



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**THE USE OF CONCEPT MAPS FOR THE DIFFUSION OF
THE DISTRIBUTED OPERATIONS CONCEPT AND THE
DISSEMINATION OF EXISTING VIRTUAL TRAINING
SIMULATIONS**

by

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March 2008

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 2008	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE The Use of Concept Maps for the Diffusion of the Distributed Operations Concept and the Dissemination of Existing Virtual Training Simulations			5. FUNDING NUMBERS	
6. AUTHOR(S) Brian S. Boone				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) The Marine Corps finds itself increasingly fighting an elusive, adaptive and decentralized enemy. Facing this type of decentralized enemy suggests the Marine Corps embrace a more decentralized approach to conventional military operations. One of the strategies that the USMC has been introducing is Distributed Operations (DO) that will enable meeting the need of commanders to fight a highly decentralized engagement. DO require that the Marine Corps add to its conventional skills the additive ability to decentralize decision making and an ability to distribute the force when it is tactically advantageous to do so. Lessons learned from the Hunter Warrior series of experiments suggest that technology can only be effectively applied once assigned tasks have been mastered. In order for the Marine Corps to enable DO capability throughout the Marine Corps, a proactive information campaign must be conducted. The thesis seeks to develop a web based collaboration tool which will link critical DO specific and conventional skills to the current simulations which train them. This will serve to increase all Marines' understanding of the requisite knowledge and introduce novel training opportunities that exist as the concept of DO is concurrently developed.				
14. SUBJECT TERMS Distributed Operations, Maneuver Warfare, Concept Map,			15. NUMBER OF PAGES 89	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18

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**THE USE OF CONCEPT MAPS FOR THE DIFFUSION OF THE DISTRIBUTED
OPERATIONS CONCEPT AND THE PROPAGATION OF EXISTING VIRTUAL
TRAINING SIMULATIONS**

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Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF SCIENCE IN MODELING VIRTUAL ENVIRONMENTS AND
SIMULATIONS (MOVES)**

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ABSTRACT

The Marine Corps finds itself increasingly fighting an elusive, adaptive and decentralized enemy. Facing this type of decentralized enemy suggests the Marine Corps embrace a more decentralized approach to conventional military operations. One of the strategies that the USMC has been introducing is Distributed Operations (DO) that will enable meeting the need of commanders to fight a highly decentralized engagement. DO require that the Marine Corps add to its conventional skills the additive ability to decentralize decision making and an ability to distribute the force when it is tactically advantageous to do so. Lessons learned from the Hunter Warrior series of experiments suggest that technology can only be effectively applied once assigned tasks have been mastered. In order for the Marine Corps to enable DO capability throughout the Marine Corps, a proactive information campaign must be conducted. The thesis seeks to develop a web based collaboration tool which will link critical DO specific and conventional skills to the current simulations which train them. This will serve to increase all Marines' understanding of the requisite knowledge and introduce novel training opportunities that exist as the concept of DO is concurrently developed.

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	PROBLEM STATEMENT	1
B.	RESEARCH QUESTIONS.....	3
C.	SCOPE	4
D.	ORGANIZATION OF THE THESIS.....	4
II.	LITERATURE REVIEW	5
A.	DISTRIBUTED OPERATIONS AS AN OPERATIONAL CONCEPT	5
B.	CONCEPTUALIZATION	7
C.	EXPERIMENTATION	10
III.	INFORMATION CAMPAIGN	13
A.	EDUCATION AND TRAINING FOR SMALL UNIT LEADERS	13
B.	NEED FOR INFORMATION CAMPAIGN.....	14
C.	CURRENT INFORMATION CHANNELS.....	14
IV.	DIFFUSION OF INNOVATION	15
A.	BASIC ELEMENTS	15
B.	INNOVATION	16
C.	COMMUNICATION CHANNEL.....	17
D.	TIME.....	18
E.	SOCIAL SYSTEM.....	19
V.	REPRESENTING USMC COMPETENCIES IN CONCEPT MAPS	21
A.	CONCEPT MAPS.....	21
B.	PURPOSE OF CONCEPT MAPS	22
C.	MILITARY APPLICATIONS	23
D.	THE CONCEPT MAP SOFTWARE TOOLKIT.....	23
E.	CONCEPT MAPS FOR CONVENTIONAL OPERATIONS.....	24
1.	FMFM-6-4 into Concept Maps.....	24
2.	Squad and Team Core Capabilities and Competencies	27
a.	<i>Amphibious Operations</i>	<i>28</i>
b.	<i>Offensive Operations.....</i>	<i>29</i>
c.	<i>Defensive Operations</i>	<i>29</i>
d.	<i>Patrolling.....</i>	<i>30</i>
e.	<i>Counterinsurgency.....</i>	<i>31</i>
f.	<i>Auxiliary Operations.....</i>	<i>31</i>
3.	Addition of DO Specific Skills	32
VI.	VIRTUAL TRAINING SIMULATIONS	33
A.	VIRTUAL TRAINING SIMULATIONS AS A SUPPLEMENT	33
B.	CONCEPT MAPS FOR VIRTUAL TRAINING SIMULATIONS.....	36
C.	AN EXAMPLE: FORWARD OBSERVER PC SIMULATOR	38
VII.	DEVELOPMENT OF SEARCH TOOL	43

A.	CMAPS INTO XML.....	43
B.	GRAPHIC USER INTERFACE	44
C.	SEARCH CAPABILITIES	45
VIII.	FUTURE WORK.....	51
IX.	CONCLUSION	53
	APPENDIX A: XML STRUCTURE OF CMAPS.....	55
	APPENDIX B: CURRENT VIRTUAL TRAINING SIMULATIONS.....	57
A.	CLOSE COMBAT MARINE (CCM)	58
B.	VIRTUAL BATTLESPACE (VBS)	62
C.	TACTICAL IRAQI	68
	LIST OF REFERENCES	71
	INITIAL DISTRIBUTION LIST	73

LIST OF FIGURES

Figure 1.	Concurrent Implementation of DO Concept (Figure taken from MCWL Power Point Presentation on DO)	6
Figure 2.	S curve of Adoption of Innovation (Figure taken from www.unodc.org)	19
Figure 3.	Squad Concept Map (with links)	26
Figure 4.	Team Level Concept Map (with links)	27
Figure 5.	Team Amphibious Operations concept map	28
Figure 6.	Squad Offensive Operations concept map	29
Figure 7.	Team Defensive Operations concept map	30
Figure 8.	Team Patrolling Operations concept map	31
Figure 9.	Training Set Fire Observation	37
Figure 10.	Forward Observer PC Simulator 2 (Figure taken from www.29palms.usmc.mil)	38
Figure 11.	Graphic User Interface	45
Figure 12.	Graphic User Interface Drop Down Menu	47
Figure 13.	Mission Areas found from Forward Observer Search	48
Figure 14.	List of Simulations returned from search of Team Techniques of Fire	49
Figure 15.	Close Combat Marine (Figure taken from www.closecombatseries.net)	58
Figure 16.	Virtual Battlespace 2 (Figure taken from www.virtualbattlespace.com)	62
Figure 17.	Tactical Iraqi (Figure taken from www.wired.com)	68

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LIST OF ACRONYMS AND ABBREVIATIONS

C2	Command and Control
CAS	Close Air Support
CFF	Calls for Fire
CMAP	Concept Map
DO	Distributed Operations
DVTE	Deployable Virtual Training Environment
ESG	Expeditionary Strike Groups
FMFM	Fleet Marine Force Manual
FOPCSIM	The Forward Observer PC Simulator
GUI	Graphical User Interface
GWOT	Global War on Terror
IDE	Integrated Development Environment
IHMC	Institute for Human and Machine Cognition
MAGTF	Marine Air-Ground Task Force
MCCLL	Marine Corps Center for Lessons Learned
MCWL	Marine Corps Warfighting Laboratory
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MOUT	Military Operations on Urban Terrain
OEF	Operation Enduring Freedom
OPFOR	Opposing Force
OPTEMPO	Operational Tempo

SME	Subject Matter Expert
TECOM	Training and Education Command
UAV	Unmanned Aerial Vehicle
USMC	United States Marine Corps
VBS	Virtual Battlefield Simulation
XML	Extensible Markup Language
XSLT	Extensible Stylesheet Language Transformation

ACKNOWLEDGMENTS

The following were instrumental throughout my time at the Naval Postgraduate School. First, I would like to thank God for all the wonderful blessings in my life (the good and the bad). My wife, Lori Ann, and my children, Brandon and Jasmine, you have sacrificed daddy for countless hours and weekends when I was required to study. At times, it was overwhelming and seemed as if it would never end. I love you very much. It's been great working with my classmates and partners for the last two years, Sevdalin Stoykov and Nabil Ouerghi, I'll miss you greatly. I would like to thank the professors from the MOVES Institute for their support and guidance, especially Professor Rudolf Darken and Professor John Falby. Finally, thanks to Commander Joseph Sullivan and my thesis advisor, Professor Amela Sadagic who worked many hours guiding me in the completion of my thesis. Thanks to you all. It has been an exciting journey.

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I. INTRODUCTION

A. PROBLEM STATEMENT

The September 11, 2001, attacks on the World Trade Center and the Pentagon was the Perl Harbor event that has pushed the United States into its current Global War on Terror (GWOT). As the United States prosecutes the GWOT, it finds itself engaged in urban, asymmetric warfare in Afghanistan and Iraq. The enemy in Afghanistan and Iraq quickly realized the futility of attempting to engage the U.S. in a conventional force on conventional force engagement. As a result the enemy has altered its warfare tactics into a style that maximizes on its critical strengths. The warfare tactics that have emerged from these conflicts by our enemy have sought to expose the limited ability of U. S. conventional forces to conduct irregular warfare. Our enemy's approach is to distribute its own forces and expose a critical vulnerability of our conventional forces. In Iraq, this tactic has worked well and continues to erode our national will.

The Marines fighting in Iraq now find themselves fighting a distributed enemy engaging in irregular warfare without possessing themselves a formalized DO capability. Marines fighting in the streets of cities in Iraq may well be fighting in close proximity to each other, but they are virtually isolated from each other due to a lack of a formalized distributed operations capability. There is emerging a critical need for Marine forces to possess an ability to conduct autonomous to semi-autonomous tactical actions to engage a distributed enemy.

What does this emerging operational concept precisely include? Currently there are no manuals or definition that one can find as compared to older concepts like maneuver warfare. There is simply not enough time to fully flush out all the details of the concept prior to implementation, the time for a formalized distributed operation capability is now. Commandant G. W. Hagee, the former Commandant of the Marine Corps, along with other top Marine theorists have entered the discussion to attempt to provide an initial idea at what the distributed operations operational concept will look like. In this emerging concept, Commanders will possess the ability to aggregate and

disaggregate their forces when it is tactically prudent to do so in order to exploit the critical vulnerabilities of the enemy. Distributed operations will be an added capability. The skill set necessary to conduct such operations will extend beyond the traditional infantry squad skills and will place much greater responsibility on the shoulders of small unit leaders. In some cases, the responsibilities that were normally handled by a first lieutenant or captain could be the responsibility of a small squad leader. Marines at all levels of command will be required to acquire higher proficiency level of the conventional skills they already possess.

In order for the Marine Corp to successfully implement the DO concept, clearly there is a requirement for a significant increase in the level of education and training given to the individual Marine. The target group for the most intense training will be small unit leaders (Goulding, 2005; Erdie, 2005). The fundamental focus of the education and training of the individual Marine must be effective small team leadership, decision making skills, and training to enable small unit leaders to become “brilliant at the basics” (Amos, 2007). The small unit leader will only be able to conduct Calls for Fire (CFF) and Close Air Support (CAS) when they are provided adequate training. Unfortunately the current operation tempo necessary to sustain the GWOT has stretched thin training opportunities throughout the Marine Corps. Due to the current OPTEMPO in support of the GWOT, there is clearly a strain on conducting the foundational training of basic infantry skills, let alone attempting to train an additive capability. In the past modeling and simulation has provided the initial procedural training for achievement of such skill sets. Modeling and simulation technology must be harnessed to further facilitate the training of Marines for distributed operations.

For distributed operations to become an operational reality, not only must the small unit leaders become “brilliance at the basics,” but commanders must possess confidence in the decision making skills of these lower level Marines (Goulding, 2006). The small unit leaders must possess the skills to carry out the commander’s intent in an irregular and complex environment. In order to effectively facilitate this operational concept there must also be a promulgation of the concept of DO itself. Essential to the conduct of DO is an understanding up and down the chain of command of the concept.

Subject matter experts in the field of distributed operation have suggested the Marine Corps undertake an information campaign even as the concept is developed (Penn, 2006). Only then, when all Marines up and down the command chain understand how best to employ this additive capability and sustain the units that provide it, will commanders have confidence and trust in small unit leaders to conduct such operations.

B. RESEARCH QUESTIONS

As stated previously, one of the major requirements for achieving a DO capability will be the further education and training of the small unit leader and the individual Marine. Since it is necessary to provide the small unit leaders a broader understanding of the requisite knowledge that unit now resides in the understanding of more senior Marines, many question as to how the Marine Corps will achieve this emerge. An initial inquiry into elements of these critical questions is what motivated this thesis work. These questions are essential for the Marine Corps to answer as it moves forward in its concurrent formulation of the concept of DO. The questions that specifically motivated this thesis work include:

1. What are the emerging training requirements which are necessary for the individual Marine to master in order to conduct distributed operations?
2. How can the identification and mapping those skills help achieve a much needed information campaign on the concept of distributed operations to the entire Marine Corps?
3. Since DO is understood to be an additive capability and the Marine Corps' OPTEMPO is straining the current training schedule, can virtual simulation training supplement the current training program?
4. What type of collaborative tools need to be created to employ the use of concept maps to empower those undertaking a DO campaign to collaboratively share information on the DO concept and point end users to virtual training simulation which can train specifically identified conventional and DO critical skills?

The work of this thesis evolved from a desire to begin to explore and answer the questions above in order to help facilitate the Marine Corps' implementation of the distributed operations concept.

C. SCOPE

The scope of this thesis will focus on answering questions 1 and 4, specifically in the support of the concurrent formulation of a concept of distributed operations. The work in this thesis will identify conventional and DO specific critical skills and develop a collaborative tool that links virtual training simulations ideal for enabling the education and training requirements which are emerging from the formulation of the DO operational concept. The thesis will also provide useful pointers and considerations for question 2 and 3. The thesis study will contribute to and become a part of a much needed information campaign to educate Marines at all ranks on the emerging concept of DO.

D. ORGANIZATION OF THE THESIS

- Chapter I: Introduction. This chapter elaborates the motivations for this research, states the research questions, and establishes a framework for pursuing answers to the stated questions.
- Chapter II: Literature Review. This chapter provides a review of the current literature that has shaped the Marine Corps concept for DO and the concurrent nature of its development.
- Chapter III: Information campaign. This chapter demonstrates the need for diffusion of the emerging concept of distributed operations throughout the Marine Corps and the need to enter into a thoughtful information push strategy for the concept of DO.
- Chapter IV: Diffusion of Innovation. This chapter discusses four major elements necessary for diffusion of innovation and how each applies to a DO information campaign.
- Chapter V: Representing USMC competencies in Concept Maps. This chapter explains the CMAP tool and the approach taken to delineate the critical skills necessary for enabling DO
- Chapter VI: Virtual Training Simulations. This chapter discusses how virtual training simulation can supplement existing training programs. An example of the essential information needed for each simulation is given. A few examples of the concept maps generated for the purpose of the thesis are given and discussed.
- Chapter VII: Development of Search Tool. This chapter explains the process of transitioning the generated concept maps into an XML format that can be used to facilitate a search capability which is necessary link critical skills to current virtual training simulations.
- Chapter VIII: Future Work. This chapter offers areas of possible future experimentation to test the usability of the diffusion tool.
- Chapter IX: Conclusion

II. LITERATURE REVIEW

This chapter of the thesis covers a review of the literature that has shaped and continues to shape the formulation of distributed operations. DO is being developed as an operational concept which is concurrently being tested and evaluated. As such, the very definition of the emerging concept is fluid and is being influenced by the current testing and experimentation. One of the most critical points emerging from this concurrent discussion, testing, and implementation is the need to focus training intensely on small unit leaders and educate them on the DO concept.

A. DISTRIBUTED OPERATIONS AS AN OPERATIONAL CONCEPT

First and foremost, it is vital to keep as a central guiding principle the fact that distributed operations is an operational concept. As an operational concept, DO must be further developed, tested and implemented. The Marine Corps cannot develop a distributed operations capability in a linear fashion where the concept is fully defined and shaped, move on to perform experiments, and then finally begin to implement the concept. Figure 1 demonstrates the concurrent manner in which DO are being developed. All three phases are happening simultaneously and are influencing and shaping each other. Bring the DO capability about in this manner will deliver the final product to the Marine Corps in the shortest time possible.

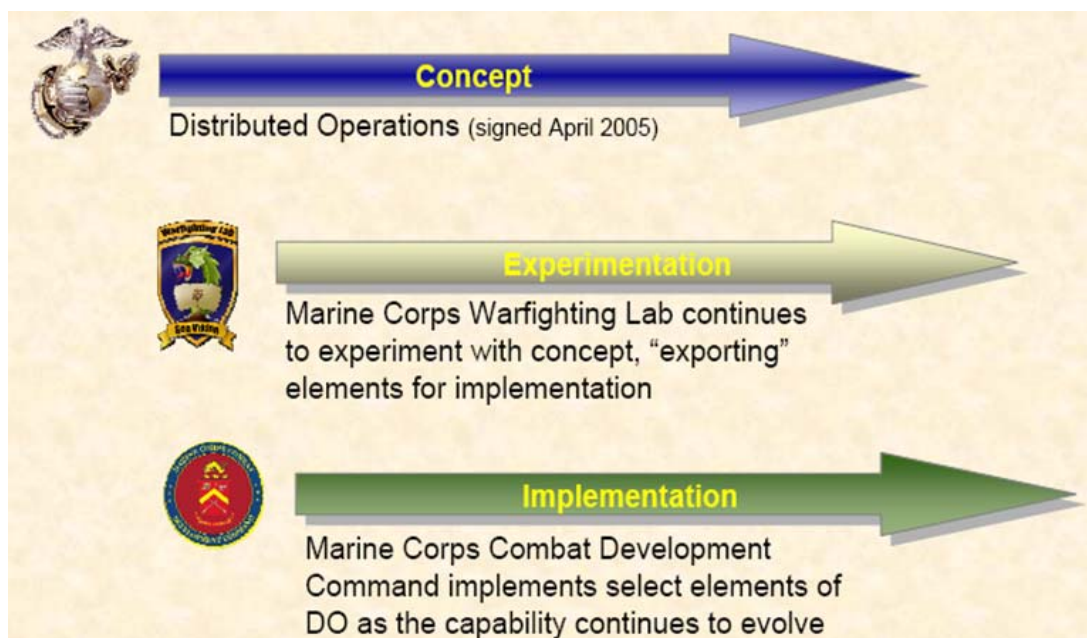


Figure 1. Concurrent Implementation of DO Concept (Figure taken from MCWL Power Point Presentation on DO)

The concept phase is being conducted by the ongoing debate on the concept which is occurring in various military journals and publications. The Experimentation phase is being conducted by groups such as MCWL, with its Sea Viking 06, Sea Viking 08, and Sea Viking 10 experiments, with the help of the Training and Education Command (TECOM) and Twentynine Palms in California. The implementation phase is being conducted with the assistance of MCWL and Twentynine Palms with the assistance of groups like the 1st Battalion, 3rd Marines (1/3) who upon the return from their deployment to Iraq in May of 2005 selected one platoon to receive specialized distributed operations training. Upon completion of the DO training, the unit subsequently deployed to Afghanistan and conducted operations in support of Operation Enduring Freedom (OEF) (Observations and lessons from Operation Enduring Freedom VI, Nov 2006). The definition, experimentation, and implementation are occurring simultaneously and are influencing each other in significant ways, all working toward the goal of the Commandant of the Marine Corps to produce in short order a formidable DO capability. Since the operational concept is being developed in such a manner, there is an emerging need to capture the critical training skills which are emerging from each phase.

B. CONCEPTUALIZATION

The fluid nature of the definition of DO itself can be seen from a careful study of the literature on the subject. In one early publication on DO it was insisted that the time had come for experts to “engage in a spirited broad based debate on distributed operations” (Hanlon, 2004). As this debate unfolded, a number of questions started to emerge on the nature of the DO concept itself. Many experts felt these questions were presenting real hindrances to a common understanding of distributed operations. These questions were initially articulated in an article (Dobson, 2004) which asked:

- Are distributed operations an additive capability or does it constitute a new mission?
- What will be the size of the distributed operations capable force and will the structure of the platoon/squad/team change?
- How will the distributed operations capable force aggregate and disaggregate to achieve the desired effects?
- What are the training requirements associated with distributed operations and how are those skills trained while maintaining proficiency in other essential tasks?

As estimated by the author, these questions were a great starting place as the concept refinement and experimentation phase commenced wrestling with the details of the operational concept. The Marine Corps Warfighting Laboratory (MCWL), which was assigned the task of conducting experimentation for the DO concept, conducted focused research efforts to identify the essential tasks behind the DO concept; the goal of which was to guide the necessary experimentation in this domain. MCWL’s experimentation Division’s Plans Branch searched the mission essential task list of various Marine units in an effort to identify what skill sets a DO unit should possess.

The Commandant of the Marine Corps, M. W. Hagee wrote an article which attempted to address some of these questions while it left most of the questions unanswered and open to further debate and experimentation. The article provided a general direction for developers and experimenters to follow. The article explained that DO included a set of tactics which aimed at gaining a tactical advantage over the enemy by deliberately separating the force, yet maintaining connectivity by leveraging the

command and control advantage enjoyed by U. S. forces. The article stated that “The essence of this concept lies in the capacity for coordinated action by dispersed units, throughout the breath and depth of the battlespace, ordered and connected within an operational design focused on a common aim” (Hagee, 2005).

In the article the Commandant stated that the concept of distributed operations “was a natural extension of maneuver warfare” which sought a spatial and temporal advantage. (Hagee, 2005). DO, it was argued, seek to create a spatial advantage with highly trained small units extending the battlespace outside the capabilities of the enemy. Distributed operations will exploit difficult terrain that the enemy is currently using as a critical strength by leveraging the extended force knowledge of the battlespace in order to conduct close combat or supporting arms. The distribution of authority to small unit leaders who are the ones most directly engaged in the fight is of the utmost importance. The article argues that “By moving authority ‘downward,’ we will dramatically increase the speed of command. This distribution of authority among many seasoned and well-trained junior leaders will result in a combination of actions that creates for the enemy a rapidly deteriorating, cascading effect, shattering his cohesion.” (Hagee, 2005)

Other contributors to the DO discussion attempted to address some of the questions which were hindering a common understanding of the DO concept. One answer emerged (Schmidle, 2004), defining distributed operations as a capability which will be additive in nature. In the article, it is stated that “Distributed Operations are characterized by the physical dispersion of networked units over an extended battlespace. Battalion – to squad-sized formations can conduct such operations. These operations avoid linear, sequential, and predictable operations”. One important thing to note is that the concept of DO critically includes the ability of squad sized units performing a distinctive set of operations. The author also asserted that “Distributed operations provide an additive capability to the MAGTF commander. They give him the ability to influence a much greater area of the battlespace, both in depth and breadth, than can be accomplished with more conventional operations”. Not only are the small units required to master the current critical skill necessary for conventional operations, but they will be required to train and master an additional set of new skills.

The material presented in (Hagee, 2005) article attempted to address the training requirements and size/structure questions by addressing the foundation of a DO capability, which is identified as the individual Marine. It was proposed that DO as a concept will not drastically change or supplant the current organization of Infantry units, nor will it diminish the unit's ability to conduct conventional warfare. DO, on the contrary, will provide an additional capability which commanders can employ as the tactical situation dictates. Commanders will be empowered to use this added capability to exploit the enemy's critical vulnerabilities and attack his strategic center of gravity. The DO concept will focus on the Marine Corps' most important asset, the individual Marine and especially the small unit leaders. In the same article, the individual Marine was clearly identified as the cornerstone on which a distributed operations capability was to be built. The article states, "One of the principle requirements for development of a distributed operations capability will be the further enhancement of training and professional education for small-unit leaders and individual Marines. Building on our existing ethos and our maneuver warfare philosophy, we must continue to elevate the already high competence of our most junior leaders, educating them to think and act at the tactical level of war, with an understanding of the application of commander's intent to achieve operational level effects". This sentiment echoed what had been previously asserted in (Schmidle, 2004), namely the importance of educating and training the small unit leader to enable a DO capability. When addressing some of the question raised by Dobson, the author stated "The basic building block of distributed operations is the rifle squad, augmented as necessary with mission essential specialists. Underpinning this capability will be additional small unit training focused on independent tactical actions. This training will be part of the ESG/MEU predeployment training cycle. These squad-sized distributed operations teams may be inserted as individual teams or collectively in platoon- or company-sized configurations. When inserted as part of a larger formation, the units can disaggregate and maneuver to their assigned operating areas or operate from a platoon or company patrol base."

As the difficult question underlying the development of a DO capability are continually expressed, debated, and answered, the conceptualization, testing, and

implementation of the DO concept continues. The articulation of the DO concept is influencing and feeding into the testing and experimentation process. As the concept continues to take its shape, the need to share the emerging concept grows as well. Emerging from the debate on the concept is the thought that the attention of the training efforts must be on the individual Marine, which is the hinge on which the DO concept turns to become a reality.

C. EXPERIMENTATION

In the interest of transitioning the Marine Corps force to possess a DO capability, the Commandant in early 2005 tasked the Marine Corps Warfighting Lab (MCWL) to conduct experiments aimed at implementing the DO concept. The Experiment Division conducted the Distributed Operations Advanced Warfighting Experiment during a period of 10 days in October of 2006. This was part of the Sea Viking 06 series of experiments, which are to be followed by similar experiments, Sea Viking 08 and Sea Viking 10. In the Quicklook Report from the Sea Viking 2006 Advanced Warfighting Experiment, it was noted that one of lessons learned from the collective experiment was that “DO required an increased level of training and education” (Penn, 2006). The article stressed that the Marine Corps leadership as a whole needed to be better educated on the concept of DO to enable commander’s to have a better understanding of a DO unit’s inherent strengths and weaknesses. At the small unit level, the focus on education and training needed to include training in the fundamentals of “small team leadership, decision making, and individuals being brilliant at the basics” (Penn, 2006)

The experiments which were conducted during Sea Viking 2006 demonstrated that small unit leaders could conduct calls for fire and close air support only when they were provided sufficient training. The study also found that a solid foundation of Basic infantry skills needed to be reestablished especially at the small unit level. The Article noted that the “decision making capability of the small unit leaders needs to be improved. Poor decisions were indicative of small unit leaders’ lack of maturity and/or the need for additional training” (Penn, 2006) The article further concluded that a dedicated DO campaign be initiated to educate all levels of the Marine Corps in order to correct the

general lack of understanding of what DO is. The article stated, “Marines at all levels in the wider Corps community generally lack understanding of that DO is, the changes that are install, the challenges, future developments, and flow-on effects in other areas. Recommendation: it is strongly asserted that a dedicated DO information campaign be instigated to push information to all areas of the Corps, especially schools, the operating force units, and staff who have an impact on the venture” (Penn, 2006)

In the Observations and lessons From Operation Enduring freedom (OEF) VI publication put together by the Marine Corps Center for Lessons Learned (MCCLL), the MCCLL team conducted interviews with 43 key leaders from the 1/3. They additionally surveyed 266 Sergeants and below upon their return to their home station. They found from the interviews and the surveys conducted on individuals involved with the DO experimentation that success in DO was based on three key factors; namely small unit self protection, positive communication, and most importantly leadership (Distributed Operations in Afghanistan, 2006). They concluded that units will distribute only down to the level at which competent leadership exists. This involves understanding commander’s intent and possessing the ability, without direct orders, to take action to facilitate commander’s intent. One interviewee noted, “The Corporal Fire Team Leader can’t be a novice at all the skills in his fire team. He needs to be able to teach them. It should not be done several levels up the training echelon. You want to do distributed operations down to the Fire Team level because there are situations where that’s certainly applicable, but then that Corporal needs to be brought up on the education level so he can not only demonstrate proficiency to the rest of his fire team and supervise that proficiency. What we saw was a platoon full of truly tremendous people that were fully motivated to do it but had never been drilled and skilled to the point. Prior to training, the Corporals really were not skilled in navigation, much less trying to teach compass reading to their Marines. The furthest we can go to making this concept completely applicable is not the technology route; it’s the training and education of the youngest leaders” (Dotto, 2006).

This suggests that the individual Infantry Squad leader must possess a much broader understanding of intelligence cycles, calls for fire, and logistics and C2 systems.

The need for extensive new training at all levels of the small unit clearly emerges from all three phases of the concurrent model. The increased training could possibly increase schooling durations for DO enabled units. The training requirements will also put a significant time strain on a Marine Corps already stretched thin trying to meet current deployment cycles in support of the GWOT. There could possibly be an increase in demand for qualified trainers for these critical skills. This is clearly an area where virtual training simulations could be used as a supplemental training tool and play an increasingly effective role.

From a close review of the current literature on DO it is clear that there is a pressing need to focus training efforts on small unit leaders. A close look at the literature demonstrates that the concept itself is being discussed and worked out in various Marine Corps publications. At the same time vital experimentation is taking place, which in itself is influencing the definition of the concept. As the DO concept is continually formed, the small unit leader must not only master the conventional skills he currently trains, but quickly ingest the additional skills which are necessary to enable DO. Equally important is the dissemination of the concept to all members of the Marine Corps. There is a pressing need for the Marine Corps to develop a push strategy to all of its individual Marines. This information campaign is as crucial as the development of the concept itself.

III. INFORMATION CAMPAIGN

In order for DO to become an operational reality it is necessary for small unit leaders become masters of the basics of conventional operations. Not only is this so, but commanders must possess confidence in the decision making skills of these small unit leaders. The small unit leaders must possess the skills to carry out the commander's intent in an ever increasingly complex environment. To facilitate this concept, the Marine Corps must initiate a focused push strategy to all Marines at every level of the chain of command. What is essential for the conduct of DO is an understanding at all levels of the chain of command of the concept. There must be subject matter experts in the field of DO who will engage in an information campaign to introduce the concept to the end users. Only when all Marines in the command chain understand how best to employ this additive capability, will commanders have confidence and trust in small unit leaders to conduct such operations.

A. EDUCATION AND TRAINING FOR SMALL UNIT LEADERS

One of the major obstacles for the Marine Corps to achieving a DO capability is the training and education of small unit leaders. The small unit leaders are the front line of implementation of the DO concept. Not only must these individuals be highly trained at the conventional skills, be brilliant at the basics and ready to disburse the force, but they must also be able to quickly learn the emerging DO specific skills. The DO concept is being developed in a concurrent manner. The time to linearly step through conceptualization, testing, and implementation does not exist. Small unit leaders need a formalized DO in today's war in Afghanistan and Iraq. The concurrent development of the DO concept suggests focusing education and training on the tip of the DO spear, the small unit leaders. As mentioned before the training time for these units is limited and it is shrinking due to operational commitments. These small unit leaders must not simply understand the technical skills necessary to enable DO, but they must gain a general understanding of the concept and their role in the overall DO concept. It is essential, if commanders will entrust low level leaders to accomplish tasks normally handled by much

senior unit leaders, that the lower level leaders understand not simply technical aspect of a call for fire, but tactically how and why this is being employed. Only then will these small unit leaders possess the semi autonomous decision skills so desperately sought by the architects of the DO concept.

B. NEED FOR INFORMATION CAMPAIGN

The more all levels of leaders in the Marine Corps familiarize themselves with the development of the concept and the critical skills required, the easier the adoption of the concept will be. The DO innovation itself is not enough to sell the idea to all rank in the Marine Corps. A concerted push strategy must be undertaken by those wanting the Marine Corps to realize a DO capability. As part of the push strategy, all viable avenues to further the understanding and development of the concept should be embraced. It is the purpose of this thesis to develop one, of what is hoped to be many, communication tools to push the concept of DO. It is essential for the Marine Corps to develop tools for users to become familiar with the essential mission areas, training tasks, and virtual simulation training available to users.

C. CURRENT INFORMATION CHANNELS

There are currently a number of information channels through which the Marine Corps disseminates critical information to members of the Corps. The communication channel can be categorized as either interpersonal or mass media. Interpersonal channels involve face to face exchanges between two or more individuals. The mass media channel is a means of transmitting information from one source to an audience of many rapidly. In the past, the Marine Corps has employed books and manuals to distribute operational concepts to various commands and school houses where leaders go about the work of providing these resources to lower level members. These traditional information channels are cumbersome, very often slow, and can be costly (production and delivery). The World Wide Web has emerged as a terrific mass media channel through which information is pushed to the maximum amount of users. Almost every Marine of all ranks has access to the web and therefore this information channel can effectively be used to distribute information. It is vital that any information campaign undertaken by the Marine Corps be designed to maximize the benefits offered by the web.

IV. DIFFUSION OF INNOVATION

This chapter looks at the critical elements that enable diffusion. A brief overview of the critical element key to the diffusion of any new innovation is discussed. The role these elements play will be laid as a foundation for the approach suggested by this thesis to assist in both an information campaign on DO and the role a communication tool can play in connecting users to information on virtual training simulations.

A. BASIC ELEMENTS

As has been previously asserted, the concurrent formulation of the DO concept presents developers, implementers, and users with unique challenges. As the concept continues to take shape there is a pressing need to disseminate the knowledge of the concept and the critical skills necessary to enable effective training to enable the concept. There is a real need for the Marine Corps to engage in a focused information campaign to diffuse the emerging notion of DO to all levels of the chain of command of the Marine Corps and beyond. For the purpose of this thesis, the theoretical framework chosen from which to implement an information campaign was adopted from Diffusion of Innovation (DI) theory. This theory has been since the early 1950 as a framework from which to understand how innovation is adopted. There are a couple of critical elements that facilitate the diffusion of any new innovation. It is important for any industry or group seeking to gain adoption of a new technology and new concepts to understand how elements such as innovation, time, social structure, and the communication channel effect the diffusion of innovation. It is important to understand how these elements could impact the diffusion of DO.

Diffusion is defined as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995). There are four main elements that emerge out of this definition which can be found in every diffusion effort. The elements are:

- Innovation
- Communication Channels

- Time
- Social Systems

A quick overview of these elements is beneficial to any work attempting to assist in an information campaign, or in an effort to have any the concept of DO diffused and accepted by adopters. A consideration of these elements will help developers understand how they can best facilitate the DO concept and ultimately to educate the users about the use of virtual training simulations available to train emerging DO skills.

Innovation must be more than just new or beneficial in order to ensure that the innovation will be adopted and best employed by the majority of its potential users. The innovation itself is not enough to sell itself; often a well planned and thought out “push” strategy is necessary. The adoption of any particular innovation is a complex phenomenon which is influenced, most heavily, by the four main factors mentioned earlier. Each factor will be examined and necessary connections to the DO domain will be made.

B. INNOVATION

An innovation “is an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 1995). Defined in this manner, it does not matter if the innovation is really new or if it is just perceived as new. This applies particularly well to the emerging concept of DO. DO have been conducted by various units in previous military conflicts. The tactics employed were never labeled distributed operations, nor were the operations formalized in any way. What now is being attempted is the formal delineation of DO as an operational concept. Once the concept is spelled out, there will be an urgent need to disseminate those tactics in order to facilitate a broad understanding and education of the concept.

DO have been described by some as a new warfighting concept which is being adopted by the United States Marine Corps and is being developed by the Marine Corps Warfighting Laboratory. It is seen by many as a response to the changing post 9-11 environment the United States finds itself in. If the enemy has incorporated a distributed posture in order to spread our forces and create moments of tactical advantages for

themselves, and if the enemy is moving the fight into environments which are more complex, it is imperative that the Marine Corps develop a conventional force which has the flexibility to employ a DO capability whenever and where ever it deems operationally advantageous.

As mentioned previously, the employment of distributed tactics has been employed in the past with great effectiveness. DO have been employed numerous times by various units from different countries. For example, the British Special Forces employed a distributed operations concept in the Falkland Islands Campaign (Hagee, 2005). The Finns employed a distributed force against a numerically superior force in the 1940 winter campaign against the Soviet Union. The Marine Corps itself employed a distributed force in combat missions in Vietnam under the operation known as Combined Action Program (Hagee, 2005). The main point is that Distributed Operations has a historical context. What is new is the desire for the Marine Corps to codify the tactic into an operational concept with specifically identified critical skills and to push this concept as quickly as possible to all members to adopt.

C. COMMUNICATION CHANNEL

Communication is defined as the process by which participants create and share information with one another in order to reach a mutual understanding” (Rogers, 1995). Diffusion is one type of communication in which the information shared involves a new idea or concept. For the case of DO, the process of communication involves:

- an innovation of DO
- an individual or other unit of adoption that has specific knowledge of the DO innovation or experience using it
- another individual or other unit without such knowledge

The aim of employing a dedicated communication tool is to act as one of several channels through which this information can be disseminated. The use of the World Wide Web and web based tools will be an integral part of this communication channel. The goal is to reach as many individuals as possible. The fact that the internet and web based tools are as widespread as contemporary communication tools, compels those who

seek the greatest diffusion of their innovation to use these tools. Each Marine unit currently enjoys access to the web. The critical infrastructure necessary for implementation of a viral communication channel already exists at almost every Marine's fingertips. Marines at most military installation also have access to the Secret Internet Protocol Router Network (SIPRNET), which can allow for the classification, access control, and dissemination of such information.

D. TIME

The next element in the consideration of diffusion is the element of time. The time element is primarily concerned with a term called the rate of adoption. The rate of adoption is defined as "the relative speed with which an innovation is adopted by members of a social system" (Rogers, 1995). The general pattern of adoption has a few early adopters in the beginning, with the rate of diffusion growing over time, with finally a period where the rate of adoption levels off. The Y axis represents the percentage of adoption and the X axis represents time. The resulting S curve represents the basic pattern for adoption of most innovation (Figure 2). The rate of adoption is normally taken to be the amount of time that is required for a certain number of users to embrace the innovation. One of the primary hopes of this thesis is that the tool developed will facilitate and increase this rate of adoption.

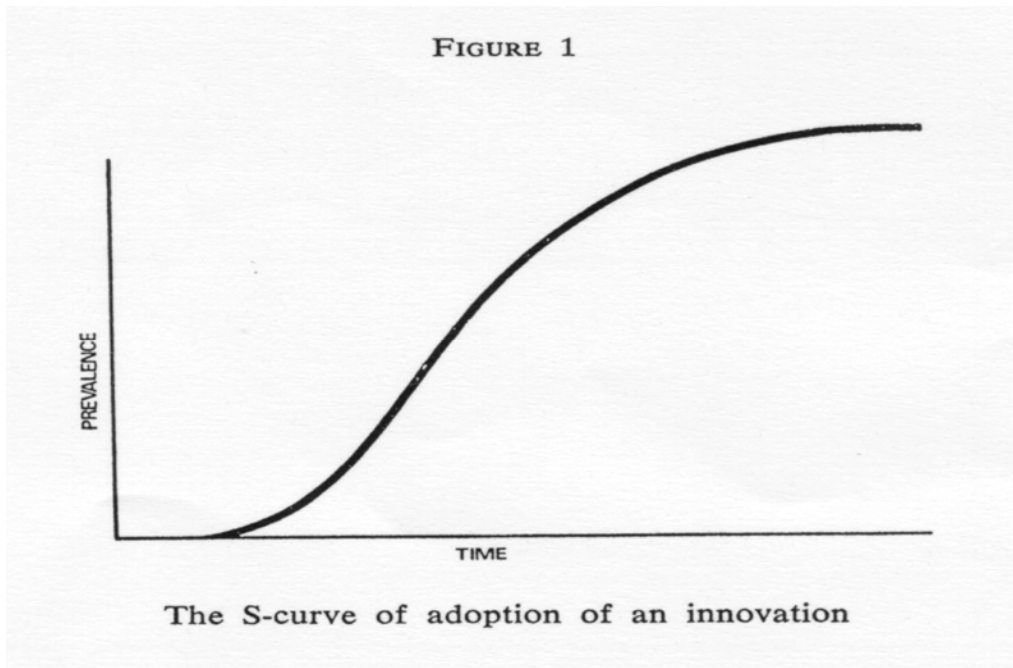


Figure 2. S curve of Adoption of Innovation (Figure taken from www.unodc.org)

E. SOCIAL SYSTEM

The military is a unique social system with its own hierarchy, activities, missions, and culture. Understanding this unique social system will yield key insights into how to best employ a push strategy for the greatest diffusion of the DO concept. The common goal of the Marine Corps is to “locate, close with, and destroy the enemy.” DO seek to codify a new set of skills by which to accomplish that common mission. The structure of the military offers unique insights into how this innovation will be diffused. The Marine Corps comprises a highly motivated group of individuals who will be less resistant to innovation once the senior leaders in the organization have embraced the innovation. The chain of command offers a specialize structure for diffusion of any particular innovation. Once the decision has been made to embrace and adopt the innovation by senior officials, normally the rank and file adopt very quickly. The military command structure offers a unique social system where adoption is facilitated by the command structure. Once the Unit leaders adopt, the command structure ensures those of subordinate ranks will adopt as well.

As the DO concept continues to evolve and take shape it is vital for the Marine Corps to understand the elements which most significantly affect the diffusion of any innovation. This understanding is necessary in order to quickly train the small unit leaders on the critical requirements. Central to developing a push strategy is the need to understand how the innovation, the communication channel, time and the social structure affect the adoption of the innovation. Being cognizant of these themes as tools are developed will maximize the impact on adoption. The hypothesis of this thesis is that an effective information campaign will increase the adoption of DO. The tool developed in this thesis was designed with these elements in mind, attempting to maximize the effectiveness of the tool on the process of adoption of the DO innovation.

V. REPRESENTING USMC COMPETENCIES IN CONCEPT MAPS

This chapter of the thesis will introduce concept maps as a knowledge representation tool and the benefits of using concept maps. The main reasons and motivation behind employing concept maps is discussed, and the key criteria that are found in good concept maps will be elaborated. Next, the reasons why concept maps are a great tool for the propagation of the concept of distributed operations will be expressed. The process by which the requirements found in the major Marine Corps publications were expressed as concept maps for the thesis is detailed. Finally, the fact core mission areas from which the key Marine Corps conventional and DO specific skills were drawn will be summarized.

A. CONCEPT MAPS

As the domain of DO continues to take shape, there is now emerging a need to provide a common framework or context with which to represent, in a visual model, the fundamental critical skills necessary to enable distributed operations. There now exists technology which enables this kind of a visual representation of domain knowledge in the form of a concept map. The concept map is a tool which allows users to create hierarchical structures of concepts and relationships between those concepts. The concept map is fundamentally a knowledge representation tool; it displays a specific label, usually a word or phrase, as one concept in a node or box. There are then added lines showing linking words which then create a meaningful statement or proposition. These concepts are then arranged hierarchically with the most general concept at the top, and the most detailed at the bottom. Propositions then become a statement about some object that shows a relationship between two or more concepts. There may also be cross-links showing relationships between concepts in two different areas of the concept map. The concept map has a simple structure which consists of:

- Concepts
- Connections

- Linking phrases
- Resources and how they can be linked to a concept

Concepts are enclosed circles which include text. Connections demonstrate the relationships between the concepts. Linking phrases should consist of verbs, conjunctions, prepositions, and are not "concepts" themselves. They contain the verbs which describe the relationships between the concepts. Ideally, an intelligible English sentence can be formed by starting at a concept and continuing through a linking phrase to another concept.

B. PURPOSE OF CONCEPT MAPS

Concept maps in general serve five main purposes. First, they can be used to increase the visibility of a particular domains knowledge sources, especially through use of intranets. This in turn can facilitate the methods of locating key experience and expertise. Secondly concept maps can increase the evaluation of “intellectual assets” (Eppler, 2001) for a given domain. Next, concept maps often enable members of a domain to interpret and assess the information in the domain. Concept maps also make the vital connection from processes to source knowledge, and go beyond merely documenting a process. Finally, they outline the essential steps for knowledge development in a particular domain.

There are numerous common criteria that are found in all good concept maps that are essential for them to be used as a tool for gaining understanding of a particular domain (Eppler, 2001). They are:

- Information Rich – it masses together large amounts of information critical to the domain
- Participative – the team creates the map interactively
- Shared – all experts working off one understanding
- Synergistic – different expertise combines to one common understanding
- Simple – the map can be viewed and understood as a whole
- Visual – illustrative icons represent information

Incorporating the essential common criteria into a concept map ensures it will be a viable tool for collaboration. These characteristics are vital qualities in any attempt to gain usable knowledge of a particular domain.

C. MILITARY APPLICATIONS

Concept Maps have found success in a variety of civilian and military domains. The US Navy's meteorology community has implemented concept maps to solve a number of challenging knowledge management problems. A knowledge modeling effort to demonstrate the usefulness of representing local meteorological expertise was undertaken at the Naval Training Meteorological and Oceanography Facility (NTMOF) at Pensacola Naval Air Station, Pensacola, FL (Hoffman, 2001). A total of 26 concept maps were created covering such topics as the local climate, the effects of the Gulf of Mexico on the weather, fog, thunderstorms, hurricanes, and frontal passages. The concept maps were found to be a highly useful, highly accessible learning resource. Many pre-existing resources were added to the model. Resources and information from graphs and personal data, and links to helpful web sites were incorporated into the models. Materials from the Local Forecaster's Handbook were included. A substantial amount of videos were created on various topics of interest and were added to the concept maps. Over 400 additional information resources were added to the original 26 concept maps.

D. THE CONCEPT MAP SOFTWARE TOOLKIT

In the past, concept map were drawn by hand. The process of iterating through many revisions of a concept map was time consuming. In the late 1980's University of Florida in coordination with professors from the Florida Institute for Human and Machine Cognition (IHMC) began development of the software package that was used in this research. The software quickly became the tool used for knowledge elicitation and was use widely as an explanatory tool for complex systems. The Institute used the tool to organize and navigate through large amounts of information via hyperlinks. The latest version of the concept map tool can be downloaded for non profit use at:

<http://cmap.ihmc.us>. The software not only makes it easy for users to construct and modify concept maps in a similar way that a word processor makes it easy to write text, it also allows users to collaborate at a distance in the construction in their maps, publish their concept maps so anybody on the Internet can access them, link resources to their maps to further explain their contents, and search the world wide web for information related to the map. All of these benefits made the CMAP program an obvious choice to represent DO domain knowledge.

E. CONCEPT MAPS FOR CONVENTIONAL OPERATIONS

Employing a concept map to identify, deduce, codify, and integrate information in the domain of DO meets two critical needs. First the concept map can be used as a central repository to organize, collect and disseminate the information critical to DO as the information continues to evolve from debates, experimentation and implementation. Second, the concept map once amassed will be instrumental in making this collection of expertise accessible through a web based visual interface. This process will be instrumental in accomplishing the much needed information campaign for DO. “Marines at all rank levels in the wider Corps community generally lack an understanding of what DO entails. It is strongly asserted that a dedicated DO information campaign be instigated to push information to all areas of the Corps, especially schools, the operating force units, and staff who have an impact on the venture.”(SV-06 Quicklook Report, 2006)

1. FMFM-6-4 into Concept Maps

In a recent Marine Corps Gazette article it was noted that “The basic building block of distributed operations is the rifle squad, augmented as necessary with mission essential specialists” (Schmidle, 2004). This thesis therefore started with the most basic elements of the “basic building block of distributed operations” (Schmidle, 2004). The logical initial starting point for the construction of a useful CMAP for the domain of distributed operations is the base knowledge contained in the FMFM 6-4 United States Marine Corps Manual. The FMFM 6-4 Marine Rifle Company/Platoon manual puts

forth the doctrine, techniques and tactics employed by the Marines for operations and training conducted by Marine rifle companies and platoons. It includes specifically information for the conduct of amphibious operations, helicopter-borne operations, offensive operations, offensive combat, defensive combat, patrolling, auxiliary operations, and finally counterinsurgency operations.

As noted earlier from the review of the current publications on distributed operations, there is a pressing need for the enablement of the DO concept of operations to focus on the squad and team, small unit leaders. It is at this critical level where much of the additional training will need to focus. Operations such as call for fire which were previously handled by more senior level Marines will now fall on the capable soldiers of these small unit leaders. Only by developing a training program which is tailored to enable the individual small unit leader to take independent tactical actions will the DO concept be enabled. These are the key elements of the rifle company which will be called upon in a disaggregated formation to achieve essential tactical actions previously performed by members of the unit with more senior positions.

The primary mission of the Marine Rifle Company and platoon is to locate, close with, and destroy the enemy. The rifle company is the basic maneuver element of the infantry battalion and performs several core combat missions. The development of the concept maps for the rifle platoon focused on two distinct levels, namely the squad level and the team level. It is down to these two core levels where the most critical decision making authority will be pushed for the employment of distributed operations. As the DO Platoon leader of the 1/3 said upon his return from conducting distributed operation in Afghanistan "The Corporal Fire Team Leader can't be a novice at all the skills in his fire team. He needs to be able to teach them. It should not be done several levels up the training echelon. You want to do distributed operations down to the Fire Team level because there are situations where that's certainly applicable, but then that Corporal needs to be brought up on the education level so he can not only demonstrate proficiency but also teach proficiency to the rest of his fire team and supervise that proficiency."(Dotto, 2006)

At each level of focus, both squad and team, seven core capabilities are mapped out to facilitate the identification and training of the competencies necessary to eventually realize a DO capable unit. These core competencies are offensive operations, defensive operations, amphibious operations, combat formations and signals, patrolling operations, and heliborne operations. The core competencies were pulled directly from the FMFM 6-4 manual for both the team and squad level. Figures 3 and 4 show how each competency listed could be represented in a concept map with a link embedded in the node of an additional concept map, which can be selected and pulled up instantly.

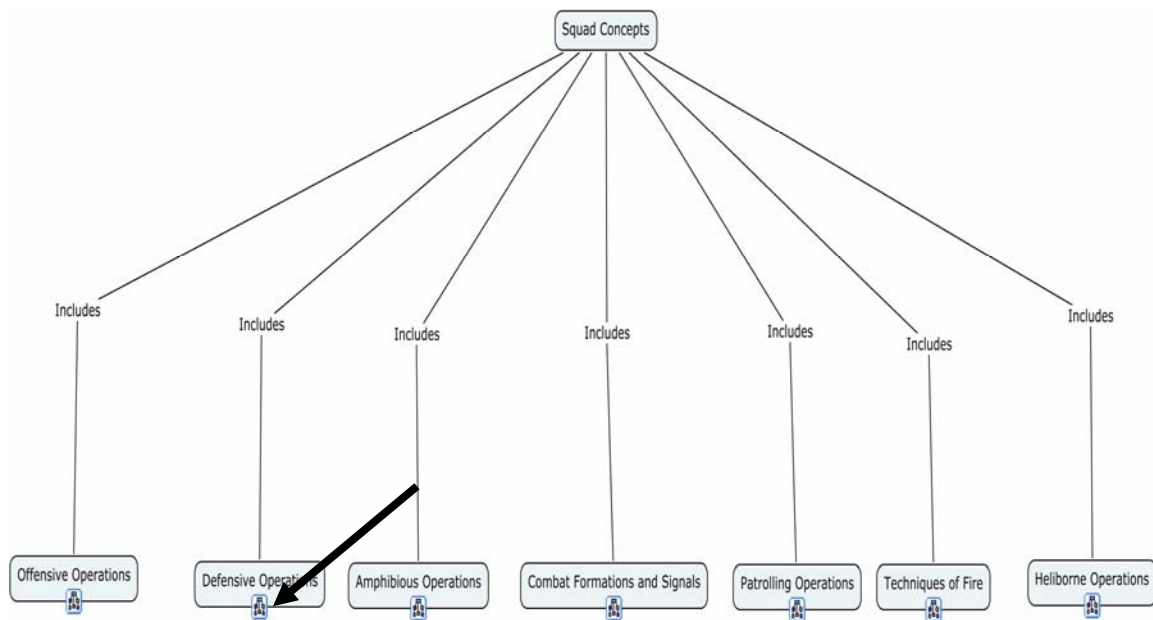


Figure 3. Squad Concept Map (with links)

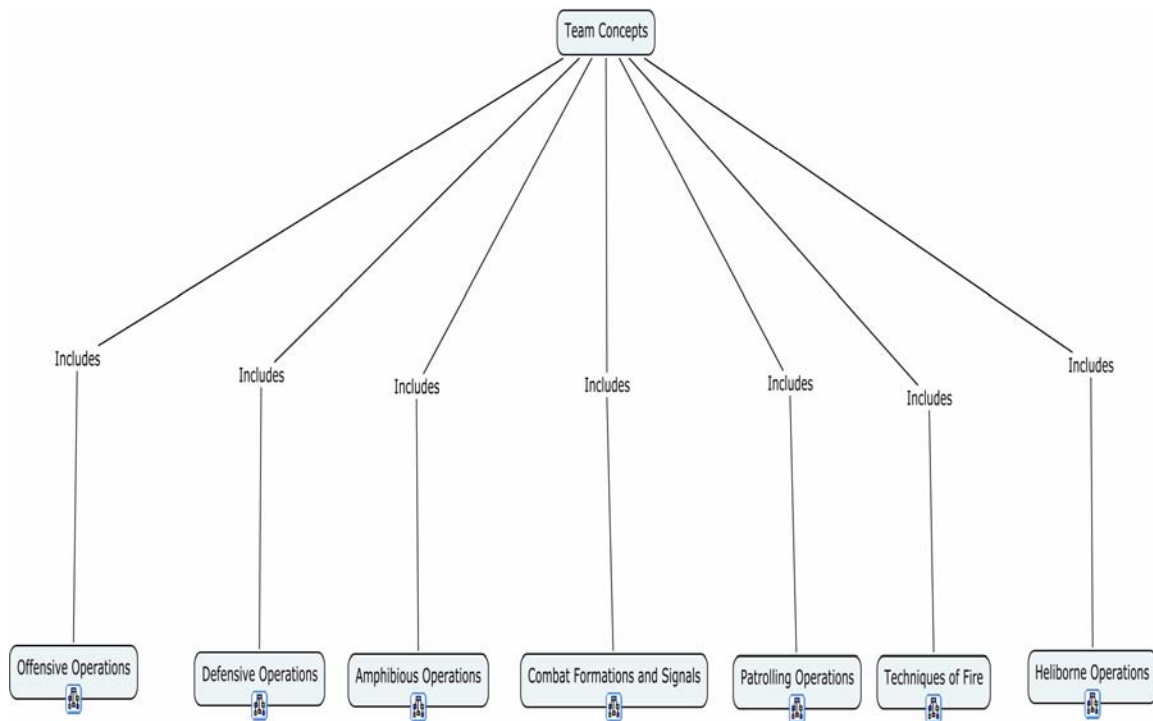


Figure 4. Team Level Concept Map (with links)

2. Squad and Team Core Capabilities and Competencies

This section covers the actual concept maps that were created for the purpose of this thesis. There are, as mentioned previously, seven major sections for the consideration of squad and team operations. A short description of each of these sections with examples of the concept maps developed will be presented. The sections which encompass the entirety of the core capabilities of the Marine Corps rifle unit are:

- Amphibious Operations
- Defensive Operations
- Combat Operations
- Combat Formations and Signals
- Patrolling Operations
- Techniques of Fire
- Heliborne Operations

A quick overview of those core competencies and several examples of the concept maps are presented in Figures 5 – 8. The presentations of the concept maps are a higher level presentation than the full presentations which were created for the purpose of the thesis.

a. Amphibious Operations

This section covers the amphibious operations as it applies to the rifle company. The rifle company may often find itself employed in independent amphibious operations. The amphibious operation is an offensive launch from naval vessels to secure a hostile shore. As shown in Figure 5, these operations are conducted for the purpose of conducting future combat operations and obtaining an area from which to launch those efforts. Amphibious operations employ sea, air, and land forces. It is primarily concerned with massing troops and equipment, moving them to an objective area. The basic pattern of amphibious operation includes the following:

- Planning
- Embarkation
- Rehearsal
- Movement
- Assault

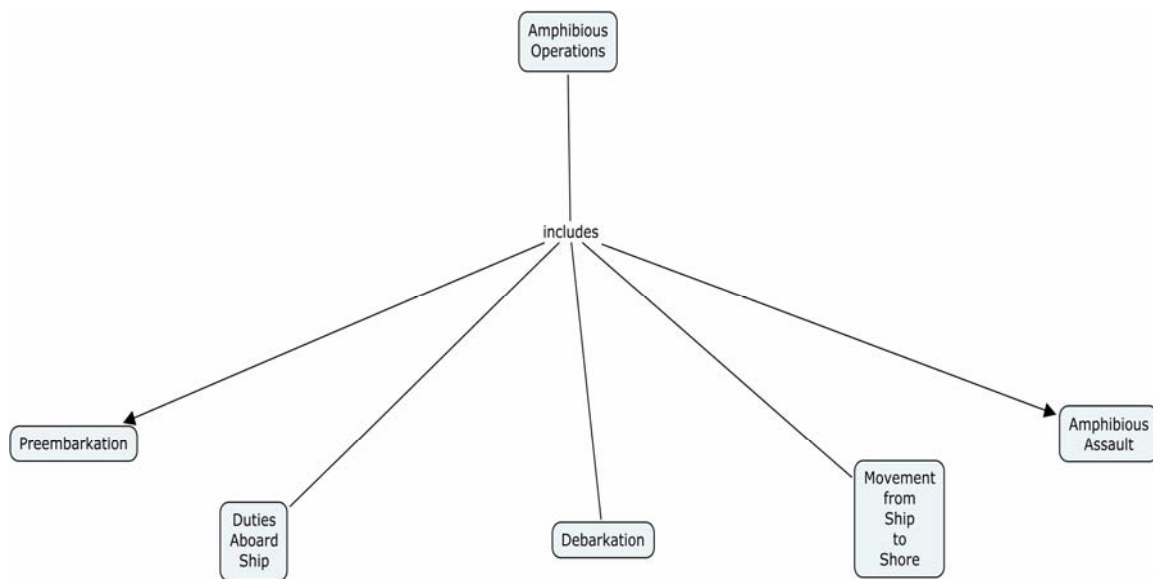


Figure 5. Team Amphibious Operations concept map

b. Offensive Operations

The offensive operations include the techniques and basic principles used at the company and platoon level for gaining contact with the enemy and defeating him. The tactics and techniques capture in this map are those skill essential in the application of land combat. Some of the key tactics, illustrated in Figure 6, include exploiting an enemy's weakness, neutralizing an enemy's capability to counter, tactics for gaining and maintaining momentum for attack, and providing security and integrity for the attacking force. The general fundamentals of offensive tactics evolved as commanders applied the principles of war. The application of these principles are what has shaped the current doctrine.

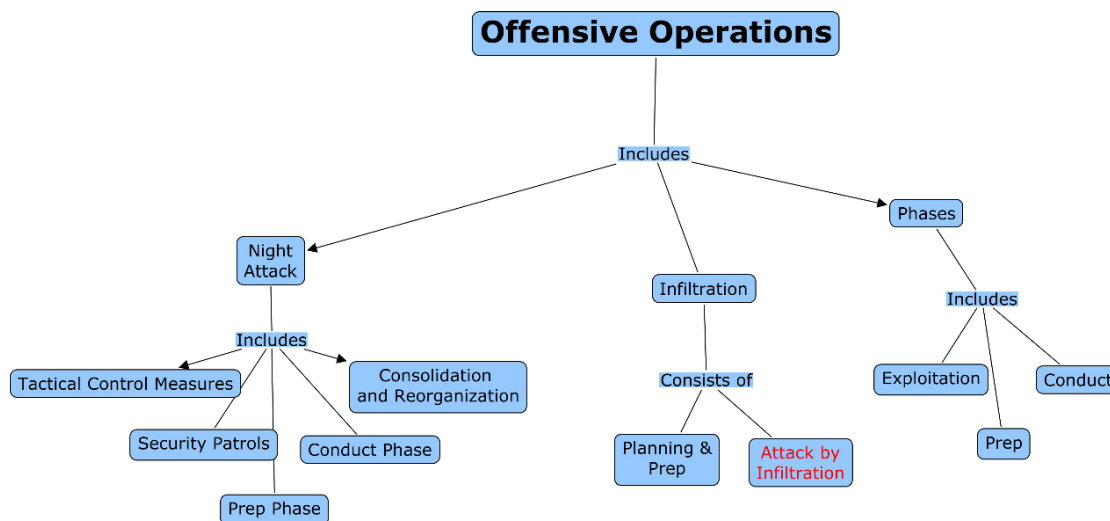


Figure 6. Squad Offensive Operations concept map

c. Defensive Operations

Figure 7 shows in defensive operations the tactics a rifle company employs in area and mobile defense. The Marine rifle company may be required, in the conduct of amphibious operations or in operations ashore, to assume a defensive position. When a Marine unit ceases to move for any reason or for any period of time, it automatically assumes a defensive posture. The unit may be employ defensive operations when ordered by a higher authority or when forced to by enemy action. There

are two basic types of defensive positions, area defense and mobile defense. The concepts articulated in this section discuss the roles of the rifle company and platoon within the framework of defensive operations.

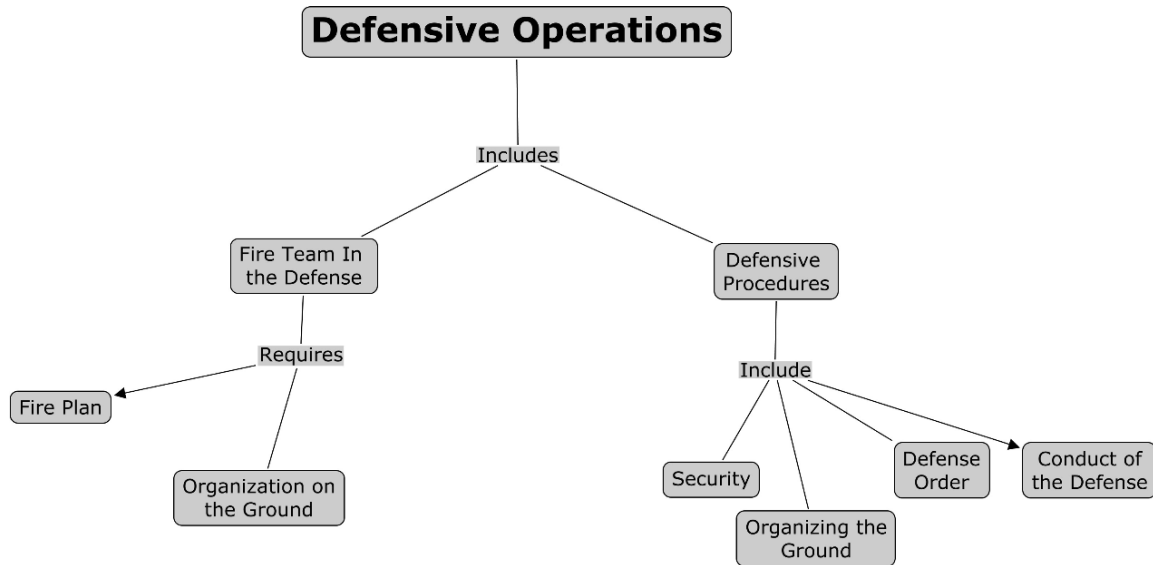


Figure 7. Team Defensive Operations concept map

d. Patrolling

Figure 8 demonstrates the concept map detailing the skills necessary for maintaining security, gathering information, and engaging, harassing, or encountering an enemy. It includes descriptions of the various roles employed in the effective use of patrolling as a part of combat operations. The patrols are limited only by the skills and aggressiveness of the members of the patrol party. Extensive and aggressive patrolling is one of the most effective information gathering tools the commander has at his disposal. The ability to conduct effective, aggressive patrolling operations is essential to the success of and Marine unit.

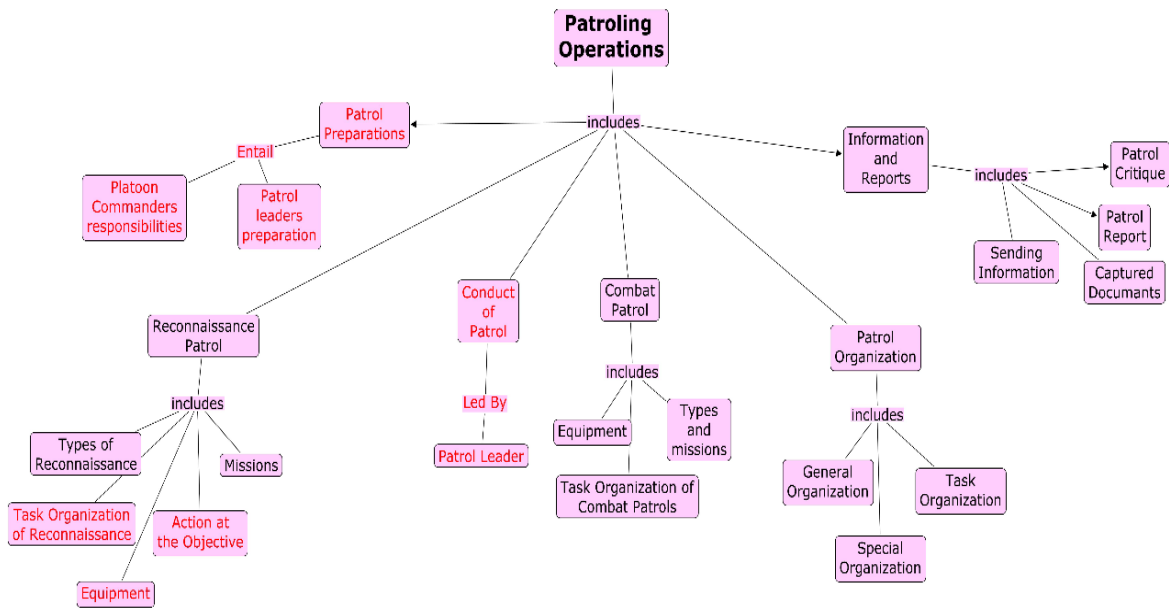


Figure 8. Team Patrolling Operations concept map

e. *Counterinsurgency*

The counterinsurgency concept map includes information and tactics vital for the Marine unit to solve the challenges of an insurgent movement. The tactics are presented in terms of U.S. forces countering an insurgent movement in a foreign nation. The tactics could as easily be applied to a domestic situation, the roles and responsibilities and the tactics remain the same. Counter-insurgency is normally conducted as a combination of conventional military operations and other means, such as propaganda, psy-ops, and assassinations. Counter-insurgency operations include many different facets and actions taken to defeat insurgency by the military.

f. *Auxiliary Operations*

The auxiliary operation concept map captures are combat related skills that aid the well-structured operation of defensive or offensive operations. The skills delineated in this map are essential to the success of a unit operating in a combat zone. The tactics included in this concept map fall under the following areas:

- Relief operations
- Reconnaissance in force
- Retrograde operations
- Mine Warfare
- Nuclear; biological, and chemical defense

3. Addition of DO Specific Skills

It is important to remember that DO is defined as an additive capability (Goulding, 2005). None of the additional critical capabilities will replace existing requirements. The Marine Corps must continue to train the basic core competencies and additionally identify and train DO specific emerging competencies. With the current OPTEMPO experienced by the Marines as the Corps finds itself engaged in two conflicts, training time will continue to be sparse. The training time given to master these skills will not decrease. As it was pointed out earlier, a major enabler for the realization of the DO concept is not just the incorporation of the new emerging DO specific competencies, but the mastery of the conventional skills which are currently taught for proficiency, not mastery. The literature currently available on DO calls for small unit Marines to become “brilliant at the basics” which implies not a proficiency of the core conventional competencies, but a much higher level of skill proficiency.

The skills required for conventional operations were first entered into the concept maps. The next step was to search publications and reports issued after MCWL experiments to attempt to identify and add the emerging DO specific skills. These skills were entered into the concept maps and the nodes were specially color coded for easy identification.

This chapter provided a rationale for choosing concept maps to express the critical requirements for the Marine Corps Rifle Unit. The concept knowledge representation tool is tailor made for the type of concurrent development adopted by the developers of the DO concept of operations. The major common criteria which are found in all effective concept maps were discussed, along with the main reference used to formulate the concept maps employed in this thesis. The need to focus the concept maps on the squad and team levels was stated and several high level examples of the concept maps were illustrated.

VI. VIRTUAL TRAINING SIMULATIONS

This chapter covers the use of virtual training simulation for military purposes. A discussion of several guiding principles for employing virtual training simulations is put forward. The use of concept maps as a knowledge representation tool for information about various virtual training simulations is explained. The essential questions used to gather the information are delineated. An example of the information gathered for the formulation of the concept map is given.

A. VIRTUAL TRAINING SIMULATIONS AS A SUPPLEMENT

Virtual Environment (VE) technology has emerged as one of the most promising new training tools. The flexibility offered by virtual training simulations allows training in a wide variety of environments and situations which are too complex, risky or expensive for live training. Virtual training simulations allow for very specific scenarios to be practiced as needed. This chapter will discuss some essential considerations for employing virtual training simulation for military applications. The primacy of real training over virtual training simulations will be asserted. There role that simulations can play to complement real training is discussed. An example of a virtual training simulation and the key features of the simulation which are important to know in order to employ the simulation will be demonstrated.

The military has long sought after simulation capabilities that will allow units to train effectively even if they do not have an opportunity to participate in high fidelity field training exercises. There is also a critical need for units and military schoolhouses to conduct effective mission rehearsal that prepare for various combat missions in various terrains. VE technologies have the potential to provide training and mission rehearsal. In response to those needs all branches of the military have sought to find critical technologies that can do a variety of military training needs such as simulate locomotion, track weapons and body position, create realistic terrain environments, and creating simulation that covered emergency procedures which could not be otherwise trained (Bell & Waag, 1998).

One of the areas where virtual reality has found practical application is in the domain of military training. From flight simulations, to game based trainers, to full bridge ship handling simulations, the military is employing simulation to immerse its members into scenario driven events to teach and evaluate their knowledge regarding certain tactics. Desktop simulations and digital game-based technologies such as Close Combat Marine, have earned much attention for their potential as training interventions (Baxter, 2004). The USMC is leveraging aspects of digital-game based methods and inserting them into tactical decision-making simulations. The military is focusing a great deal of effort on developing virtual world technologies that will allow training combat skills in flight simulators (Bell, 1998). As simulator technology has improved, the scope of simulator-based training has expanded. Today, simulator-based training for military flight includes emergency procedures, basic system use, and transition flight.

When dealing with virtual training simulations, there are some essential guiding principles to hold fast to. It is important to remember that virtual simulation trainers are only a tool and that other elements of training setups are still needed (Sadagic, 2007). In most of the training situation they are considered as part of a set of potential aids to the training problem. Virtual training simulations are often used not as a replacement for current training tactics but as a supplement to current training tactics. A simulation will always be just that; a simulation, and it can seldom completely replace the experiences of real field exercises. Finally, simulations should be employed when there is evidence that they provide the better solution to a particular training need (Sadagic, 2007). The simulation might be the best approach for solving one particular training need, this does not instantly make it the one size solution to all training problems.

As alluded to in the previous paragraph, virtual training simulations are increasingly being demonstrated as effective tools to supplement the training needs of military units. Simulations are gaining widespread acceptance because they meet some essential needs of the military. First they have a potential to preserve precious resources and gain cost savings wherever possible. Once the initial cost for a simulation system is incurred, there is little expenses left like those normally encountered with live training systems. With simulations there are no expenditures for such things as ammunition,

logistical support, fuel, equipment, transportation, and weapons. Second, employing simulations in training provides the users with increased flexibility. In the ever increasing OPTEMPO faced by today's units, finding extra time to train is rare. Simulations can be quickly loaded with various libraries to facilitate training in a number of environments and terrains. Adding a new scenario is often a matter of loading a new library rather than restructuring an entire trainer.

As the critical training requirements continue to emerge from the concurrent development of DO, the number of new skills required to be train quickly also increases. It is important to remember that DO is an additive capability. Units are going to be required to master the DO essential skills in addition to the emerging DO skills. Any advantage offered by simulation to supplement live training must be capitalized on. Next, the use of virtual training simulations can facilitate the initial procedural training and necessary refresher training critical for maintaining a high degree of readiness. Simulations often have the effect of increasing the motivation of users to employ these systems and learn tactics. The ability of some simulation to have the look and feel of video games makes easier for the gamer generation to learn.

The military is investing a great amount of resources into acquiring and implementing virtual training simulations. While the military continues to invest large resources in procuring these systems, the rate at which the virtual training systems are being adopted by potential users is very slow. There appears to be a lack of serious diffusion of simulation training to the masses of military units. The pressing need is to develop tools which facilitate the adopting of the DO innovation by the largest percentage of users. Understanding how can the military encourage and enable the masses of military units to embrace the evolving DO concept will significantly shape the tools that are developed for that employ. The primary focus of this thesis is on developing the best tools to enable and encourage the majority of DO adopters to understand the DO concept and to embrace and employ the virtual simulation technology to train the critical DO skills.

B. CONCEPT MAPS FOR VIRTUAL TRAINING SIMULATIONS

In order to best propagate the DO concept and to link users to virtual training simulation it was necessary to develop a basic user friendly tool. For the purpose of developing this tool, a list was generated of the best available virtual training simulations which are employed throughout the military for the specific training of the skills identified as essential for both conventional operations and distributed operations. Experts from MCWL and TECOM, well versed in both conventional operations and the DO concept, were queried and they provided inputs for the set of virtual training simulations most frequently used by USMC units. Once those core simulations were identified, a list of supplementary information necessary for the efficient use of these simulations was compiled. Included in this list are such information as:

1. General summary of the simulation.
2. What websites are available that provides additional information on the simulation?
3. What are the critical skills (conventional/DO specific) the system is designed to train?
4. What can the system simulate?
5. What is the number of personnel the training system is able to train?
6. Are there different proficiency levels the simulation is designed to train?
7. Is there a downloadable version of the training simulation?
8. What are the hardware requirements?
9. What are the software requirements?
10. Is there any technical support available for the simulation?
11. Is there any instructor support needed/ available?
12. Is there a library of scenarios available for use?
13. Where are these simulations currently being employed?
14. What manuals/research papers are available on using this simulation?
15. Units that have reported experience with the simulation

The list gathered was by no means exhaustive. The main goal was a first attempt to build a tool which is robust enough to be updated and shaped later by being reviewed by subject matter experts. In other words, the idea is to build a framework into which can be brought expert knowledge.

In a manner similar to the transitioning of tactics from the FMFM 6-4 manual for the team and squad level, the collection of virtual training simulation was transitioned into a concept map. This was accomplished for all fourteen of the major training simulations. An example of one such concept map is presented in Figure 9.

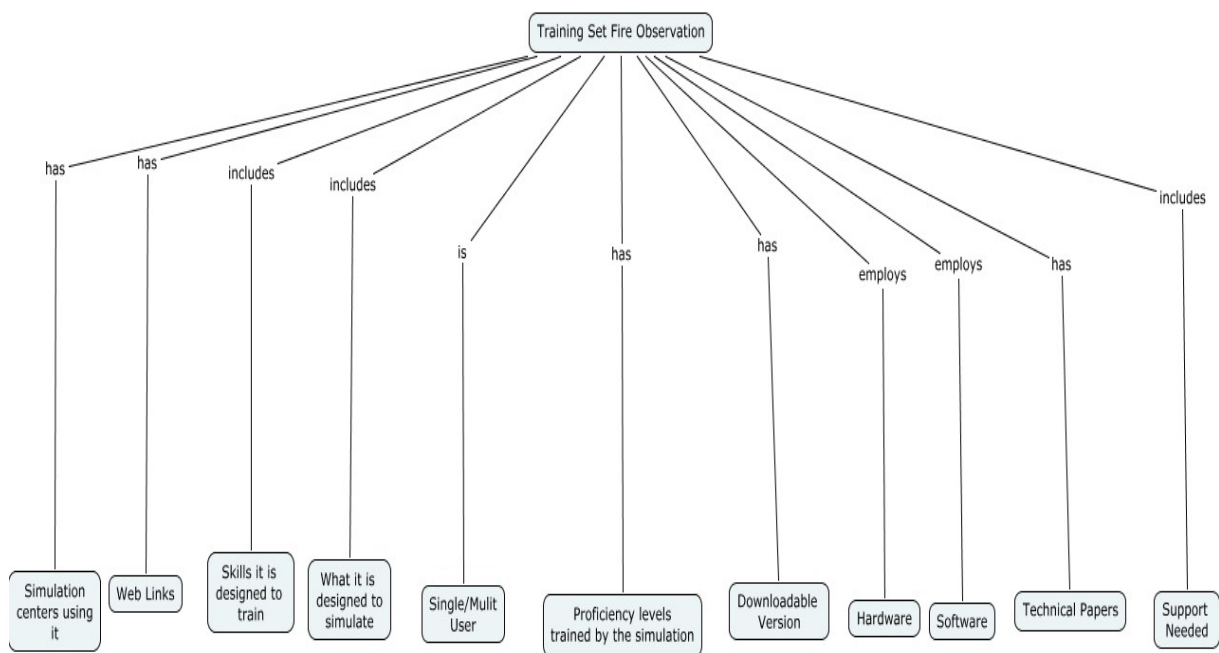


Figure 9. Training Set Fire Observation

Once the list of virtual training simulations was gathered, and the best supporting information was gathered, the information was compiled into a corresponding concept map for each virtual training simulation. The gathering of these concept maps created a database from which to compare and match critical skills which need to be trained for both conventional skills and DO skills. There are two bodies of information available to search, one containing conventional skills derived from Marine Corps manuals and DO skills from literature, and a second body of information with currently available virtual training simulations and the essential supplemental information about them.

C. AN EXAMPLE: FORWARD OBSERVER PC SIMULATOR

The following is an example for the Forward Observer PC Simulator of the supplemental information which was gathered to assist users in implementing virtual training simulation to supplement their real time training requirements. For each virtual training simulation various categories were considered and information gathered.

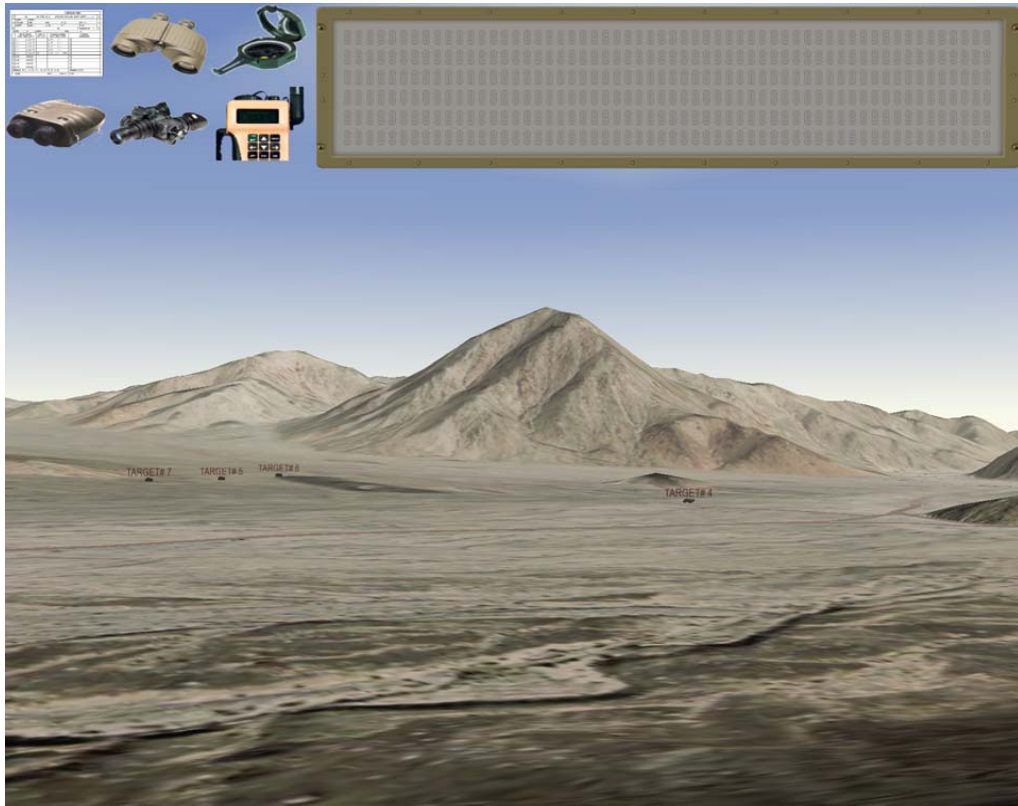


Figure 10. Forward Observer PC Simulator 2 (Figure taken from www.29palms.usmc.mil)

1. Summary

FOPCSIM is a Call for Fire Simulator that was developed by Marines at the Naval Postgraduate School in Monterey California. FOPCSIM allows users to conduct call for fire training on simulated Twentynine Palms terrain. FOPCSIM is a procedural trainer for artillery and mortar Call for Fire that provides scoring and feedback on the standards of performance prescribed in the training and Readiness Manuals for observed fire. FOPCSIM uses a 3D visual representation of real world terrain and an interface to

provide a training environment for doctrinal Call for Fire procedures. Each mission is scored based on the Ft. Sill Observed Fire grading standard. FOPCSIM has realistic enemy targets which the user must correctly identify and then determine the correct munitions to engage it with.

This is a PC based first person perspective call for fire Artillery simulation. It can be used in a distributed networked or in a stand alone mode. FOPCSIM is designed to allow Marines of all skill levels to develop and practice their call for fire skills on a variety of targets (both stationary and mobile). It can provide doctrinal feedback on calls made, and help novices correct errors. User settings can be easily adjusted to create more challenging missions so that students remain challenged as their skill level increases. FOPCSIM is part of the Deployed Virtual Training Environment (DVTE) suite of simulations.

2. Web Links

Downloadable version: <http://www.army.mil/ako/>

Downloadable version also at www.fopcsimmarines.com

3. Skills Simulation is Designed to Train

Call for Fire missions

Combined Arms

- Conduct a call for fire using Polar, grid, and Shift from a known point
- Conduct fire support team operations

4. What can the system simulate?

<Information needed>.

5. Single/Multi User

Multiple modes: Individual player, Classroom mode, Networked Mode

6. Downloadable Version

Open Source using Delta 3D

Unlimited Distribution- featured on Army Knowledge Online (AKO) Fires knowledge Network

7. Proficiency Levels

<Information needed>.

8. Hardware

1 GHz CPU (Pentium 4 or Athlon)

DirectX 8.1 capable video card with 64 MB video RAM

1 GB free disk space

256 MB RAM

9. Software requirements

<Information needed>

10. Technical Support

Technical support is available through contact with Twentynine palms.

11. Instructor Support

<http://www.29palms.usmc.mil/dirs/ont/mands/fopcsim.asp>

This site is the homepage of the Marine Corps Air Ground Combat Center at the Marine Air Ground Force Training Command.

12. Library of Scenarios

Fully customizable scenario via XML

13. Simulation Centers Currently Employing System

The Basic School, Quantico, VA

FOPCSim replaced TSFO for Squad Leader's Course

14. Research Papers/Manuals

Naval Postgraduate School thesis (McDonough and Strom, 2005)

<http://handle.dtic.mil/100.2/ADA439644>

Book entitled “Storming Media”

<http://stinet.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA439644>

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VII. DEVELOPMENT OF SEARCH TOOL

This chapter discusses the development of the search tool to allow users to link critical conventional and DO specific skills identified in the tactics database with the virtual training simulations which can train those skills. The process of converting the concept maps into an XML format is covered along with the general structure of the XML code. The XML files, once converted, had several issues and limitations detailed in the text. The basic use of the tool is discussed including some of the considerations which went into the choice of the tool development.

A. CMAPS INTO XML

Transitioning the concept maps into XML files is a simple process that is built into the CMAP program itself. Once the knowledge of a certain domain is captured in the concept maps the user can simply under the file menu choose the “export file as” option and then choose the “XML” option. A .cxl file is generated which has a fairly basic structure (see Appendix A).

There are some limitations which could present problems for the users of the maps as an effective diffusion tool. The following limitations have been perceived, for instance, if a search is performed for a specific training skill, say call for fire, the search will return the title of the concept map which the user can then access and search. For the purpose of this thesis, a more robust functionality is desired. As mentioned earlier the CMAP tool allows users to export the concept map as an xml file, but this process is not perfect as some of the text contained in the nodes becomes scrambled in the XML file. Any special characters contained in the nodes of the original concept map enter into the XML code as special characters. For the purpose of the thesis, and for general usability, it was necessary to go in by hand and correct all the places in the code where the special character code manifested itself.

The next step in the development of an effective search tool was to create a database of all the concept maps for both the team and squad levels for the eight essential

mission areas covered by the FMFM 6-4. Once all of the concept map files were exported as .cxl files and the special characters were deleted from the XML code, a data base of tactics now existed which an end user could use to search for certain conventional and DO related skills. Next, all of the concept maps which contained information on the fourteen virtual training simulations were converted to XML and gathered into a common database. A database from which to match critical DO and conventional skills to corresponding virtual training simulations was created.

B. GRAPHIC USER INTERFACE

In order to develop an effective search tool, there was a need to build an application that conducts an efficient search between these two databases. In order to provide desired functionality, the attention was focused on designing a GUI to search and return search results between the two databases. As demonstrated in Figure 11, the main screen of the application contains three panels. They are:

- Search for Tactics
- Squad/Team Mission Area
- Simulations

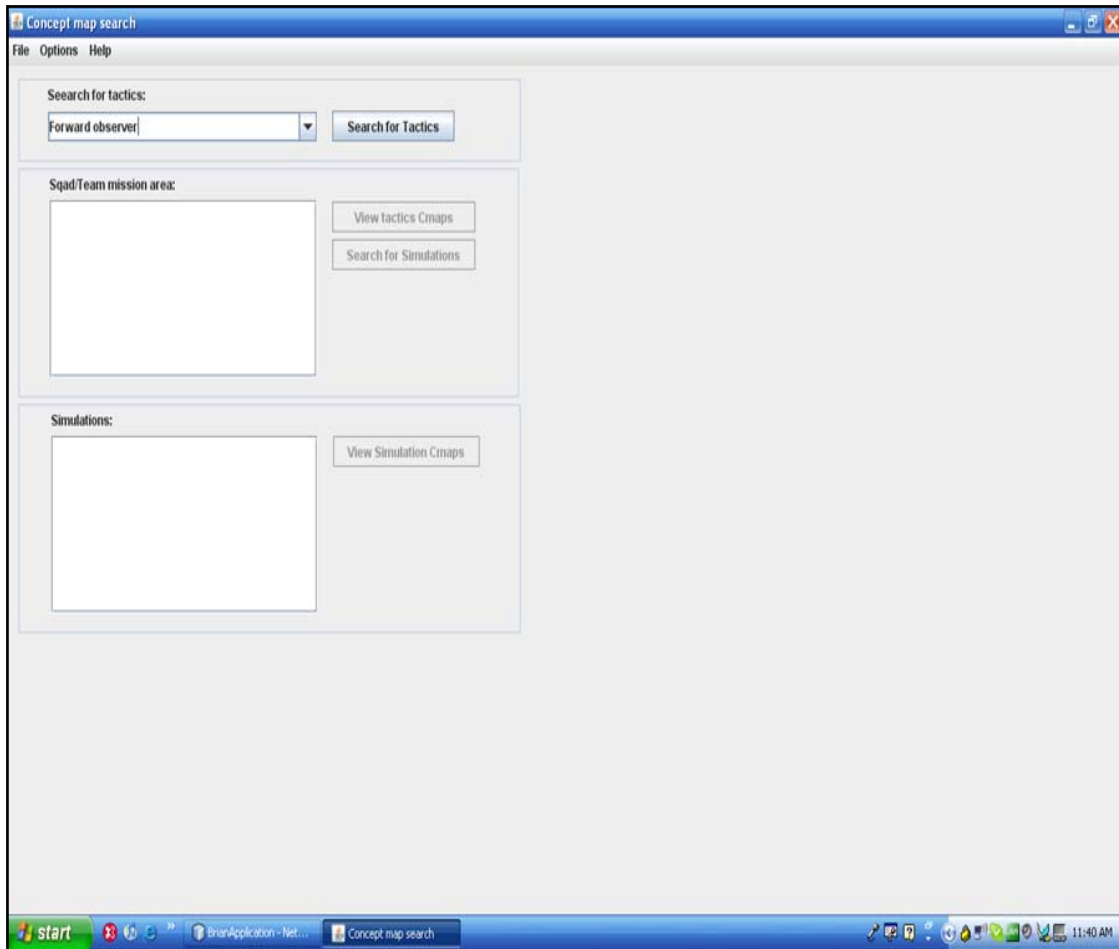


Figure 11. Graphic User Interface

C. SEARCH CAPABILITIES

The GUI interface is based on JAVA Foundation Classes Swing GUI. Using the JFC and Swing allow the GUI to incorporate the features such as drop down lists, buttons, text areas, and built in menu capabilities. The code consists of four main classes; the classes correspond to the windows which the user will interact with in the GUI (AboutForm, MainForm, OptionsForm, and ViewForm). These classes contain all the necessary functionality and presentation for the corresponding window.

The main advantage of employing the JFC Swing GUI is its ability to graphically construct the components of the GUI by dragging and dropping the desired features in the GUI. Netbeans integrated development environment (IDE) generates the necessary code

for the message processing in the GUI. The classes in the code consist of two types of methods. One is from the built in framework of the event driven procedures in the GUI, for example a selection from the drop down list. The others are the functions which are created by the designer of the GUI to add supported functionality to the application.

The development of the search function could have been conducted between the databases in two main ways. The first method would have involved using XSLT in a program such as ALTOVA XML SPY to extract the data, and the second method which could have been employed would be a JAVA application. For the thesis, the JAVA application was chosen to provide the necessary search feature for the following reasons:

- The XML that is generated by the CMAP has a complex structure. Creating an XSTL that would extract the data is not a trivial problem.
- Java is a more universal language, and is more flexible to manipulate data structures.
- Java is better suited for the development of GUI applications.
- By creating the application with JAVA, future enhancements can more easily be employed onto various data sources.

The process of exporting the concept maps into xml was relatively simple to accomplish. The program exports an xml file which can be imported into any one of a number of integrated development environments. For the purpose of the thesis work, XML spy was not chosen due to the difficulty in implementing an effective search functionality. Employing a JAVA based IED allowed for the development of a much more robust GUI.

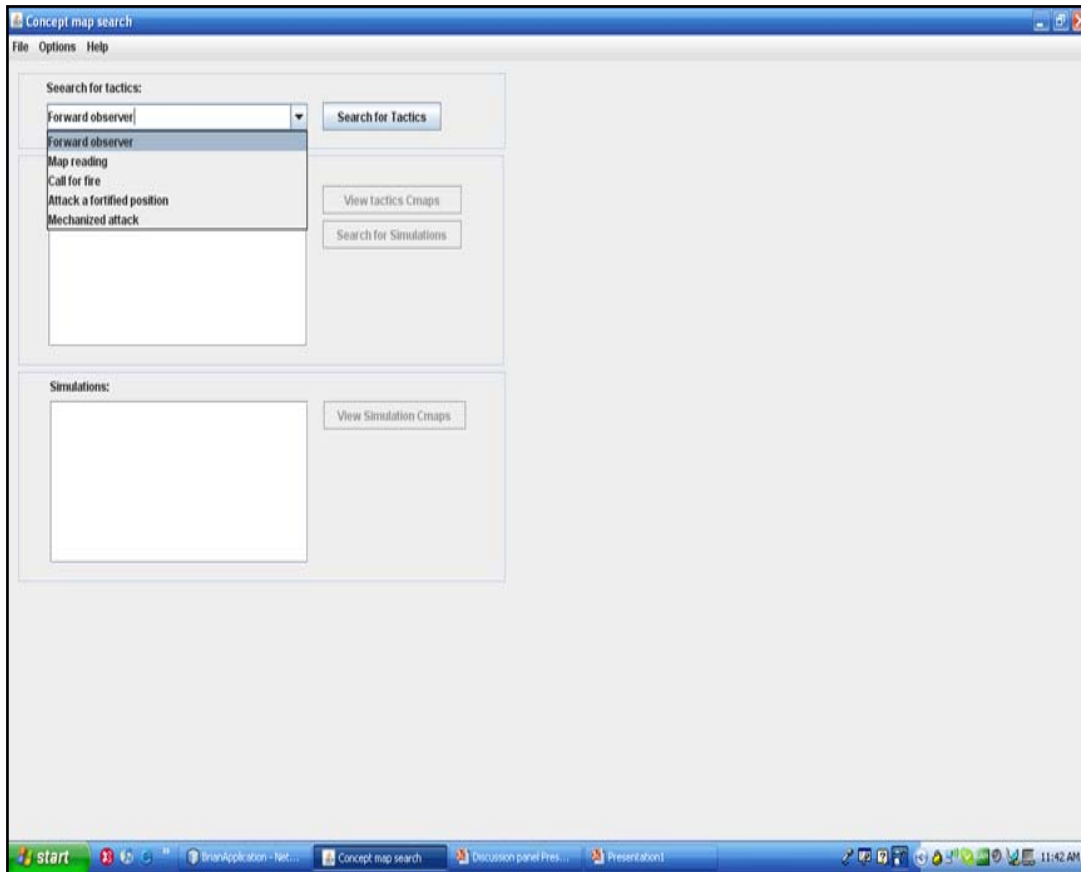


Figure 12. Graphic User Interface Drop Down Menu

As illustrated in Figure 12, the search for tactics section contains a drop down menu. This menu contains predefined tactics or the end user can customize his search criteria. The drop down can easily be customized to give the user a sampling of useful tactics to be searched. The squad/team mission area represents the list of mission areas which contain the searched tactics. The simulation section displays the names of the simulation that have training capabilities for the searched tactics.

There are several steps to proceed through when using this tool. First, as seen in Figure 12, in the search for tactics area the user can either choose from predefined tactics, or the user can add his/her own text for alternative searches. The automatic drop down menu's predefined tactics were added to enhance the usability for Marines who are not familiar with specific conventional or DO related tactics and to make this input easier and faster. The user conducts the search by simple selecting the "search for tactics" button.

As illustrated in Figure 13, if a drop down menu item is selected then the GUI will return one of eight mission essential areas for either team or squad.

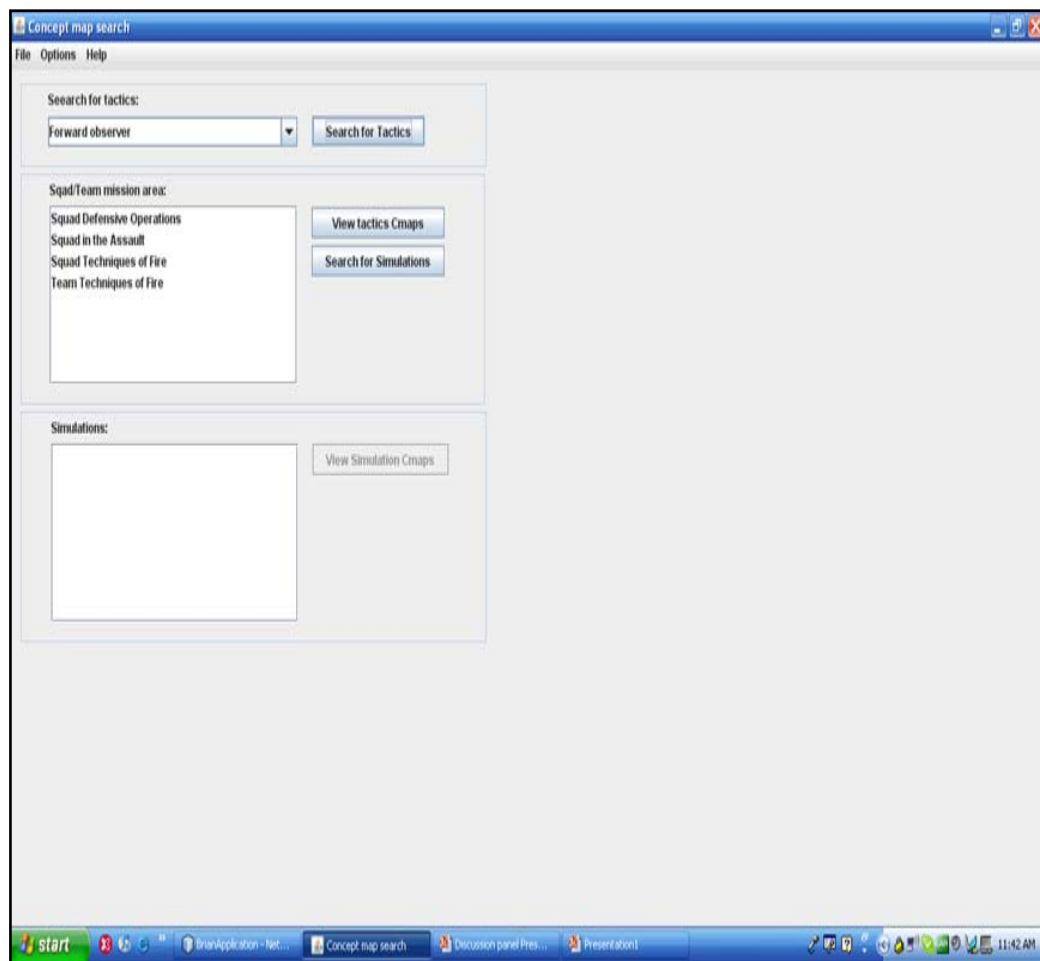


Figure 13. Mission Areas found from Forward Observer Search

On the other hand, if user conducts a customized search that GUI may return either one of eight mission areas or a message identifying that the concept was not found in the database. For each concept that is returned, as in Figure 13, the user can select “search for simulations” which will start the search of the simulations database for all simulation containing capabilities to train the searched tactics. If a simulation is found, as in Figure 14, the user can then extract more detailed information on that specific simulation by selecting the “view simulation” button.

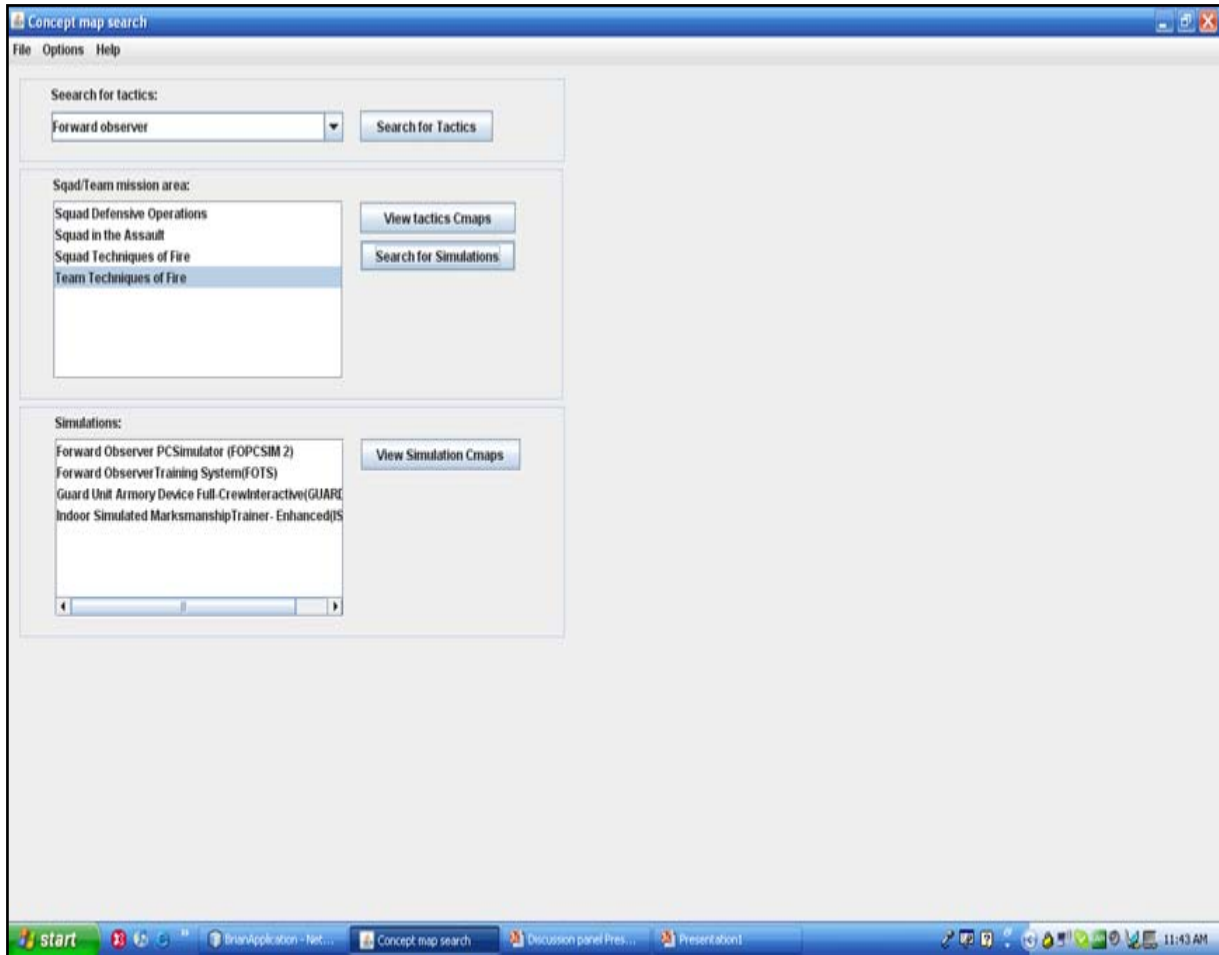


Figure 14. List of Simulations returned from search of Team Techniques of Fire

The user at any time can view the entire concept map of either the Squad/Team mission area or the simulations by selecting either the View Tactics Cmap or View Simulations Cmap. The data associated with the concept maps are stored on a server, and they will appear as a web page that illustrates the structure of a given concept map. All links attached to the web page concept map are interactive and can take the user to web documents or manuals associated with a particular simulation.

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VIII. FUTURE WORK

There are several issues identified for future work.

1. For the purpose of this thesis SME input was sought at every step of the development. The author received help and guidance from individuals who are playing key roles in the development of the concept of DO. Personnel from TECOM and MCWL offered information and inputs at several key junctures of the development of the CMAP tool. What is lacking though is a thorough review and validation of the tool. A logical next step would be to have Marine Corp SME on the subject of DO review the accuracy of the information gathered. This information will continue to be shaped by the development of the DO concept itself. Therefore, a periodic review as the concept concurrently develops is needed to update this tool and make it useful and relevant for the end users.
2. The next logical extension of the tool would be to conduct a study where a group of users could use the tool to examine the degree to which the use of this tool contributes to an effective information campaign (another group of users, a control group, would not have access to this tool). It is vitally important to design and conduct experiments to see if the tool played an effective role in the dissemination of the concept of DO, especially to the small group leaders who are invaluable to the accomplishment of DO. Such a study would be longitudinal in its nature, and therefore it would not be feasible to be part of this thesis work.
3. In the development of the GUI interface that connects and provides the search capability for the thesis, it was noted that new search capabilities could be added to identify the skill areas where no virtual training simulations that train those skills currently exist. As the virtual training simulation database gets continuously updated and the critical DO skills identified and added, an end user would have accurate information on what set of skills are still not supported by the existing simulations.

It is strongly hoped that future students in the MOVES and HSI departments will take this work and continue to develop and shape the communication tool developed here. Only by seriously analyzing the usability of the tool and getting subject matter experts oversight on the tool will it become an affective medium of propagation of the DO concept. Linking the end users to the set of virtual training simulation currently available would increase their awareness about those simulations and consequently it would increase their use and training effectiveness.

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IX. CONCLUSION

The need for the Marine Corps to develop and implement a formalized DO concept is pressing. The Operational commitments in Iraq and Afghanistan have made clear that there is a requirement for a capability to distribute the force when it is to its tactical advantage to do so. In order for the Marine Corp to successfully implement the DO concept, clearly there is a requirement for a significant increase in the level of education and training given to the individual Marine. It has been strongly recommended both by USMC leadership and from interviewed small unit leaders that a dedicated DO information campaign should be instigated to push information to all areas of the Marine Corps.

The work on this thesis included a number of steps focused on creating an effective web based collaborative tool. This particular tool is designed with the intention to be used by DO SME's and end users with the goal to increase their understanding of both conventional and DO skills as well as a range of virtual training simulations that can be used to train those skills. The hope is that this effort will be a valuable contribution towards a much needed information campaign to educate all Marines.

It is hoped that this initial attempt at identifying and understanding the issues related to the real world problem, and the design of a communication tool will be carried on. Only when focused, proactive information campaign for the entire USMC community is undertaken, the adoption of the DO innovation will be successful. A successful information campaign will enable all Marines up and down the chain of command to comprehend the DO concept, and it will provide small unit leaders with a broader understanding of the requisite knowledge and novel training opportunities that are currently known only to more senior leaders.

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APPENDIX A: XML STRUCTURE OF CMAPS

This appendix contains the construct used for converting the concept maps into an XML format. This same construct is used for all of the files for both the tactics database and the simulations database.

- o <cmap>
 - <map>
 - <concept-list>
 - o <concept>
 - ID
 - Label
 - o </concept>
 - </concept-list>
 - <linking-phrase-list>
 - o <linking-phrase>
 - ID
 - Label
 - o </linking-phrase>
 - <linking-phrase-list>
 - <connection-list>
 - o <connection>
 - ID
 - From-ID
 - To-ID
 - o </connection>
 - </connection-list>
 - <connection-list>
 - o <connection-appearance><linking-phrase-appearance>
 - ID
 - X

- Y
 - Width
 - Height
 - Text alignment
 - Stylesheet id
- o </connection-appearance><linking-phrase-appearance>
 - </connection-list>
- </map>
- o </cmap>

APPENDIX B: CURRENT VIRTUAL TRAINING SIMULATIONS

This appendix contains the information gathered for three virtual training simulations currently used by the USMC. Note that the given simulations are only illustrations of the complete data set collected and represented in the concept maps and the tool. The full set consists of information about the following virtual training simulations:

- Guard Unit Armory Device Full-Crew Interactive Simulation Trainer (GUARDFIST II)
- Call-For-Fire Trainer
- Indoor Simulated Marksmanship Trainer-Enhanced (ISMT-E)
- Forward Observer Training System (FOTS)
- Forward Observer PC Simulator 2 (FOPCSIM 2)
- DOTTS 10
- Close Combat Marine (CCM)
- Virtual Battlespace (VBS-1&2)
- Tactical Iraqi
- Virtual Combat Convoy Trainer-Marine (VCCT-M)
- Infantry Immersion Trainer (IIM)
- FOCUSS 2

This information was transferred into concept maps and use to establish a database of simulation to which the GUI matched various tactics.

A. CLOSE COMBAT MARINE (CCM)



Figure 15. Close Combat Marine (Figure taken from www.closecombatseries.net)

1. Summary

Close Combat Marine is a real-time strategy tactical decision making simulation which is published by Atomic Games. The focus of the computer combat simulation is on infantry combat at the small-unit level. The game teaches Non-commissioned Officers (NCOs), Staff NCOs, and junior officers multiple tactics on a virtual battlefield. The simulation can be played against the computer Artificial Intelligence, head to head or in a multiplayer mode with up to three players on each side. The game was designed to be a supplement to regular field exercises by allowing enabling instructors to create the scenarios which trainees need most.

2. Web Links

Close Combat Marine Blog and download page:

<http://www.closecombat.org/forums/showthread.php?t=6254>

Web site where to download the CCM series:

<http://www.closecombatseries.net/CCS/modules.php?name=Name&file=article&sid=23>

3. Skills Simulation is Designed to Train

Combat Actions

- Participate in realistic rehearsals
- Collect and report information
- Conduct a debrief
- Issue an order
- Navigate using current maps and imagery with or without the aid of GPS
- Employing guardian angel

Combined Arms

- Plan and execute Close Air Support
- Plan and execute a Fire support Plan
- Conduct Fire and movement
- Knock out a bunker
- Conduct tank-infantry attack
- Conduct a supported attack of fortified position
- Plan, integrate and employ combined arms
- Attack a fortified position

Cultural Training

First Aid/ CASEVAC

IED Defeat

Entry Control Point/Vehicle Check Point

Military Operations in Urban Terrain

- Move through a built up area
- Attack a building

Conduct an urban Attack

Conduct urban fire support

Conduct urban defense

Motorized Operations

Conduct a convoy

Take immediate action against unblocked ambush during a convoy

Employ vehicles in support of dismounted operations

Plan and conduct convoy operations

Conduct a motorized movement to contact

Conduct route clearance

The simulation can be employed to train Marines on numerous tactics such as:

Infantry Defense

Support by Fire Tactics

Assault/Defense in Urban Terrain

Mortar Tactics

Anti-Tank Tactics

4. What can the system simulate?

<Information needed>

5. Single/Multi User

Single player/ Multi Player

6. Downloadable Version

CD ROM availability

7. Proficiency Levels

<Information needed>

8. Hardware

Basic Computer system, keyboard Mouse, speakers. Computers must have networking capability

9. Software requirements

Different releases Version 3.1 was released via the Marine Corps Gazette. Version 4.0 was released in September of 2005 and the latest version (v5.1) was released soon after. In November 2007, Matrix games released “Close Combat: Modern Tactics for commercial purposes.

10. Technical Support

<Information needed>

11. Instructor Support

<Information needed>

12. Library of Scenarios

<Information needed>

13. Simulation Centers Currently Employing System

<Information needed>

14. Research Papers/Manuals

<Information needed>

B. VIRTUAL BATTLESPACE (VBS)



Figure 16. Virtual Battlespace 2 (Figure taken from www.virtualbattlespace.com)

1. Summary

VBS2 is the next generation tactical simulation that is in the process of replacing VBS1. VBS2 is a personal computer based “First Person” system with a mission rehearsal capability. The system employs fully configurable virtual battlefield and can simulate all MAGTF platforms and weapons. See Figure 11 for screen shots of this simulation. The system is extremely flexible and can create numerous scenarios that are tailored to the specific training requirements of any unit. Training system is robust enough to engage up to 100 Marines in a single scenario to train various tactics, techniques, and procedures. Marines are able to train in a number of challenging environments and the level of opposition can be manipulated to meet the unit’s proficiency level. Marines can act as a single unit against a simulated OPFOR or the training unit can be divided into two groups which compete against one another. Both VBS1 and VBS2 are part of the suite of application which comprises DVTE.

2. Web Links

The home page for everything related to Virtual Battlespace 1:

<http://www.virtualbattlespace.com/>

The home page for everything related to Virtual Battlespace 2:

<http://virtualbattlespace.vbs2.com/>

3. Skills Simulation is Designed to Train

Enduring Combat Actions

Conduct 5 and 25 meter checks

Execute EOF procedures

Apply rules of engagement in operations

Conduct realistic rehearsal

Conduct a brief

Issue an order

Collection and report information

Navigate using

Conduct tactical questioning

Gather evidence

Employ Guardian Angel

Military Operations in Urban Terrain

Searching a building/dwelling

Clear a building

Conduct urban fire support

Conduct urban defense

Conduct urban Attack

React to contact with ambush, sniper, and IED

Conduct (4) man entry, (4) man clear

Clear a stairwell

Employ Grenades in MOUT

Move through a built up area

Motorized Operations

Conduct a convoy

Take immediate action against blocked ambush during a convoy

Defend against mines/booby traps (IEDs)

Conduct Vehicle Recovery

Establish and execute a bump plan

Take immediate action against Sniper(s)

Execute turret (5 hole) actions

Conduct a motorized movement to contact

Conduct route clearance

Employ vehicles in support of dismounted operations

Entry Control Point/Vehicle Check Point

Conduct deliberate VCP/ECP

Conduct Hasty VCP

Establish a snap VCP

First Aid/CASEVAC

Establish and operate casualty collection point

Conduct a CASEVAC

Plan, brief and rehearse CASEVAC

Establish and operate a Casualty Collection point

Conduct LZ operations

IED Defeat

Conduct IED Hunting Ops

Conduct Ops to defeat IED system predict; prevent; detect;
neutralize, mitigate

React to a possible ground emplaced IED

Prepare for a VBIED or suicide bomber attack

4. What the System Can Simulate

Opposing forces via the mission editor

Opposing forces can be live or AI

AI advanced semi-automated forces to simulate military behavior

Observer module

Addon Terrain Pack

Core Island Pack

Vehicles: A-10, AH-1, CH-47, UH-60, M1A1, 5-ton Truck, HMMWV

Weapons: M16, M4, M249, M24, MP5, M9 Beretta, LAW, Carl Gustav, Stinger

Weapons: Hand grenades, Smoke grenades, Satchel charges, AT Mines, Flares,
Binoculars, Night vision goggles

5. Single/Multi User

Single player downloadable version

Multi-user

The multi-user capability works with up to 32+ total users with no degradation in performance and can be operated in either a standalone mode/ or across a LAN or Internet.

VBS can take the form of many different combat scenarios and environments, which can immerse between one and one hundred Marines into a virtual world where small-unit leaders can test their SOP and conduct rehearsals.

6. Proficiency Levels

<Information needed>

7. Downloadable Version

A special license version of VBS is available to Marines for personal use. It is a single player version that may be used to design and save multiplayer scenarios which can be saved to a thumb drive and taken to the Battle Simulation Center for multiplayer use.

[http://www.torrentreactor.net/torrents/929584/Virtual-Battlespace-1-0-\(reseed\)](http://www.torrentreactor.net/torrents/929584/Virtual-Battlespace-1-0-(reseed))

8. Hardware

VBS2 Minimum System Requirements

CPU :

Intel : Pentium D 2.5 GHZ

AMD :Athlon 64 2.5 GHZ

OS :

Windows XP 32-Bit Service Pack 2

Windows Vista 32-Bit Release

RAM :

1 GB

Hard Drive Space :

8 GB Removable Disk :

(Optional, for installation only)

DVD, Dual-Layer

Video Specifications:

Shader Model : 3

Video Memory : 256MB

Hardware DirectX : 9.0c Software DirectX : 9.0c

Display Resolution : 800x600

USB : One port free required for HASP-based license key

Network : (Optional, for network sessions) 100mbit LAN 54Mbit 802.11g

Audio System : (Optional)

OpenAL 1.2 compatible

9. Software requirements

<Information needed>

10. Technical Support

Requests for training support william.yates@usmc.mil

11. Instructor Support

Assistance in developing scenarios is available from the Battle Simulation Staff.

12. Library of Scenarios

Scenarios can be developed by Platoon Commanders, Squad Leaders, and Fireteam Leaders to design training scenarios to meet specific training objectives for their unit's needs, stored to thumb drives and loaded at the simulation center. There are a variety of predefined scenarios already available for all purposes of training.

13. Simulation Centers Currently Employing System

Twentynine Palms

14. Research Papers/Manuals

User's Handbook provides the techniques and procedures for in-scenario employment of the USArmy1 Module in the Virtual Battlespace 1 simulated environment:

<http://www.virtualbattlespace.com/shop/USArmy%20Manual.pdf>

C. TACTICAL IRAQI



Figure 17. Tactical Iraqi (Figure taken from www.wired.com)

1. Summary

Tactical Iraqi Language and Cultural Trainer (TILCT) is a simulation that is designed to teach individual Marines the basics of the Iraqi Arabic language along with some experience understanding different cultural nuances of Iraqi life. It is a PC based trainer which is designed to develop proficiency with the Arabic language and culture. The simulation uses a mixture of skill building lessons and practice missions. It is capable of training various skill levels and employs a voice recognition system to facilitate practicing speaking. Tactical Iraqi is currently being used at the Battle Simulation Center and the Learning Resource Center. The simulation center also offers Afghanistan and Tactical French (for use in Africa) and the system is a part of the Deployed Virtual Training Environment (DVTE) suite of simulations.

2. Web Links

Essential web link to current information for the employment of Tactical Iraqi:

www.tacticallanguage.com

This site is the homepage of the Marine Corps Air Ground Combat Center at the Marine Air Ground Force Training Command.

<http://www.29palms.usmc.mil/dirs/ont/mands/tlts.asp>

3. Skills Simulation is Designed to Train

Practice language proficiencies in virtual conversations in order to meet mission objectives.

4. What the System Can Simulate

Virtual civilians

AI entities to carry on simulations and conversations

Phonetic pronunciations of language builder vocabulary

5. Single/Multi User

Single user, desktop application

6. Proficiency Levels

Skill builder format exists which includes hearing the spoken word by a native speaker, phonetic pronunciation.

7. Downloadable Version

The software is available for download and may be installed on personally owned computers that meet the hardware requirements. To download a copy of software one must register at the www.tacticallanguage.com website and provide an military email address to access the installation program.

8. Hardware

1 GB RAM

2 GHz CPU

DirectX 9.0 video card

Microphone

Monitor

9. Software

Speech recognition software

Tactical language software (downloadable format)

10. Technical Support

<http://www.29palms.usmc.mil/dirs/ont/mands/tlts.asp>

11. Instructor Support

None needed

12. Library of Scenarios

Various Scenarios: Tactical Iraqi is divided into three parts: lessons; arcade games; and a mission/game mode. The vocabulary and culture tutor listens to students' utterances and applies speech-recognition technology to assess progress. Students may also navigate through a set of arcade games by speaking Arabic commands, including directions (such as left, right, north, south, and toward the river), along with place names, color names, and military rank. The more complicated the utterance, the more points the game awards. In listening modes, trainees respond to computer-delivered Arabic commands.

13. Simulation Centers Currently Employing System

Twentynine Palms

14. Research Papers/Manuals

Brochure: Tactical Language & Culture Training System:

http://support.tacticallanguage.com/index.php?option=com_docman&task=cat_view&gid=33&Itemid=74

In Country with Tactical Iraqi: Trust, Identity, and Language Learning in a Military Video Game. Article by: Elizabeth Losh

<https://eee.uci.edu/faculty/losh/virtualpolitik/DAC2005.pdf>

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