The Future Immersive Training Environment JCTD: Technical Challenges in Demonstrating Virtual Reality for Infantry Training

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ABSTRACT

While crewed-vehicle simulation technology is quite mature, the application of immersive simulation technology to infantry skills training is in its relative infancy. At the same time, the need for highly trained infantry, able to make rapid decisions in a complex tactical and cultural environment against an adaptive adversary has never been of greater importance. The goal of the Future Immersive Training Environment (FITE) Joint Capability Technology Demonstration (JCTD) is to integrate state-of-the-art technologies and assess their operational utility for training rapid decision making at the infantry squad level. This is in furtherance of the vision of creating technology as sophisticated and effective for the unique requirements infantry training as that currently provided to vehicle crews.

This paper describes the challenges encountered in creating the FITE JCTD Individual worn Virtual Environment system. Chief among these challenges is that infantrymen interact with their environment in a much more detailed and subtle way than vehicle crewmen. This requires replicating visual, auditory, haptic, and olfactory elements of the operational environment. Similarly, supporting the intuitive yet complex way infantrymen move through the environment is a challenge. The hardware and software subsystems selected and integrated to create the Individual worn Virtual Environment will be described. These include the means for tracking an individual's head, weapon, and posture, presenting visual cues via a head worn display, providing collective olfactory cues, and providing shot feedback. In addition, challenges in the integration and extension of a powerful game-based virtual environment, as an overall framework for the system will be described.

The use of this system to train U.S. Marine Corps and Army squads was formally evaluated by an independent assessor in Operational Demonstrations held in February and March 2010. Keys lessons from this evaluation as they relate to the underlying technologies will be reported.

ABOUT THE AUTHORS

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John Carswell is the ExpeditionDI program manager with CG2, a Quantum3D company. Mr Carswell has served as a technology developer and Principle Investigator on numerous immersive infantry simulation programs over the past decade. Prior to focusing on infantry simulation, Mr. Carswell was a key contributor to DoD simulation database interoperability initiatives, including SEDRIS, as a developer of database generation and interchange tools for both Lockheed Martin and SAIC. Mr. Carswell holds a BA in Computer Science from Stetson University.

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INTRODUCTION

The Joint Capabilities Technology Demonstration (JCTD) program is an Office of Secretary Defense (OSD) program to demonstrate, operationally assess and transition innovative concepts and capabilities to address operational gaps and shortfalls. The Future Immersive Training Environment (FITE) is a two-year JCTD to demonstrate the utility of immersive training technology for infantry squads. It is composed of two spirals. Spiral 1 developed and demonstrated an Individual worn virtual reality training system. Spiral 2 will conclude in 2010 and is demonstrating Mixed and Augmented Reality technologies. This paper reports on the Spiral 1 effort. FITE is motivated by the goal, often expressed by US Joint Forces Command (USJFCOM) Commander, General James Mattis of creating and deploying technology as sophisticated and effective for the unique requirements infantry training as that currently provided to vehicle crews.

Since JCTDs are focused on the demonstration of a prototype system in an operational environment, they require incorporating relative mature subsystem components. In terms of DoD technology readiness levels (TRL), they require taking hardware components, software modules, or subsystems that at a minimum have been validated in a relevant environment (TRL level 5) and creating a prototype system ready for operational testing (TRL level 7). For the FITE JCTD, this required integrating subsystems to replicate the visual, auditory, haptic, and olfactory cues required to train infantry squads within an immersive virtual environment. This paper describes the technology challenges encountered in creating this Individual Worn Virtual Reality system.

HARDWARE PLATFORM

The FITE system is based on and extends Quantum3D's ExpeditionDI system (Figure 1). The ExpeditionDI is a man-worn system that includes a custom integrated computer, helmet-mounted display (HMD) and head tracker, wireless instrumented weapon with integrated tracker, and a posture tracker. The ExpeditionDI had been previously used by the U.S. Army Simulation & Technology Training Center (STTC) and the USMC Warfighting Lab (MCWL) for demonstrations and experiments, but it had never been used for training a full infantry squad (nine soldiers or thirteen Marines).

The integrated computer, called Thermite, runs the software generating the virtual training environment, and outputs the visual display of the world to the trainee via the HMD. The coupled head tracker provides for a full 360 degree field-of-regard. As the trainee moves his head in the physical world, his view of the virtual world is appropriately rendered. In addition, the Thermite computer provides wireless networking capabilities, allowing a full infantry squad to train in coordinated missions within the same virtual environment.

The training weapons were realistic mockups of the actual weapons used by a squad: M4 rifle, M4 with an M203 40 mm grenade launcher, and an M249 Squad

Automatic Weapon. The weapons are wireless and tracked independently from the head. The trainees interact (e.g. walk, open doors, and climb ladders) with the virtual world via these instrumented weapons. Each weapon has a hand-grip controller containing four finger-activated buttons and an analog two-axis thumb joystick. The joystick is used to move forward/backwards and strafe left/right in the virtual world. The posture sensor provides stance information (standing, kneeling, or prone). Taken together, the joystick and posture sensor allow for intuitive locomotion within the virtual environment.

SOFTWARE SUBSYSTEM

Virtual Battlespace 2 (VBS2) is game-based military training software developed by Bohemia Interactive. It is based on the commercial game Armed Assault and has a heritage that traces back to VBS 1 and Operation Flashpoint. The U.S. Marine Corps, the U.S. Army, and many foreign militaries use VBS2. Because of its wide use and interest from the services, it was chosen as the basis of the virtual environment.

Although Bohemia's VBS2 had been previously demonstrated on the ExpeditionDI, significant integration was still needed to meet the requirements of the JCTD. The initial challenge was more programmatic than technical. The Army and USMC license agreements with Bohemia restricted its use to only within each of those services, whereas the JCTD required joint use. Ultimately, Bohemia supplied a no-cost extension of the USMC VBS2 license for FITE JCTD purposes.

To protect their software, Bohemia used Aladdin's HASP hardware-based USB dongle authentication system. While this system worked well for desktop and laptop systems, it was less suited for the Thermite body worn computers. Among other constraints, it consumed one of the limited number of external USB ports on the Thermite computer. Fortunately, it was a relatively easy shift to Aladdin's software only authentication system. This also simplified FITE software distribution to the FITE team, allowing scenario and technology developers as well as independent assessors to obtain fully-licensed functionality without the logistical overhead of distributing and tracking hardware dongles.

In August 2009, the VBS2 licensing issues were resolved and the scenario development team released a scenario draft. As the System Integrator began testing on the ExpeditionDI hardware, it became clear that the standard ExpedtionDI body worn computer was underpowered for this role. Working closely with Quantum3D, we upgraded to a more powerful Thermite, adapted from a model used in vehicular applications. While this computer performed well, it was originally designed to run off a high voltage military vehicle battery and required wiring changes to the ExpeditionDI vest.

When we started integration of the FITE JCTD, the current version of VBS2 was 1.23. We made an early commitment to use version 1.3, as it was to incorporate many engine and animation improvements. In addition to the planned 1.3 improvements, Bohemia implemented a number of extensions to support FITE's requirements. These included content expansion, such as motion capture for the addition of subtle cultural gestures and the addition of specific insurgent and suicide bomber characters. An example of a subtle gesture addition was the attitude conveyed by different cigarette smoking gestures. Technical enhancements included the capability for characters to have different heights and body types and the ability to, either automatically or under instructor control, create glint from optics such as binoculars and weapon sights. In addition to run-time improvements, we also sponsored improvements to the After Action Review capability.

VBS2 is notable for the ability of end users to extend and tailor the virtual environment. The system integrators took advantage of these capabilities to implement the functions described in the following sections. In addition, VBS2's capabilities to support call for fire, rotary-wing close air support, UAV displays were tailored to FITE needs. Other tailoring efforts included improved weapon optics, user GUIs for the various hardware peripherals, and external supplements to the After Action Review capability.

HAPTICS

We experimented with several different technologies for providing physical shot feedback to the trainee. PhaseSpace, a small technology company, working with the Worcester Polytechnic Institute developed a prototype modular vest that uses computer controlled vibro-tactile motors. While this approach has been used in a number of research programs, it is primarily used as an alternative information channel (Lindeman, 2006). Our trainees wanted a haptic signal that was more intense and suggestive of an actual bullet impact. Another approach from TN Games, uses compressed air to drive a grid of pneumatic actuators on a vest. Although promising, the trainees we tried it on wanted a significantly more pronounced effect.

We also examined devices that use high voltage electrical discharges to provide feedback. We obtained an Electronic Prisoner Transport Belt from NOVA-USA that provides 50,000 volts for 6 seconds when activated. The effect is painful and incapacitating, and it is not suitable for use in a training environment. In addition, the possession or sale of devices in this class is restricted or outlawed in some U.S. cities and states.

We evaluated the ThreatFire belt and ThreatFire II portable shock devices from VirTra™ Systems, which, unlike the Prisoner Transport Belt, was specifically designed for use in a training environment. Each solution featured computer-controllable shock durations, in the range from 20 milliseconds to 2.5 seconds, a wireless interface, and an API allowing integration with the FITE virtual environment. Electrical interference issues were evaluated, and we did extensive testing to ensure the ThreatFires did not interfere with or damage the ExpeditionDI hardware.

Feedback from the Marines and soldiers on the effectiveness of the ThreatFire devices for increasing the realism and immersiveness of the training was overwhelmingly positive. Overall, trainees stated that the fear of being shocked by the devices was one of the key factors for them taking the training seriously, rather than treating it like a video game. The devices helped keep them cautious and observant, as if they were on an actual patrol.

OLFACTORY

While a number of prototype systems to deliver scents to immersed individuals have been developed (Washburn, 2004), this technology is relatively immature. Consequently, for the JCTD we selected a COTS scent generator to provide collective olfactory cues to trainees. The chosen system, the EnviroScent™ ScentPalette SDS100 scent delivery system, allows the real-time dispersion of one of eight pre-selected scents under computer control.

Each ScentPalette is supplied with compressed air, AC power, and a USB interface to the operator station. Under computer control, compressed air is directed into one of eight scent reservoirs. The scent stream is then dispersed by a set of four fans. These dispersal fans run continuously to clear the air of scents when no scents are call for. Nine scents were selected by the scenario team and made available for use in individual scenarios: diesel exhaust, cinnamon, Moroccan market, garbage, weapon fire, body odor, dirt floor, raw sewage, and gun powder. A subset of scents can be selected for any individual scenario and multiple reservoirs can be employed if a more intense scent is desired.

The ScentPalettes were placed in fixed locations within the training room, one with each fire team and one supporting the squad leader. Consequently, either four or five systems were employed, depending on whether a Marine or Army squad was being trained. The system integrators developed a VBS2 plug-in for monitoring and operating the scent machines. Using VBS2's scenario editor, the scenario designer can designate scents to fire based on locations, such as a market place, movable objects, such as diesel exhaust near a truck or body odor near individuals, or events, such the gun fire scent when squad is firing their weapons. The duration of the scent event is also controllable. In addition, scents can be manually triggered under instructor control. The scents had an effective range of about 20 feet.

During independent assessment and evaluation, olfactory realism received a low score. The response was surprising since the observers could clearly smell the scents. However, in surveys conducted after the training, many trainees did not report noticing them. It may be that while detected during training and perhaps influencing behavior, the scents themselves were not a memorable part of the experience. At the same time, some trainees even felt the scents were distracting.

One approach to enhancing the salience of olfactory cues would be to pre-brief trainees on the significance key odors and the potential information that could be obtained from this detection. For example, entering a room where Improvised Explosive Devices (IEDs) are being manufactured could trigger a strong ammonia smell. If the trainees were previously informed about this smell, they can make a decision affecting the outcome of the scenario based on its detection. While not sufficiently mature for inclusion in the JCTD, individually worn scent systems are a promising avenue for future development.

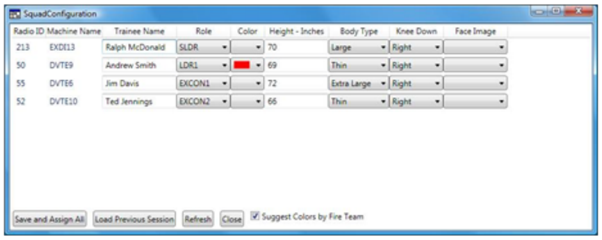
AUDITORY

The integrators evaluated several methods for the supporting the various forms of communication relevant to squad training. These included talking within a squad, radio communications within the squad and between the squad leader and higher headquarters, and interaction with virtual role players at laptop computer workstations. The initial plan was to use noise-blocking earphones and throat microphones. The noise blocking earphones were chosen for their ability to more fully immerse the trainee into the environment by excluding outside sounds. All voice data would therefore need to be transmitted over the network in order to be heard. Throat microphones were chosen in order to eliminate a trainee picking up the speech of another nearby trainee on their microphone, which would interfere with both operations and the collection of communications by the After Action Review system. The throat microphones had the side effect of altering the voice of the user, making it more difficult to determine the person speaking based on their voice signature. This coupled with the lack of visual cues one would normally use in a face-to-face conversation made it difficult to distinguish one conversation from another, even with attenuation and localization of the voice data. Further complicating matters was the short delay inherent with electronic re-transmission of voice. This led us to focus on another approach, which had been developed in parallel.

This alternative approach was a hybrid solution where trainees used non-occluding over the ear headsets with boom-style microphones. Intra-squad voice communications occurred through the air, while simultaneously being recorded through the boom microphones for After Action Review purposes. One complication this causes is that while trainees may be miles apart in the virtual world, they would still be able to hear each other in the physical space of the training facility. Therefore trainees were instructed to take into account the virtual location of any fellow squad members they wished to talk communicate with. Exercise controllers also kept an eye out for this type of cheating the system. Radio communication and role players to squad member communication occurred via electronic transmission. As an additional audio cue, all simulated radio traffic was preceded and ended by a short indicatory beep to notify the trainee that the traffic was from their radio and not a role player. This solution dramatically lowered the amount of voice traffic a trainee had to filter and allowed the trainees to communicate with role players, even if the other squad members were talking. A technological challenge for the future is an affordable and sufficiently realistic spatial sound implementation that would allow trainee to pick out a voice from a crowd with the same facility they do in real life.

INSTRUCTOR SUPPORT STATION LAUNCHER

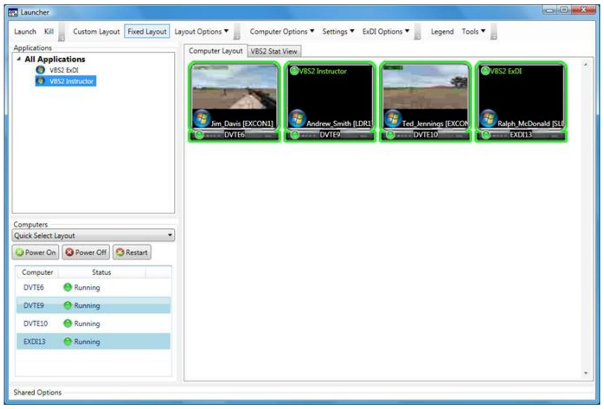
The logistics of preparing, launching, and monitoring an entire squad and exercise controller's worth of computers (over 25 computers at the Marine demonstrations) quickly becomes daunting. Some tasks include: mapping the players to their respective role, configuring the settings based on role, launching the same scenario on all computers simultaneously and monitoring the ExpeditionDI tracker status. To simplify these tasks, the system integrators developed the Instructor Support Station (ISS) launcher. The launcher was based on the ONR funded Next generation Expeditionary Warfare Intelligent Training (NEW-IT) ISS. The ISS software consists of two components: the Launcher and the Remote Listener. The Remote Listener runs in the background on every machine that will be a part of the training exercise. The listeners all communicate with the Launcher, which runs on the Operator Station.



Radio ID	Machine Name	Trainee Name	Role	Color	Height - Inches	Body Type	Knee Down	Face Image
213	EXDI13	Ralph McDonald	SLDR		70	Large	Right	
50	DVTE9	Andrew Smith	LDR1	🟥	69	Thin	Right	
55	DVTE6	Jim Davis	EXCON1		72	Extra Large	Right	
52	DVTE10	Ted Jennings	EXCON2		66	Thin	Right	

Figure 2. Squad Configuration Dialog

The Launcher allows a single operator to easily prepare, launch, and monitor the health of the entire system. Figure 2 shows how the launcher simplifies the task of assigning roles to the squad members, personalizing height and body type, specifying handedness, and setting the trainees facial image. The latter was used so that each trainee had a picture of his own face used on his respective virtual entity.



Computer	Status
DVTE6	Running
DVTE9	Running
DVTE10	Running
EXDI13	Running

Figure 3. ISS Launcher showing Status

Figure 3 illustrates monitoring of the entire system. The left panel of the application allows the operator to remotely power on (using wake-on-LAN) or off all the computers on the training network. The status of all computers with an active Remote Listener is also displayed. Lastly, a user editable list of applications to run on the computers is available. This simplifies the launching of different applications (or the same application with different run-time arguments passed) on the various entities.

In the main panel, the operator has the option of viewing live screen snapshots of the remote stations, or even remotely taking control. The layout of the machines on this panel is also user controlled, allowing the virtual layout to match the physical setup. The custom layout simplifies the task of locating a malfunctioning machine.

In addition to easily launching and shutting down, all other common tasks are available from the menu. Live VBS2 statistics are provided in the VBS2 stats view tab. Right clicking a computer in the main window will also bring up a context specific dialog of options to run on the respective machine. This allows altering of certain settings on the fly, without a need for physically interacting with a trainee's computer.

AUGMENTED AFTER ACTION REVIEW

The Army Research Institute recommended specific AAR capabilities, which included displaying the characters Field of View and adding “inkspots” which grew larger if the character did not move. We sponsored the development of these additions to VBS2. The integrators were also tasked with collecting additional statistics. These augmented statistics included Blue-on-Blue fire and Blue-on-Noncombatant fire and user defined metrics associated with VBS2 events. The integrators wrote a VBS2 plug-in which displays a separate window to the left of the VBS2 main window containing the augmented statistics. This window also gives a graphical representation of radio activity, synchronized with playback time.

During rehearsals, it became apparent that the AAR playback provided by VBS2 was insufficient. VBS2 provided a mechanism for placing bookmarks at key events (determined either automatically or by a human observer); however, the bookmarking mechanism did not allow the user to specify where to place the camera or have any integration with the radio simulation for specifying whom to listen to. In practice, we found the instructor would jump to a bookmark, mute the volume, and spend time trying to move and orient the camera on the area of interest. To improve the AAR playback experience, the system integrators wrote a VBS2 plug-in to automate the playback experience. Figure 4 illustrates the augmented bookmarking system. The instructor can choose on whom to focus the camera when the bookmark is loaded, and what voice channels to listen to. It also allows the instructor to start the playback some specified seconds before the event. This is useful, for example, for gunfire events. The instructor can playback the prior 10 seconds before the fire event, allowing the trainees to see the build up to the event.

FITE JCTD TECHNICAL EXCURSIONS

In addition to the immersive virtual reality system, there are a number of technical excursions, which represent unique individual capabilities that could be integrated into a future training system. The excursions we explored fall into three broad categories: software extensions to VBS2 to provide unique capabilities, particularly in culture and language, alternative locomotion technologies, and innovative hardware.

Bookmarks:
- 🟢 00:02:44 - Step off
- 🔴 00:09:12 - 2 Tm Ldr Commo
- 🟢 00:10:13 - 3 Trong
- 🔴 00:12:46 - 4 trng
- 🔴 00:13:42 - 5 fire tm to village
- 🟢 00:16:09 - 6 talking to villager
- 🔴 00:18:13 - 7 link w/elder
- 🔴 00:19:47 - 8 sqd frago
- 🟢 00:22:38 - 9 rpt
- 🔴 00:23:15 - 10
- 🔴 00:24:42 - 11 QRF
- 🔴 00:26:59 - 12 QRF Decision
- 🔴 00:28:37 - first shot fired
- 🔴 00:28:56 - 13 Shots
- 🔴 00:30:02 - 14 WIA
- 🔴 00:31:06 - 15 CASEVAC

Description: reporting set up of cordon - CASEVAC

Move the camera to: Schermer

Default offset: 30

Additional Offset: 0

Radio Nets:
- 🔴 Squad Net
- 🔴 Platoon Net

Voice Channels:

Squad:

1st Team:
- 🔴 Schermer
- 🔴 Truong
- 🔴 Nichols
- 🔴 Hayman

2nd Team:
- 🔴 Zajaczkowski
- 🔴 Placencia
- 🔴 Thies
- 🔴 Sonora

3rd Team:
- 🔴 Lindsey
- 🔴 Reinsberg
- 🔴 Navarro
- 🔴 Sheldon

EXCON:
- 🟢 EXCON1: Sgt_Rahman
- 🟢 EXCON2: EXCON2
- 🟢 EXCON3: EXCON3
- 🟢 EXCON4: EXCON4
- 🟢 EXCON5: EXCON5
- 🟢 EXCON6: EXCON6
- 🟢 EXCON7: EXCON7
- 🟢 EXCON8: EXCON8
- 🟢 EXCON9: EXCON9
- 🟢 EXCON10: EXCON10
- 🟢 EXCON11: EXCON11
- 🟢 EXCON12: EXCON12
- 🟢 EXCON15: EXCON15
- 🟢 EXCON18: Andy

Figure 4. Augmented After Action Review Bookmarking Dialog

Although all of these systems provide value, they were not deemed critical to the goals of the FITE JCTD and were not carried past the Technical Demonstration in Camp Pendleton,CA.

CULTURE AND LANGUAGE IN VBS2

CAATE (Culturally Aware Agents for Training Environments)

CAATE (Charles River Analytics, Cambridge, MA) is an easy-to-use graphical tool that allows trainers to rapidly develop and execute sophisticated, interactive behaviors for virtual characters. This enables trainers to efficiently create new training scenarios or to adapt existing scenarios based on the skills and needs of a particular unit being trained. CAATE reduces the need for role players, eases authoring for the rapid creation of training experiences, and enriches training programs with an improved ability for socio-cultural training. It has been demonstrated in a number of simulation environments including Forterra Systems' OLIVE and Bohemia Interactive's VBS2. CAATE has been funded by the Army Research Institute (ARI) and the OSD Human Social Cultural Behavior Modeling (HSCB) program.

NonKin Village (Non-Kinetic Village)

NonKin Village (University of Pennsylvania, Philadelphia, PA) is a world that brings life to virtual factions and agents in a sort of emergent SimCity. Nonkin Village combines state of the art theories and models from the social sciences into a "model of models" that portrays a given culture and set of personalities quite accurately (based on numerous validity studies in the MidEast, SE Asia, and Africa). It permits players to learn about cultural sensitivities and how operations cause emergent effects at the tactical level. A story engine and narrative authoring tools exist to help training developers introduce specific pedagogical encounters with the simulated individuals and groups.

A version of NonKin is being explored by the USMC for use in profiling real villages rather than just a mock one. NonKin Village has been funded by ONR and the OSD HSCB program.

Virtual Role Players (VRP)

Virtual Role Players (Alelo, Los Angeles, CA) adds the ability of avatars to communicate using culturally appropriate language and gestures. VRPs are integrated through a plug-in to VBS2 and other mission rehearsal and training systems. The technology used in VRP builds upon the award winning Tactical Language & Culture Systems. VRP comprises sophisticated language recognition and behavior generation technologies that can be tailored for pedagogical functions. Libraries of VRPs are available to model Arabic-speaking Iraqis and Pashto-speaking Afghans; additional libraries are being developed. VRP has been funded by USMC PMTRASYS.

CoJACK

CoJACK (AOS Inc, West River, MD) is a cognitive architecture that provides realistic cognitive behavior for virtual actors. When integrated with VBS2's virtual actors, each is augmented with cognitive properties and essentially becomes a CoJACK agent. These actor-agents have a number of actions available to them to deal with their current situation, much as humans do when dealing with everyday life. So when the situation changes within the VBS2 environment, the actor-agent knows about it and responds in a human-like manner. In addition, behavior moderators in CoJACK can vary these responses so actor-agents can show different levels of fear, fatigue, confusion and morale.

LOCOMOTION

Pointman

Pointman (Naval Research Laboratory, Washington, DC) gives the user a greater degree of control over the posture and movement of the avatar than is available using anything less than a full body-tracked system. It gives the user direct, continuous control over the direction of view, aim, and lean of the torso; postural height when standing or prone; turning the body; and taking a step of any length in any direction. The user interface combines a dual-joystick gamepad, head tracker, and sliding foot-pedals. The gamepad allows the user to turn the avatar's body, direct its course of motion, and actuate virtual weapons. A six degree-of-freedom head tracker allows the user to direct the view and aim, and lean the avatar's torso in any direction. Rudder pedals (as used in helicopter simulators) allow the user to take steps by sliding their feet back and forth, and to lower the avatar's postural height by pressing down. Pointman was funded by NRL and transition by ONR Rapid Technology Transition Program.

Wii Balance Board

Inspired by a demonstration by RDECOM/STTC at GameTech 2009 in Orlando, Lockheed Martin (Burlington, MA) expanded on the prototype implementation to provide a low-cost intuitive locomotion system for VBS2. Although the controller was inexpensive, users did not find the leaning motions natural or useful for locomotion.

Virtual Locomotion Controller (VLC)

VLC (SoVoZ, Princeton, NJ) combines data from orientation sensors, accelerometers, ultrasonic range sensors and force sensitive foot pads to provide the simulation engine (in this case VBS2) with information about the movement and orientation of the feet. It allows for user movements such as walking, jogging, running, and stepping (in place) in the real world to control avatar movements in the virtual world. VLC was developed though an SBIR with RDECOM/STTC (SoVoZ Inc., 2009).

INNOVATIVE DEVICES

SX60 and SX45 Head Worn Display (HWD)

Rockwell Collins, Carlsbad, CA, demonstrated the SimEye SX45 and SimEye SX60 which attach to a helmet. With 1280 x 1024 Super eXtended Graphics Array (SXGA) resolution, the SX45 provides a forty-five degree Field of View (FOV) which delivers high image fidelity and is the optimal display for viewing fine details at long range distances. The SX60, with its wider sixty degree FOV, provides heightened situational awareness in the virtual environment. Weighing less than one pound, these HMDs operate on less than three watts of power, maximizing battery life. The SX45 and SX60 can also be powered through a USB port.

Scent Collar

From the Institute for Creative Technologies (ICT) at USC, Marina del Rey, CA, the personal scent generator prototype delivers four different scents under control of a VBS2 scenario. This development was sponsored by U.S. Army RDECOM/STTC.

Recoil Kit

The recoil kit (VirTra, Tempe, AZ) uses a special bolt and a magazine containing a high pressure carbon dioxide cylinder and custom electronics to provide realistic recoil to a real M16 or M4 rifle. Shots are wirelessly relayed to a receiver that incorporates the shot data into the virtual environment.

SPOTLITE

From Aptima, Woburn, MA, SPOTLITE (Scenario-based Performance Observation Tool for Learning in Team Environments) is an observer-based assessment tool that helps instructors capture team performance data in real-time. Using SPOTLITE, instructors, observer controllers or small unit leaders can assess trainees while simulation and live training exercises are taking place, then present and review the trainees' performance data in debrief sessions. SPOTLITE consists of performance assessment software running on a tablet PC or laptop. SPOTLITE was an Air Force Research Laboratory (AFRL), MESA SBIR and has also received funding from JIEDDO through PMTRASYS.

CONCLUSIONS

Immersive virtual reality systems still have limitations for infantry training, but they also have significant potential. The FITE JCTD has brought national and international attention to squad-level infantry training. The USMC, USSOCOM, and the USAF are all seeking funding to train with and evaluate the FITE Spiral 1 systems. The lessons learned from the FITE JCTD will inform the PEO STRI Close Combat Tactical Trainer (CCTT) Dismounted Soldier program that plans to begin fielding immersive infantry virtual reality systems in July 2011.

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