Training
Objective Force Embedded Training (OFET)
Users’ Functional Description

Summary. This pamphlet lays out the operational requirements, from a user’s perspective, of embedded training (ET) in the Objective Force (OF). It provides a wide range of ET requirements that can be reviewed and selected for application to specific OF systems as necessary to generate a Users’ Functional Description for a particular system.

Applicability. This pamphlet applies to Headquarters, U.S. Army Training and Doctrine Command (TRADOC), and all subordinate organizations responsible for developing requirements for ET components of OF systems.

Suggested improvements. The proponent of this pamphlet is the Deputy Chief of Staff for Operations and Training (DCSOPS&T). Send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) through channels to Commander, U.S. Army Training Support Center, ATTN: ATIC-SAlI, Fort Eustis, VA 23604-5166. Suggested improvements may also be submitted using DA Form 1045 (Army Ideas for Excellence Program (AIEP) Proposal).

Availability. This publication is available on the TRADOC Homepage at http://www.tradoc.army.mil/htm

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Chapter 1
Introduction

1-1. Purpose.

   a. This Users’ Functional Description (UFD) pamphlet lays out the operational requirements for embedded training (ET) in the Objective Force (OF). The Objective Force Embedded Training (OFET) UFD will serve as a basis for mutual understanding, between users and the developer, regarding the operational requirements for an embedded, full-task trainer. The UFD will also be used as the basis for development of system tests.

   b. The composition of the OF covers a wide range of systems. The range of systems extends from mainstay systems of Future Combat System (FCS), Objective Force Warrior (OFW), Comanche, Objective Force Command and Control System/Force XXII Battle Command Brigade-and-below (FBCB2), and Interim Armored Vehicle/FCS, to the rest of the 60 plus systems planned for the OF. This pamphlet is designed to cover this range of systems. When a particular system is being considered, this pamphlet can be tailored to fit the specifics of the particular system. While specifics may change from system to system, there must be consensus on the core requirements needed, to enable the systems to participate together in a training environment. The ET application will need to send data to, and receive data from, OF weapon systems, training devices, learning management system, and sources for training and performance support material. Collective training across the OF depends on systems complying with the ET standards, and thus making it possible for them to operate in the network centric training battlespace.

1-2. References. Required and related publications are listed in appendix A.

1-3. Explanation of abbreviations and terms. Abbreviations and terms used in this pamphlet are explained in the glossary.

1-4. Embedded training. Embedded training is defined as a function hosted in hardware and/or software, integrated into the overall equipment configuration. (See the glossary for a full definition of ET.) The diagram at figure 1-1 shows how the ET subsystem connects and communicates with other systems, both within and external to the system/platform. The soldier receives information from the displays, and takes action by making menu selections, pushing buttons, etc. The ET application on the system senses the actions and injects stimulus, changing the displays. When crew actions change the common operating picture (COP), the information is transmitted to other platforms, updating the COP in all the other platforms in the exercise.
Communication with the infrastructure is also required. The ET application uses the system/platform communication system for these communications. Connection between the ET application and communication system is over the weapon system/platform internal network.

1-5. Challenge. A growing range of operational scenarios that must be handled complicates the training of warfighters, responsible for using complex weapon systems in combat. Rapid changes in warfighting capabilities are driven by incorporation of new components and versions. In traditional systems, training is carried out using occasional courses and long-term accumulation of experience, gained by participation in progressively challenging training exercises. On the contrary, current and future warfighters need weapon systems with new training modes that can deliver a full spectrum of effective training strategies, in a complex and rapidly changing operational and technological environment. Potential ET possibilities, and the processes for designing, testing, and producing new and innovative ET applications, are poorly understood. For over a decade, the Army has been trying to obtain new weapon systems with "embedded training" capabilities. Despite the best intentions on the part of materiel, combat, and training developers, punctuated by a few remarkable successes, ET is a widely misunderstood concept that is not yet ubiquitous. At the core of the problem are requirements for ET applications that have been poorly defined, both by the Government, which contracts for it, and by industry as a whole, which developed them. Whether ET actually produces the desired training outcomes is also suspect, because many “successes” cannot be satisfactorily tested or shown to produce a training benefit. Part of the problem is that, to date, ET has been approached in a manner that emphasizes the administrative process, and disregards disciplined technical processes—an all-too-common practice that results in a high-risk manner of operation. In the majority of cases, upfront requirements identified in operational requirements documents (ORDs) merely state that ET will be provided, or words to that effect. It follows that projects to embed training capabilities in operational equipment and systems have not succeeded for technical reasons, notwithstanding efforts in the area of new equipment training (NET) applications that are exceptional by being successes. New equipment training is provided to system operators and other key personnel upon initial fielding of new systems. Materiel developers are responsible for NET. But, NET is entry-level training on “knob-ology,” the type of skills traditionally documented in user manuals, not “battle-focused” training that achieves and sustains proficiency on all possible soldier, leader, and collective tasks.

1-6. Vision. The OFET program envisions future training operations as a continuous process, supported by integral, ET support systems. These ET support systems will assist commanders and tactical operations staff, units, and soldiers to practice and hone critical warfighting skills, through direct interactions with their warfighting systems. Their warfighting systems will incorporate a full spectrum of training support modes as integral components of the system design. Objective Force Embedded Training capabilities will integrate with warfighting system components that monitor system operations. They will automatically interoperate with training system servers to collect training data; simulate weapons and weapon effects; allow for control and stimulus of training exercises; support effective collection, organization, and transfer of training information regarding training experiences and lessons learned; and extract training scenarios from digital libraries. The OFET support systems will provide hands-on training in the full-training spectrum, from new equipment (operator/maintenance) training and sustainment training, to participation in stressful and challenging tactical exercise scenarios, including
“normal” offensive and defensive maneuvers and engagements, and stressful retrograde and emergency scenarios.

Figure 1-1. Embedded training concept diagram
Chapter 2
System Summary

2-1. Background.

a. Trained and ready forces are the key to our Nation’s security, and our National Military Strategy. Our ET strategy, as laid out in this pamphlet, will prepare our commanders, staffs, and soldiers, to fight and win on a network centric battlefield that will be a seamless web of data, information, and knowledge. The application of this modern technology will continue to alter the way soldiers and commanders view the battlefield and carry out their military operations.

b. Training is the cornerstone of readiness, and the basis for credible deterrence and capable defense; therefore, the OF will need a full spectrum of training and performance support capabilities. Training must ensure soldiers and leaders are prepared to employ the Maneuver Unit of Action (UA) and achieve its full combat potential of full spectrum dominance. Embedded training will be the key training component and will support new equipment training, unit sustainment training, as well as battle-focused, mission-essential individual and collective training.

c. Soldiers, leaders, and units must always be prepared and ready to support the Army’s basic mission—to fight and win in war. Continuous practice and training is the price for developing and maintaining warfighting proficiency of soldiers, units, and leaders, and sustaining the confidence they will require in combat. The training of soldiers to use complex weapon systems in combat is increasingly challenging. The knowledge required to operate these systems effectively is very complex, and changes very rapidly. Complexity is driven by several factors: growing richness of features, combinations of interactions among an expanding number of system components, and a growing range of operational scenarios that must be handled. Incorporation of improved capabilities, and new versions of software, drive rapid changes in warfighting capabilities. Soldiers in the OF will rely on ET and performance support, to be prepared for information intensive combat missions.

d. This UFD pamphlet focuses on the requirements needed to develop and implement ET for warfighters in the OF. Future training operations must be a continuous process, supported by integral ET. Objective Force units must be resourced to achieve this level of proficiency. Objective Force leaders will depend on ET capabilities for their units, thus reducing the training development burden, by providing access to existing training support packages, and semiautomated tools, for tailoring them to users’ needs. As part of this vision, network-based operator, maintainer, leader, and collective training applications will work with weapon system-embedded components, to deliver products like NET, sustainment training, engagement simulation, target, and exercise control capabilities.

2-2. Objectives. Use ET and performance support to deliver effective training to the tactical users of the system anytime, anywhere, using their operational equipment.
2-3. Existing methods and procedures.

a. Figure 2-1 compares today’s training capability against the future training capability, as addressed in the Army Training Strategy. In the past, first generation embedded and virtual simulators were only fielded for a few weapon systems at select sites. Today, newer, virtual tactical trainers are already being used for combined arms training. Embedded and virtual training opportunities will increase, but they will not replace live training. Instead, units will increasingly use embedded and virtual trainers for soldier, leader, and crew gated training tasks, in preparation for scheduled live training. This will be consistent with the unit’s Combined Arms Training Strategy (CATS), and the commander’s unit training plan, in accordance with (IAW) Field Manual (FM) 7.0 (previously FM 25-100), and FM 25-101, training management doctrine. Therefore, the size of the embedded and virtual circles increases within the future training model to enhance, but not replace, the “run” stage live training.

![Figure 2-1. Training capabilities](image)

b. There are training devices available at a unit’s home station and at combat training centers (CTCs); however, in many cases these devices are not available to the soldier. Systems are increasingly becoming more reliant on data from other systems. Awareness of the battlespace depends more on sensors in collateral systems. Training a soldier or crew on their weapon system depends on receipt of the same types of data from those collateral systems, or simulation of those systems.

2-4. Proposed methods and procedures.

a. Embedded, full-task trainer is one part of the overall OF training strategy. Embedded training is only one of several available methods of training, but for the OF, it is the primary one based on Department of the Army (DA) guidance. There is a number of training delivery techniques (for example, text, lecture, computer-based training, guided practice, apprenticeship, and discovery learning). Embedded training is not appropriate in all cases. This pamphlet describes the cases where ET is appropriate, and necessary.
b. The ET audience includes several categories, operators, maintainers, unit leaders, and other tactical users. Each of these categories may require different training, and perhaps different training methods. Even if each of these groups requires the same training, it is important to determine this early in the Systems Approach to Training process.

c. The proposed OFET can be thought of in two pieces. One piece is embedded in the system. The second piece is the Training Support System (TSS) accessed via a reach (communication) capability. If required, it is possible that reach capability may allow some elements of the ET system to be shifted off the platform, and moved to the TSS training information infrastructure. The more that is shifted, the more “reach” capability will be required, to link the ET platform with its reach-back sources. Additionally, “reach” capability includes the need for ET to respond to the TSS reaching forward, to gather data-like performance data, lessons learned, tactics, techniques, and procedures, and tailored Training Support Packages (TSP), thus creating a learning environment, or knowledge network.

2-5. Assumptions and constraints. The following are the OFET assumptions and constraints:

a. Communication (via tactical communication systems), with TSS infrastructure, is available and able to provide robust, interoperable capability, supporting the “reach” required for OFET.

b. Operational equipment is available for training.

c. Operational equipment has both internal and external power sources to operate training application.

d. Training mode is separated (using a foolproof system) from operational mode, but uses all instruments, controls, menus, and screens used in the operational mode.

(1) Embedded training will be able to use system devices providing information to soldiers/crew members (for example, devices like dials, displays, gauges, and indicators).

(2) Embedded training will be able to use system devices receiving information from soldiers/crew members (for example, devices like cursor, mouse, trigger, control handle, pedals, wheel, switch, valve, buttons, and levers).

e. Equipment operational hours profile includes the training mode of operation.

f. En route mission planning and rehearsal communication system will be available for training.

g. A three-dimensional digital terrain database is an operational requirement, and will be available for training.

h. Security management audit requirements for operational system will also cover requirements for ET.
i. Intrusion detection and alert notification for operational system will also cover requirements for ET.

j. Encryption requirement for operational system will also cover requirements for ET.

Chapter 3
Detailed Characteristics

3-1. Performance requirements. Training subsystems should respond with the same speed as the operational system. They must have the same manpower and personnel integration, and visual and holistic performance characteristics. Additionally, changes to the operational system must result in concurrent changes to the training subsystem. The training subsystem should operate, even though the primary weapon system engine is off. The network connection should support data transmissions that are required to use the TSS reach capability. Data transfer/refresh rates, and video display rates, must be sufficient to support the integration of live-virtual-constructive (LVC) training into an integrated synthetic training environment (STE). For example, all participants in an integrated LVC exercise should be able to nearly simultaneously observe the destruction of a target entity. In other words, update time should be fast enough to accurately portray the operational system’s capability.

3-2. Functional requirements. The operational system contains interfaces between the system and operators, maintainers, or other users. Interfaces include displays, dials, indicators, menus, screens, windows, buttons, switches, control handles, levelers, pedals, wheels, valves and an “out of the hatch” view of the battlespace. Each of these interfaces is involved in individual, section/crew, unit leaders, battle staff, or battle commander tasks. Each of these interfaces must operate in the training mode, just as it would in the operational mode. Embedded Training is not the sole description of training requirements. The OF will also require web, or computer-based courseware, including Military Occupational Specialty (MOS)-related training, and leader development materials/opportunities. This course material is not necessarily stored on the operational system, but is obtainable (via reach capabilities) over the network, just as it is by laptop computer, or personal digital assistant.

a. Plan Training.

(1) Long Range - the system must be compliant with Army Training Information Architecture-Migrated (ATIA-M), and communicate with the Standard Army Training System (SATS).

(a) Provide calendar (months, quarters, and years) for planning and coordinating unit level training, to include specific units, list of missions, Mission Essential Task List (METL) tasks, and training objectives.

(b) Select TSP or set up time schedule for TSP modification.

(2) Short Range - the system must be compliant with ATIA-M and communicate with the SATS.
(a) Provide calendar (weeks and months) for planning training by individual and crew serial number weapon systems.

(b) Identify training events with training objectives, list resources required supporting agencies for coordination and specify training guidance.

(3) Near term - the system must be compliant with ATIA-M, communicate with the SATS, and provide calendar and clock for planning training by individual.

(4) Training Support Package development base.

(a) Individual soldier/crew skills training.

- Provide shot grouping, battle sight zeroing, scaled target practice, and proficiency course firing.
- Provide capability for soldiers to fire at targets (at distance comparable to those on battlefield); develop speed in target engagements; and develop confidence in individual ability.
- Provide capability for soldiers to practice engaging personnel targets in a simulated combat environment.
- Provide capability for soldiers to take multimedia courseware.
- Conduct individual exercise of crew position in a STE.

(b) Collective tasks.

- **Offensive Operations:**
  - Attack against prepared infantry defense.
  - Counterattack, or attack against advancing mechanized infantry forces.
  - Conduct operational maneuver to rapidly reposition by intratheater lift.

- **Defensive Operations:**
  - Conduct hasty defense against dismounted attack.
  - Conduct hasty defense against mounted and dismounted attacks.
  - Establish strong point defense against numerically superior dismounted forces.

- **Stability Operations:**
  - Secure a zone to separate warring factions, establish stability, and enforce treaty.

- **Support Operations:**
  - Conduct foreign humanitarian assistance (relief operations).

- **Other Mission Tasks:**
  - Conduct security operations in division and corps rear areas, to deny disruption.
  - Conduct reconnaissance in force to develop situation.
° Conduct an advanced guard in support of a division task force, versus a moving enemy.
° Conduct rapid overland forcible entry to secure airfield 50 km from landing site.

(c) Provide context sensitive help screens.

(d) Provide standardized graphical interface.

(e) Use standard conventions in the training mode as used for the operational mode.

(f) Use the same common style guide (look, feel, and function) for the training mode as used for the operational mode.

(g) Edit inputs for reasonableness, and question unreasonable inputs.

(h) Setting user preferences for the operational systems establishes the same preferences for the training mode.

b. **System Preparation.**

(1) Movement to Site.

(a) If there are additional training components required (which are not embedded in the system), present checklist to assist in preparation of shipping document and packaging of these components, using containers suitable for the mode of transportation.

(b) Every effort must be made to ensure that there are no components in addition to the embedded components, but if there must be, they should deploy on, or with, the platform.

(2) Installation. Present instruction for unpacking, and installation.

(3) System Initialization. Present instruction for power up, test, and load of software.

(4) Training Preparation. There are a number of selections necessary before training starts. Each individual/platform participating in the training will have to make some selections. Establish defaults to make some of the following selections automatic. Selecting an advanced function will provide a means to select something other than the default. The sequence of selection can be built to eliminate the presentation of menu after menu of selections. For example, trainers and leaders provide the exercise scenario, while soldiers participating in the training may adjust some parameters. At a minimum, the individuals, crews, and units participating must be recorded.

(a) Provide a means for trainee(s) to log in for identification (possibly by using a smart card and password for authentication) and set defaults automatically to their preference.

(b) Provide a means to choose training level (e.g., individual, crew, small unit, or unit leader/battle staff).
(c) Provide a means to choose type of training (e.g., qualification or informal).

(d) Provide access to standard training templates and tools, to modify these templates to meet the specific training needs of the unit.

(e) Leverage established communication capabilities to access selected external training systems and repositories (FCS ORD 3122).

(f) Provide means to select/configure Opposing Forces (OPFOR) echelon options (FCS ORD 3124 and 3127).

(g) Provide means to select/configure friendly force, including coalition forces echelon options (FCS ORD 3124 and 3127).

(h) Provide means to select/configure TSP/scenario from library (FCS ORD 3124 and 3127).

(i) Provide means to select/configure target set.

(j) Provide means to select/configure HyperText Markup Language web-based training (WBT).

(k) Provide means to select/configure Interactive Multimedia Instruction (IMI) from onboard library.

(l) Provide means to select IMI from external library, with options to temporary download.

(m) Provide means to immobilize selected vehicle/mechanical components for stationary training.

(n) Provide performance aids to assist in preparation for training activities (e.g., checklists for settings of switches and circuit breakers).

(o) Provide means to select/configure training for deterministic (fixed) scenario or stochastic (probabilistic) simulation.

(p) Provide means to select/configure deterministic or stochastic gunnery.

(q) Provide context-sensitive help screens.

(r) Provide standardized graphical interface for ease of learning.

(s) Use the same common style guide (look, feel, and function) for the training mode as used for the operational mode.
(t) Edit inputs for reasonableness, and question unreasonable inputs.

(5) Review and Overview Prior to Training.

(a) Provide means to review and confirm selections from scenario preparation.

(b) Provide means to quickly overview scenario, so the trainer can become familiar with material.

(6) Training Preparation Verification. Provide performance aids to assist in preparation for training activities (e.g., present information indicating all system components are on-line, and ready for training to commence).

c. Training Execution.

(1) General Training Execution.

(a) Deliver training at institutions, home station, deployed, en route, or in CTCs. (FCS ORD 1016)

(b) Train individuals, crews, and unit leaders/battle staff concurrently during separate exercises on the same network.

(c) Train using the soldier’s own operational equipment, including displays, menus, controls, dials, indicators, buttons, switches, pedals, levers, etc.

(d) Present realistic operational conditions/situation.

(e) Control operational displays presenting completely simulated data.

(f) Overlay live operational data with simulated targets or threats, and adjunct friendly forces.

(g) In the training mode, sense and transmit soldier’s responses to the situation using operational equipment.

(h) Simulate and display the operational situation in response to soldier’s actions.

(i) Change the display, showing the operational situation in the training mode, based on ongoing actions and inputs from live, virtual, or constructive simulators/stimulators.

(j) Receive, process, and display training data in the same way as the operational system receives, processes, and displays operational information.

(k) Support rehearsal of planned missions in digital terrain, representing mission area and anticipated OPFOR, in both stand-alone and networked mode.
(l) Generate simulated operational input data (target, threat, enemy, friendly, etc.).

(m) Accommodate common training in a LVC simulation environment.

(n) Provide training in degraded operational modes (operating without the full range of capabilities).

(o) Training mode should be easy to initiate, scenarios should be easy to update, and training applications should be easy to change.

(p) Support easy update of software, and provide notice to user when updated.

(q) Support easy selection of OPFOR parameters, strength, type, tactics, etc. (FCS ORD 3124 and 3127)

(r) Support easy development or selection of exercise scenario. (FCS ORD 3124 and 3127)

(s) Support easy selection of precision gunnery table exercises.

(t) Respond with audio (explosion sound) and visual (smoke) cues.

(u) Provide visual references, including daylight, nighttime, weather, lighting conditions, atmospheric visibility, and obscurants; for dismounted soldier—optical sight, vision block, and out-the-hatch views.

(v) Provide capability in the training mode for individuals to make inputs associated with their position tasks, and provide system response, through tactical equipment operation, or through simulation with appropriate outputs.

(w) Display data and accept inputs to navigate unfamiliar terrain.

(x) Provide automation features designed to reduce driver/crew workload in the training mode by employment of operational equipment, or by simulation of the function of the operational equipment.

(y) Provide the ability to train the skills of maneuver of unmanned platforms with manned platforms, performing reconnaissance and lethality functions, when in the training mode, by employment of operational equipment, or by simulation of the function of the operational equipment.

(z) Interoperate, transport, support and augment OFW.

(aa) The ET system must provide the ability for OFW to remotely control operational or simulated FCS weapons and intelligence surveillance reconnaissance, when in the training mode.
(bb) Support the use of Mobility Decision Aids that use geospatial information, enemy situations, and future actions, to recommend mobility operating areas when in the training mode, through the employment of operational equipment, or through the simulation of the function of operational equipment.

(cc) Provide the use of the mobility system to detect, identify, clear, and breach obstacles from a stand-off position when in the training mode, either through the use of the operational equipment, or through the simulation of the function of the operational equipment.

(dd) Provide the capability to mark areas for hazards and operating areas, and to update the COP when in the training mode, through the employment of the operational equipment, or through the simulation of the function of the operational equipment.

(ee) Provide the ET capability, when in the training mode, to recognize voice commands, including specified voice cues used among crew, team, squad, and platoon members.

(ff) Provide the capability, when in the training mode, to recognize hand signals, including established leader instructions, directions, and information used intrasquads, intersquads, and platoons.

(gg) Operate an “on-the-platform” simulations/simulator that enables crews to conduct multiple drills, on the move, without external training aids or facilities. (FCS ORD 1078)

.hh) Provide the capability to simulate sensor data, including performance under normal conditions, influence of weather and atmospheric conditions, implications of porous and nonporous foliage, and the effects of varying target characteristics and behavior (for example, temperature contrast, color and background contrast, movement, and size).

(ii) Support access to, or simulation of, interaction with higher headquarters (HQ), and joint, interagency, multinational and special operations forces HQ, and also to simulate the interaction with all lower echelons, down to, and including, small tactical units/individual platforms in support of training exercises.

(jj) Support courseware, including highly interactive text; three-dimensional graphics; audio, animation, color, and full screen video; IMI; Computer Based Training (CBT); Computer Based Instruction (CBI); WBT, Intelligent Tutor System (ITS), and intelligent Computer Assisted Instruction (CAI).

(kk) Provide tutorial for soldier, crewmember, unit leader, staff member showing position and operation of controls, menus, displays, indicators, etc.

(ll) Provide access to Interactive Electronic Technical Manuals for operation and maintenance of the system, while in the training mode.

(mm) Support reach to life-long learning resources in Reimer Digital Library (RDL) and other institutional sources or knowledge repositories compliant with Army Knowledge Enterprise. (FCS ORD 3341)
(nn) Training mode will have the same functionality and work-arounds as the operational system.

(oo) Provide FCS characteristics to the modeling activities, to update legacy simulations.

(pp) Support ability to operate/analyze on-board power recharging capabilities. (FCS ORD 1046)

(qq) Support the ability to operate laser warning and detection system. (FCS ORD 1068)

(rr) Support the use of voice and digital command and control (C2)/COP capabilities in a secure mode. (FCS ORD 1496)

(ss) Support the use of on-board system to acquire, detect, recognize, and identify targets. (FCS ORD 1499)

(tt) Support the ability to accept, analyze, and access on-board and external sensor inputs. (FCS ORD 1501)

(uu) Support operation of power source to maintain battery charge to equipment. (FCS ORD 1513)

(vv) Simulate launch, recovery, and storage of organic unmanned ground and air vehicles. (FCS ORD 1517)

(ww) Support operation of crewed platform by one crewman, including operating fire control and armament systems while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1519 and 3405)

(xx) Support remote operation of all platform capacities/tasks by dismounted crewman. (FCS ORD 1535)

(yy) Support employment of primary and secondary weapons and protective systems upon initiation of main power. (FCS ORD 1547)

(zz) Support assuming control of unmanned system from “owning” crew/agent. (FCS ORD 1558)

(aaa) Support use of sensors, reconnaissance, and communication systems to send information to the Reconnaissance and Surveillance Vehicle (RSV), while stationary, or on the move, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1565)
(bbb) Support operation of RSV close support weapons, while dismounted, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.  (FCS ORD 1623)

(ccc) Support operation of the common operator interface for the laser designator/rangefinder, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.  (FCS ORD 3317)

(2) Individual Training Support.

   (a) Provide shot grouping, battle sight zeroing, scaled target practice, and proficiency course firing.

   (b) Provide the capability for soldiers in training to engage targets, under realistic battlefield conditions, to develop target engagement speed, and individual confidence.

   (c) Provide capability for soldiers in training to practice engaging targets in a simulated combat environment.

   (d) Provide capability for soldiers to take multimedia courseware.

   (e) Conduct individual exercise of crew position in a STE.

   (f) Provide MOS sustainment skill level training.

   (g) Provide ET systems that enable soldiers to access the requirements for professional development for their current MOS.

   (h) Provide access to career mapping, which will be available via the Army Training Information Architecture (ATIA), that will clearly define for the soldier those requirements for MOS maintainability, promotion, self-development, and career advancement.

   (i) Provide soldiers with the capability to access WBT, utilize online equipment diagnostic capabilities, and initiate correspondence courses for self-development.

   (j) Resident training will be dramatically reduced in length, but not scope. Soldiers will be required to attend technical portions of their MOS requirements in residence.

(3) Collective Training Support.

   (a) General Collective Training.

      • Provide training mode support for the execution of collaborative and cognitive full-range mission planning and rehearsal, from alert, through deployment, to employment, through the use of operational equipment, or through the simulation of the function of the operational equipment.  (FCS ORD 1139)
• Provide training mode support to the acquisition of skills involved in integrating the force into gaining theater command during movement, through the use of operational equipment, or through the simulation of the function of the operational equipment. (FCS ORD 1016)

• Provide support for the acquisition of skill in transitioning quickly between tasks, purposes, and directions, and maneuvering into and out of contact, when in the training mode, by the employment of operational equipment, or through simulation of the function of operational equipment.

• Support horizontal maneuver, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support vertical maneuver, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support day and night maneuver, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support maneuver in all terrain conditions, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support maneuver in all weather conditions, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support maneuver, synchronized with combined arms Army forces, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support maneuver, synchronized with Joint fires, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support maneuver, synchronized with reconnaissance, surveillance, and target acquisition (RSTA), using Mission Equipment Package sensors, to coordinate non-line-of-sight (NLOS)/Beyond Line-of-Sight (BLOS) fires in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2542)

• Support interoperation with Army legacy systems, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support interoperation with Army interim systems, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support interoperation with joint and interagency systems, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support interoperation with allies’, coalitions’, and nongovernmental organization’s (NGO) systems in the training mode, by the presentation of required data generated
from operational equipment, or by the simulation of the function of operational equipment.

- Support operation of machine language translation for text-to-text, text-to-voice, voice-to-text, and voice-to-voice translations, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1040)

- Support the operation of problem solving/decision aids across battlefield functional areas, for all echelons and joint assets, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1061)

- Support communication with dismounted and mounted forces, their leaders, and soldiers, with mutually supporting and relevant situational understanding, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support the control of unmanned technology in manned systems, to enhance continuous 24-7 operations, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support the operation of early warning systems to detect enemy ground launched conventional and smart weapons, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support the interception of enemy ground launched conventional and smart weapons, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support the interception of enemy air threats, primarily helicopters and Unmanned Arial Vehicles (UAVs), in a multifunctional all-arms approach, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1249)

(b) Electronic warfare (EW) requirements.

- Simulate the signatures and electronic emissions of high value enemy C2 positions.

- Display effects of EW attack signals.

- Display effects of command, control, communications, and computers (C4) network attack.

- Collect and report data gathered from EW sensors, to training instrumentation systems.

- Collect and report data collected, during EW attacks on friendly systems, to training instrumentation systems.

- Collect and report data collected, concerning unit response to EW attack, to training instrumentation systems.

- Support detection of intruders and malicious software introduction into the network, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the prevention of intruders, and malicious software and information introduction into the network, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support the identification of points of intrusion, and of information compromised when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support training in the identification of the origin of information compromised, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support training in the identification of malicious information introduced into the network, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support training in the identification of malicious information introduced into the network, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support training in the identification of malicious information introduced into the network, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support the operation of systems for blinding of the enemy, through use of multispectral obscurants and countermeasures, jamming, signature reduction, deception, and pattern avoidance techniques, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2512)

• Support the use of multispectral obscurants and countermeasures, jamming, signature reduction, deception, disinformation, and pattern avoidance techniques, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2512)

• Support the employment of RSTA to detect and find, then defeat, disrupt, or neutralize enemy sensors, through security operations, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

(c) Engineer warfare and countermine (EWC) requirements.

• Simulate intelligent minefield capabilities.

• Stimulate hand-held and vehicular mounted sensors, and mine hunter-killer sensors, by simulating a variety of metallic and nonmetallic mines in surface, buried, side attack, and scatterable modes.

• Collect and report data collected from intelligent minefield employment, to training instrumentation systems.

• Collect and report data collected from mine sensor system, to training instrumentation systems.

• Support employment of robotic systems to execute hazardous tasks, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support detection of the presence of antitank (AT) and antipersonnel (AP) mines, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the identification of the disposition of AT and AP mines, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the countering of AT/AP mines, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the conduct of route reconnaissance, with forward looking and off-road sensors, to detect, locate, and defeat obstacles, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the conduct of route reconnaissance, with forward looking and off-road sensors, to neutralize mines at a distance, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support real-time dissemination of obstacle information throughout the force, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the crossing of streams and irrigation ditches, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Support the conduct of dismounted assaults in urban terrain, and the entry into multistory buildings through roofs and upper floors, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the terrain and the function of operational equipment.
• Support the conduct of dismounted assaults in urban terrain, and entry into and through subterranean complexes, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the terrain and the function of operational equipment. (FCS ORD 1036)
• Support the conduct of dismounted assaults in urban terrain, by the breaching of walls (50 inch x 70 inch holes, through all types of construction), while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the terrain, the effects of breaching weapons, and the function of operational equipment.
• Support the detection and neutralization of mines and booby traps, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of mines and booby traps, and the function of operational equipment and weapons. (FCS ORD 2758)
• Support employment of obstacle/hazard area marking capabilities, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation. (FCS ORD 2906)

(d) Chemical, Biological, Radiological, and Nuclear (CBRN) requirements.

• Simulate CBRN agents, in various forms of solids, liquids, and gases, as they are dispersed on the battlefield. Includes proper transport and diffusion of the agents in
the environment (e.g., visual cue: vaporous clouds will appear in the air after artillery, missile, or aircraft disperses it).

- Display interaction between sensors and the CBRN agents based on their location and concentration. Sensors will only react when the proper concentration is achieved for activation.

- Activation of sensor when a CBRN agent is detected, and then must stimulate the command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) system in the FCS appropriately.

- Method of determining if personnel don appropriate protective equipment (e.g., protective mask and suits). If personnel are exposed to the agent without protection, or the FCS providing protection, then the personnel are designated as casualties, and cannot further perform their functions. Embedded training must disable their capabilities to operate.

- Provide method of determining if the FCS is providing protection. Open hatches create overpressure contamination inside, and personnel must don protective masks.

- Provide method of simulating the effects of electro-magnetic pulse effects on electronic equipment as it affects the operational systems.

- Support the administration of sensor/detector capability, to provide real-time warning and dissemination to protect the force against CBRN hazards, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of CBRN hazard appearance and effects, and the function of operational equipment.

- Simulate effects of CBRN attacks on friendly and enemy systems and personnel.

- Support operation and analysis of air quality (CBRN/Toxic Industrial Chemicals/Toxic Industrial Material) monitors, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation. (FCS ORD 2807)

- Support operation and analysis of air-quality protection system performance, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation. (FCS ORD 2810)

(e) Ground-to-ground (GTG) requirements.

- Simulate the effects of less-than-lethal weapons, and lethal weapons.

- React to nonlethal weapons capabilities, through the creation of a probability of disability (Pd) function, with new protocols for the severity and duration of disability. (FCS ORD 1248)

- Simulate the results of tactical engagements by advanced weapons.

- Simulate the results of engagements using kinetic energy weapons, NLOS bursting, and late flight-line-of-sight guidance systems. (FCS ORD 1182)

- Accurately simulate probability of hit/probability of kill (Ph/Pk) characteristics caused by improved weapons accuracy.

- Accurately simulate Ph/Pk vulnerability characteristics caused by improved protection capabilities of targets.
• Collect and report simulated engagement data for a wide variety of weapons systems, including shoulder-fired personal weapons, vehicle-mounted weapons, and advanced terminally guided weapons.

• Display data for simulated engagements employing predictive/stand-off detection capabilities against a dismounted enemy force. (FCS ORD 2771)

• Display data for simulated engagements with precision-guided systems.

• Display data for simulated engagements with shoulder-fired airburst munitions.

• Display data for simulated engagements with nonlethal riot/crowd control weapons. (FCS ORD 1248)

• Display data for simulated engagements with weapons possessing autonomous, countermeasure capabilities.

• Display data for advanced reconnaissance, guidance, and target-seeking sensors, installed on manned platforms, unmanned platforms, and weapon systems. Provide a virtual simulation that blends Tactical Engagement Simulations (TES)/Instrumentation System (IS) capability.

• Display data for simulated bore sight, simulated alignment, and simulated zeroing of weapon systems.

• Support employment of advanced, highly mobile Army and Joint fire delivery systems, when in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support employment of precision munitions, which can loiter or be maneuvered in flight, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these munitions and of operational equipment.

• Support the operation of sensor-to-shooter linkages to engage targets quickly, using automated, semiautomated, or manual fire control, distribution and clearance procedures, and automated target identification, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1215)

• While in the training mode, support scaling per Mission, Enemy, Terrain, Troops and Time, from lethal to nonlethal effects, to focus effects precisely on selected targets, while separating targeted formations from the population, without collateral damage and noncombatant casualties, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support employment, while in the training mode, of precision-delivered, self-healing minefields that can be remotely armed and disarmed, by the presentation of required data generated from operational equipment, or by the simulation of the function of these munitions and of operational equipment.

• Display data, and accept inputs to operate system to provide 360 degree hemispheric long-range acquisition and targeting, using the full spectrum of simulated sensors to represent views from manned and unmanned ground, air, and space platforms. (FCS ORD 3409, 3160, 1503 and 1506)

• Support, while in the training mode, proactive engagement of integrated precision, cooperative, and autonomous line-of-sight (LOS)/BLOS/NLOS targets, based on target detection and identification provided in the COP, by the presentation of
required data generated from operational equipment, or by the simulation of the function of LOS/BLOS/NLOS munitions and of operational equipment. (FCS ORD 1182 and 2838)

- Support, while in the training mode, integration of combat information, targeting data and intelligence, to provide a fused COP, down to the OF soldier level. (FCS ORD 1064)

- Support the operation of cooperative direct counterfire systems to ‘revenge’ kill enemy systems engaging, or preparing to engage, friendly systems, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support simulation of Unattended Ground Sensor (UGS) and Unmanned System Payloads (USP), with the operator control unit using passive/active thermal, TV, acoustic, seismic, electromagnetic or magnetic sensors, and remote programming of the sensor, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1243 and 3281)

- Support simulation of receipt of data from organic Unmanned Ground Vehicles (UGVs)/UAV Class II and IV, as well as other networked organic sensors. (FCS ORD 1505)

- Support simulation of control of UGS/USP.

- Support simulation Small Unmanned Ground Vehicle (SUGV), RSTA, mine detection, sentry services, and mounted sensors.

- Support simulation of control of SUGV in operations, including Military Operations in Urban Terrain (MOUT) and subterranean environments.

- Support ability to dynamically manage direct fire at the company and below level, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2340)

- Support ability to acquire, access, and disseminate accurate terrain information over the area of operations, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2467)

- Support ability to implement remote blocking of a captured/compromised battle command system platform, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2488)

- Support the ability to receive, display, develop, and transmit graphics/text, to present the operating environment down to platform level, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3158)

- Support the ability to receive information, and develop a complete air picture, integrated with common ground picture, within battalion/brigade’s vicinity, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support the engagement of stationary or moving ground targets, in day or night, and all-weather conditions, while in the training mode, by the presentation of required
data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2847)

- Support detection, cure, tracking, reporting, and responding to high explosive antitank, heavy machineguns, antiamaterial rifles, and medium/large caliber cannons, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3204)

- Support engagement of targets with coaxially mounted machinegun, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3410)

- Support transfer of control of NLOS Launch System to another unit or service while, in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

- Support the capability to engage and destroy enemy aerial targets (slow moving rotary wing (less than 40 knots), hovering rotary wing, and unmanned aerial vehicles).

(f) Ground-to-air (GTA) requirements.

- Support the employment of shoulder-fired anti-air missiles, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these munitions and of operational equipment.

- Support the employment of directed energy weapons (DEWs) with selectable lethality, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these weapons and of operational equipment.

- Support the employment of kinetic energy and chemical energy weapons, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these weapons and of operational equipment. (FCS ORD 1182)

- Support the conduct of engagements between imaging infrared (IR) missiles, and countermeasure equipped helicopters, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these weapons and of operational equipment.

- Collect and report data, from reconnaissance sensors and engagements between weapons, to training instrumentation system.

- Simulate engagements between systems equipped with countermeasures and counter-countermeasures.

- Support the engagement of stationary or moving ground targets, in day or night, and all-weather conditions, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2847)

- Support engagement of aerial targets, including stationary/slow moving rotary wing aircraft and UAVs, while in the training mode, by the presentation of required data
generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3313 and 3319)

(g) Air-to-air (ATA) requirements.

- Simulate ATA engagements, and self-healing aircraft defensive measures, with adjustable Ph/Pk (incorporating "hit but healed" capability), and a variety of weapons systems, including ATA missiles, DEWs, and electromagnetic weapons.
- Collect and report data from these engagements to training instrumentation systems.
- Support position and event reporting about nap-of-the-earth flights, aerial vehicle position location, and acceptance of data from advanced pilotage sensors and instruments, while in the training mode by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
- Support bore sighting, aligning, and zeroing of individual aircraft weapon systems, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these weapon systems and of operational equipment.
- Support the collection and reporting of fire and crew qualification data, while in the training mode, by the collection of required data generated from operational equipment, or by collection of equivalent data from the simulation of the function of these weapon systems and of operational equipment.
- Support simulated collective training exercises for helicopters.
- Support emplace, report, control, and recover Intelligent Munitions Systems, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems and of operational equipment. (FCS ORD 2869 and 2873)
- Support sending in-flight target updates to munitions, after firing, while in the training mode, by the presentation of required data generated from operational


(i) Smart fire-and-forget systems (SFFS) requirements.

- Support simulation of terminal guidance of fire-and-forget weapons, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation. (FCS ORD 2304)
- Support simulation of engagements between smart munitions and smart targets. Capabilities must include replication of hit avoidance technologies, multirole system capabilities, and scalable defensive measures.
- Collect and report information on engagements between smart weapons and smart targets. The system will collect data from these engagements, while simulating the characteristics of attack and defense during training exercises.
- Support emplace, report, control, and recover Intelligent Munitions Systems, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems and of operational equipment. (FCS ORD 2869 and 2873)
- Support sending in-flight target updates to munitions, after firing, while in the training mode, by the presentation of required data generated from operational
equipment, or by the simulation of the function of these systems and of operational equipment. (FCS ORD 2300 and 2761)

(j) Intelligence and communications systems (ICS) requirements.

- Support the presentation of sensor data from airborne target acquisition, and intelligence sensors and emitters, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems, and of operational equipment.
- Support the presentation of data from ground target acquisition sensors and emitters, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these sensor and emitter systems, and of operational equipment.
- Support an integrated COP to enable early understanding of threat actions/intentions, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function operational equipment. (FCS ORD 2850)
- Support visualization and dissemination of tactical scheme through concurrent collaboration planning (vertically and horizontally), and execution at all levels, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function operational equipment. (FCS ORD 1073)
- Support the administration of automated integration and dissemination of information to appropriate levels, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
- Support the availability and handling of information, provided to leaders in usable forms, for estimate of situation, to retransmit to subordinates, or to ‘cut and paste’ into orders, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
- Capture and archive training performance data from humans, sensors, and robots, to build a library of friendly and enemy Doctrine, Organizations, Training, Materiel Leadership and Education, Personnel, and Facilities (DOTMLPF)/lessons learned, to support of After Action Review (AAR), and to assess and improve the training process.
- Support the administration of the system, to provide leaders and staffs with situational awareness, updated in near-real time, from a variety of automated and human sources, to provide the means for situation understanding, and establish, maintain, and distribute a synthesized COP, tailored to unit task, purpose, and situation, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
- Support administration of the integration of joint sensors to fulfill friendly force, terrain, weather, and enemy combat information requirements, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the operational equipment.
• Support operation of the digital three-dimensional mapping tool for high terrain resolution, to enable C2 of small unit tactical action in close, complex terrain, virtual rehearsals, terrain analysis, and visualization inside buildings and subterranean environments, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support operation of sensors (manned and unmanned ground, air, and space) to see the full range of operational variables (terrain, weather, friendly and enemy force, noncombatants, and detect threat actions in all environments), while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support operation of the automated system for pattern analysis to detect, locate, and identify enemy combatants and systems, and provide highly precise target data from sensor to shooter, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2406)

• Support the production of reliable, timely battle damage assessment, to identify dangerous and high payoff for engagement tactical standoff targets, and to set favorable conditions for tactical maneuver, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.

• Support the operation of the system to integrate Joint and Army manned and unmanned, air and ground RSTA, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems and of operational equipment.

• Support administration of the system for providing near real-time combat identification of friend, foe, and noncombatant, across the spectrum of operations, through platform-to-platform, platform-to-soldier, soldier-to-platform, and soldier-to-soldier interrogation, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems and of operational equipment.

• Enable C2 needed to synchronize fire, maneuver, and RSTA in real time, to close with and destroy the enemy, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems and of operational equipment.

• Enable employment of robots to perform manpower-intensive, high-risk functions, such as RSTA missions in urban operations (inside buildings and the subterranean environment), and reconnaissance/reduction of minefields, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems and of operational equipment. (FCS ORD 1268)

• Enable operation of knowledge-based C4ISR architecture supporting reach to local, regional, and nondeployed sources, in both governmental and nongovernmental agencies, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems/sources and of operational equipment.
• Support employment of unmanned decoy capability, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1011)

• Support activation of on-board electronic deception capacities for unmanned systems, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1012)

• Support reaction to audio sensor detection alerts, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1317)

• Support attaining, analyzing, and accessing data transmitted from UAVs, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1422 and 1432)

• Support operation and accessing of UAVs’ automated mission planning functions, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1433 and 1489)

• Support use of aided and automatic target recognition system, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2712)

• Support engagement of threats with FCS vehicle weapons, when RSTA-equipped armored recovery vehicle is threatened, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2714)

• Support operation of countermeasures to threats against FCS UAV operations, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2801)

• Support operation of countermeasures to detection of FCS UAVs, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 2802 and 2803)

• Support detection/reporting of attack on UAVs, Class I, II, III, and IV to controller, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3147)

• Support remote activation of self-destruct mechanism, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3152)

• Support operation of Urban/MOUT Advanced Sensor System with Operator Control Unit to provide security warning, detect changes inside buildings, monitor subterranean avenues of approach, provide overwatch, and act as communications relays, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3223 and 3225)
• Support operation of UAV Class IV with Operator Control Unit, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3281)

(k) Force Sustainment.

• Simulate the acceptance and processing of requests for ammunition.
• Simulate the acceptance and processing of requests for fuel.
• Simulate the acceptance and processing of requests for rations. (FCS ORD 3477)
• Simulate the acceptance and processing requests for medical assistance.
• Present data, and accept input, to simulate the operation of multimodal distribution concepts.
• Present data, and accept input, to support simulation of crew level on-site repairs.
• Present data, and accept input, to support simulation operation of like, and self-recoverability of platforms, for rapid evacuation.
• Present data, and accept input, to support simulation of use of embedded diagnostics and prognostics. (FCS ORD 1241)
• Present data, and accept input, to support simulation of operation of potable water generation and replenishment system. (FCS ORD 3477 and 1198)
• Present data, and accept input, to support simulation of operation of system to monitor, report, and submit requests to facilitate anticipatory sustainment. (FCS ORD 1240)
• Present data, and accept input, to support simulation of available personnel, supplies, and equipment, at all echelons. (FCS ORD 3446 and 3468)
• Present data, and accept input, to support simulation of transport using standard/nonstandard, manned and unmanned, organic, and external systems.
• Present data, and accept input, to support simulation of transport between platforms and units, in contact, and on the move.
• Operate the system to dynamically reroute and track supply delivery, as priorities dictate, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment.
• Operate Modular Universal Laser Equipment (MULE)-like robotic capability, to perform a variety of sustainment/replenishment functions, including switching MULE from semiautonomous to tele-operation control, and retasking, via en route mission planning function, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 1346 and 1347)
• Present data, and accept input, to support simulation of employment of robotic systems, to perform redundant and appropriate maneuver sustainment tasks, in order to enhance continuous operations.
• Present data, and accept input, to support simulation of telemedicine/teleconsultation support between FCS personnel, combat lifesavers, combat medics, unit medical elements, and higher level medical treatment facilities, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems, and of operational equipment.
• Support simulated resuscitation and stabilization in an area, for surgical intervention and treatment on the move.

• Support operation of a fully automated, self-contained intensive care environment, capable of maintaining a simulated stable casualty for up to 72 hours, when in the training mode.

• Support interface with casualty’s medical information device, and collective medical records database, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems, and of operational equipment. (FCS ORD 1595)

• Support conduct of remote triage, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems, and of operational equipment. (FCS ORD 1641)

• Support treatment and evacuation of patients, during movement operations, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems. (FCS ORD 3068)

• Support treatment and evacuation of casualties in a CBRN threat and contaminated environment, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems. (FCS ORD 3081)

• Support procedures and treatments, using networked medical interfaces, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems. (FCS ORD 3083)

• Support on-board physiological monitor, suction, and oxygen systems, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of these systems. (FCS ORD 3087, 3098 and 3105)

• Support use of embedded diagnostics and prognostics, to enhance situational awareness/understanding, while in the training mode, by the presentation of required data generated from operational equipment, or by the simulation of the function of operational equipment. (FCS ORD 3397)

(1) Command and Control.

• Support acceptance and processing of a maneuver report, when in the training mode.

• Support acceptance and processing of a fires and effects report, when in the training mode.

• Support acceptance and processing of a scout observation’s report, when in the training mode.

• Support reception and display of maneuver orders, when in the training mode.

• Support reception and display of OPFOR data, when in the training mode.

• Support reception and display of friendly forces’ data, when in the training mode.

(4) Weapon effect simulation requirements.

(a) Provide weapon visual effects at target (own weapon system, if it is OPFOR target).
(b) Provide weapon audio effects at target (own weapon system, if it is OPFOR target).

(c) Provides miss and location of round on target indications.

(d) Electronic warfare weapon effects on command, control, communications, and intelligence (C3I) and other weapon systems, to support individual soldier and crew skills training.

(e) Simulates suppression, neutralization, and destruction of vehicle, personnel, and communication targets, to support individual and collective task exercises.

(f) Provides realistic simulation of damage and weapon effects on friendly, neutral, and OPFOR targets, for casualty and battle damage assessments.

(g) Simulate the damage and casualty producing capability of weapon systems.

(h) Simulate the visual/aural/spectral signature, mobility, survivability, radio frequency (RF) emitting, and casualty producing (i.e., lethality) capability of the weapon systems.

(5) Target control requirements. Provide target control personnel/function, with the capability to synchronize live and virtual target presentation.

(6) Target presentation requirements. Simulate the multispectral signature and exposure of friendly, neutral, and OPFOR targets.

(7) Data collection requirements.

(a) Training and firing events at each location.

(b) Type and caliber of weapons, weapon systems, and ammunition employed.

(c) Known or estimated, number of duds located in range impact areas.

(d) Ordnance fired.

(e) Rate of fire.

(f) Volume of fire.

(g) Battle damage assessment.

(h) Time of detection/hit/kill/miss/disability.

(i) Indirect fire trajectories.

(j) Location of ordnance footprint/pattern/impact.
(k) Location of round on target.

(l) Status of Supply Class V.

(m) Status of supply procedures.

(n) Ammunition allocated/expended/remaining.

(o) Safety observations.

(p) Suppression effectiveness.

(q) Smoke effectiveness.

(r) Fratricide incidents due to unexploded ordnance.

(s) Voice, video, and digital training performance data.

(t) Simulated rounds fired.

(u) Simulated battle damage sustained.

(v) Shooter identification, position, and time.

(w) Virtual and constructive exercise data elements.

(x) Recordings from sensor video and sensor controls (state/activity, etc.).

(8) Data management requirements.

(a) Capabilities to process voice, video, and digital training performance data.

(b) Calculate results for exercise reports and summaries.

(c) Manipulate digital data to display battle events.

(d) Retrieve voice, video, and digital training performance data from temporary storage.

(e) Display, organize, sort, collate, and distribute voice, video, and digital training performance data.

(f) Display, organize, sort, collate, and distribute sensor video, and sensor control setting (state/activity) encountered during virtual and constructive exercises.

(9) Exercise control requirements.
(a) Provide communications between exercise controllers/training analysts and Observer Controllers (OCs), exercise controllers and units, and exercise controllers/training analysts and interface devices, for live training exercises.

(b) Transmit and receive voice, video, and digital training performance data.

(c) Monitor voice, video, and digital representations of the exercise, to ensure safety and scenario integrity.

(d) Apply stimulus through engagement simulation capabilities.

(e) Any system/platform can be designated to provide the exercise control functions.

(10) Data analysis requirements.

(a) Analyze training performance data that support assessment of individual and collective unit training performance.

(b) Measure the demonstrated ability of soldiers, leaders, and units to perform a task against Army standards.

(c) Summarizes data collected by force (e.g., armor, mechanized infantry, light infantry, airborne, and air assault), and echelon (individual soldier, team, crew, squad, platoon, company, and battalion).

d. Training Feedback. Embedded training components provide and support feedback, during the course of the training, and after completion of training execution. Depending on the type of ET, synthetic environment or multimedia, feedback is controlled differently, and presented differently.

(1) Intrinsic Feedback.

(a) During synthetic environment ET, the intrinsic feedback is part of the conduct of the exercise.

(b) During multimedia ET, intrinsic feedback is controlled by the courseware application, and not the ET application used to display the courseware.

(2) Extrinsic Feedback.

(a) For synthetic environment ET, feedback data is collected while the training is being conducted, and the AAR is presented at the completion of the exercise.

• Identify training deficiencies. Assess unit, leader, and soldier performance, by comparing their action against desired actions.
• Present Information. Provide feedback to unit, leader, and soldiers in an AAR, to apprise them of their training status; and reinforce and improve performance.
• Distribute Information. Allow for distribution of AAR to leaders, other units, and knowledge repositories.

(b) During multimedia ET, extrinsic feedback is controlled by the courseware application, in conjunction with the learning management system.

e. System Support.

(1) Deployment/redeployment. All components accompany the prime equipment item.

(2) Safety support. Provide interlocks to prevent operation/movement of selected mechanical system components in stationary virtual training environment.

(3) Maintenance.

(a) Ensure ET components are easy to remove and replace. Provide access to ET components, without removal of other components.

(b) Receive software updates as part of the block upgrades for the operational system.

(c) Maintain file of reported software problems and scheduled fixes.

(d) Provide system to report problems and recommended improvements.

(4) Equipment Recovery. Simulate recovery actions as necessary for execution of scenario.

(5) System Reset. The ET system must be capable of restarting exercises, repeating exercises, and entering into new training exercise cycles.

(6) Availability Verification. Perform checks/tests to report operational status of all system components.

3-3. Inputs/outputs (data requirements).

a. The operational weapon system interfaces receive and transmit data. Each operational input and output has a corresponding training input and output, containing the data used during training. Data to stimulate the interfaces in the training mode has two sources, internal and external. Internal sources include inputs from the soldier, and inputs from the weapon system sensors. For example, at the CTC, the thermal display is stimulated by the vehicle’s sensor. On the other hand, when the weapon system is not in the field, the thermal display is stimulated by simulated digital terrain data. A third possibility is the combination of real terrain and simulated targets.
b. The system receives inputs from the soldier via pushing buttons; throwing switches; turning valves, a wheel, or a dial; pressing pedals; moving control grip; squeezing trigger; turning crank; selecting menu items; typing on keyboard (entering data in data fields); moving cursor; clicking mouse; touching screen; or voice, scanner, stylist, light pen, or other device. System generates outputs to the soldier via screen displays, popup windows, dials, indicator lights, audio warning and prompts from system, vision block view (visual), audio from crew/commander, printer, headset, speaker, tape, floppy disk, compact disc, digital versatile disk (DVD), or other device.

c. The system-generated outputs must be of a quality equal to the operational system. Individual outputs can be described using one, or several, of the following terms:

- Fidelity – how close is the display to the real display?
- Reality – is the situation presented believable?
- Identification – can the soldier recognize the image?
- Discrimination – can the soldier tell the difference between this display and others?
- Interpret – does the soldier understand the information?
- Detect – does the soldier see or hear the information?
- Comprehend – is the information clear enough to understand?

d. The combination of built-in components and a network connection to other operational systems, supporting simulators/stimulators and other infrastructure data, is the most versatile, and most likely design to be used. Figure 1-1 shows a concept of how ET would operate. On the weapon system, the soldier is presented with information on system displays. Depending on the system, the displays could be menus on a screen, dials, or indicators presenting data to the soldier. Based on the information displayed, the soldier takes some action, like selecting a menu item, making a data entry, issuing an order, or pulling the trigger. These actions are sensed by the onboard ET application, and the displayed information is changed, based on the action taken. A way to keep the onboard ET application as small as possible is to rely on external simulators/stimulators, like One Semi-Automated Force, Digital Battle Staff Trainer, or command-level C4ISR simulation/stimulation from Warfighter Simulation. In combined arms, there will also be communication with other weapon systems, as well as the range instrumentation, and the learning management system, to record the results of the training.

e. Every data element received, or transmitted, by the operational system, has the equivalent data element in the training mode. The data element can come from the operational system operating in the training mode, or a simulator/stimulator representing the operational system.

3-4. Failure contingencies.

a. Failures of the training subsystem can be divided into several categories: failure of onboard ET components (onboard operational components used during training); failure of the communication network; and failure of the TSS (training information infrastructure). The system must notify the soldier of failures, and provide alternatives available to continue training. Failure types and alternatives are shown in table 3-1.
b. Failures of the ET components will be minimized because the functions performed will be limited to sensing what the weapon is doing, injecting stimulus driven by models, simulation, and simulators internal to the training application, and communicating with the infrastructure.

**Table 3-1**
Failure types and alternatives

<table>
<thead>
<tr>
<th>Failure</th>
<th>Extent of Failure</th>
<th>Impact</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onboard embedded training component</td>
<td>Partial</td>
<td>Training limited to functioning systems</td>
<td>Use an alternate vehicle/system</td>
</tr>
<tr>
<td></td>
<td>Complete</td>
<td>Training not possible</td>
<td>Use an alternate vehicle/system</td>
</tr>
<tr>
<td>Onboard operational component used for training</td>
<td>Not all crew position</td>
<td>Full crew training not possible</td>
<td>Simulate position(s)</td>
</tr>
<tr>
<td></td>
<td>All crew positions</td>
<td>Training not possible</td>
<td>Use an alternate vehicle/system</td>
</tr>
<tr>
<td>Communication network – local area</td>
<td>Partial</td>
<td>Training limited to functioning systems</td>
<td>Conduct degraded unit training</td>
</tr>
<tr>
<td></td>
<td>Complete</td>
<td>Unit training not possible</td>
<td>Conduct individual or crew training using resident materials</td>
</tr>
<tr>
<td>Communication network – wide area</td>
<td>Partial</td>
<td>Live combined arms not possible</td>
<td>Conduct degraded unit training</td>
</tr>
<tr>
<td></td>
<td>Complete</td>
<td>Live combined arms not possible</td>
<td>Conduct individual or crew training using resident materials</td>
</tr>
<tr>
<td>TSS training information infrastructure (course material, and some simulators/ Stimulators)</td>
<td>Not all components</td>
<td>Limited course material available</td>
<td>Restrict training to available material</td>
</tr>
<tr>
<td></td>
<td>All components</td>
<td>Sources for course material not available</td>
<td>Restrict training to resident material – materials in secondary storage, Compact Disk-Read Only Memory (CD-ROM), DVD, memory stick, etc.</td>
</tr>
<tr>
<td>Other collateral weapon systems</td>
<td>Other systems not operational, or data from other weapon systems not available</td>
<td>Full unit training not available</td>
<td>Conduct less than full unit training</td>
</tr>
<tr>
<td>Training sensors</td>
<td>Training sensors system inoperable</td>
<td>Field exercises limited</td>
<td>Conduct virtual exercises</td>
</tr>
<tr>
<td>Learning Management System (LMS)</td>
<td>No communication with central LMS</td>
<td>LMS functions not available</td>
<td>Buffer data for later transmission to LMS</td>
</tr>
</tbody>
</table>

**Chapter 4**
Operational Mode Summary/Mission Profile

4-1. **Operational mode summary.** The following diagram (figure 4-1) shows the major operational modes. Below each mode are the activities conducted as part of the operational mode. Each activity is described in more detail in the following subparagraphs.
Figure 4-1. Operational modes of embedded training

a. **Plan Training.** Embedded training applications will integrate approved Army planning systems that support training event planning and scenario development activities. These activities take place prior to the execution of the training event. (See FM 7-0, chap 4.)

   (1) Long-Range Planning. Long-range capabilities support long-range planning activities, including selection of missions, determination of METL tasks, establishment of training objectives, and development of task organization.

   (2) Short-Range Planning. Short range capabilities support short-range major training event planning activities, including cross-reference of training events with training objectives,
identification and allocation of resources, coordination with support agencies, and publication of training guidance and planning calendar.

(3) Near-Term Planning. Near-term capabilities support near-term major training event planning activities, including determination of sequence for training, allocation of training aids, devices, simulators, and simulations, and other resources, publication of detailed schedule, and provision for training execution and evaluation.

(4) Training Support Package Development. Training Support Package development capabilities support scenario development activities, including exercise design, development of Master Events List (MEL), and production of exercise support materials.

b. System Preparation. Embedded training components may be fixed site, transportable, portable, fully embedded in weapon systems, and appended/umbilical, as discrete characteristics, or in any combination, without altering the platform combat configuration. As appropriate, the following capabilities are required:

(1) Movement to Site. Training will be imbedded in, and will move with, the weapon system. If the ET capability requires external devices, forces, or systems (for example, legacy or multinational forces), those devices, forces, or systems must be made available to the platform’s sensors.

(2) Installation. Installation capabilities support unpacking, assembly, and applying power to, and configuration of, ET components. (Some of these actions may apply to ET applications added to legacy systems.) Connect to power supply, as necessary. Make network connection, as necessary.

(3) Emplacement. The results of the commander’s exercise planning process indicate the type of training exercise that ET will support. Embedded training components will be capable of being arranged and assembled into a configuration suitable for the type of exercise desired by the commander. This may apply to ET application added to legacy systems.

(4) System Initialization. System initialization capabilities support activities that bring ET components to a mission-capable condition to support the training event, and may include the requirement to check for software updates over the network.

(5) Scenario Preparation. A scenario is a process of training stimulation and actuation events that provide a simulation of battlefield entities, including individual targets, civilian and noncombatant entities, and a threat force. Scenario preparation capabilities support the input of the MEL, creation of operational plans and scenario information for each training event, and production of exercise control support materials.

(6) Rehearsal. Exercise rehearsal capabilities allow trainers to perform and practice the task in the scenario being trained. This allows trainers to visualize how training events might develop, and finalize preparation of ET components.
(7) Issue. Issue of OFET components to soldiers and units occurs before scheduled training exercises. This may apply to ET application added to legacy systems. The OFET components are capable of supporting the issue process that:

- Establishes accounts for individuals authorized to use training equipment.
- Establishes procedures for requesting and scheduling ET components, including quantities, and issue and turn-in dates.
- Uses local and DA forms.
- Defines unit and personnel responsibilities for safeguarding equipment, maintaining accountability, and issue and turn-in.
- Provides for exchange of inoperable equipment.
- Defines priorities for issue.
- Defines procedures for lost or damaged equipment.
- Provides the tools and documentation that instructs the user on how to set up ET equipment (i.e., erect, connect to existing platform, and connect to the network) and procedures for troubleshooting.

(8) Readiness Verification. Readiness verification capabilities must support activities, to verify the readiness of ET components to support the training event.

c. Training Execution.

(1) Individual Training Support. Embedded Training components and applications support two essential strategies for individual skill training: initial training, and sustainment training. In order to further our understanding of what ET-supported individual training applications might be, it is necessary to consider general requirements associated with NET, and sustainment training of common operator and maintainer tasks and skills. Embedding these types of training, in an operational weapon system, effectively transforms the weapon into a delivery medium for computer-based courses, operation in the synthetic environment, and reach.

(a) Interactive Multimedia Instruction – New Equipment Training, institutional, and sustainment TSP may employ IMI. Training Support Packages will be Advanced Distributed Learning products, compliant/structured IAW the Joint Technical Architecture-Army, ATIA, Shareable Courseware Object Resource Model, and the publishing guidelines of the RDL.

(b) Computer Based Training – Embedded training, NET, and sustainment training capabilities will probably use CBT methodologies. Computer-Based Training is any training that uses a computer as the focal point for instructional delivery. With CBT, training is provided through the use of a computer and software, which guides a learner through an instructional program. (Computer Assisted Instruction is also a term for delivering instruction through the medium of a computer. This is an alternative term for computer-based training.) New Equipment Training, and sustainment training, can occur in several teaching modes:

- **Computer Assisted Learning (CAL).** Using a computer as an adjunct tool to aid in a traditional learning situation, like classroom training. The computer is a device to assist the instructor during the training process, like a blackboard, or handouts.
• **Computer Assisted Testing (CAT).** Assessing an individual through the medium of a computer. Individuals take the test at the computer, and the computer records and scores the test. CAT is imbedded in most computer-based training.

• **Computer Based Instruction.** Computer Based Instruction is defined as the use of the computer in the delivery of instruction. Some operational categories of CBI are:
  - *Drill and practice exercises* designed to increase fluency in a new skill, or body of knowledge, or to refresh an existing skill, or body of knowledge (tutorials are used to introduce new content to learners, in much the same manner that a human teacher might).
  - *Simulation* is a form of CBI that provides a simplified representation of a real situation, phenomenon, or process. Simulation provides the opportunity for students to apply knowledge in a realistic format, but without the time, expense, or risk associated with the real thing.
  - *Instructional games* may be considered as a subset of other types, e.g., drill and practice, or simulation applications modified to include gaming elements.
  - *Problem solving* is a CBI training application designed to foster thinking or problem solving skills, and focuses on a specific type of problem solving, and provides practice on a number or variety of problems.

• **Computer Assisted Instruction.** The use of computers to support the delivery of instructor-led instruction (to include drill and practice, remediation tool, resource tool, etc.). Computer Assisted Instruction exploits computer technology, to provide for the storage and retrieval of information, for both the instructor and student.

• **Intelligent Computer Assisted Instruction.** Computer-based instructional dialogue based upon techniques in artificial intelligence. (Similar to ITS.)

• **Synthetic Environment.** Individual training, in the synthetic environment, allows operation of one crew station, while the other crew stations are unmanned. Actions normally taken by the missing crewmembers are simulated.

• **Reach.** An individual has the capability to “reach” to knowledge repositories, and search for information.

(2) Collective Training Support. Objective Force Embedded Training components, and applications, support the training of commanders, staffs, soldiers, and units in a full-task trainer. Warfighting skills mastered during training exercises are applied to full spectrum operations in a Joint Improvement and Modernization/Special Operations Forces environment, across all aspects of terrain. Requirements for collective training support OFET applications, including:

  (a) **Electronic Warfare Training Applications** - Electronic warfare training requires that warfighting systems provide capabilities to conduct an EW attack, measure the impact of the attack on a unit, and report on the unit’s response to the attack. The OFET concept requires the development of a new functionality in weapon systems, to replicate EW sources, through actual
or replicated signals that stimulate sensors, and simulate the tactical engagement of communications systems, without interfering with the frequency spectrum, possibly affecting civilian and/or government real-time operations. These synergistic efforts are combined aspects of engagement simulation, weapon effect replication, and training data collection, to provide a realistic electronic warfare training capability. *Rationale:* Impact if not executed: Soldiers will be unable to train to employ electronic warfare sensors, or electronic attack devices. Soldiers will be unable to practice immediate reaction drills in response to electronic attack. Commanders will be unable to prepare units for combat on an electronic battlefield. Reliance upon increasingly sophisticated computer communications systems requires effective preparation of immediate reaction to attack. Observer Controllers and training analysts will be unable to provide feedback concerning the employment of EW sensors, employment of EW attack capability, or information on a unit’s reaction to electronic attack.

(b) **Engineer Warfare and Countermine Training Applications** - Engineer warfare and countermine training requires that warfighting systems provide engagement simulation capabilities to replicate reconnaissance; prepare fortifications; prepare and maintain routes of movement; clear obstacles; equip and maintain gap crossings; establish engineer obstacles; carry out engineer camouflage measures; extract and purify water, and establish supply points; carry out engineer measures, to eliminate after effects of nuclear strikes; and perform minefield deployment/attack/breaching/reduction. The training application also provides capabilities to collect training performance information on minefield deployment, attack, breaching, and reduction. *Rationale:* Impact if not executed: Soldiers will be unable to train to engage in engineer warfare, or to detect and counter minefields in a realistic manner. Commanders will be unable to develop the techniques required to train their units to engage in engineer warfare, and react to, and negate, the effects of a minefield. Observer Controllers and training analysts will be unable to provide training feedback concerning a unit’s ability to perform engineer warfare, or detect, neutralize, and cross a minefield.

(c) **Chemical, Biological, Radiological, and Nuclear Training Applications** – Chemical, Biological, Radiological, and Nuclear Training Applications require that warfighting systems integrate design solutions that provide engagement simulation capabilities, to replicate sensing and effects of CBRN weapons employment, and provide capabilities to collect data from CBRN defensive systems. Another important aspect of CBRN training is the degradation impacts on personnel and equipment from protective gear. The soldiers must operate in a protective posture if their vehicle is open, or they are operating outside. The vehicle provides some protection with its overpressure filtration system. If personnel do not take protective measures, they become casualties, and cannot function in their crew position. Personnel must also react to sensor alerts. The FCS will have onboard detectors for CBRN agents, and will warn the crew of the presence of those agents. They must take appropriate actions to take protection, and alert others. Automated communications systems will alert other vehicles of an immediate hazard. *Rationale:* Impact if not executed: Soldiers cannot realistically train for combat, on a CBRN battlefield, without replication of CBRN attack effects. Commanders are unable to prepare their units to fight on a contaminated battlefield. Immediate action drills do not create the sense of urgency required to survive an actual attack. Observer Controllers, and Training and Analysis Facility Analysts, cannot provide adequate feedback concerning a unit’s use of CBRN sensing and systems, and its response in reacting to a CBRN attack.
(d) **Ground-to-Ground Engagement Training Applications** – Ground-to-Ground engagement training applications require that weapon systems provide engagement simulation capabilities, to replicate employment of GTG weapons integrated, and to collect data from advanced weapons systems engagements. These include sensor systems, as well as weapon systems, e.g., UGS, manned reconnaissance vehicles, and unmanned reconnaissance vehicles, to include the need to provide appropriate cues for detection, classification, and identification, as a function of vegetation (porous and nonporous canopies), and weather. **Rationale:** Impact if not executed: Soldiers and commanders will be unable to effectively train using tactical engagement simulations involving advanced GTG weapons, including manned and unmanned systems, in the full range of weather, terrain, and vegetation conditions. Soldiers will be unable to replicate engagements, using the full range of advanced lethal direct fire and bursting rounds, and nonlethal weapon capabilities. Soldiers and commanders will be unable to effectively train with weapons having the increased Ph/Pk of improved autonomous seekers. Training scenarios will be unable to replicate the positive effects of soldier protection sensor capabilities, and protective coverings for soldiers. Soldier protection will impact the ability to provide a realistic Ph/Pk. Nonlethal weapons training capabilities will be unable to simulate the severity and duration of disability. Training analysts will be unable to obtain location and firing data from howitzers, to train indirect fire engagements. Battlefield combat identification data will not be provided to the training analysts, to provide feedback on fratricide/avoidance related actions. Training analysts will be unable to collect adequate engagement, location, and identification data, allowing OCs to provide meaningful training feedback on tactical engagements. Observer Controllers and training analysts will be unable to provide effective training feedback, unless engagement data, position data, and identification data is collected and processed, in light of enhanced lethality, vulnerability, and survivability weapon characteristics. Observer Controllers’ and training analysts’ workload will increase, while providing subjective and anecdotal engagement results, vice automated IS engagement results.

(e) **Ground-to-Air Engagement Training Applications** - Ground-to-Air Engagement Training Applications require that warfighting systems provide engagement simulation capabilities, to replicate sensing, and effects of GTA weapons employment, and capabilities to collect data from GTA weapons engagements. **Rationale:** Impact if not executed: Air defense weapon system crews and commanders will be unable to train in tactical engagement simulations involving GTA weapons. Air defenders will be unable to replicate engagements, using advanced weapons against conventional aircraft, and aircraft using self-protection, or aircraft self-healing capabilities. Variations in aircraft self-protection will affect Ph/Pk to such an extent, that engagement results will become unrealistic. Training instrumentation systems will be unable to collect adequate engagement, cockpit, and pilotage data, to allow OCs and training analysts to provide meaningful training feedback on air engagements. Observer Controller’s and training analyst’s workload will increase, providing subjective and anecdotal engagement results, vice objective, computed engagement results.

(f) **Air-to-Air/Air-to-Ground Engagement Training Applications** – Air-to-Air/Air-to-Ground engagement training requires that warfighting systems provide engagement simulation capabilities to replicate ATA weapons employment. The application will also provide the capabilities to collect data from aerial offensive and defensive systems, and aerial engagement simulation systems. Air-to-Air/Air-to-Ground engagement training applications will provide the capability to exercise airborne weapons in ATA and ATG engagement exercises. Systems
include sensor systems, as well as weapon systems, e.g., UAVs, manned reconnaissance vehicles, and unmanned reconnaissance vehicles, to include the need to provide appropriate cues for detection, classification, and identification as a function of vegetation (porous and nonporous canopies), and weather. **Rationale:** Impact if not executed: Aircrews and commanders will be unable to train with ATA/ATG weapons, including UAVs. Aircrews will be unable to exercise engagement skills using the full range of advanced nonlethal to lethal weapons, masked targeting seekers, or aircraft self-healing capabilities. Variations in lethality will affect Ph/Pk/Pd, to an extent, where engagement results will become unrealistic, and provide poor preparation for real-world missions. Nonlethal weapons will drive the need to add a probability of disability function (Pd) into simulations of tactical engagements. The IS will be unable to collect adequate TES engagement, cockpit, and pilotage data, to allow OCs and training analysts to provide meaningful training feedback on air engagements. Observer Controller’s and training analyst’s workload will increase, while trying to provide subjective and anecdotal engagement results, vice automated IS computed engagement results.

(g) **Smart Fire-and-Forget Systems Engagements Training Applications** - Smart fire-and-forget systems engagements training application requires that warfighting systems provide engagement simulation capabilities to replicate sensing and effects of smart weapons employment. This includes sensor systems, as well as weapon systems, e.g., UGS, manned reconnaissance vehicles, and unmanned reconnaissance vehicles, to include the need to provide appropriate cues for detection, classification, and identification as a function of vegetation (porous and nonporous canopies), and weather. The SFFS engagements training application provides capabilities to collect data from smart weapons engagements. **Rationale:** Impact if not executed: Soldiers and commanders will be unable to train in TES involving weapons that employ terminal guidance capabilities, sensors systems, and manned/unmanned reconnaissance vehicles. Soldiers will be unable to replicate engagements between smart weapons, against targets that employ smart defensive reactions. This will affect Ph/Pk/Pd to an extent that engagement results will become unrealistic, and provide poor training outcomes. Training instrumentation will be unable to collect adequate engagement data to allow OCs and training analysts to provide meaningful training feedback on smart weapons engagements. Observer Controller’s and training analyst’s workload will increase, while trying to provide subjective and anecdotal engagement results, vice automated IS computed engagement results.

(h) **Intelligence and Communications Systems Training Applications** - Intelligence and communications training applications requires that warfighting systems provide collective training capabilities, to collect data from intelligence gathering sensors, and battlefield tactical C4 systems. The OFET training application provides OCs, and training analysts, the ability to monitor, and track, intelligence gathering activities and communications, during CTC training. **Rationale:** Impact if not executed: Soldiers and commanders will be unable to train, in the live environment, to effectively use data from ground and airborne target acquisition and intelligence sensors. Observer Controllers and training analysts will be unable to provide meaningful training feedback on the employment of these sensors. Soldiers and commanders will be unable to train to effectively integrate and use data from advanced C4 ground and space-based communications systems, to provide battlefield situational understanding. Observer Controllers and training analysts will be unable to provide meaningful training feedback on the employment of advanced C4 ground and space-based communications systems.
(i) **Force Sustainment** – Replenishment of supplies and material, including fuel, ammunition and rations. Also, requesting maintenance assistance, recover, or medical support.

(j) **Command and Control** – Battle staff and commander communication with forces. Receiving and transmitting C4ISR data to command authority.

(3) **Weapon Simulation.** Embedded training components and applications support full-scale live fire exercises, subcaliber live fire exercises, and training simulation of actual combat weapon operation. Engagement simulation applications and supporting procedures simulate the damage and casualty producing capability of weapon systems. Embedded training components and applications simulate the visual/aural/spectral signature, mobility, survivability, RF emitting, and casualty producing (i.e., lethality) capability of the weapon systems they portray in field training exercises.

(a) **Electronic Warfare Training Applications** - Electronic warfare training requires that warfighting systems provide capabilities to simulate electronic emitters, conduct an EW attack, through tactical engagement simulation, measure the impact of the attack on a unit, and report on the unit’s response to the attack. This requires training support application capabilities to replicate electronic attack and defense. Embedded training application capabilities must replicate:

- The signatures and electronic emissions of enemy C2 nodes and facilities.
- EW attack signals, to stimulate situational awareness and targeting sensors.
- C4 network attack.

(b) **Engineer Warfare and Countermine Training Applications** - Engineer Warfare and Countermine training requires that warfighting systems provide engagement simulation capabilities to replicate minefield deployment, attack, breaching, and reduction. Engagement simulation capabilities must replicate intelligent minefield capabilities, stimulate handheld and vehicular mounted sensors, and mine hunter-killer sensors, by simulating a variety of metallic and nonmetallic mines in surface, buried, side attack, and scatterable modes.

(c) **Chemical, Biological, Radiological, and Nuclear Training Applications.** The important aspect of CBRN training to the OF, is the degradation impacts on personnel and equipment from protective gear. The soldiers will operate in a protective posture if their vehicle is open, or they are operating outside. The vehicle provides some protection with its overpressure filtration system. If personnel do not take protective measures, they become casualties, and cannot function in their crew position. The other aspect of CBRN training is the reaction to sensor alerts. The FCS will have onboard detectors for CBRN agents, and will warn the crew of the presence of those agents. They will take appropriate actions to take protection, and alert others. Automated communications systems will alert other vehicles of an immediate hazard. The ET application capabilities must:

- Simulate detection of chemical agents (in liquid, aerosol, and gaseous forms).
- Replicate chemical employment signals to joint warning and reporting systems.
- Measure the effective donning of protective masks.
(d) **Ground-to-Ground Engagement Training Applications** – Ground-to-Ground engagement training applications require that weapon systems provide engagement simulation capabilities to replicate employment of GTG weapons. Ground-to-Ground engagement training applications require embedded capabilities to simulate tactical engagements using new weaponry. Embedded training application capabilities must:

- Replicate the effects of less-than-lethal weapons and lethal weapons.
- Accurately reflect nonlethal weapons capabilities, through the creation of a Pd function, with new protocols for the severity and duration of disability.
- Effectively replicate tactical engagements by advanced weapons.
- Replicate engagements using kinetic energy weapons, NLOS bursting, and late flight-line-of-sight guidance systems.
- Reflect validated Ph/Pk/Pd characteristics, caused by improved weapons accuracy.
- Reflect validated Ph/Pk/Pd vulnerability characteristics, caused by improved protection capabilities of victims.
- Provide replication and simulation of engagements for extended range, precision guided systems, shoulder-fired airburst munitions, nonlethal riot/crowd control weapons, and weapons possessing autonomous, countermeasure capabilities.

(e) **Ground-to-Air Engagement Training Applications** - Ground-to-Air engagement training applications require that warfighting systems provide engagement simulation capabilities to replicate sensing and effects of GTA weapons employment. Ground-to-Air Engagement Training Applications require the capability to conduct realistic engagements between land forces and rotary wing aviation. Embedded training application capabilities must replicate shoulder-fired anti-air missiles, ballistic, and DEWs, with selectable lethality, kinetic energy weapons, and engagements between imaging IR missiles, and countermeasure equipped helicopters. Embedded Training application must replicate and simulate engagements between systems equipped with countermeasures and counter-countermeasures.

(f) **Air-to-Air/Air-to-Ground Engagement Training Applications** – Air-to-Air/Air-to-Ground engagement training requires that warfighting systems provide engagement simulation capabilities to replicate ATA weapons employment. Air-to-Air/Air-to-Ground engagement training applications will provide the capability to exercise crew operation of airborne weapons, in ATA and ATG engagement exercises, using onboard EW, weapon, or sensor systems. Embedded training application must replicate ATA engagements, and self-healing aircraft defensive measures, with adjustable Ph/Pk (incorporating "hit but healed" capability), and a variety of weapons systems, including ATA missiles, DEWs, and electromagnetic weapons. Embedded training application capabilities must allow instrumentation systems to collect the data from these engagements. Embedded training application requirements include position and event reporting about nap-of-the-earth flights, aerial vehicle position location, and acceptance of data from advanced pilotage sensors and instruments.

(g) **Smart Fire-and-Forget Systems Engagements Training Applications** - Smart fire-and-forget systems engagements training application requires that warfighting systems provide engagement simulation capabilities to replicate sensing, and effects of smart weapons employment. Embedded training application must simulate terminal guidance of fire-and-forget weapons, and replicate engagements between smart munitions and smart targets. Smart fire-and-
forget enhanced ET TES/IS capabilities will replicate hit avoidance technologies, multirole system capabilities, and scalable defensive measures.

(h) **Intelligence and Communications Systems Training Applications** - Intelligence and communications training applications require that warfighting systems provide collective training capabilities, to simulate, and stimulate, intelligence gathering sensors and battlefield tactical C4 systems. Embedded training application capabilities must simulate and stimulate:

- Sensor data from airborne target acquisition, and intelligence sensors and emitters.
- Data from ground target acquisition sensors and emitters.
- Data from UAV/UGV sensors and emitters.
- Information from voice and digital communications occurring on the live training environment battlefield.

(4) **Weapon Effect Simulation.** Embedded training components and applications provide miss and location of round on target indications, and EW weapon effects on C3I and other weapon systems, to support individual soldier and crew skills training. This capability simulates suppression, neutralization, and destruction of vehicle, personnel, and communication targets, to support individual and collective task exercises, and, provides realistic simulation of damage and weapon effects on friendly, neutral, and threat targets, for casualty and battle damage assessments.

(5) **Sensor Effect Simulation.** Embedded training must provide simulation of the following sensors, and provide parameters such as temperature, temperature contrast, visibility, humidity, precipitation obscurants, foliage, camouflage, etc.

- System: Environmental variables
- UAV: Cloud conditions, winds, temperature at altitude, humidity
- UGV: Terrain type, soil condition, vegetation type, and density

(6) **Target Control.** Target control provides controllers with the capability to synchronize the target presentation function. Embedded training components interface and work with targetry systems to present targets using the selected scenario.

(7) **Target Presentation.** Target presentation is the capability of the ET applications and components to simulate the signature and exposure of friendly, neutral, and threat targets. Target presentation capabilities provide a realistic target signature and a realistic target exposure.

(8) **Data Collection.** Embedded training components and applications must have capabilities that include collection of training data that includes:

- Types and quantities of ammunition fired into impact areas.
- Training and firing events at each location.
- Type and caliber of weapons, weapon systems, and ammunition employed.
- Known, or estimated, number of duds located in range impact areas.
- Ordnance fired.
• Rate of fire.
• Volume of fire.
• Battle Damage Assessment.
• Time of hit/kill/miss.
• Indirect fire trajectories.
• Location of ordnance footprint/pattern/impact.
• Location of round on target.
• Status of supply Class V.
• Status of supply procedures.
• Ammunition allocated/expended/remaining.
• Safety observations.
• Suppression effectiveness.
• Smoke effectiveness.
• Fratricide incidents due to unexploded ordnance.
• Voice, video, and digital training performance data.
• Simulated rounds fired.
• Simulated battle damage sustained.
• Shooter identification, position, and time.
• Sensor indication.

(9) Data Management. Embedded training applications have data management capabilities, support activities to process voice, video, and digital training performance data; calculate results for exercise reports and summaries; manipulate digital data to display battle events; retrieve voice, video, and digital training performance data from temporary storage; display digital data; and organize, sort, collate, and distribute voice, video, and digital training performance data. System will use standard data elements specified in Army Regulation (AR) 25-1.

(10) Exercise Control. Embedded training applications have exercise control capabilities; and support activities to provide communications between exercise controllers/training analysts and OCs; exercise controllers and units; and exercise controllers/training analysts and interface devices. They transmit and receive voice, video, and digital training performance data; and monitor voice, video, and digital representations of the exercise to ensure safety and scenario integrity. Exercise control is also provided as a capability to apply stimulus, through engagement simulation capabilities.

(11) Data Analysis. Embedded training applications provide analysis capabilities, and support activities to analyze training performance data that support assessment of individual and collective unit training performance. Each training event is evaluated during training execution. Evaluation of training measures the demonstrated ability of soldiers, leaders, and units to perform a task against Army standards. Analysis summarizes data collected by force (e.g., armor, mechanized infantry, light infantry, airborne, and air assault); and echelon (individual soldier, team, crew, squad, platoon, company, and battalion).

d. Training Feedback. Embedded training components provide and support intrinsic and extrinsic training feedback.
(1) Intrinsic Feedback. Embedded training components and applications provide downrange feedback to the shooter, and to other training exercise players. This capability generates stimuli that simulate communications and intelligence feeds from notional entities, readouts, and sensor indicators on weapon platforms, weapon effects and battle damage, and visual/aural cues.

(2) Extrinsic Feedback. Embedded training applications support after-action training feedback by providing the following capabilities:

   (a) Information Preparation. Embedded training applications have information preparation capabilities that support training organizations to prepare topographic maps, and maintain a catalog of range assets. These applications also support activities to convert training performance data into information used in training performance feedback; manipulate information required in the production of feedback products; and create AARs.

   (b) Information Presentation. Embedded training applications support activities to present training performance information to units in the AAR.

   (c) Information/Result Distribution. Embedded training applications support the capability to produce reports for distribution. Embedded training applications have information distribution capabilities to support activities in transferring training performance information from ET components to external storage media, and support information requirements of external agencies.

   e. System Support. Training is an inherently periodical, cyclical, and recurring process. Embedded training components are capable of restarting exercises, repeating exercises, and entering into new training exercise cycles. This requires the following capabilities:

   (1) Deployment/Redeployment. Typically, ET applications are an internal part of the weapon system, and will move with the weapon system. If the ET capability requires external devices (i.e. legacy forces), those systems must be transported with the platform, and will not require additional transportation support to the extent practical.

   (2) Safety Support. Safety precautions minimize the possibility of accidents by troops in training when operating ET components. Standing operational procedures for the safe operation of ET components must be developed. Local procedures or regulations, designed to minimize the potential for personnel injury and property damage, will refer to additional precautions in applicable technical manuals and FMs for training ammunition.

   (3) Maintenance/Storage. Embedded training components have maintenance and storage capabilities that support breakdown and removal, recovery, and packing of components, to support periods between utilization.

   (4) Component/Equipment Recovery. If the ET capability requires external devices (i.e., legacy forces) those systems must be transported with the platform, and will not require additional transportation support. Embedded training external devices have design characteristics that support recovery capabilities, such as breakdown/removal, packaging, and
recovery of components, to support the next exercise. Embedded training components are capable of disassembly and packaging, for commercial air and ground transportable shipment; and diagnostic checkout, coincident with breakdown/removal and recovery.

(5) System Reset. Embedded training components and applications have reset capabilities that support activities to return components and software to the pre-exercise configuration.

(6) Availability Verification. Availability verification capabilities support activities to verify the availability of ET components and applications, to support the next training event.

4-2. Mission profile. Figure 4-2 is a time-phased flowchart showing the operational events the ET goes through for a specific mission.

![Mission Profile](image)

Figure 4-2. Flowchart of embedded training operational events

Chapter 5
External Environments

5-1. Physical environment. The training environment is the same as for the operational system. The ET application component must meet the same requirements as the base operational systems. Thus, the components must meet the same temperature, humidity, vibration, etc., criteria as the weapon system.
5-2. System architecture.

a. The ET architecture uses weapon system operational components, embedded ET components, and infrastructure. The training application in the embedded ET component (hardware, software, or combination) relies on the operational components to provide inputs from the soldier, and output to the soldier (see fig 3-1). The embedded ET component injects stimuli based on the soldier’s inputs, models, and simulations integral to the training application, and communicates with the infrastructure, and other operational systems for additional input. The ET component also transmits (through the operational communication system) output data, which becomes input data to other weapon systems (including the land warrior system), as part of a larger unit. The mix of inputs, from the internal training application, versus the infrastructure, is a trade-off requiring design analysis. To provide more stand-alone capability, the internal application should be as robust as possible. However, given a limited internal capacity, additional data and storage requirements will be placed on the training infrastructure. Support from the infrastructure, on the other hand, places a load requirement on communication systems.

b. The concept for combined arms training can be seen in figure 5-1. Within each weapon system, the ET application is a key element in the conduct of the training. The communication network allows the weapon system to be physically located at home station, or CTC, or deployed, and still “play” in the scenario with the other OF systems. This includes mission rehearsal/mission planning.

c. Additionally, ET supports a mixture of live, virtual, or constructive environments involved in the training scenario, on different platforms, at the same time (see figure 5-2). In the field, virtual targets are overlaid on live terrain, while other forces, physical in the motor pool, are virtually on the same battlefield, seeing the same terrain virtually, and same virtual targets.

d. The ET system depends on C4ISR data to drive the exercise, similar to the planning and rehearsal function. Thus, the architecture must be established to provide for interoperability with the objective force C4ISR systems, and the planning and rehearsal function.

5-3. Organizational environment. This functional description is meant to cover a variety of organization elements and echelons. The beginning point is the individual soldier’s interface with their duty station equipment. This could be a gunner, an intelligence specialist, or a network maintainer. Moving up from this point, the soldier is part of a crew or staff. The training audience includes this level. The crew or staff is also part of a larger unit. The components of the larger unit can train together in a live, virtual, or constructive training environment using ET.

5-4. Threat environment. Embedded training must operate in a number of environments. Embedded training will be used across all training domains (institution, home station, deployed—including en route—and CTCs). To maintain the system’s effectiveness, it must change with changes (upgrades and engineering change proposal) incorporated in the operational weapon system. The difficulty in keeping up with the changes is multiplied by the number of interconnected weapons systems sharing data and operating with, or against, one another. Each system is changing and its changes have an impact on the overall effectiveness and outcome of
the training exercise. Embedded training must have a methodical update process to keep it current, as the weapon systems evolve.

Figure 5-1. Concept for combined arms training
Figure 5-2. Functional area combined arms application
Chapter 6
Security

6-1. Background. The ET application would have the same security classification of the operational system. If the operational system contains classified information, and the training application is running on the same system, then the training will be at the same security level as the operational system. Additionally, training records are sensitive material, and need to be controlled, due the personal nature of the data.

6-2. Control points. Embedded training control points will conform to the operational system control point. Embedded training will follow the same procedures for access and use of the system as the operational system. Physical security is provided at the same level as the operational equipment including the following:

a. Identification and Authentication. To preclude unauthorized access, ET shall require users to identify themselves, and authenticate their identity.

b. Discretionary Access Control provides controls for unauthorized access, or modification, of data. The ET system/security administrators shall specify access privileges to individuals, and/or defined groups of individuals.

c. Audit. The audit feature shall record the date, time, user, type event, and results for each security relevant event. Security events may include log-ins, access to files, creation and deletion of files, programs executed, and action taken by the system/security administrators.

d. Label. Sensitivity labels, specifying the hierarchical and nonhierarchical classification/caveat, shall be associated with each system resource (e.g., file). Use sensitivity labels as the basis for mandatory access control decisions.

e. Mandatory Access Control. Access control decisions shall be based on a comparison of the user’s (subject’s) sensitivity label, and the object’s sensitivity label.

f. Object Reuse. Electronic storage media (e.g., disk, Random Access Memory) shall be cleared of all information previously contained, before being made available for reuse by the system. This shall preclude the possibility of either intentional or inadvertent access to data by an unauthorized user. See AR 380-19 for approved cleaning and purging requirements.

g. System Integrity. Hardware and/or software features, that periodically validate the correct operation of hardware, or firmware elements, shall maintain the integrity of ET applications.

h. System Architecture. The system architecture for ET involves protecting the operating system from external interference or tampering. Security features shall allow only selected users (normally system/security administrators) to make changes that affect the operating system.

i. Security Testing. System testing for ET shall validate that there are no obvious ways for an unauthorized user to bypass, or otherwise defeat, implemented security measures. Embedded training shall be certified as part of the operational system accreditation process.
j. Documentation. The system developer for ET applications shall provide sufficient
documentation, to substantiate proper level of security assurance is provided.

k. Vulnerabilities. Embedded training vulnerabilities fall into two categories: internal and
external. Internal vulnerabilities are those stemming from malicious, or inadvertent, attacks by
authorized personnel. This can result in data alteration or destruction, unauthorized access to
classified information, or denial of service. The external vulnerabilities may be environmental,
(e.g., flood, hurricane), or subversive attacks, designed to sabotage system resources. Embedded
training applications will also be subject to overrun and capture by enemy forces during wartime.

l. Safeguards. Safeguards to protect against internal vulnerabilities are inherent in the proper
class of security, as described in subparagraph 6-2a, above. Users shall be required to identify
themselves before logging on the system, and verifying both their identity and clearance level.
Use of audit trails is a deterrent for users who may have reason to maliciously attack ET. All
users shall be required to maintain a security clearance for the highest level of data for which
they must access. All users shall be trained in the appropriate use of ET. Use of any
unauthorized software on FBCB2 shall be prohibited. Antiviral protection mechanisms shall be
in place.

Chapter 7
System Development

7-1. Priority of user requirements. Three priority categories of ET requirements are provided
to assist the Materiel Developer in creating an evolutionary, or incremental, system development
plan, and to assist in the determination of progress on high priority capabilities required for
system development.

7-2. Priority categories. There are three priority categories of ET requirements:

a. Synthetic environment combat training. This first category includes training requirements
related to combat training of OF mission sets. Typically, the blocking is determined based on the
technical, performance, integration, and cost risk. The low risk features are assigned to early
blocks, and high risk is assigned to later blocks. However, the ET capability cannot be blocked
based on the technical risk. The training capability must follow the mission capability; thus, the
training capability must be included in the same block as the operational capability. Embedded
training, as the primary means for training combat skills, must be available with the mission
capability, for conduct of training in the synthetic environment at home station, CTC, and while
deployed.

b. Multimedia training. This second category includes requirements for presenting
multimedia training. These capabilities are important to support the need for training anytime,
anywhere, and to support life-long learning. However, there are other alternatives available for
retrieval, storage, and presentation of these courseware materials.
c. Training administration. This third category includes planning training, tailoring TSP, and updating training records.

7-3. Point of contact. Should there be a need for additional information about the requirements in the document, contact the Training Support Assistance and Integration Directorate, Integration Division, Program Integration Team at 757-878-3841 or DSN 826-3841, or at the following address: Commander, U.S. Army Training Support Center, ATTN: ATIC-SAIL-PI, Building 1728, 5th and Patton, Fort Eustis, Virginia 23604-5166.

Chapter 8
Domain Impacts

8-1. Doctrine. The ET infrastructure will support training, in response to a broad array of threats and threat scenarios that are best addressed during the development of individual applications. The threats used in training must be accurate and consistent throughout TRADOC; however, they do change over time, and individual ET training applications will also change. The Combined Arms Center threat manager produces the primary threat source documents used for training, and identifies other specific documents as approved references for threat training. Other finished intelligence products may be used, when necessary, to supplement primary source documents. Generally, these threats will fall into one, or more, of the following categories:

a. Armor threat.

(1) Mechanized armies base their capabilities on masses of armored fighting vehicles, especially tanks. These possess high mobility, flexibility, firepower, and shock effect, and consequently, can quickly exploit any weakness in the defense, to generate operational maneuver into the defender’s rear area.

(2) Armored thrusts may be complemented and aided by airborne or heliborne (or in coastal areas, amphibious) operations. These threaten to undermine the defense by disrupting C2 and logistics systems, and by seizing vital ground.

(3) Wheeled and tracked platforms.

(a) Medium tanks.

(b) Light armored vehicles (infantry fighting vehicles, armored scout cars, armored command vehicles, armored personnel carriers, armored recovery vehicles, armored prime movers, mobile reconnaissance posts, and chemical reconnaissance vehicles).

(c) Armored engineer and route-clearing vehicles.

b. Indirect fire support threats. Artillery threats include the following guided and unguided weapon systems:

(1) Multiple rocket launchers (MRLs), guns, howitzers, gun-howitzers, and mortars.
(2) Surface-to-surface missiles (SSMs).

(3) Free rockets over ground (FROGs).

(4) Antitank artillery.

(5) Antitank weapons (i.e., AT guns and AT guided missiles) are also parts of the fire support system. They are capable of delivering accurate point fire at direct fire ranges. Antitank guns also have an indirect fire capability.

(6) Fixed-wing aviation provides air interdiction of forces out of range of tube artillery. Helicopters give the equivalent of close air support to provide supporting fires at the front lines.

(7) The fire support based chemical delivery capability is limited, but may expand in the future. Principal delivery means are SSMs, FROGs, MRLs, and OPFOR cannon artillery, all of which are capable of delivering chemical munitions. Incapacitating agents and irritants, mainly riot control type, are available to tactical commanders.

(8) General AT weapon systems include missiles, aircraft, tanks, and artillery. The purpose of these systems is to destroy a wide variety of battlefield targets, but they may also deploy to fire against tanks and other armored vehicles. Artillery-type weapon (over 20 mm) will probably have an AT capability. Antitank forces often include direct fire field artillery. Antiaircraft guns can also fire against ground targets.

(9) Special AT weapon systems consist of antitank guided missile (ATGMs), AT guns, grenade launchers, and recoilless guns. These weapons destroy tanks, and their crews, by direct fire. The direct fire weapons provide quick response fires at medium, short, and point-blank ranges, on broken ground, and under favorable visibility conditions.

(10) The capability to deliver chemical, radiological, and nuclear munitions is available in all levels of indirect fire support. This includes, tube artillery, SSMs, FROGs, MRLs, and long-range missiles. The OPFOR commander considers these munitions as part of the overall fire support and obstacle plans.

c. Aviation threats.

(1) Naval aviation. Maritime strike, reconnaissance, and tactical aviation can support amphibious landings that are a part of a front, or theater, operation. They may also help to repel enemy amphibious landings, or prevent enemy reinforcement in the theater.

(2) Tactical aviation. High performance fighters and fighter-bombers, and some light bombers, comprise the threat’s air armies. Tactical aviation also includes a substantial number of medium and heavy lift, and electronic countermeasure (ECM) helicopters that can be used to support high priority Army operations. The threat also includes UAVs that can be loaded with reconnaissance payloads, or used as weapons platforms. The strength and composition of the air
assets of a front can vary considerably, according to the importance of the front’s mission, and the phase of the operation.

(3) As permitted by economic constraints, the threat continues to introduce high-performance aircraft with:

(a) Improved avionics.

(b) Improved ECM and electronic counter-countermeasures (ECCM) equipment.

(c) Increased payload.

(d) Larger combat radius.

(e) Improved fire support. The threat continues to add ATGMs to attack helicopters, to increase their AT capability. Some medium lift transport helicopters and general-purpose light helicopters can also mount ATGMs. The OPFOR has also improved the survivability of its attack helicopters on the battlefield. All attack helicopters likely to operate near the forward combat areas have active and passive self-screening jammers (SSJ); they also have flare dispensers, and sometimes engine emission filters, to reduce the danger from heat seeking surface-to-air missiles. Some threat helicopters have additional armor, to protect the crew, or vital helicopter components.

(f) Improved reconnaissance helicopters. Helicopter reconnaissance is generally confined to the protection of the ground forces’ air defense umbrella. Threat helicopters perform such tasks as route or CBRN reconnaissance. However, more daring use of helicopters is certain when the situation becomes very fluid. All missions crossing the line of contact can also provide information in the form of in-flight reports.

(g) Improved accuracy of munitions delivery. The threat is working on the problems of providing more reliable air support, by improving the accuracy of munitions delivery. Air-to-air missiles, antiradiation missiles, and improved ATGMs are in service, and work is continuing in this field. Ongoing efforts to improve nighttime and poor weather reconnaissance and combat capabilities may allow continuity of air support, around the clock. Newer and improved platforms continue to appear in the threat inventory, improving payload-range characteristics.

(h) Improved radioelectronic combat (REC). The threat continues to improve its REC capabilities, including sophisticated jamming equipment. It may deploy equipment on its aircraft, to jam multiple enemy radar, using a single transmitter; or jam only when the target radar reaches certain intensity, to select the correct jamming signal for the specific target radar.

d. Air defense threats.

(1) Current threat air defense systems present a formidable threat to any potential air enemy. Threat air defense efforts can approach near state-of-the-art, when viewed as a whole. The threat can employ air defense weapons, in types and quantities unmatched by any prior military force.
(2) Air defense is an integral part of all threat operations. Threat air defense coverage is layered horizontally and vertically, to provide redundant coverage of tactical, operational, and strategic forces.

(3) The threat inventory of air defense weapons includes a variety of missiles, guns, and support equipment. Air defense weapons exist at nearly every level. As with its other weapon systems, the threat has incorporated recent technological developments into its newly designed air defense weapons. The threat has also improved weapons already in production. In addition, it has developed a variety of air defense missiles, while continuing to develop antiaircraft artillery.

(4) The threat has extensive and effective radar target detection and fire control systems. The radars fall into two general categories—surveillance and fire control. Surveillance includes early warning, target acquisition, and height finding radars. Some fire control radars also have limited target acquisition capability. Threat radars work as systems, and as separate units. Threat target acquisition radars detect and monitor the targets. These radars provide the necessary data for engagement, without unnecessarily exposing the air defense firing battery and radars, and mounted transporter-erector-launcher and radar, to detection by enemy forces, and subsequent neutralization by ECM or destruction.

(5) The deployment of a wide array of mobile and semimobile air defense systems has given ground formations greater freedom of maneuver. This deployment simultaneously frees aircraft from air defense missions for the ground support role.

(6) The threat is dedicated to improving the quality of air defense systems and capabilities. If economically feasible, the threat will continue to upgrade and increase the lethality of its air defense weapons. Consequently, threat air defense forces continually acquire new weapons systems, and modify previously fielded systems. The overall quality of threat air defense assets will continue to improve. Technological developments in remotely guided standoff weapons will affect future OPFOR air defense weapon development.

e. Engineer threats. The threat recognizes that engineer support is vital for the successful execution of combined arms operations. Engineer elements are found at all echelons, and special engineer equipment is found at all echelons, to give lower-level units a rudimentary autonomous capability to perform some engineer-type tasks. Engineers are divided into combat engineers, and special engineers. The basic engineer tasks are:

- Reconnaissance.
- Prepare fortifications.
- Prepare and maintain routes of movement.
- Clear obstacle.
- Equip and maintain gap crossings.
- Establish engineer obstacles.
- Carry out engineer camouflage measures.
- Extract and purify water and establish supply points.
- Carry out engineer measures to eliminate after effects of nuclear strikes.

The above three engineer tasks that are primarily combat engineer tasks are reconnaissance, clear obstacle, and establish engineer obstacles. The threat uses obstacles in three categories:

- Explosive obstacles – minefields, groups of mines, and objects prepared for demolition.
- Non-explosive obstacles – antitank ditches, escarpments, abates, wire barriers, and water obstacles.
- Combination obstacles – a combination of explosive and non-explosive obstacles.

(1) Minefield obstacles. The threat’s commitment to the defensive use of mines is unprecedented. Mines are usually emplaced in groups, or in minefields. There are five basic types of threat minefields:

- Antitank - serves to destroy or disable armored vehicles.
- Antipersonnel - targets personnel.
- Mixed - consist of both AT and AP mines.
- Decoy - a significant form of deception.
- Antilanding - prevent landings by amphibious, airborne, or heliborne assault forces.

The threat also makes a distinction between controlled (command-operated by hard wire or radio linkage, or autonomously sensor controlled), and uncontrolled minefields. Emplacement means may be manual, mechanical, or remote. Manual emplacement is not possible when there is little time, or during high-speed maneuver operations. Therefore, mechanical and remote means have become more prevalent in recent years. Rapidly laid and scatterable AT mines, in support of maneuver operations, will predominate on most future battlefields. If the threat plans only a temporary halt, or defensive action, it will mechanically surface-lay small protective minefields. It may also use remotely laid minefields (probably with self-destruct options), and controllable minefields. The threat may use not only mechanical minelayers, but also air and artillery means to emplace minefields.

(2) Obstacle clearing. The methods for creating breaches and passages depend on the situation, and on the type of barriers used by the enemy. Obstacles are explosive, nonexplosive, or a combination of the two. Of the obstacles the threat expects to encounter, mines are the most significant. The advent of remotely delivered, scatterable mines has increased the threat to the rear area; it has also made clearing explosive obstacles a primary task for troops on the march. Minefield breaching, during the offense, is generally the responsibility of the combined arms unit/subunit. Engineers reconnoiter the minefield, but the initial breaching is not primarily an engineer task.

(3) Engineer reconnaissance. Engineer patrols and groups, observation posts, and photographic reconnaissance posts perform engineer reconnaissance. Means of collecting information include observation; ground and aerial photography; and exploitation of documents, prisoners, and local residents. When enemy forces are within visible range, the threat establishes engineer observation posts. When visibility is restricted, it supplements these with listening posts.
(4) Fortifications. Preparing fortified positions is a task for engineers on the march, in the offense, and in the defense. Fortified positions increase weapons effectiveness, and protect personnel, weapons, and materiel against enemy attack. Priority is given to digging in command posts (CPs) and SSMs. Fortification preparation combines, and uses to best advantage, the terrain’s protective properties, local construction materials, and engineer excavation equipment.

(5) Gap Crossing. The threat may use two methods of overcoming water obstacles: forcing (when expecting enemy contact), and crossing (when not expecting enemy contact). Crossing often involves using bridges, ferries, or amphibious combat equipment. The “assault crossing” is an expeditious forcing, executed in waves, using only organic means. It requires minimal preparation and engineer support.

(6) The threat uses six types of technical camouflage:

- Camouflage paint.
- Artificial camouflage (nets and screens).
- Antiradar camouflage.
- Mock-ups (decoys).
- Light and thermal camouflage.
- Smoke camouflage.

f. Radioelectronic Combat Threats.

(1) Radioelectronic combat is similar to the U.S. doctrine of command, control, and communications countermeasures (C3CM). Integral to REC is the use of physical destruction. Radioelectronic combat is an integrated program of C3CM, using a combination of reconnaissance, jamming, firepower, and deception, to attack enemy organizations and systems through their means of control.

(2) The threat has a wide variety of assets for signals intelligence (SIGINT), which includes both communications intelligence (COMINT), and electronic intelligence (ELINT). All components of the threat have made technical advancements in SIGINT, as well as in ECM measures, employed to neutralize enemy communications and electronics, through jamming and deception. The threat has also placed major emphasis on ECCM, through strict enforcement of signal security, equipment redundancy, alternate subsystems, system design, and operator skill.

(a) Radio and Radar Reconnaissance. Radioelectronic reconnaissance includes radio reconnaissance and radar reconnaissance. The former—sometimes called radio intercept and direction finding (DF) – is the equivalent of the U.S. COMINT; the latter—sometimes called radar intercept and DF—equates to ELINT.

(b) Intercept. Radio intercept is the ability to monitor and understand message content. The threat has extensive intercept capability, for both radio transmissions, and radar emissions. Airborne radioelectronic reconnaissance platforms provide a much-improved capability to intercept radio and radar signals more frequently, and at greater distances, than ground-based
systems. The aim of these airborne platforms is the detection and location of enemy battlefield surveillance radars, CPs, communication centers, and tactical nuclear delivery systems.

(c) Direction finding. The purpose of radio and radar DF is to locate transmitting stations and radar emitters. Various types of mobile antenna systems serve in a DF role. Forward-area mobile elements include a very high frequency tactical radio direction finder, as well as radar direction finders. Opposing Forces’ DF elements can pick up tactical Frequency Modulation (FM) radios, operating on low power, at distances in excess of 10 kilometers (km), and detect high-power signals at distances up to 40 km.

(d) Jamming. Another element of the OPFOR REC concept is the requirement to jam, at critical times, enemy C2 and weapon system communications, when they cannot be destroyed by firepower. The principle means of OPFOR jamming are:

- Radar jamming, by using barrage and spot noise, pulse, chaff, and decoys.
- Electronic jamming of command guidance systems—using pulse and simulation techniques.
- Radio noise jamming of Amplitude Modulation and FM signals.

The threat may deploy a communications jammer on vehicles, such as mounted on an amphibious armored tracked vehicle, or, on very primitive platforms, including animals. Additionally, the threat ground forces are deploying newer, and more technically advanced jammers, to include expendable jammers. The threat supplements its communications jamming capability with a considerable number of ground-based radar jamming sets. The threat continues to modernize its radar jamming assets in response to advances in radar technology. This effort emphasizes the threats’ intention to disrupt enemy airborne radars, thereby supporting both its own air operations, and air defense of high value rear area targets. Aviation supporting front operations also performs spot, or barrage, jamming and dispenses chaff directed against enemy air defense early warning and fire control radars. It may also eject chaff to achieve jamming, deception, and camouflage. Individual aircraft may carry SSJ and chaff dispensers. The threat continues to upgrade its airborne assets. To complement advances in ground-based communications jamming systems, the threat has deployed heliborne jamming platforms. These heliborne systems offer the distinct advantages of greatly increased range, mission flexibility, mobility, and brute jamming power.

(e) Directed Energy Warfare. Directed energy is a highly directional beam of concentrated electromagnetic energy, or atomic/subatomic particles. It has potential for a number of military applications, including ranging, communications, and target acquisition and designation. The term directed energy weapon refers to three weapon concepts, based on laser, radio frequency, or particle beams:

- Laser weapons would employ an intense beam of coherent electromagnetic radiation at IR, optical, ultraviolet, or X-ray frequencies.
- Radio frequency weapons would employ an intense beam of electromagnetic radiation at microwave or millimeter wave frequencies.
- Particle beam weapons would employ an intense beam of charged or neutral particles, such as electrons, protons, or hydrogen atoms.
g. Synthetic environment. Factors in the synthetic environment, like terrain, vegetation, and weather, directly impact mobility, weapon effects, and sensor effects. Each of these factors should support the 12 common missions (paragraph 3-2a(4)(b)). The impact of terrain and weather on the weapon and sensor systems that will be incorporated in the UA is relatively complex, and requires careful analysis.

h. Dismounted threats. The dismounted soldier faces dismounted threats, ranging from combating terrorism at home, to combat activities in a given area of operations. Each of these threats requires careful analysis, and inclusion in ET capabilities and exercise scenarios.

i. Civil military. Civil military operation covers civilian attitudes, and changes in attitude, based on military actions and responses. The system must be able to account for changes in relationship, as terror is employed by factions outside host nation government, or by host nation government. It must also be able to accurately portray changes in the social/economic/political situation within the nation, as the scenario develops. Civil military operations include:

   1. Liaison with Host-nation Government officials.
   2. Coordination with allied forces, NGO(s), and private voluntary organization(s).
   3. Facilitating local contracts.
   4. Resolving issues with local population, contractors, and government.

j. Peacekeeping. Peacekeeping operations are military operations that maintain peace already obtained through diplomatic efforts. A peacekeeping force supervises, and implements, a negotiated truce to which belligerent parties have agreed. The force operates strictly within the parameters of its terms of reference, doing neither more, nor less, than its mandate prescribes. A distinguishing feature of these operations is that the peacekeeping force is normally forbidden to use violence to accomplish its mission. In most cases, it can use force only for self-defense. (See FM 3-07.)

k. Operations Other than War (OOTW). The general goals of U.S. military operations, during OOTW, are to support national objectives, deter war, and return to a state of peace. Such operations involve a greater risk that U.S. forces could become involved in combat, than operations conducted to promote peace. The physical presence of U.S. forces, coupled with their potential employment, can serve as a deterrent, and facilitate achieving strategic aims. Should this deterrence fail, force may be required to compel compliance, for example, in the form of raids or strikes. Other such operations include peace enforcement, counterterrorism, enforcement of sanctions, support to insurgency and counterinsurgency, maritime interception, and evacuation of noncombatants. At any point when force, or the threat of its use, is contemplated, those responsible for ordering, planning, or executing such action should remember Carl von Clausewitz’s dictum—that the use of force and violence introduces the fear, physical strain, and the uncertainty that are some of the hallmarks of the nature of warfare. Just as there are important political, diplomatic, and legal differences between war and OOTW, there is also a singularly important threshold where using military force of any kind, or the threat of its
use, comes into play. In the range of military operations, this threshold is the distinction between combat and noncombat operations. (See Joint Publication 3-0, chap 1.)


(1) Stability operations apply military power to influence the political and civil environment, facilitate diplomacy, and interrupt illegal activities. They may take place before, during, and after offensive, defensive, and support operations. The purpose is to deter or thwart aggression; reassure allies, friendly governments, and agencies; encourage a weak or faltering government; stabilize a restless area; maintain or restore order; and enforce agreements or policies. Stability missions include:

- Peace operations.
- Combating terrorism.
- Counterdrug operations.
- Noncombatant evacuations.
- Arms control.
- Nation assistance.
- Support to insurgencies.
- Support to counter insurgencies.
- Show of force.
- Civil disturbances.

(2) Support operations provide essential supplies and services to assist designated groups. Support missions may be independent, or complement the offensive, defensive, or stabilizing operations. The purpose is to save lives, reduce suffering, recover essential infrastructure, improve quality of life, and restore situations to normal. The ultimate goal of support is to meet the immediate needs of designated groups, and to transfer responsibility, quickly and efficiently, to appropriate civilian authorities.

8-2. Organizations. Embedded training application will not require a change to the Army’s table of organization and equipment.

8-3. Training and Education. Embedded training applications will be used for institutional training at institutional schools, unit training programs at home station, and during deployments to CTCs and employment areas. There are three major categories of embedded training. The first category is synthetic operation of the equipment. Second category is presentation of courseware, and the third category is training management. Professional military education (PME) is supported by the on-board reach capability (part of the courseware presentation category) which provides the means for soldiers to participate in PME programs wherever the unit is located, when every time is available, by whoever wants to avail themselves of the opportunity. The embedded system can teach soldier tasks inherent in Duty Military Occupational Specialty, including discrete critical skills, skill levels, associated special skill identifiers and qualifiers, and varied leader development.
8-4. Materiel.

a. The material involved in adopting ET takes several forms. For modernization weapon systems, ET functions will be included in the design. Most functions will be accomplished by the operation equipment, with the addition of one small highly reliable component to sense what the weapon is doing, inject stimulus to system components, and communicate with the infrastructure.

b. Recapitalized legacy force systems will need to interface with CTC instrumentation systems, and other objective force systems, in order for them to participate in combined arms training. Through the recapitalization process, and reverse engineering, the legacy systems will be brought up to the standard set for the OF.

c. Legacy and modernization systems need to interface, not only at CTCs, but also at home station, when deployed, and within the institutional training base. Additionally, all of these systems eventually will need to have some joint connectivity/interoperability. Recapitalization is but an element of the Army’s Modernization Plan. There are only 17 systems selected for this program. At this juncture, the schedule is unknown for bringing these systems up to OF standards for ET applications. Rather, it is a goal. The reason is that transformation to the OF is a 30-plus year proposition; embedded training is a desired end-state.

8-5. Leadership. Embedded training, driven by increasing more strenuous exercise scenarios, can be designed to produce conditions for realistic testing of critical battle-focused analysis skills, or test/produce adaptive leadership skills, and/or critical thinking skills. With ET, the frequency of the leadership training exercises does not depend on scheduling and fielding large numbers of forces and equipment. Leadership exercises can be conducted in a virtual environment, as frequently as the unit leadership determines.

8-6. Personnel. There is no change in the Army’s MOS structure anticipated to support this system. In fact, like a well-designed schoolhouse to the soldier distance learning, embedded systems have the potential of expanding training; and time and cost-savings may accrue.

8-7. Facilities. There are limited facilities necessary for extended operation of ET systems. While many of the platforms have power generation capabilities without running the main engine, commercial power connection available in the motor pool will reduce wear on the operational power generation equipment. Additionally, network connects using a physical wire plant will again reduce operational tactical radio usage.
Appendix A
References

Section I
Required Publications

AR 5-11
Management of Army Models and Simulations

AR 25-1
Army Information Management

AR 350-1
Army Training

AR 380-19
Information Systems Security

Army Embedded Training Action Plan, Army Training Support Center, 30 Nov 01
(http://www.atsc.army.mil/tsaid/embeddedTrg.asp)

FM 3-0
Operations

FM 3-07
Stability Operations and Support Operations

FM 7-0
Training the Force

FM 25-101
Battle Focused Training

Joint Pub 3-0
Doctrine for Joint Operations

TRADOC Pam 71-9
Requirements Determination

TRADOC Reg 350-70
Systems Approach to Training Management, Processes, and Products

Section II
Related Publications

AR 350-50
Combat Training Center Program
Glossary

Section I
Abbreviations

AAR After Action Review
AKM Army Knowledge Management
AP antipersonnel
AT antitank
ATA Air-to-Air
ATG Air-to-Ground
ATGM Antitank Guided Missile
ATIA Army Training Information Architecture
ATIA-M Army Training Information Architecture-Migrated
BLOS beyond line-of-sight
C2 command and control
C3CM command, control, and communications countermeasures
C3I command, control, communications, and intelligence
C4 command, control, communications, and computers
C4I command, control, communications, computers, and intelligence
C4ISR command, control, communications, computers, intelligence, surveillance, and reconnaissance
CAI Computer Assisted Instruction
CAL Computer Assisted Learning
CAT Computer Assisted Testing
CATS Combined Arms Training Strategy
CBI Computer Based Instruction
CBRN Chemical, Biological, Radiological, and Nuclear
CBT Computer Based Training
COMINT communications intelligence
COP common operating picture
CP command post
CTC Combat Training Center
DA Department of the Army
DEW directed energy weapon
DF direction finding
DOD Department of Defense
DOTMLPF Doctrine, Organizations, Training, Materiel, Leadership and Education, Personnel, and Facilities
DCSOPS&T Deputy Chief of Staff for Operations and Training
DVD digital versatile disk
ECCM electronic counter-counter measures
ECM electronic counter measures
ELINT electronic intelligence
ET embedded training
EW electronic warfare
EWC engineer warfare and countermine
FBCB2 Force XXII Battle Command Brigade-and-below
FCS Future Combat System
FM Field Manual
FROGs Free rockets over ground
GTA Ground-to-Air
GTG Ground-to-Ground
HLA High Level Architecture
HQ headquarters
IAW in accordance with
ICS intelligence and communications systems
IMI Interactive Multimedia Instruction
IR infrared
IS Instrumentation System
ITS Intelligent Tutor System
km kilometer
LMS Learning Management System
LOS line-of-sight
LVC live-virtual-constructive
M&S models and simulations
MEL Master Events List
METL Mission Essential Task List
MOS Military Occupational Specialty
MOUT Military Operations in Urban Terrain
MRL multiple rocket launcher
MULE Modular Universal Laser Equipment
NCO noncommissioned officer
NET new equipment training
NGO nongovernmental organization
NLOS non-line-of-sight
OC Observer Controller
Section II
Terms

After-Action Review (AAR)
A method of providing feedback to units, by involving participants in the training diagnostic process, in order to increase and reinforce learning. The AAR leader guides participants in identifying deficiencies, and seeking solutions.

audience (as defined by the Army Digital Training Strategy)
The target audience includes a wide range of soldiers in varying grades and MOSs who acquire the skills, knowledge, and attitudes to perform functional tasks on digital systems that support specific operational requirements.
a. **Individual.** The individual is a person found in all training domains, who acquires the skills, knowledge, and attributes to perform functional tasks of digital systems that support specific operational requirements. Individuals include operators, leaders, and administrators.

b. **Leader.** The leader is a person who requires the ability to operate a digital system at a functional level, and understands both the “vertical” and “horizontal” relationship of the system, or systems, within the C4ISR network. Leaders provide supervisory-level guidance to other operators, understand the functionality of select digital systems, and understand how to integrate and synchronize systems and information to reach their maximum potential. The leader is an integrator performing tasks to collate, synthesize, and integrate information.

c. **Communication/System Administrator.** The communication/system administrator is a functional operator of a digital system that provides system and network support to other digital systems in an operational environment. The communication/system administrator requires functional and technical skills that normally exceed basic operator and leader skills.

d. **Unit.** Units include staffs, crews, teams, sections, cells, and organizations where training is performed to accomplish an operational mission. Training consists of performance-oriented individual and collective training, with leader participation, in combined arms, and joint, multinational, and interagency training.

**collective training**
Training in units to prepare cohesive teams and units to accomplish their combined arms missions on the integrated battlefield.

**combat developer**
A command, agency, organization, or individual that commands, directs, manages, or accomplishes the combat developments work.

**Combined Arms Training Strategy**
The Combined Arms Training Strategy describes how the doctrinal force trains and lists resources required for training. Combined Arms Training Strategy integrates training of heavy, light, and special operating forces of both Active and Reserve Components. The foundation of CATS is a series of proponent-generated strategies for schools and units that describe the events, frequencies, and resources required for training to standard.

**combined training**
Training involving elements of two or more forces of two or more allied nations.

**Combat Training Center Program**
An Army program established to provide realistic joint service and combined arms training in accordance with Army doctrine. It is designed to provide training units opportunities to increase collective proficiency on the most realistic battlefield available during peacetime. The four components of the CTC Program are the National Training Center, the Combat Maneuver Training Center, the Joint Readiness Training Center, and the Battle Command Training Program.
command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR)
The collection of equipment, software, and personnel required for obtaining information and intelligence for commanders, at any level, to command those forces under their authority. The elements include, but are not limited to, sensor data processing displays, communications, software, the concomitant systems engineering required to tie these technologies together, and the personnel to make these systems function. The functions also include information systems and information warfare.

constructive simulation
Models and simulations (M&S) that involve simulated people operating simulated systems.

crew drill
A collective action that a crew of a weapon, or piece of equipment, must perform, to use the weapon or equipment successfully in combat, or preserve life. This action is a trained response to a given stimulus, such as a simple leader order, or the status of the weapon or equipment. It requires minimal leader orders to accomplish, and is standard for that weapon, or piece of equipment, throughout the Army.

data
A representation of facts, concepts, or instructions, in a formalized manner, suitable for communication, interpretation, or processing by humans, or by automatic means.

domains (as defined by the Army Digital Training Strategy)

a. Institution. Resident institution training is the foundation of career-long learning, and provides a key enabler for unit readiness. It can be conducted at a school in a resident status, or non-resident through distributed learning capabilities. Resident training is conducted at training sites that have the necessary facilities and equipment to support all training requirements. The training develops competent, confident, disciplined, leaders, soldiers, and civilians. Institution training focuses on common tasks and a selected portion of occupation-related critical tasks.

b. Home Station. Home station training is all training conducted by individuals and/or units in a stable, infrastructure-supported environment, where a habitual relationship of base operations and infrastructure support exists. Home station could be an armory for an ARNG soldier, or an installation such as Fort Bragg, NC, or Camp Casey, Korea.

c. Combat Training Centers (CTC). The CTCs provide hands-on, highly realistic and stressful combined arms and joint training in an environment that approximates actual combat conditions. Training at the CTCs is designed to exercise the unit's METL. Combat Training Centers focus on soldier tasks, collective tasks, and leadership skills that contribute directly to the success or failure of collective tasks, and the unit’s mission. Combat Training Centers provide an operational experience for soldiers, leaders, and units; and develop leaders. The CTCs consist of the Battle Command Training Program (primarily, a constructive training environment) and the three maneuver CTCs (Joint Readiness Training Center, National Training Center, and Combat Maneuver Training Center)—primarily, a live training environment.
d. Deployed. Training conducted by individuals and units away from their habitual home station is deployed training. Deployed training is conducted in environments ranging from austere, with no base operations infrastructure support, to environments with complete base operations capability that provides modern infrastructure support. Units deploy for training or for operations. A unit conducting training at one of the CTCs, or conducting training during peace operations in Bosnia-Herzegovina is considered deployed training.

embedded training
A function hosted in hardware and/or software, integrated into the overall equipment configuration. Embedded training supports training, assessment, and control of exercises on the operational equipment, with auxiliary equipment and data sources, as necessary. Embedded training, when activated, starts a training session, or overlays the system’s normal operational mode, to enter a training and assessment mode. Embedded training will accomplish the following:

- Concept
  - Provide a system or family of systems synthetic operational environment.
  - Present training to individuals, crews/teams, units, unit leaders, and staffs.
  - Enable training individuals through collective task in all domains and environments, to any audience, at any level. (Note: see definitions for terms in italic.)

- Simulation/Stimulation Data
  - Simulate operational data not available from actual data sources.
  - Receive operational data from actual data sources.
  - Integrate simulated and actual data.
  - Present data to the operator(s), maintainer(s), leader(s), and other user(s), by means of their normal operational equipment.
  - Require operator(s), maintainer(s), leader(s), and other user(s) to perform their job tasks and duties in response to data presented.

- Capability
  - Ability to simulate faults and errors to allow training in degraded modes of operation.
  - Ability to tailor training based on user(s)’ needs, performance, and choice, as appropriate. This includes the capability for leaders to tailor training exercises to meet units’ needs.
  - Ability to control an exercise, and inject data into an exercise.

- Interconnectivity
  - Provide training interoperability with joint, coalition, allied, non-Department of Defense (DOD), and other external agencies operating in the Global Information Grid, IAW DoD accepted standards and protocols.
  - Interface with on-board communication systems to reach to remote distributed repositories.
  - Interface with range instrumentation to transport data.

- Training Feedback
Assess, collect, and record the performance of the operator(s), maintainer(s), leader(s), and other user(s).

Provide feedback on the performance of the operator(s), maintainer(s), leader(s), and other user(s).

Aggregate performance records (for individuals, crews, units, and unit leader) over time.

**individual training**
Training that the officer, noncommissioned officer (NCO), or soldier receives in institutions, units, or by on-the-job training or self-study. This training prepares the individual to perform specified duties, or tasks, related to the assigned or next higher specialty code, or MOS skill level and duty position.

**institutional training**
Training conducted in schools (Army service school, United States Army Reserve school, NCO Academy) or Army training centers. Institutions that conduct this training are commonly referred to as being part of the training base.

**Interactive Multimedia Instruction (IMI)**
A group of computer-based training and training support products. Interactive Multimedia Instruction includes source materials that are commonly used in IMI products; electronic products used in the delivery of, or supporting the delivery of, instruction; and software management tools used to support instructional programs.

**interoperability**
The ability of systems, units, or forces to provide services to, and accept services from, other systems, units, or forces, and to use the services exchanged to enable them to operate effectively together.

- The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases.
- Interoperability of a tactical automated system is the ability of two or more systems to directly exchange and process data.
- The ability of systems, units, or forces to provide services to, and accept services from, other systems, units, or forces, and to use these services to enable them to operate effectively together.

**Interoperability with Models and Simulations**

a. Department of Defense Directive 5000.59 establishes DoD policy, assigns responsibilities, prescribes procedures for the management of M&S, and establishes the Defense Modeling and Simulation Office, which serves as the DoD focal point for M&S. This regulation instantiates those policies and procedures for the Army.

b. The High Level Architecture (HLA) has been designated as the standard technical architecture for all DoD simulations. This mandate for HLA compliance supersedes all previous
requirements for DoD simulations, to comply with other simulation standards, such as Distributed Interactive Simulation or Aggregate-Level Simulation Protocol. All Army simulations will meet DoD standards. High Level Architecture establishes a common high-level simulation architecture, to facilitate the interoperability of all types of simulations, among themselves, and with command, control, communications, computers, and intelligence (C4I) systems. The HLA will also facilitate the reuse of M&S, as the Army moves into an era of federations of simulations producing synthetic battle environments, across all domains.

c. All Army M&S will be compatible with the Joint Technical Architecture-Army. Models and simulations implementors shall specifically use, but not be limited to, (1) Section 2 (Information Processing Standards)—specifically the acceptable programming languages; (2) Section 4 (Information Modeling and Data Exchange Standards); and (3) Appendix G (Modeling and Simulation Standards).

environments (as defined by the Army Digital Training Strategy)
These are the locations where individual and collective training occur.

a. **Live.** The live training environment is comprised of soldiers, crews, and units physically conducting training with their organic equipment, while exposed to the full effects of weather, terrain, and limited visibility. This environment includes the use of training aids and devices to enhance live training. Examples of live training include a company conducting a field training exercise in the local training area, or a battalion task force fighting the OPFOR in a force-on-force battle at one of the maneuver combat training centers.

b. **Virtual.** Training that constitutes individual soldiers, crews, and units, using hands-on training to operate simulators that replicate all, or part, of their actual combat systems. An example of a virtual trainer is the Close Combat Tactical Trainer. It is a family of simulators that allow soldiers, crews, and units to safely practice individual, crew, and combined arms training tasks without expending fuel and ammunition, and without subjecting themselves to the danger associated with live weapons firing. Other examples include engagement skills trainers, and unit conduct of fire trainers. Virtual simulators provide realistic tools to train METL-based tasks.

c. **Constructive.** The constructive environment consists of units and staffs using maps, role players, and computers to conduct training. Computer simulations are used to drive command post exercises to train command and staff functions of units through the corps level. A division Battle Command Training Program Warfighter Exercise or battalion command post exercise is an example of a constructive training environment event.

d. **Synthetic training environment.** The STE is a nearly “seamless” connection of any combination of live, virtual, and constructive training environments to enable soldiers, leaders, battle staffs, and commanders to more realistically collectively “train as we fight.” An example of an STE event is a live brigade command post exercise, with CPs operating in the local training area, driven by constructive simulations, and with virtual UAVs providing real-time intelligence.

e. **Distributed learning.** Distributed learning constitutes individual soldier, leader, staff, and small group training that provides skills and abilities that support collective training. Distributed
training consists of traditional text, interactive multimedia, web-based, video training, etc. It can be conducted anywhere—from a kitchen table at home, to a deployed tactical operations center.

**Joint Technical Architecture**  
Identifies a common set of mandatory information technology standards and guidelines for use in all new and upgraded C4I Information Technology.

**Joint Training**  
Training in which elements of more than one service of the same nation participate.

**Knowledge Management**  
Embedding Knowledge Management involves understanding the ways in which people work, and creating systems to support the work. Army Knowledge Management (AKM) strategy is the center of the Army’s information revolution. It is the enabler for mission operations, knowledge generation, information delivery, and technology innovation. The AKM vision encompasses a transformed Army, with agile capabilities and adaptive processes, powered by world-class, network-centric access to knowledge systems and services, interoperable with the joint environment. It embraces Army and DOD imperatives for information dominance, and integrates technology, e-business, and knowledge management concepts.

**leader development**  
A continuous, progressive, and sequential process through which leaders acquire the skills, knowledge, and behavior necessary to maintain a trained and ready Army in peacetime, to deter war.

**Live, Virtual, and Constructive Simulation**

- **Live Simulation**: A simulation involving real people, operating real systems. The degree of human participation is infinitely variable, as is the degree of equipment realism.
- **Virtual Simulation**: A simulation involving real people, operating simulated systems. Virtual simulations inject humans-in-the-loop in a central role, by exercising motor skills, decision skills, or communication skills.
- **Constructive Simulation**: Models or simulations that involve simulated people operating simulated systems.

**materiel developer**  
The Research, Development, and Acquisition (RDA) command, agency, or office assigned responsibility for the system under development, or being acquired. The term may be used generically, to refer to the RDA community in the material acquisition process (counterpart to the generic use of combat developers).

**Mission Essential Task List (METL)**  
A compilation of collective mission essential tasks that must be successfully performed, if an organization is to accomplish its wartime mission(s).
**Mission Rehearsal Exercise**
The Mission Rehearsal Exercise is a contingency focused exercise, specifically designed to prepare individuals and units for impending military operations. Mission Rehearsal Exercises are conducted during predeployment, deployment, and hostilities.

**Mission Profile**
A time-phased description of the events and environments a system experiences, from initiation, to completion of a specified mission.

**new equipment training**
Training to prepare commanders, leaders, trainers, users, and maintenance personnel during development and fielding of new equipment. It includes training to prepare commanders, staff, and junior leaders to fight with new weapons and equipment.

**Operational Mode Summary**
A description of the expected percentage of use for each mission profile, and the environmental conditions for which the system was designed.

**Operational Requirements Document (ORD)**
An ORD is a requirements document that contains all necessary performance and related operational parameters for a proposed concept or system. The combat developer prepares the ORD, with assistance from the materiel developer.

**probability of hit (Ph)**
Probability of hit is based on six independent variables: motion of target and firing unit (accounting for two of the six variables), shooter class, target class, target exposure, range to target unit, and target unit orientation.

**probability of kill (Pk)**
The probability of a specific munition or weapon system causing the disablement or destruction of a target.

**precision gunnery**
Precision gunnery allows on-vehicle precision gunnery without the expenditure of actual ammunition. Precision gunnery is fully integrated with the vehicle fire control system, requiring the crew member(s) to perform gunnery functions (lead, super-elevation, and lase) exactly as they would in combat. Provides visual tracers, burst, and obscuration, through the vehicle sights. All event data are recorded for After-Action Review.

**required capabilities**
Operational abilities needed to perform the range of future military operations, as described in the capstone concept and subordinate concepts. Capabilities may be explicitly stated in concepts, or derived through analyses of one or more concepts, or facets, of military operations. Capabilities are attained through changes to, or development of, new doctrine, training, leader development, organization, materiel, and/or soldier support.
scenario

a. Description of an exercise (“initial conditions” in military terms). It is part of the session database that configures the units and platforms, and places them in specific locations, with specific missions.

b. An initial set of conditions and timeline of significant events imposed on participants, to achieve exercise objectives.

simulators
A training medium that replicates or represents the functions of a weapon, weapon system, or item of equipment, generally supporting individual, crew, or crew subset training. Simulators may stand alone, or be embedded.

simulations
A training medium designed to replicate or represent battlefield environments in support of command and staff training. Simulations may stand alone, or be embedded.

stimulate
To provide input to a system, in order to observe, or evaluate, the system’s response.

self-study
Individual study by which a soldier learns a new skill, or reinforces a skill already learned. Study may include participation in the Army Correspondence Course Program. It includes preparation for the Skill Qualification Test.

Sustaintment training
Training required for maintaining the minimum acceptable level of proficiency, or capability, required to accomplish a training objective.

synthetic environments
Internetted simulations that represent activities at a high level of realism, from simulations of theaters of war, to factories and manufacturing processes. These environments may be created within a single computer, or a vast distributed network connected by local and wide area networks, and augmented by super-realistic special effects, and accurate behavioral models. They allow visualization of, and immersion into, the environment being simulated.

synthetic operational environment
Simulated composite of all conditions, circumstances, and influences that affect the employment of military forces, and bear on the decisions of the unit commander.

Synthetic Training Environment (STE)
The evolution of expanding battlespace to accommodate the use of digitization, to include M&S capabilities, within the live, virtual, and constructive training environment, in support of combat readiness.
system-of-systems
A set, or arrangement, of systems that are related or connected, to provide a given capability. The loss of any part of the system will degrade the performance, or capabilities, of the whole.

task
A clearly defined and measurable activity accomplished by individuals and organizations. Tasks are specific activities that contribute to the accomplishment of encompassing missions, or other requirements.

threat
Ability of an enemy, or potential enemy, to limit, neutralize, or destroy effectiveness of current or projected mission, organization, or item of equipment. A statement of that threat is prepared in sufficient detail to support Army planning and development of concepts, doctrine, training, and material. A statement of a capability prepared in necessary detail, in context of its relationship to a specific program or project, to provide support for Army planning and development of concepts, doctrine, and materiel.

training
The instruction of personnel to individually, and collectively, increase their capacity to perform specific military functions and tasks.

training assessment
An analytical process used by Army leaders to determine an organization's current levels of training proficiency on mission essential tasks.

training evaluation
The process used to measure the demonstrated ability of individuals and units to accomplish specified training objectives.

training objective
A statement that describes the desired outcome of a training activity. A training objective consists of the following three parts:

  a. Task. A clearly defined and measurable activity accomplished by soldiers, leaders, or units.

  b. Condition(s). The circumstances and environment in which a task is to be performed.

  c. Standard. The minimum acceptable proficiency required in the performance of a particular training task.

Training Support Package
A complete, exportable package integrating training products, materials, and/or information necessary to train one or more critical tasks. Its contents will vary depending on the training site or user. A training support package for individual training is a complete, exportable package integrating training products/materials necessary to train one or more critical individual tasks. A training support package for collective training is a package that can be used to train critical collective and supporting critical individual tasks (including leader and battle staff).
unit training
Training (individual, collective, and joint or combined) conducted in a unit.

user
Table of Organization and Equipment, or Table of Distribution and Allowance command, unit, element, agency, crew, or person (soldier or civilian) operating, maintaining, and/or otherwise applying DOTMLPFS products, in accomplishment of a designated mission.

users’ functional description
A vehicle used by combat developers with users, materiel developers, testers, and evaluators to refine and amplify operational requirements for automated capabilities.

virtual simulation
A simulation involving real people operating simulated systems. Virtual simulations inject humans-in-the-loop in a central role, by exercising motor skills, decision skills, or communication skills.

weapon
The part of a system used to defeat or counter a threat element.

FOR THE COMMANDER:

OFFICIAL: ANTHONY R. JONES
Lieutenant General, U.S. Army
Deputy Commanding General/
Chief of Staff

/signed/
GREGORY J. PREMO
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