ASYMMETRIC TRAINING

PEO STRI weighs the possibilities and trade-offs in developing autonomous live fire target system

by Michelle K. García Gómez and James Todd

Former SMA Glen E. Morrell stated, "Training then—both good and bad—is habit-forming. The difference is that one develops the battlefield habits that win; the other gets you killed." To extend this thought, static and linear training prepare only for static and linear conditions.

In a world driven by asymmetric conditions, static and linear training translate to a readiness gap for Soldiers facing adverse, unpredictable circumstances. Within the Army's live fire training environment, this gap is evident in the limited (static and linear) target training systems used to prepare Soldiers, from weapon familiarization to maneuver and tactics, from basic marksmanship to advanced sniper training. This gap is defined by the inability to represent an asymmetric threat independent of terrain and simulating escalation of force, actions and reactions, and group dynamics.

Based on feedback from training units, static position and linear-based rail moving targets provide Soldiers with an unrealistic and limited training, especially with respect to urban operations and escalation-of-force environments.

The primary issues lie in the targets' linear constraint of motion, which allows Soldiers to reliably predict the movement and future positions of the targets.

PERFORMANCE OBJECTIVES

To overcome these limiting conditions would require development of an autonomous live fire target system. The system technology would support a high-fidelity, immersive capability within the live training domain, providing a more accurate and realistic portrayal of individual-, group-, and vehicle-based threats.

The performance objectives for an autonomous live fire target system would include:

- Realistic convoy (with oblique angles of approach), escalation-of-force (featuring asymmetric behaviors and group behaviors), and close-quarters live fire training with trackless, nonlinear moving targets.
- A realistic behavior pattern, through implementation of Semi-Automated Forces (SAF) behavior models coupled with sensor and external data inputs.
- Real-time control for individual and group target representations.

LIVE-FIRE POWER

Maneuverability over a variety of improved and unimproved terrains, as well as in urban areas, is one performance objective for an autonomous live fire target system. Here, Soldiers of 4th Battalion, 118th Infantry Regiment (4/118) of the South Carolina Army National Guard engage targets after assaulting and clearing a trench system, during a platoon live fire exercise July 31at the Udairi Range Complex in northern Kuwait. (U.S. Army photo by SFC Raymond Drumsta, 4/118)

QUALIFYING ROUNDS
Soldiers of the 100th Missile Defense Brigade shoot down pop-up targets during the brigade's semiannual 9mm range practice at Fort Carson, CO, Sept. 3. The range consists of five tables in which Soldiers must hit 16 out of 30 targets to qualify. (U.S. Army photo by SGT Michael Cost)

- Maneuverability over a variety of improved and unimproved terrains, as well as throughout an urban area.
- An accurate, reliable system to score hits and near misses.
- A self-powered, ruggedized system that can survive the lethality of the live fire training environment.

In short, the system could allow for 3-D representations of either virtual or constructive training entities to be extended into the live fire training environment and act within an integrated training event. The system would be free to move, act, and react based upon the initial conditions, training focus, and changes in either the live, virtual, or constructive training domain, making each event unique and ensuring a greater variety of training. This would also help avoid the negative training associated with on-deck Soldiers gaining insight into the targets' locations and behaviors before they start the exercise.

TECHNOLOGY FOCUS

There are multiple underlying challenges to achieving these performance requirements for an autonomous target system.

The core technology focus for an autonomous target system would be on achieving adaptive individual, group, and vehicular behaviors. This focus should seek to embed or integrate the autonomous target platforms with a SAF simulation model, allowing the target presentation to behave and react in line with the standard models while also allowing for various scenarios.

This synchronization would define the reaction behaviors and behavior probabilities as well as the difficulties and modes of operation to support different styles of learning. If the SAF models are run centrally, they could be used to create group behaviors and dynamics. If the SAF models are decentralized (on the target system), then a mesh communication system would have to be integrated to support the creation of group behaviors and dynamics.

A secondary focus would be on developing and integrating sensor arrays for ballistic proximity and hit detection as well as obstacle identification and avoidance. The ballistic sensors would be used to define the targets' behavior for near-miss events, determine the lethality for hit events, and generate valuable after-action review data. By contrast, the obstacle avoidance sensor would be used primarily to allow the target system to move autonomously in a training venue and in conjunction with other autonomous systems. This would be required to increase realism and meet safety requirements, including concerns regarding ricochet, tripping, and other factors.

The autonomous target system would also require a mechanism to track its geoposition, for internal use or reporting purposes. These data would be synchronized with terrain map and/or other tracking technology to allow for direct manipulation of the autonomous target system virtually, using real-time controls.

POSSIBLE SOLUTIONS

The technologies required for an autonomous target system exist today; the challenges lie in the integration, protection, and affordability of the solution, posing a dilemma of trade-offs. The more technology is integrated into the solution, the more protection will be required, and the more the system will cost. Inversely, attempts at a more cost-effective solution are likely to come at the expense of multiple performance and survivability requirements; thus an affordable solution may be lacking in both protection and performance.

A quick market survey shows that multiple solutions are readily available, but they generally represent one of the three dilemmas noted above. One high-end solution meets the protection and function requirements but is unaffordable, for either immediate

procurement or sustainment, given current funding constraints. There do exist several lower-end solutions; while affordable, these systems lack the adaptive and group behaviors, as well as the required sensor arrays, needed to stimulate reactive behaviors. A great but unaffordable solution is about as meaningless as an affordable solution that does not provide adequate training.

Therefore, the solution will have to strike a balance capturing most of the adaptive functionalities at a low per-unit cost. This optimal autonomous target system would provide an abstraction of real-time control functions to a centralized processor, a simplistic real-time radio control motor, and a simple array of hit/miss detection and obstacle avoidance sensors. A significant challenge still to be considered with the optimal solution, as well as the existing systems, will be related to radio frequency allocation and bandwidth use for real-time control of the targets; this challenge will only intensify as the number of deployed autonomous target systems increases.

CONCLUSION

A truly autonomous target system would allow for scaled training events, taking into account individual differences in learning style, experience, knowledge, skills, and readiness in a small-unit environment while providing accurate, realistic feedback through movements, representation, and engagement behavior (acting and reacting based on trainees' actions). The autonomous target system would also provide dynamic, nonlinear, and asymmetric training, resulting in a higher level of preparedness, readiness, and survivability.

Overall, the autonomous target system would provide Soldiers with more realistic training in open-air live fire conditions, and the unpredictability of the target system would drive more adaptive learning. Moreover, each training event would result in new and fresh objectives that would better support live fire training for individuals and teams. These events also would support enhanced after-action reviews and reporting by proving a highly adaptive, high-fidelity, immersive training system.

To prepare for dynamic and nonlinear conditions, Soldiers must have dynamic and nonlinear training. Autonomous target systems would provide the "good" training that develops battlefield habits that win.

For more information, send inquiries to ***TargetMod@us.army.mil.***

STATIC TARGETS

An autonomous live fire target system would provide Soldiers with more realistic training in open-air conditions, and the unpredictability of the target system would drive more adaptive learning. Here, a Soldier conducts marksmanship training with static distance targets at Fort Eustis, VA. (U.S. Army photo by James Todd, Program Executive Office Simulation, Training, and Instrumentation)

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