Training Devices and Simulations

—combining realism and safety

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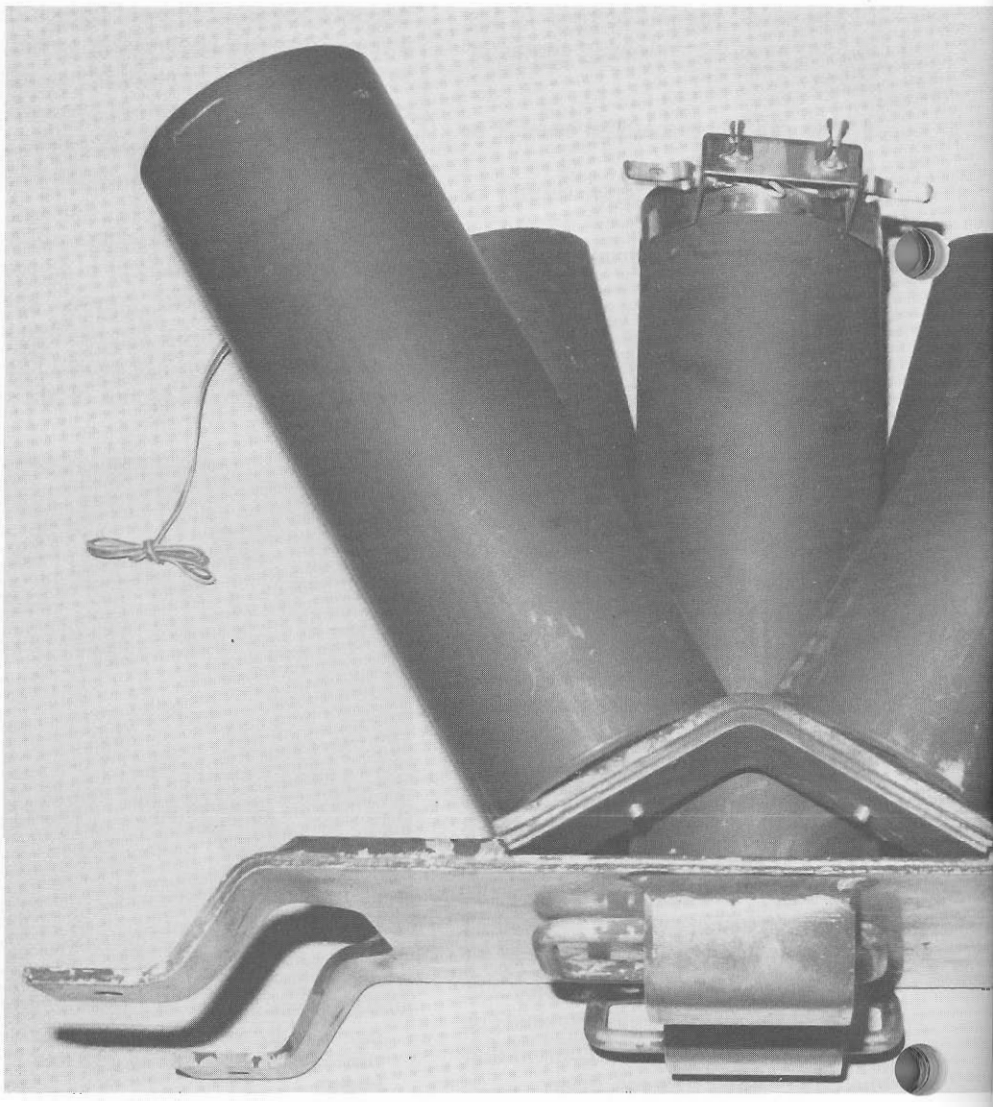
The US Army Chemical School (USACMLS) has initiated an innovative training device development program designed to revolutionize nuclear, biological, and chemical (NBC) training at both institutional and field levels. This task/mission-oriented training device program trains soldiers with cues (signals designed to trigger specific actions or reactions) expected to be experienced on actual NBC battlefields, and provides realistic simulation in an area of training heretofore neglected because of troop and environmental safety constraints.

"Unit training should simulate as closely as possible the battlefield's tempo, scope, and uncertainty."

FM 100-5, Operations, 5 May 86

Introduction

Past NBC training separated NBC skills into separate training exercises—NBC olympics, or NBC volleyball or softball games played by soldiers wearing MOPP (protective) gear and gas masks. This type of training in a garrison environment appears to fulfill NBC training requirements. And training in a field environment for an Army Training and Evaluation Program (ARTEP) exer-



This item, the Launcher, Projectile, Liquid Airburst (M267) is to be used in chemical defense training exercises, and will improve upon the capability of the M9 SPAL currently fielded. The device will simulate contamination of troops, vehicles, or terrain with liquid agent simulant which will react with detector paper.

cise, for instance, generally relegates NBC training to "simulation" (and the word is used lightly).

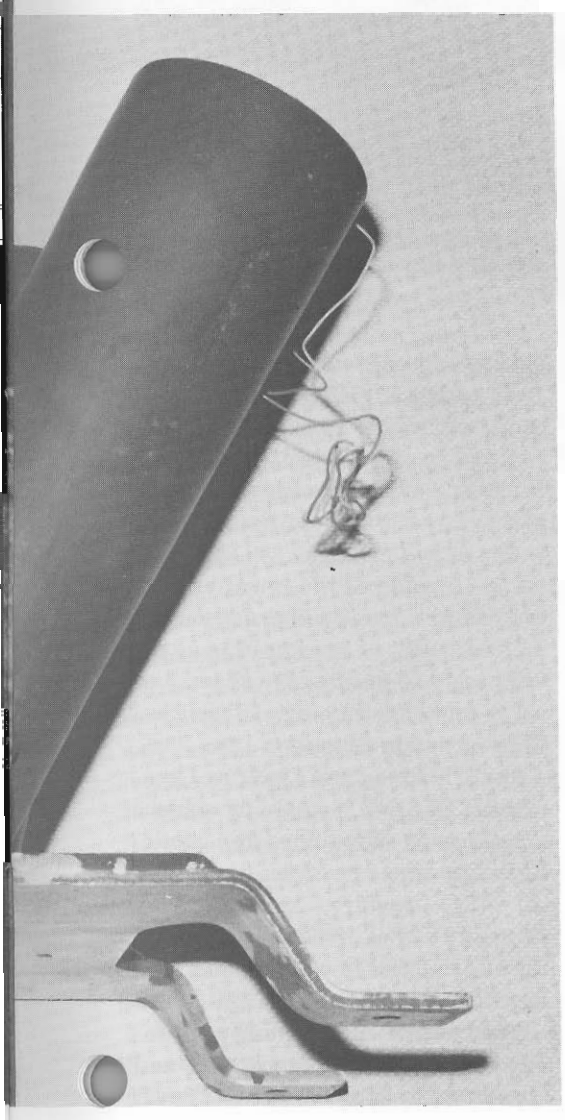
Such simulation usually requires an NBC evaluator to toss a colored smoke grenade, activate a unit's chemical agent alarm, and announce to a group of soldiers that a random selection of individuals (selected on a scientific "hey you" basis) are determined to be casualties.

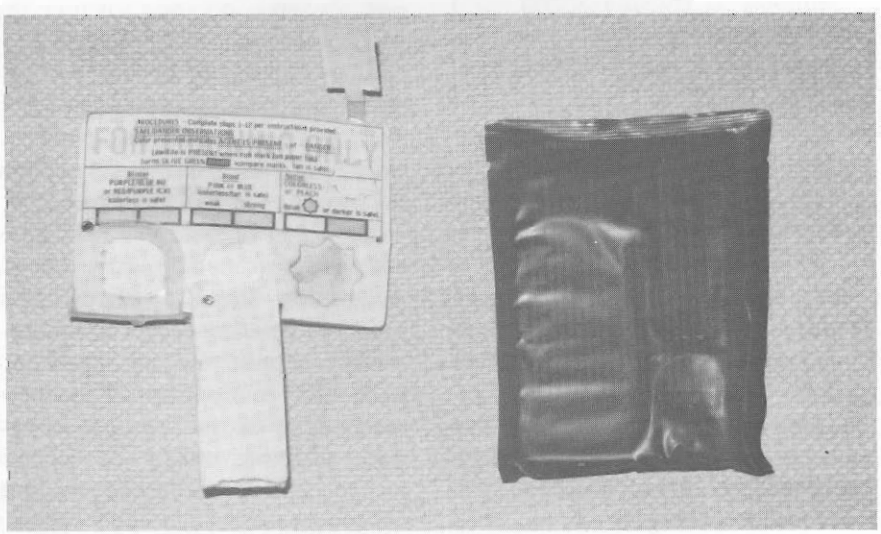
It does not matter whether the individual soldier reacts properly or whether his equipment is operational. The evaluator needs casualties, so he can observe noncasualty reactions to a chemical agent attack. But soldiers are reacting to information provided by the evaluator, not information provided by the unit's organic detection equipment.

An alternative "simulation" uses riot control agents on military reservations where the public will not be harmed. The use of riot control agents trains soldiers to wear their masks when they smell CS gas (not the usual way Threat delivers chemical agents).

Soldiers learn quickly who in their unit controls the use of training gas. Any time they see a known Chemical Corps soldier in a CS free play training area, they react to the presence of that individual, not to a chemical agent threat. The only alternative to these two scenarios is the introduction of training devices for simulated agent delivery and detection on a limited basis—such as the Simulated Projectile, Airburst Liquid (SPAL), simulated persistent agents polyethylene glycol 200 (PEG 200), and N-butylmercaptan (BUSH).

All of these systems rely on technologies borrowed from other countries and developed separately without the benefit of a unified system. They are quick fixes to individual shortfalls in training. The SPAL cannot be fired over troops, and PEG 200 simulates only one type of persistent agent, thereby making identification easy in exercises using the NBC Warning and Reporting System. BUSH gives false cues and is difficult to store. Other programs were initiated and their development and fielding continues. But now they





A filter-sized, computerized element, the Nuclear, Biological, and Chemical Agent Casualty Assessment system (NBC-CAS) will be usable in current and future protective masks and provide a realistic assessment of NBC casualties on the AirLand battlefield. The Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) is being developed for use with the M256 Chemical Agent Detector Kit during full-scale chemical operations. It will contain 367 samplers to simulate positive and negative responses. TRAINS uses M256 Kit sampler/detectors that have been preengineered to give positive simulated agent responses when activated without the presence of agent simulants.

Figure 1.
TDAS Management Plan*

- Nuclear Weapons Effects Simulator
- Total Dose/Dose Rate Simulator
- Radiation Automatic Casualty Assessment System
- Biological Agent Simulant
- Biological Agent Casualty Assessment System
- Biological Agent Decontamination Simulant
- Chemical and Biological Agent Delivery System
- Nonpersistent Chemical Agent Simulant
- Chemical Agent Casualty Assessment System
- Persistent Chemical Agent Simulant/Chemical Agent Disclosure Solution
- Biological Detection and Alarm Training System
- Chemical Detection and Alarm Training System
- NBC Evaluation/Training System
- NBC Computer Assisted Training System
- Scale Model NBC Equipment
- NBC Wargames and Simulations Training System
- Projected Smoke Simulator
- Infrared Defeating Smoke Simulator
- Multi-Media Threat Training System

*These devices or systems are in varying stages of development.

will be a part of the USACMLS program, which began in 1982.

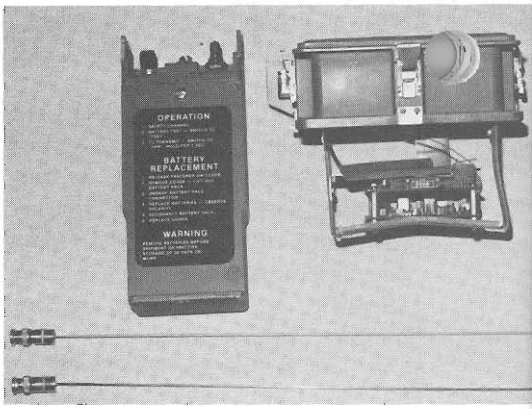
TDAS Acquisition Strategy

The mission of the Chemical School's Training Devices and Simulations (TDAS) Branch, Unit Training Division, Directorate of Training and Doctrine, is one of the most important in the Army today. One part of the TDAS story tells how this mission is being carried out. The other part explains how the program attempts to duplicate—in NBC warfare training—what the Multiple Integrated Laser Engagement System (MILES) does for direct fire, force-on-force tactical engagement simulation exercises.

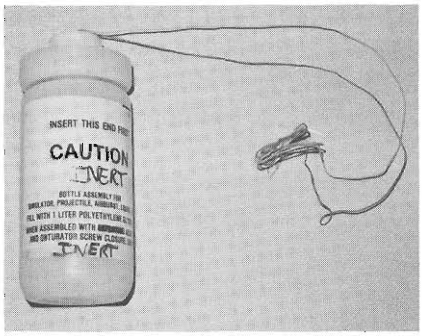
This program began as an initiative of the USACMLS Commandant in June of 1982. During that month, the directors of USACMLS met to address the Army's need for NBC training devices. The Army disbanded the Chemical School in 1974 and reactivated it in 1979. During this five-year period, with no single agency assigned to coordinate NBC training technology, multiple agencies within the Army took up the tasks.

The Chemical Corps, reactivated and relocated to Fort McClellan in 1979, faced an expanded worldwide threat, antiquated equipment, and a new, dynamic doctrine for how the Army intended to fight the next war. Soldiers fighting on the AirLand battlefield must train as they are expected to fight. Playing volleyball in protective clothing and gas masks is not how the war is expected to be fought.

The result of this 1982 meeting is a document called Training Device Acquisition Strategy (TDAS). The TDAS summarizes the necessary concepts to support training in a simulated NBC environment. This document serves as the principal instrument directing efforts to conceptualize, develop, and acquire training equipment, simulants, and support packages/procedures for training.



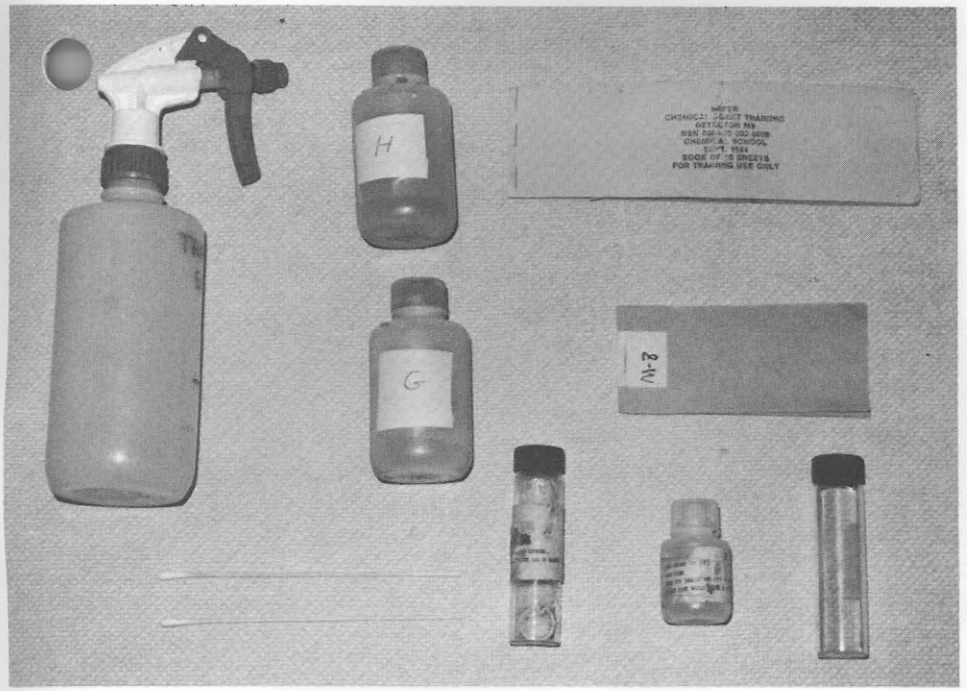
The M81, a portable transmitter receiver system capable of remotely triggering the M43 detector to simulate the contamination of a given area with toxic chemical agent, provides integrated training for the M8 Automatic Chemical Agent Alarm. It helps create a total training environment in which both individuals and units may become proficient in chemical defense procedures. Composed of four radio receiver assemblies, four antennas, and one radio transmitter, it may be stored in a carrying case which is supplied with the system.

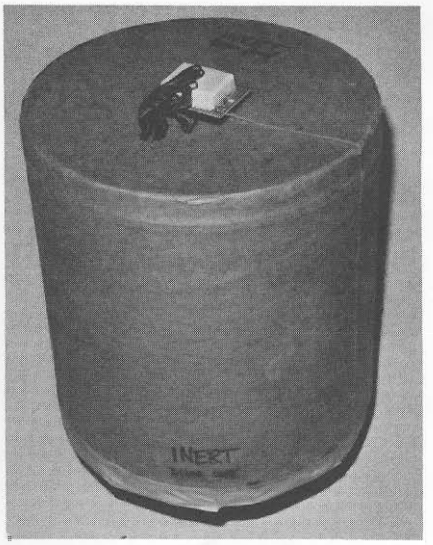


The M11 SPAL, filled with persistent chemical agent simulant is to be used with the M267 launcher to simulate a liquid agent airburst attack.

The original TDAS consisted of 22 proposed devices or systems and today remains the basis of USACMLS Training Device Acquisition Strategy Management Plan (see figure 1). As a dynamic document, TDAS continues to guide development efforts, expanding as new training deficiencies are identified, or reorganizing as developing systems are consolidated to solve multiple training deficiencies. This program supports the U.S. Army's Training and Doctrine Command (TRADOC) goals to achieve substitution, simulation, and miniaturization where possible. In the field of NBC warfare, simulation is necessary owing to the very nature of the environment in which soldiers are required to train.

The creation of a training environment must address both system and nonsystem training devices. A system





The Nuclear Weapons Effects Simulator (NWES), a pyrotechnic air display, provides flash, bang, and cloud cues.

A realistic simulation of persistent chemical agents used by Threat forces is provided by the Persistent Chemical Agent Simulant (PCAS). It can be used to train both individuals and units to survive in a chemical warfare environment, for recon exercises, using the NBC warning and reporting system, and for equipment and personnel decon training. The Chemical Agent Decontamination Simulant (CADS) allows objective evaluation of the effectiveness of individuals, crews, and unit decon teams in basic skills, and detailed equipment decon procedures.

device is developed to support a specific materiel system and is designed for use only with that system. A nonsystem device supports general military training. To create a comprehensive NBC-integrated simulated battlefield, both system and nonsystem devices will be used with development carefully coordinated for maximum use and minimum cost. Therefore, the system and nonsystem training devices must work together. The development of the Chemical Agent Monitor (CAM) serves as an example of a new system development for the US Army. The liquid simulant for training should be compatible with currently fielded detection paper and should be used in the field in the same way as the chemical agent it will replicate. If other detectors for the field use a simulant, the new system training simulant should be compatible.

Field Training Initiatives

To coordinate USACMLS efforts with artillery and mines training systems for tactical engagement, force-on-force field training exercises, TRADOC headquarters directed its tactical engagements simulations office to monitor the Simulated Area Weapons Effects (SAWE) program. The SAWE program is a force-on-force tactical engagement system for indirect fire weapons and mines. SAWE is designed to be interoperable with the MILES system, to better replicate the total effects of the AirLand battlefield.

USACMLS contributed several components from the original TDAS document (known as SAWE-NBC) to the SAWE program and is moving ahead of development of artillery and mines components.

SAWE-NBC evolved from TDAS efforts to better define requirements for the TDAS items and to determine how they should be employed for training throughout the Army. After determining which tasks must be trained—from the soldiers manuals of common tasks (STP 21-1-SMCT and STP 21-24-SMCT)—and military occupational specialty (MOS) manuals—the efforts for training device development were redirected toward finding the appropriate "cues" to trigger actions resulting in task evaluations of both individuals and units.

The initial determination of what cues needed to be simulated for the NBC environment were made by Jet Propulsion Laboratory (JPL) in their Best Technological Approach (BTA) published May of 1986. Both the training developer community and the materiel developer met regularly with JPL to provide user guidance in development of the BTA. The Training Advisory Group (TAG) (see figure 2) provided guidance.

The JPL BTA lists the technologies available to provide necessary cues for: initiating soldier reaction, creating the desired training environment, and assessing casualties

The Radiac Set Trainer (RST), a replica of the AN/PDR56 Alpha Radiac Detector, uses radio waves to simulate alpha radiation, giving the commander with a nuclear accident/response assistance mission the ability to train without the hazard of real alpha radiation.

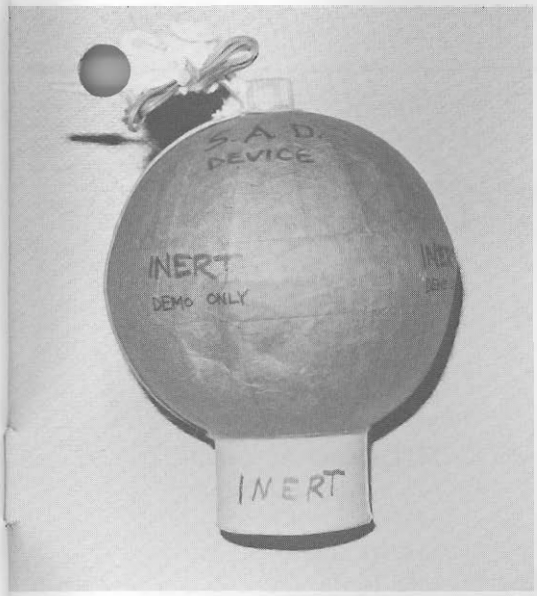
(penalties) for inappropriate responses. The use of two technologies for three TDAS items exemplifies this. The recommended technology for the Nuclear Weapons Effects Simulator (NWES) is pyrotechnics.

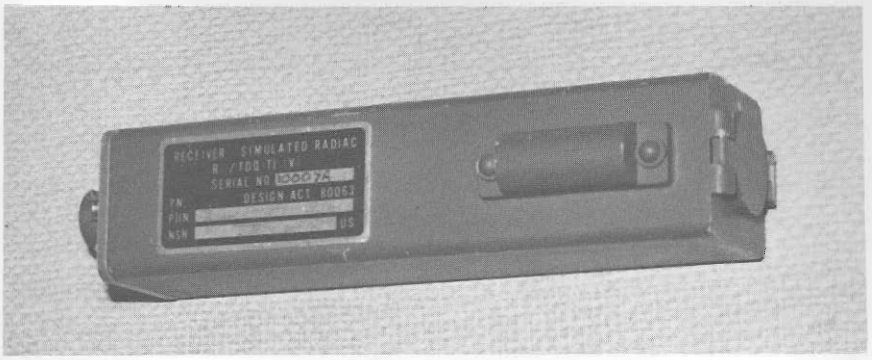
The JPL prototype, which fulfills the requirements outlined by the TAG, provides visual and acoustical cues (flash and bang) of a nuclear event. The prototype NWES provides a cloud, or visual cue, and a bang, which allows soldiers to prepare appropriate reports and weapons yield calculations. This is an example of a common task skill—reaction to a nuclear attack, and an MOS-specific skill—calculation of downwind hazards.

This does not end the training, however. Once the physical cues are provided, the monitoring and survey systems also must be cued to correspond with what the soldier has seen and heard. The recommended solution for this action is radio frequency (RF) technology. By activating a transmitter simultaneously with the audio/visual cues, radio receivers constructed to operate as fielded radiological monitoring and survey instruments should reflect accurate expected readings.

This RF recommendation from the BTA for the Total Dose/Dose Rate Simulator (TD/DRS) demonstrates the systematic approach for creating an integrated training environment. When integrated with the Radiation Automatic Casualty Assessment System (RACAS), another RF system, the TD/DRS allows commanders to conduct training with a unit's simulated organic equipment, assess casualties for inappropriate subordinate commanders' decisions, and train for an environment in a manner not possible in the past. Use of the three devices named above—the RACAS, the TD/DRS, and the NWES—provides training for 20 common soldier tasks.

Many devices in the TDAS can be combined, merging individual items of similar technology into one system. Because the Biological Agent Casualty Assessment System (BACAS), Chemical Agent Casualty Assessment System (CACAS), Radiation Automatic Casualty Assessment System (RACAS), and the Nonpersistent





The Chemical/Biological Agent Delivery System (CBADS), left, simulates an artillery airburst CB agent attack. Electrically actuated, the device is launched like the NWES. An advantage of the CBADS over the M11 SPAL is that it can be fired safely over the heads of troops. The training probe simulates the activity of the radiac meter probe during operations, using radio waves to activate the meter on the VDR-2 radiac.

Figure 2.
NBC Training Advisory Group (TAG)

- Chemical School
- Armor School
- CRDEC
- Artillery School
- PM TRADE
- British Exchange Officer
- USA Tng Sup Ctr
- German Liaison Officer
- DA Surgeon General
- FORSCOM
- USAF
- USMC
- Infantry School
- DCSOPS
- 7th ATC
- NTC

Chemical Agent Simulant (NCAS) are all RF technology, a single system named the NBC Casualty Assessment System (NBC-CAS) can replace all four of the single devices. This reduces the number of transmitters necessary to create the simulated NBC environment by providing one transmitter that operates on a single frequency that emits coded messages for appropriate receivers.

Institutional TDAS

While USACMLS moves forward to field devices for all soldiers in the area of tactical engagement field exercises, efforts continue to modernize training for resident soldiers at Fort McClellan. Central to this effort is the design of the Battle Simulation Complex (BSC) and the integration of fielded training devices and institutional elements of the TDAS. The planned facilities will allow individual and collective training using state-of-the-art technology for all ranks and services trained at USACMLS. It is also planned for use by Reserve and National Guard units. Once completed, the BSC will be capable of conducting small unit instrumented field evaluations and command post exercises for resident classes and Guard and Reserve units.

Conclusion

The task/mission approach to training device development shows great promise for future training Army wide. Problematic "bugs" still exist in the system, and there is room for improvement in the area of coordinating system devices for the training arena. Meanwhile, TDAS efforts to improve fielding continue, with the realization that these problems affect not just the Chemical Corps or the Army, but the entire Department of Defense. Flexibility and adaptability in the areas of coordination and openness to recommendations are the chief hallmarks of this successful problem-solving approach.

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