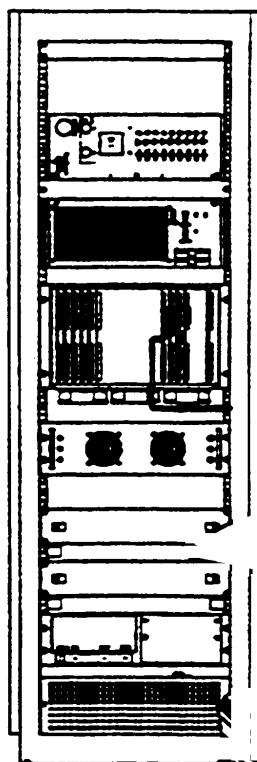
Figure 5-4. AGTS electronic interface device.

SPECIAL-PURPOSE COMPUTER

The SPC contains the electronics for the development of the visual scenes projected into the optical systems of the crew station.
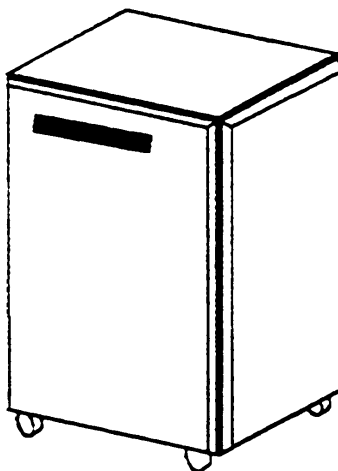
Figure 5-5. AGTS special-purpose computer.

GENERAL-PURPOSE COMPUTER

The GPC provides memory storage, input/output interface, and crew station image generator interface for system power up, system diagnostics, crew training, and system power down.
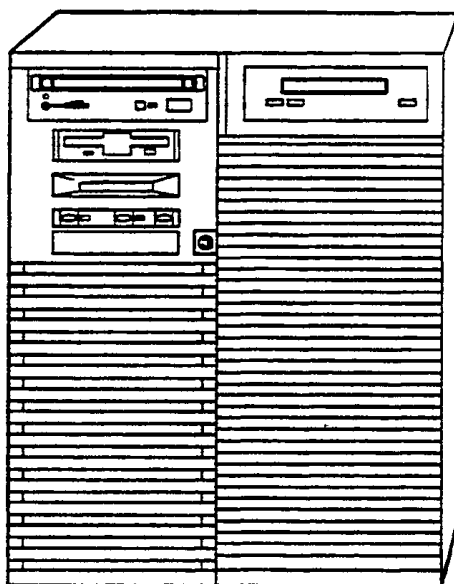
Figure 5-6. AGTS general-purpose computer.

Capabilities and Limitations

Although the AGTS places the TC and gunner in a realistically simulated crew station and presents them with a full range of computer-controlled engagement situations, some functions of the TC and gunner stations are physically simulated and some are not.

CAPABILITIES

The AGTS provides initial, refresher, and sustainment training for tank commander/gunner teams. The system utilizes computer-generated visual scenes, targetry, and special effects to simulate the engagement of targets. The majority of the fire control system is replicated in both physical and functional aspects. The system trains both fully operational and degraded-mode gunnery techniques under a wide variety of conditions.

The system simulates the following visual effects:

- Multiple, single, and delayed targets (M1A1, M1A2, T-80, truck with snapper ATGM, T-72, BMP, BMP2, BTR, BRDM, ZSU-23-4, HIND-D, MI-8C, truck GAZ-69, rocket-propelled grenade [RPG] team, troops, M1, M2/M3, M60A3, AH-64, Leopard 1 and 2, Marder, AMX-10, AMX-30, Chieftain, Challenger, M-113, and Merkava).
- Varied ranges, speeds, exposure times, and reactive targets.
- Own vehicle, moving and stationary.
- Primary, alternate, and subsequent defensive firing positions.
- Round tracer.
- Scene obscuration.
- Round impact and effect on target.
- Round impact on terrain.
- Catastrophic kill.
- Mobility kill.
- Burning wreck models.
- Smoke from grenade launchers.
- Enemy direct and indirect fire.
- Near miss on own vehicle.
- Own vehicle hit and kill.

The system provides the following visibility conditions:

- Day unlimited.
- Day with haze (European data base).
- Day with dust (desert data base).
- Day with fog.
- Dawn and dusk.
- Night unlimited (thermal).
- Night with thermal clutter.
- Mortar illumination.

The system provides the following aural cues to the crew:

- Enemy fire, including artillery.
- Round loading and reloading sounds.
- Loader's "UP."

- Main gun, M240, and M2 machine gun firing.
- Track clatter.
- Engine and transmission sounds.
- Gun jump.
- TIS cooling fan.
- NBC system.
- CITV fan and shutter
- Own vehicle hit and kill.
- Friendly fire.

LIMITATIONS

The following items are not functionally simulated on the AGTS:

- TC's periscopes. The three forward unity periscopes are operational; the other periscopes around the TC's hatch are not functional.
- TC's hatch will not open.
- M2 machine gun is not replicated on the AGTS.
- Not all circuit breakers are supported from the display panels.
- Hydraulic pressure gauge.
- Gunner's unity periscope.
- Ammunition temperature gauge.
- Gunner's TIS focus knob.
- M240 machine gun. The M240 machine gun is partially simulated. Manual fire cannot be accomplished. The charging handle can be used to apply immediate action for simulated stoppages.
- Driver's and loader's stations are not simulated.
- Exterior turret components are not simulated.

AGTS Training

AGTS INSTRUCTOR/OPERATOR

The IO is critical in AGTS training and must be well trained and highly motivated. Operation of the AGTS is simple, but quality training demands an IO with an in-depth knowledge of the tank and tank gunnery. AGTS IOs perform the following duties:

- Place the AGTS in operation.
- Prepare for AGTS training (analyze crew records, plan the training session, prepare and conduct briefings).
- Conduct prep-to-fire checks and screening exercises.
- Conduct training sessions.
- Conduct AARs.
- Power down the AGTS.
- Perform operator maintenance.
- Maintain crew records.

SENIOR INSTRUCTOR/OPERATOR

The SIO is the subject matter expert on the AGTS; he is the only person who can certify new IOs and make changes in the AGTS training management subsystem. The SIOs perform the following duties:

- Train new IOs using the exportable training packet.
- Supervise IOs, to include:
  - Inspect AGTS training.
  - Maintain IO proficiency.
  - Evaluate training.
- Recertify IOs annually.
- Help the unit commander set up an AGTS training program.
- Serve as training manager, as directed.
- Manage AGTS training records.
- Reposition crews in the matrix.

MASTER GUNNER

The master gunner should be IO certified and should attend the SIO course. He performs the following duties:

- Helps the unit commander plan and implement the total gunnery program.
- Ensures gunnery skills are taught to standard (quality control).
- Coordinates with the SIO on matters pertaining to the AGTS.

TRAINING MANAGER

The battalion S3 and master gunner manage the AGTS training program. The training manager should attend the following training:

- AGTS Instructor/Operator Course (NET or ETP certified).
- Senior Instructor/Operator Course (USAARMS).

Training with AGTS

AGTS CREW TRAINING PROGRAM SOFTWARE

The AGTS crew training program is very similar to the advanced matrix on the COFT. The crew training program consists of basic gunnery, advanced gunnery, sustainment, and special-purpose exercises that are designed to train fully operational precision gunnery and battlesight gunnery techniques. The training program also trains the crew coordination required for the execution of precision and degraded-mode engagements.

BASIC-GUNNERY EXERCISES

The basic-gunnery exercises are comprised of 11 different exercises, which are based on the Tank Table VIII tasks from FM 12-12-1-1/-2, *Tank Gunnery (Abrams)*. These exercises are completed in linear order; the first seven exercises are basic pre-live fire (BPLF) exercises. Once the seven BPLF exercises are successfully completed, the crew will conduct a complete gate-to-live-fire (GTLF) exercise, consisting of ten Tank Table VIII tasks. The scoring criteria for passing the GTLF exercises is in accordance with the qualification standards set forth in FM 17-12-1-2, Chapter 15.

ADVANCED-GUNNERY SKILLS EXERCISES

Advanced-gunnery skills exercises are grouped into three skill levels. Each skill level consists of 36 unique exercises, for a total of 108 different exercises. The difficulty level in each skill level increases as the tank crew progresses through the training program, see Table 5-1.

SUSTAINMENT EXERCISES

The sustainment exercises are selected randomly by the computer from all three of the advanced skill levels, with the conditions from Skill Level 3 applied. Crews in sustainment training will find that these exercises continue to be extremely challenging and reinforce their combat critical gunnery skills.

SPECIAL-PURPOSE EXERCISES

There are 43 special-purpose exercises in the AGTS exercise library. These exercises are divided into 10 groups. Exercises in this library are designed to familiarize crews with the AGTS and train specific tasks, which are not included in the crew training program matrix. The ten groups within the special-purpose exercises are:

- Orientation/familiarization.
- Acquisition/manipulation.
- CITV target hand-off.
- IVIS message generation.
- OIP gunnery.
- Coax machine gun gunnery.
- Long range gunnery.
- Evasive helicopter.
- Killer tank.
- Boresight/zero/LFAS.

EXERCISE LIBRARY FOR AGTS CREW TRAINING PROGRAM	
Basic Pre-Live Fire	7 Exercises
Gate to Live Fire	4 Exercises
Group 1	36 Exercises
Group 2	36 Exercises
Group 3	36 Exercises
Group 4 Sustainment	108 Exercises
Special Purpose	43 Exercises

Table 5-1. Exercise library for AGTS crew training program.

TANK GUNNERY TABLES ON AGTS

Tank Tables I through III can be trained on the AGTS using the guidelines outlined in Table 5-2.

AGTS	
Table I	Completion of Advanced Skill Level I
Table II	Completion of Advanced Skill Level I
Table III	Completion of Advanced Skill Level I

Table 5-2. AGTS tank gunnery tables.

TRAINING GUIDELINES

The TC and gunner should master the preparatory tank gunnery training requirements as outlined in FM 17-12-1-2, Chapter 13, before beginning AGTS training. Although the AGTS can be used for part of this training, it is more efficient to train to minimum proficiency before training on the AGTS.

Crews should be required to complete all seven BPLF exercises and qualify on a GTLF exercise (live-fire prerequisites) during an intense initial training period. For an average TC/gunner combination, this intense initial training phase should take approximately 10 hours of trainer time (5 2-hour training sessions). The goal for completing the intense training phase should be within 45 days of the TC/gunner combination being battle-rostered.

Minimizing crew turbulence is crucial to ensuring all battle-rostered crews receive four hours of AGTS training monthly, as a minimum. The goal of only 20 percent of battle-rostered crews being in the intensive training phase should be used to ensure all crews receive adequate training time.

Training milestones for AGTS and the approximate time to achieve them are shown in Table 5-3.

AGTS TRAINING MILESTONES		
Milestone	**Description**	**Training Time (approximate)**
Initial Training	Initial training consists of tank gunnery training before beginning AGTS training. The following skills are trained in the initial phase: • Use of the fire control system (GCDP, CID, CITV). • Issuing and responding to fire commands. • Proper engagement techniques and procedures. • Target acquisition and identification. • Laying the main gun for direction, including target designate.	35 to 40 hours
Intensive Training	Intensive training on the AGTS is used to build gunnery skills to a level that can be retained with less frequent training sessions. Crews should attain the following level within the intensive phase: • Pass the seven basic prelive-fire exercises. • Complete a gate-to-live-fire exercise with a passing score.	8 to 12 hours
Basic Gunnery Training	Advanced Skill Level 1.	10 to 15 hours
Intermediate Gunnery Training	Advanced Skill Level 2.	18 to 24 hours
Advanced Gunnery Training	Advanced Skill Level 3.	26 to 30 hours
Sustainment Training	Random exercises from the entire matrix, with combat conditions.	Unlimited replications

Table 5-3. AGTS Training Milestones.

Once crews have reached the minimum prerequisites to live fire, they should continue to progress through the matrix using computer recommendations, attempting to reach the sustainment level. It is not recommended that crews be moved back in the crew training program after completion of a gunnery cycle. The crew training program is designed to continue to train combat-critical gunnery skills under progressively more difficult conditions.

The training schedule for one training day on the AGTS is the same as shown in Chapter 4, Table 4-5, page 4-12, this manual.

Note. The two crews in the Headquarters Tank Section are usually attached to one of the line companies and share in that line company's 60 hours of AGTS training time; each of the 16 crews receive 3.75 hours of AGTS time. By adding only 2 training sessions on any day during the week, all 16 crews would receive their recommended 4 hours of AGTS time per month.

AFTER-ACTION REVIEW

The evaluation software and various page printouts provide an extremely comprehensive data package for an IO to conduct an AAR on the crew's performance. In addition to these page printouts, the IO should utilize handwritten notes and instant recall to emphasize training strengths and weaknesses. An AAR should take no longer than 15 minutes to prepare and conduct. Once the AAR is complete and the training session has been concluded, the various page printouts and the session summary for the crew should be placed with their records. This is particularly important for the next IO to conduct a training session with the crew, as it provides the IO the means to review the strengths and weaknesses of the firing crew, and conduct an effective prebrief.

System Information

For more information about the AGTS, to include future upgrades and general information, contact the Senior Instructor Operator Section, Hill Hall, Fort Knox, KY, (DSN) 464-5364, (Commercial) 502-624-5364 or Crew Gunnery Doctrine Branch, DTDD, COFT Subject Matter Expert, Fort Knox, KY, (DSN) 464-5806/3633, (Commercial) 502-624-5806/3633.

Chapter 6

Platoon Gunnery Trainer (PGT)

The PGT is designed to train armor platoon leaders and platoon sergeants in command and control and fire distribution to destroy enemy targets in a tactical scenario. It does this by presenting the platoon with a series of realistic combat situations that require proper planning, reporting, and execution if the platoon is to be successful. The system reinforces those skills already learned using the COFT or AGTS. It requires the TC/gunner combinations to continue to engage targets using correct precision and degraded-mode gunnery techniques.

There are two versions of the PGT currently fielded: COFT PGT and AGTS PGT. Both versions consist of four linked trainers with an attached platoon after-action review (PAAR) station.

COFT PGT

There are only three COFT PGTs currently fielded worldwide, making this an extremely limited throughput device. The current locations for the COFT PGTs are Fort Knox, KY, Vilseck, GE, and Schweinfurt, GE. All COFT PGT crew stations are configured for the M1A1 tank.

COFT PGT CONFIGURATION

The COFT PGT system consists of four, linked crew stations; four IOSs; and a PAAR station. Duty assignments for platoon members are designated at the IOS at the time of exercise initialization. Each IOS is equipped with a topographical display monitor that displays the terrain and all of the platoon members' vehicle locations. The vehicle locations are shown using an icon and the vehicle bumper number. Figure 6-1 shows the layout of the COFT PGT.
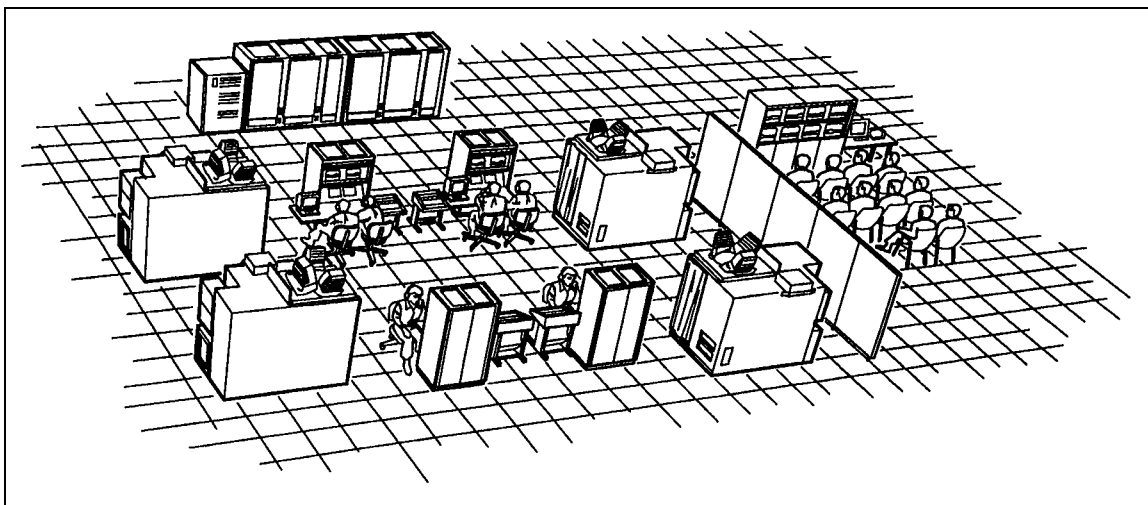
Figure 6-1. COFT PGT layout.

The PAAR station provides audio playback, visual playback for all sight pictures, and VCR playback of the completed exercise. Figure 6-2 shows the configuration of the COFT PGT PAAR station.
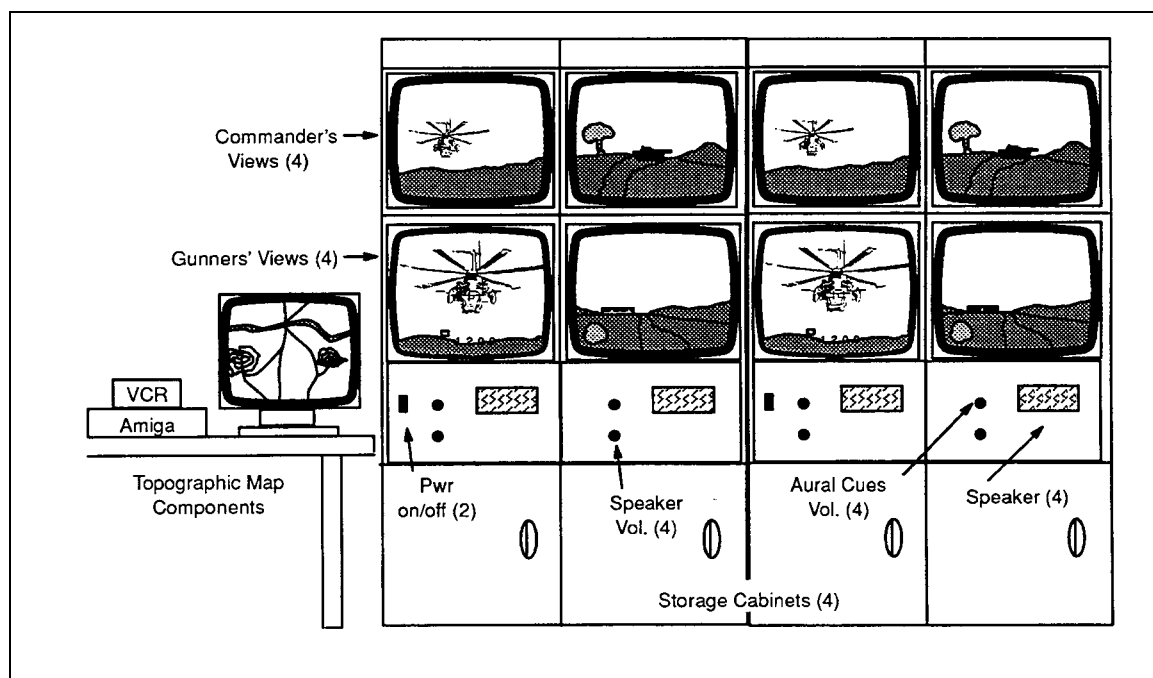
Figure 6-2. COFT PGT PAAR Station Configuration.

COFT PGT EXERCISE LIBRARY

The exercise library for the COFT PGT consists of 16 tactical scenarios. These scenarios contain both offensive and defensive missions, as well as combined missions with both offensive and defensive tasks. The training system utilization handbook (TSUH) for the M1A1 COFT PGT contains in-depth descriptions of these exercises.

AGTS PGT

All divisions and regiments fielded with the AGTS will have one PGT. The AGTS PGT crew stations are configured for the M1A2 tank.

AGTS PGT CONFIGURATION

The AGTS PGT system consists of four, linked crew stations; four IOSs; and a PAAR. Duty assignments for platoon members are designated at the IOS at the time of exercise initialization. The layout for the AGTS PGT consists of either four sheltered systems or four permanent systems linked via a hub located at the PAAR station. Figure 6-3 shows the configuration of the AGTS PGT PAAR station.

The PAAR station has the capability to log an exercise in progress while an AAR is being conducted. Capabilities of the PAAR are discussed in detail in the AGTS TSUH.
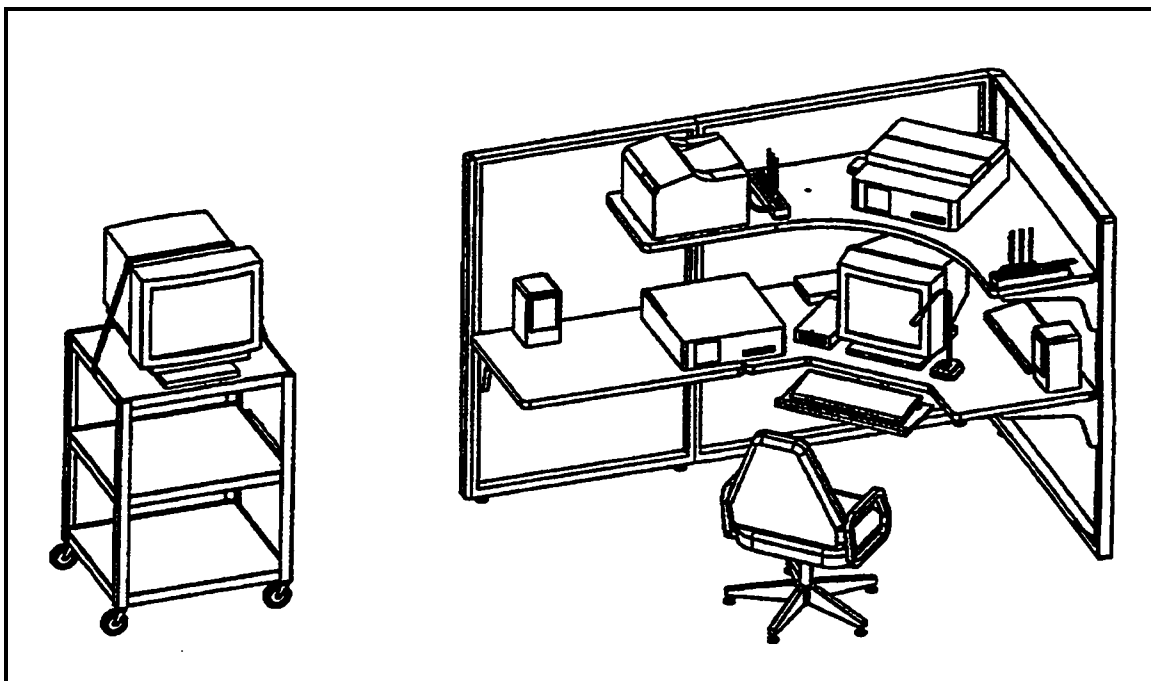
Figure 6-3. AGTS PGT PAAR station configuration.

AGTS PGT EXERCISE LIBRARY

The exercise library for the AGTS PGT consists of 56 exercises. These exercises are broken down into basic, intermediate, and advanced difficulty levels. Exercises exist that support defensive, offensive, combined, and command and control tasks, requiring the employment of tactical fire to engage targets.

PGT Training

Units should try to schedule all platoons for PGT training once a month. The training session should last two hours per platoon, which would allow enough time to conduct at least two exercises.

Note. STRAC currently resources platoon gunnery training 12 times a year for 8 hours each time.

A typical training session is divided into four phases: orientation, preliminary training, performance training, and AAR.

PHASE 1. ORIENTATION

The orientation phase should focus on the system configuration, records, safety briefing, and the system limitations.

PHASE 2. PRELIMINARY TRAINING

Preliminary training should consist of the following:
- Conduct a review of platoon fire planning techniques.
- Issue the company/troop OPORD.
- The platoon leader should prepare a platoon OPORD while the platoon conducts precombat checks.
- The platoon leader should issue the OPORD.

PHASE 3. PERFORMANCE TRAINING

Performance training consists of executing the platoon leader's plan in the PGT. The platoon must use proper gunnery techniques and reporting procedures (digital reporting via IVIS for the AGTS).

PHASE 4. AFTER-ACTION REVIEW

The final phase consists of a formal AAR. The AAR is conducted using a sand table (if available) and the system playback. As a minimum, the following training points should be reviewed:

- Offensive/defensive fire planning.
- Actions on contact.
- Platoon fire commands, techniques of engagement, and fire patterns.
- Reporting procedures (digital reporting via IVIS for the AGTS).
- Platoon records, including target kill percentage (a 70-percent kill of all enemy targets is required to pass).

Note. At some point before or after the AAR, each IO should be given the opportunity to critique the individual crews using records generated during the session.

System Information

For more information about the PGT systems, to include future upgrades and general information, contact the Senior Instructor Operator Section, Hill Hall, Fort Knox, KY, (DSN) 464-5364, (Commercial) 502-624-5364 or Crew Gunnery Doctrine Branch, DTDD, COFT Subject Matter Expert, Fort Knox, KY, (DSN) 464-1089/5807, (Commercial) 502-624-1089/5807.

Chapter 7

Abrams Full-Crew Interactive Simulator Trainer (AFIST)

The AFIST is an appended tank gunnery training device for use on a powerless, stationary, sheltered, M1 or M1A1 tank. With AFIST, M1 and M1A1 tank crews can conduct tank gunnery training using the actual controls and input devices of the tank.

AFIST Configurations

There are two different configurations for the AFIST: the 17/162A model (see Figure 7-1) and the 17/162B model (see Figure 7-2). The only difference between these two models is that the 17/162B is man transportable, and the 17/162A requires a forklift to transport.
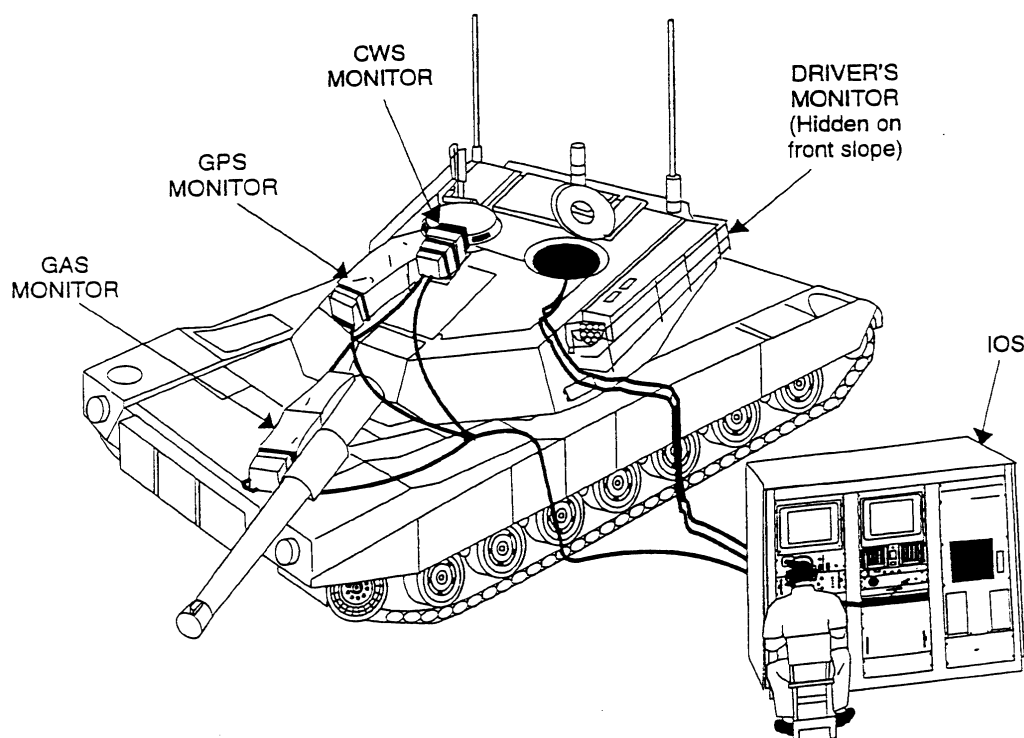
Figure 7-1. 17/162A AFIST model.
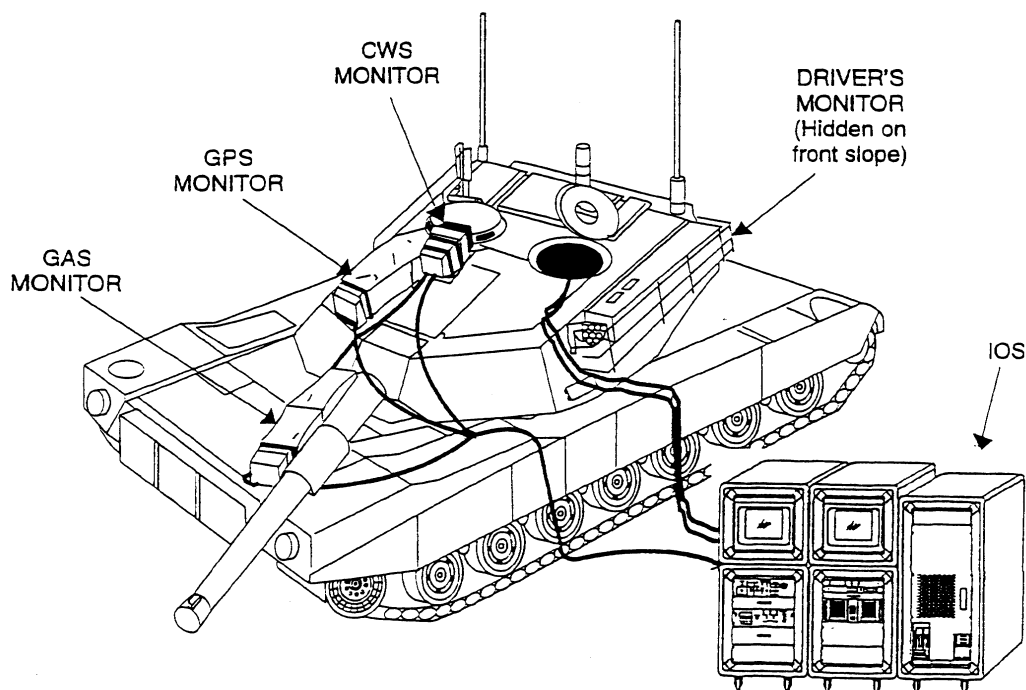
Figure 7-2. 17/162B AFIST model.

AFIST Components

The AFIST consists of three major subsystems: the IOSs, the optical assemblies, and the sensors and control mock-ups.

INSTRUCTOR/OPERATOR STATION

The IOS provides the means by which the IO controls and monitors a crew's performance during an exercise. The IOS is tethered to the training vehicle via cabling to the various crew control sensors and indicators and optical devices mounted on the tank. The IOS allows the IO to select the desired training exercise and print a hard copy of the firing crew's performance. The IOS station for the 17/162A IOS consists of a three-rack cabinet (see Figure 7-1), and the 17/162B IOS consists of five man-portable transit cases (see Figure 7-2).

OPTICAL ASSEMBLIES

The optical assemblies appended to the tank allow the crew members to view the generated visual scenes, special effects, and targetry through their sighting systems. There are four video monitors appended to the exterior of the tank, which project imagery into the gun sights and vision blocks. These assemblies include custom lens assemblies and the video monitors on which the images are displayed.

SENSORS AND CONTROL MOCK-UPS

The sensors attach to the actual controls of the vehicle, and the control mock-ups attach to or are close to the actual vehicular controls. The sensors and control mock-ups provide the means by which the crew controls the vehicle during the running of an exercise.

AFIST Capabilities and Limitations

SYSTEM CAPABILITIES

The AFIST provides gunnery training using the majority of the fire control system and computer-generated graphics. The computational system of the AFIST determines point of aim for the weapon system in use and computes the trajectory of the round and point of impact.

The AFIST simulates the following visual effects:

- Tracer.
- Burst on target.
- Burst on ground.
- Hostile fire signature.
- Obscuration.

The AFIST supports day unlimited and night unlimited visibility conditions, as well as the following degraded-mode engagements:

- NBC conditions.
- Stabilization failure.
- Laser range finder failure.
- Firing from the gunner's auxiliary sight.

SYSTEM LIMITATIONS

The AFIST, although appended to the actual tank, requires the use of mock ups to be used on certain portions of the fire control system, altering the actual positioning of the components. AFIST does not support firing the caliber .50 machine gun using the commander's weapon station or manual-mode engagements using the manual traversing handle and manual elevation hand pump.

Exercises within the AFIST training matrix contain only one replication of the exercise, allowing crews to easily memorize target activation points. Training exercises in the training matrix contain only one situation per exercise, further allowing the crew to memorize the activation points for targetry. The AFIST does not contain a boresight exercise to train this combat-critical task.

Training with AFIST

AFIST training should be conducted whenever possible to maintain gunnery proficiency or begin initial training for newly assigned or inexperienced crews.

Training milestones for the AFIST and the approximate time to achieve them is shown in Table 7-1.

AFIST TRAINING MILESTONES		
Milestone	**Description**	**Training Time (approximate)**
Preparatory Training	Tank combat training before beginning AFIST training.	15 to 20 hours
Initial Training	Initial training consists of tank gunnery training before beginning AFIST training. The following skills are trained in the initial phase: • Use of the fire control system. • Issuing and responding to fire commands. • Target acquisition and identification. • Laying the main gun for direction. • Occupy defensive fighting position.	35 to 40 hours
Intensive Training	Intensive training on AFIST is used to build gunnery skills to a level with less frequent training occasions. Crews should attain the following levels within the intensive phase: • Groups 1 through 4. • Tank Table IV Qualification. • Tank Table VIII Qualification per FM 17-12-1-1/-2 standards.	8 to 12 hours
Sustainment Training	Groups 4 and 6 Evaluation.	Unlimited replications
Note.	The training requirement to achieve the prerequisite to live fire is not satisfied by AFIST alone; it should be performed in accordance with FM 17-12-1-2, Chapter 13.	

Table 7-1. AFIST training milestones.

AFIST TRAINING SYSTEM

The AFIST training system has a training matrix that consists of the orientation, training, and evaluation training modes. The training matrix contains 504 training tasks, most of which can be conducted in either a European or Desert database (see Table 7-2). The exercise matrix is divided into six different groups, which allow tank crews to progress to increasingly more difficult firing conditions.

AFIST TRAINING MATRIX	
Group 1	90 Tasks
Group 2	90 Tasks
Group 3	90 Tasks
Group 4	82 Tasks
Group 5	90 Tasks
Group 6	62 Tasks
Total	**504 Tasks**

Table 7-2. AFIST training matrix.

ORIENTATION MODE

Exercises conducted in the orientation mode allocate three minutes for the crew to complete and can be selected from the TC's position in the tank if an IO is not present for training. The orientation mode is designed for entry-level training to develop the crew's coordination in engaging targets using the fire control system.

TRAINING MODE

Exercises conducted in the training mode are the same exercises as those in the orientation mode, but allot only 45 to 65 seconds to complete and cannot be selected from the TC's position in the tank. An IO must be present when crews are training in the training mode, to evaluate the crew's performance and determine when the crew is proficient enough to progress to the evaluation mode.

EVALUATION MODE

Exercises conducted in the evaluation mode are unique in that the time standards applied to the evaluation criteria are derived from the standards set forth in the FM 17-12-1-1/-2, dated 19 March 1993. Crews must pass the evaluation exercise for each group before progressing to the next group.

TRAINING TANK GUNNERY TABLES ON AFIST

The AFIST training matrix contains a selection of exercises designed to train crews on Tank Tables IV and VIII tasks. Tank Tables I through III can be trained on the AFIST using the guidelines outlined in Table 7-3.

AFIST	
Table I	Completion of Group 4.
Table II	Completion of Group 4.
Table III	Completion of Group 4. (AFIST does not support manual exercises.)

Table 7-3. AFIST tank gunnery tables.

System Information

For more information about the AFIST, to include future upgrades and general information, contact the AFIST NETT, Gowan Field, ID, (DSN) 422-4076 or the National Guard Representative Office of the Special Assistant to the CG, Fort Knox, KY, (DSN) 464-3214, (Commercial) 502-624-3214.

Chapter 8

Thru-Sight Video (TSV) System

The TSV is a vehicle-appended system that provides video and audio recording of gunnery or tactical engagements in real time. The TSV is designed to support training at all proficiency levels during dry- or live-firing engagements.

TSV Components

The TSV consists of two subsystems: the audio and video recording (AVR) subsystem and the after-action review subsystem.

AUDIO AND VIDEO RECORDING SUBSYSTEM

The AVR subsystem simultaneously records, on videotape, the commander's sight picture and the oral responses of the crew during training exercises. The AVR subsystem is contained in two transit cases and is the part of the TSV system that is appended to the vehicle.
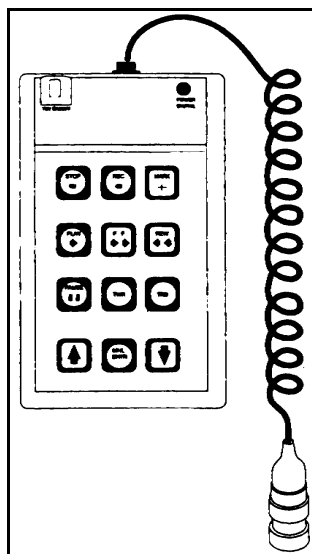
Figure 8-1. Remote control unit (RCU).
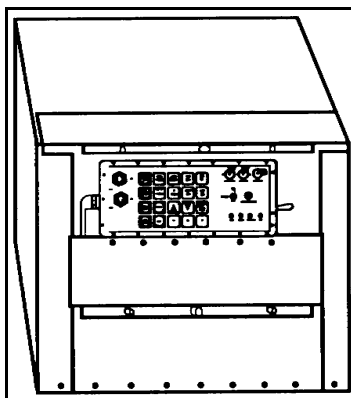
Figure 8-2. Environmental enclosure unit.
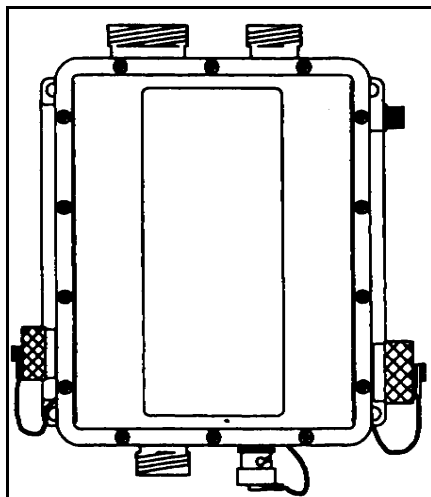
Figure 8-3. Camera control and junction unit.
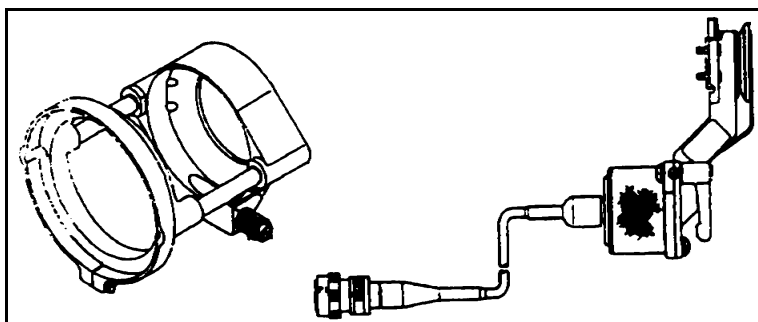
Figure 8-4. Optical sight unit (OSU).

AFTER-ACTION REVIEW SUBSYSTEM

The AAR subsystem is a stand-alone component of the TSV system that may be set up anywhere a 110/220V power source is available. It is used to replay the videotape recorded by the AVR subsystem while debriefing the crew.

Note.   The TSV operator's manual describes the components in detail, to include installation instructions.
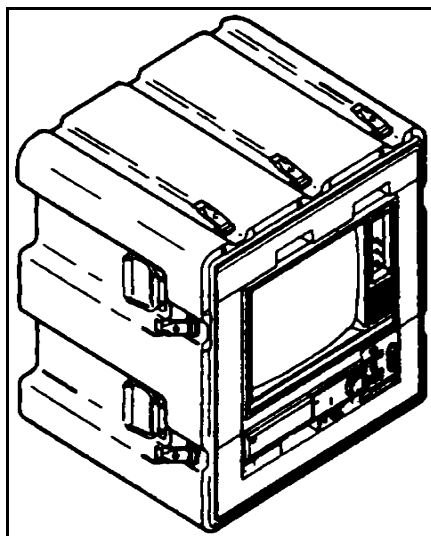
Figure 8-5. After-action review subsystem.

TSV Capabilities and Limitations

CAPABILITES

The TSV provides the trainer with the capability to capture the oral commands of the crew and sight picture of the gunner's primary sight extension (GPSE) on a standard high-density VCR tape. The system can be used with TWGSS to further enhance the amount of data available to conduct an AAR of a crew.

LIMITATIONS

When attached to the GPSE, the TSV causes an approximate 3 to 5 percent reduction of the tank commander's field of view.

Training with the TSV

The TSV system enhances both gunnery and tactical training. It should be used whenever training is being conducted and the system is available.

System Information

For more information about the TSV, to include future upgrades and general information, contact the Chief, Systems Branch (Armor Training Devices), DTDD, Fort Knox, KY, (DSN) 464-5656, (Commercial) 502-624-5656.

Chapter 9

Caliber .50 Inbore Device

The Caliber .50 Inbore Device is an internally mounted, subcaliber gunnery training device that can be used to enhance a unit's gunnery training. This system can be used most effectively on Tank Tables IX and XI and can also be used on VI.

SPECIAL NOTICE

The Caliber .50 Inbore Device *will not* be used on qualification tables.

Training with the Caliber .50 Inbore Device

Training with the Caliber .50 Inbore Device can enhance gunnery training on certain tank tables where main gun ammunition is limited. This device should be used whenever live-fire gunnery training is being conducted and TWGSS is not available.

The Caliber .50 Inbore Device can provide effective training on Tank Tables IX and XI. It allows tank crews to observe direct fires and provide sensings for other firing vehicles. The inbore device also enables leaders to control and distribute fires.

Any caliber .50 ammunition can be used with this device; however, the M962 SLAP-T round is the closest ballistically matched round that will simulate the 120-mm M830 HEAT and the 105-mm M456A1 HEAT rounds out to 2000 meters.

System Information

For more information about the Caliber .50 Inbore Device, to include future upgrades and general information, contact the Chief, Systems Branch (Armor Training Devices), DTDD, Fort Knox, KY, (DSN) 464-5656, (Commercial) 502-624-5656.

Chapter 10

Targets and Target Mechanisms

The targets and activating mechanisms in this chapter are used on the scaled ranges described in TC 25-8, *Training Ranges* and with the tank gunnery tables in FM 17-12-1-2, *Tank Gunnery (Abrams)*.

Full-Scale Targets

Full-scale targets are used for tactical and gunnery training on armor and infantry gunnery ranges. They are classified into three major gunnery engagement categories:

- The heavy (H) target designator is for threat targets engaged with the main gun or tube-launched, optically tracked, wire-guided (TOW) missile systems only.
- The medium (M) target designator is for threat tank-like, antitank, and antiaircraft vehicles and personnel carriers. These are normally engaged with selected main gun, TOW, 25-mm, or caliber .50 weapon systems.
- The light (L) target designator is primarily for light infantry vehicles, trucks, antitank guns, and personnel targets engaged with 25-mm, caliber .50, or 7.62-mm weapon systems.

The additional target designator for thermal (T) indicates the recommended placement of thermal panels on the targets. When used as indicated, these panels closely represent the thermal signature of a particular threat vehicle as viewed through thermal sighting systems. Several of these targets have replaced the standard NATO targets.

FULL-SCALE TARGET DESIGNATORS		
Target	**Standard**	**NATO**
T-64/T-72 Front	H-1	70
T-64/T-72 Flank	H-2	58/71
T-64/T-72 Partial Defilade	H-3	60
T-64/T-72 Turret	H-5	-
HIND Front	H-7	-
BMP Front	M-1	59
BMP Flank	M-2	58
BRDM Front	M-5	-
BRDM Flank	M-6	58
ZSU-23/4Front	M-9	-
ZSU-23/4 Flank	M-10	-
BTR Front	M-11	61
BTR Flank	M-6	58
Truck (U-375) Front	L-1	-
Truck (U-375) Flank	L-2	31
BMD Front	L-3	-
BMD Flank	L-4	-
T-12 Antitank Gun Front	L-5	61
Personnel	L-6	E-type
Personnel	L-7	E-type
Personnel	L-8	E-type
Partial Personnel	L-9	F-type
ATGM Team	L-6, L-7, L-9	E-type, F-type
RPG Team	L-6, L-7, L-9	E-type, F-type

Table 10-1. Full-scale target designators.

Units can order the thermal target modules in Figure 10-1 via an open contract with the Project Manager for Training Devices (PM TRADE) at the U.S. Naval Training Center, Orlando, FL. The contract number is N61339-82-D-0010. The address is PM TRADE, ATTN: Code 632, U.S. Naval Training Center, Orlando, FL 38213-7100.

All orders must include the part number and quantity of each module required and the part number of the proper harness to connect the modules.

Note. A specific contract has not been awarded to supply thermal targets to the U.S. Army.

Figure 10-1. Thermal target module ordering information.

The full-scale targets in this section are easily adapted to smaller scale versions by using the conversion chart below the diagram of each target (see Figures 10-2 through 10-18).

All measurements in inches are rounded off to the nearest 1/10-inch. Use the chart below to round the decimal fraction to the nearest 1/16 inch for construction purposes.

FRACTION-TO-DECIMAL CONVERSION CHART			
1/16 = .0625	5/16 = .3125	9/16 = .5625	13/16 = .8125
1/8 = .125	3/8 = .375	5/8 = .625	7/8 = .875
3/16 = .1875	7/16 = .4375	11/16 = .6875	15/16 = .935
1/4 = .25	1/2 = .50	3/4 = .75	1 = 1.0

Table 10-2. Fraction-to-decimal conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M
1:1	in	132	16	16.5	87	6.5	16	87	20	92	16	20	55	32
	cm	335	40	17.5	220	17.5	40	220	50	235	40	50	140	80
1:2	in	66	8	3.25	43.5	3.25	8	43.5	10	46	8	10	27.5	16
	cm	167.5	20	8.75	110	8.75	20	110	25	117.5	20	25	70	40
1:5	in	26.4	3.2	1.3	17.4	1.3	3.2	17.4	4	18.4	3.2	4	11	6.4
	cm	67	8	3.5	44	3.5	8	44	10	47	8	10	28	16
1:10	in	13.2	1.6	0.7	8.7	0.7	1.6	8.7	2	9.2	1.6	2	5.5	3.2
	cm	33.5	4	1.8	22	1.8	4	22	5	23.5	4	5	14	8

Figure 10-2. H-1 and conversion chart.

Figure 10-3. H-2 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I
1:1	in	79	16	87	16	79	276	55	87	32
	cm	200	40	220	40	200	700	140	220	80
1:2	in	39.5	8	43	8	39.5	138	27.5	43.5	16
	cm	100	20	110	20	100	350	70	110	40
1:5	in	15.8	3.2	17.2	3.2	15.8	55.2	11	17.4	6.4
	cm	40	8	44	8	40	140	28	44	16
1:10	in	7.9	1.6	8.6	1.6	7.9	27.6	5.5	8.7	3.2
	cm	20	4	22	4	20	70	14	22	8

SCALE	In/cm	A	B	C	D	E	F	G	H
1:1	in	132	16	6.5	87	6.5	16	32	16
	cm	335	40	17.5	220	17.5	40	80	40
1:2	in	66	8	3.25	43.5	3.25	8	16	8
	cm	167.5	20	8.75	110	8.75	20	40	20
1:5	in	26.4	3.2	1.3	17.4	1	3.2	6.4	3.2
	cm	67	8	3.5	44	3.5	8	16	8
1:10	in	13.2	1.6	0.7	8.7	0.7	1.6	3.2	1.6
	cm	33.5	4	1.8	22	1.8	4	8	4

Figure 10-4. H-3 and conversion chart.

Figure 10-5. H-5 and conversion chart.

SCALE	In/cm	A	B	C	D	E
1:1	in	5.5	87	5.5	32	98
	cm	15	220	15	80	250
1:2	in	2.5	43.5	2.5	16	49
	cm	7.5	110	7.5	40	125
1:5	in	1.1	17.4	1.1	6.4	19.6
	cm	3	44	3	16	50
1:10	in	0.6	8.7	0.6	3.2	9.8
	cm	1.5	22	1.5	8	25

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L
1:1	in	12	36	24	36	12	60	12	48	12	60	120	192
	cm	31	91	61	91	31	152	31	122	31	152	305	488
1:2	in	6	18	12	18	6	30	6	24	6	30	60	96
	cm	15.5	45.5	30.5	45.5	15.5	76	15.5	61	15.5	76	152.5	244
1:5	in	2.4	7.2	4.8	7.2	2.4	12	2.4	9.6	2.4	12	24	38.4
	cm	6.2	18.2	12.2	18.2	6.2	30.4	6.2	24.2	6.2	30.4	61	89.6
1:10	in	1.2	3.6	2.4	3.6	1.2	6	1.2	4.8	1.2	6	12	19.2
	cm	3.1	9.1	6.1	9.1	3.1	15.2	3.1	12.2	3.1	15.2	30.5	44.8

Figure 10-6. H-7 and conversion chart.

Figure 10-7. M-1 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M
1:1	in	16	10	70	10	16	16	71	12	96	122	16	12	87
	cm	40	25.5	179	25.5	40	40	180	30	250	310	40	30	220
1:2	in	8	5	35	5	8	8	35.5	6	49	61	8	6	43.5
	cm	20	12.75	89.5	12.75	20	20	90	15	125	155	20	15	110
1:5	in	3.2	2	14	2	3.2	3.2	14.2	2.4	19.6	24.4	3.2	2.4	17.4
	cm	8	5.1	35.8	5.1	8	8	36	6	50	62	8	6	44
1:10	in	1.6	1	7	1	1.6	1.6	7.1	1.2	9.8	12.2	1.6	1.2	8.7
	cm	4	2.6	17.9	2.6	4	4	18	3	25	31	4	3	22

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1:1	in	268	61	77	18	12	67	12	39	18	87	69	173	95	61	8
	cm	680	155	195	45	30	170	30	100	45	220	175	440	240	155	20
1:2	in	134	30.5	38.5	9	6	33.5	6	19.5	9	43.5	34.5	86.5	47.5	30.5	4
	cm	340	77.5	97.5	22.5	15	85	15	50	22.5	110	87.5	220	120	77.5	10
1:5	in	53.6	12.2	15.4	3.6	2.4	13.4	2.4	7.8	3.6	17.4	13.8	34.6	19	12.2	1.6
	cm	136	31	39	9	6	34	6	20	9	44	35	88	48	31	4
1:10	in	26.8	6.1	7.7	1.8	1.2	6.7	1.2	3.9	1.8	8.7	6.9	17.3	9.5	6.1	0.8
	cm	68	15.5	19.5	4.5	3	17	3	10	4.5	22	17.5	44	24	15.5	2

Figure 10-8. M-2 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K
1:1	in	4	16	47	16	4	12	63	16	12	59	35
	cm	10	40	120	40	10	30	160	40	30	150	90
1:2	in	2	8	23.5	8	2	6	31.5	8	6	29.5	17.5
	cm	5	20	60	20	5	15	80	20	15	75	45
1:5	in	0.8	3.2	9.4	3.2	0.8	2.4	12.6	3.2	2.4	11.8	7
	cm	2	8	24	8	2	6	32	8	6	30	18
1:10	in	0.4	1.6	4.7	1.6	0.4	1.2	6.3	1.6	1.2	5.9	3.5
	cm	1	4	12	4	1	3	16	4	3	15	9

Figure 10-9. M-5 and conversion chart.

Figure 10-10. M-6 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1:1	in	31	25	87	81	11	48	24	47	75	20	224	31	55	28	8	20
	cm	79	64	221	206	28	122	61	120	190	51	570	79	140	71	20	51
1:2	in	15.5	12.5	43.5	40.5	5.5	24	12	23.5	37.5	10	112	15.5	27.5	14	4	10
	cm	39.5	32	110.5	103	14	61	30.5	110	95	25.5	285	39.5	70	35.5	10	25.5
1:5	in	6.2	5	17.4	16.2	2.2	9.6	4.8	9.4	15	4	44.8	6.2	11	5.6	1.6	4
	cm	15.8	12.8	44.2	41.2	5.6	24.4	12.2	24	38	10.2	114	15.8	28	14.2	4	10.2
1:10	in	3.1	2.5	8.7	8.1	1.1	4.8	2.4	4.7	7.5	2	22.4	3.1	5.5	2.8	0.8	2
	cm	7.9	6.4	22	20.6	2.8	12.2	6.1	12	19	5.1	57	7.9	14	7.1	2	5.1

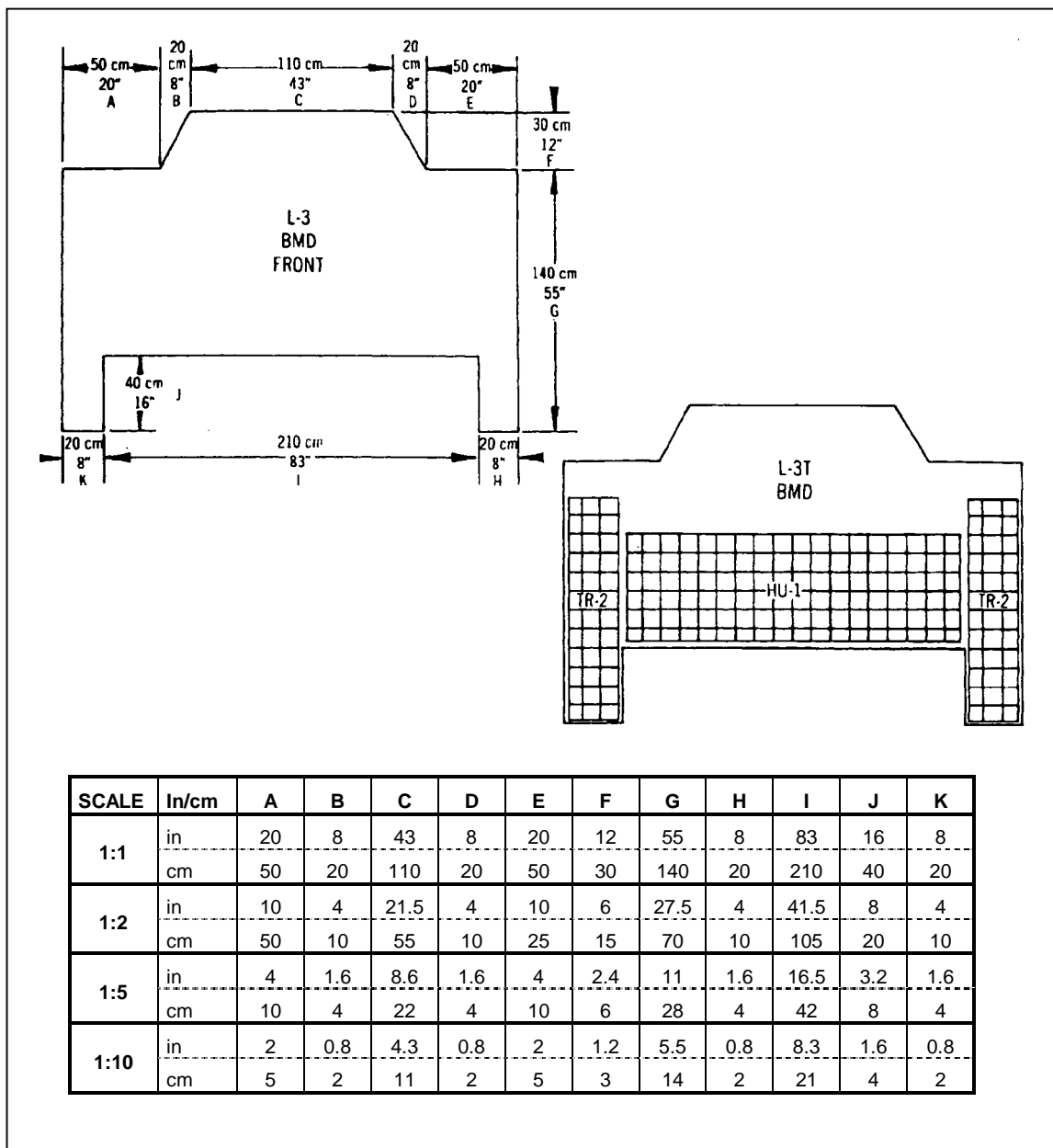| SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M
1:1	in	8	33.5	35	20	20	33.5	8	12	59	14	16	90	14
	cm	20	85	90	50	50	85	20	30	150	36	40	228	36
1:2	in	4	16.75	17.5	10	10	16.75	4	6	29.5	7	8	45	7
	cm	10	42.5	45	25	25	42.5	10	15	75	18	20	114	18
1:5	in	1.6	6.7	7	4	4	6.7	1.6	2.4	11.8	2.8	3.2	18	2.8
	cm	4	17	18	10	10	17	4	6	30	7.2	8	45.6	7.2
1:10	in	0.8	3.4	3.5	2	2	3.4	0.8	1.2	5.9	1.4	1.6	9	1.4
	cm	2	8.5	9	5	5	8.5	2	3	15	3.6	4	22.8	3.6

Figure 10-11. M-9 and conversion chart.

Figure 10-12. M-10 and conversion chart.

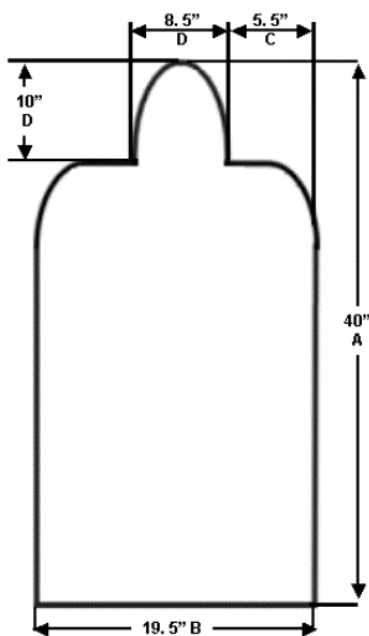| SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K
1:1	in	47	20	98	39	24	47	63	47	236	47	24
	cm	120	50	250	100	60	120	160	120	600	120	60
1:2	in	23.5	10	49	19.5	12	23.5	32.5	23.5	118	23.5	12
	cm	110	25	125	50	30	110	80	110	300	110	30
1:5	in	9.4	4	19.6	7.8	4.8	9.4	12.6	9.4	47.2	9.4	4.8
	cm	24	10	50	20	12	24	32	24	120	24	12
1:10	in	4.7	2	9.8	3.9	2.4	4.7	6.3	4.7	23.6	4.7	2.4
	cm	12	5	25	10	6	12	16	12	60	12	6

Figure 10-13. M-11 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1:1	in	110	16	14	10	30	10	14	16	16	31	39	16	78	20	16	87
	cm	280	40	35	25	80	25	35	40	40	80	100	40	200	50	40	220
1:2	in	55	8	7	5	15	5	7	8	8	15.5	29.5	8	39	10	8	43
	cm	140	20	17.5	12.5	30	12.5	17.5	20	20	40	50	20	100	25	20	110
1:5	in	22	3.2	2.8	2	6	2	2.8	3.2	3.2	6.2	7.8	3.2	15.6	4	3.2	17.2
	cm	56	8	7	5	16	5	7	8	8	16	20	8	40	10	8	44
1:10	in	11	1.6	1.4	1	3	1	1.4	1.6	1.6	3.1	3.9	1.6	7.8	2	1.6	8.6
	cm	28	4	3.5	2.5	8	2.5	3.5	4	4	8	10	4	20	5	4	22

SCALE	In/cm	A	B	C	D	E	F
1:1	in	102	12	78	16	12	102
	cm	260	30	200	40	30	260
1:2	in	51	6	39	8	6	51
	cm	130	15	100	20	15	130
1:5	in	20.4	2.4	15.6	3.2	2.4	20.4
	cm	52	6	40	8	6	52
1:10	in	10.2	1.2	7.8	1.6	1.2	10.2
	cm	26	3	20	4	3	26

Figure 10-14. L-1 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1:1	in	59	40	177	102	24	24	71	126	276	31	24	24	47	24	7
	cm	150	100	450	260	61	61	180	320	700	78	61	61	120	61	18
1:2	in	29.5	20	88.5	51	12	12	35.5	63	138	15.5	12	12	23.5	12	3.5
	cm	75	50	225	130	30.5	30.5	90	160	350	39	30.5	30.5	60	30.5	9
1:5	in	11.8	8	35.4	20.4	4.8	4.8	14.2	25.2	55.2	6.2	4.8	4.8	9.4	4.8	1.4
	cm	30	20	90	52	12.2	12.2	36	64	140	15.6	12.2	12.2	24	12.2	3.6
1:10	in	5.9	4	17.7	10.2	2.4	2.4	7.1	12.6	27.6	3.1	2.4	2.4	4.7	2.4	0.7
	cm	15	10	45	26	6.1	6.1	18	32	70	7.8	6.1	6.1	12	6.1	1.8

Figure 10-15. L-2 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J	K
1:1	in	20	8	43	8	20	12	55	8	83	16	8
	cm	50	20	110	20	50	30	140	20	210	40	20
1:2	in	10	4	21.5	4	10	6	27.5	4	41.5	8	4
	cm	50	10	55	10	25	15	70	10	105	20	10
1:5	in	4	1.6	8.6	1.6	4	2.4	11	1.6	16.5	3.2	1.6
	cm	10	4	22	4	10	6	28	4	42	8	4
1:10	in	2	0.8	4.3	0.8	2	1.2	5.5	0.8	8.3	1.6	0.8
	cm	5	2	11	2	5	3	14	2	21	4	2

Figure 10-16. L-3 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F	G	H	I	J
1:1	in	67	7	45	7	87	12	55	173	213	40
	cm	170	18	114	18	221	30	140	439	541	102
1:2	in	33.5	3.5	22.5	3.5	43.5	6	27.5	86.5	106.5	20
	cm	85	9	57	9	110.5	15	70	219.5	270.5	51
1:5	in	13.4	1.4	9	1.4	17.4	2.4	11	34.6	42.6	8
	cm	34	3.6	22.8	3.6	44.2	6	28	87.8	108	20.4
1:10	in	6.7	0.7	4.5	0.7	8.7	1.2	5.5	17.3	21.3	4
	cm	17	1.8	11.4	1.8	22.1	3	14	43.9	54.1	10.2
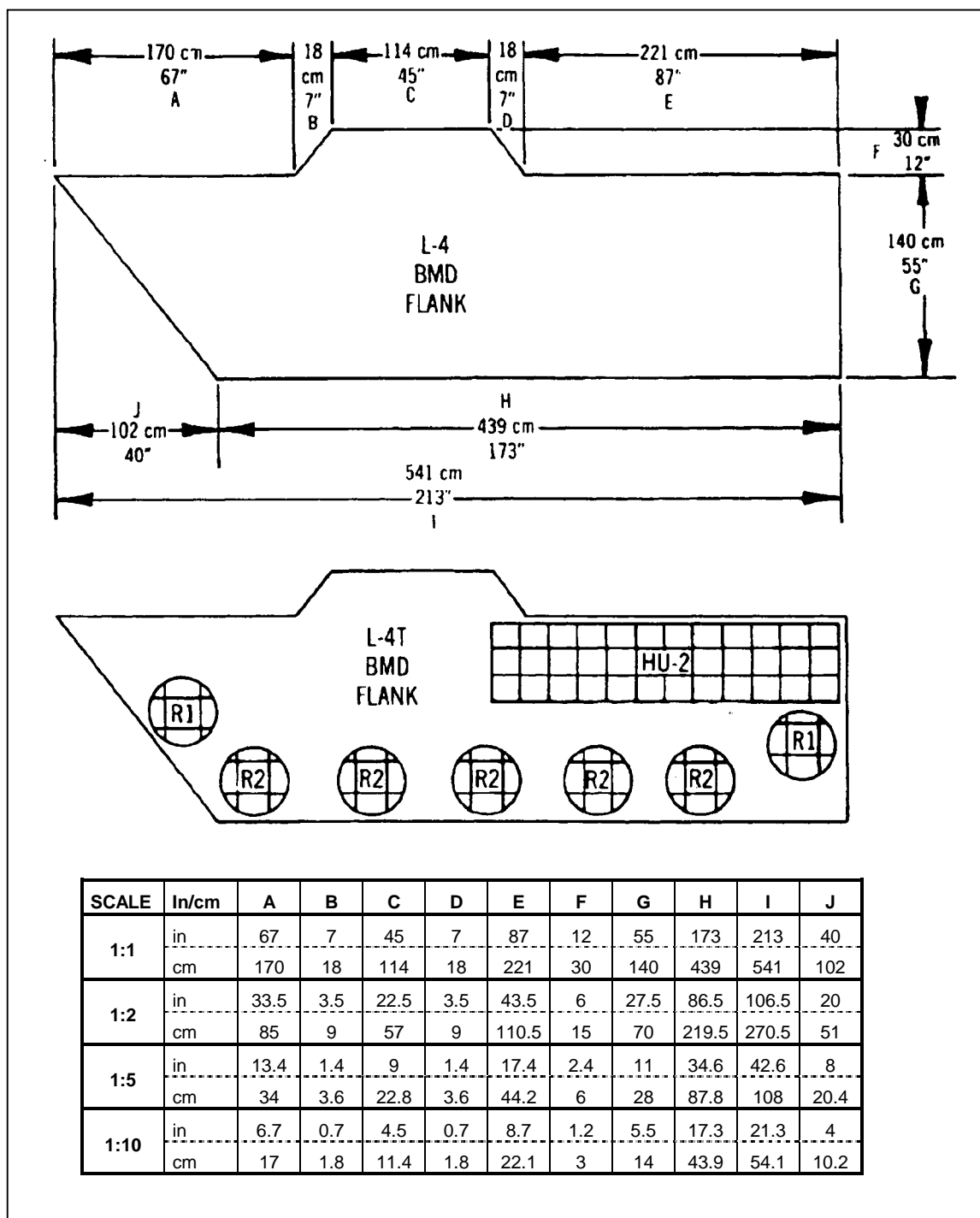
Figure 10-17. L-4 and conversion chart.

SCALE	In/cm	A	B	C	D	E	F
1:1	in	48	48	12	24	12	18
	cm	122	122	30.5	61	30.5	46
1:2	in	24	24	6	12	6	9
	cm	61	61	15.25	30.5	15.25	23
1:5	in	9.6	9.6	2.4	4.8	2.4	3.6
	cm	24.4	24.4	6.1	12.2	6.1	9.2
1:10	in	4.8	4.8	1.2	2.4	1.2	1.8
	cm	12.2	12.2	3	6.1	3	4.6

Figure 10-18. L-5 and conversion chart.

L-6 Troop Silhouette

SCALE	In/cm	A	B	C	D	E
1:1	in	21	25.75	10	7.875	10
	cm	53.3	65.4	25.4	20	25.4
1:2	in	10.5	12.875	5	3.9375	5
	cm	26.7	32.7	12.7	10	12.7
1:10	in	2.1	2.575	1	.7875	1
	cm	5.3	6.5	2.5	2	2.5

L-7 Troop Silhouette

SCALE	In/cm	A	B	C	D	E
1:1	in	40	19.5	8.5	5.5	10
	cm	101.6	49.5	21.6	14	25.4
1:2	in	20	9.75	4.25	2.75	5
	cm	50.8	24.7	10.7	6.9	12.7
1:10	in	4	1.95	.85	.55	1
	cm	10.2	5	2.2	1.4	2.5

Figure 10-19. L6 and L7 and conversion charts.

Target Mechanisms

TARGET-HOLDING MECHANISM—TANK GUNNERY

The target-holding mechanism—tank gunnery (THMTG) raises and lowers a full-scale silhouette and indicates when a hit is made. It is portable and designed for use in local or major training areas.

The THMTG consists of a target-lifting device and a remote radio transmitter (RT). The RT sends FM signals to a receiver in the target-lifting device. The signals are translated into logic levels by an electronics unit. These logic levels are used to raise and lower the target silhouette or to operate the optional Hostile Fire Simulator, as selected (see Figure 10-20).
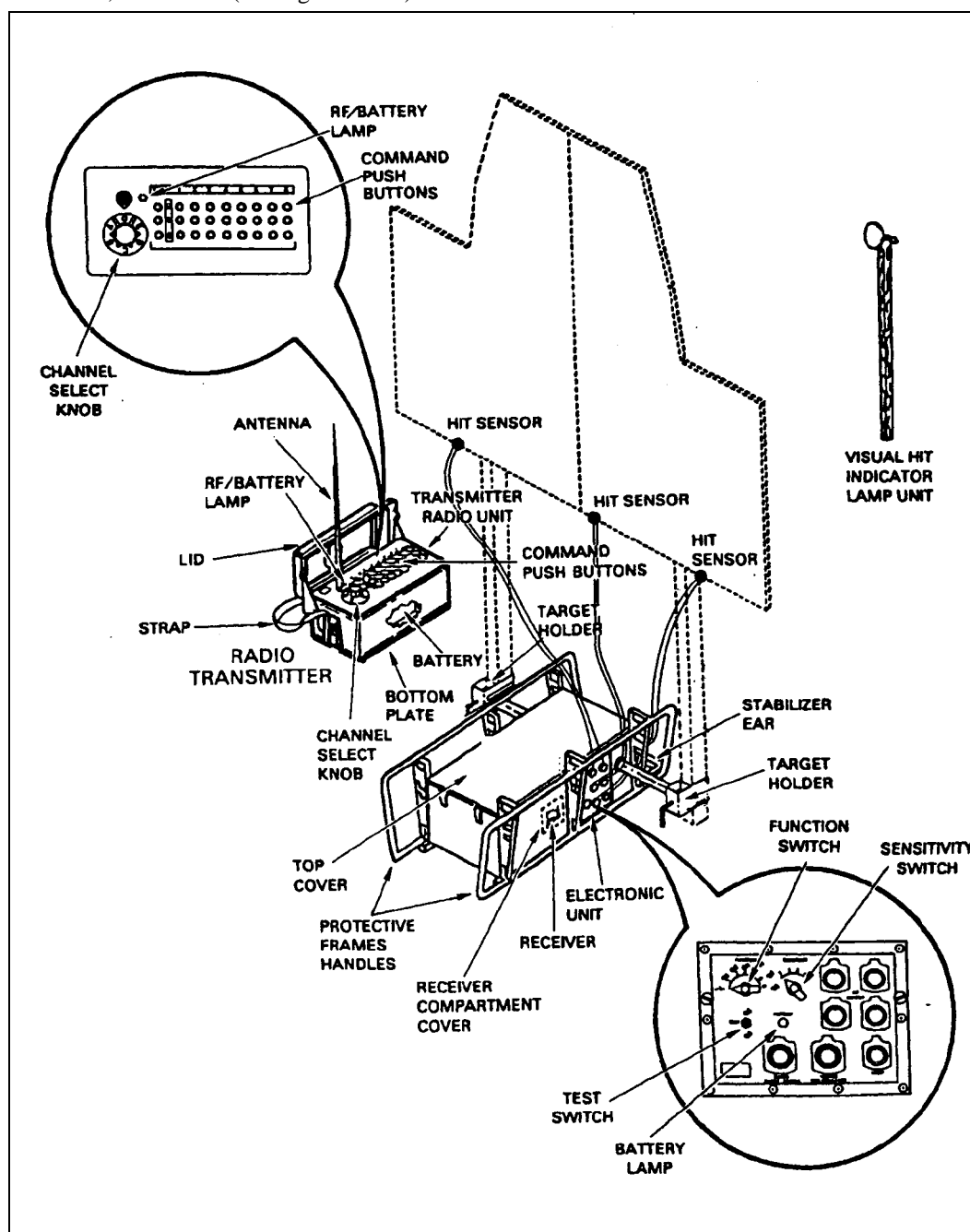
Figure 10-20. Target-holding mechanism.

Hit sensors attached to the target silhouette detect target hits of the following ammunition:

NEW	OLD
Caliber .50 or larger, setting 1	Caliber .50 or larger, setting 1
20mm or larger, setting 2	20mm or larger, setting 2
105mm or larger, setting 3	105mm or larger, setting 3
120mm or larger, setting 4	ATGM, setting 4
ATGM, setting 5	

A target hit activates the visual hit indicator lamp or optional visual hit smoke scorer and causes the target to fall. The visual hit indicator lamp flashes for 0.5 to 1.5 seconds when actuated. Hit sensor sensitivity can be adjusted to determine the size round the target will accept for a kill and minimize the response to near misses, close shot debris, muzzle blast, or wind effects.

The electronics unit controls the scoring options available for the target-lifting device. The electronics unit reacts to stimulation from the hit sensors.

REMOTED-TARGET SYSTEM

The remoted-target system (RETS) trains tank crews, mechanized infantry, scout crews, and platoons in tank combat table exercises and antitank and helicopter gunnery.

The RETS is a series of standardized target mechanisms installed on the (digital) multipurpose range complex ([D]MPRC) and (digital) multipurpose training range. The (D)MPRC provides moving target systems, stationary target bunkers, and hard-wire systems for power and control.

Components of the RETS (see Figure 10-20) and their functions are—

- The stationary target elevating mechanism (STEM) raises and lowers vehicular targets.
- The target interface unit (TIU) receives encoded target control data from the range control system and decodes it into control signals.
- The visual flash simulator (VFS) produces the steel-on-steel flash of a target hit.
- The armor moving target carrier (AMTC) simulates a tank moving from one concealed position to another.
- The M31A1 target mechanism is a motor-driven device used in automatic or semiautomatic rifle fire training.
- The target kill simulator (TKS) gives the effect of a vehicle burning after a target kill.
- The power distribution and control unit (PDCU) provides the power and control signals for the TKS, VFS, and AMTC.
- The interconnecting box (high/low power) serves as an interface for the RETS range and each target.
- The sensing and scoring subsystem detects a variety caliber of rounds and relays target hit data to the control system.
- The control console can be programmed to cause all target mechanisms and accessories to react or operate on a predetermined basis. The control console also provides a hard copy (printout) of exercise sequencing and results.

STEM

INTERCONNECTING BOX,
TIU

VFS

AMTC

M31A1 TARGET
MECHANISM

TKS

PDCU

INTERCONNECTING BOX
(HIGH/LOW POWER)
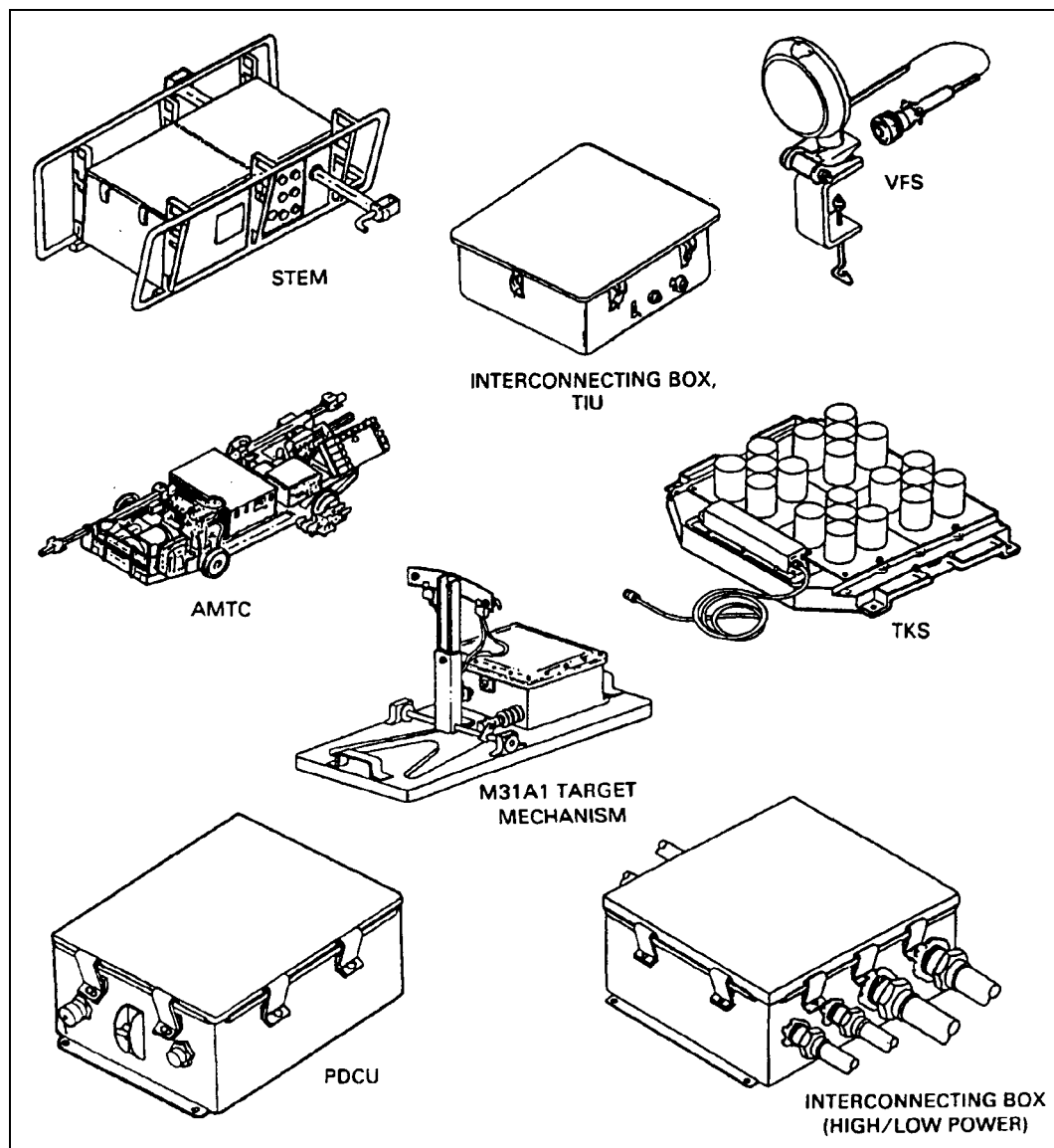
Figure 10-21. Remoted-target system.

Chapter 11

Boresighting and Calibration Devices

Boresight devices allow the crew to boresight weapon systems and the calibration devices and check the accuracy of the fire control system. These devices improve the accuracy of various tank weapon systems, as well as save ammunition, range time, and training time.

Boresight Devices

M26A1 AND M27A1 MUZZLE BORESIGHT DEVICES

The M26A1 MBD is used to boresight the 105-mm gun. The M27A1 MBD is used to boresight the 120-mm gun. The only difference between the two is in the expanding adapter collet. The adapter collet for the M27A1 is larger to accommodate the 120-mm gun (see Figure 11-1).

These devices are 10X magnification telescopes. They have the following components:

- A right-angled eyepiece assembly with diopter adjustment.
- A reticle illumination port for night operations.
- An expanding adapter operating handle for operation of the 105-mm or 120-mm expanding adapter collet.
- A 105-mm or 120-mm tapered muzzle cone to center the device in the end of the gun.
- A 105-mm or 120-mm expanding adapter collet with expanding fingers to ensure centerline location in the gun.
- Reticle adjustment screws.
- A rotating protective shroud for the reticle adjustment screws.
- Purge valve and a purge bleed screw.

Note. The M26A1 and M27A1 MBD may have either three or four reticle adjustment screws.
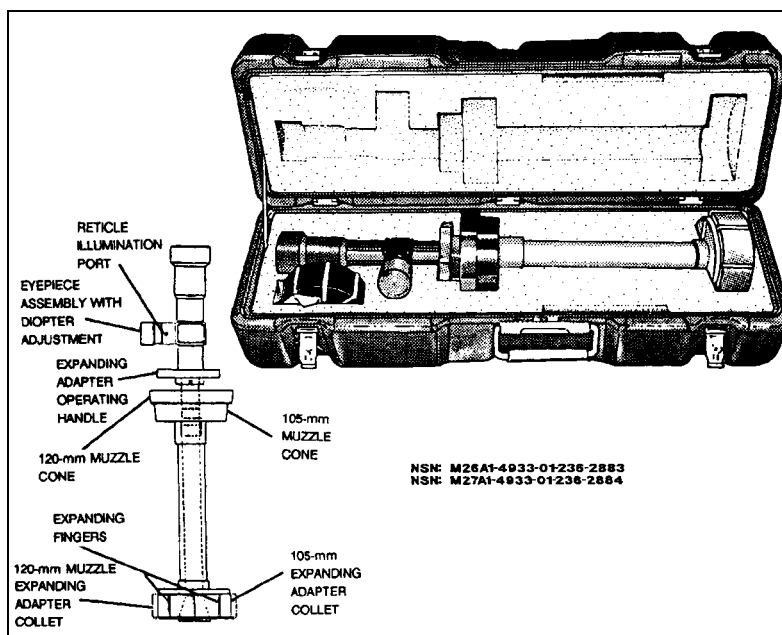
Figure 11-1. M26A1 and M27A1 MBD.

M26A2 AND M27A2 MUZZLE BORESIGHT DEVICES

The M26A2 MBD is used to boresight the 105-mm gun. The M27A2 MBD is used to boresight the 120-mm gun. The only difference between the two is in the pinned expanding adapter collet. The adapter collet for the M27A1 is larger to accommodate the 120-mm gun (see Figure 11-2).

These devices are 10X magnification telescopes. They have the following components:

- A right-angled eyepiece assembly with diopter adjustment.
- A reticle illumination port for night operations.
- An expanding adapter operating handle for operation of the 105-mm or 120-mm pinned, expanding-adapter collet.
- A 105-mm or 120-mm tapered muzzle cone to center the device in the end of the gun.
- A 105-mm or 120-mm pinned, expanding-adapter collet with expanding fingers to ensure centerline location in the gun.
- A torque indicator plate for use during boresighting procedures.
- Azimuth and elevation reticle adjustment knobs to collimate the MBD to a particular gun tube.

NSN: M26A2 – 4933 – 01 – 437 – 2613

NSN: M27A2 – 4933 – 01 – 437 - 6234

COLLIMATION ADJUSTMENT KNOBS
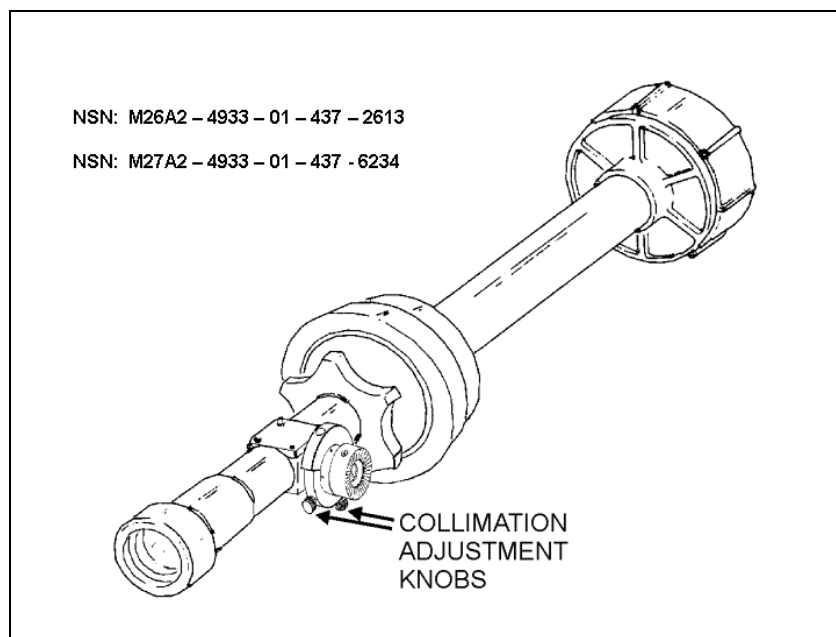
Figure 11-2. M26A2 and M27A2 MBD.

LENZAR MBD (KIT BORESIGHT DEVICE, CALIBER .50)

The Lenzar MBD is used to boresight the M2 HB caliber .50 machine gun. It can also be used to boresight the M240 machine gun in the commander's weapon station. The device is a 5X magnification telescope. When properly installed into the muzzle end of the machine gun, the sighting piece is positioned at 12 o'clock. There are two focus adjustments knobs, a reticle focus for the cross hairs, and an objective focus for the target (see Figure 11-3).
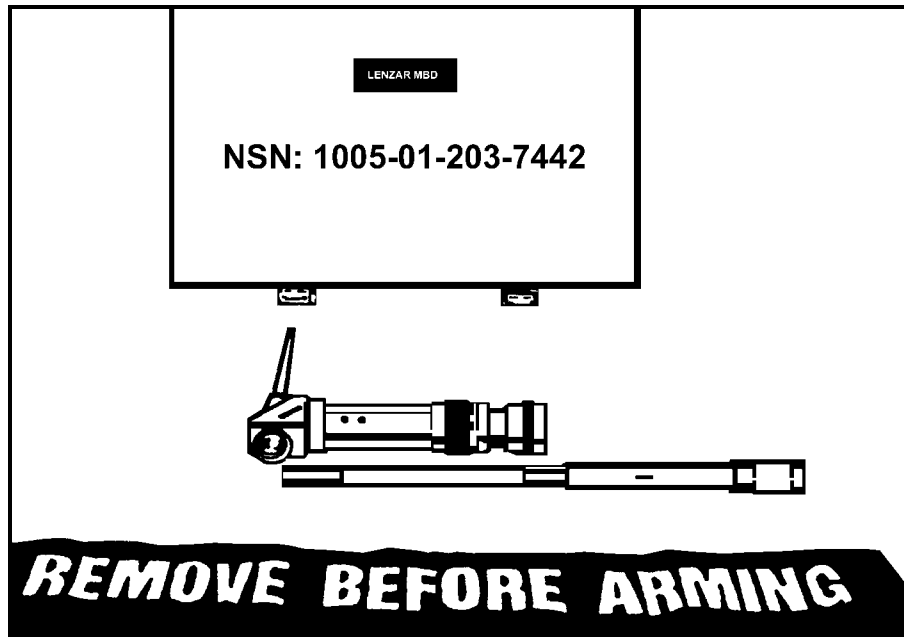
Figure 11-3. Lenzar MBD (Kit Boresight Device, Caliber .50).

Calibration Devices

Calibration devices are needed to test the tank's fire control system and check for boresight accuracy. The various calibration devices discussed in this chapter are the ballistic solution boards, boresight panel, screening test targets, and proofing test panel.

BALLISTIC SOLUTION BOARDS

A ballistic solution board is used to check that the tank's fire control system is correctly implementing ballistic solutions in all main gun channels. Ballistic solution boards are made from plywood. They are maintained at unit level. The board must be placed 100 meters (plus or minus 1 meter) from the vehicle's front slope at the same height as the tank gun trunnions. All solution boards have the following standard features:

- Gunner's primary sight gun/sight boxes are 12 inches by 12 inches.
- Solution rectangles are 2 inches wide and 4 inches high. Each has a 6-inch horizontal line and an 8-inch vertical line through its center.
- Solution board lettering or numbering is at least 4 inches high.
- Distances between lettering or numbering and the solution board rectangles or sight, ammunition, gun, or GPS boxes are 2 inches.
- Boards are standard black and white.

COMBINED SOLUTION BOARDS

Previously, units needed two solution boards to complete Armament Accuracy Checks 4 and 5. Reports from units in the field indicate that combining the solution boards for Checks 4 and 5 simplifies the procedures. The Abrams Combined Solution Board also reduces the space needed to transport the boards for field use (see Figure 11-4).
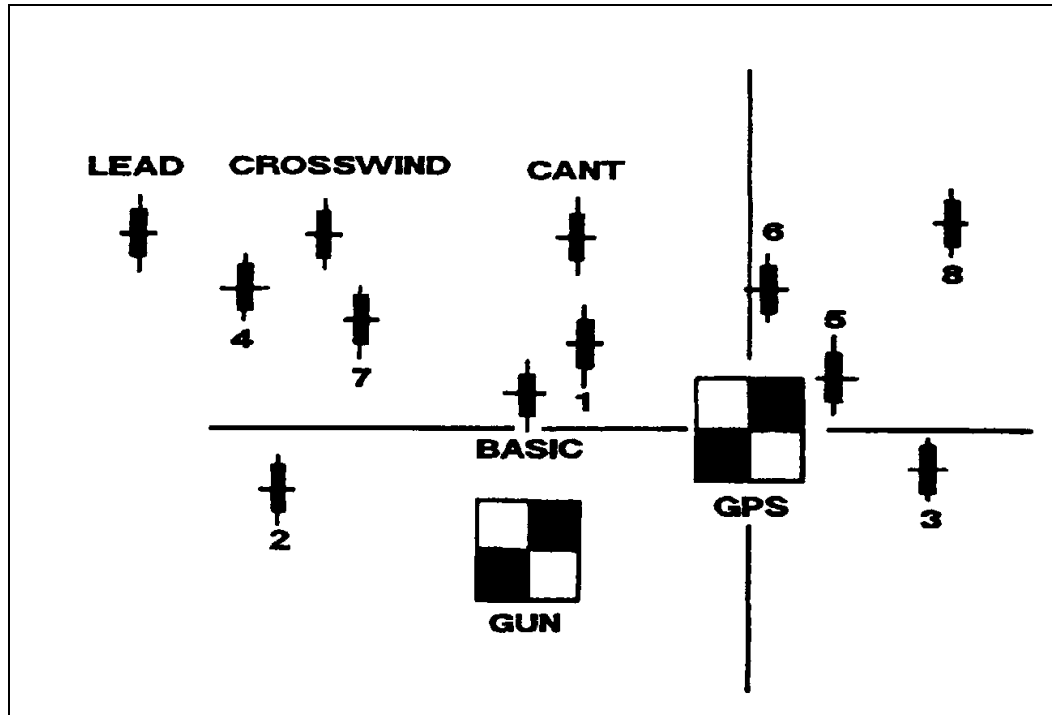
Figure 11-4. Sample Abrams combined solution board.

DIMENSIONS OF THE COMBINED SOLUTION BOARD

- Minimum solution board dimensions are 96 inches wide by 60 inches high.
- GUN and GPS squares are 12 inches on each side. The upper right and lower left quadrants are dark colored.
- The solution rectangles are 2 inches by 4 inches, dark colored, with 6-inch horizontal and vertical lines through the center of each rectangle.
- All lettering is at least 4 inches high.
- Place the center of the GUN target right 48 inches and up 12 inches, from the lower left corner of the solution board.
- All other measurements are from the center of the GUN target:

To center of GPS	Right 22 inches, up 16 inches
To center of BASIC	Right 0 inches, up 19 inches
To center of CANT	Right 6 inches, up 39 inches
To center of CROSSWIND	Left 24 inches, up 39 inches
To center of LEAD	Left 46 inches, up 39 inches
To center of rectangle 1	Right 3 inches, up 26 inches
To center of rectangle 2	Left 33 inches, up 7 inches
To center of rectangle 3	Right 43 inches, up 12 inches
To center of rectangle 4	Left 38 inches, up 32 inches
To center of rectangle 5	Right 32 inches, up 20 inches
To center of rectangle 6	Right 24 inches, up 32 inches
To center of rectangle 7	Left 22 inches, up 29 inches
To center of rectangle 8	Right 46 inches, up 42 inches

Note. When constructing a combined solution board, all measurements must be accurate. Inaccurate measurements will result in false test results.

DATA SHEETS

Data sheets are used by the crew to record the exact lay of the gun while performing AACs. See Figures 11-5 through 11-7 for samples of data sheets for checks 4 and 5 on the M1, M1A1, and M1A2 tanks.

Note. Each data sheet has multiple rectangles for some numbers on the board. This is for use when a particular rectangle is used more than once. For example, on the M1 AAC board (Figure 11-5), rectangle 6 is used with SUBDES 1 and 0.

Figure 11-5. Sample M1 data sheet for armament accuracy checks 4 and 5.

Figure 11-6. Sample M1A1 data sheet for armament accuracy checks 4 and 5.

M1A2 AAC DATA SHEET FOR CHECKS 4 AND 5

Figure 11-7. Sample M1A2 data sheet for special input and ballistic solution checks.

BORESIGHT PANEL

It is impossible to fire accurately without sight alignment; therefore, boresighting using the boresight panel at a known range is fundamental to tank gunnery. The boresight panel is used with standard boresighting procedures for all tank systems. It measures 6 feet square. It has defined aiming points on one edge or in the center (see Figure 11-8). Lights and a thermal marker should be used to define the aiming points on the panel.
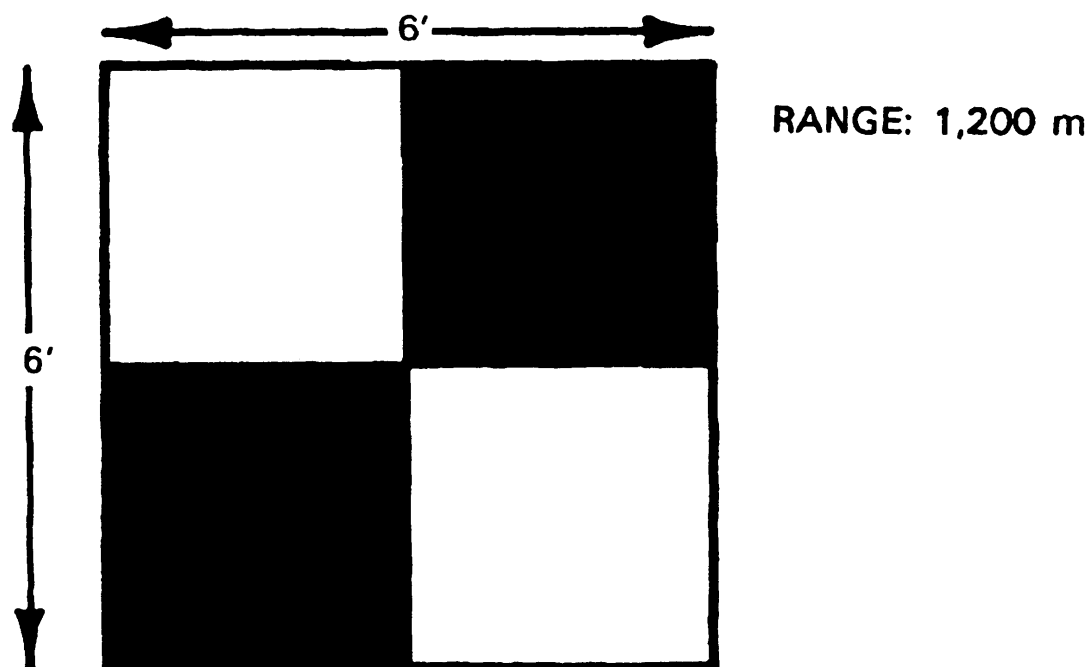
Figure 11-8. Standard boresight panel.

SCREENING TEST TARGET (ST-5)

The screening test target is used during an LFAST to confirm fire control system accuracy (see Figure 11-9).
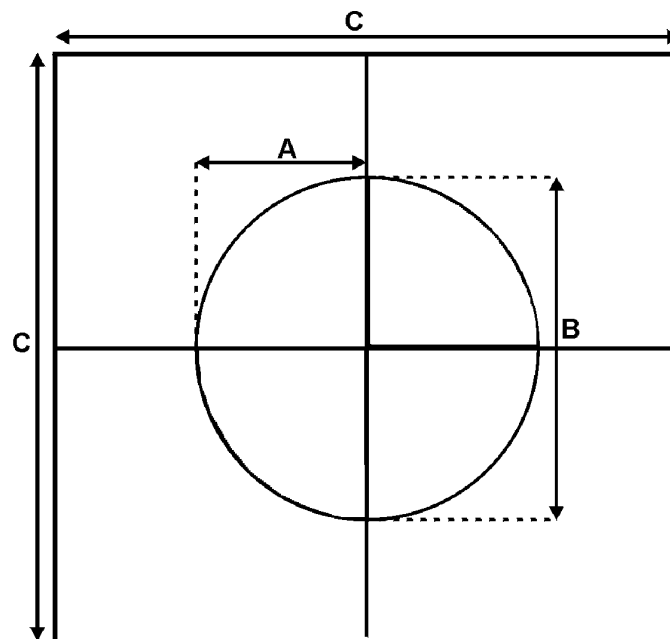
DIMENSIONS OF SCREENING TARGETS 120mm			
RANGE	A	B	C
1500m	87.5cm	175cm	10ft X 10ft
1400m	81.7cm	163.3cm	*9ft 4in X 9ft 4in
1300m	75.8cm	151.7cm	*8ft 8in X 8ft 8in
1200m	70.0cm	140.0cm	*8ft X 8ft
1100m	64.2cm	128.3cm	*7ft 4in X 7ft 4in
1000m	58.3cm	116.7cm	*6ft 8in X 6ft 8in
900m	52.5cm	105.0cm	*6ft X 6ft
800m	46.7cm	93.3cm	*5ft 4in X 5ft 4in
700m	40.8cm	81.7cm	*4ft 8in X 4ft 8in
600m	35.0cm	70.0cm	*4ft X 4ft
500m	29.2cm	58.3cm	*3ft 4in X 3ft 4in
*Sizes shown are the minimum for the background board.			

Figure 11-9. Screening test target (ST-5), 1,500 meters.

Note. For the 105mm main gun, the screening panel is placed at 1,200m and is the same dimension as the 120-mm panel at 1,500m.

Appendix

Gunnery Event Device Suitability

This appendix shows the devices described in Chapters 3 through 9 by type, with their suitability code for tank-table training.

Gunnery Event Device Suitability							
EVENT	TWGSS	COFT	AGTS	PGT	TSV	AFIST	Caliber .50 Inbore Device
TT I	X	X	X	X	X	X	X
TT II	E	T	T	X	E	T	X
TT III	T	T	T	X	E	T	X
TT IV	T	P	P	X	E	P	X
TT V	P	P	P	X	E	X	X
TT VI	T	X	X	X	E	X	E
TT VII	P	X	X	X	E	X	P
TT VIII	X	P	P	X	X	P	X
TT XI	X	X	X	P	E	X	E
TT XII	X	X	X	P	X	X	X

Suitability Codes:

T—Suitable for training this event.

P—Suitable for preliminary training for the event.

E—Enhances gunnery event when used.

X—Not suitable for training this event.

APPENDIX A

Proposed Training Devices

This appendix contains information on devices that are being tested to determine if they suit the Army's needs. The devices were selected for their potential impact on future training of tank combat skills. Artists' renderings show how each device will look. The figures, based on the most recent test data, are subject to change as testing progresses. If fielded, these devices will give trainers more to choose from in developing training programs.

Ml TANK DRIVER TRAINER

The Ml TDT will provide initial, transition, and mobilization training for Ml tank drivers.

The cab of the TDT duplicates the driver's station. It is mounted on a hydraulic motion platform that produces pitch, roll, yaw, surge, sway, and heave. A computer image generator provides visual real-time cuing to the cab. The instructor's station allows control and instructional input such as standard driving scenarios, vehicle malfunctions, and emergency situations. A monitoring station for students and automatic evaluation of student performance are also provided (see Figure A-1).

The TDT will be used at the institutional level only.
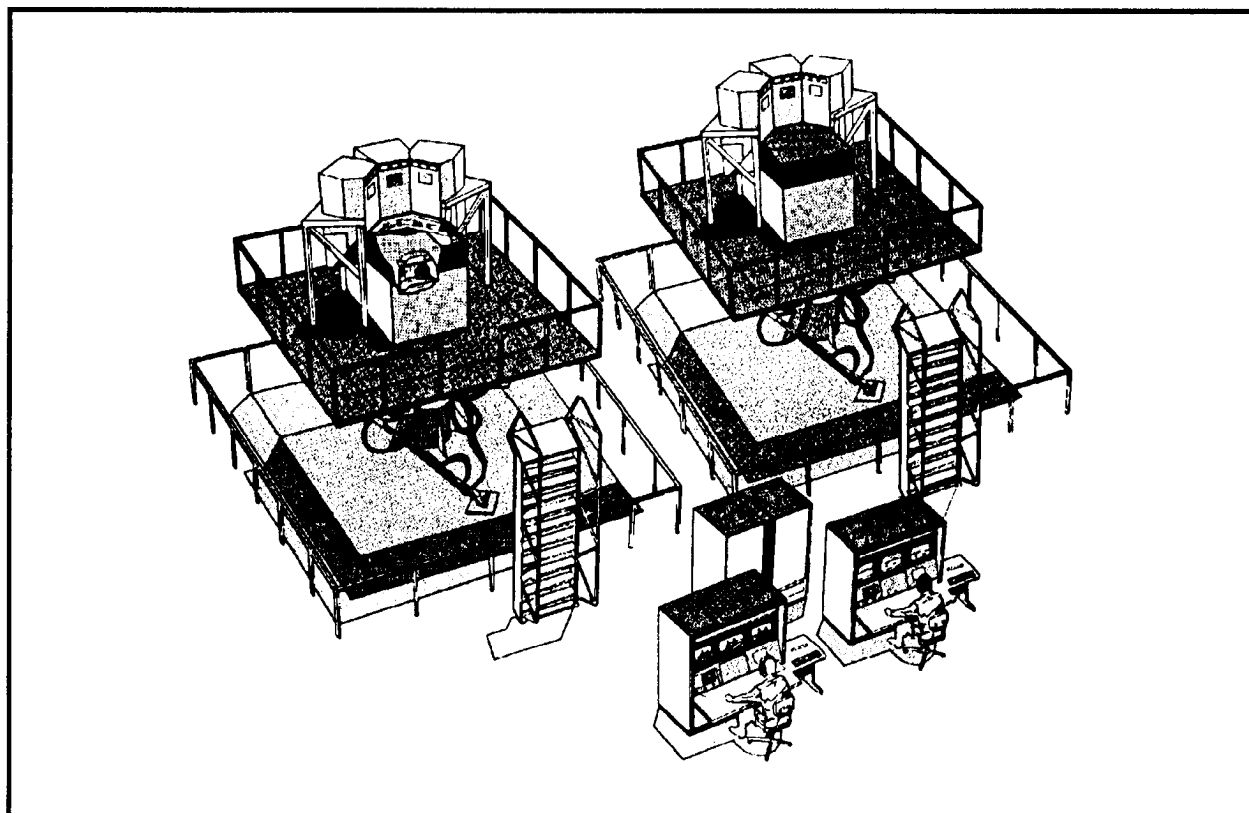
Figure A-1. M1 TDT (Artist's Concept).

THRU-SIGHT VIDEO

The thru-sight video (TSV) (see Figure A-2) will record the audio and video of a gunner's perform-ance and crew duties for after-action review (AAR). A television camera linked to the gunner's primary sight (GPS) and wired to an equipment support enclosure (ESE) package records the gunner's sight picture. The ESE package includes--

- A video cassette recorder (VCR).

- The time code generator (TCG) that superimposes realtime or stopwatch time onto the recorded video tape.

- An events generator (EG) that superimposes a visual indicator on the video recording at the instant the gunner pulls the trigger.

- A separate video player and television monitor for audio and video playback at the AAR site.
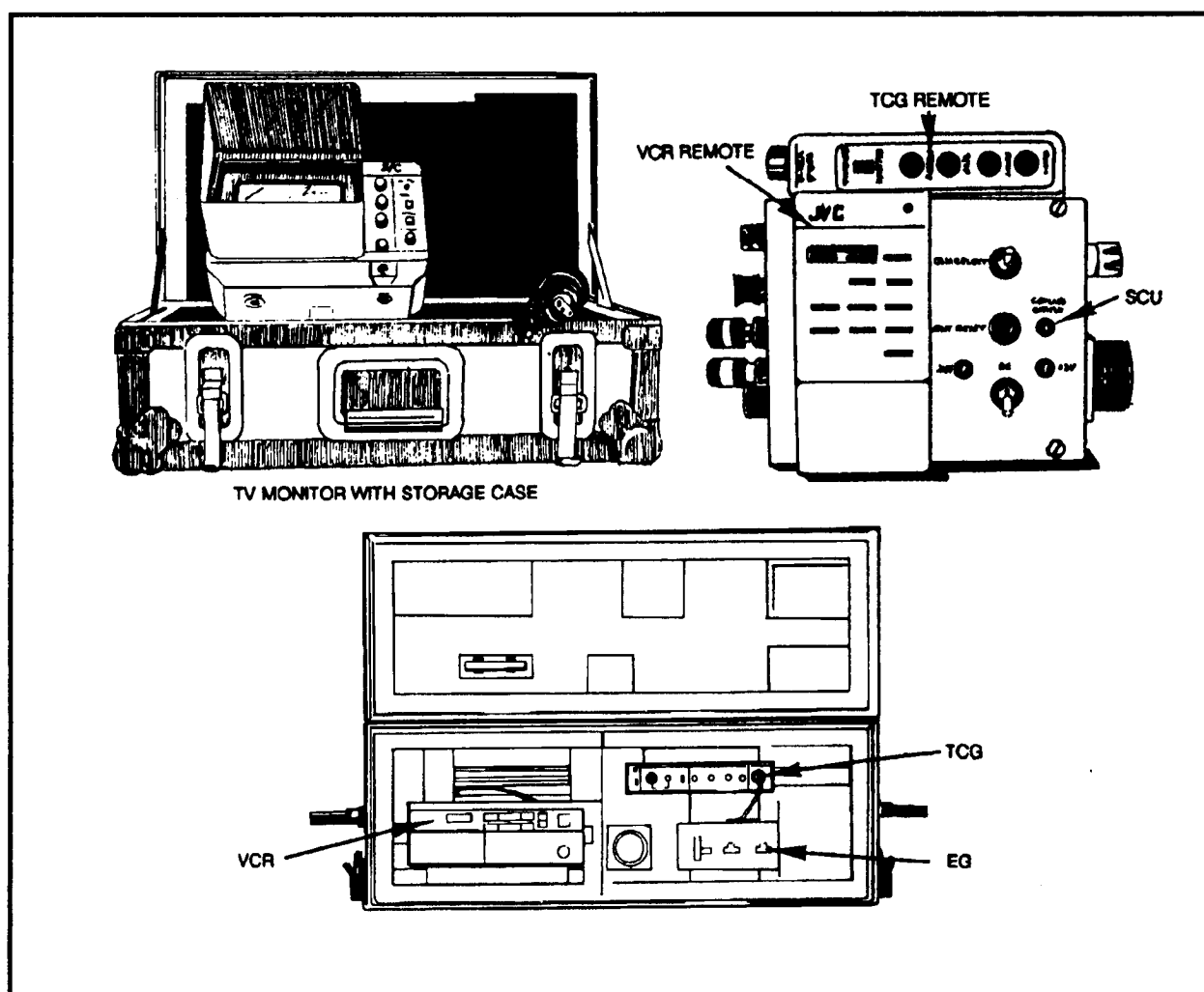
Figure A-2. TSV Components (Artist's Concept).

GUARD UNIT ARMORY DEVICE FULL-CREW INTERACTIVE SIMULATION TRAINER

National Guard units will use the Guard unit armory device full-crew interactive simulation trainer (GUARDFIST) during inactive duty training at local armories. The concept for GUARDFIST I is to integrate computer generated imagery (CGI) with the controls and sights of the Ml tank. The same scene will be concurrently presented to each crew member from his own perspective. Targets will be generated and integrated into the scene for gunnery and driver training. The crew will be able to fire and drive into the scene with full-crew interaction (see Figure A-3).
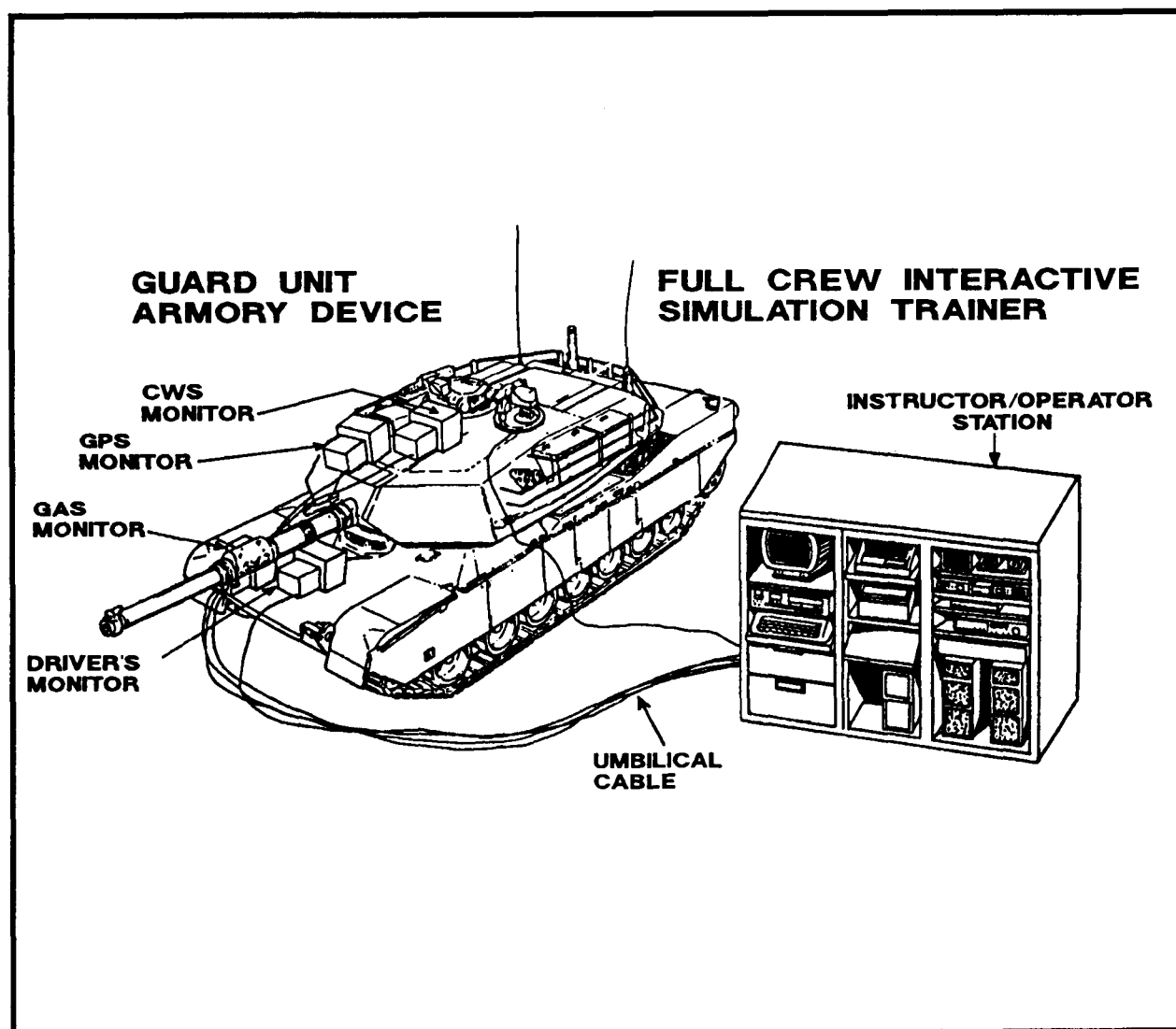
Figure A-3. GUARDFIST I (Artist's Concept).

TANK PRECISION GUNNERY INBORE DEVICE

The tank precision gunnery inbore devicc (TPGID) will fire 35-mm rounds. The rounds are ballistically matched to 120-mm armor-piercing fin-stabilized discarding sabot (APFSDS) and high-explosive antitank (HEAT) ammunition. The TPGID will allow full-crew interaction during precision and degraded mode gunnery exercises (see Figure A-4).
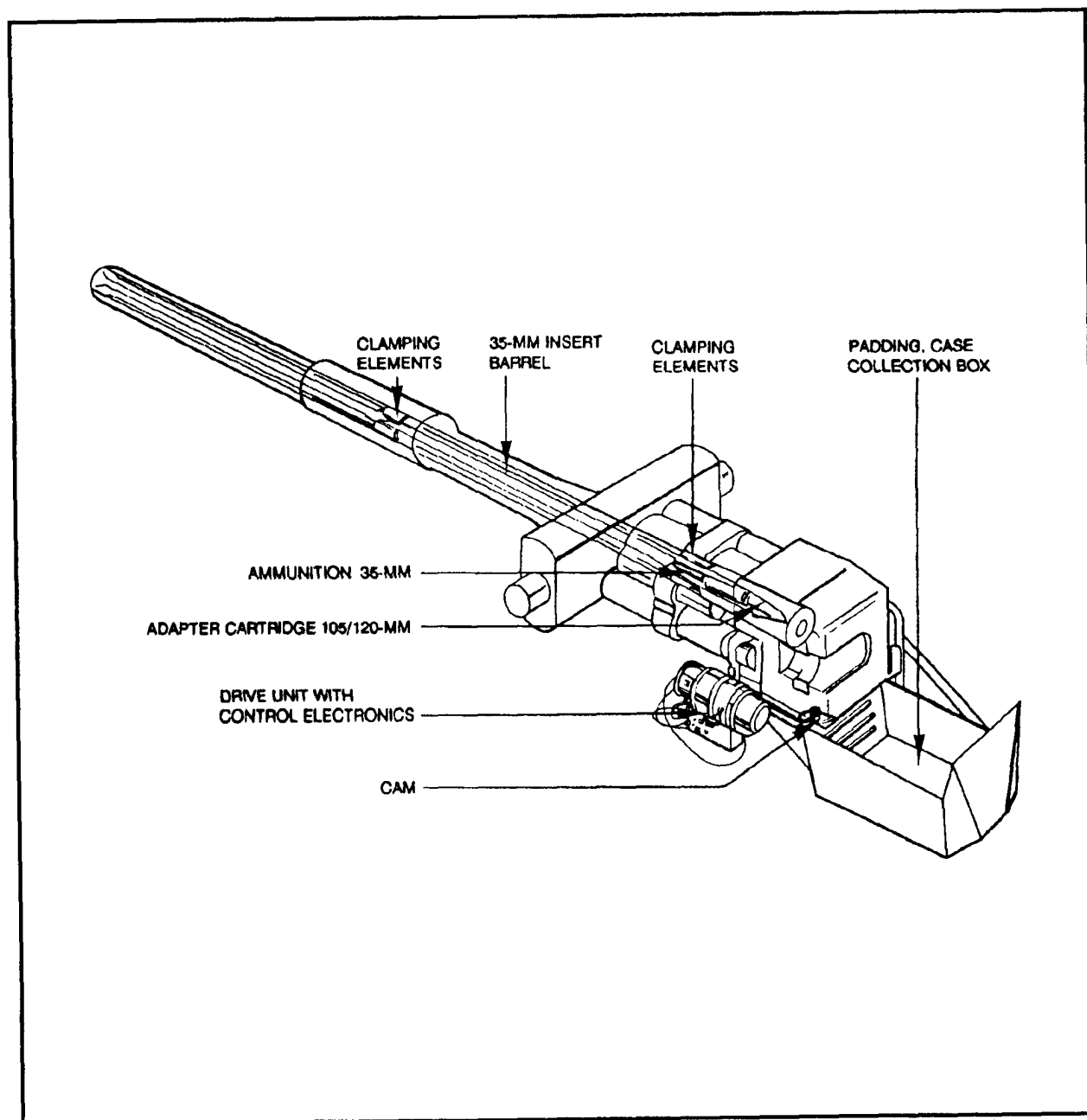
Figure A-4. TPGID (Artist's Concept).

MAIN TANK GUN WEAPONS EFFECT SIGNATURE SIMULATOR

The main tank gun weapons effect signature simulator (MTG-WESS) will provide a more cost-effective and realistic means of simulating the flash, bang, and smoke of the main gun. It will be used in force-on-force tactical engagement simulation exercises. The MTG-WESS holds 60 M24 cartridges closely replicating the vehicle's basic load. The M24 cartridge has the size and appearance of a 10-gage shotgun shell. The M55, M551, and M60--series tanks will mount the MTG-WESS on the bore evacuator. The Ml-series tanks will mount the device on the side of the turret in front of the grenade launcher (see Figure A-5).

Note. The MTG-WESS will eventually replace the Hoffman device.

M551 AND M60-SERIES TANKS   M1-SERIES
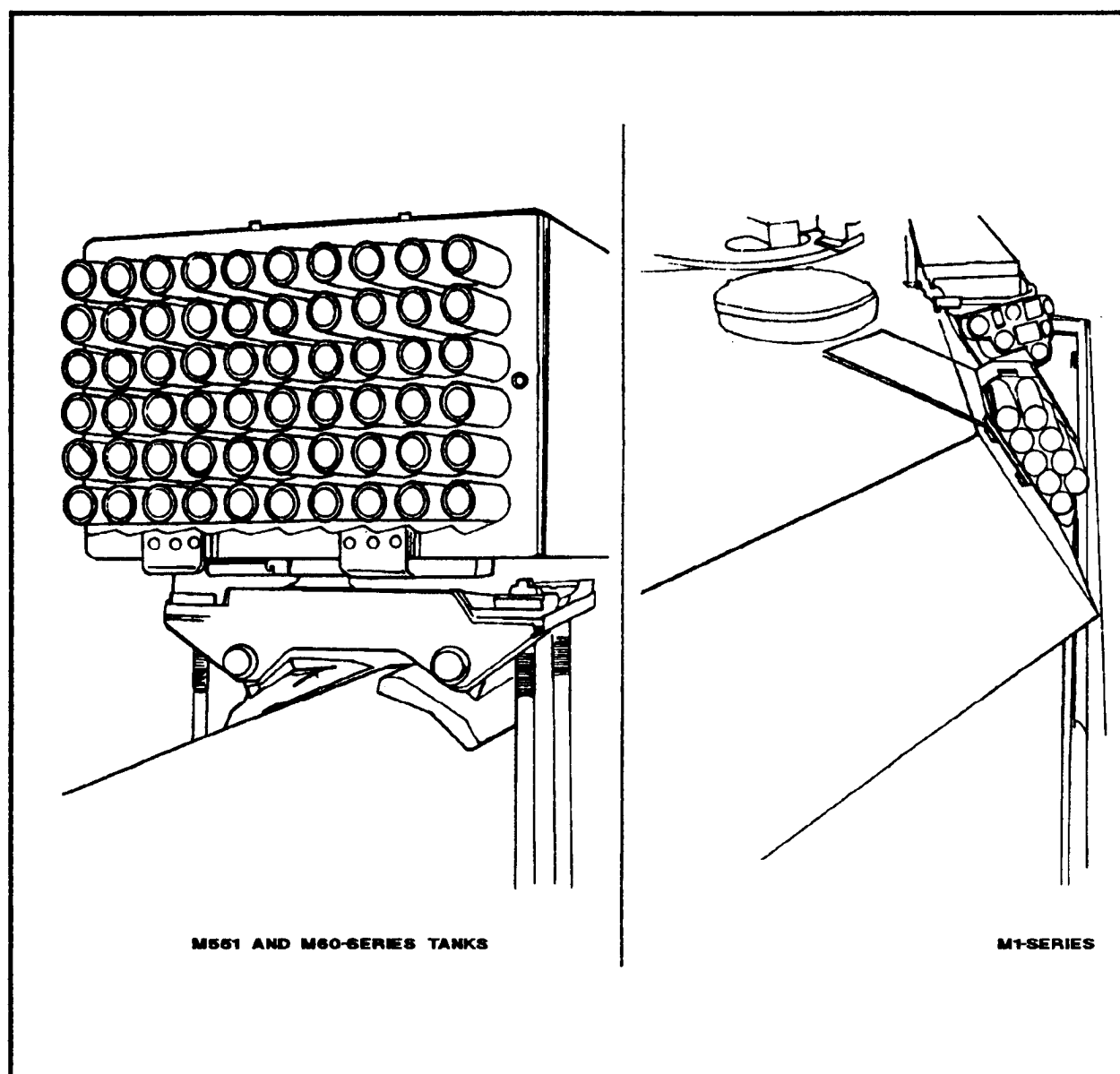
Figure A-5. MTG-WESS (Artist's Concept).

ARMOR HOSTILE FIRE SIMULATOR

The armor hostile fire simulator (AHFS) is an adaptation of the MTG-WESS. The AHFS will be used on live-fire ranges with either an M24 cartridge or a black smoke cartridge. The M24 cartridge will simulate the flash and bang of a firing enemy target. This feature will alert tank crews to a target location. By emitting a cloud of black smoke, the black smoke cartridge will signal tank crews that a target has been hit and destroyed. With either cartridge, the AHFS will enhance the overall training experience during live-fire exercises (see Figure A-6).
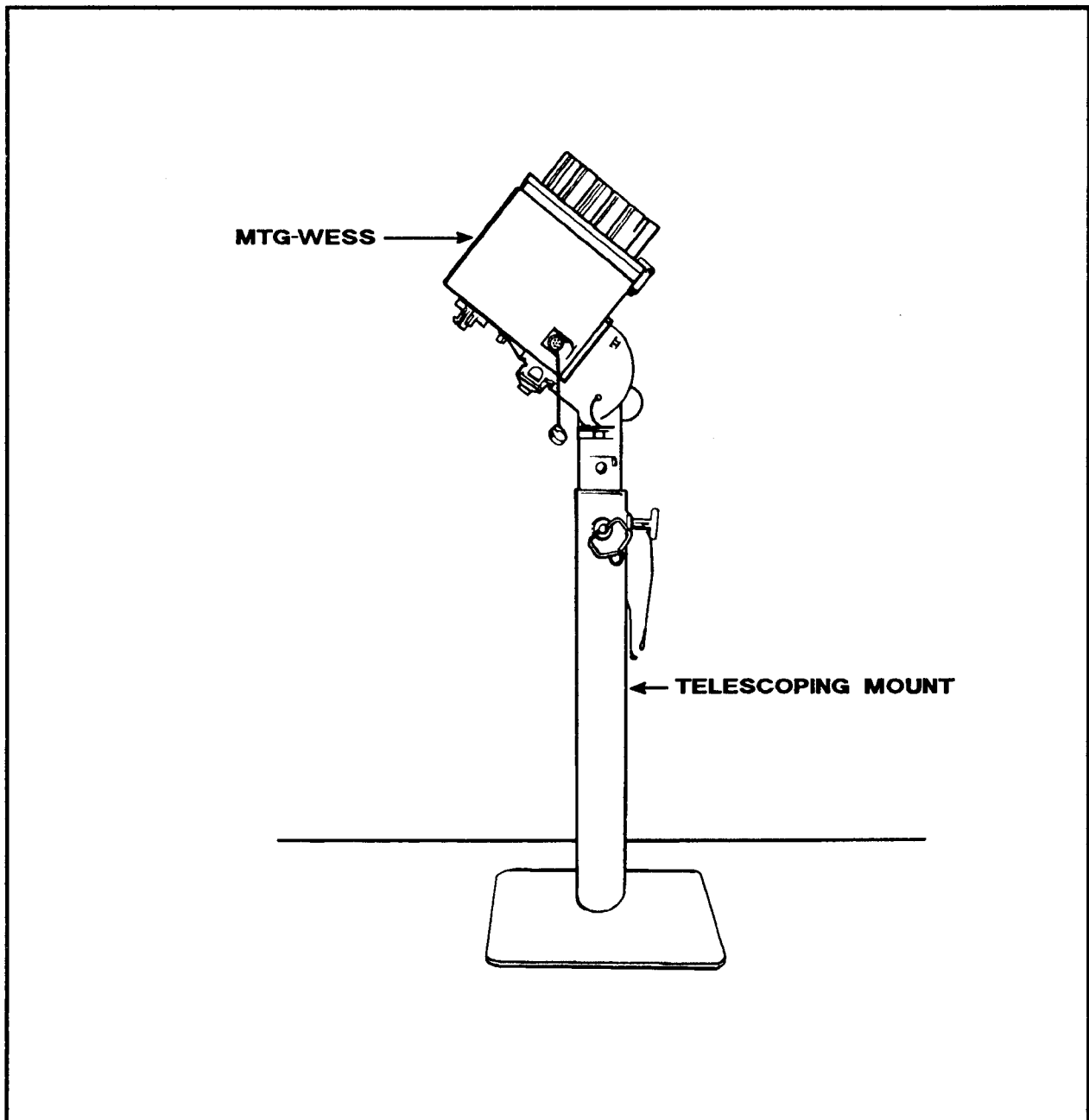
Figure A-6. AHFS (Artist's Concept).

SIMULATION NETWORKING

Simulation networking (SIMNET), an Army sponsored Defense Advanced Research Project Agency (DARPA) technology effort, provided 236 vehicle simulators in seven sites around the world. The simulators are now used on an interim basis for collective task tactical training until the Army fields the close combat tactical trainer (CCTT).
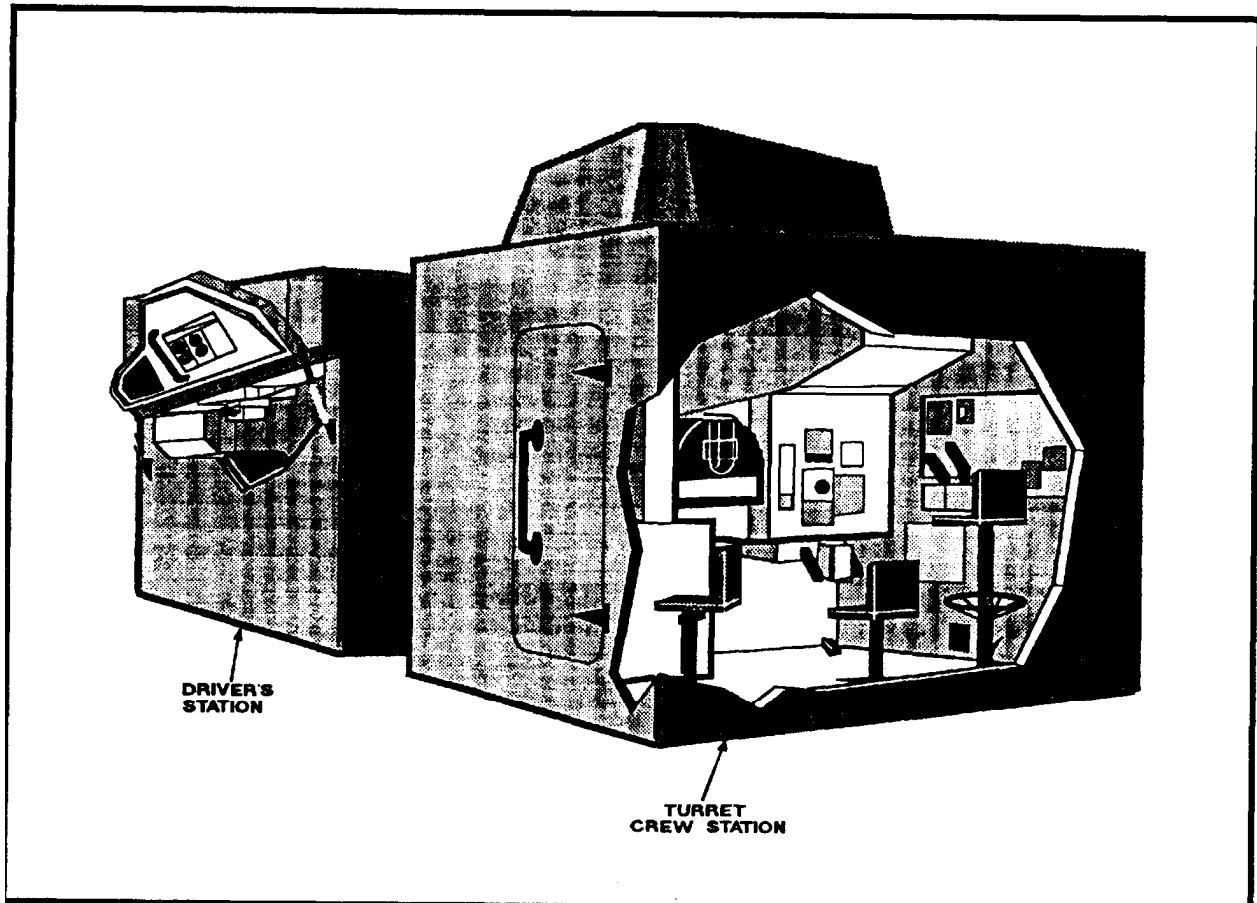
Figure A-7. SIMNET (Artist's Concept).

TANK WEAPONS GUNNERY SIMULATION SYSTEM

The tank weapons gunnery simulation system (TWGSS) will be used at local or major training areas for firing gunnery tables and conducting tactical exercises.

The TWGSS is a tank-appended gunnery training system for simulating main gun firing. It interfaces with the tank's fire control system and allows precision gunnery, taking into account lead, superelevation, range, and ammunition type. A simulated tracer and an impact indication are superimposed in the
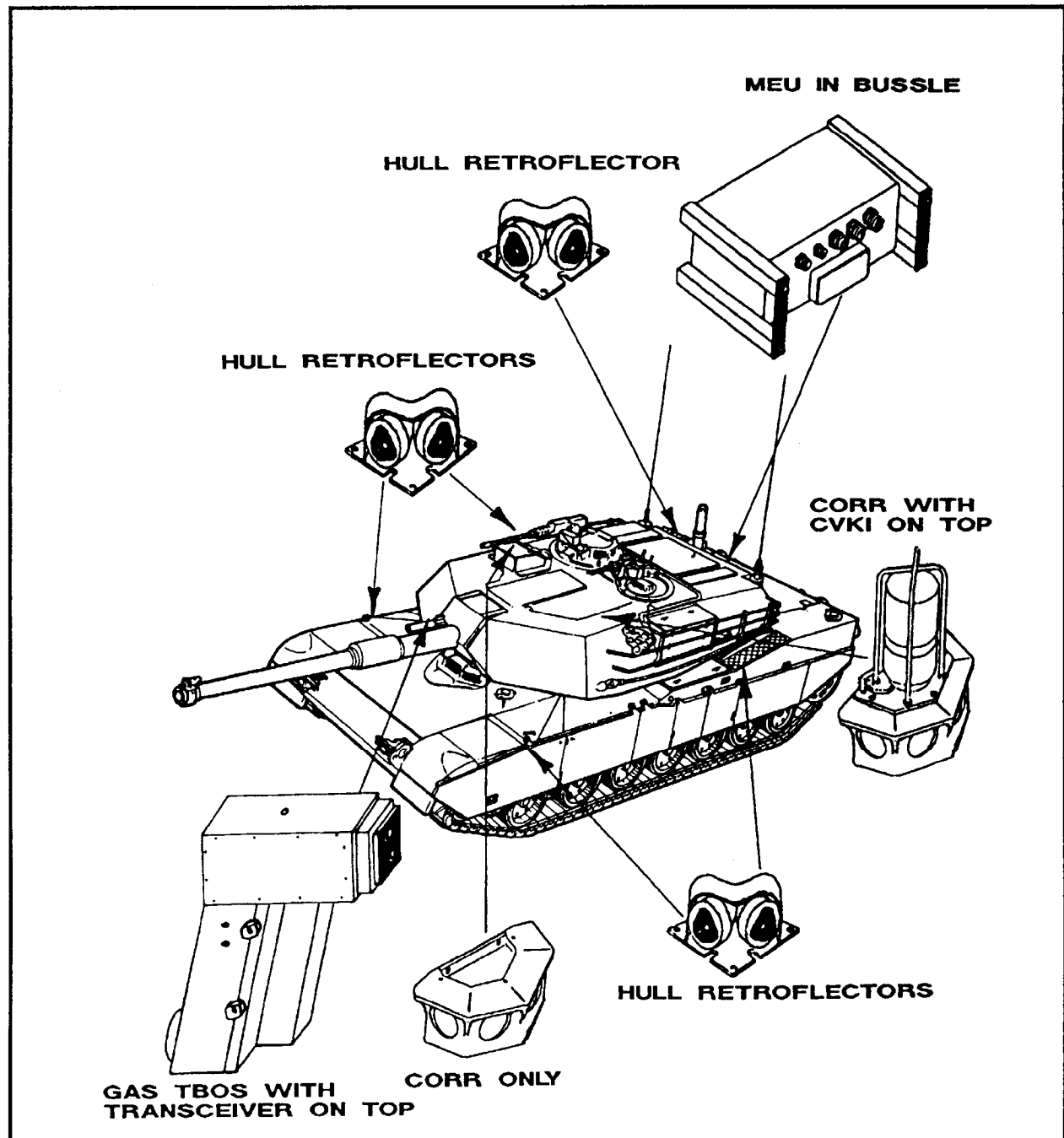

Figure A-8. Location of Major TWGSS Components (Exterior).

sight. Obscuration at firing, sight displacement, and target effects are also simulated. A crew evaluation subsystem provides a hard-copy record of engagement parameters. This enables the trainer to reconstruct the firing sequence for crew evaluation and critique. The TWGSS will be compatible with the multiple integrated laser engagement system (MILES) for use during tactical training (see Figures A-8 and A-9).
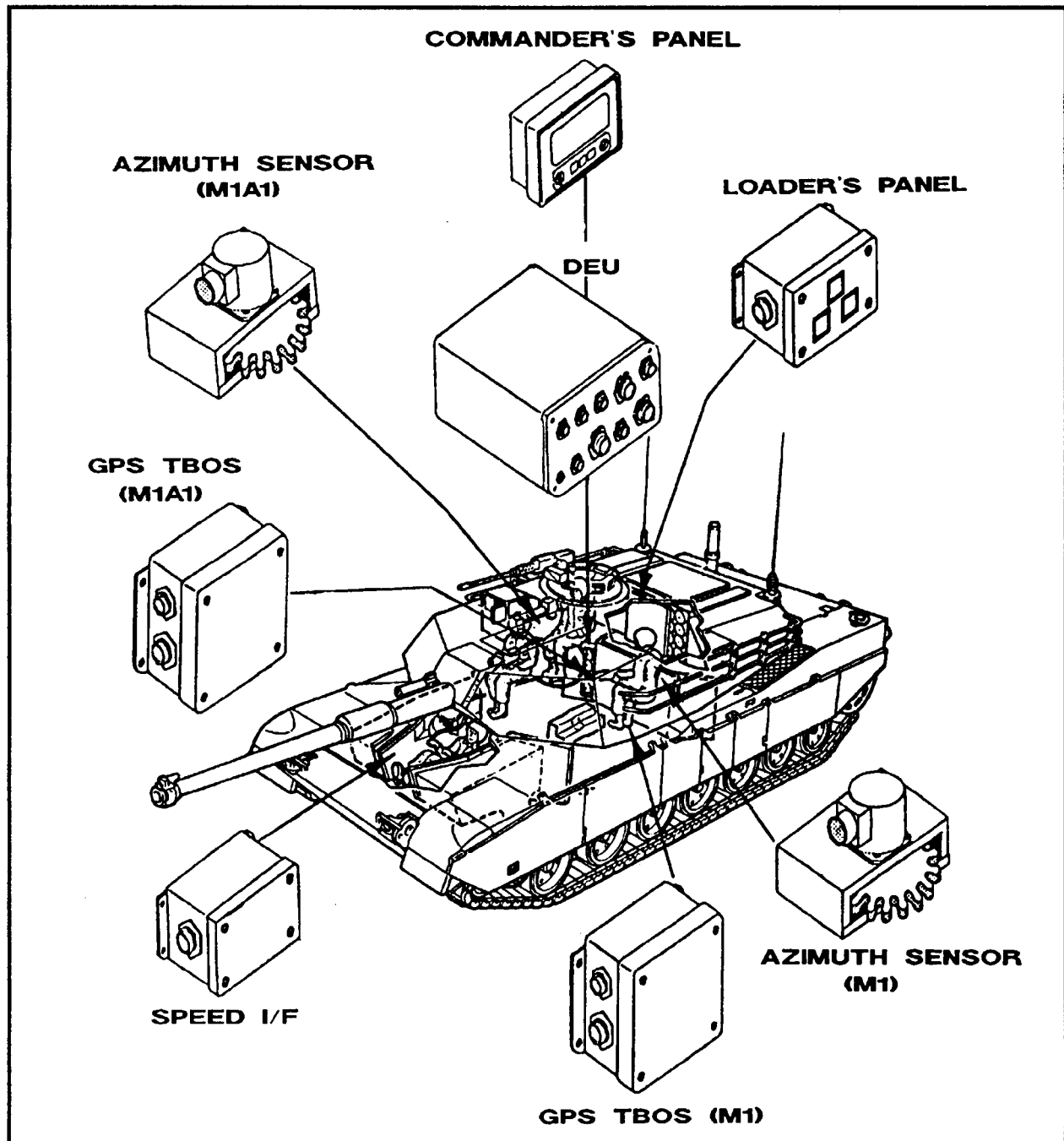

Figure A-9. Location of Major TWGSS Components (Interior).

CLOSE-COMBAT TACTICAL TRAINER

Close-combat tactical trainer (CCTT) is a system of computer-driven combat vehicle simulators including the Ml Abrams tank, the M2 Bradley fighting vehicle, the M3 cavalry fighting vehicle, and the M981 fire support team vehicle. Emulators control some vehicle models and functions. Other vehicle models and functions are controlled by crew members inside the simulators. All the vehicle models and functions then interact to simulate battlefield conditions. All simulators and emulators are connected via a local area network (see Figure A-10). The system's computers create a simulated battlefield which, when viewed by soldiers who are using the system, creates the illusion of moving and fighting over actual terrain. The vehicle crews, while operating or riding inside the simulators, employ their vehicle mounted weapon systems in free play action. CCTT will initially be fielded into fixed and mobile sites that provide platoon and company team or cavalry troop training for active and reserve components (Army National Guard and Army Reserve).

CCTT will be used in institutional and unit training to--

- Train tactical collective tasks in accordance with ARTEP mission training plans.

- Support principles of training outlined in FM 25-100.

- Provide battle focused training as outlined in FM 25-101.

- Present an environment that meets growing maneuver resource constraints to sustain tactical proficiency and train battlefield operating systems in accordance with unit or organization mission-essential task list (METL).

- Build teamwork, confidence, and decision-making ability, and synchronize the battlefield in a variety of conditions.
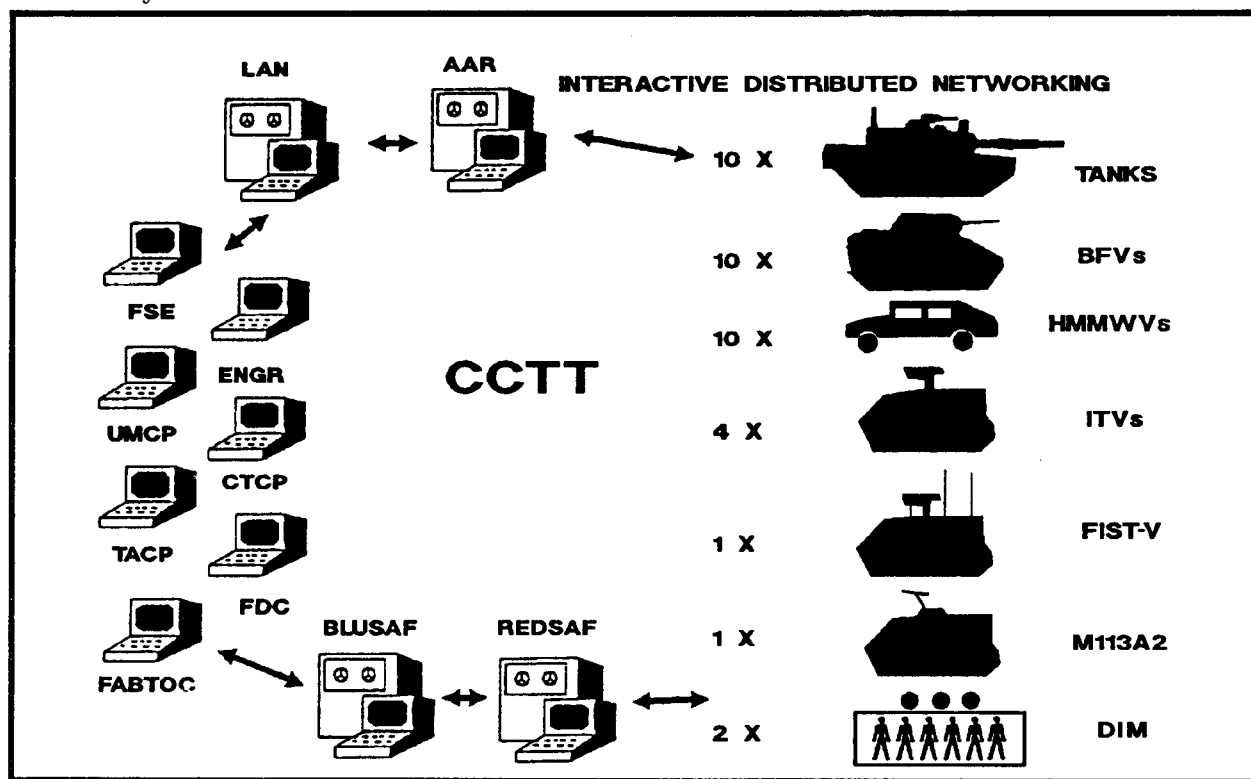

Figure A-10. Company Team Site Composition.

APPENDIX B

Tank Tables and Devices Matrices

This appendix contains information on how to select the appropriate device to train a specific objective, skill, or knowledge required in a tank table. The matrices in this appendix reflect the selection process. Matrix 1 (Tank Tables with Training Devices) and Matrix 2 (Tank Tables with Proposed Training Devices) cover the abilities of various devices to train tank tables. Matrix 3 (Tank Table Targets) shows the size of scaled targets to use for each tank table. Following the guidance in this appendix will ensure that each device is used to maximum advantage in training tank tables.

RECOMMENDED TRAINING DEVICES

Table[1]	Brewster[2]	Stout Board[3]	Snake Board[4]	Telfare[5]	MILES[6]	U-COFT[7]	VIGS[8]	.50 cal[9] Inbore
I	X	X	X			X	X	
II	X	X				X	X	
III				X	X	X	X	X
IV				X	X	X		X
V								
VI				X	X	X		X
VII				X	X	X		X
VIII								
IX				X	X			X
X				X	X			X
XI				X	X			X
XII				X	X			X

Note. An "X" indicates that a device is suitable to train an individual tank table. Superscript numbers indicate--

- 1--Table numbers correspond to the appropriate tank table number in Chapters 11, FM 17-12-1; FM 17-12-2; and FM 17-12-3.

- 2--Used with either the M55 laser or the M16 and 5.56-mm ammunition or caliber .22 with the rimfire adapter.

- 3--Used with either the M55 laser or the M16 and caliber .22 ammunition with the rimfire adapter.

- 4--Should be used with the M55 laser mounted in the Brewster device.

- 5--Used with the HEP cam on the M48A5/M60A1; used with the HEP ammunition selection button on the M60A3; on the M1, the ammunition selector switch must be in the HEP position (unless the tank has the caliber .50 SUBDES); on the M1A1, used with the caliber .50 SUBDES. Maximum effective range on the M48A5, M60-series, M1, and M1A1 tanks is 1,200 meters. The Telfare can be employed at ranges between 1,200 meters and 1,400 meters with limited accuracy.

- 6--Used to train degraded mode gunnery only. Used with LTIDs.

- 7--Selected or recommended exercises should be used. No loader or driver training can be accomplished. TC cannot practice full-crew vehicle management. M48A5/M60A1 U-COFT systems are not planned.

- 8--Used to teach basic gunnery skills. Some tasks may have to be modified.

- 9--Used to teach basic, intermediate, and advanced gunnery skills.

Matrix 1. Tank Tables with Training Devices.

ANALYSIS AND SELECTION

The trainer first considers training value when selecting a device. Matrices 1 and 3 can help match the training objective, skill, or knowledge to be taught with the appropriate training devices. (Matrix 2 shows how proposed devices will fit into training programs as they become available.) In some cases, devices are nearly as effective as live fire in helping the crew maintain proficiency.

Some devices do have negative aspects, however. The trainer must consider these drawbacks and determine how to compensate for them. For example, when the M179 Telfare device is used, only high-explosive plastic (HEP) ammunition can be indexed into the computer. To compensate, a caliber .50 solution has been incorporated as a subdesignation (SUBDES) in M1A1 tanks.

PROPOSED DEVICES

Table	GUARDFIST I	TPGID	TWGSS
I			
II			
III	X		
IV	X		X
V			
VI	X	X	X
VII	X	X	X
VIII			
IX		X	X
X		X	X
XI		X	X
XII		X	X

Note.   An "X" indicates that a device is projected to be suitable to train an individual tank table. The exact use of a device will not be determined until testing has been completed. It is possible the device may not be able to accomplish its projected task or may be able to accomplish more than expected.

Matrix 2. Tank Tables with Proposed Training Devices.

RECOMMENDED SCALED TARGET SIZE

Table	Full	1:2	1:5/1:10	1:30/1:60
I	X^1	X^1		X
II	X^1	X^1		X
III	X	X	X	
IV	X	X	X	
V	X			
VI	X			
VII	X	X^2		
VIII	X			
IX	X^2	X^2		
X	X^2	X^2		
XI	X^2	X^2		
XII	X	X^2		

Note. An "X" indicates that targets are suitable to train individual tank tables. Superscript numbers indicate--

- 1--Used with the Stout board.
- 2--Used with the Telfare device.

Matrix 3. Tank Table Targets.

TRAINING

Once the trainer has selected a device, he prepares a training plan and conducts the training. If tables cannot be trained with available devices or if devices impart negative aspects to training, he compensates with remedial or concurrent training or with actual main gun fire.

APPENDIX C

Training Aids Supply Procedures

Army trainers quickly learn they cannot organize an effective training program without assistance from the local Training Support Center (TSC). As their name implies, TSCs work with units to supply items needed to support training. The procedures outlined in this appendix will help the trainer get started on the road to a successful tank combat training program.

ACCOUNT ESTABLISHMENT

Each company, detachment, separate office, and activity can establish a training aids supply account. The first step is submission, in duplicate, of DA Form 1687 (Notice of Delegation of Authority--Receipt for Supplies). This designates a responsible officer and his authorized representatives. Upon receipt of this signature card, the TSC will assign an account number and return a copy of the signature card to the unit. The unit designation must be that of a specific company, detachment, office, or activity as opposed to a "headquarters," because a headquarters could have more than one account. (For example, the 100th Tank Battalion could have an account for the commander, the S3, and the S4.) Once an account is established, all items issued to the responsible officer/hand-receipt holder are listed on DA Form 2062 (Hand Receipt/Annex Number).

PROCEDURES FOR CHANGING RESPONSIBLE OFFICER

The following steps outline the procedures for changing the responsible officer/hand-receipt holder.

Off-Post Activities

- The organization notifies the TSC of the desired change and effective date.

- Upon notification, the TSC prepares an adjusted hand receipt and forwards it to the responsible officer/hand-receipt holder.

- Upon receipt of the adjusted hand receipt, the outgoing and incoming responsible officers/hand-receipt holders conduct a 100 percent joint inventory of all training aids property.

- Upon completion of the inventory, the incoming responsible officer/hand-receipt holder signs and dates the appropriate column of DA Form 2062 and returns the original to the TSC.

- If the responsible officer/hand-receipt holder delegates someone to handle individual turn-in and issue transactions for him, a DA Form 1687 must be submitted in accordance with AR 710-2.

- Under no circumstances are the quantities on the adjusted hand receipt changed. Necessary adjustments must be handled in accordance with procedures outlined in this appendix.

On-Post Activities

- The organization notifies the TSC of the desired change and effective date.

- The outgoing responsible officer/hand-receipt holder reports to the TSC with his copy of the hand receipt for adjustment.

- After adjustment is completed, the outgoing and incoming responsible officers/hand-receipt holders conduct a 100 percent joint inventory of all training aids property.

- Upon completion of the inventory, the outgoing and incoming responsible officers/hand-receipt holders report to the TSC. At this time, the incoming responsible officer signs the hand receipt and assumes responsibility for the unit's training aids.

- If the new responsible officer/hand-receipt holder delegates someone to handle individual turn-in and issue transactions for him, a DA For-m 1687 must be submitted in accordance with AR 710-2.

RENEWAL OR ADJUSTMENT OF HAND RECEIPTS

In accordance with AR 710-2, temporary hand receipts (subhand receipts) must be adjusted at least every six months or before a change of hand-/subhand-receipt holders, whichever comes first. Adjusted hand receipts, prepared by the TSC when due, include all transactions (issues and turn-ins) that have occurred since the last hand receipt adjustment. This procedure keeps individual accounts updated. It requires the responsible officer to inventory the organization's training aids and to reconcile his property records on a scheduled basis.

On-Post Accounts

When a hand receipt is due for an adjustment, the TSC notifies the responsible officer/hand-receipt holder, who reports to the TSC within five working days with his copy of the hand receipt. The adjustments are made by the TSC clerk, and the adjusted hand receipt is signed at that time.

Off-Post Accounts

Adjusted hand receipts are prepared by the TSC and mailed to the hand-receipt holder for authentication. The hand-receipt holder must return the original document within 21 days. Failure to return the signed, adjusted hand receipt within the suspense time results in temporary suspension of the account. All transactions, including production request processing, are suspended until the adjusted hand receipt is returned.

If the responsible officer/hand receipt-holder has delegated individuals to conduct issue and turn-in transactions for him, he should renew or update DA Form 1687. The TSC furnishes this form along with the adjusted hand receipt.

The adjusted hand receipt is prepared from valid individual receipt documents; therefore, quantities are not charged without authorization. Changes must be properly processed at the TSC after the adjusted hand receipt is authenticated and returned.

ACCOUNTABILITY AND RESPONSIBILITY

The TSC is accountable for all training aids. Responsibility for training aids issued on a loan basis, however, is transferred to the using unit.

SUPPLY CLASSIFICATIONS

The four general supply classifications for training aids are--

- Expendable. Items that normally do not have to be returned, and items that are subject to consumption and/or operational loss through normal use. Individual handouts are examples of this classification.

- Expendable/Returnable. Items having the general characteristics of expendable items but not necessarily subject to consumption and/or operational loss through normal use. Examples include GTAs, portfolios, charts, painters, and so forth. If such items are still serviceable when no longer needed, they should be returned to stock.

- Durable. Items required to be turned in for recovery of materials or reissue but not covered by another classification. Most classroom items and flat boards are included in this classification.

- Nonexpendable. Items that must be returned or accounted for by a proper adjustment document in accordance with AR 735-11-1. Large models, mock-ups, trainers, and most commercially produced devices are examples of this classification.

REQUESTS FOR LOAN AND TURN-IN

DA Form 3161 (Request for Issue or Turn-In) or DD Form 1150 (Request for Issue or Turn-In) is used to request loan or turn-in either of standard items or of returnable items produced on a training aids work request. The loan period is the exact period the aids are required to support training. It is indicated in the body of the request. Requisitions submitted to the TSC should contain the following information:

- Unit designation.

- Account number assigned to the specific unit.

- Signature of the responsible officer or designated representative as shown on the signature card.

- Loan period.

- Stock numbers and nomenclature of items requested.

REQUESTS FOR PRODUCTION OF NONSTANDARD ITEMS

The TSC can design, develop, and produce training aids to fit a specific instructional need. Such production is requested on DA Form 3903 (Training-Audiovisual Work Order). The requesting unit must provide clear, complete information in the description and justification sections of the request.

MAINTENANCE OF UNSERVICEABLE OR DAMAGED ITEMS

The TSC is responsible for maintenance of all training aids beyond the operator/user level. A unit with training aids in need of such maintenance reports the nature of the problem. Based on this information, the TSC furnishes maintenance assistance or disposition instructions. When possible, a direct exchange is made. Equipment that has been damaged as a result of negligence is handled in accordance with AR 735-11-1.

LOST, DAMAGED, OR DESTROYED PROPERTY

All lost, damaged, or destroyed property must be handled in accordance with AR 735-11-1.

PROHIBITED WORK

The TSC does not honor requests for work that is operational or administrative in nature and does not directly support training. Examples include, but are not limited to, mementos, farewell gifts, plaques, desk and administrative signs, and exhibits and displays not directly related to training. Work requests for such items are disapproved and returned to the requester.

Glossary

A

AAC	armament accuracy check
AAR	after-action review
AFIST	Abrams full-crew interactive simulator trainer
AGTS	advanced gunnery training system
AH	attack helicopter
AMC	United States Army Materiel Command
AMTC	armor moving target carrier
Apr	April
ATGM	antitank guided missile
ATTN	attention
AVR	audio and video recording

B

BAT CHG	battery charge (computer control panel nomenclature)
BIT	built-in test
BMD	Soviet vehicle
BMP	Soviet vehicle
BPLF	basic pre-live fire
BRDM	Soviet vehicle
BTR	Soviet vehicle

C

cdr	commander
CG	commanding general
CID	commander's integrated display
CITV	commander's independent thermal viewer
CKT BKR	circuit breaker (computer control panel nomenclature)
CLS	contractor logistical support
cm	centimeter(s)
COFT	Conduct-of-Fire Trainer
CPU	central processing unit
CWS	commander's weapon station

D

DA	Department of the Army
DATA	drawings for Army training aids
(D)MPRC	(digital) multipurpose range complex
DTDD	Directorate of Training and Doctrine Development
DVC-D	data devices
DVC-T	TRADOC devices

E

| EID | electronic interface device |
| ETP | exportable training package |

F

FCS	fire control system
FKSM	Fort Knox supplemental material
FL	Florida
FM	field manual, frequency modulator
FSR	field service representative
ft	foot (feet)
FTX	field training exercises

G

GAS	gunner's auxiliary sight
GCDP	gunner's control and display panel
GE	Germany
GPC	general-purpose computer
GPS	gunner's primary sight
GPSE	gunner's primary sight extension
GTA	graphic training aids
GTLF	gate-to-live fire

H

H	heavy (target designator)
HIND-D	Soviet vehicle
HQ	headquarters

I

ID	Idaho
in	inch(es)
IO	instructor/operator
IOS	instructor/operator station
ITGS	improved tank gunfire simulator
IUH	Instructor Utilization Handbook
IVIS	intervehicular information system

K

| KY | Kentucky |

L

L	light (target designator)
LFAST	live-fire accuracy screening test
LTID	laser target interface device

M

M	medium (target designator)
m	meter(s)
MBD	muzzle boresight device
MCOFT	Mobile Conduct-of-Fire Trainer
METL	mission-essential task list
MILES	multiple integrated laser engagement system
mm	millimeter
MPAT	multipurpose antitank (ammunition)

N

NATO	North Atlantic Treaty Organization
NBC	nuclear, biological, and chemical
NET	new equipment training
NETT	new equipment training team
NSN	national stock number

O

OIP	optical improvement package
OPORD	operation order
OPTEMPO	operational tempo
OSU	optical sight unit

P

PAAR	platoon after-action review
PDCU	power distribution and control unit
PGS	precision gunnery system
PGT	platoon gunnery trainer
PM TRADE	Project Manager for Training Devices
pwr	power

R

RETS	remoted-target system
RF	radio frequency
RPG	rocket-propelled grenade
RT	radio transmitter

S

S3	Operations and Training Officer (U.S. Army)
SIO	senior instructor/operator
SPC	special-purpose computer
ST	screening test
STEM	stationary target elevating mechanism
STRAC	Standards in Training Commission

T

T	thermal (target designator)
TBOS	tracer, burst, obscuration simulator
TC	tank commander, training circular
TCGST	Tank Crew Gunnery Skills Test
TD	training device, training documents
TDRS	training data retrieval system
THMTG	target-holding mechanism-tank gunnery
TIS	thermal imaging system
TIU	target interface unit
TKS	target kill simulator
TM	technical manual
TOW	tube-launched, optically tracked, wire-guided (missile)
TPS	turret position sensor
TRADOC	United States Army Training and Doctrine Command
TSC	Training Support Center
TSUH	Training System Utilization Handbook
TSV	Thru-Sight Video
TT	tank table
TWGSS	tank weapon gunnery simulation system

U

U.S.	United States (of America)
USAARMC	United States Army Armor Center
USAARMS	United Stated Army Armor School

V

VCR	video cassette recorder
VFS	visual flash simulator
vol	volume

X

X	power (magnification)

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By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0022201

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