

**NAVAL POSTGRADUATE SCHOOL
Monterey, California**



THESIS

**PROCESS DEVELOPMENT FOR WEB-ENABLED
DOCTRINE: USING A COMMERCIAL OFF THE SHELF
(COTS) DISTRIBUTIVE COLLABORATIVE TECHNOLOGY
(DCT)**

by

Michael J. Harris
Rachel J. Velasco-Lind

March 2002

Thesis Advisor: Erik Jansen
Co-Advisor: Raymond Buettner

Approved for public release; distribution is unlimited

Report Documentation Page

Report Date 29 Mar 2002	Report Type N/A	Dates Covered (from... to) -
Title and Subtitle Process Development for Web-enabled Doctrine: Using A Commercial Off the Shelf (COTS) Distributive Collaborative Technology (DCT)	Contract Number	
	Grant Number	
	Program Element Number	
Author(s) Harris, Michael Velasco-Lind, Rachel	Project Number	
	Task Number	
	Work Unit Number	
Performing Organization Name(s) and Address(es) Naval Postgraduate School Monterey, California	Performing Organization Report Number	
Sponsoring/Monitoring Agency Name(s) and Address(es)	Sponsor/Monitor's Acronym(s)	
	Sponsor/Monitor's Report Number(s)	
Distribution/Availability Statement Approved for public release, distribution unlimited		
Supplementary Notes The original document contains color images.		
Abstract		
Subject Terms		
Report Classification unclassified	Classification of this page unclassified	
Classification of Abstract unclassified	Limitation of Abstract UU	
Number of Pages 82		

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
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 2002	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE Process Development for Web-Enabled Doctrine: Using a Commercial Off the Shelf (COTS) Distributive Collaborative Technology (DCT)		5. FUNDING NUMBERS	
6. AUTHOR (S) Michael J. Harris and Rachel J. Velasco-Lind		8. PERFORMING ORGANIZATION REPORT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)		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 U.S. 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) Navy Warfare Development Command has established Web-Enabled Doctrine (WED) in an effort to enable the Navy's transition from platform-centric operations to Network Centric Operations. The focus of this research is to describe, analyze, and evaluate the current process of developing Navy Doctrine and whether that process can be enhanced with a commercially available distributive collaborative technology (DCT). The goal of WED is to ensure that Navy Doctrine remains operationally relevant and directly connected with the Fleet. WED hopes to accomplish this by active Fleet participation in doctrinal development and reducing timelines. The Chief of Naval Operations has set forth several priorities for the 21 st century Navy, which include service unification, improved current and future readiness, and the leveraging of enabling technologies. Several commercially available DCT products appear promising to enable the Navy's transformation to web based Doctrine development. This research focuses on one such product to determine the adaptability of a DCT to the Navy Doctrine process. The process uses an information system network that allows personnel the ability to remain readily engaged in the form of discussion groups during doctrinal development. This reduces cost, time, and incorporates lessons learned from subject matter experts in the Fleet.			
14. SUBJECT TERMS Web-Enabled Doctrine, Commercial Off the Shelf (COTS), Distributive Collaborative Technology, Doctrine Process		15. NUMBER OF PAGES 82	
17. SECURITY CLASSIFICATION OF REPORT Unclassified		18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified
			20. LIMITATION OF ABSTRACT UL
			16. PRICE CODE

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

**PROCESS DEVELOPMENT FOR WEB-ENABLED DOCTRINE: USING A
COMMERCIAL OFF THE SHELF (COTS) DISTRIBUTIVE COLLABORATIVE
TECHNOLOGY (DCT)**

Michael J. Harris
Lieutenant, United States Navy
B.B.A., Iowa State University, 1995

Rachel J. Velasco-Lind
Lieutenant, United States Navy
B.S., Northern Arizona University, 1994

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS AND OPERATIONS

from the

**NAVAL POSTGRADUATE SCHOOL
March 2002**

Authors: Michael J. Harris

Rachel J. Velasco-Lind

Approved by: Erik Jansen
Thesis Advisor

Raymond Buettner
Associate Advisor

Dan C. Boger, Chairman
Information Systems Academic Group

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Navy Warfare Development Command has established Web-Enabled Doctrine (WED) in an effort to enable the Navy's transition from platform-centric operations to Network Centric Operations. The focus of this research is to describe, analyze, and evaluate the current process of developing Navy Doctrine and whether that process can be enhanced with a commercially available distributive collaborative technology (DCT). The goal of WED is to ensure that Navy Doctrine remains operationally relevant and directly connected with the Fleet. WED hopes to accomplish this by active Fleet participation in doctrinal development and reducing timelines. The Chief of Naval Operations has set forth several priorities for the 21st century Navy, which include service unification, improved current and future readiness, and the leveraging of enabling technologies. Several commercially available DCT products appear promising to enable the Navy's transformation to web based Doctrine development. This research focuses on one such product to determine the adaptability of a DCT to the Navy Doctrine process. The process uses an information system network that allows personnel the ability to remain readily engaged in the form of discussion groups during doctrinal development. This reduces cost, time, and incorporates lessons learned from subject matter experts in the Fleet.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I. INTRODUCTION	1
A. PURPOSE	1
B. RESEARCH QUESTIONS	3
1. Primary	3
2. Secondary	4
C. THESIS OUTLINE	4
D. METHODOLOGY	5
E. EXPECTED BENEFITS OF THIS THESIS	6
II. BACKGROUND	7
A. THE ROLE OF DOCTRINE IN THE U.S. NAVY	7
B. NETWORK CENTRIC OPERATIONS (NCO)	8
C. U.S. NAVY DOCTRINAL PROCESS	11
1. Traditional Doctrine Process	11
2. Web-Enabled Doctrine (WED) Process	18
III. COMMERCIAL OFF THE SHELF AND DISTRIBUTIVE COLLABORATIVE TECHNOLOGY	21
A. COMMERCIAL OFF THE SHELF (COTS)	21
1. The Burden of COTS	24
2. The Benefits of COTS	25
B. DISTRIBUTIVE COLLABORATIVE TECHNOLOGY (DCT)	26
C. COTS DCT PRODUCT REVIEW	28
IV. COTS DCT WITHIN THE NAVY DOCTRINAL PROCESS	37
A. APPLICABILITY OF COTS DCT WITHIN THE NAVY	37
B. APPLYING COTS DCT TO THE DOCTRINE PROCESS	38
C. THE VITEPROJECT MANAGER	42
1. VITEPROJECT Model	44
2. Analysis of COTS DCT and Traditional Doctrine Process Using VITEPROJECT Manager ...	47
V. CONCLUSIONS AND RECOMMENDATIONS	53
A. CONCLUSIONS	53
B. RECOMMENDATIONS	55
C. SUGGESTED FURTHER STUDIES	55
APPENDIX	57
LIST OF REFERENCES	59
BIBLIOGRAPHY	63
INITIAL DISTRIBUTION LIST	67

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

Figure 1.	Platform-Centric Operations [Ref. 11].....	8
Figure 2.	Network-Centric Operations [Ref. 11].....	9
Figure 3.	Links and Nodes of NCO [Ref. 11].....	10
Figure 4.	Doctrine Development Process [Ref. 14].....	16
Figure 5.	Fundamental Doctrine Development Process.....	17
Figure 6.	WED Screen Shot [Ref. 17].....	19
Figure 7.	Fundamental Change to COTS [Ref. 23].....	23
Figure 8.	Appmail Message [Ref. 30:p. 3].....	29
Figure 9.	Interactive Web Page [Ref. 30:p. 9].....	34
Figure 10.	DCT Doctrine Development Process [Ref. 32].....	41
Figure 11.	Current Doctrine Model [Ref. 32].....	46
Figure 12.	DCT Doctrine Model [Ref. 32].....	47
Figure 13.	Current Doctrine Process Gantt Chart.....	50
Figure 14.	DCT Gantt Chart.....	51

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1.	Zaplet™ Building Block Library [Ref. 30:p. 6].....	31
Table 2.	VITEPROJECT Symbolization [Ref. 32]	43
Table 3.	CPM Cost and Duration Results [Ref. 32]	48
Table 4.	Simulation Cost and Duration Results [Ref. 32]	48

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGEMENTS

The authors appreciate the diligent guidance of our thesis advisors, Dr. Erik Jansen and LCDR Raymond Buettner, USN, throughout the writing portion of this thesis.

The authors thank Mr. Eugene Levitsky and Mr. David Roberts of Zaplet Inc., for their candor and insights regarding distributive collaborative technologies and process engineering.

The authors thank members of the Navy Warfare Doctrine Command's Doctrine department, especially Mr. Seerden and Mr. Gabor.

The authors thank Dr. John Arquilla and LCDR Steve Iatrou for their support and guidance.

Mike: Sally, I would like to thank you for your understanding, support, and thoughtfulness; without it the NPS experience would not have been as worthwhile. I would also like to thank Teresa and Victoria for helping me keep my perspective in line. A special thanks to Cy and his many feathered friends for their unique way of allowing me a stress release.

Rachel: I would like to thank my family and friends for their endless support. Eric, thank you for your undying support throughout my NPS experience and life. You truly are my best friend. I would also like to thank my son, Daniel. Danny Boy you are my "Poges." You have definitely redefined what really counts in life. And to the Short Bus... Mike and I could not of done this without you.

I. INTRODUCTION

The introduction of a new technology into the military places in jeopardy -- and indeed may even destroy--many long-standing "mores and structures" of the established military society. - Elting Morison [Ref. 1].

A. PURPOSE

September 11, 2001, introduced the United States (U.S.) to a new kind of war. The U.S. has undertaken the challenge of locating and bringing to justice terrorist networks and those who harbor them. The first step in this challenge is Operation Enduring Freedom. The involvement of U.S. Armed Forces in disabling a terrorist network differs from the traditional warfare of the past. This fundamental shift in strategy, Doctrine and tactics characterizes an ongoing trend in the revolution in military affairs (RMA) [Ref. 2:p. 125].

The Navy is aggressively pursuing the benefits of the RMA. The RMA revolves around information. Information, information processing, and communications networks are at the core of every military activity [Ref. 3:p. 8]. Attaining Information Superiority implies transforming information into superior knowledge and decisions [Ref. 3:p. 8]. Long term success requires translation of this information and knowledge into Doctrine through concept development.

Military Doctrine plays a critical role in how the U.S. will employ its Armed Forces in its war against terrorism. Doctrine provides commanders the knowledge base

needed to process information and employ courses of action (COA). Without Doctrine, commanders would have to go through lengthy and timely steps such as: gathering and evaluating information, providing a COA, submitting it for approval up the chain of command (COC), waiting for a response, and, based on the response, gathering assets necessary to fulfill the COA, before finally executing actions. Doctrine already incorporates these steps and provides guidelines for COAs. The inputs to military Doctrine include current policy, available resources, current strategy, current Doctrine, threats, history and lessons learned, strategic traditions, fielded and emerging technology, geography and demographics, and type of government [Ref. 4:p. 30].

The war on terrorism represents an asymmetrical type of warfare that U.S. forces must deal with in the future. U.S. forces have two choices: rely on Doctrine already in place or develop and implement Doctrine as the war continues. To ensure military Doctrine remains a living, fluid document demands that the military to do the latter. In order for Doctrine to be effective, a force must conduct parallel technological and doctrinal development [Ref. 5:p. 17].

The Navy Warfare Development Command (NWDC) has established Web-Enabled Doctrine (WED) in an effort to enable the Navy's transition from platform-centric operations (PCO) to Network Centric Operations (NCO). The Navy's traditional Doctrine development process consisted of thirteen steps, which resulted in a slow, timeline driven process. NWDC has embraced the concept of WED to

speed this process up. WED is to be content driven. The WED breaks new ground by incorporating widespread input into its development of Doctrine. NWDC envisions the WED to be "authored" by the Fleet, to include widespread deckplate level engagement in the process; WED should reduce the process timeline to days or weeks vice months or years, become a responsive system, and maintain relevant, current Doctrine and Tactics Techniques and Procedures (TTPs) [Ref. 6].

There are many commercial off the shelf (COTS) distributive collaborative technologies (DCT) available. If implemented appropriately a COTS DCT can enable the WED process. The primary focus of this research is to determine whether COTS DCT have the potential to more effectively and efficiently enable the Navy Doctrine process. The success of this dynamic development process is important in today's RMA because a lack of Doctrine development either can stifle an emerging RMA or lead to defeat by a force that has taken advantage of an RMA [Ref. 5:p. 17].

B. RESEARCH QUESTIONS

This study provides baseline knowledge of the Navy Doctrine process. This research examines how to determine COTS DCT's adaptability to the Navy Doctrine process.

1. Primary

Do commercial off the shelf distributed collaborative technologies have the potential to more effectively and efficiently enable the Navy Doctrine process?

2. Secondary

- What processes are involved in Navy Doctrinal development?
- How can a COTS DCT improve the Doctrine process?

C. THESIS OUTLINE

This study begins with a description of the role Doctrine plays in the U.S. Navy in Chapter II. This section of the study reviews the literature, including Naval Warfare Publications. A flowchart represents the traditional Navy Doctrine process.

Chapter II continues with a brief description and justification of NCO. Research for the NCO portion of the study consisted of reviewing a Capstone Article, relevant literature, NWDC's website, and various other websites. Leaders in today's Navy believe the future lies in NCO. The Navy's shift from PCO to NCO leads to the *Navy after Next*. The WED is a major step down the road to NCO.

Chapter II concludes with a description of U.S. Navy doctrinal development process. This is divided into two sections. The first section describes the doctrinal development process that NWDC has used since 1998. This process is referred to as the traditional doctrinal process. The second section concludes with the WED process. The WED process has been in place since February of 2001. The model of the WED process is being used to facilitate the future development of other U.S. Navy publications. Presently WED is a web-based newsgroup model designed to increase Fleet participation in the doctrinal

development process. Research for this portion of the study consisted of a literature review, the NWDC website, PowerPoint presentations, and email correspondence.

Chapter III begins by defining and discussing the purpose of COTS and DCT. DCTs are becoming commonplace throughout the civilian sector and are credited with making the decision processes more efficient and effective. Due to rapid technological developments, COTS products appear to offer system enhancements faster than products of custom development. This section explores the benefits and burdens of COTS products followed by a product overview of a COTS DCT.

Chapter IV examines the applicability of a COTS DCT product to the Doctrine development process. The chapter investigates how a COTS DCT can be adapted to the Navy's doctrinal process. The model chosen for this study is VITEPROJECT. VITEPROJECT is used as an exemplar to demonstrate the benefits of using a COTS DCT in the Doctrine development process.

Chapter V, the final chapter, presents conclusions and recommendations based on the analysis of applying a COTS DCT to the Navy's doctrinal process. A discussion of how COTS can improve WED is included. Areas for further research are discussed.

D. METHODOLOGY

Information collected in this study includes a literature review, interviews, email correspondence, and information gathered via the web. The information collected for the background of Navy Doctrine and WED were

gathered through literature reviews, PowerPoint presentations from the NWDC website, and interviews through email correspondence. Information collected for COTS and DCT were gathered through a literature review. Data collected for Appmail were gathered by a literature review, interviews and at the Zaplet website.

An unstructured interview was conducted with Zaplet's Vice President of Sales and Co-founder into COTS DCT as an evolving technology. The interview also provided a thorough explanation of their DCT.

The comparison and analysis portion of this study uses VITEPROJECT software. Two models were derived to illustrate the traditional Doctrine process with and without a COTS DCT product.

E. EXPECTED BENEFITS OF THIS THESIS

This thesis provides a stepping-stone for COTS adaptability to Naval systems. With greater collaborative abilities, future face-to-face meetings are likely to occur less frequently and allow more on station time for warfighters.

This thesis was motivated by the desire for Navy Doctrine to remain a living, fluid knowledge base. Adapting a COTS DCT to the Navy Doctrine process seems to be a promising approach to ensuring the parallel development of technology and Doctrine.

II. BACKGROUND

A. THE ROLE OF DOCTRINE IN THE U.S. NAVY

Webster's Dictionary defines Doctrine as, "a principle or position or the body of principles in a branch of knowledge or a system of belief" [Ref. 7:p. 342]. For the warfighter, the following is a more practical description:

Military Doctrines are beliefs or teachings, which have been reasoned from principles; that is, they flow from principles as a source. They are intended to be general guides for the application of mutually accepted principles...and...a practical basis for coordination under the extremely difficult conditions governing contact between hostile forces [Ref. 8:p. 334].

In order for Doctrine in the military to be successful, it must function at the strategic, operational, and tactical levels of warfare [Ref. 9:p. 2]. In addition, Doctrine must function for each individual service in the armed forces, in multi-service or joint contexts, and in multi-national or combined contexts.

The vital role of Navy Doctrine contributes to the success of the Navy's decentralized command structure. Because of the decentralized command structure the Navy has the ability to react and or act quickly. Web-Enabled Doctrine combines an old concept of coordination (Doctrine) with new information technology. It seems to hold the

promise, when fully developed, of providing Navy warfighters the ability of rapid independent action.

The Navy, along with the rest of DoD, is trying to enact a Revolution in Military Affairs (RMA). The RMA revolves around information. Information, information processing, and communications networks are at the core of every military activity [Ref. 3:p. 8]. Attaining Information Superiority implies transforming information into superior knowledge and decisions [Ref. 3:p. 8]. Doctrine is central to this effort.

B. NETWORK CENTRIC OPERATIONS (NCO)

In order to understand the importance of WED, we first look at Network Centric Operations (NCO). The NCO concept is the organizing principle for developing future Navy forces [Ref. 10:p. 6]. This transformation into the Navy *after Next* requires a shift from platform-centric operations (PCO) to NCO. Figure 1 demonstrates how PCO center on individual entities that make up a larger entity or group, but lack continuity with each other. NCO, on the other hand, contains the vital continuity lacking in PCO as illustrated in Figure 2.

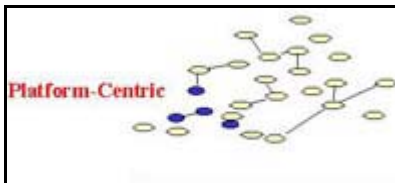


Figure 1. Platform-Centric Operations [Ref. 11]

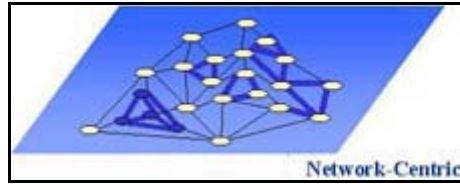


Figure 2. Network-Centric Operations [Ref. 11]

This shift from PCO to NCO provides a vision for the Navy's modernization of its Fleet and dramatically changes its warfighting capabilities and operations [Ref. 12:p.33].

The Navy's initiative to change its warfighting capability is driven by the following: joint, effects-based combat, reliance on information superiority, and the potential for adversaries to quickly develop technology for asymmetric use against U.S. forces. PCO prevent U.S. Naval Forces from achieving their full information advantage in a timely manner. Such an information advantage is imperative in order for U.S. Naval Forces to counter the above-mentioned, asymmetric threats. The four supporting concepts of NCO that are considered foundational to ensuring the U.S. Navy's ability to achieve information superiority are: gaining information and knowledge advantage, assured access, effects-based operations (EBO), and forward sea-based forces.

NCO are designed to effectively pair networking and information technology with EBO.

It will exploit state-of-the art information and networking technology to integrate widely dispersed human decision makers, situational, and targeting sensors, and forces and weapons into a highly adaptive comprehensive system to achieve

unprecedented mission effectiveness [Ref. 13:p. 1].

These network centric capabilities enable a geographically dispersed naval force to meet its desired objectives. The objectives are accomplished through NCO links sensors, shooters, and command-and-control nodes. Figure 3 illustrates these links and nodes. The nodes and links of the network enable an economy of force through enhanced speed of decision-making and rapid self-synchronization. With greater operational demands and fewer assets, economy of force is vital in today's Navy, making NCO ideal.

We must use and work with current assets and capabilities while continuing to improve upon them. The use of new capabilities must be balanced within the future Navy while complementing our legacy forces [Ref. 10: p. 33]. Developing this balance while moving the Navy to NCO requires the co-evolution of Doctrine, organization, education, and technology [Ref. 10: p. 33].

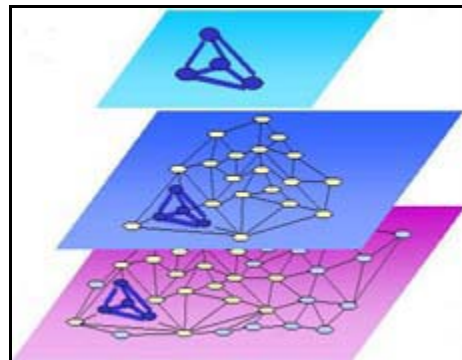


Figure 3. Links and Nodes of NCO [Ref. 11]

WED is at the forefront of the evolving technology that allows the Navy to accomplish NCO. WED is part of a dynamic process that allows NWDC to develop or continuously update Navy Doctrine Publications (NDPs), Navy Warfare Publications (NWPs), Navy Tactics, Techniques, and Procedures (NTTP), and the Navy Lessons Learned System (NLLS). The WED as a dynamic tool is able to collect and distribute vital information throughout a network. Primary sources of information for the WED are through collaborative Fleet dialogue, Fleet Battle Experiments (FBE), modeling, and simulation. The WED is designed to ensure the rapid development of joint-compatible Doctrine and operational concepts. By embedding naval assets within this information network and infrastructure, adjustments and adaptations to a situation within a battlespace can occur dynamically as they emerge [Ref. 13:p. 2].

C. U.S. NAVY DOCTRINAL PROCESS

This section discusses the two current methods of creating Navy Doctrine. The first part discusses the U.S. Navy doctrinal process created by NWDC. This process is referred to as the traditional Doctrine process. The second part discusses the WED process introduced in February of 2000.

1. Traditional Doctrine Process

The process of developing Doctrine is complex. The Navy's Doctrine Process is a decentralized sequential process. Taking an idea or concept from initial thought to a finished document is a lengthy process. It entails

planning in order to work. Several factors and processes work together as well as oppose one another. Figure 4 illustrates this process.

The transition from idea to Doctrine begins with a proposal. Proposals identify a deficiency or the need to update current Doctrine. Theoretically, any person can initiate a proposal, but the Primary Review Authority (PRA) usually initiates proposals. The PRA, which is assigned by NWDC, is a command with expertise in the proposal area. PRAs can be an individual command, a Warfare Center of Excellence, or from the office of the Chief of Naval Operations (OPNAV). Most proposals are discussed and endorsed in a meeting called the Navy Doctrine Working Party (NDWP) [Ref. 14:p. 3-2].

While this thesis focuses on the overall Doctrine process, the NDWP needs to be discussed in a broad sense. NDWP is a bi-annual forum in which many items concerning current and emerging Doctrine and tactics are discussed. The NDWP also serves to consolidate Fleet inputs and validate proposals. An Executive Steering Committee (ESC) heads this forum. Its members include representatives from the three geographic Commander in Chiefs (CINCs): Commander in Chief Atlantic Fleet (CINCLANTFLT), Commander in Chief Pacific Fleet (CINCPACFLT), and Commander in Chief U.S. Naval Forces Europe (CINCUSNAVEUR). The committee also includes representatives from Commander, U.S. Naval Forces Central Command (COMUSNAVCENT). The final member of the committee is the Facilitator, Commander, and Navy Warfare Development Command. These members make up the voting body that determines which ideas become proposals [Ref. 15].

Membership to the NDWP is not limited to the ESC but includes advisory members and observers. Advisory members are representatives from numbered Fleet Commands, Type Commands, Carrier Groups, Destroyer Groups, and Amphibious Groups. Advisory members are officially invited and are responsible for providing recommendations on doctrinal issues and articulating operational concerns. Observers are the other Navy organizations that have requested to attend the round-table [Ref. 15].

NWDC is responsible for all Doctrine affecting the Navy. They validate all proposals or program directives (PD) issued by OPNAV or a PRA. Validation is necessary to determine the need for new Doctrine or an existing insufficiency in current Doctrine. Proposals have to be well articulated and in a specific format to receive approval. Those proposals and or PDs considered inadequate are returned for further revision or terminated [Ref. 14:p. 3-2].

NWDC endorses the proposal and then issues a Program Directive (PD). A PD sent by formal Navy message provides the preliminary documentation needed for planning and resource allocation in the development or revision of Doctrine. The PD identifies the scope of the publication to be produced, the audience and other publications affected by the Doctrine project, milestones, and administrative items. It also designates the primary actors assigned to the Doctrine development task. The main actors are the PRA, Coordinating Review Authority (CRA), Technical Cognizant Office (TCO), and NWDC Action Officer [Ref. 14:p. 3-3].

The PRA is responsible for all doctrinal publications assigned to them from "cradle to grave." This includes developing, coordinating, reviewing, and maintaining the publications. The CRA is responsible to the PRA and assists the PRA in performing its assigned tasks. The CRA assists in developing the draft, performing necessary research, and providing comments where appropriate. The CRA is the liaison between the Fleet and the PRA. The TCO is responsible for money and resources. The TCO ensures that appropriate funds, technical support, and manpower are programmed and available. The NWDC Action Officer is the liaison between the PRA and NWDC [Ref. 14:p. 2-4].

Composing the draft is the next stage in Doctrine development. Before actual composition, the PRA along with the CRA designate Contributing Commands (CCs) [Ref. 14:p. 3-3]. CCs provide technical and tactical input for the publication. The PRA and CRA determine the CC's responsibilities [Ref. 14:p. 2-7].

The PRA, together with the CRA, TCO, and CC, develops an outline from information contained in the proposal, PD, Navy Lessons Learned Library (NLL), After Action Reports, operation tests, Fleet Battle Experiments (FBE) and various available sources. NWDC receives the outline for approval. At this point, the proposed document is at its most vulnerable. NWDC can terminate the entire project if it finds that the proposed Doctrine is not necessary or return the outline to the PRA for further development. NWDC also has the option of sending the project back to the proposal stage for re-evaluation and thus starting the process over again.

Once the outline has been approved, the PRA, in order to minimize delays, has to establish a date after which no new information will be accepted, with the exception of safety related findings or critical requirements [Ref. 14:p. 3-3].

From the outline, the PRA creates a draft. This draft is sent to the CRA, CC and NWDC, as it is developed. The CRA and CC are required to review and make comments as necessary. The PRA and CRA may restrict the CC to advisory comments only if they see fit. The PRA resolves comments by the CRAs and CCs. If the PRA cannot resolve the comments, then the NWDC becomes the adjudicating authority on Navy Warfare Publications. For publications other than NWPs, resolution could be an endless loop between the CRA and PRA [Ref. 14:p. 3-4].

Once the draft has been resolved, NWDC conducts a final review of the document. NWDC endorses and forwards the document to the Technical Publications branch for distribution [Ref. 14:p. 3-5].

This process is repeated for revisions, changes, and reviews. Usually reviews are required at two to three year intervals depending on the publication [Ref. 14:p. 3-6]. Revisions occur at intervals no greater than ten years [Ref. 14:p. 3-2]. There is no established timeline for the doctrinal process; however, this process may take up to eighteen months. Although timeliness is necessary, quality content is a more highly desired outcome.

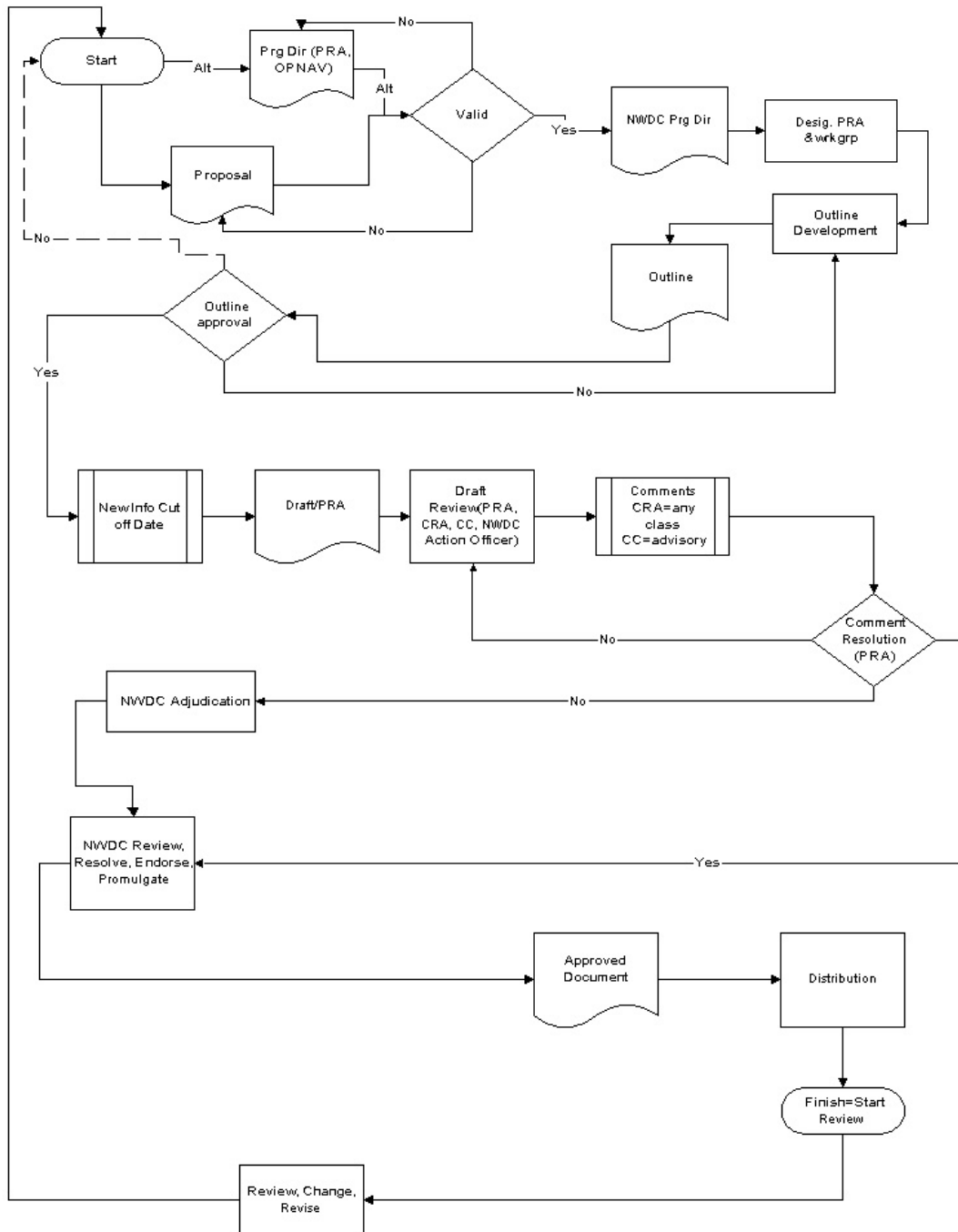


Figure 4. Doctrine Development Process¹ [Ref. 14]


¹  Signifies a predefined process

Figure 5 represents the fundamental Doctrine development process. Decision points are removed because, for Doctrine to be completed, all decisions require a "yes." Once a proposal is made, a PD is issued. The PD identifies the project leader and other supporting project members. Research and analysis of the PD and proposal begin after the work group is identified. An outline is then created, and a draft is developed. The members of the project team review and scrutinize the draft. Project leaders make resolutions to the draft after the review process. The resolved document is forwarded for further review and revision. This process produces the final Doctrine document. The approved document is sent to publishing for distribution to the Fleet. After a specified amount of time, the document is reviewed, and the process begins again.

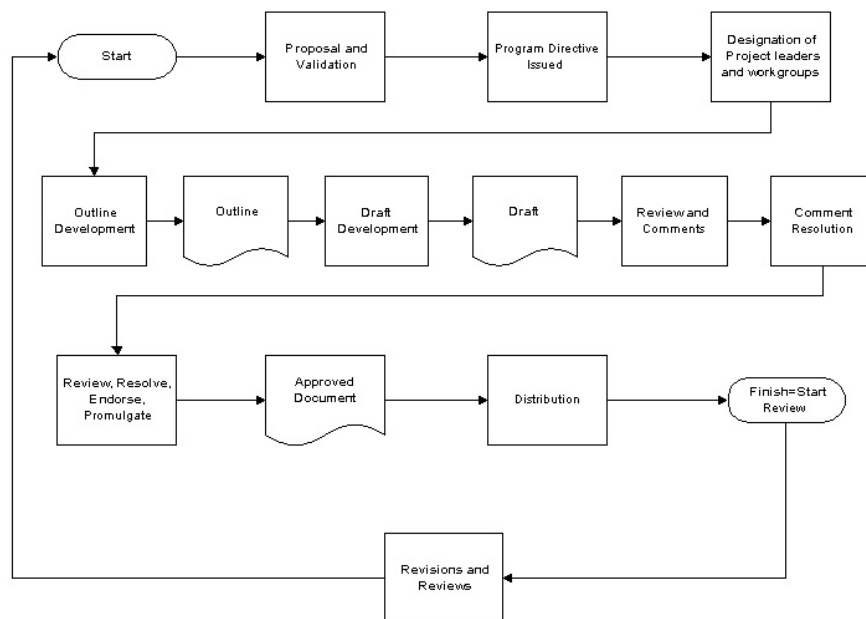


Figure 5. Fundamental Doctrine Development Process

2. Web-Enabled Doctrine (WED) Process

Web-Enabled Doctrine (WED) is a means to provide operationally relevant Doctrine to the Fleet. WED enables the Fleet to participate in the development of Doctrine in ways other than testing. Embracing the concept of WED enables the Navy to accelerate its transformation to NCO. The WED has been online for over a year. It is a dynamic process meant to capture, develop, and validate doctrinal insights from proven at-sea experience. WED requires the experience of the sailor on the deck plates who incorporates Doctrine into their daily routines.

The WED process parallels the traditional process previously discussed. It is initiated by a Navy major command, Warfare Center of Excellence, or senior leadership board [Ref. 2:p. 73] that presents a proposal to the Navy Doctrine Working Party (NDWP).

Figure 6 is a screen shot of the current WED comment entry site. This form, much like a network trouble call form, is designed to accept input from the fleet. This first step towards collaborating in a distributive environment is currently cumbersome and difficult to use. The sailor who operates the equipment still has to get his idea to the initiating entities discussed above. The comment that sent via the web site becomes an internal working memorandum that is visible to those who have access. The progression of the comment is not as readily visible, and, thus the initiator is left out of the rest of the process.

Post Comments

JP 3-60	Status:Preliminary Coordination
Subject(Title of you post): <input type="text"/>	
Page: <input type="text"/>	Paragraph: <input type="text"/>
Line Number: <input type="text"/>	Comment Characterization: Critical <input type="text"/>
Comments: <input type="text"/>	
Your E-Mail Address: <input type="text"/>	Attach File (if needed): <input type="text"/> Browse...
Name: <input type="text"/>	Command: <input type="text"/>
Billet: <input type="text"/>	Would you like to receive E-Mail notifications when new comments are posted on this pub? Yes: <input type="checkbox"/>
<input type="button" value="Post Your Comments"/>	

Figure 6. WED Screen Shot [Ref. 17]

WED is designed to enable the Fleet to enter into the development of Doctrine rather than restricting participants to senior level commands and leadership symposiums. Fleet involvement in the development process allows for engagement at the lowest echelons. The Fleet has first hand knowledge of its day-to-day operations. It is familiar with the employment of its systems and assets. WED is designed to enable sailors, whose lives revolve around their ships and their operations, to infuse innovative insights and practical experience into Doctrine.

Another aspect of WED is to reduce the time required for Doctrine development. The NWDC currently takes months or years to develop and produce Doctrine. WED makes possible a real time, collaborative, responsive system as opposed to waiting for Fleet or command input to be

processed, reevaluated, and disseminated for more assessment. By reducing the amount of time in the development process, it increases the likelihood the Fleet is in possession of the most relevant and current Doctrine at its disposal.

RMA requires a transformation of the U.S. military's "scattergun approach" to combat Doctrine, strategy, and tactics [Ref. 6:p. 23]. The envisioned WED is the enabler that allows the Fleet active participation in the entire development process from conception to the final document known as Doctrine.

III. COMMERCIAL OFF THE SHELF AND DISTRIBUTIVE COLLABORATIVE TECHNOLOGY

A. COMMERCIAL OFF THE SHELF (COTS)

Traditionally, purchases by the DoD were managed by a set of Federal Specifications (FEDSPECS) and Military Specifications (MILSPECS). FEDSPECS are standards that developers use to sell goods to the government. MILSPECS are the approval criteria for purchases for military use. As the government used these specifications as purchasing criteria, it resulted in increased costs and delays in access to new technology [Ref. 19].

As the progression of the RMA continues, the defense environment continues to change alongside it. For nearly 200 years, the tools and tactics of how we fight have evolved with military technologies [Ref. 18:p. 1]. In the past, militaries have been the creators and keepers of new technologies. During the 1970s, DoD COTS use was minimal. Because the commercial market sold items at a cheaper price, COTS products were used solely to save money in the 1980s. By 1990, money and time became huge factors in acquiring COTS products. Developing and fielding new systems became expensive and consumed large amounts of time. Today the developmental role has shifted to the common marketplace. The RMA is characterized by the co-evolution of economics, information technology, and business processes and organizations [Ref. 18:p. 2].

The fields of communications, electronics, and computers, and the pace of technological evolution resulting from high commercial demand outstrip the

capabilities of any government research and development (R&D) program [Ref.20]. The fact is that our traditional processes and strategies for acquiring, developing, fielding, and supporting weapons and business systems must be adapted to the world we live in [Ref. 21].

The beauty of COTS products is their applicability to a spectrum of systems. COTS have evolved to encompass a multitude of uses, especially within the area of information technology. They range from geographic information systems for command and control, product data management for sustainment support, and financial packages for comptrollers. The preference for COTS usage is demonstrated by DoD supporting and Congress passing the Federal Acquisition Streamlining Act (FASA) of 1994, Section 8104 [Ref. 22:p. 1]. COTS, by definition, are items customarily used for non-government purposes. COTS is further defined by DoD Directive 5000.2R as:

Any item that (1) has been sold, leased, or licensed to the general public; or (2) has been offered for sale, lease, or license to the general public; or any item that evolved through advances in technology or performance and that is not yet available in the marketplace, but will be available in the commercial marketplace in time to satisfy the delivery requirements under a Government solicitation [Ref. 22:p. 2].

The definition also includes services in support of a commercial item.

Because of shrinking budgets, COTS is ideal for many government agencies. Typically, the Navy or DoD would develop a system from cradle to grave. Developing a system

from cradle to grave includes identifying requirements, identifying, designing, and detailing architecture, subsystems and modules. Integrating the system and subsystem occurs after coding and debugging. Nevertheless, with COTS, there is a fundamental change from development to composition as shown in Figure 7. COTS allow an organization to construct a system from building blocks.

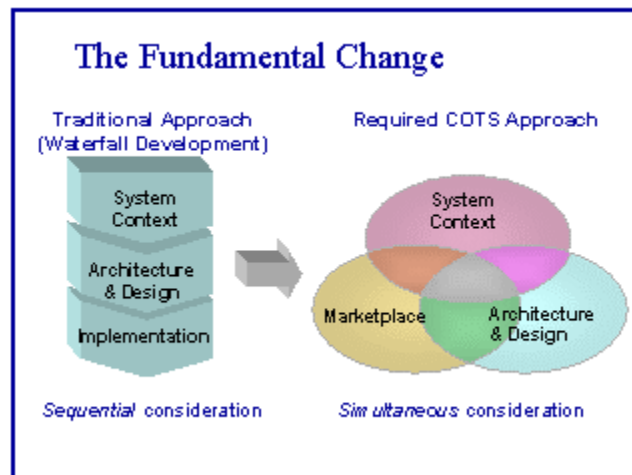


Figure 7. Fundamental Change to COTS [Ref. 23]

The fundamental change to COTS involves a dynamic interaction between the system context, marketplace, and the architecture and design. Market mechanisms allow for simultaneous consideration as opposed to the traditional sequential approach [Ref. 24:p. 5]. Because the traditional approach is sequential, system development is dependent on the success of the previous stage, which equates to consuming time. At the conclusion of this process, one hopes that the system satisfies the intent of the design. If the system does not satisfy its intent, money and time are wasted and the development of a new

system must begin. However, maximizing COTS can save time and money. COTS adapts requirements to the capabilities available in the marketplace rather than adapting commercial capabilities to DoD requirements [Ref. 24:p. 5].

The primary approach used in the acquisition of command and control and information systems is the buy-and-adapt Model [Ref. 25:p. 3]. As the model's name implies, the commercial system that meets most of the requirements is purchased. This system then is tailored to meet or overcome the deficiencies of the acquisition agency's requirements. This study uses a buy-and-adapt approach to COTS.

1. The Burden of COTS

A major disadvantage with COTS products is that they entail a set of trade-offs. When the Navy develops its own system, plans are in place for planned maintenance, parts replacements, and system upgrades. Specific requirements must be sufficiently flexible to accommodate a variety of available commercial products and their associated fluctuations over time [Ref. 26:p. 3].

If an organization cannot remain flexible when using COTS, then COTS becomes a burden within their system. Flexibility is mandatory because the inherent problem of continuous upgrading exists with COTS usage. The marketplace coordinates this need for continuous upgrading. Competition among COTS developers remains intense. Each developer strives to be the first to develop a faster more innovative product that is easily adaptable within a system of systems.

Integration can be accomplished via this same market logic. However, there will be occasions when the use of COTS, especially software, inevitably leads to integration concerns. One factor that comes into play when integration begins is compatibility. COTS upgrades may no longer be compatible. This incompatibility creates a chain reaction that has the potential to obstruct the entire system. For the DoD this is a critical concern. Blocking or stalling a Command and Control (C2) system while compatibility is being pursued is unacceptable. Foreseeing such integration problems requires strong acquisition and management programs and practices.

2. The Benefits of COTS

COTS products offer several benefits. They offer cost savings, greater choice, the newest and most innovative features, increased convenience and accessibility, bulk purchasing, and decreased redundancy and duplication [Ref. 19]. However, in order to reap the benefits of COTS, the organization has to be willing to accept the existing capabilities and limitations of the software. Failure to accept these terms results in COTS becoming a burden rather than a benefit. When considering COTS, there must be a complete understanding of the technology involved within the system.

Increased convenience relates directly to immediate availability. COTS products can be viewed and tested immediately [Ref. 27:p. 2]. Because COTS is readily available, it reduces the time required to implement a solution [Ref. 27:p. 1]. Solutions that are implemented

rapidly reduce project risk. There are no longer lengthy waiting periods or expensive expenditures before the final system can be viewed and tested [Ref. 27:p. 1].

Ready availability applies only to the COTS product itself. This benefit is available only to COTS products that are completely system compatible. If such compatibility is not reached, the result is delayed benefits. Nevertheless, once compatibility is achieved, the benefits of rapid technological advancement can be realized.

COTS are innovative in nature. The designers and developers of COTS concentrate on producing a product that is one step ahead of its competitors. This provides the benefit of greater choice and a broad industrial base. The ability to choose, as opposed to developing, the appropriate component saves time and money. Again choosing the appropriate COTS component for a system takes appropriate program management competencies to ensure that proper integration is attainable; otherwise, the benefits may not be realized.

Cost savings is the benefit most touted by COTS developers. Together with bulk purchasing, COTS offers a cheaper alternative to rapidly deploying the most innovated system components. It is cost-effective for DoD to have access to this state-of-the-art technology.

B. DISTRIBUTIVE COLLABORATIVE TECHNOLOGY (DCT)

Distributive Collaborative Technology (DCT) is one of the many refrains of the information revolution. To clearly understand DCT, a definition of distributive and

collaborative is needed. Distributive is defined in terms of the dispersed nature of networks and the people who use them, while collaborative is defined as working together and in cooperation. DCTs are products that synchronously or asynchronously enable many to many, one to many, and many to one communications [Ref. 28:p. 1]. These tools enable users to manage knowledge in a virtual domain through virtual collaboration.

Collaboration tools increase productivity by simplifying decision cycles in the Observe, Orient, Decide, and Act (OODA) Loop. Collaborative technology provides users with the ability to share information and make decisions in a near real time environment. Distances between users are not a factor [Ref. 28:p. 1]. The collaborative environment also fosters innovation through shared ideas [Ref. 28:p. 4].

Increasing numbers of networks and the startling growth of the Internet are the technical drivers of DCT. Changes in our culture and the desire for increasing efficiency are pushing collaboration to the forefront of business practices. Large numbers of people are choosing to work at home in order to enjoy more leisure time or increase their work capacity. There is a robust volume of information. Many large corporations are redefining their business practices to incorporate DCTs in order to make informative, rapid decisions [Ref. 28:p. 10].

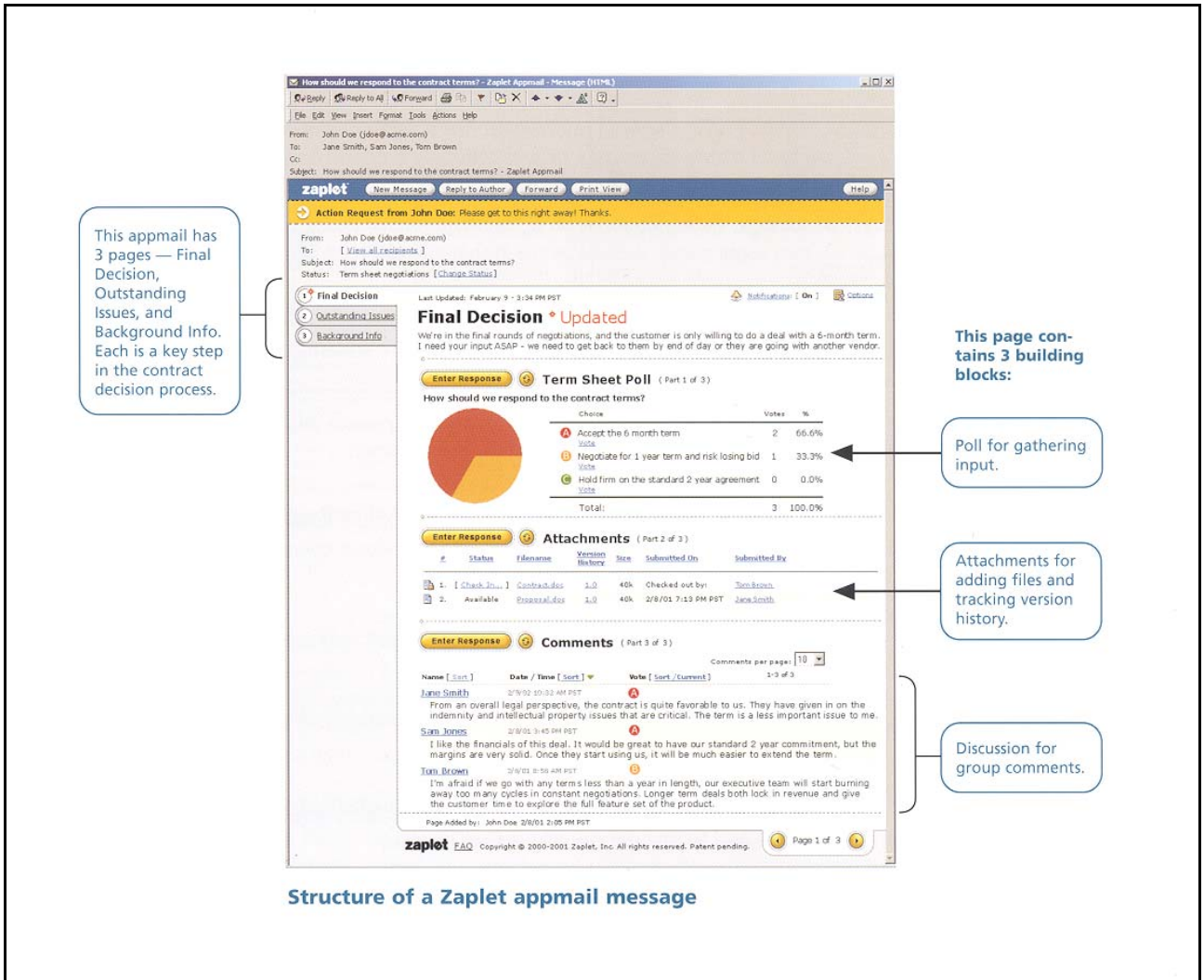
DCTs not only affect business corporations, they also affect other facets of life. The most common forms of DCTs are email and calendar software packages such as Microsoft Outlook. The U.S. military uses another collaborative

tool, the Global Command and Control System (GCCS) [Ref. 28:p. 1]. This system allows military units to observe the entire battlespace and make inputs visible to all system users.

C. COTS DCT PRODUCT REVIEW

Zaplet Inc. developed the Zaplet Appmail Suite™ as a server-based DCT. This DCT is the exemplar or model for this study, because it closely resembles the ideas of the envisioned WED. The Zaplet Appmail Suite™ provides technologies that allow people to collaborate and share information through the application of Appmail [Ref. 29]. The Appmail application provides a window to the server. It allows the user accessibility to the most current information.

The design of the Appmail application allows any user to initiate it. The project lead uses tools and building blocks provided by Zaplet to create the Appmail. The project lead initiates and develops the Appmail in a way that best suits the project [Ref. 30:p. 5]. Figure 8 displays the Appmail structure.



Structure of a Zaplet appmail message

Figure 8. Appmail Message [Ref. 30:p. 3]

Most employees spend a substantial amount of time checking their email. Appmail takes advantage of this phenomenon and uses email as a launch platform for its DCT. Most organizations use email programs such as Microsoft Outlook and Netscape Communicator. Appmail is applicable to these major email programs [Ref. 30 p.16]. Acting on the principles of email, the Appmail is sent and delivered to the inbox of the addressee. To display the latest collaboration requires the addressee to open the Appmail.

The Appmail automatically organizes, summarizes, and processes the contributions of each recipient and is continuously updated to reflect the latest input [Ref. 30:p. 4]. The project lead sends notification messages through email to its group to review, collaborate, and take action. Because pertinent information is located within the Appmail, members can render a decision, collaborate, or formulate a response. This saves team members time. They no longer have to process and read separate emails in a threaded discussion. Instead, their information is located in one email message.

Appmail is constructed by using a core of building blocks from the Zaplet Appmail Builder™. Table 1 illustrates the building block library.










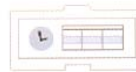




	Discussion: Initiate a discussion and view everyone's comments in one place. Use to brainstorm ideas and gather feedback.
	Poll: Gather opinions and feedback on a specific question. See voters' comments and a chart of the results.
	Interactive Web Page: Interact with web-based content, application, or service within the appmail.
	File Sharing: Distribute files for review and collaboration. A version control option allows participants to refer back to previous file versions.
	Inline Document: View an uploaded document inline within the appmail, eliminating the need to launch a separate application.
	Table: Create a table of information that a group can share and update. Useful for shared management tasks such as collecting data and tracking action items.
	Ratings: Gather opinions on up to 50 questions. Recipients respond to each question using a scale defined by the author and can see a chart of the results.
	Survey: Gather quantitative or qualitative feedback from recipients across multiple types of questions. Survey initiator can view dynamically tabulated results at any time and easily export merged data.
	Approval List: Request approval for any file, process, or issue. Participants can either approve or disapprove and share comments.
	Schedule: Arrange a meeting or event by specifying dates and times for group scheduling. Export agreed meeting time to desktop calendar application.
	Image: Display an image for sharing and review.
	Image Gallery: Display up to 36 images for sharing and review within the appmail.
	Invitation: Invite colleagues to meetings and other events, display event details, and collect RSVPs and comments from invitees.
	Information Fields: Build forms using fields such as name, date, and location.

Table 1. Zaplet™ Building Block Library [Ref. 30:p. 6]

Enabling specific functions, these building blocks contain user interface, data elements and processing capability [Ref. 30: p. 5]. These building blocks form the collaborative page. The collaborative page can be transformed into multiple pages. The project lead sets the pages in precedence to ensure that the proper process occurs. The project lead can edit, add, or delete the collaborative page even after the Appmail is sent.

An organization can save the Appmail application it built after its use. The application is saved and stored in a personal or shared folder, which is accessible to members within the organization. This saves time and diverts effort towards adjusting the blocks to accommodate a new task.

The Zaplet Appmail Starter SetTM is a collection of general-purpose applications. These applications address common business tasks and activities that occur among project teams and departments, such as coordinating meetings, sharing files, or gathering group input to formulate a decision [Ref. 30:p. 8].

The general-purpose applications are divided into three categories. They are Collect and Structure Feedback, Share Information, and Make Group Decisions. Collect and Structure Feedback consist of three subcategories: Discussion, Table, and Survey. The attributes of Discussion include the ability to rapidly solicit feedback and collect opinions viewed in a single location. The Table collects and structures common data. Survey gathers internal and external feedback and can be done with or

without anonymity. Respondents have the ability to change their vote or suggestion.

The Share Information category consists of the following subcategories: File Sharing, Inline Document, and Interactive Web Page. File Sharing is a means of distributing information to team members. Inline Document allows users to place a document directly within the Appmail, with full scrolling capabilities [Ref. 30:p. 9]. The Interactive Web Page is an embedded web page with full navigational capabilities within the Appmail (as opposed to having a link) [Ref. 30:p. 9]. Figure 9 displays the embedded web page.

The Make Group Decisions category includes the application of Poll, File Approval, and Ratings. The Poll application collects votes and comments in order to gain a census among the participants. Appmail displays the votes and comments. These results can be revealed at a specified time. The user is able to vote for more than one option, vote anonymously, or construct a secret ballot [Ref. 30:p 10]. The File Approval application brings people who are geographically dispersed together through a single Appmail in order to make an approval. It reduces the amount of time to gather relevant information for a presentation to the group through its design. The Ratings application is based on the author's rating scale. It presents preferences and opinions of the group.

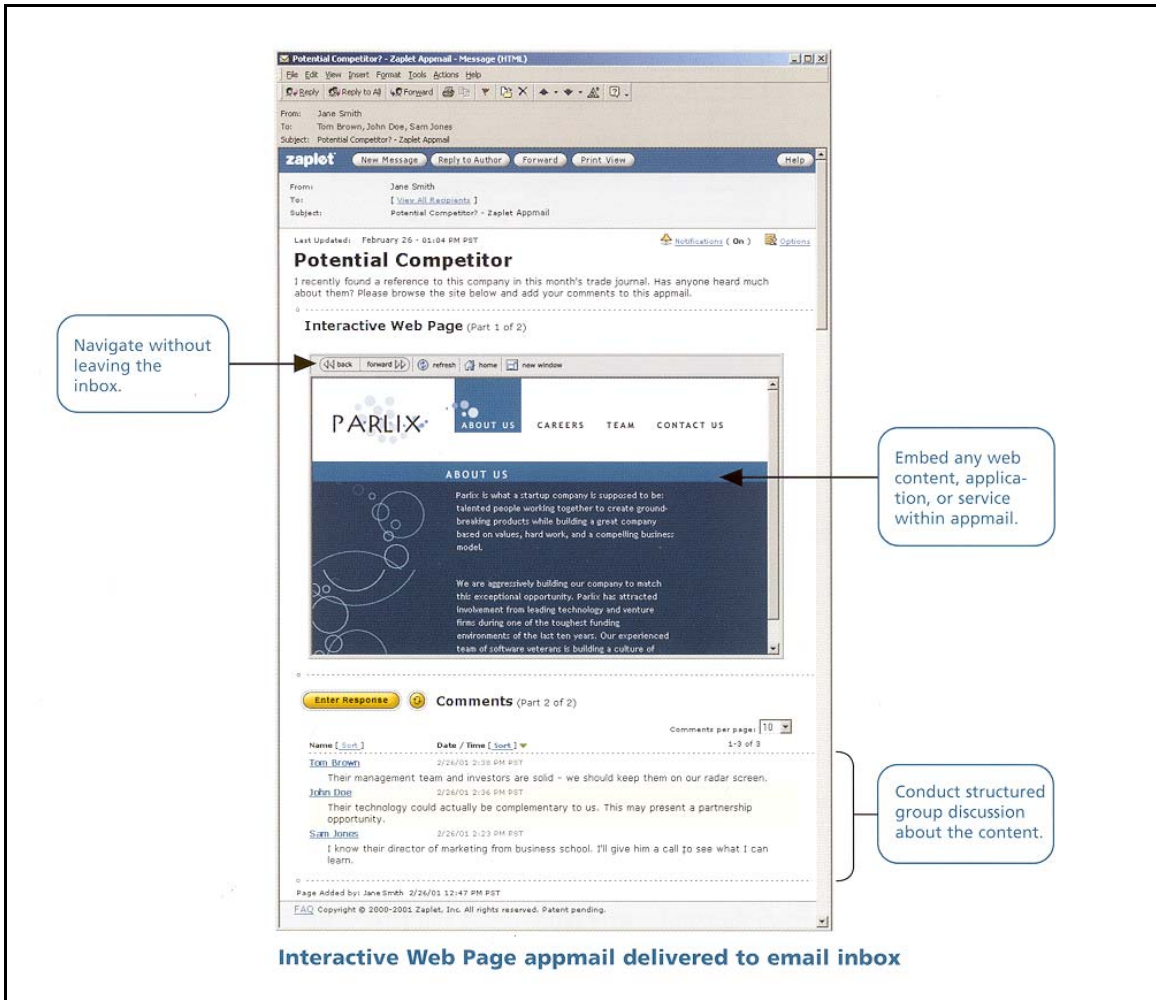


Figure 9. Interactive Web Page [Ref. 30:p. 9]

The Zaplet Portal™ is the secure, convenient web-based destination for users to access the tools and services needed to create, send, and manage Zaplet applications [Ref. 30:p. 13]. The Portal stores both sent and received Appmails in the user's personal archive

The Zaplet Appmail Server™ provides the infrastructure needed to use, develop, and deploy Appmail [Ref. 30:p. 15]. The Appmail Server contains platform services such as security, access control, notification, synchronization of

Appmail for offline use, and integration with corporate directories. These services enhance the value of Appmail to end users, while meeting enterprise requirements for broad deployment [Ref. 30:p. 15].

Appmail's security platform is a combination of existing security products and a unique security feature. The security framework is based on the standards of industry-leading security solutions already in place at the system level. User authentication and encryption are used to ensure the privacy of the user and sensitive data. The Server can be integrated with leading email and network systems to provide the convenience of a single sign-on to access the Appmail Suite [Ref. 30:p. 15]. This allows the Appmail Suite to provide seamless integration with the security environment and policies of the enterprise [Ref. 30: p. 15]

The Zaplet Appmail Server[™] allows secure collaboration through unique security features and can be coupled with other, existing security products. The Appmail and most of its content is located within the Appmail Server. Because all the applications for Appmail reside in the server, it prevents harmful content from being delivered to the client system of a recipient. The security platform offers the ability to restrict forwarding or restrict forwarding beyond the original recipient list. Appmail is maintained on a central server. It allows the information technology staff to have more control over attached files.

Access control is administered through Zaplet Portal[™]. The portal contains the list of registered users within the Suite. The author of the Appmail determines the list of

users who are able to view the Appmail, or the author may limit the visibility of pages or portions of the Appmail to certain users. Through the security framework, the Appmail Server can leverage existing access control databases within the enterprise to determine access privileges [Ref. 30:p. 15].

Notifications notify the user of changes to an Appmail or if the user's attention is required. Notifications do not necessary apply to the entire Appmail. Notifications can be directed to a specific portion of the Appmail. For example, in an Appmail with multiple tasks and discussions, the user may only wish to be notified when a schedule is updated, but not when comments are received [Ref. 30:p. 15].

Appmail demonstrates its dynamic ability by synchronizing Appmail for offline use. By synchronizing Appmail with the Zaplet Plug-in, a client-side software plug-in for Microsoft Outlook© 2000, the Appmail Server allows users to interact with any Appmail when offline [Ref. 30:p. 16].

Zaplet's DCT is simple and versatile. It is a collaborative application designed specifically for users of email in mind. The application uses email fundamentals as a launch platform, which is accessible through the users email inbox or web browser [Ref. Zaplet Meeting]. This DCT contains applications that can enhance the WED process. Chapter IV applies the Zaplet DCT to the WED process. The chapter uses VITEPROJECT Manager as the model to determine the effectiveness and efficiency of applying a COTS DCT to the WED process.

IV. COTS DCT WITHIN THE NAVY DOCTRINAL PROCESS

A. APPLICABILITY OF COTS DCT WITHIN THE NAVY

This section of Chapter IV discusses the applicability of Zaplet Appmail to the Navy Doctrinal process. The Doctrine development process is part of the Navy's legacy system. Changes to that legacy system often are met with resistance. Adapting to a new system is difficult. The user's comfort and confidence level may be decreased. Nevertheless, the fundamental shift to NCO forces legacy systems to adapt to the fast pace of evolving technologies. Zaplet's Appmail gives the Navy the ability to transform its Doctrine development process for the 21st century. The transformation is transparent. The launch platform for Appmail is email. The familiarity with email makes the applicability of Appmail to the Doctrine process easy.

Appmail uses applications and programs currently used within the Navy organization. The Navy is an asynchronous organization due to the dispersal of its ships. Technology, such as VTC, has allowed Naval units to overcome long distances for face-to-face collaboration. However, there are trade offs associated with VTCs. VTC requires a large amount of bandwidth. Smaller ships such as cruisers and destroyers lack the capability to support VTC due to bandwidth constraints. Although VTC can overcome distance, it has a drawback associated with time. Key personnel located throughout various time zones hinder collaboration through VTC. Personnel unable to participate in VTCs do not obtain the disclosed information delivered during the session. Zaplet's Appmail replaces the

requirement of attendance at meetings. Through Appmail's applications, personnel are notified through their email accounts of an updated information exchange. By accessing their email, users can display near real time information. The asynchronous characteristic of Appmail makes it an ideal collaborative tool for the Navy. NWDC desires a dynamically developed process for Doctrine. WED is the first step to achieving the goal of dynamic Doctrine. Figure 9 applies Zaplet to the Doctrine development process.

The next section describes the current Doctrine development process in four phases using Zaplet Appmail. During these phases, activities occur concurrently vice sequentially.

B. APPLYING COTS DCT TO THE DOCTRINE PROCESS

Phase One is Requirement Collection. In this phase, there are three activities: proposal and validation, program directive, and project assignments. These three activities are not any different from those previously described in Chapter II. All Doctrine starts as an idea formally introduced as a proposal. Once the proposal has been made, the PD and project assignments are developed. The difference with DCT enabled Doctrine development is the manner in which the activities are accomplished. All the activities in Phase One begin at the same time. Information and ideas are shared and exchanged continually in the mutual environment created by COTS DCT. With an application such as Appmail, the Fleet would be able to have some direct influence during the Doctrine development

cycle. As new items are posted, actors in the process are able to see new developments. As the proposal develops, NWDC can assign project team members and issue the directive to create Doctrine. The difference between the current Doctrine process and this process is a reduction of time in the decision loop. Take for example the proposal validation step in current Doctrine development. This step has the potential to backlog several actors waiting for a response from NWDC and, if there is a negative response, the result is a large amount of wasted time and energy to return to the start. The advantage with a COTS DCT is that the developers of Doctrine receive nearly immediate correction and direction. This results in a shorter length of time in a decision cycle and more time spent on developing an outstanding document.

The next Phase, collaboration to create, is where the Fleet can provide the most and arguably the best input. There are four activities; outline development, draft development, review, and comment resolution. The outline input and draft are sequential but also simultaneous. While the draft requires an outline, draft development can occur with the parts of the outline already approved. Review and comment resolution occurs throughout the entire phase of collaborate to create. Rework is not eliminated, but turnaround is shortened due the near simultaneous processing features with a COTS DCT.

The third Phase in this process is document production. The activities are endorsement, approval, and distribution. These tasks are mostly administrative. The entire document has been developed dynamically and the

approving authority has been involved since the inception of the original idea.

The fourth and final Phase is the feedback and review portion of the Doctrine development process. This phase is important because doctrinal ideas continue beyond publication. There are requirements for timely reviews, but this phase also allows input based on the intuition of the sailor and DCT provides a portal through which these insights can pass.

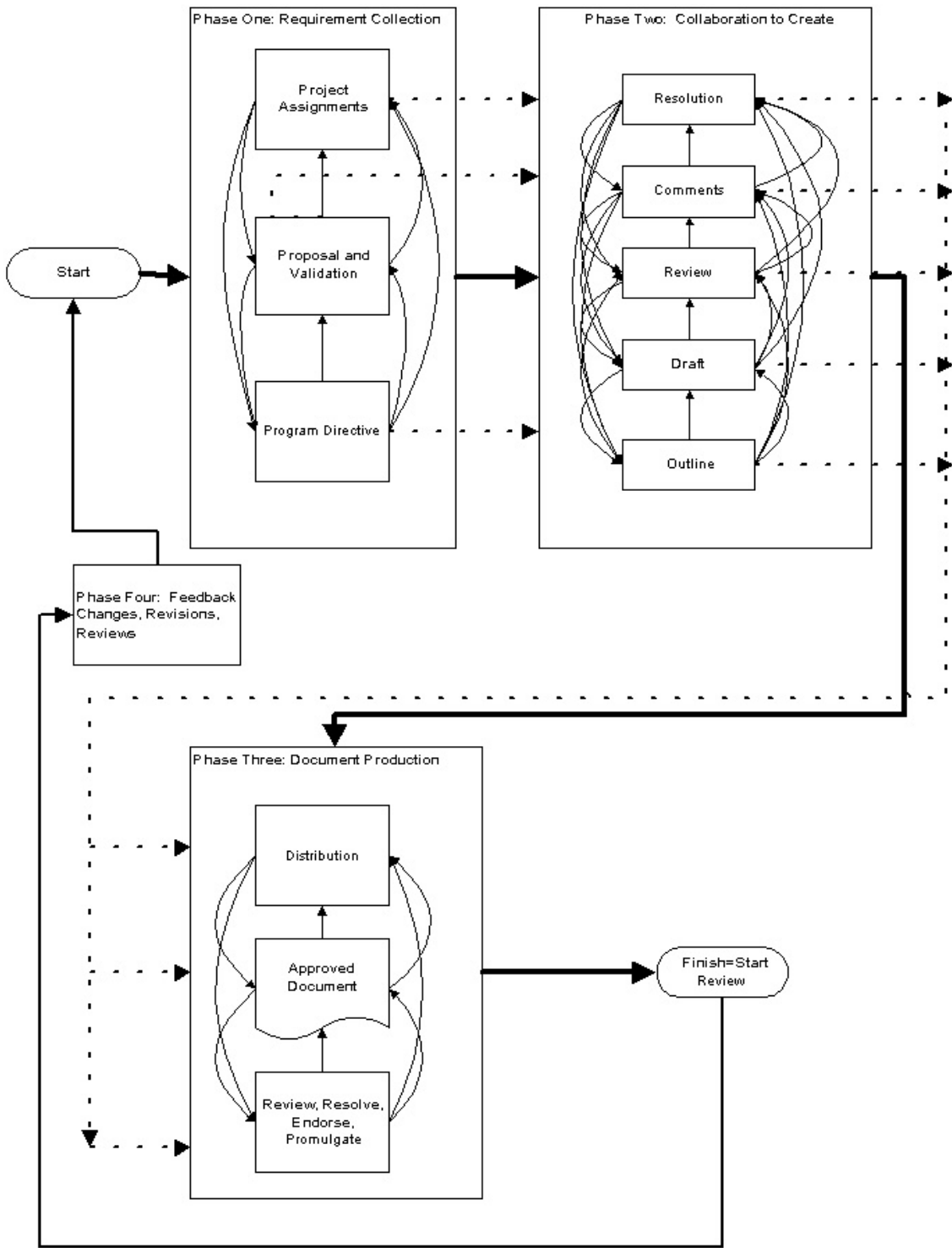


Figure 10. DCT Doctrine Development Process [Ref. 32].

C. THE VITEPROJECT MANAGER

VITEPROJECT is the application for modeling the Doctrine Development cycle. VITEPROJECT Manager is a management software package with a graphical user interface (GUI) developed by a group of researchers at Stanford University [Ref. 32]. This application is used in this study for modeling the Doctrine development process under two scenarios. This software package allows leaders and managers to develop and test work processes and related organizational structures in a benign environment. VITEPROJECT Manager can analyze both sequential and concurrent activities. VITEPROJECT allows managers to develop project models to examine the complex relationship between human and task accomplishment. Project managers can identify shortfalls and inefficiencies in the modeled plan through VITEPROJECT [Ref. 32].

The user develops the model using the VITEPROJECT framework. The activity portion of the model is developed first. These are the project's tasks, milestones, and meetings. The actor portion of the model is developed next. This portion contains the individuals and groups of individuals involved with and working on the project. Table 2 displays and defines the GUI for the first two portions [Ref. 32].

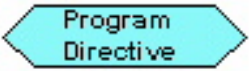


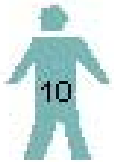



Symbolization	Description
	<p>Milestones: Key events or goals that must occur in the overall process. [Ref. 32: p.3-4]</p>
	<p>Activities: The processes or work accomplished before achieving the milestone. Activities have only one actor. [Ref. 32:p. 3-4]</p>
	<p>Precedence Relationships: Defines the flow of the process. [Ref. 32:p. 3-5]</p>
	<p>Actors: People or groups of people that do the work in the activity. Each actor is assigned at least one activity. Actors are linked to activities with a solid blue line. [Ref. 32:p. 3-5]</p>
	<p>Information Exchanges: Represents communications and the sharing of ideas. [Ref. 32:p. 3-11]</p>
	<p>Dependency Links: In complex projects with concurrent processes, some of the processes are dependent upon the completion of previous events or activities [Ref. 32:p. 3-11].</p>
	<p>Meetings: Meetings are linked to actors by gray dashed lines. [Ref. 32:p. 3-13]</p>

Table 2. VITEPROJECT Symbolization [Ref. 32]

The settings on the activity and actors are adjustable to increase or decrease the fidelity desired for the simulation and output of the model. For the purposes of this research, the model is set to the default settings [Ref. 32].

The simulation is the next step of the VITEPROJECT model. At this point, VITEPROJECT executes and simulates an actual working environment with predictable coordination and rework based on the actor and activity models. Depending on the model parameters, VITEPROJECT results are as detailed and specific as the parameters dictate. The detailed outputs from VITEPROJECT are displayed in Gantt charts, bar graphs, and line graphs [Ref. 32].

1. VITEPROJECT Model

This study uses VITEPROJECT to model and compare the current method of Doctrine development and a proposed COTS DCT method of Doctrine development. The models are heuristic and suggestive. (There is no single current method for developing Doctrine. The actual processes thus vary considerably around the ideal type presented as the current model.) The two models thus analyze total cost and duration under ideal conditions.

The work process plan for each scenario is represented within the framework provide by VITEPROJECT. Thus, the activities, meetings, and milestones from Figures 5 and 10 are placed into the model [Ref. 32:p 3-2 to 3-4]. The organizational structure is created to complete the activities defined in the previous step. Because the goal of this research focuses on task-technology processes rather than the assignment of responsibility in roles, the organizational structure was not modeled. Processes simply were assigned to unspecified "Actors". Actors are representative of the structural collection of individuals and teams that perform each activity [Ref. 32:p 3-5].

Thus, the models are set on default settings to hold non-process factors between the scenarios constant. Information exchanges and dependency links are inserted to illustrate the requisite interactions between tasks [Ref. 32:p 3-11 to 3-12].

Figure 11 illustrates the linear, sequential functional flow of work processes in the current Doctrine development process. In this model, dependent relationships are predefined due to the sequential nature of the process flow. *Meetings* are positioned in the model to illustrate the periodic need for coordination, project re-acquaintance, and review. Meetings also represent time away from the project. *Information exchanges* are placed between the following activities: *Idea* and *Initial Proposal*, *Comments* and *Review*, and *Final Review* and *Endorsement*. An idea is shared among colleagues, later discussed at the NDWP and then becomes a proposal; hence the information exchange. Comments derived from reviews and an exchange of information between the reviewers and subject matter experts occur.

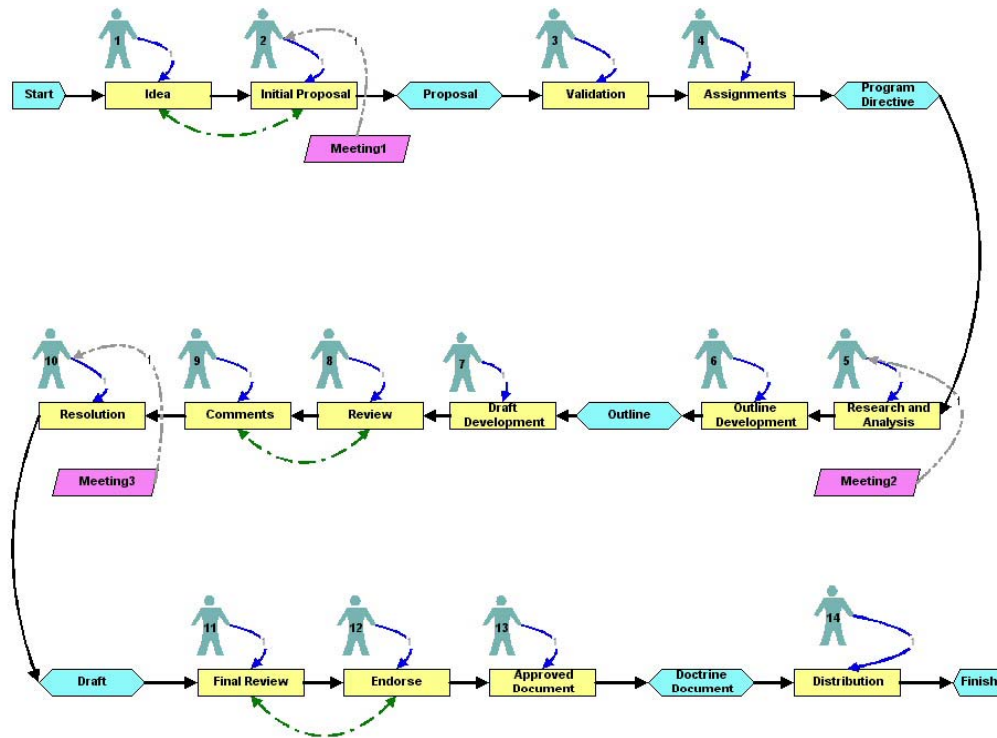


Figure 11. Current Doctrine Model [Ref. 32]

The DCT model, Figure 12, represents the parallel and concurrent processing of activities during the Doctrine process. This output oriented collaborative model is derived from the process flow outlined by Figure 10. This model represents a collaborative effort across a computer network, which results in an increased number of information exchanges. Networks enable collaboration to occur outside the limits of physical co-location. The high volume of *Information Exchanges* and collaboration in this DCT scenario reduces the need for face-to-face meetings. Because this scenario is based on work conducted across a network, the information is readily available to users who would otherwise have to coordinate through meetings. The trade off between concurrent and parallel operations depends on the relationships between the activities. The

following activity pairs are dependent relationships: *Outline* and *PD*, and *Approved Document* and *Resolution of Comments*. An outline is not produced until a PD is issued. The document's approval rests with the resolution of all the comments made to the draft document.

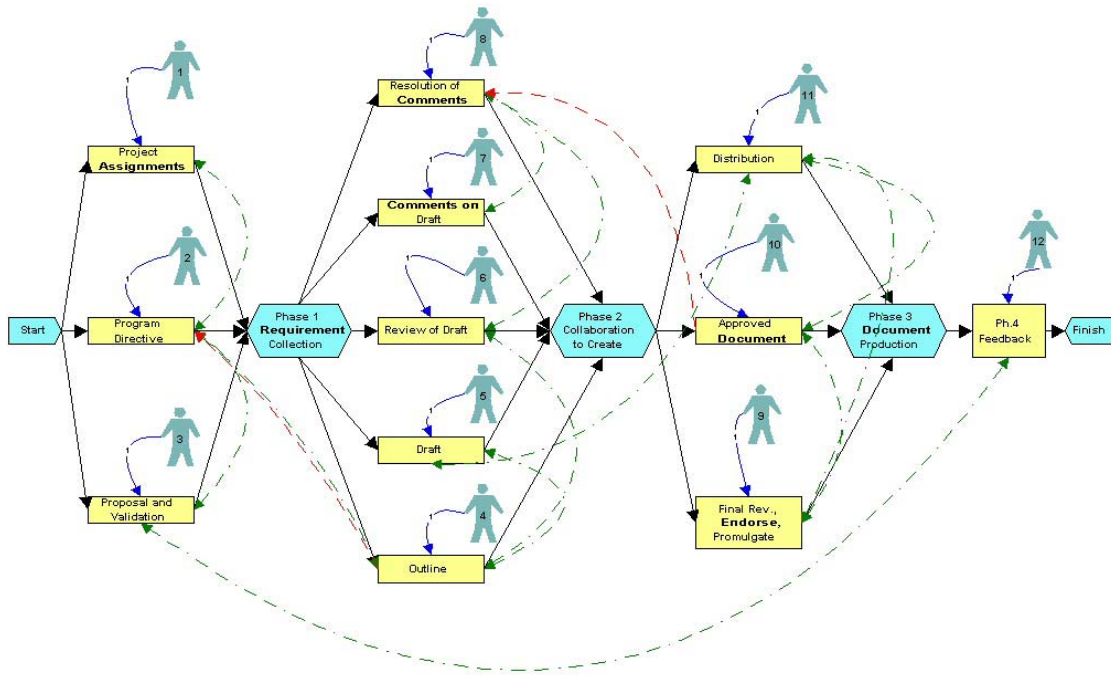


Figure 12. DCT Doctrine Model [Ref. 32]

2. Analysis of COTS DCT and Traditional Doctrine Process Using VITEPROJECT Manager

The objective of the analysis is to critically contrast the overall flow of processes of Doctrine development in the COTS DCT and traditional Doctrine scenarios. Timeliness in the development of Doctrine is important, but the quality of the Doctrine is more important. The bottom line is quality Doctrine driven by quality content. The results of this analysis are displayed in the following tables and figures.

Current Model		COTS DCT Model	
Duration	Cost	Duration	Cost
19 Months	168000	5 Months	144000

Table 3. CPM Cost and Duration Results [Ref. 32]

Table 3 represents the Critical Path Method (CPM) simulation results. The CPM simulation provides the user a baseline on which to compare the other simulation runs. The CPM simulation is resource-constrained. Errors, coordination, and rework are not considered during this run. Default probability settings for error rates, information exchange frequencies, and noise are set at zero [Ref. 32: p 3-10]. In other words, this run represents a perfect world. From Table 3, it is apparent that a COTS DCT process enables Doctrine in a world without outside distractions.

Table 4 represents the results from the same models in a simulation mode. In this mode, the probabilities mentioned in the CPM mode are reset to default positions.

Current Model		COTS DCT Model	
Duration	Cost	Duration	Cost
20 Months	216000	8 Months	255000

Table 4. Simulation Cost and Duration Results [Ref. 32]

Duration is the same for the simulation run, but the costs associated with the collaborative model are nearly doubled. These costs represent the increase in cost and difficulty expected by coordinating concurrent interdependent activities [Ref. 32]. However, these simulations cannot accurately represent the cost savings of a DCT: they treat each individual in a coordinative network as a single entity relating to another single entity. The entire reason for a DCTs existence is to nullify this assumption. The tool combines coordinative responses from multiple sources into a single response, thus dramatically reducing costs.

The following Gantt charts are used to visualize the results of each simulation run. The left side presents the names of the activities and milestones in their order of precedence. The upper bar in both charts represents the CPM calculations. Remember the CPM relates to perfect conditions in a perfect world. The lower bars represent the simulation using default settings. Blue colored bars represent non-critical activities. Gray bars represent float time for non-critical activities. Critical activities are shown in red. The diamonds represents project milestones. Gray diamonds are planned dates from the CPM run. Black diamonds are the dates from the simulation under default settings [Ref. 32: p. 3-10].

Figure 13² displays the current Doctrine process scenario. The functionality of sequential processing is exhibited in this chart. Delays and rework are not illustrated as well, because the activity must be completed before being passed to the next activity or milestone. The information obtained from the data above and this Gantt chart reveal nothing out of the ordinary. Sequential flows in an ideal and perfect world are similar in duration and costs.

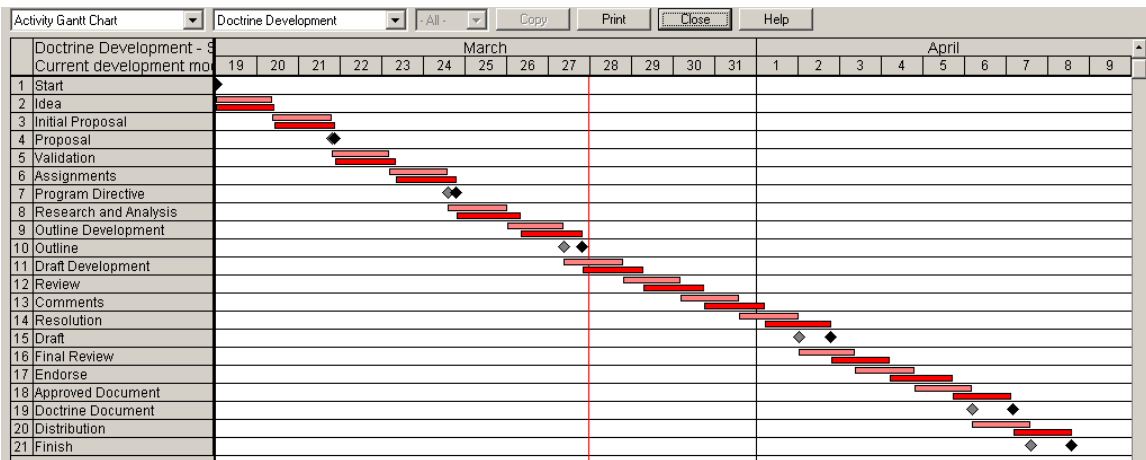


Figure 13. Current Doctrine Process Gantt Chart

Figure 14³ is the Doctrine process with a COTS DCT applied. The benefits of collaboration are apparent as the display reveals that several activities become non-critical. Critical Paths are reduced through the exchange

² The Gantt chart is represented in days. This allows display of the entire duration.

³ The Gantt chart is represented in days. This allows display of the entire duration.

of information and working activities concurrently. This allows a more focused effort toward critical tasks.

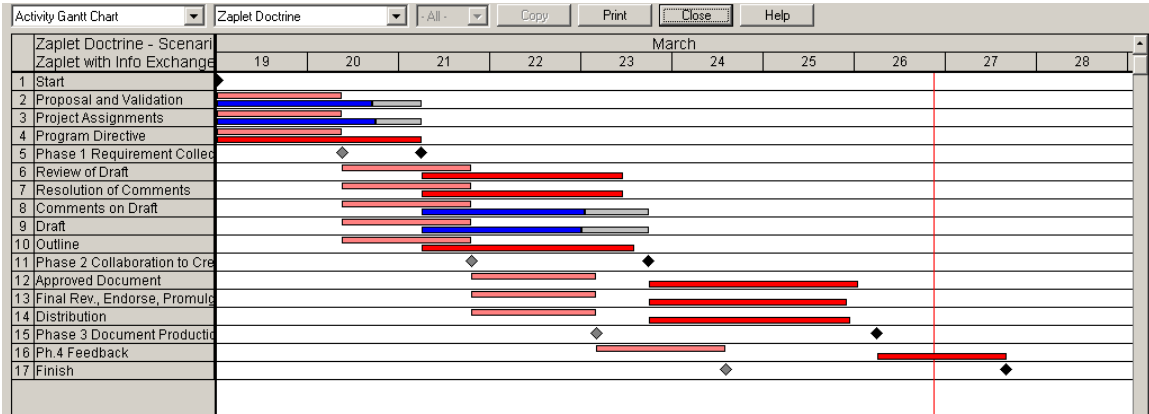


Figure 14. DCT Gantt Chart

This model is designed to show benefits and trade-offs associated with changing an organization's way of processing work activities [Ref 32]. VITEPROJECT illustrates that the DCT Doctrine process results in increased communications through virtual collaboration. The model does show a decrease in overall duration for Doctrine development due to parallel task activities and increased collaboration. The model thus illustrates that, probably as a worst case scenario, a small increase in collaboration costs may be required for potentially large gains in the quality of Doctrine, as well as decreased time to produce this Doctrine.

THIS PAGE INTENTIONALLY LEFT BLANK

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This study examined whether a COTS DCT has the potential to more effectively and efficiently enable the Navy Doctrine process. The role of Navy Doctrine is crucial to the decentralized command and control of a network centric Navy. Doctrine allows the Navy's actors to react rapidly and independently. Doctrine provides Navy warfighters with the basic awareness to engage their tactics.

To remain operationally relevant, Doctrine development needs to parallel the changing technological environment. The traditional way of creating Doctrine is slow and time consuming. NWDC initiated WED to enhance the Doctrine development process by garnering Fleet input.

Current WED is based on the traditional Doctrine process as discussed in Chapter II. It consists of threaded discussions concerning Doctrine development. The current design of WED has not alleviated delays in Doctrine development. Fleet input has not been as robust as anticipated. In order for the WED to be an output-oriented process with high levels of Fleet involvement, we argue that the Navy needs to implement a collaborative Doctrine development environment.

There are many COTS DCTs available that can be adapted to the WED process. A COTS DCT based WED can enhance overall effectiveness and efficiency in the Doctrine development process as suggested by the VITEPROJECT simulations.

A more precise estimate of cost savings could be made if more realistic data on times and task flows could have been collected and used in the modeling process. In addition, identifying specific actor's roles and skills and their relationships in their hierarchy could generate a higher fidelity model. None-the-less, in the absence of the availability of data, the idealized, simplified simulation heuristically illustrates that the DCT WED scenario produces gains in timeliness of Doctrine through the parallel, collaborative work processes. These collaborative processes, although not free, are viewed as being very inexpensive for the expected gains in quality, thanks to the DCT. Thus, VITEPROJECT manager illustrates how the DCT Doctrine process has the potential to efficiently enable an increase in communications, efficiency and quality of Doctrine through virtual collaboration.

The benefits of creating Doctrine collaboratively through a COTS DCT can enable the Fleet to actively participate in developing Doctrine. A web-based process can enable the Fleet to view and offer input to enhance the incorporation of emerging technologies. The continuous review capability offered by a DCT increases the likelihood of a quality Doctrine being produced. Increased collaboration decreases the number of critical paths due to increased information flows.

Collaborative production methods are output oriented. Since Doctrine is content driven, implying an output orientation, the Doctrine development process should be accomplished through a collaborative environment. We have

shown that a DCT such as Zaplet can be adapted to provide a cost effective, time saving, easy to use environment for Doctrine development.

B. RECOMMENDATIONS

The vision of NCO is leading the Navy towards a more collaborative and network centric foundation. Computers and networked information centers are becoming commonplace. Budgetary constraints and the political environment are forcing all DoD agencies and entities to use innovative technology.

COTS DCT enables the Navy to work smarter. The Navy's workforce can benefit greatly from the incorporation of commercial technologies in the work place. Creating Doctrine collaboratively demonstrates an appropriate "intelligence over force" concept. For example, COTS DCT results in fewer meetings. Collaboration improves Doctrine by gathering the insight and needs of warfighters.

There are several COTS products available in the marketplace today. This study concentrated on the Zaplet Appmail Suite™. Zaplet's product easily assimilates to the Navy's needs. This product works with established systems in the Navy, such as Microsoft Outlook. Several corporations use Zaplet's product. U.S. Government agencies such as the Central Intelligence Agency (CIA) are beginning to use Zaplet as well [Ref. 29].

This thesis thus recommends strong consideration of COTS DCT for further research and inclusion into the WED Doctrine development process.

C. SUGGESTED FURTHER STUDIES

Several areas of this study lend themselves to expansion for further research. Most obviously, models could be developed in closer cooperation with the Doctrine command in order to manipulate and analyze tasks at a finer resolution and to examine alternative organizational structures. This might identify additional changes in work and organizational processes that would further enable a higher quality Doctrine product. Additional studies incorporating test case or use analysis using projects currently in the Doctrine process would be beneficial. Such studies would require a more careful cost analysis and might contrast a COTS DCT versus the traditional Doctrine process. This type of study can determine if a COTS product is more cost effective vice a custom developed product.

This study discusses the security features associated with Zaplet's Appmail application. The application uses industry standard levels of security. An in depth study of security issues and COTS DCTs is suggested. Use analysis or incorporating a COTS DCT in the WED process can be determine if the application is compatible with the Navy's security standards.

APPENDIX

ACRONYMS & ABBREVIATIONS

C2	Command and Control
CC	Contributing Command
CINC	Commander in Chief
CINCLANTFLT	Commander in Chief Atlantic Fleet
CINCPACFLT	Commander in Chief Pacific Fleet
CINCUSNAVEUR	Commander in Chief U.S. Navy Europe
COA	Course of Action
COC	Chain of Command
COMUSNAVCEN	Commander U.S. Navy Central
COTS	Commercial Off the Shelf
CPM	Critical Path Method
CRA	Coordinating Review Authority
DCT	Distributive Collaborative Technology
DoD	Department of Defense
EBO	Effects-based Operations
ESC	Executive Steering Committee
FASA	Federal Streamlining Acquisition Act
FBE	Fleet Battle Experiment
FEDSPECS	Federal Specifications
GCCS	Global Command and Control System
GUI	Graphical User Interface

MILSPECS	Military Specifications
NCO	Network Centric Operations
NDP	Naval Doctrine Publication
NDWP	Navy Doctrine Working Party
NLL	Navy Lessons Learned
NLLS	Navy Lessons Learned System
NTTP	Navy Tactics, Techniques, and Procedures
NWDC	Navy Warfare Doctrine Command
NWP	Naval Warfare Publication
OPNAV	Office of the Chief of Naval Operations
PCO	Platform-centric Operations
POC	Point of Contact
PRA	Primary Review Authority
R&D	Research and Development
RMA	Revolution in Military Affairs
SEI	Software Engineering Institute
TCO	Technical Cognizant Office
TTP	Tactics, Techniques, and Procedures
U.S.	United States
VTC	Video Tele-Conference
WED	Web-Enabled Doctrine

LIST OF REFERENCES

1. FitzSimonds, James R., "The Cultural Challenge of Information Technology."
[<http://www.nwc.navy.mil/press/Review/1998/summer/art1su98.htm>]. (29 January 2002).
2. Tritten, James J. and Donolo, Luigi, *A Doctrine Reader: The Navies of the United States, Great Britain, France, Italy, and Spain*. Naval War College Press, 1995.
3. U.S. Joint Chiefs of Staff. Joint Vision 2020. Washington D.C.: June 2000.
4. Tritten, James, J., *Lessons and Conclusions From the History of Navy and Military Doctrinal Development*. Naval Doctrine Command, January 1995.
5. Fauth IV, Joseph, *Web-Enabled Doctrine: The Evolution of a Dynamic Doctrine Development Process in the U. S. Navy*. Naval Postgraduate School, 2001.
6. Commander, Navy Warfare Development Command. Web Enabled Doctrine/TTP Development, Naval Message. 06 February 2001.
7. Mish, Fredrick (Ed.), *Merriam-Webster's Collegiate Dictionary*, 10th Edition, Merriam-Webster Incorporated, 1995.
8. Tritten, James, "Naval Perspectives For Military Doctrine Development." November 2000.
[<http://www.nshspts.med.navy.mil/corres/service/manual/Ndc/manual.htm>]. (29 January 2002)
9. Knox, Dudley W., "The Role of Doctrine in Naval Warfare, " *United States Naval Institute Proceedings*, Vol. 41, No. 2, pp. 325-365, March-April 1915.
10. "Network Centric Operations: A Capstone Concept for Naval Operations in the Information Age."
[http://www.nwdc.navy.mil/concepts/capstone_concept.asp], (12 February 2002).

11. Alberts, David, "Information Superiority & Network Centric Warfare." 1999.
[<http://www.iwar.org.uk/iwar/resources/info-superiority1999>]. (28 February 2002).
12. Sprigg, Robert G., "The Navy's Crossroads For Innovation and Transformation, " *Sea Power*, Ed., Vol., February 2001.
13. Committee on Network-Centric Naval Forces, Naval Studies Board, National Research Council, *Network-Centric Naval Forces: A Transition Strategy for Enhancing Operational Capabilities*. National Academy Press. 2000.
14. Department of the Navy. *The Navy Warfare Library NTP 1-01 (Rev. B)*. Commander, Navy Warfare Development Command, December 2001.
15. Commander, Navy Warfare Development Command. Navy Doctrine Working Party. Instruction 5400.1X. Newport, RI: September 2000.
16. Owens, Bill and Offley, Ed, *Lifting the Fog of War*, Farrar, Straus and Giroux, 2000.
17. Seerden, Jim, "Web-Based Doctrine Development," Microsoft Power Point.
[<http://www.nwdc.navy.mil/Conference/DoctrineESC/Posted files/IntDocDevWebSite.ppt>]. (07 December 2001).
18. Cebrowski, Arthur and Garstka, John, "Network-Centric Warfare: Its Origin and Future." Proceedings, January 1998.
[<http://www.usni.org/Proceedings/Articles98/PROcebrowski.htm>]. (27 February 2002).
19. Castino, Tom, "Defense Goes COTS/NDI: How Do We Respond?" Microsoft Power Point. 01 March 2000.
[<http://www.dtic.mil/ndia/marketplace/castino.pdf>]. (28 February 2002).
20. Defense Standardization Program, SD-2 Buying Commercial & Nondevelopmental Items Handbook. 23 July 1999. [<http://www.dsp.dla.mil/documents/sd-2>]. (25 February 2002).

21. Money, Arthur and Gansler, J., to Department of Defense. 14 July 2000. "Letter of Office of the Secretary of Defense." Pentagon. Washington D.C.
22. Commercial-off-the-Shelf and Non-Development Items (COTS/NDI)." [<http://www.acq-Ref.navy.mil/tools/turbo/topics/v.cfm>]. (12 February 2002).
23. Carnegie Mellon Software Engineering Institute, "CBS Overview." December 2001. [<http://www.sei.cmu.edu/cbs/overview.html>]. (12 February 2002).
24. "Commercial Item Acquisition: Considerations and Lessons Learned." 26 June 2000. [<http://www.acq-ref.navy.mil/tools/turbo/refs/cots062600.doc>]. (28 February 2002).
25. Vigder, Mark, Gentleman, W., and Dean, John, "COTS Software Integration: State of the art." January 1996.
26. Brownsword, Lisa, Carney, David, and Oberndorf, Tricia, "The Opportunities and Complexities of Applying Commercial-Off-the Shelf Components." June 1998 [http://www.sei.cmu.edu/interactive/Features/1998/June/Applying_COTS/Applying_Cots.htm]. (12 February 2002).
27. "COTS- A Shared Solution." [<http://www.gentax.com/Pages/COTS.htm>]. (12 February 2002).
28. McKenna, Heidi, *Collaborative Planning Solutions: Using USMC Standard Collaboration Tools To Assist With Mission Planning and Execution*. Naval Postgraduate School, September 2001.
29. Zaplet Inc, "In-Q-Tel Licenses Zaplet's Enterprise Software Platform." 08 January 2002.
30. Zaplet Inc, *Zaplet Appmail Suite™ 1.0 Product Overview*. 2001.

31. Interview between Eugene Levitsky, Vice President of Marketing, Zaplet Inc., David Roberts, Co-Founder, Zaplet Inc., Zaplet Corporate Offices, Redwood City, CA. and authors. 01 February 2002.
32. Levitt, Raymond E, "*THE VITEPROJECT HANDBOOK: A User's Guide to Modeling and Analyzing Project Work Processes and Organizations.*" 1999.

BIBLIOGRAPHY

1. Alberts, David, "Information Superiority & Network Centric Warfare." 1999.
[<http://www.iwar.org.uk/iwar/resources/info-superiority1999>]. (28 February 2002).
2. Brownsword, Lisa, Carney, David, and Oberndorf, Tricia, "The Opportunities and Complexities of Applying Commercial-Off-the Shelf Components." June 1998
[http://www.sei.cmu.edu/interactive/Features/1998/June/Applying_COTS/Applying_Cots.htm]. (12 February 2002).
3. Bodnar, John and Dengler, Rebecca, "The Emergence of a Command Network."
[<http://www.nwc.navy.mil/press/Review/1996/autumn/comm-a96.htm>]. (29 January 2002).
4. Carnegie Mellon Software Engineering Institute, "CBS Overview." December 2001.
[<http://www.sei.cmu.edu/cbs/overview.html>]. (12 February 2002).
5. Carnegie Mellon Software Engineering Institute, "COTS-Based Systems (CBS) Initiative." December 2001.
[<http://www.sei.cmu.edu/cbs>]. (12 February 2002).
6. Castino, Tom, "Defense Goes COTS/NDI: How Do We Respond?" Microsoft Power Point. 01 March 2000.
[<http://www.dtic.mil/ndia/marketplace/castino.pdf>]. (28 February 2002).
7. Cebrowski, Arthur and Garstka, John, "Network-Centric Warfare: Its Origin and Future." Proceedings, January 1998.
[<http://www.usni.org/Proceedings/Articles98/PROcebrowski.htm>]. (27 February 2002).
8. Commander, Navy Warfare Development Command. Navy Doctrine Working Party. Instruction 5400.1X. Newport, RI: September 2000.

9. Commander, Navy Warfare Development Command. Web Enabled Doctrine/TTP Development, Naval Message. 06 February 2001.
10. "Commercial Item Acquisition: Considerations and Lessons Learned." 26 June 2000. [<http://www.acq-ref.navy.mil/tools/turbo/refs/cots062600.doc>]. (28 February 2002).
11. Commercial-off-the-Shelf and Non-Development Items (COTS/NDI). [<http://www.acq-ref.navy.mil/tools/turbo/topics/v.cfm>]. (12 February 2002).
12. Committee on Network-Centric Naval Forces, Naval Studies Board, National Research Council, *Network-Centric Naval Forces: A Transition Strategy for Enhancing Operational Capabilities*. National Academy Press. 2000.
13. "COTS- A Shared Solution." [<http://www.gentax.com/Pages/COTS.htm>]. (12 February 2002).
14. Defense Standardization Program, SD-2 Buying Commercial & Nondevelopmental Items Handbook. 23 July 1999. [<http://www.dsp.dla.mil/documents/sd-2>]. (25 February 2002).
15. Department of the Navy. *The Navy Warfare Library NTTP 1-01 (Rev. B)*. Commander, Navy Warfare Development Command, December 2001.
16. Fauth IV, Joseph, *Web-Enabled Doctrine: The Evolution of a Dynamic Doctrine Development Process in the U. S. Navy*. Naval Postgraduate School, 2001.
17. FitzSimonds, James R., "The Cultural Challenge of Information Technology." [<http://www.nwc.navy.mil/press/Review/1998/summer/art1su98.htm>]. (29 January 2002).
18. Knox, Dudley W., "The Role of Doctrine in Naval Warfare," *United States Naval Institute Proceedings*, Vol. 41, No. 2, pp. 325-365, March-April 1915.

19. Levitt, Raymond E, "THE VITEPROJECT HANDBOOK: A User's Guide to Modeling and Analyzing Project Work Processes and Organizations." 1999.
20. McKenna, Heidi, *Collaborative Planning Solutions : Using USMC Standard Collaboration Tools To Assist With Mission Planning and Execution*. Naval Postgraduate School, September 2001.
21. Mish, Fredrick (Ed.), *Merriam-Webster's Collegiate Dictionary*, 10th Edition, Merriam-Webster Incorporated, 1995.
22. Money, Arthur and Gansler, J., to Department of Defense. 14 July 2000. "Letter of Office of the Secretary of Defense." Pentagon. Washington D.C
23. "Navy Warfare Development Command."
[<http://www.nwdc.navy.mil>]], (01 December 2002).
24. "Network Centric Operations: A Capstone Concept for Naval Operations in the Information Age."
[http://www.nwdc.navy.mil/concepts/capstone_concept.asp], (12 February 2002).
25. Owens, Bill and Offley, Ed, *Lifting the Fog of War*, Farrar, Straus and Giroux, 2000.
26. Seerden, Jim, "Web-Based Doctrine Development," Microsoft Power Point.
[<http://www.nwdc.navy.mil/Conference/DoctrineESC/Posted files/IntDocDevWebSite.ppt>]. (07 December 2001).
27. Sprigg, Robert G., "The Navy's Crossroads For Innovation and Transformation, " *Sea Power*, Ed., Vol., February 2001.
28. Tritten, James J. and Donolo, Luigi, *A Doctrine Reader: The Navies of the United States, Great Britain, France, Italy, and Spain*. Naval War College Press, 1995.
29. Tritten, James, J., *Lessons and Conclusions From the History of Navy and Military Doctrinal Development*. Naval Doctrine Command, January 1995.

30. Tritten, James., "Naval Perspectives For Military Doctrine Development." November 2000.
[<http://www.nshspts.med.navy.mil/corres/service/manual/Ndc/manual.htm>]. (29 January 2002)
31. U.S. Joint Chiefs of Staff. Joint Vision 2020.
Washington D.C.: June 2000.
32. Vader, Mark, Gentleman, W., and Dean, John, "COTS Software Integration: State of the art." January 1996.
33. "Web Enabled Doctrine," Microsoft Power Point presentation.
[<http://www.nwdc.navy.mil/Conference/DoctrineESC/01Briefs/WebEnabledNwdcp1.pps>]. (07 December 2001).
34. "Zaplet." [<http://www.Zaplet.com>], (07 December 2001).
35. Zaplet Inc, *Appmail The New Way to Collaborate*. 2001
36. Zaplet Inc, "In-Q-Tel Licenses Zaplet's Enterprise Software Platform." 08 January 2002.
37. Zaplet Inc, *Zaplet Appmail SuiteTM 1.0 Product Overview*. 2001.
38. Interview between Eugene Levitsky, Vice President of Marketing, Zaplet Inc., David Roberts, Co-Founder, Zaplet Inc., Zaplet Corporate Offices, Redwood City, CA. and authors. 01 February 2002

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Fort Belvoir, VA 22060-6218
2. Dudley Knox Library
Naval Postgraduate School
Monterey, CA
3. Department of the Navy
Office of the Chief of Naval Operations (N6109)
Washington DC
4. Fleet Information Warfare Center
NAB Little Creek
Norfolk, VA
5. LCDR Steven J. Iatrou
Naval Postgraduate School
Code IW/IS
Monterey, CA
6. Professor Erik Jansen
Naval Postgraduate School
Monterey, CA
7. LCDR Raymond Buettner
Naval Postgraduate School
Code IW/IS
Monterey, CA
8. LT Michael J. Harris
West Branch, IA
9. LT Rachel J. Velasco-Lind
San Diego, CA