Maximizing the Benefits of Digital Ranges

by Samuel Epstein

A new armor crew walks into an after-action review (AAR) conducted by a recently promoted sergeant vehicle-crew evaluator (VCE) who just graduated from training. The tank commander, gunner, loader and driver eagerly wait to learn how well they engaged the presented targets during their Table VI crew gunnery qualification. They know they dropped one engagement but feel confident about the others.

Earlier that morning, contractors had appended Integrated Player Unit Recorders (IPURs) and thru-sight video (TSV) optical devices on their sights to capture their conversations, location, bus data, scanning techniques and targeting procedures.

The crew did not do as well as expected on this daytime run. They passed four of the five engagements, with 377 points and an ability to obtain Q1 status with a successful night event. They saw the engagements captured with TSV and field cameras and didn't disagree with any of the scores.

"I don't know," the vehicle commander (VC) said as he walked away with less confidence than he possessed 20 minutes earlier. "I still don't know why we missed two of the three targets on that final engagement."

How did this happen? The AAR occurred immediately after the table execution, involved all participants in the discussion and focused on training objectives and standards. Unfortunately, this crew never learned why they dropped the engagement, even with available answers, because:

- There was little to no leader presence or participation in the AAR (AAR fundamentals derive from ***The Leader's Guide to After-Action Reviews***);
- Leaders and VCEs do not know how to use the instrumentation available on digital ranges;
- VCEs were not qualified on the platform on which they give the AAR;
- Planners made a conscious decision not to employ the full array of feedback enablers; and
- The VCE by default was the AAR gunnery expert and facilitator rather than someone who supports the experienced facilitator and trainer (two levels up) with scoring and information retrieval.

The vignette reflects a real encounter observed during a 12-month post-fielding training-effectiveness analysis (PFTEA) of the Digital Range Training System (DRTS) that the Army's deputy chief of staff G-3/7 initiated. The crews and units participated in Gunnery Tables V/VI, IX and XI/XII in M1 Abrams tanks, M2/M3 Bradley Fighting Vehicles (BFVs), Stryker Infantry Carrier Vehicles and AH-64D Apache helicopters.

The Combined Arms Center-Training (CAC-T) Training Support Analysis and Integration Directorate (TSAID) conducted the PFTEA, working in unison with U.S. Army Training and Doctrine Command (TRADOC) Capability Manager (TCM)-Ranges and Program Executive Office for Simulation, Training and Instrumentation (PEO-STRI). The team assessed the effectiveness of DRTS-equipped ranges "to determine whether units achieve desired readiness levels with or without DRTS" and to "determine optimal management options." The team coordinated all data-collection efforts with U.S. Army Forces Command and the Army National Guard Bureau.

TSAID used surveys, observations and discussions with leaders and planners during site visits for its analysis. It collected responses from 739 Active Component and Army National Guard Soldiers (privates through lieutenant colonels) assigned to nine units across four installations using digital and non-digital ranges.

Based on the PFTEA results, CAC-T started incorporating recommended programmatic changes to improve DRTS. PEO-STRI testing is underway on new sights and equipment to improve the human interface. However, only the chain of command can implement the necessary steps to maximize training effectiveness on the ranges.

Step 1: leader presence at AARs

Throughout the PFTEA, analysts noted little to no leader presence or participation at armored brigade combat team (ABCT) crew-level AARs. For example, during two days of crew-level Table VI qualification events, on two ranges, analysts attended daylight AARs for two tank companies and 30 Bradley crews. A platoon leader, master gunner or senior noncommissioned officer (NCO) (staff sergeant or above not a member of the vehicle crew)

attended just five AARs). Two of those five AARs had external senior leadership in the audience, and two had platoon leaders as the crew commander. Enlisted VCs benefited from senior mentorship for only one of the AARs.

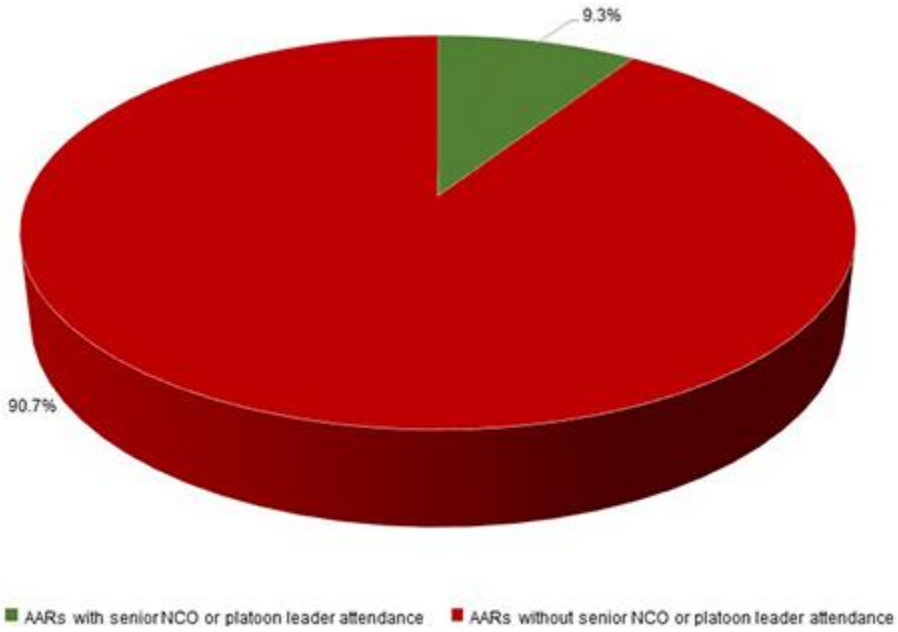

Figure 1. Observed senior NCO or platoon-leader attendance at crew-level qualification AARs during one site visit. Almost 91 percent of the AARs lacked senior NCO or platoon-leader attendance.

Other ranges and installations lacked leadership during ABCT crew-level AARs. For example, during Table V/VI gunneries on the non-instrumented multi-purpose range complex, the battalion command sergeant major attended one AAR. During two consecutive days of observing daylight Table VI events, the analyst did not see the company commander or first sergeant at any AAR, nor observe platoon sergeants or platoon leaders regularly attend crew debriefs.

Because leaders abrogated their training responsibilities, VCEs conducted AARs and served as the primary trainers during qualification training. While enthusiastically conducting their duties, some VCEs do not have the background, experience and/or vehicle expertise to effectively scrutinize crew interactions and dissect gunnery techniques. Current directives do not uniformly require VCEs to hold qualifications on the evaluated platform or as a vehicle commander. The VCE's mostly platform-neutral instruction emphasized scoring vice targeting and crew coordination.

Leaders cannot forfeit their duties to VCEs. They provide experience and expertise and should team with VCEs to explore areas of improvement based upon an inherent understanding of the crew's strengths while simultaneously gaining insight on possible unit-wide training shortfalls. During the PFTEA's observations, leaders – not the VCE or crew – initiated almost every instance of positive AAR feedback and real learning.

Step 2: know the equipment

Learning how to use the ability available through the DRTS instrumentation to provide "ground truth" rapidly allows AAR facilitators to leverage those capabilities to enhance feedback sessions.

Digital (i.e., "instrumented") and non-digital ranges provide comparable maneuvering area and train similar echelons (Table 1). However, digital ranges also collect Global Positioning System (GPS) information for the vehicle and deliver live TSV (including scanning sectors); internal and external audio communications; and internal bus information (vehicle-dependent) through an integrated network (Figure 2).[1] This immediately enables the AAR's facilitator to establish the cause-and-effect of crew actions and allows the facilitator and the crew to move rapidly forward to the learning necessary to improve crew performance.

	RANGE FACILITY	Non-automated	Automated	Instrumented	Team / section / squad	Platoon	Company	Mounted	Unstabilized	Stabilized	Aviation	Air defense	Unamanned aircraft system	Indirect
DIGITAL RANGES	Battle Area Complex (BAX)		X	X	X	X	X	X	X	X	X	X	X	X
	Digital Air Ground Integration Range (DAGIR)		X	X	X	X	X	X	X	X	X	X	X	X
	Digital Multipurpose Range Complex (DMPRC)		X	X	X	X	X	X	X	X	X	X	X	X
	Digital Multipurpose Traning Range (DMPTR)		X	X	X			X	X	X	X	X	X	X
NON-DIGITAL RANGES	Automated Multipurpose Range Complex-Heavy (MPRC-H)		X		X	X	X	X	X	X	X	X	X	X
	Automated Multipupose Training Range (MPTR)		X		X			X	X	X	X	X	X	X
	Scout/Recce Gunnery Complex (SRGC)		X		X			X	X	X		X	X	

Table 1. Range-capabilities matrix (from TC 25-8, *Training Ranges*, July 22, 2016).

Between four and 12 field cameras (depending on the installation and range) provide color and thermal images that operators may configure to automatically slew to the targets in each engagement upon exposure. DRTS incorporates Aerial Weapon Scoring System (AWSS) (on the Digital Air-Ground Integration Range) or portable AWSS (other digital ranges) for aviation units. Leaders may request information on a DVD or upload the results to a hard drive for review back in the command area. The ability to reuse AAR products and high-quality video allows leaders to leverage these products to assess crew improvement and provide examples of exceptional performance, or provide techniques and procedures of highly trained crew to crews that may not yet be at that level.

DRTS' scenario-development tool (SDT) provides a stand-alone software package that guides master gunners through preparing a targeting plan that meets the commander's intent. SDT, normally (but not necessarily) located at the Range Control Safety Office, allows personnel to create and export a scenario file without physically visiting the range. This tool allows commanders and their master gunners to introduce operational variables and conditions to challenge crews.

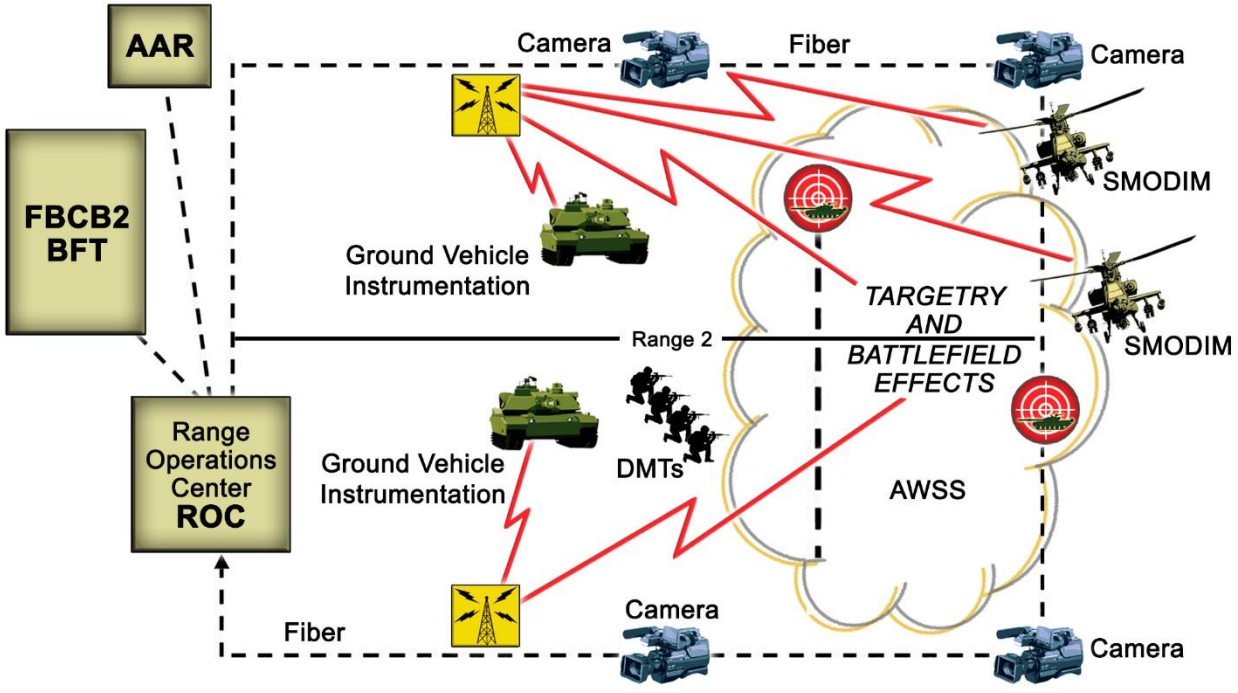

Figure 2. Typical layout of an Instrumented Range (IR)/DRTS.

However, some said the instrumentation simply took too long to install. During timed installations, contractors required less than 20 minutes to append DRTS equipment on vehicles. Crews and contractors overwhelmingly

reported less than one hour to mount IPUR network gear. For a very small amount of time invested, the digitally supported AAR with an experienced trainer/facilitator can dramatically improve training effectiveness.

Leaders may also incorporate the Dismounted Tracker (DMT), which provides real-time GPS position location of dismounts throughout the digital range. Facilitators may subsequently use DMT playback and camera information during AARs.

Depending on the vehicle, DRTS records the targeted and true range to an objective based on GPS. With DRTS, the VCE begins assembling the AAR in the tower during gunnery events the unit plans. Master gunners, working with commanders, continue to assess execution of the gunnery tables according to field manuals and training circulars (TCs).

During engagements, the VCE may mark specific segments for review or prepare the chart for areas of interest. This allows the VCE to assist a trained and experienced AAR trainer/facilitator to focus the AAR on specific areas for improvement. Again, users on a digital range may request DRTS contractor operators to burn AARs to DVDs or download them to a unit-provided hard drive for later review (Figure 3).

Figure 3. A view of the AAR take-home package.

DRTS allows tower operators, master gunners, unit leadership and VCEs to see targets as sighted by the crew during live-fire events. Not only does this afford opportunities for more comprehensive AARs, senior leaders also noted it provided more safety. DRTS also offers line alerts, useable as phase lines in an operations order, which trigger targets to expose during a step or engagement. Force XXI Battle Command Brigade and Below (FBCB2) tactical-operations center kits allow the user to create and transmit Blue Force Tracker (BFT) messages to meet the digital requirements of gunnery tables. This enables the complex training environments that our maneuver force requires to fight and win in a complex world.

TSV, coupled with information from the IPUR network, presents a wealth of information for crew, team and platoon-level AARs. With appropriate leadership participation and properly experienced and trained VCEs, DRTS provides multiple methods to positively reinforce proper techniques and guide the crew to improve proficiency where needed. In other words, it offers video, audio, spatial and graphical representations for an AAR's "sustains" and "improves" (Figure 4).[2]

Figure 4. DMPTR AAR.

Step 3: employ all feedback enablers

DRTS provides the ability to conduct an AAR immediately as crews dismount from their vehicles and report for their evaluation. Responses to the statement that the AAR "proved worth the wait" did not differ significantly between the digital and non-digital ranges (Figure 5).

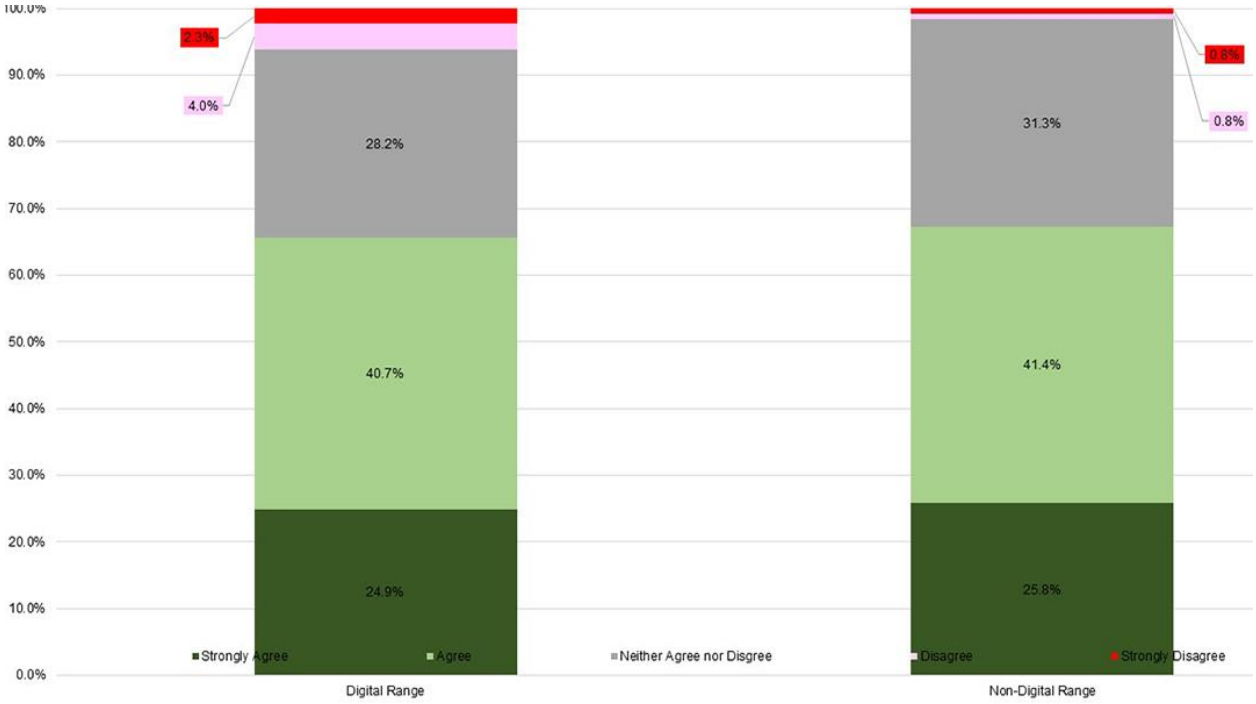

Figure 5. Leadership response to the AAR proved "worth the wait." To the question, was the AAR "worth the wait," about 25 percent answered "strongly agree" and about 41 percent indicated "agree." There was little difference between the digital-range survey, left, and the non-digital range survey, right.

On a practical level, DRTS offers insights not available on standard, non-instrumented ranges. For instance, during one site visit, one sergeant first class said during a Table V AAR preview before the VC's entrance, "He needs to see this to understand why he's not hitting it." On the following day on a different range, a VCE asked a crewmember while engaging the target, "Why didn't you narrow the field of vision?"

When employed by engaged leadership, supplemented with an experienced and qualified VCE, DRTS provides an array of capabilities not available on a comparable non-digital range. The ability to incorporate easily audio, video,

targeting and positioning information to provide graphic insights – without requiring extra time to prepare the AAR – allows crews to use multiple learning styles of self-identified methods of improvements and offers the potential to advance gunnery outcomes.

ABCT AARs primarily used instrumentation and TSV as an instant replay during crew-level (Table V/VI) events the PFTEA observed, not to correct gunnery procedures. Quantifying an example from one site visit, over a four-day period on two ranges with different vehicles and units, only three AARs witnessed by one analyst used TSV to correct gunnery techniques (although one AAR used it on multiple occasions).

Several months later, with a different unit, a VCE used a portion of information available from the TSV to review gunnery procedures. Unfortunately, other important aspects of the Table VI event, including leaving the sight in boresight mode, only became obvious to the crew upon interjection by the brigade master gunner, present because of a visit by senior leaders.

Leaders can schedule digital multi-purpose range complexes for 24-hour operations for up to 10 consecutive days and DMPTRs for 16-hour operations for up to 10 consecutive days. While unhesitatingly using the DRTS training areas, no ABCT elected to append instrumentation on all their vehicles for every Table XII event. Company first sergeants appeared unaware of the ability to track dismounted Soldiers via the DMT.

During the hotwash conducted following one Table XII, the company commander noted the BFV along the right flank failed to engage multiple targets. Had the unit used TSV and a geographic display of scanning techniques in the AAR, the evaluation would likely contain more definitive information as to the number of targets not engaged and help assess why the crew did not shoot at the targets during their lane transit. The crew did not use any audio or video feedback during their hotwash, nor did they capture it for future replay in a take-home package.

At a separate Table XII event, platoons scored primarily in the 60 percent to 70 percent range (with one platoon scoring in mid-80s). The lead evaluator (an infantry first lieutenant) and the VCE (an Armor sergeant) did not know that DRTS could show the Armor platoon's scanning procedures and each combat vehicle's sector. Only two vehicles included TSV and IPURs.

Step 4: leadership offers gunnery expertise with VCE support

During the PFTEA, analysts observed that AH-64D crews worked in conjunction with the RQ-7 Shadow unmanned aerial vehicle and dismounted Soldiers during training events on a digital range. With master gunners, battalion staff and company commanders attending or delivering the AH-64D AARs, crews benefitted from multiple levels of experience. They also routinely used the advanced feedback that instrumentation provides.

In both surveys and conversations, AH-64D crews strongly favored digital ranges and the AAR capabilities. During company events, AH-64D crews benefitted from visualizing sensor orientation, crew audio and video, multiple target-effect data and aircraft location, and target-effect data. Not surprisingly, AH-64D aviators expressed a strong preference for the digital range (Figure 6).

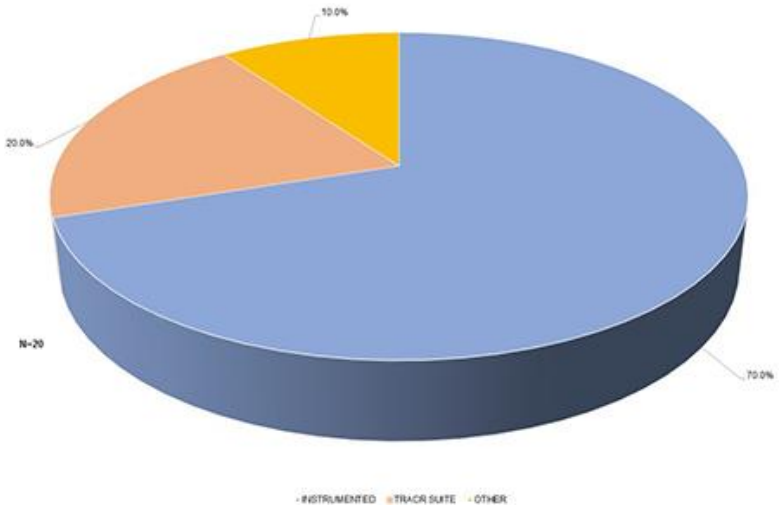

Figure 6. AH-64D aviator range preferences. AH-64D aviators expressed a strong preference for the digital range, shown in blue.

Conversely, ABCT crews expressed ambivalence toward digital ranges. The Army's digital ranges provide tanks, Bradleys and Strykers the same level of feedback available to aviators. While offering the same technical infrastructure, ABCTs failed to use the demonstrably capable feedback tools to assess performance.

Way ahead

The PFTEA identified aspects of program management that may expand the availability of training hours on digital ranges. However, only commanders can take the most effective actions to improve live-training events. Steps within the commander's purview include:

- Consider the VCE's qualifications. If not satisfied with the VCE's level of experience, express your concern to the division master gunner and S-3.
- Conversely, only assign NCOs to VCE training that already hold VC qualifications in a crew-level gunnery event. In other words, assign a VCE for training and observation with the same skills and experience sought for AARs.
- Learn what DRTS provides and how to incorporate the information during AARs while planning the gunnery event. Discovering the capabilities when arriving on the range will not afford enough time to instruct VCEs and unit leadership how to maximize DRTS.
- Equip dismounted Soldiers with DMT to graphically display approach patterns.
- Plan to use the AAR facilities available on DRTS ranges. DRTS operators provide instrumented inputs to VCEs with enough lead time as to allow training to continue unabated. During observations, leaders did not report any variance in the time necessary to receive the AAR with the enhanced feedback DRTS provides.
- Inquire into expanding time on DRTS ranges. Though nominally available for five days a week, installations can extend the range hours – without adding overtime – with advanced notification.

Most importantly, ***leaders must engage their crews in AARs***. Unit leadership, whether a senior NCO or someone external to the platoon or company, improves the feedback crews receive. Training is only as effective as the feedback the events receive. Technology cannot eliminate the need for a leader's participation, nor can it mitigate the lack of leader involvement.

Digital ranges offer incontrovertible and quantitative feedback to ground combat and aviation crews not available on their non-instrumented counterparts. Through use of sight optics, GPS location date and sensor feedback, digital ranges offer expanded awareness of the crew's gunnery event.

One year of observations only confirms that engaged leadership two levels up remains the most important aspect of any training event.

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Endnotes

[1] Product manager, digitized training and TCM-Ranges, IR/DRTS concept of operations, Feb. 1, 2016.
[2] TSAID, July 26, 2016.

Acronym Quick-Scan

AAR – after-action review
ABCT – armor brigade combat team
AWSS – Aerial Weapon Scoring System

BFT – Blue Force Tracker
BFV – Bradley Fighting Vehicle
CAC-T – Combined Arms Center-Training
DMPTR – Digital Multipurpose Training Range
DMT – Dismounted Tracker
DRTS – Digital Range Training System
FBCB2 – Force XXI Battle Command Brigade and Below
GPS – Global Positioning System
IPUR – Integrated Player Unit Recorder
IR – instrumented range
NCO – noncommissioned officer
PEO-STRI – Program Executive Office for Simulation, Training and Instrumentation
PFTEA – post-fielding training-effectiveness analysis
SDT – scenario-development tool
TC – training circular
TCM – TRADOC capability manager
TRADOC – (U.S. Army) Training and Doctrine Command
TSAID – Training Support Analysis and Integration Directorate
TSV – thru-sight video
VC – vehicle commander
VCE – vehicle-crew evaluator