Enhance Warfighter Lethality with Mixed Reality-Based Training



Reality-based Technologies Enable Training in Future Complex Operating Environments

The incorporation of reality-based technologies in the DoD and other government agencies provides the means to train in complex multi-domain environments. Blending learning content with the latest immersive technologies and simulation systems optimizes team and individual performance by creating robust virtual training that is synchronized with live events. A review of studies on the effectiveness of computer-based simulation training concluded that they have demonstrated positive results for knowledge transfer.

Mixed Reality: The Latest Development in Reality-based Training

MR goes beyond VR and AR to incorporate a wide variety of advanced technologies to deliver high fidelity training in more immersive, cost-effective environments. The key differentiator of MR technology is that it enables digital content and real-world content to interact with each other in real-time. AR and VR platforms can't simulate the impact of external sensations – the dirt, dust, smell and sweat of combat – on the warfighter. Until now the obstacle to MR-based training implementation has been the integration of external senses in training courses that can be delivered at the point of need (PoN).

VIRTUAL REALITY (VR)

Completely digital environment



Fully enclosed, synthetic experience with no sense of the real world

AUGMENTED REALITY (AR)

Real world with digital information overlay



Real world remains central to the experience, enhanced by virtual details

MIXED REALITY (MR)

Real and the virtual are intertwined



Interaction with and manipulation of both the physical and virtual environment

Figure 1: AR/VR/MR Compared

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Kratos overcomes this obstacle with a MR Simulation Platform that uses standards, orchestration and pre-integration to blend best-of-class Commercial Off-The-Shelf (COTS) devices with advancements in gaming, display and similar technologies to achieve fully immersive solutions. COTs action requests (i.e.: initiate sight, smell, sound, haptic senses, etc.) are communicated to the platform's shared central memory module where Kratos developed software automatically triggers the desired action. The result is improved training quality, affordability and speed to market.

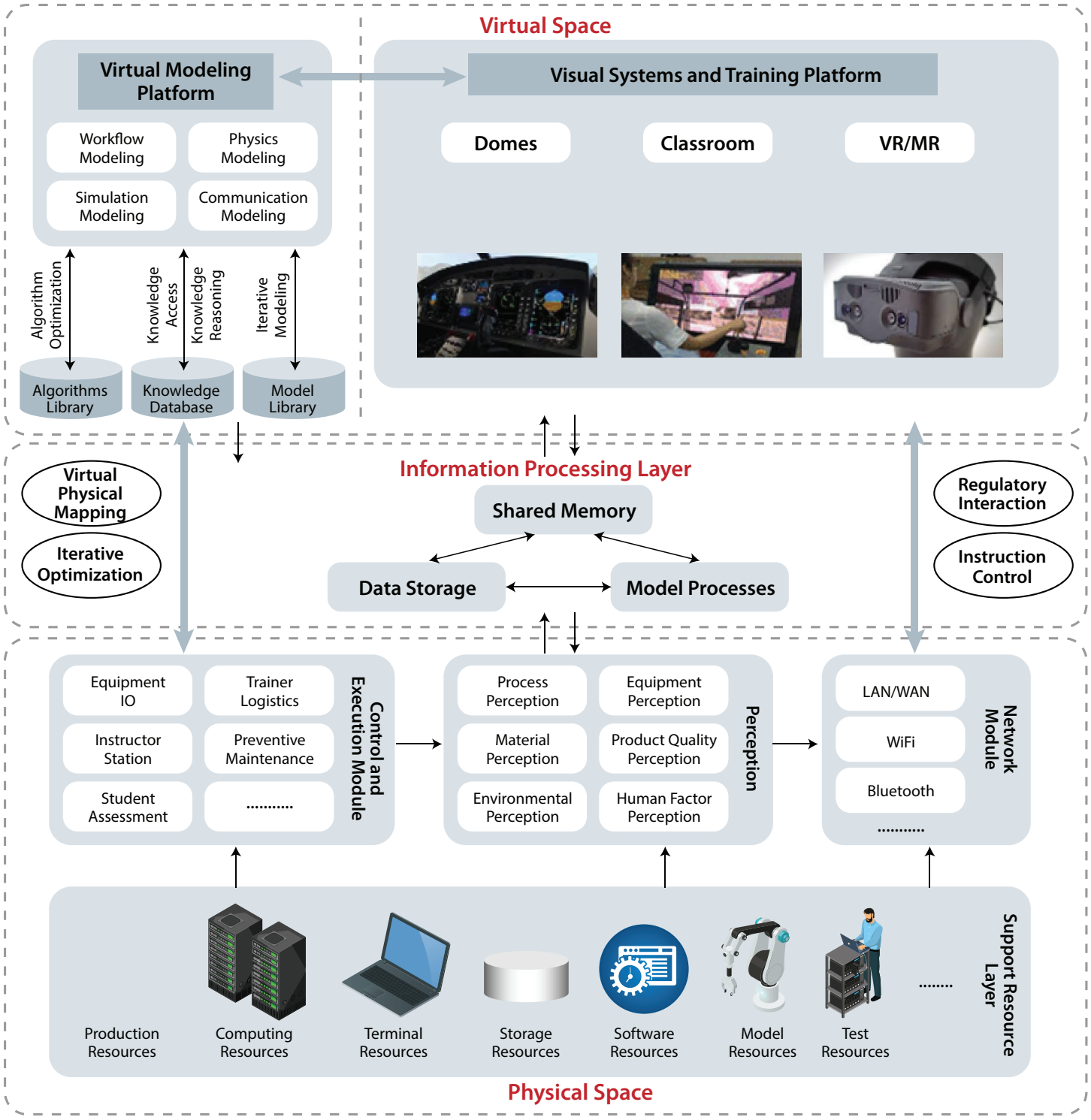


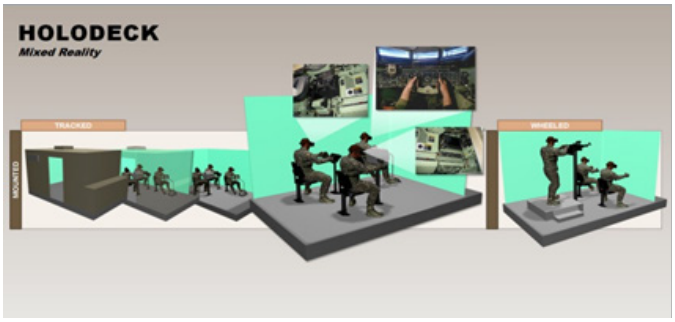
Figure 2: Platform Architecture

Open Architecture Design of MR System Maximizes Interoperability

The mixed reality system (Figure 2) is designed with an open architecture to maximize interoperability, reuse and reduction in ownership cost. The use of technologies like openVR allows for several different COTS components and software solutions to be integrated into the system. The Information processing layer has an open API and allows for new systems to receive and transmit events and messages. Agnostic integration efforts were used specifically for allowing modular and scale (size) flexibility.

The Kratos Holodeck

Figure 3: The Kratos Holodeck consists of an image generator (IG), host, and VR Headsets with stereoscopic cameras providing a dynamic viewpoint Head Tracking system and a unique lighting technology.





Training at the Point of Need

The greatest advantage of this platform is that it enables MR-based training to be delivered to the point of need (PoN) in virtually any suitable environment. The light source panels can be configured to accommodate various sizes and shapes – from rotary aircraft cabins, to air traffic control towers or marksmanship firing ranges and the Kratos Holodeck.

- One DoD component is utilizing Kratos' mixed reality holodeck to evaluate new technologies and products in support of Soldier Lethality. This effort will advance Mixed Reality technology to include eye tracking, induced signal to noise ratios, picture-in-picture, overlays, higher HMD resolution and increased Field of View (FOV).) The goal is to utilize the technology to measure warfighter performance, physical and psychological, so that data can be collected and used to determine warfighter effectiveness in various conditions.

- An MR-based Air Traffic Control (ATC) demonstrator allows trainees to utilize real ATC computers and physical components, while working in a virtual world. In this evaluation scenario the system is networked to an Apache simulator so the student can interact with the pilot in the simulator as he approaches the ATC tower.

- Other examples in the simulation and training environments include gunnery trainers utilizing high fidelity weapons in the virtual world. Kratos has developed V-22, UH-60, CH-47 gunnery trainers in mixed reality environments.

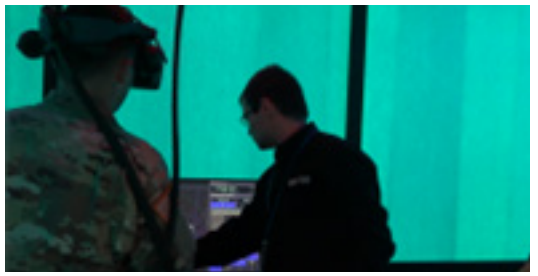




Figure 4: One DoD component is utilizing mixed reality to evaluate next generation technology and products for soldier lethality.

Cost Savings Potential

The cost savings potential of a mixed reality-based training environment far exceeds the operating cost of legacy training environments. Increased use of reality-based training could cut costs by lowering maintenance costs, reducing costly trainee errors, and shrinking logistics costs associated with coordinating multifaceted exercises.

Technology, Simulation Systems, Training Services

To help ensure that warfighters are ready for battle and to changing battlefield dynamics, Kratos integrates the latest in Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) technology with its state of the art simulation systems and learning management capabilities, to create blended training systems that reduce costs, speed development and deliver high fidelity performance.

Kratos Total Training Solutions are comprised of a holistic combination of three interrelated components:

- **Advanced simulation systems** for air, ground and maritime, and soon space domains
- **Training Services** including course development, aircrew training center and sustainment services
- **Advanced interactive, web, gaming, technologies** including VR, AR, and MR technologies needed to create the virtual battlefield training environments

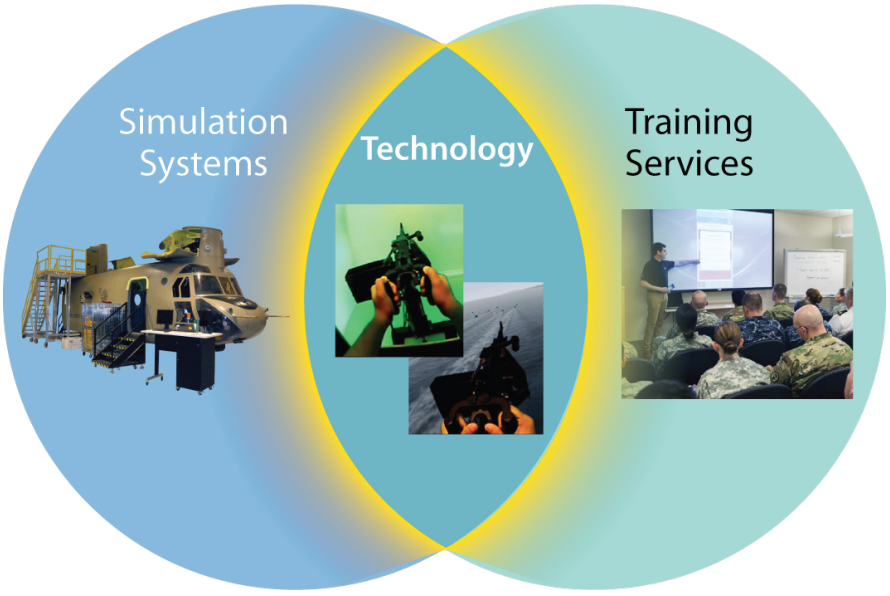


Figure 5: Kratos Total Training Solutions

Kratos' training solutions employ an extensive array of products and services for air, ground and naval platforms. As a full-spectrum learning solutions provider Kratos delivers performance-based training solutions in an optimal blend of media by developing courseware that blends industry-leading simulation systems, advanced interactive, web, gaming, social media and mobile technologies into a holistic training solution.

Automation Speeds Delivery

Kratos automates the development of the simulation based curriculum and Interactive Media Instruction (IMI) for large scale production with a training curriculum design using a data driven content development and management system. This integrates the simulation and virtual elements for all phases of training: instructor led, student paced IMI, practical activities on trainers and assessment, allowing instructors to teach with electronic lesson plans integrated with the virtual/simulated aircraft and simulated schematics.

Optimal Course Development and Implementation

Kratos gaming and simulation solutions accelerate time to proficiency with effective instructional strategies and implementation of training via mobile platforms, web-based training, and deployable mobile classrooms. These courseware development solutions accelerate delivery time by use of database authoring in which the content is used for multiple lessons and documentation, accelerating reviews, ensuring accuracy across documentation and minimizing time to update.

Kratos Sustainment Services to Maintain Training Systems

Kratos offers a broad portfolio of Support Services including: Global Contractor Instructor Services (CIS) to support management and sustainment of all training curriculum and material; Contractor Logistics Support (CLS) to integrate logistics support functions such engineering, material, equipment, personnel and maintenance on weapons and weapons training systems; and Contractor Support Services (CSS) to enhance decision-making with Programmatic Support and Manpower, Personnel & Training (MPT) planning.