IMMERSIVE TRAINING PROVIDES CRITICAL CAPABILITIES FOR READYING A MODERN MILITARY
The Challenge: Traditional Training Approaches Struggle to Achieve Readiness Returns

Military training has long been a balancing act between richness and reach. In-person live training, in which military personnel apply battlefield tactics and skills on a training range in scenario-driven exercises delivers a richness of experience that is essential to military readiness. But while live exercises provide valuable training experiences, their reach is limited: they require significant amounts of time, preparation and resources to execute, and as a result, they occur only at a few fixed locations and only a few times a year.

On the other end of the spectrum are training programs centered around classrooms, on-the-job training, simulators, manuals, books and online training tools. These offer far greater reach than live training exercises: their lower cost makes them widely accessible around the globe. But such training tactics, by themselves, are incapable of preparing military personnel for the rigors of a real battlefield experience.

This traditional trade-off — executing few expensive, live exercises or offering widespread, static training tools — is now struggling to remain relevant in today’s military environment. Specifically, it presents two key challenges to military leaders: delivering experiential value amid shrinking budgets and managing expectations of digital natives entering service.

COMPLEXITY, ACCESS AND COST ARE CHALLENGING TRAINING RICHNESS

The Defense Department continues to invest in live exercises at fixed central locations that require complex and intensive logistics preparations using highly specialized equipment — such as high-performance stealth aircraft, ships, advanced radar or munitions. However, even when the required equipment is available, some training environments often cannot accurately represent battlefield environments due to technological, security or even regulatory limitations. An attack against a Navy ship by a swarm of small boats would be difficult to execute for example, as would a simulated attack involving a swarm of drones or an advanced fifth-generation aircraft in use by near-peer competitors. In some cases, live training may be constrained due to concerns about
revealing sensitive information about U.S. tactics and capabilities or U.S. military knowledge about adversaries’ tactics and capabilities.

Geographic limitations can also present challenges such as size, access and poor weather conditions. Even concerns about the impact of training on nearby wildlife or endangered species can limit the scope and scale of training. For example, training ranges supporting aviation units in the U.S. Indo-Pacific Command were recently found by auditors to be too small, underfunded, inaccessible and outdated to support aviation readiness for units assigned to the command.1 As a result, some of those units were not able to train as they would fight and, consequently, were assessed as not mission ready.

And, of course, live training is costly. A training exercise encompassing thousands of military personnel can cost millions of dollars in travel and billeting alone. There are considerable maintenance costs to address wear and tear on military equipment and still additional costs to address the ripple effect of disruption of servicemembers temporarily pulled away from their regular duty stations.

**TODAY’S SERVICEMEMBERS EXPECT MORE FROM TRAINING REACH**

For most recruits entering service, the most popular forms of entertainment are often video games. When it comes to training, many expect that same type of training environment that not only includes vivid detail but also in-depth scenario-based storytelling and availability from wherever they are sitting. However, most servicemembers deployed to the schoolhouse may still encounter classrooms, printed manuals and limited, tablet-based tools.

What’s — more few, if any, of today’s DoD training approaches generate, capture and leverage the variety and volume of performance data that can quickly improve training effectiveness and efficiency. Many advanced, commercial training technologies are integrating sensors, cloud computing, artificial intelligence (AI) and machine learning, three-dimensional modeling, virtual and augmented reality (VR and AR). While these technologies and their immersive experience greatly enhance skill acquisition and retention, even more critical is the fact that they can also produce vast amounts of data on the performance of a trainee so the training can be personalized and more effectively address his or her skills gaps. As a result of the lack of data utilization, military training programs today are not nearly as effective and responsive to today’s readiness needs — particularly at the individual and small unit level — as they could be.

Taken together, these challenges constrain how much and how well U.S. military personnel train as well as how effective that training is in preparing them for scenarios they are likely to face when called upon to fight.
A New Perspective: Data-Driven Immersive Training Delivers Reach, Realism and Affordability for Improved Readiness

We believe that immersive training — with the rich, virtual experiences and low-cost portability it can deliver — offers an enormous opportunity to improve military readiness and address the challenges that constrain military training today. But to truly transform training, leaders must take advantage of the available data captured by advanced sensors used throughout the immersive environment. Using advanced data analytics, leaders can access immediate insights into the effectiveness of the training as well as where more training is needed.

Immersive training collapses the long-held dichotomy between richness and reach when it comes to military training. Previously, if servicemembers were going through simulation-based training with a high level of realism, they would need to travel to a fixed site where large simulators were based. Such opportunities were often limited. Today’s immersive solutions deliver rich, high-fidelity experiences — but they are also often mobile, allowing the training to be delivered at the point of need at any time, regardless of weather or other constraints. Even a small, forward-deployed unit can accomplish realistic counter aerial drone training using head-mounted displays, a laptop and other mobile gear. The same is true for certain aspects of pilot training. A portable protective case can house the electronics and computer capability coupled with head-mounted displays for realistic flight training that can reach many users and generate valuable data.

Immersive training also is capable of circumventing many of the traditional constraints seen with live training today. For example, it enables training for situations that would be dangerous, expensive or difficult to replicate in a live environment, such as a pilot evacuation or first response procedures in the wake of a terrorist attack.

As the data and simulation technologies of immersive solutions have steadily advanced, their costs have steadily declined. A multi-player simulation with a dome projector that tracks only limited movements of students might have cost more than $1 million a decade ago. Now, commercially available headsets with eye-tracking capabilities, coupled with gear to track other bodily movements, cost a small fraction of that amount.

In addition, continuing improvements in computing power and fidelity in head-mounted displays have combined to create an ever-narrowing gap between user perceptions of the real and virtual worlds. The result is an immersive training experience that is highly realistic and highly effective. Indeed, the overall view from training experts is that immersive technologies have reached a level of maturation that strengthens readiness and augments training in live exercises.

However, unlike most live exercises or classroom training, immersive training collects data on characteristics such as a user’s physical actions, response times and eye movements. A headset coupled with eye-tracking capabilities and body sensors allows the trainer to understand down to the millisecond where the trainee is looking, what actions they are taking and what their body posture is. The data enables instructors the ability to personalize training and improve overall readiness in ways not possible with conventional training.

Because it is data-driven, immersive training adjusts to the needs of the trainee in real time. This means trainees can be given more training in areas where they are struggling and less in areas they
have mastered. For example, to improve a trainee’s reaction time or accuracy in a simulated armed conflict, immersive training tools track exactly where a trainee is pointing his weapon, where her eyes are focused, how long it takes for her to engage her weapon, lock onto a target and pull the trigger. Immersive training tools also can modify simulations by introducing additional factors or attributes to invoke a better training response customized to the trainee. This can even be combined with more advanced sensor systems, such as from commercial high-end athletic systems, resulting in a full-body data pipeline.

Military leaders are already encouraged by how these advances are helping the military reimagine training. Gen. Robert Neller, the commander of the U.S. Marine Corps, said the service “is working to leverage virtual and constructive training environments with better tools to train higher level staffs and a focus on our leaders, from the battalion to the Marine Expeditionary Force level. Enabled by technology, we will increase the amount of training each unit can accomplish in mentally and physically stressing environments for all elements of the Marine Air Ground Task Force before they execute on a live training range or in combat.” The Army likewise is focused on improving training and readiness through immersive training that interacts with and augments live training. Maj. Gen. Maria Gervais, a top Army training official, said the effort “is the most revolutionary thing since developing our live training environment at our combat training centers... We see this as a second revolution in training for the United States Army.”
IMMERSIVE TRAINING IS ALREADY DELIVERING IMPROVED READINESS THROUGH DATA SCIENCE

A range of immersive training efforts across the U.S. military services are already yielding readiness dividends. Here are just a few examples:

Planning Military Exercises: Department of Defense leaders have stressed the need for a so-called “point of need” planning and training tool that incorporates artificial intelligence-driven tools to assist in exercise planning. One solution has been an immersive training system known as Tabletop Commander, a next-generation battlefield simulation that employs VR systems and algorithms to construct a virtual battlespace for military exercises based upon given parameters. Adversaries, weather systems, non-visual components like network connections and power supply and other data sets can also be added to facilitate exercise planning, modeling and simulation.

Training to Combat Improvised Explosive Devices (IEDs): The Defense Department is incorporating immersive training as an alternative to passive, instructor-led counter-IED training by integrating AR to facilitate active, self-directed learning in a real-world, outdoor environment. Incorporating AR and iPads, the military uses an application that displays 3D visualizations of critical training elements. The app uses standard game and instructional design elements such as scoring, leaderboards and knowledge checks in the form of interactive quizzes to encourage user engagement and reinforce learning objectives. Users can train on their own time to improve their understanding before going into a facilitated session. The system has opened doors to mobile AR training applications for other areas of the military as well as a potential VR version of the training.

Training for Close Air Support: The Pentagon is developing an immersive tool to conduct Joint Terminal Attack Controller (JTAC) training using a VR system. A JTAC refers to a forward-positioned service member who directs aircraft engaged in close air support and other air operations. In an immersive VR environment system, a JTAC can practice the main tasks associated with engagements, from target identification to target elimination. This type of mission training is in high demand across all U.S. military services, but live training is expensive and less advanced virtual systems lack sufficient realism to provide full confidence for certification. The JTAC VR trainer offers the potential for significant cost savings while accomplishing far more realistic and effective training.

Immersive training technologies are advancing rapidly and have surpassed the performance levels and cost points making them an affordable and highly effective tool for delivering realistic military training. Moreover, immersive training technologies coupled with strategies that leverage the vast data captured from those technologies can be harnessed to create entirely new training opportunities that previously did not exist. By effectively utilizing data-driven immersive training, military trainers will be able to deliver increased reach, realism and affordability resulting in improved readiness.
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