Factors Affecting the Adoption of a Training Game

Bruce Roberts, David Diller, David Schmitt
BBN Technologies
Cambridge, Massachusetts
broberts@bbn.com, ddiller@bbn.com, dschmitt@bbn.com

ABSTRACT

DARWARS Ambush! is a multi-player, game-based training system for convoy operations, developed for DARPA in 2004 and currently in use by our warfighters at numerous bases in the U.S. and abroad. It was designed originally to reinforce the practical skills and TTPs (tactics, techniques and procedures) needed to anticipate and react to convoy ambushes and improvised explosive devices. However, its users have extended its application to address leadership skills, rules of engagement, dismounted urban operations, and many types of missions. We will describe the factors we see having led to the widespread grass-roots adoption of DARWARS Ambush! and the implications for developing and deploying other game-based training systems. We will also discuss the innovations—both in content and application—made by the Ambush! user community, and reported on at the recent Ambush! Users Conference. This example of adoption and innovation by the user community, with minimal contractor assistance, illustrates the value of putting training content creation into the hands of people close to the action, and that the ability for users to control and adapt content themselves leads to an effective, flexible training environment.

ABOUT THE AUTHORS

Bruce Roberts is a Division Scientist at BBN Technologies. He has a B.S.E. and M.S. from the University of Michigan and has been on the research staff at the MIT Artificial Intelligence Laboratory. He has been responsible for the development of numerous intelligent systems to aid in the design, operation, and repair of complex devices. He is currently the principle investigator for the DARPA DARWARS project where he leads the team developing the architecture for DARWARS, allowing multiple simulation-based training systems to interoperate and interact within a framework of learning objectives. Bruce led the team that produced DARWARS Ambush!.

David Diller is a Senior Scientist at BBN Technologies in Cambridge, MA. He holds a B.S. in Computer Science and Psychology from Taylor University, a M.S. in Computer Science from Indiana University, and a joint Ph.D. in Cognitive Science and Cognitive Psychology from Indiana University. His current focus includes cognitive modeling, mixed-initiative agent-based systems, and simulation-based training applications.

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BACKGROUND

DARWARS Ambush! is a networked, multi-player PC-based convoy trainer designed to save lives and improve effectiveness in Iraq, Afghanistan, and future conflicts. It allows soldiers and Marines to both experience lessons that others have learned and to construct their own scenarios based on actual experiences. Individual trainees move about in a shared, immersive, first-person-perspective environment where they carry out mounted and dismounted operations, operate ground and air vehicles, use small arms and vehicle-mounted weapons, and communicate over multiple radio nets. They learn to anticipate and respond to ambush situations, practice existing tactics techniques and procedures (TTPs), and experiment with new ones. Figure 1 is a screen shot from DARWARS Ambush!.

Figure 1. Scene from DARWARS Ambush!.

DARWARS Ambush! was designed to deal specifically with the threats associated with convoy operations as currently experienced in the field. However, it is also being used for a number of other uses, including leadership training and training in rules of engagement. Based on a commercial game engine that has been adapted to suit military training needs, Ambush! provides a variety of ways to train in a multi-player environment, with support for synthetic team members and opposing forces. Alternatively, participants can assume the role of insurgents or observer/controllers during a mission. Ambush! improves readiness by exposing deploying troops repeatedly to recent lessons learned by in-theater forces. Instructors can author scenarios in the field and conduct after-action reviews of training sessions using built-in, easy-to-use tools.

A DARWARS Ambush! installation consists of a network of PC workstations or laptops connected via a LAN or WAN, enabling training of up-to-platoon-sized elements. It comes with a complete set of documentation, including hardware setup instructions, a trainee guide, and instructor materials. An initial set of 25 training missions are also provided and can be extended using authoring tools included as part of the system. For additional details about the system capabilities, architecture, and its utilization see Diller, Roberts, Blankenship, & Nielsen (2004) and Diller, Roberts, & Willmuth (2005).

Sponsored by the Defense Advanced Research Projects Agency (DARPA), DARWARS Ambush! was developed by BBN Technologies, Total Immersion Software, Savage Entertainment and Jason Robar Consulting—bringing together a wide range of expertise, including game development and production, training-system design, simulation, and military operations. Our goal was an ambitious one: to design, develop, and deploy DARWARS Ambush! within six months. A group of early adopters was quickly identified: the 1st Brigade, 25th Infantry Division, Stryker Brigade Combat Team, and we worked with them to develop the initial curriculum content and to conduct a series of system evaluations prior to their deployment to Iraq at the end of the our six month development cycle.

The project's goal was to produce a training system that would be accessible to any unit that wanted it. It is extremely modest cost (roughly $10 per seat to purchase the underlying game for each workstation), and has relatively low hardware requirements. No specialized hardware is required and the training system runs on typical commercial PC or laptop systems. Operational overhead is also low because the system does not require specialized staff for system operation and maintenance.

Our effort did not conclude with the deployment DARWARS Ambush!. We were funded to publicize,

distribute, and provide user support. In order to publicize the availability and capabilities of DARWARS Ambush!, we authored papers for training and simulation conferences with a military emphasis such as the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) and the SISO Simulation Interoperability Workshop (Diller, Roberts, Blankenship, & Nielsen, 2004); Diller, Roberts, & Willmuth, 2005), television and print media coverage (National Defense, Defense News, The Boston Globe, American Forces Network, Stars and Stripes, KGO TV News, etc.), developed a website, and traveled to a large number of military bases demonstrating the system and training instructors in how to best use the system.

Figure 2. A unit at Ft. Lewis participates in an urban convoy operation scenario. (Photo by Jason Kaye of The Northwest Guardian, the authorized newspaper of Ft. Lewis, used with permission.)

Responsibility for the continued development, support, and maintenance of DARWARS Ambush! has transitioned from DARPA to the Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI) with the signing of a Memorandum of Agreement between the two agencies.

HOW IS AMBUSH! BEING USED TODAY?

DARWARS Ambush! Sites. Ambush! has been widely distributed since its initial release in September 2004. Over 150 copies of the software have been mailed out by us, by DARPA, and by PEO STRI. This does not count the copies that have been passed on from person to person. (A single copy is adequate for a site installation.) Currently, Army, Air Force, and Marine units are using DARWARS Ambush! at over 20 sites, including those in Europe, Iraq, and Afghanistan. One of the largest installations is the Ft. Lewis Mission Support Training Facility (MSTF) which has multiple platoon-sized installations of DARWARS Ambush!. Figure 3 shows a portion of the DARWARS Ambush! facility at the Ft. Lewis MSTF. Other large-scale installations can be found at U.S. Army Europe (USAREUR), which currently has Ambush! in use at three Battle Command Training Centers (BCTCs), including the Joint Multinational Training Command (JMTC), Southern European Task Force (SETAF), and 2nd Brigade, 1st Armored Division, utilizing approximately 150 workstations.

Non-convoy Operations. The original focus of Ambush! was convoy security, and most of our users are using it for just that purpose. There are some surprising users however—surprising until one realizes that many types of organizations participate in convoys (e.g., we have received inquiries from organizations as diverse as the USAF 21st Space Communications Squadron and US Army Chaplain Center and School). In addition, current conflicts necessitate that troops be exposed to and trained in a broader range of situations-frequently ambiguous and potential volatile situations-than historically required. Ambush! has been shown to be adaptable to training across a wide spectrum of other types of missions, including reacting to escalation of force, cordon and search, checkpoint security, questioning, crowds, and VIP protection and transport. We have previously reported (Diller, Roberts, & Willmuth, 2005) on our work sponsored by the Defense Modeling and Simulation Office (DMSO) to explore using Ambush! for Rules of Engagement (ROE) training. That paper also reports on the integration of Ambush! with live training by the Ft. Lewis MSTF (e.g., inserting live vehicle searches in a checkpoint scenario within Ambush!) And we are developing a family of missions for the Air Force Office of Special Investigations (AFOSI) which emphasize a number of specialized tasks such as VIP protection and transport, surveillance, and hostage rescue, as well as more typical military operations. Finally, we are also exploring the use of Ambush! for training against chemical, biological, radiological, nuclear or explosive (CBRNE) attacks.

Living Lessons Learned. An important goal for the DARWARS Ambush! project was to put the ability to modify and develop new scenarios into the hands of the users, who have the most up-to-date knowledge of what situations might be encountered and the highest motivation for creating training that is relevant to their own needs. The MSTF at Ft. Lewis, WA, who are in daily contact with the deployed Stryker Brigade, have created new missions based on the brigade's experiences in Iraq and have trained thousands of soon-to-be-deployed troops on the insurgents' latest tactics and the TTP's being developed to counter them.

Similar scenario customization based on local user requirements is occurring at USAREUR's Joint Multinational Training Center (JMTC), 3BCT 10th Mountain Division, Ft. Riley Simulation Center, the USMC's II MEF Simulation Center, and the U.S. Military Academy, to name a few.

Figure 3. DARWARS Ambush! simulation bay at the Ft. Lewis MSTF.

Distributed Training. Although the usual configuration for an Ambush! training event involves workstations connect an a local area network, Ambush! can operate over a wide area network. The distributed nature of Ambush! allows units located all over the world to conduct training exercises together. The Texas National Guard and the ADL CoLab in Alexandria VA have conducted a series of experiments focused on distributed mission training for National Guard units.

> A recent survey of Texas National Guard users – many of whom had just returned from Iraq – showed 100% satisfaction with DARWARS Ambush!. They stated that the system was useful preparation for real missions, and suggested that soldiers assigned to convoy missions should spend an average of 10 days a year training with DARWARS Ambush!
>
> — ADL Co-Lab, Alexandria, VA

Additionally, 3BCT, 10th Mountain Division has plans to deploy two systems in theater and will be experimenting with distributed mission training linking troops in theater and their relief units back home.

PEO STRI and DARPA sponsored a two-day DARWARS Ambush! Users Conference in late February 2006, which was attended by nearly fifty participants from the joint community, including the Army, Marines, Homeland Security, Federal Law Enforcement, and the U.S. Military Academy. Users reported on several unanticipated applications of Ambush! in their training programs.

Leadership Training. The Ft. Lewis MSTF and USAREUR's JMTC both have found ways to incorporate Ambush! into their leadership courses. Both use Ambush! as part of the Non-Commissioned Officer Academy's Warrior Leaders Course (WLC), which targets junior leaders such as Specialists and Sergeants. Ambush! is now a permanent part of the Program of Instruction for the Non-Commissioned Officer Academy. In addition, the Ft. Lewis MSTF uses Ambush! as part of their Officer Professional Development (OPD) program to create situations to challenge the leader's decision-making ability. They use Ambush! to generate a scenario with several decision points at which the group is asked the question "What now, Commander?". Finally, Ambush! is also being used to capture and illustrate "school solutions". Videos with voice-over narration are produced showing the doctrinally appropriate methods of performing convoy battle drills, executed in Ambush!.[1]

Disaster Relief Planning. One of the more novel adaptations of Ambush! was developed at Ft. Polk. The Emergency Operations Center (EOC) there utilized DARWARS Ambush! for natural disaster (tornado) emergency response training. After recreating a portion of Ft. Polk terrain within Ambush!, they mimicked the effects of a tornado by driving a group of tanks along the route of the tornado, knocking down trees, overturning cars, and generally leaving a path of destruction in their wake. They are currently in the planning stages for an annual training event to take place in the late summer that will utilize Ambush! and include both military and civilian first responders such as state police, local law enforcement, Leesville Hospital, FEMA representatives, and the local fire departments. Previous events have involved as many as 400-500 personnel.

The extension of Ambush! beyond its designer's original intent is testament to its pliability but more importantly to the power of end users to innovate when given a chance. von Hippel (2005) presents many examples of this phenomenon (End User Innovation) in the commercial sector and describes a process (Lead User Design) many companies are using to recognize and capitalize on it. We will return to this issue later in the paper.

[1] Using DARWARS Ambush! as a movie production technique mimics a popular practice among game enthusiasts, called *machinima*.

REASONS FOR ADOPTION

Why was Ambush! adopted? Conversations with Ambush! users have led us to some conclusions as to why they chose to incorporate Ambush! in their training programs, and in many cases modify those programs to take advantage of capabilities Ambush! provided. This section summarizes these conversations and the many comments we have picked up over the last several months.

Focus on small unit operations. Our focus on the troops paid off, and in the process revealed an under-supported niche in the training landscape.

For example, we encountered many circumstances where units (*e.g*., artillery units) were being reassigned to convoy security with little relevant (convoy) training, or where elements of a brigade support battalion were being called upon to rapidly develop required skills.

> This software fills a gap in our simulation training package. We have good individual training simulations as well as staff simulations, but what we need is a good small-unit tactical simulator that units can use at home stations as well as at our training centers. DARWARS Ambush! fills the bill!
>
> — Colonel Patrick Hamilton, G3, Texas National Guard

Training judged critical by deploying troops. When we began work on Ambush! in Spring 2004 we rapidly homed in on convoy operations and in particular the threat of Improvised Explosive Devices (IEDs) as an area of widespread concern. At that time, as is still the case, the largest proportion of casualties in Iraq were occurring from IED attacks. One of the reasons was that virtually everyone is involved in convoy operations at some point. The following recent email is representative:

> I completed my deployment to Iraq in September of last year. Prior to my arrival in theater in November of 2004, I received no convoy training. Because I was a volunteer who did not mobilize with his unit, I didn't get a lot of the high speed training others got in Kuwait and stateside. While I was over in Iraq I was the convoy commander of at least 100 convoys. …, many of the convoys included British, US, contractor, Iraqi, and sometime even Polish or Ukrainian forces. Granted they were only convoys of 30 clicks or so, but the danger is the same know matter how long or short the trip, outside the wire, when you are in Iraq. I learned on the fly, and luckily I brought my men and women home safe.
>
> There is an excellent chance that I may go back to Iraq next year. I would like to utilize your software and share it with other soldiers in my unit who have gone or may go in the future. I don't want to rely solely on luck anymore, and believe the lessons learned will assist me in becoming a better leader.

We relied primarily on our ties to the Stryker Brigade Combat Team (SBCT), our early adopter, for guidance in choosing the situations and threats that caused them the most concern. They filtered and prioritized the wealth of lessons learned material available, and provided a first-hand glimpse of their training at the Joint Readiness Training Center at Ft Polk. Coincidently they were deploying in the same timeframe we had been given for delivering Ambush! (six months) and consequently were highly motivated to identify what was needed to be prepared. Their daily contact with the SBCT already deployed provided them with a direct link to current events.

Built and deployed in a timely manner. Six months was a very short time. We were assured that much of the content would still be relevant. During this time we had monthly spirals of development and testing with the troops at Ft. Lewis.

Low-cost, "lightweight" solution. The price point for acquiring Ambush! was, of course, attractive, but that by itself would not have guaranteed continued use—Ambush! had to be seen as providing training value. Nevertheless it made the decision to evaluate the software easier and the plan to install a suite of machines more economical. In most cases, users did not have to go out and buy new hardware. The game engine underlying Ambush! is a generation-or-two old, but an advantage is that it places less demand on the computer's CPU, memory, and graphics card for acceptable performance.

Supplementary training tools. Ambush! extends a commercial game, enhancing it to match—as closely as practicable—the terrain, vehicles, weapons, characters, and actions to which we wanted to expose trainees. However, two critical functions were unavailable within the game itself.

Communications play a critical role in any convoy operation, and our early trials revealed the need to provide a radio communication capability and the value it would have to convoy training. We built an application (BBNTalk™) to fill this gap. It provided multiple radio nets, push-to-talk and voice activation, recording, and used Voice over IP (VoIP) for easy distribution.

Much of the value of experience-based training happens in the after action review (AAR). We built a separate AAR application to coordinate the playback of in-game video capture, movements of units, actions and voice communications.

While a game is a great starting point for building a training system it may be necessary to go beyond it to provide a complete training environment.

Thoroughly tested software. We adopted more than technology from our game developer partners; we also borrowed some of their work practices. If you come from an industry that hopes to ship millions of copies of your software, and have planned and coordinated a release date timed to the buying cycle of your customers, you do not want thousands of bug reports showing up the day after Christmas. You test your software thoroughly. We have had remarkably few quirks appear and no serious bugs reported over the months since the initial distribution of Ambush! In addition to happy users, this also meant that support costs were reduced and that we did not have to subject our user community to a series of software patches to be downloaded, installed and tracked.

Well documented training approach. Ambush! was released with four collections of multi-player missions, and several single-player familiarization missions—24 in all. Each mission was thoroughly described in an Instructor Guide that laid out the mission design, a map (see Figure 4) and photograph of the mission area with annotations (*e.g.*, good locations for the Observer/Controller), a BLUFOR convoy brief, a brief for any human OPFOR with several variations, and mission-specific After Action Review (AAR) questions.

The documentation also included a Setup Guide covering how to configure a suite of Ambush! workstations; a Trainer Handbook and User Manual covering use of the basic game software; a Mission Editing Guide covering how to modify the missions; a Orientation PowerPoint™ presentation and accompanying script for use by an instructor; and a map of the terrain modeled in Ambush!

Taken together, this documentation allows someone to acquire a copy of Ambush! and not only figure out how to install and operate it, but how to *train* with it. When possible we supplemented the written material with live on-site "train-the-trainer" sessions, dividing the time among setup, running a training session, and editing. These were enormously effective in getting people comfortable with Ambush! training.

Figure 4. Sample mission map.

Malleable. In our view this is the feature of DARWARS Ambush! that contributed most to its adoption and continued use. We deliberately based the trainer on a game with a best-of-breed mission authoring tool that allowed end users to select and position entities in the virtual world and manipulate their behaviors. The original release of Ambush! included more than twenty fully specified missions which serve as jumping off points for creating additional missions and illustrating how to access the rich collection of assets developed for the trainer—terrain features, models, and scripts. In addition, an active on-line user community had grown up around the underlying game, producing thousands of add-ons. The net result was a training system that could be tuned and extended to present situations unforeseen by its developers.

Our decision to encourage the use of human OPFOR—even though all the missions include acceptable synthetic (AI) OPFOR—opened up another dimension of adaptability. Human OPFOR can vary tactics to accommodate the skill level of the BLUFOR, introduce variability so the same missions can be reused, and mimic the latest insurgent tactics. Similarly, although we include mission briefs, we allow users to set different conditions for a training exercise by substituting their own ROEs, TTPs, and SOPs. A lesson we learned was *not* to program in too much about tactics, either BLUFOR or OPFOR, because tactics are bound to become obsolete—TTPs change over time and vary from unit to unit.

Amplifies other forms of training. DARWARS Ambush! is an "80% solution". For example, no one expects you to learn how to drive a 10-ton truck in Ambush!, but you *can* practice maintaining appropriate separation from the vehicle in front of you. This is characteristic of all simulation-based training. Users have found Ambush! to be an economical and effective

platform for introducing and rehearsing many of the decision-making and team-coordination skills inherent in convoy operations. In particular they applaud its applicability to the early phases of the "crawl-walk-run" approach for training. The ease and the flexibility of training with a lightweight solution such as Ambush! means that skills like communications discipline can be honed before one gets to live training or larger exercises. Consequently, more time can be devoted in these more resource-intensive forms of training to the skills that can only be acquired there.

Support for community. Etienne Wenger (Wenger, 1998) talks lucidly about the significance of "communities of practice" that grow up around dedicated practitioners in a domain. The value of Ambush!, and other experience-based training systems is predicated on the need to practice and to talk about the experience with others as a route to mastery. While the AAR provides the forum during each training session, mechanisms to support continued interchange over longer periods of time are needed too. Taking another cue from the commercial game world, we stood up an Ambush! users website blatantly modeled on those in the game sector (albeit with more subdued graphics), containing user forums, FAQs, user and developer feedback, additional documentation, upcoming events, etc. The site was password-protected with access limited to individuals with ".mil" domain addresses; more than 350 users have accounts presently. Topics on this site focus on the technical details attending the use of the software, although we have a mechanism for posting and downloading user-generated content. We recognize the need for a separate communication channel appropriate for such topics as the use of a particular mission to replicate a recent attack. We are exploring options for having these more sensitive discussions hosted behind the Army Knowledge Online portal, and the Marine Corps Tactical Decision-making Simulation Mission Support Center.

The Ambush! User Conference mentioned previously was another valuable forum for bringing together the community of users to share their accomplishments, experiences, and suggestions. One of the two days was devoted to advanced instruction on using the authoring tools for terrain and mission development.

Visibility. To butcher an oft-quoted aphorism: "If you build it they will come…but only if they know it exists." Ambush! was released on schedule six months after start, the SBCT took delivery of the software and two hardware suites, and a demonstration for battalion commanders at the MSTF serendipitously exposed the training personnel to Ambush! They determined to set up a suite of machines at the facility, and we returned soon thereafter to run a two-day train-the-trainer course. Ambush! was highly visible at Ft. Lewis, but they were far from the only audience. How were we to make its existence more widely known in the fragmented military training community?

The decision, shared by our DARPA sponsor (often reluctant to actively seek publicity for its programs), was to use the public press to spread the word. We secured an interview with a syndicated columnist from a local newspaper, which resulted in an article (Bray, 2004) published to coincide with I/ITSEC 2004. The article was picked up by other media, which spawned other interviews and coverage; and, more importantly, requests to evaluate Ambush!.

In addition to actively seeking publicity we demonstrated Ambush! at conferences and bases around the country: Ft. Polk, Ft. Lee, Ft. Eustis, Central Command, Ft. Hood, Ft. Belvoir, Ft. Leavenworth, USMC's 29 Palms, Lackland AFB, National Guard Bureau, DARPATech, I/ITSEC, and others. These were not demonstrations per se, but involved staging training sessions on a suite of 13 laptops with our audience in the role of trainees. We learned that this first-person encounter with Ambush! was extremely effective at conveying an accurate sense of its training potential and applicability.

OBSTACLES TO ADOPTION

Command staff turnover. Frequent command staff turnover at training centers proved a source of frustration in our efforts to encourage and support the continued use of Ambush!. For example, at the Ft. Lewis MSTF we have seen three Chiefs come and go over the last two years. Each new arrival naturally wants to review and reassess the mix of training in their organization, and therefore needs to be briefed anew about the training system and its uses. In the case of the Ft. Lewis MSTF, each new Chief became an even more enthusiastic advocate than the previous, but in general each command transition introduces an element of uncertainty and generates the need for renewed contact to re-introduce the value of Ambush! in training.

It is important to identify sources of continuity at training centers—people who span changes in command staff and serve as the long-term institutional memory for the organization. We learned that these often can be found among the civilian staff and contract training support personnel attached to the command. These people often have the day-to-day

responsibility for scheduling and facilitating training sessions, and over time develop considerable skill in modifying and creating Ambush! missions. Unfortunately, even these personnel can change on short notice when contracts are renegotiated.

Installation on government hardware connected to government networks. As discussed above one of the attractions of Ambush! was that it does not make extreme demands of the hardware required to run it. Notwithstanding this we encountered units who were hoping to repurpose hardware to create an Ambush! training suite and ran up against hardware limitations; for example, machines purchased to support distance learning that had woefully inadequate on-board graphics chips. In several situations units were able to overcome these limitations by upgrading memory and video cards at modest expense—something they could meet themselves with discretionary funds. In general game-based training systems require the computer hardware capabilities that were current when the underlying game came out. Training facilities should ensure that they have sufficiently capable hardware to meet these requirement or they will face frustrations over not being able to take full advantage of the coming wave of game-based training.

From time to time we encountered resistance of a more serious sort—serious in that the solution was not so straightforward as buying a new graphics card. The desire for some units to repurpose available hardware led them to consider computers that fell under their organization's information assurance (IA) policies. These policies govern what software can be installed on a machine and typically require prior certification and accreditation of that software from a recognized DoD authority (Common Criteria Project; DITSCAP). No certification was available for Ambush! nor for the game software on which it depends.

Obtaining certification is an obscure and lengthy process. (There are companies whose sole business is to shepherd software through the certification process.) Certification appear to need a government organization to serve as advocate; it is not something easily accomplished from outside the DoD. Obtaining certification entails determining the answers to many questions about the software that require in-depth knowledge of its design and implementation. In the case of Ambush! this would have meant going back to the developer of the game we "modded" to create Ambush! and involving them in the process, not a task they would be naturally inclined to undertake.

Although motivated by legitimate concerns for maintaining information security on our government networks, these policies nevertheless constitute a barrier to the open trial, distribution, and adoption of training software. In the move from large monolithic training systems to lightweight PC-based training this problem is likely to surface more frequently.

On the other hand, given the pervasiveness of IA awareness, it is surprising that more problems did not arise. We attribute this to the fact that many training centers already operate essentially standalone networks with dedicated hardware. This was also true of units setting up their own suites for Ambush! use. By running on an isolated local area network and being prudent about the source of the software, they were willing to accept some limited risk. Policies at other sites allow for exceptional circumstances. Reassurances from the IT staff at other Ambush! user sites went a long way to assuage concerns.

In addition to restrictions on what software can be installed on a machine, IA policies also impose restrictions on connecting that machine to a network; that of course being the greater concern. Our experience was that once training centers becomes familiar with Ambush! they invariably start asking about interoperation with other simulations and C2 systems. Short of full interoperation, just being able to *feed* C2 systems opens up possibilities for training with higher echelons and for replicating the digital information increasingly available on the battlefield (e.g., FBCB2 and Blue Force Tracker). Having Ambush! stimulate these systems is straightforward, but at many sites C2 systems operate on classified networks that restrict what can be connected.

Information Assurance is here to stay. The lesson is to start thinking about it and planning for certification and accreditation from the beginning so that the issue doesn't impede the adoption and use of your training system.

A Game is not a Trainer. There is a perception—some of it created by the claims and the wishful thinking of those proposing to build and acquire game-based training—that the game component by itself will serve to ensure that training happens. This is not our experience with Ambush!. Ambush! provides the stage set, some of the (non-player) characters, and even the script in the form of mission documentation, but the play does not go on without the director, and the director in this instance is a human instructor, facilitator, or leader. Without this role a group sitting down to Ambush! invariably reverts to play; enjoyable, diverting, and even revealing play, but play nonetheless. (Incidently, we have witnessed this phenomenon with groups ranging anywhere from

Privates to Lieutenant Colonels.) Training with Ambush! is no different than training on a firing range or in a live exercise in that it requires direction and clearly established training objectives, constraints, and leadership. The implication is that as use of Ambush! grows beyond small scale unit self-training, the need to provide staff to oversee, facilitate or lead training grows as well.

ADOPTION BY THE TRAINING ESTABLISHMENT

If it has not become clear by now, let us state it explicitly: the adoption of Ambush! was entirely a grass-roots phenomena. DARPA funded its creation and distribution as an exemplar of a new class of training inspired and made possible by the availability of low-cost high-quality PC games, and motivated by a sincere desire to make a difference *now* to protect our forces deployed in Afghanistan and Iraq. Decisions to use Ambush!, to assemble or acquire the hardware to run it, and to devote training time to it, were made independently by operational units and training centers. Each made its own assessment of mission applicability and training effectiveness. Each determined how to juggle the competing demands of pre-deployment preparations.

It helped that Ambush! was financially within reach of many individuals, readily available, and easy to use, but these factors do not guarantee continued use. The many reasons why we think Ambush! held an appeal were discussed earlier. The point to note here is that the decisions were being made independently at the fringes of the military rather than by a centralized authority. In this sense Ambush! represents a form of "guerilla training" whose acceptance and growth happened outside the training establishment through a process of diffusion.

While this diffusion process worked well for getting Ambush! into the hands of those who could benefit from it, it is not a solution to the longer term issue of support. DARPA does not fund Operations and Maintenance efforts. Turning to individual users with demands for support contracts violates the spirit of the original goals of Ambush! and, in any event, operational dollars remain tight and will not pay for ongoing support. It also turns out to be very difficult to come up with a business case that can turn support into a profitable venture.

What constitutes support? Despite the inherent ability for users to extend Ambush!, there arises with use the desire for capabilities that require expert skills to implement and incorporate into the training system. At a recent Ambush! User Conference a list of 75 or more suggestions were put forth: more variants of Stryker vehicles; more sophisticated treatment of casualty evacuation; greater ethnic, gender, height, and age variations among the avatars; ability to shoot out streetlights; turn signals; towing; geo-specific terrain; and so on. The list of desired features was subsequently prioritized drawing on the collective experiences of Ambush! users at Ft. Lewis, Ft. Drum, Ft. Riley, and elsewhere, with additional input from USMC Training And Education Command (TECOM). A user group was formed. There was open discussion with the developers about the level of effort required to satisfy each item and the underlying difficulties. This was followed by a re-ordering of priorities, aggregation, refining what training experience a feature *really* had to provide, rescaling expectations (some features can be addressed to varying levels of completeness; e.g., do you *really* need all four new Stryker variants), and in some cases finding simpler but adequate short-term solutions (*e.g.*, stimulating FBCB2 but not providing full ABCS interoperability). The goal was to sensibly pool the community's needs, implement, test, document and disseminate the updates to all. Support is intrinsically an activity shared across all users and therefore benefits from a centralized structure. In addition to adoption by its users a training system ultimately needs to be adopted by the training establishment as well to ensure its long term health.

In the case of Ambush!, the Memorandum of Agreement with DARPA represents PEO STRI's interest and intent to be the broker for providing ongoing support. But in fact Ambush! is not currently associated with a Program of Record and is dependent on a loose coalition of users and individual requests for assistance or improvements.

What are the implications of training systems like Ambush! for the institutions charged with overseeing and providing training: setting requirements, procuring training systems and content, evaluating effectiveness, and providing life-cycle support? The ability for units and training centers to choose training systems and to develop their own content is not well provided for within current policy and practice. But there is a role that needs to be filled in this new paradigm.

The previous discussion about long-term support suggests one aspect: recognizing the value of training approaches being developed in the field, making them more widely available, and underwriting their support. In other words, take advantage of the experimentation being done throughout the Services to explore a wider variety of training approaches; do an early assessment

of training effectiveness and other factors (cost, scalability, generality, etc); act as a clearinghouse for these new approaches by fostering communication among the early adopters; be a distribution point for the training software and content; and take responsibility for matching the training approach to existing requirements and developing new requirements based on users' demonstrated needs. This echoes our earlier reference to End User Innovation as a reality to be recognized and encouraged. The new role for the training establishment is to manage the *process* by which training is being developed and disseminated, not the product per se.

We are sometimes asked: Who set the requirements for Ambush!? The answer is: the 1st Brigade, 25th Infantry Division, by telling us (and showing us when we accompanied them to the Joint Readiness Training Center) what situations and threats they wanted to prepare for, what battle drills, SOPs, and TTPs they want to refine and practice, and what missions their sister unit in Iraq were being tasked with. It turned out that their concerns were widely shared, and so the content provided in the initial Ambush! release found many other eager users. It seemed perfectly reasonable to us to respect their opinions on this matter; after all, they had done their research, and it was their lives on the line.

The perils of top-down training requirements definition are that 1) it doesn't keep pace with the rapidly evolving demands on the warfighter, 2) it leads to procurements that try to satisfy *all the* imagined requirements, itself a lengthy and costly process, and 3) it promotes a one-size-fits-all mentality with respect to what requirements a unit actually cares about at any point in time. Paying attention to the training approaches and content being adopted at the edges of the establishment can be a source of insight into better, more economical "80% solutions" like Ambush!, while at the same time exposing the gaps in current training requirements and suggesting how to bridge them.

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