



ARI Research Product 2005-01

**Symposium on PC-based Simulations
and Gaming for Military Training**

October 2004

Advanced Training Methods Research Unit

**U.S. Army Research Institute
for the Behavioral and Social Sciences**

20050322 119

Approved for public release; distribution is unlimited

**U.S. Army Research Institute
for the Behavioral And Social Sciences**

A Directorate of the U.S. Army Human Resources Command

**ZITA M. SIMUTIS
Director**

Technical Review by

Joseph Psotka, U.S. Army Research Institute
Barbara Black, U.S. Army Research Institute
Dan Horn, U.S. Army Research Institute

NOTICES

DISTRIBUTION: This Research Product has been cleared for release to the Defense Technical Information Center (DTIC) to comply with regulatory requirements. It has been given no primary distribution other than to DTIC and will be available only through DTIC or the National Technical Information Service (NTIS).

FINAL DISPOSITION: This Research Product may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The views, opinions, and findings in this Research Product are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) October 2004		2. REPORT TYPE Final		3. DATES COVERED (from . . . to) November 2003 – September 2004	
4. TITLE AND SUBTITLE Symposium on PC-based Simulations and Gaming for Military Training				5a. CONTRACT OR GRANT NUMBER	
				5b. PROGRAM ELEMENT NUMBER 633007A	
6. AUTHOR(S) James Belanich (U.S. Army Research Institute), Laura N. Mullin (The Catholic University of America), and J. Douglas Dressel (U.S. Army Research Institute)				5c. PROJECT NUMBER A792	
				5d. TASK NUMBER 214	
				5e. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences Advanced Training Methods Research Unit 2511 Jefferson Davis Highway Arlington, VA 22202-3926				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences Advanced Training Methods Research Unit 2511 Jefferson Davis Highway Arlington, VA 22202-3926				10. MONITOR ACRONYM ARI	
				11. MONITOR REPORT NUMBER Research Product 2005-01	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES Subject Matter POC: James Belanich (703) 602-7937					
14. ABSTRACT (<i>Maximum 200 words</i>): In November 2003, the Advanced Training Methods Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences held a two-day symposium on DoD's use of training games. The 50 participants in attendance listened to presentations on the use of games for training purposes from the three military services, academia, and private sector representatives. Each presentation was followed by a discussion on the use of PC-based simulations and games for military training. Topics included the effective use of training games, their integration into courses, barriers to implementation, return on investment, and evaluating training effectiveness. A key finding highlighted in several presentations was that the few training games in use work best when closely monitored by instructors or subject matter experts and are integrated with existing courses and their specific objectives. Another recurring theme was that the more effective training games require developers, subject matter experts, instructors, and evaluators to work together through the entire development process. Participant feedback indicated that the symposium was very timely and filled a continuing need in a growing, rapidly changing community.					
15. SUBJECT TERMS games, desktop simulations, training, wargames, computer games, military training					
SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	32	Ellen Kinzer Technical Publication Specialist (703) 602-8047

ARI Research Product 2005-01

**Symposium on PC-based Simulations
and Gaming for Military Training**

James Belanich
U.S. Army Research Institute

Laura N. Mullin
The Catholic University of America
Consortium Research Fellows Program

J. Douglas Dressel
U.S. Army Research Institute

Advanced Training Methods Research Unit
Guy L. Siebold, Acting Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926

October 2004

Army Project Number
633007A792

Personnel, Performance
and Training

Approved for public release; distribution is unlimited

FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), as part of its *Training for Interactive Distributed Environments* project, held a symposium on the use of training games in the U.S. Military. ARI seeks to provide the Army with guidance on how games can be used for military training.

On 5-6 November 2003, ARI's Advanced Training Methods Research Unit held a symposium on DoD's training game usage through a contract with Booz Allen Hamilton. Presenters from all Military branches, academia and the private sector covered topics that included effective training games, course integration, barriers to implementation, economical implementation, and evaluation. Participants stated that the symposium was timely and encouraged periodic follow up meetings.

The findings were shared with representatives from the NATO Research and Technology Organization - Modeling and Simulation Group, as they planned for an October 2004 workshop on the use of commercial games for military purposes. A summary of this symposium was also briefed to representatives from the Research, Development, Experimentation Command/Simulation and Training Technology Center (RDECOM/STTC), the Training and Doctrine Command - Training Development and Analysis Directorate (TRADOC-TDAD), the Army Research Laboratory - Human Research and Engineering Directorate (ARL-HRED), and the Institute for Creative Technologies (ICT) on 28 September 2004.



PAUL A. GADE
Acting Technical Director

SYMPOSIUM ON PC-BASED SIMULATIONS AND GAMING FOR MILITARY TRAINING

EXECUTIVE SUMMARY

Research Requirement:

There is an increasing use of PC-based games and simulations as a means of training within the U.S. military, and many of these efforts are being done in isolation with little coordination within or across services. To bring together individuals with experience in the use of games for training purposes to share lessons learned, the U.S. Army Research Institute for the Behavioral and Social Sciences hosted a symposium including personnel from all branches of the military to discuss how training games and game-like simulations are currently being used by the military.

Method:

The symposium consisted of 11 presentations given by training representatives from all services, military training researchers, and training game developers. Additionally, time was allocated for group discussion among the 50 symposium participants since all attendees were experienced in the use of training games for military purposes. Note-takers recorded the presentations and the discussions, which are summarized in this report. At the beginning of the symposium, five organizing questions were presented to the group to focus the discussions. The questions were: 1) how are training games used effectively; 2) what interferes with training games; 3) how can instructors/SMEs facilitate the use of training games; 4) how should training game developers be supported; and 5) what are barriers to training games? This report is organized according to these questions.

Findings:

The primary findings were based on the five organizing questions posed at the beginning of the symposium. The highlights of the discussion were: 1) training games need to be used along with good instructional techniques; 2) the use of unrealistic or inappropriate training scenarios limit the effectiveness of training games; 3) trainers are required to guide the learner through the instruction, and the games are training tools that the trainers can use; 4) frequent and reciprocal communication between Instructors/SMEs and game developers is critical for successful training game development; and 5) a lack of policy and administrative support for training games is a barrier to the implementation of training games.

Utilization of Findings:

The results of this research provide information beneficial to individuals interested in the effective use of training games for military purposes. The organizing structure of the symposium was shared with representatives from the NATO Research and Technology Organization - Modeling and Simulation Group, as they planned for an October 2004 workshop on exploiting commercial games for military use.

SYMPOSIUM ON PC-BASED SIMULATIONS AND GAMING FOR MILITARY TRAINING

CONTENTS

	Page
Introduction	1
Question - Topics	3
How are Training Games Used Effectively?.....	3
What Interferes with Training Games?	5
How can Instructors/SMEs Facilitate Use of Training Games?	6
How should Training Game Developers be Supported?.....	6
What are Barriers to Training Games?.....	7
Questions Still Unanswered	8
Summary	9
Appendix A List of Presenters and Attendees.	A-1
Appendix B Resource List	B-1

List of Tables

Table 1 List of Presentations.....	2
Table 2 Organizing Questions for the Symposium.....	3

Introduction

On 5-6 November 2003, the Advanced Training Methods Research Unit (ATMRU) of the U.S. Army Research Institute for Behavioral and Social Sciences hosted a symposium on the use of training games and game-like simulations across the Department of Defense (DoD). The rationale for the symposium was that although there is an increasing use of PC-based games and simulations as a means of training within the U.S. Military, many of these efforts are being done in isolation with little coordination within or across services. The objectives of this symposium were to bring personnel from all branches of the military together to discuss how training games and game-like simulations are currently being used by the military, to identify ways they may be used more effectively, and to help develop a community of practitioners to facilitate future development and effective use of games for military training. Participating in this two-day event were instructors from the U.S. Army, Navy, Air Force, and Marines, as well as, training developers, commercial simulation/game developers, training researchers from all services, and representatives from the Office of the Secretary of Defense.

To share lessons learned, 11 presentations were given by training representatives from all services, military training researchers, and training game developers. A list of the presenters, their affiliations, and the title of presentations are displayed in Table 1. In addition, time was allocated for discussion and focus groups since all of the approximately 50 symposium participants in attendance were to some extent involved with the use of training games and desktop simulations (see Appendix A for a full list of all participants). This discussion time included 10-20 minute question periods after each presentation, a 90 minute breakout group sessions at the end of the first day, and a summary review of the symposium proceedings at the end of the second day.

Table 1
List of Presentations

<i>Name</i>	<i>Presentation title</i>
Mike Crane U.S. Air Force Academy	"The Range of Training Game Options"
Capt. Erik W. Jilson TECOM, U.S. Marine Corp	"The USMC's PC-Based Tactical Decision Simulations"
CPT Carl Jacquet U.S. Military Academy	"An Instructor's View on the Use of Training Games and Desktop Simulations"
Dr. Scott Beal U.S. Army Research Institute	"Evaluation of a Command and Control Training Game"
Rob Sears Legless Productions	"Development of Commercial Platform Training Aids"
CMSgt Teresa Clark Nebraska National Guard	"Economical Interactions in Online Training"
CDR Charles Frye Naval Air Systems Command	"Training Game Research and Applications"
MAJ Pat Connors Battle Command Battle Lab Fort Leavenworth	"Providing the Warfighter with a Low-Cost, Low-Overhead, PC-Based Tactical Trainer - A Use Case "
Jim Dunnigan New York, NY	"Military Training Games"
Dr. Ralph Chatham Defense Advanced Research Projects Agency	"Developing a Massive Multiplayer Online Game for Training"
Dr. Harry O'Neil University of Southern California	"Evaluating the Effectiveness of Training Games"

All participants, including the presenters, were asked to consider a set of questions during the symposium in an effort to identify the "state of the practice." The five organizing questions are presented in Table 2. In addition to gathering responses to these questions at the symposium, the questions were also emailed to all participants one week after the symposium. The participants were asked to respond via email if they wanted to contribute additional comments that were not covered during the symposium. In an effort to document some of the thoughts and opinions of knowledgeable persons in the field of the use of training games for military purposes, the following provides a summary of the information provided both during the symposium and from the follow-up email responses, organized according these principle questions.

Table 2
Organizing Questions for the Symposium

Questions presented before discussion groups

1. How are training games used effectively?
 2. What interferes with training games?
 3. How can instructors/SMEs facilitate the use of training games?
 4. How should training game developers be supported?
 5. What are barriers to training games?
-

The information presented in the main body of this manuscript covers the thoughts and opinions of the symposium participants. For practical purposes, a limit of 50 participants was set for the symposium. The authors admit that this may have excluded some valuable input. Therefore, additional information on the topics discussed in this paper is presented in a list of resources appearing in Appendix B.

Question - Topics

How are Training Games Used Effectively?

This question was interpreted two different ways: a) what makes the use of training games an effective training methodology, and b) what are types of training where games can be used effectively. Both interpretations of the question are discussed below.

In response to what makes training games an effective training methodology, the overwhelming consensus was that training games need to be integrated with good instructional techniques. Training games are instructional tools. As with all types of tools they can either be used properly or improperly, which tends to lead to positive or negative outcomes, respectively. Several of the presenters stated that one of the reasons training games can be effective is that they promote active learning. Training games allow learners to actively engage in the content they are learning, which is likely to produce positive learning outcomes.

The instructional methodology that was mentioned most frequently was the proper use of Instructor/SME feedback to the trainee. For training games this feedback can be presented in various forms, ranging from global to specific. Global feedback can be given in the form of an after-action review (AAR) after the game has been completed, or more immediate specific feedback can also be provided during the flow of the game. Both global and specific feedback can promote learning. The importance of the instructor providing feedback to the trainees was to highlight important lessons learned by trainees and to diminish the possibility of learning incorrect procedures from the game. Without instructors monitoring game use, many participants stated that there was the possibility for negative training to occur.

Other beneficial instructional techniques mentioned were: the presence of progressive goals, reliable outcome measures, the need for realistic interfaces, and scenario flexibility. The instructional techniques for games have not yet been fully explored through empirical research,

but the research is beginning. Symposium participants stated that basic, effective instructional methodology should apply to games, although more research is needed to verify specific instruction methodologies and their effectiveness in particular training game contexts.

In response to the question of the types of training for which games can be used effectively, the majority of the participants stated that training games can be used to train cognitive skills. Most of the actions portrayed in games are not conducted with a game interface that is identical to the interface used in a real world context; therefore, the physical requirements for the game may not transfer as well to the real world. However, the cognitive aspects of the game-tasks may transfer better. For example, if the training objective for a game is to clear a building, the trainees may learn the sequence of steps (e.g., progressing through the building in a specific order) required to clear the building, but they probably won't learn the actual physical tasks (e.g., running through halls and knocking down doors).

Many participants stated that games could not replace live fire exercises and live simulations such as those conducted at the National Training Center, the Joint Readiness Training Center, and other facilities. However, many participants expressed the opinion that training games could be useful in preparing personnel to learn some of the prerequisite cognitively-based skills that could then be transferred to a training center. Training games might bridge the gap between classroom learning and live training exercises thereby enabling more effective use of the latter costly resource.

The participants also stated that training games can be used to demonstrate or introduce general concepts. Some of the presenters who were instructors stated that when they use games to demonstrate concepts, they first provide some background information on a particular topic before having the learners use the game to "try-out" the concept. This allows the learners to actively engage the material. This approach was seen as a way to provide clear concrete examples in a format that is far more compelling, and it also provides a different means for conveying the information that involves the learners more than just straight lecture.

Motivation was also discussed as an aspect of games that provided instructional value. Motivated learners are more likely to engage in the training task than unmotivated learners, and many of today's military personnel are motivated by games. In order to benefit from increased trainee motivation based on the use of training games, the training games need be interesting and engaging, which subsequently promotes continued use that should translate to increased practice time and higher levels of learning.

Training games allow instructors to overcome some of the constraints of time and distance, adding to the utility of the training they provide. For example, to take a class to the field for training requires travel time and expense. A game-based simulation can be used to augment this form of training, providing the instructor with a tool to run quick scenarios where trainees can take part in the simulation without ever leaving the classroom; further, a training game can be used individually by students at their own convenience.

There are other benefits to controlling time and distance. With regards to time, the instructors can easily "pause" a game to provide feedback or additional information to the

trainees. The instructor also has the ability to jump around the virtual environment much more quickly than a real environment, allowing them to monitor trainees from multiple perspectives. Another benefit of controlling distance is that the instructor may be able to modify the scale, angle, or visual perspective of what is observed, which allows learners to get a better understanding of what occurs during the game and what could occur in the real world.

What Interferes with Training Games?

Interference with the training aspect of training games can occur in a variety of ways. The interference can be thought of as a matter of degree; what causes the game to fall short of its training potential (limited effectiveness) or what keeps training games from being used at all.

The most frequently mentioned factor that may limit the effectiveness of training games was the use of unrealistic or inappropriate training scenarios. The scenario must match the learning objectives for the training. The inability to edit a scenario was considered a major limitation of some games because it did not allow the instructor to customize the game/simulation for specific training needs. Instructors stated that having the ability to modify scenarios allows them to create targeted training that can focus on the desired learning objectives.

It was also noted by participants that the possibility of negative training or the training of improper "stuff" may occur with some training games. The lack of SME involvement in game development, the lack of instructor involvement (e.g., monitoring trainee actions and providing useful feedback to trainees), and a lack of clear training objectives were all reasons stated for how negative training could occur with the use of training games.

The inclusion of extraneous features (bells and whistles that are not realistic to the training scenario) was also cited as interfering with training effectiveness. For example, some games provide a hyper-reality, in that they make information or resources available to trainees that an ordinary person in a similar real-life situation would not have available (e.g., god's-eye views, unlimited ammunition, and coming back to life quickly after being killed). A few of the participants felt that the inclusion of these extraneous features might lead to trainees becoming reliant on the additional resources that won't always be available to them. This could lead to inappropriate actions when trying to apply what they learned to real-world situations.

Another identified interference was a lack of "buy in" by supervisors and administrators. This kept training games from being used in situations where they might have been effective. As with many innovations, there is initial resistance, but with demonstrated usefulness this resistance is minimized over time. A related point was that some people cringe when they hear the word "games" in respect to military training, with the thought that games are fun while training is serious. For this reason, some of the participants suggest using alternative terms like: *training simulations*, *desktop simulations*, or *PC-based training tools* to minimize this difficulty.

Another barrier to the effective use of training games was that not all people like to play games. There is a misconception that almost everyone in the current generation entering military service is an expert with video games. While video games are popular, there are also a large

number of people who rarely play these games. The issue of the divide between those with extensive gaming experience and those who are relatively new to such games was discussed and will be further explored in the "Questions still unanswered" section.

How can Instructors/SMEs Facilitate Use of Training Games?

Across the board, participants stated that instructors/SMEs were critical to the success of training games. While some game developers may tout their game as a stand-alone training tool, the majority of the attendees stated that a game by itself would not necessarily train. Instructors are needed to facilitate/guide the instruction. This section covers what actions instructors can perform in order to maximize the positive impact of the training experience.

In order for the instruction to be effective, the instructor should possess a high level of understanding of the subject matter. In addition, the instructor must be familiar with the specific game being used. For example, how to set up and run the game, modify scenarios, and address any issues as needed when events do not work out as planned.

When using a training game, the instructor has to channel students' efforts towards the game and the training objectives. The instructor should ensure that the training objectives are being met by the students. The goal is not for the students to play the game but to achieve the training objectives. It is a waste of time if a student excels at a game but can not use what is learned in an applied setting. Some students may attempt to "game the game," which is finding an alternative way to score well or reach objectives through inappropriate means. Instructors need to make sure that students are using the game appropriately and learning the training objectives, not bypassing them and therefore bypassing the training.

In addition, the ability to provide feedback to students about their performance was considered important. This feedback should be scaled to the learner and the task at hand. For example, when a learner is performing a novel task, they may need more directed and frequent feedback. As the learner becomes more skilled at particular tasks, the feedback can be scaled back.

How should Training Game Developers be Supported?

For the development of effective training games, instructors/SMEs need to provide support to the game developers. Communication between instructors/SMEs and game developers was stated as critical for successful training game development. This communication should include the clear identification of the training objectives and explanations of how the game will be used to train students (e.g., stand alone training vs. use as a training tool). The pedagogical focus of the game must also be clearly described; otherwise the game may not train what it should train. This communication needs to be reciprocal, in that game developers also need to clearly communicate their capabilities to provide the training game functionality expected by the instructors/SMEs.

To facilitate this mutual communication, one suggestion made by a presenter was the development of a prototypical board game as part of the process to develop a PC-based training

game. The development of a board game allows for the interested parties to discuss and observe the dynamics of the game before a lot of time and money is spent writing the code to develop the PC-based version. This should allow the developers and the instructors/SMEs to clearly communicate, because they would be able to demonstrate what they are thinking with the board game. It also allows them to explore different ways in which the game can be used.

After a game has been developed (or during beta-testing) communication continues to be important to the continued improvement of the game. PC-based games can be modified and new scenarios can be added, increasing the quantity of training content. In the commercial PC-gaming world, users regularly develop "mods" (modifications to the game scenarios). This ability to develop mods is a strength of games and the gaming community in that the new and varied training scenarios can be developed with little cost. With varied training scenarios, learners may better generalize and transfer the skills they learn from one setting to another.

What are Barriers to Training Games?

The noted barriers to the effective use of training games fell within two categories. The first set dealt with how the game was implemented in the instruction or factors specific to particular games. The second dealt with more administrative concerns, things external to the game/instructor setting.

Participants cited vague training objectives as a barrier that limits the instructional effectiveness of training games. Unless the training objectives were clear and the game was well suited for these particular training objectives, appropriate learning was unlikely to take place. Another barrier to the effective use of training games was follow-through by instructors. In some instances an instructor might provide a game and then just let students play, and the instructor might not monitor the training. This lack of instructor monitoring could lead to negative training, where the students learn inappropriate procedures from the game.

Finally, a concern over the time spent learning how to play the game was mentioned. For example, if it takes an hour to learn all of the controls of the game and then another hour of playing in order to learn material that can be equally well learned through 10 minutes of lecture, then the game would not be a time efficient means for training this particular material. However, if the two hours of training game use lead to increased retention and ability to apply the training content to real-world situations, then the increased time may be justified.

In the category of administrative barriers, the lack of a clear policy governing the use of training games was mentioned as a barrier to their implementation. Several of the participants mentioned training administrators that were reluctant to embrace this new form of training. Another issue mentioned was the fear that the use of training games will lead to a reduced training budget. The need for better technical support to ensure that the use of the training games run without technical glitches was also a factor identified as a barrier to implementation.

Questions Still Unanswered

There were a wide range of topics discussed regarding the questions that were still unanswered in the use of games as a training medium for military purposes. The most often mentioned was the question of funding. Where will the funding to develop needed training games come from? Most of the games currently developed by DoD are more experimental (proof-of-concepts) to show that a specific type of game can be developed, but these training games do not regularly make it to the classroom. The funding for implementation of the game (e.g., producing supporting training material and maintaining or modifying the game) is not allocated as part of the research and development process. Right now, at the point of instruction many of the games used are commercial-off-the-shelf (COTS) that meet only some of the training requirements. The budget for these games involves the purchase of the COTS version, but there is usually little to no money available for game development or for modifying games so that they can be adapted to the specific training objectives needed for instruction.

The issue of the lack of empirical research regarding the effectiveness of training games was also raised. Are these games truly effective training tools, and what factors can maximize their effectiveness? While there seemed to be near consensus that games can be effective training tools, very little empirical research has confirmed such results. Most of the evidence that training games can be effective is anecdotal or lacks a control group for proper comparison.

The place that training games will take in the overall realm of training options also needs clarification. What are the situational variables that indicate when a training game should be used to augment existing training? There are various types of skills (e.g., cognitive and motor) and topic areas (e.g., tactics, vehicle maintenance, and medical procedures) that may or may not be trained effectively by particular types of games. For example, some types of games such as first-person-perspective games may be effective for training cognitive strategies during military exercises but may not be effective for training verbal information. This type of research, identifying the relative training potential of different types of games for training different types of skills or topics, has yet to be done.

Not everyone has extensive experience with games, and that could influence the effectiveness of games as a training medium across individuals. The initiation of non-gamers into a gaming environment was a concern mentioned during the symposium. What methods should be used to ensure that trainees with minimal computer gaming experience can benefit from the training as well as experienced gamers? For learners with minimal gaming experience, there may be some prerequisite training that could provide the necessary foundation so that the learner could take full advantage of game-based learning.

The creation of clear metrics for the measurement of performance in the training game and performance in the process of the game was also raised as an issue. How do we measure game performance to determine how well a person has been trained? Some games have a scoring mechanism, but the value of the score may not match the training objectives of the instruction. The score might be based on the number of enemies killed, but may not take into consideration the number of friendlies killed. So a person could score high by shooting everything in sight. This could lead to learners scoring high but not learning what they are

supposed to learn. Also, a single score may not represent what a trainee learned while using the game, especially if the score is for a team.

While games have been used for training purposes for decades and are becoming more popular in their use, we are still in the infancy stage of empirically determining the factors and training techniques with which we can maximize the use of games for effective training. Additional research and experience must be accumulated to answer some of the questions posed above. Also, while answering some of these questions, new questions will assuredly arise.

Summary

During the symposium, the questions provided an organizing structure for the presentations and discussion. Within this structure, several dominant themes emerged and are highlighted below. The overarching theme was that training games can be useful for military training purposes, but there are still considerable obstacles to be overcome.

- PC-based simulations and games need to be treated as a training delivery system that includes instructor/SME support/monitoring, supporting training material, in addition to the game itself. Today's training games can not provide quality training in isolation; they must be part of a sequence of instruction that may include the learning of basic concepts which can then be applied in a gaming environment.
- Sound instructional design must be used whereby learning objectives are provided by military SMEs working with game developers to ensure these training objectives are supported by the game scenarios. Game engine-based simulations should also provide feedback to the trainee and incorporate some form of AAR. In addition, instructors should provide additional feedback to the trainee to ensure that only correct military procedures and performances are reinforced. Soldiers should not learn or practice incorrect behaviors, which could have negative operational consequences.
- Presenters also stressed that the game-based simulations do not train in isolation; trainers train, and games are just a training tool they can use. At this point, games should be used as training tools along with instructional guidance provided by trainers. Trainers should know the game, and know how the game supports achievement of the military training objectives. Trainers can then meaningfully interact and coach the students to enhance the value of the game-based simulation.
- There is a need for objective evaluation of the training effectiveness of games. There is a wealth of anecdotal evidence to support the use of various training games, but a dearth of empirical evidence. Research needs to identify and assess where, when, and how training games can be used effectively.

Training games have a wide variety of potential applications; they can be used to provide and reinforce initial training; and they can provide practice, rehearsal, and refresher training. Game-based simulations can be used for training a vast spectrum of military skills and tasks on an "any time, anywhere" basis from flight simulations to periscope visual training to platoon

leadership to intravenous needle insertions. The potential for training games is high, but considerable work remains to be done to reach that potential.

Appendix A

Table 3. List of presenters and attendees

<i>NAME</i>	<i>ORGANIZATION</i>
Abell, Millie	TRADOC
Allen, Robert	NAVAIR
Armstrong, Wayman	Engineering & Computer Simulations
Beal, Scott	ARI, IFRU
Belanich, Jim	ARI, ATMURU
Blunt, Rick	Booz Allen Hamilton
Boelter, Ronald	TDCD DL
Cabrera, Nancy	MITRE
Chatham, Ralph	DARPA
Clark, CMSgt Teresa	Nebraska National Guard
Connors, MAJ Pat	BCBL, Leavenworth
Crane, Michael	Air Force Academy
Dressel, Doug	ARI, ATMURU
Dunnigan, Jim	
Freeman, Mike	OSD, ADL Initiative
Frye, CDR Charles	NAVAIR
Garris, Rosemary	NAVAIR
Geertsen, Mike	Microsoft
Gehrki, Frank	Alion
Hiller, Jack	Northrup Grumman
Howse, Bill	ARI, RWARU
Jacquet, CPT Carl	USMA
Jilson, Capt. Erik	TECOM, Quantico
Jones, Steve	MITRE
Juntif, LTC George	Army Game Project
Kenny, Patrick	Soar Technology
King, Ben	
Konya, Steve	IDA
Lawson, John	DRA
Leser, Jeff	Command & General Staff College
Lunsford, Jim	MAK Technologies
Mathes, Capt. Don	USMC
McCarley, Britt	TRADOC Military History

(table continues)

Table 3. (continued)

<i>NAME</i>	<i>ORGANIZATION</i>
Morrison, John	IDA
Moses, Frank	ARI, ATMURU
Mullin, Laura	ARI, ATMURU
Nichols, Paul	
Oerlert, Mark	Booz Allen Hamilton
O'Neil, Harry	USC
Perez, Ray	ONR
Perla, Peter	Center for Naval Analyses
Peterson, Charlie	Microsoft
Portis, Frederick	SOC
Quinkert, Kathy	ARI, TRADOC
Robar, Jason	Jason Robar Consulting
Sams, Michelle	Teknowledge
Sears, Rob	Legless Productions
Singer, Mike	ARI, SSRU
Smith, Brent	Engineering & Computer Simulations
Tiller, John	
Velazquez, Luis	
Wisher, Robert	OSD

Appendix B – Resource List

Web-based Resources

Department of Defense Game Developer's Community (www.dodgamecommunity.com). This DoD funded website is designed to bring together the community of game developers and game users within the U. S. military.

Marine Technology and Education Command site that covers the use of gaming technology for training (<http://www.tecom.usmc.mil/techdiv/ITK/ITKHome/ITKHome.htm>)

Milgames listserv – to join, send an email to milgames-subscribe@yahoogroups.com

Modeling and Simulation Offices:

- Defense Modeling and Simulation Office (<https://www.dmsso.mil>)
- Army Model & Simulation Office (AMSO) (<http://www.amso.army.mil/>)
- Army Simulation, Training & Instrumentation Command (STRICOM) (www.peostri.army.mil)
- Naval Air Systems Command Training Systems Division (NAVAIR-TSD) (<http://www.ntsc.navy.mil/>)
- Air Force Agency for Modeling & Simulation (AFAMS) (<http://www.afams.af.mil>)
- Defense Advanced Research Project Agency - Training Superiority (DARWARS) (http://www.darpa.mil/dso/thrust/biosci/training_super.htm)

Serious Games Initiative (www.seriousgames.org) - focuses on the use of games in education, training, health, and public policy.

Training with Games

Gee, James Paul (2003). *What video games have to teach us about learning and literacy*. Palgrave Macmillan: New York.

Greenfield, Patricia M. (1984). *Mind and Media: The Effects of Television, Video Games and Computers*. Cambridge, MA: Harvard University Press.

Prensky, M. (2001). *Digital Game-Based Learning*. New York: McGraw-Hill.

Herz, J. C., (1997). *Joystick nation: how videogames ate our quarters, won our hearts, and rewired our minds*. New York: Little, Brown and Company.

Herz, J. C. & Macedonia, M. R. (2002). Computer games and the military: Two views. *Defense Horizons, 11*. Retrieved at <http://www.ndu.edu/inss/DefHor/DH11/DH11.htm> on 7/8/2003.

Taylor, J. L. & Walford, R. (1978). *Learning and the simulation game*. Beverly Hills, CA: Sage Publications.

War Games

- Dunnigan, J. F. (1992). *The complete wargames handbook : how to play, design, and find them*. New York: Morrow.
- Featherstone, D. F. (1962). *War Games*. London: Stanley Paul & Co.
- Perla, Peter P. (1990). *The Art of Wargaming: a guide for professionals and hobbyists*. Annapolis, MD: Naval Institute Press.

Training Games Research

- Beal, S. A., & Christ, R. E. (2004). *Training effectiveness of the Full Spectrum Command game* (Technical Report 1140). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (Defense Technical Information Center No. ADA419670)
- Belanich, J., Sibley, D. E., & Orvis, K. L. (2004). *Instructional characteristics and motivational features of a PC-based game* (Research Report 1822). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (Defense Technical Information Center No. ADA422808)
- Bessemer, D. W., & Lampton, D. R. (1985). *Development of Trax I: a tank platoon game modifying Dunn-Kempf* (Research Note 85-75). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Bowman, R. F. (1982). A "Pac-Man" theory of motivation: Tactical implications for classroom instruction. *Educational Technology*, September, 14-16.
- Corbeil, P. (1999). Learning from the children: Practical and theoretical reflections on playing and learning. *Simulation & Gaming*, 30(2), 163-180.
- Fabricatore, C., Nussbaum, M., & Rosas, R. (2002). Playability in action videogames: A qualitative design model. *Human-Computer Interaction*, 17, 311-368.
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, 33(4), 441-467.
- Gopher, D., Weil, M., & Bareket, T. (1994). Transfer of skill from a computer game trainer to flight. *Human Factors*, 36(3), 387-405.
- Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, 423(29-May), 534-537.

- Jacobs, J. W., & Dempsey, J. V. (1993). Simulation and gaming: Fidelity, feedback, and motivation. In J. V. Dempsey & G. C. Sales (Eds.), *Interactive Instruction and Feedback*, (197-227). Englewood Cliffs, NJ: Educational Technology Publications.
- Knerr, B. W., Simutis, Z. M., & Johnson, R. M. (1979). Computer-based simulations for maintenance training: Current ARI research (Technical Report 544). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 4, 333-369.
- Malone, T. W., & Lepper, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. E. Snow and M. J. Farr (Eds.), *Aptitude, Learning and Instruction, Vol. 3: Cognitive and Affective Process Analysis* (pp. 223-253). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Ricci, K. E., Salas, E., & Cannon-Bowers, J. A. (1996). Do computer-based games facilitate knowledge acquisition and retention? *Military Psychology*, 89(4), 295-307.
- Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research & Development*, 44(2), 43-58.
- Sims V. K., & Mayer, R. E. (2002). Domain specificity of spatial expertise: The case of video game players. *Applied Cognitive Psychology*, 16, 97-115.