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Locating and searching electronic documents: a user study of supply publications in the United States Marine Corps

Stahl, Scott A.

Monterey California. Naval Postgraduate School

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MBA PROFESSIONAL REPORT

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a User Study of Supply Publications
in the United States Marine Corps

By: **Scott A. Stahl**
December 2007

Advisors: **Cynthia King**
Anita Salem
Gail Thomas

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13. ABSTRACT (maximum 200 words)

This exploratory study assesses the usability of an online policy document system, specifically with company grade supply officers in the United States Marine Corps. Using common work scenarios, users were asked to search for specific policy documents. Their efforts to navigate through the system were recorded and analyzed to better understand areas in the system that posed challenges to supply officers' efforts at policy retrieval and understanding. The primary purpose of this study is to provide recommendations, based on the test findings, that will address opportunities to enhance the effectiveness and efficiency of the current electronic publication system. Based on this analysis, the second purpose of this study was to provide recommendations to enhance the effectiveness, efficiency, and user satisfaction with the electronic document system.

Five participants were observed as they used electronic policy and regulatory documents related to financial management and property control functions. The participants were chosen because they represent the user population and are familiar with the electronic document system. Each participant conducted typical search and retrieval tasks using think-aloud protocols. Each session was videotaped, and participants were interviewed afterwards.

In-depth analysis of the data indicates that participants are generally satisfied with the system, but significant opportunities exist to improve its effectiveness and efficiency. Most notable recommendations are: increase search capability, provide consolidated offering of content, allow personalization and portability, improve ability to see context/location within documents, create additional linking mechanisms, and migrate away from .pdf file format. Additional recommendations address the need for iterative testing and triangulation of problem areas to increase data reliability.

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LOCATING AND SEARCHING ELECTRONIC DOCUMENTS: A USER STUDY OF SUPPLY PUBLICATIONS IN THE UNITED STATES MARINE CORPS

Scott A. Stahl, Captain, United States Marine Corps

Submitted in partial fulfillment of the requirements for the degree of

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Author: _____
Scott A. Stahl

Approved by: _____
Cynthia King, Lead Advisor

_____
Anita Salem, Support Advisor

_____
Gail Thomas, Support Advisor

_____
Robert N. Beck, Dean
Graduate School of Business and Public Policy

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I. INTRODUCTION

A. PURPOSE

A key function of a supply officer's duties is to retrieve, interpret, and advise on new and existing military policy. Traditionally, such policies were housed in a paper-based library; however, in the past 10 years the policy libraries have been migrating to an electronic system, accessible via the internet. The purpose of the current study is to assess the usability of an online policy document system, specifically with company grade supply officers in the United States Marine Corps. Using common work scenarios, users were asked to search for specific policy documents. Their efforts to navigate through the system were recorded and analyzed to better understand areas in the system that posed challenges to supply officers' efforts at policy retrieval and understanding. Based on this analysis, the second purpose of this study was to provide recommendations to enhance the effectiveness, efficiency, and user satisfaction with the electronic document system.

B. BACKGROUND

In this section, I discuss the need to study the electronic supply policy document system to demonstrate the effectiveness and efficiency of the existing tool. First, I provide an historical context by addressing the significance of supply to Marine Corps commands. Second, I discuss the importance of locating and retrieving policy documents for supply officers. Third, I provide an overview of the migration from a paper-based to an electronic-based policy document system. Fourth, I present the business case analysis that discusses the importance of usability for aiding supply officers in their use of electronic policy documents. Fifth, I provide an overview of usability research. Sixth, I present the research questions that governed this study. Finally I provide an overview of the project.

Throughout this research, I shall limit discussion to Marine Corps supply officers and the publications and training related to their duties. Although supply functionality is largely executed by capable and well-trained enlisted Marines, the supply officer has a

direct and potentially far-reaching impact on command operations through an advisory role to the commander and supervisory role of supply operations. Enlisted Marines contribute enormously toward that goal, yet the supply officer is ultimately responsible. For this reason, supply officers and the policy documents they use to conduct their duties were selected for this study.[1] The participants of the study are discussed further in Chapter II.

1. Significance of Supply & Supply Policy

Supply is a crucial element in the operational readiness of any command. In fact, most readiness reporting includes supply readiness and maintenance readiness as primary measures of overall command readiness. The significance of supply is discussed in Marine Corps Order 4400.163, which states that "Massive manpower is not the prime asset of the United States; this nation's prime asset is skilled manpower equipped with the proper tools."[2] Equipping is a complex function that encompasses over $336.1 trillion dollars in Department of Defense (DoD) assets. Consequently, it is critical that supply management be effective, both for national security and economic reasons.[3]

Ground supply officers supervise the execution of policies and procedures that govern the complex function of Supply. To execute these policies, officers rely on the expertise and advice of enlisted personnel. Supply officers also consult with peers, higher authority, and others to help guide their duties. Although enlisted personnel and other officers assist the supply officers with policy retrieval and interpretation, proficient supply officers must be capable of retrieving and understanding policy documents themselves to conduct their functions as an advisor, trainer, and supervisor. This capability is necessary so that supply officers can advise and make recommendations to commanders regarding policy, and take corrective or preventive action when they

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[1] As a Marine Corps Supply Officer for seven years, I have first-hand knowledge of the domain, responsibilities, and importance of the Supply Officer contribution.

[2] Marine Corps Order 4400.163, *Department of Defense Supply Management Reference Book*, Section 1-2 (1985). http://www.usmc.mil/directiv.nsf/l?OpenView&Count=3000 (accessed November 15, 2007).

[3] Ibid., section 1-3.

encounter detrimental supply situations.[4] An effective policy document system, then, is one that will help Supply officers achieve their goal of retrieving, understanding, and advising others on matters of supply policy.

2. Locating and Retrieving Policy Information

Under the expansive policy document system, the procedural answers supply officers seek can be obscured by the complexity of the system itself. At a minimum, a user who wishes to retrieve and explore policy and regulations related to a specific task must:

1. Determine relevant publications governing the task,
2. Possess or locate the applicable publications,
3. Search for information related to the task from within those publications,
4. Comprehensively integrate the results, and
5. Interpret the intent of the author

In addition to an already complex process, the characteristics of the electronic document system further complicate the task. For example, the officer's effort may be complicated because: a) documents originate from multiple sources and various levels of authority; b) policy information is parsed, segregated, or falls in overlapping topic areas; c) policies are in constant flux due to frequent updates, deletions, clarifications, or other additional alterations; and d) policies are extensively cross-referenced both within documents and amongst documents. Given this complexity, it is important that the electronic document system be as easy to use as possible.

[4] Marine Corps Order P4400.150E w/Erratum and change 1-2, *Marine Corps Consumer Level Supply Policy Manual*, Section 1003.2a (2001) (hereafter cited as MCO P4400.150E). http://www.usmc.mil/directiv.nsf/l?OpenView&Count=3000 (accessed November 15, 2007).

3. Paper-Based Policy Document System

Historically, Marine Corps supply officers were required to have physical copies of all relevant publications.[5] This collection of policy documents (known as a publication library) alleviated the burden of seeking out policy references for recurring tasks by providing ready reference to the policy and regulatory guidance right off-the-shelf.

In some ways, the paper-based system allowed users to control aspects of effectiveness and efficiency. By physically manipulating their personal copies, users were able to organize them in a manner they deemed useful and efficient. Users could also bookmark, highlight, and tab relevant or repetitive areas of interest for future use. Furthermore, the paper-based system provided users the ability to search for information in familiar ways that are traditionally employed with paper documents and books (e.g., indexes, table of contents, scanning). A major drawback to this system, however, was the need to constantly maintain the publication library. Maintaining the system took a significant amount of time, and publications were often missing change notices, updates, or complete documents.

4. Electronic Policy Document System

The advent of the internet brought forth a new and more useful medium through which the Department of Defense (DoD) could distribute its policies. In a policy statement issued in 1998, the DoD Web Site Administration Policy and Procedures proclaimed, "It is the policy of the DoD that…using the World Wide Web is strongly encouraged in that it provides the DoD with a powerful tool to convey information quickly and efficiently on a broad range of topics relating to its activities, objectives, policies and programs."[6]

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[5] Marine Corps Order P4400.150E

[6] Department of Defense, *Web Site Administration Policies and Procedures*, Part I. 4.1 (1998). http://www.defenselink.mil/webmasters/policy/dod_web_policy_12071998_with_amendments_and_corrections.html (accessed December 6, 2007).

The Marine Corps embraced this move toward paperless policy documents in 1997. It was then that the Corps began revising its printing and publications regulations to take advantage of new technologies, and to comply with the Paperwork Reduction Act and the Assistant Commandant of the Marine Corps (ACMC's) Paperwork Reduction Initiative.[7] In 1998 the regulation was updated to authorize electronic publication libraries rather than printed libraries. And, in 2001, a further update announced, "The Marine Corps homepage at http://www.usmc.mil is the official Marine Corps web page to access Marine Corps directives online."[8] These announcements authorized electronic access alone as sufficient to meet the requirement for on-hand publications libraries as long the documents were kept up-to-date. The policies further stipulated that the internet could be used as a source as long as the digitized files were downloaded and kept locally.[9]

Many units have since abandoned maintenance of a paper-based library in favor of an electronic library. This migration is in keeping with the DoD and Marine Corps trend of converting (or originating) the majority of publications and documents to digital format and making them available for use electronically. Steve Sherman, Director of the Document Automation and Production Service (DAPS),[10] acknowledges this trend on the DAPS website, stating "online document services are now the largest part of our business. They have increased by 114 percent in the past seven years."[11]

5. Business Case for Usability

Regardless of the medium, the goal of policy is to ensure compliance with procedure, and supply officers use policy documents as a primary resource to achieve that

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[7] Marine Corps Order P5600.31G w/ Change 1-3, *Printing and Publications Regulations*, Background (2001). http://www.usmc.mil/directiv.nsf/gam?OpenView&Count=3000 (accessed October 5, 2007).

[8] Ibid., part 3113.

[9] Ibid., part 3206.1.

[10] DAPS is a division of the Defense Logistics Agency charged with providing effective and efficient document services support to the DoD components. Department of Defense Instruction 5330.03, *Document Automation and Production Service* (February 2006).

[11] Document Automated Printing Service website, http://www.daps.dla.mil/DAPS_MORE_THAN_A_PRINTER.asp (accessed September 26, 2007).

goal. As previously noted, supply officers have traditionally used a paper-based document system that afforded them the opportunity to personalize documents, to have them readily available, and to search and navigate them in familiar ways. Today, supply officers have an electronic capability to achieve their goals. However, using an electronic system may be challenging if the system does not properly address the differing aspects of electronic and paper-based documents.

Significant research exists regarding the differences in electronic and paper-based documents. In a study of hypertext documents, for example, researchers showed that if electronic documents merely imitate paper, the paper documents will be preferred. The research also showed that readers who feel disoriented, worry they are overlooking crucial information, or cannot use the search mechanism will either abandon the electronic document for paper, or abandon the task altogether.[12] Other research argues that electronic documents "must be at least as easy to use as a printed book."[13] Therefore, merely scanning paper documents onto the web may not fully maximize the intent of the DoD policy of conveying information quickly and efficiently, and users may opt instead for the old paper-based system.

A more effective, efficient, and satisfying electronic document system should incorporate well-designed documents and institute advantages of online documents available via the internet. For example, one advantage is keyword searching, which enables an officer to find a specific area of interest in a large document, or in a collection of documents, within seconds. Another advantage of online documents is the ability to hyperlink to related areas within or between documents, which may further enhance the officer's ability to access cross-references more efficiently. These features and others of

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[12] Florence M. Fillion and Craig D. B. Boyle, "Important issues in hypertext documentation usability," In *Proceedings of the 9th Annual international Conference on Systems Documentation* (Chicago, Illinois, 1991). SIGDOC '91. ACM, New York, NY, 59-66. DOI= http://doi.acm.org/10.1145/122778.122788.

[13] Laurie Kantner, Roberta Shroyer, and Stephanie Rosenbaum, "Structured heuristic evaluation of online documentation," In *Professional Communication Conference, (2002). IPCC 2002. Proceedings. IEEE International*, 331-342. http://ieeexplore.ieee.org/iel5/8118/22469/01049115.pdf?isnumber=22469[]=STD&arnumber=1049115&arnumber=1049115&arSt=+331&ared=+342&arAuthor=Kantner%2C+L.%3B+Shroyer%2C+R.%3B+Rosenbaum%2C+S.

an electronic document system can reduce the burden of policy retrieval, potentially resulting in a higher level of policy compliance.

Additionally, these features need to be well-designed and incorporated in an overall system that aids the supply officer in finding policy information efficiently. For example, an ineffective search engine that provides unexpected results may be far less effective than a paper-based system: in short, the features must support the specific needs of the user. If the Marine Corps intends for the supply community to reap benefits from, and fully embrace, an electronic supply policy document system, the system must be one that works effectively and efficiently. An exploratory usability study is one method to assess the effectiveness of a system and to provide a basis for recommended changes.

6. Overview of Usability Research

The International Organization for Standardization (ISO 9241-11), defines usability as:

> The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.[14]

There are three critical issues embedded in this definition:

1. Usability tests are focused on a product
2. Usability is defined and measured along three axes
3. Usability tests have specific users, tasks, and contexts

First, the goal of usability tests is to improve the product, not explain or predict phenomena through inference or extrapolation of data. Usability practitioners Dumas and Redish define this goal as follows:

[14] International Organization for Standardization, *Guidance on Usability*, ISO 9241-11 (1998).

> The primary goal of a usability test is to improve the usability of the product that is being tested…This characteristic distinguishes a usability test from a research study, in which the goal is to investigate the existence of some phenomenon.[15]

Second, usability is defined and measured along three specific criteria: effectiveness, efficiency, and satisfaction. These elements are defined as follows:

- Effectiveness: The user's ability to achieve specific goals in the environment
- Efficiency: The resources used (time, money, and mental effort) when performing a system-supported task
- Satisfaction: The user's comfort level and acceptance of the system overall[16]

These three factors can be measured in a variety of ways that may include, for example, tracking of errors encountered [effectiveness], number of mouse clicks to a defined destination [efficiency], time spent on a task [efficiency], confusion/frustration observed [satisfaction], and many others.[17] (The specific measures that I examined for this study, and their accompanying metrics, are discussed in more detail in Methods, Chapter II).

Finally, a usability test is distinguished by its focus on specific users doing specific tasks in specific contexts of use. When designing usability tests, the usability practitioner must define who the users are, what common tasks are to be investigated, under what conditions the test will occur, and how usability will be measured. For example, in this study, I am interested in how supply officers, in their daily work, locate

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[15] Joseph S. Dumas and Janice C. Redish, *A Practical Guide to Usability Testing* (Norwood, NJ: Ablex Publishing, 1993), 22.

[16] Ibid.

[17] Ibid, 185.

electronic policy documents. I therefore selected active supply officers, situated the test at the participants' work space, and asked them to do common representative tasks (A more detailed description of criteria used to select appropriate participants, tasks, and key interactions is discussed in Methods, Chapter II).

There is some debate in the literature about how many users are necessary to derive valid results. However, studies have shown that five users can discover 80% of usability problems.[18] Usability expert Jakob Nielsen pioneered a 1989 study that established a precedent for the required number of users for what he termed a "discount" usability study. He argued that "elaborate usability tests are a waste of resources. The best results come from testing no more than five users and running as many small tests as you can afford."[19] He argues that after six users, there is a clearly diminished return for number of problems detected. As Figure 1 (below) indicates, there is a negligible gain of problem identification between 6 and 9 users, and almost no gain between 9 and 15 users.

More recently, some research has challenged the assertion that five participants are enough for a sufficient study. In 2001, Jared Spool's report contradicted the model after conducting a series of website tests which only indicated identification of 35% of problems after five users, and some serious usability problems were not identified until after the thirteenth or fifteenth user.[20]

Despite these challenges, however, the purpose of usability testing must be taken into consideration—usability is about improving the design of a product. Even Spool acknowledges that any number of users can help uncover issues: "For whatever value of 'N' [number of users] they [design teams] choose, 'N' users will always be better than

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[18] Jakob Nielsen, "Usability engineering at a discount." In *Proceedings of the Third international Conference on Human-Computer interaction on Designing and Using Human-Computer interfaces and Knowledge Based Systems (2nd Ed.)* (Boston, Massachusettss). G. Salvendy and M. J. Smith, Eds. Elsevier Science, New York, NY, 394-401.

[19] Jakob Nielsen's usability Web site, http://www.useit.com/alertbox/20000319.html (accessed October 10, 2007).

[20] Jared Spool and Will Schroeder, "Testing web sites: five users is nowhere near enough." In *CHI '01 Extended Abstracts on Human Factors in Computing Systems* (Seattle, Washington, March 31 - April 05, 2001). CHI '01. ACM, New York, NY, 285-286. DOI= http://doi.acm.org/10.1145/634067.634236

zero."[21] Other types of studies may net greater findings, but can be very costly. And, as Neilsen argues, a considerable number of problems can be detected even with only a few participants. No study will be "perfect," he noted, nor will it "discover everything that's possible to know about the design, but we accept this trade-off in return for having more iterations in the design process."[22]

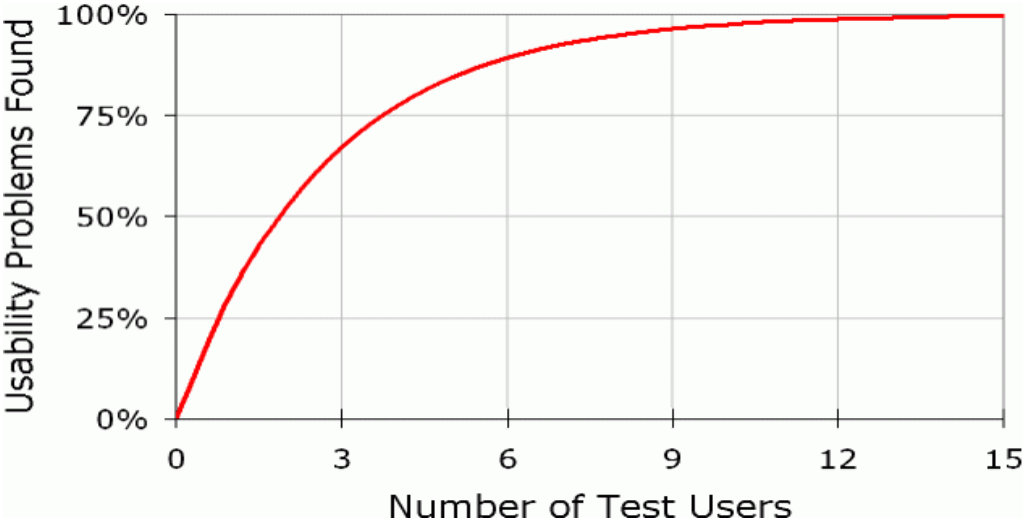

Figure 1. Usability Findings by Number of Users[23]

In this usability study, there is no expectation that all the usability problems will be uncovered. However, as Neilsen points out, we can still expect to gain valuable insights from which we can derive recommendations.

[21] Nigel Bevan and others, "The 'magic number 5': is it enough for web testing?" In *CHI '03 Extended Abstracts on Human Factors in Computing Systems* (Ft. Lauderdale, Florida, USA, April 05 - 10, 2003). CHI '03. ACM, New York, NY, 698-699. DOI= http://doi.acm.org/10.1145/765891.765936

[22] Ibid.

[23] See note 19.

7. Research Questions

For this study, I identified three specific research questions related to how well supply officers could retrieve online policy information:

1. Can users easily and efficiently locate financial management and property control regulations?
2. Can users easily and efficiently locate all necessary information to answer work-related questions?
3. How do users look for information?

8. Preview of Project

Following this introductory chapter, the rest of the project is divided into three additional chapters. Chapter II presents the methods I used in preparing for and conducting the usability test. Chapter III presents the findings from the study, including direct quotes from participants as well as observations of user behavior. Chapter IV provides recommendations for changes to the system based on the findings derived from testing and user feedback.

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II. METHODS AND PROTOCOLS

This chapter details the procedures used to conduct the usability test. In the Methods section, I:

- Provide an overview of the test
- Describe the test participants
- Describe users' key tasks
- Present the underlying research questions
- Present the test scenarios
- Present the metrics and protocols used for analysis

In the Protocols section, I describe specific approaches used in collecting and analyzing the survey and verbal data.

A. METHODS

1. Overview

The usability test involved five participants who would regularly use the system to retrieve policy documents online in the daily conduct of their work. For the purposes of this study, I defined the online system as "the collection of official policy source documents and any means used to electronically retrieve those documents." This definition allowed me to explore the user's natural approach to locating and searching electronic policy documents.

I chose participants based on preliminary research of users of the documents; I reviewed demographic data for the Marine Corps and conducted a preliminary survey. The preliminary survey focused on identifying common information retrieval tasks and underlying user goals.

During the test, participants were each given two scenarios that required them to navigate and search online policy documents. While executing specific tasks, participants were asked to "think aloud" while the researcher directly observed and video-taped the sessions. Upon completion of the specified tasks, the participants completed a 15-minute interview followed by a short, 10-question, satisfaction interview questionnaire known as the System Usability Scale (SUS) (See Appendix A). The interview and SUS explored participants' experience with and evaluation of the system.

2. Preliminary User Survey

Prior to designing the usability test, I wanted to understand the key drivers for information retrieval. To help me identify the appropriate participants and tasks, I created a short survey instrument (see Appendix B) that identified common policy areas and specific tasks that Marine Corps supply officers would likely encounter. For example, I selected key areas such as property control or requisition management. Within each area, I also provided a selection of tasks that would be appropriate to that area, such as sub-custody receipting (CMRs) or inventory would be for the property control area. Drawing from the Total Force Data Warehouse (TFDW) database[24], I identified 258 potential participants and contacted them via email. Of the 258 number contacted, 109 responded. The survey asked respondents to select the policy area they most frequently consulted and the primary tasks within those policy areas that they most frequently conducted. Additionally, I asked them to identify the three most common reasons for using electronic publications. Finally, I used the survey as a recruiting tool: the final question asked if they were willing to be contacted to be a participant in the study. Results are summarized in Table 1, below:

[24] TFDW accessed via Marine Online website, http://mol.usmc.mil (accessed September 1, 2007).

Table 1. Summary of results from preliminary user survey

Response	Three Most Common Reasons for Consulting Policy Documents
59.8%	Advise Commander
57.8%	Prove/Justify Procedures to an Interested Party
53.9%	Verify Personal Action/Procedure Complies with Reference
Response	**% Time Spent Seeking Policy Information in Electronic Documents**
41.2%	10% - 20%
22.7%	Less than 10%
20.6%	20% - 30%
Response	**Area and (Task within that area) Requiring the Most Time**
30.4% (64.5%)	Financial Management (Government Commercial Purchase Card)
29.4% (44.8%)	Property Control (CMR)

I used the results of this preliminary survey to select test participants and to choose test scenarios and tasks.

3. Participants

In usability tests, it is important to be sure that our test participants align with our business and practical goals. In this current study of electronic supply documents, possible user populations included supply personnel, government contractors, legislative bodies, commanders, and many others. However, for this usability test, I focused

specifically on intermediate-level officer leadership (company grade officers) within the Marine Corps. I selected this representative user group for four primary reasons:

1. They have a large impact on the organization
2. Their characteristics are typical of the targeted user base
3. They have varying degrees of familiarity with the interface
4. They were readily and locally available

Additionally, based on the rationale provided by Neilsen's standard-setting research showing that nearly 80% of usability problems can be found by testing only five users,[25] I targeted five users for this test.

a) Supply Officers' Impact on the Organization

When selecting test participants, I wanted to ensure that the participants were key users of the system. When looking at the various roles associated with the use of supply policy documents, supply officers stood out as key business users. As advisors to the Commander, trainers of junior officers, and supervisors of enlisted men, supply officers have a large impact on their command. First, supply officers are directly charged with advising and recommending corrective procedures based on policies, laws, and other regulatory guidance contained in supply policy documents.[26] Second, the Marine Corps mandates that supply officers establish an "ongoing and effective training program" on policies and procedures.[27] Even though actual training is often conducted by subordinate leaders, the overall responsibility for creating the training is explicitly that of the supply officer. Finally, given that there is approximately one officer for every ten enlisted

[25] See note 18 above.

[26] See note 4 above.

[27] MCO P4400.150E, Section 1011.

Marines,[28] the supply officer has significant supervisory and oversight responsibilities related to policy understanding and compliance.

b) Supply Officers are Typical of Targeted User Base

In usability testing, it is important to select your test participants based on the alignment of their personal characteristics with the key user population. Key characteristics to look at include personal demographics and skill levels. As part of our recruiting process, we verbally verified that participants met the desired characteristics prior to scheduling them. In addition, we verified their characteristics prior to administering the test.

For this study, I selected participants that would closely match the demographics of supply officers. Marine Corps officers are largely homogenous in terms of education, rank, and age. In addition, occupational assignments within the Marine Corps are not tied to skills—all supply officers receive formal supply training at the Ground Supply Officer Course (GSOC). Therefore, we selected participants based on the following Marine Corps demographic trends:

- 90% hold a BA degree or higher [29]
- 55% of total supply officers are captains or first lieutenants
- 47% are between the ages of 26 and 35[30]
- Captains predominantly have 4-10 years military experience and first lieutenants have 2-4 years experience[31]

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[28] Headquarters, United States Marine Corps, *2007 Marine Corps Almanac*, Headquarters Marine Corps website (2007). http://hqinet001.hqmc.usmc.mil/p&r/concepts/2007/CHPT5.htm (accessed September 18, 2007).

[29] Marine Corps Community Services, *Marine Corps Community Services Demographics Update* (June 2007). http://www.usmc-mccs.org/aboutmccs/downloads/pom/Demographics%20Update.pdf (accessed October 12, 2007). The data for the report is extracted from the Marine Corps Total Force Data Warehouse.

[30] See note 28, above.

[31] Department of Defense Instruction 1320.13, *Commissioned Officer Promotion Reports (COPRs) and Procedures*, (June1996). http://www0.dtic.mil/whs/directives/corres/html/132013.htm (accessed October 12, 2007).

c) Supply Officers Have Varying Familiarity with the Interface

Within my five participants, I recruited officers who were both more familiar and less familiar with retrieving policy information online (see Table 2, below). These participants represented the larger user population whose responses in the preliminary survey indicated similar variance in familiarity. Specifically, 41.2% of respondents indicated that they spent between 10% and 20% of their time looking for information in electronic publications, and another 22.7% indicated that they spend less than 10% of their time doing so. Therefore, selecting participants that had different levels of familiarity with the system gave a better approximation of the actual user group as a whole.

More junior officers (second lieutenants) were excluded from the user population since their lower job experience level may have strongly and negatively impacted their performance. However, these more novice users may be an important secondary audience to consider in future studies.

d) Participant Availability

Finally, while I tried to recruit representative participants, the short time frame for this study, and the resources involved in soliciting from a larger participant pool, meant that I had to limit my participant base to California. All participants were selected from Marine Corps Base, Camp Pendleton due to its proximity and ready access to users. However, to ensure that our participants were appropriate, we included a brief pre-test questionnaire (see Appendix C) to verify that their characteristics were consistent with the target user profile derived from Marine Corps demographics: Captains and First Lieutenants between the ages of 26 and 35 with no less than two years of service and a minimum four-year college degree. Table 2 summarizes the actual characteristics of our five test participants.

Table 2. Pre-Test Survey Results

Stats from Pre-Test Questionnaire

Age Group	Age 26-35	All Users	100%
Internet familiarity	Very familiar	User 1,4	40%
	Familiar	User 2,3,5	60%
Time spent on pubs	0-10%	User 1,4,5	60%
	10%-20%	User 3	20%
	30%-50%	User 2	20%
How long in supply?	yrs 2-4	User 4,5	40%
	yrs 4-10	User 1,2,3	60%
Education	BA/S degree	User 2,3,4,5	80%
	graduate degree	User 1	20%

4. Selecting Appropriate Tasks

Tasks conducted during a usability test must represent tasks that the defined users would realistically be expected to perform; this requirement necessitates an understanding of users' jobs and tasks.[32] The results of the preliminary survey (see Table 1, page 15) provided valuable insights and helped me to better understand user tasks.

Driven by these survey responses and my own experience with practical situations in those areas, I created two scenarios based on the most common tasks selected by respondents[33] (a synopsis of the scenarios is provided later in this chapter).

5. Targeting Components

A usability test, depending on its goals, targets certain components of the overall system. Typical components include help systems, navigation systems, page layouts, and others. However, testing every component of a system can be cost-prohibitive and time-

[32] Dumas and Redish, *A Practical Guide to Usability Testing*, 23.

[33] Test results indicated that users found the selected tasks to be relevant and realistic of those they would conduct on the job (See chapter III).

consuming. In this study, I was interested in understanding how users "naturally" use the system to locate and retrieve information; in other words, users needed to be free to navigate and search as they would normally. Therefore, for this test, I selected components which are key to locating information—information navigation and search.

a) Information Navigation

The policy documents, as previously indicated, come from multiple sources, in a variety of policy document types, and have frequent changes, supplements, and cancellations. Additionally, many Web sources make internal references and cross-references to other policy documents which may or may not be located under the same source. This system complexity may impede the users' ability to find the documents they need, and to collate the information in an effective and efficient manner. To understand navigation difficulties better, I focused on instances where a user cannot accomplish the following:

- Identify the correct location
- Return to a previous location
- Find information believed to exist somewhere, or
- Remember key points learned[34]

If a navigational aid is effective, it should assist the user in finding information effectively and efficiently.

b) Search

A primary benefit of electronic resources is that systems can improve how users can search for information, which can positively impact effectiveness and efficiency. Keyword searching, hyperlinking, and other methods have brought new access capabilities when compared with paper-based systems. Search mechanisms are

[34] Deborah M. Edwards and Lynda Hardman, "Lost in hyperspace: cognitive mapping and navigation in a hypertext environment" In *Hypertext: theory into Practice*, R. McAleese, Ed. Intellect Books, (Exeter, UK, 1999), 90-105.

particularly valuable with regard to policy documents where the user's primary purpose is to retrieve specific policy information rather than simply browsing or reading for enjoyment. In this study, I targeted the component of search mechanisms because of its particular importance to my users' key tasks.

B. RESEARCH QUESTIONS AND USABILITY MEASUREMENTS

Scenario tests should be based on realistic scenarios that drive to specific research questions. For this study, I identified three specific research questions that focused on basic information retrieval (question 1) and on the larger issues of goal (question 2) and process (question 3):

1. Can users easily and efficiently locate financial management and property control regulations?
2. Can users easily and efficiently locate all necessary information to answer work-related questions?
3. How do users look for information?

1. Usability Measurements

Each of the above research questions were broken down into key usability elements around the issues of navigation and search. I have also identified the primary modes of answering these research questions (indicated parenthetically).

a) Issue 1 -- Effectiveness

Issue 1.1 Do the navigation and search tools effectively aid users in locating a Marine Corps policy document that will help them achieve their goals? (task one failure rates – property control scenario)

Issue 1.2 Do the navigation and search tools effectively aid users in locating policy documents that originate from other sources? (task three failure rates – financial management scenario)

Issue 1.3 Do search tools and navigational design within documents provide an effective means for users to locate critical information related to their goals? (task two and task four failure rates, verbal data)

Issue 1.4 Degree to which users believe the system supports their work (subjective scale question)

b) Issue 2 -- Efficiency

Issue 2.1 Do navigation design and search tools assist users by enabling easy and efficient location of policy documents? (number of methods used/paths followed, failed keyword searches, verbal data)

Issue 2.2 Do navigation design and search tools assist users by enabling easy and efficient searching for information within documents? (number of methods used/paths followed, failed keyword searches, verbal data)

c) Issue 3 -- Satisfaction

Issue 3.1 Overall user confidence in the system (subjective scale questions, System Usability Score (SUS), verbal data)

2. Summary

The following summary table provides a graphic illustration of how the scenarios relate to the areas of concern (issues) and the components for which I desire to gain insight through the testing. Additionally, the methods of observation for each scenario are also provided:

Table 3. Project Overview

Task	Scenario	Issue	Components	Observation
1	• Electronically locate supply policy documents to guide you in accounting for SL-3 items	• Easily Locate Marine Corps documents • Currency/source reliability • Satisfaction	• Navigation Aids • Search tools	• Task failure rates • Survey response • Verbal • SUS
2	• Use electronic supply policy documents to determine authority to establish quantity, and procedures for accounting for UURI SL-3 items	• Locate critical information • Easily search critical information • Satisfaction	• Navigation Aids • Search tools	• Task failure rates • Methods used • Failed Searches • Verbal
3	• Electronically locate governing GCPC policy documents	• Easily locate documents from another source • Currency/source reliability • Satisfaction	• Navigation Aids • Search tools	• Task failure rates • Survey response • Verbal • SUS
4	• Use electronic GCPC documents to determine authority to purchase	• Locate critical information • Easily search critical information • Satisfaction	• Navigation Aids • Search tools	• Task failure rates • Methods used • Failed Searches • Verbal

Each of my research questions, along with the targeted tasks and components, drove the design of the test scenarios. My goal was to create test scenarios and tasks that would drive users to suspected usability problem areas and provide the basis for measurements of usability.[35]

[35] Dumas and Redish, *A Practical Guide to Usability Testing*, 176.

3. Scenarios and Tasks

The following section provides a synopsis of the scenarios and tasks given to participants. The researcher created the tasks in accordance with guidance from *A Practical Guide to Usability Testing* [36] that cites four criteria for selecting tasks:

- Tasks that probe potential usability problems
- Tasks suggested from your concerns and experience
- Tasks derived from other criteria
- Tasks that users will do with the product

The preliminary survey results indicated that the two tasks most commonly conducted were in the areas of property control and financial management. So, participants were given two scenarios, one in each of the two areas. After the test, participants confirmed that the scenarios were realistic. As one participant put it, "these are great scenarios…because I've been there." Another participant noted, "It's funny, I've actually seen stuff like this before," and still another echoed that, "I've had personal experience with something similar." The complete details of the scenarios and tasks can be found in the test plan in Appendix D.

a) Property Control Scenario

The property control scenario required the participant to investigate proper accountability procedures regarding "Using Unit Responsibility Item" (UURI). The specific instructions required the participant to advise the commander as to whether or not specific items are to be recorded on supply property records and, if so, who would be authorized to establish an allowance for such an item.

Task One. The first task under this scenario required participants to locate policy documents they thought were applicable. Participants may or may not know the title or numerical designator of the policy source when executing the task. The task

[36] Ibid, 160.

required search and navigation to a specific internal Marine Corps supply procedure. Participants were given a five minute time limit to complete this task. The task specifically targets the user's ability to locate a particular Marine Corps policy document that will help them achieve their goals (issues 1.1 and 2.1).

Task Two. The second task for this scenario targets a more complex issue—whether or not users can use navigation and search aids within a document to effectively and efficiently locate and collate information into a cohesive response to a policy-related question (issues 1.3, 1.4, 2.2). A time limit of ten minutes applied to this task.

b) Financial Management Scenario

The financial management scenario required the participant to determine the legality of a proposed purchase of un-priced maintenance services for a General Services Administration (GSA) vehicle with the Government Commercial Purchase Card (GCPC), given an estimated cost of $2600.

Task Three. Task three falls under the financial management scenario and essentially mirrors task one in the preceding scenario; the participant must locate the applicable electronic policy documents within a five minute time limit. The differentiating factor is that the GCPC program is not governed directly by the Marine Corps and thus tests how users might look for policy documents when the source is less obvious. Therefore, this task targets the user's ability to locate a policy document that originates from a source other than the Marine Corps and that will help achieve the user's goals (issue 1.2 and 2.1).

Task Four. Task four targets the user's ability to easily and efficiently search for information within documents to answer a work-related question. In this scenario, participants were asked to identify three items: whether the purchase exceeds the purchase amount threshold, if the policy prohibits a purchase of this type (un-priced service), and if any authority prohibits the purchase of this particular item (GSA vehicle). A time limit of ten minutes applied and the resulting data were used to address research issues relating to the effectiveness of search tools and navigational design within

documents (issue 1.3), the efficiency of those navigation and search tools (issue 2.2), and overall user confidence in the system (issue 3.1).

4. Metrics

In this section, I define metrics that I used to evaluate performance including failure rates, verbal data, System Usability Scale (SUS), number of paths followed, and failed keyword searches.

a) Failure Rates (Task 1 - Property Control Scenario)

Task success was defined as a participant's retrieval of a policy document which could provide the answers required in task two within a time limit of five minutes. Time began after participants had read the scenario and began to use the computer. The primary policy document which provides these answers is Marine Corps Order P4400.150E, the Marine Corps Consumer Level Supply Policy Manual, located on the Marine Corps homepage at www.usmc.mil. There are multiple ways in which the document could have been accessed. One possible navigational approach was to select 'Publications' from the main screen menu, and then select 'Orders and Directives.' This would lead the user to another screen which lists methods of browsing documents. From there, selecting 'MCO "P" Directives' would provide the entire listing from which the user could select this document.

b) Failure Rates (Task 2 - Property Control Scenario)

Participants who were unsuccessful in locating a policy document during task one were given MCO 4400.150E as a starting point for task two. Task success was determined by the participant's correct response to the two requirements of the task within a ten minute time limit. A correct response to the first question required

identification of the commanding officer as the proper authority to establish an allowance for a type II UURI SL-3 item. This information was located in paragraph 2011c, which states:

> …where "AR" (as required) is the stated quantity, the commander must establish, in writing, the authorized quantity to be held by the command.[37]

The correct response for item two was located in the next paragraph 2011c(1), which stated:

> UURI's that are identified as having a type 1 or 2 TAMCN [Table of Authorized Material Control Number] should be validated against the unit's EAF [Equipment Allowance File] and accounted for on the unit property records.[38]

c) Failure Rates (Task 3 - Financial Management Scenario)

Task success was defined as a participant's retrieval of a policy document which originated from an official government source, and which could provide the answers required in task four, within a time limit of five minutes. Time began after participants had read the scenario and began to use the computer. The primary policy document which governs the Government-Wide Commercial Credit Card Program (GCPC) within the United States Marine corps is NAVSUPINST 4200.99, issued by the Department of the Navy.[39] A variety of other documents also provide policy guidance for the program, and originate from official government sources, including Standard Operating Procedures (SOPs), Guidebooks, Internal Operating Procedures (IOPs) from subordinate commands and many others.

At the time of the test, two primary options existed to retrieve an acceptable policy document. One option was the Marine Corps' Contract Management

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[37] MCO P4400.150E, Section 2011c.

[38] Ibid., section 2011c(1).

[39] Naval Supply Instruction (NAVSUPINST) 4200.99, *Department of the Navy (DON) Policies and Procedures for the Operation and Management of the Government-Wide Commercial Purchase Card Program (GCPC)*, (October 2006) (hereafter cited as NAVSUPINST 4200.99). http://hqinet001.hqmc.usmc.mil/I%26L/V2/CMPG/ (accessed October 18, 2007).

Process Guide (CMPG) (NAVSUPINST 4200.99), located at http://hqinet001.hqmc.usmc.mil/i&L/v2/CMPG/index.htm. Additionally, the Marine Corps Base, Camp Pendleton, GCPC program is a source for this information.[40]

d) Failure Rates (Task 4 - Financial Management Scenario)

Participants who were unable to locate a document in task three were given an electronic pdf file of NAVSUPINST 4200.99 retrieved from the Marine Corps CMPG site identified in paragraph (b) above, as a starting point for task two. Task success was determined by the participant's determination that the purchase was unauthorized by explicitly referencing one of the three factors which would have prohibited the purchase and doing so within a time limit of ten minutes. The three factors were:

1. Dollar amount exceeds purchase limit threshold,[41]
2. An un-priced service without an established ceiling price is unauthorized,[42] or
3. The specific exclusion of purchasing services for GSA-leased vehicles.[43]

Additionally, the information must have been derived from an official government source as defined in paragraph (b) above. There were three acceptable solutions:

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[40] Regional Contracting Office – Southwest (Marine Corps Base, Camp Pendleton, CA). http://www.rcosw.com/apporders.htm (accessed October 10, 2007).

[41] NAVSUPINST 4200.99, section 1.4.b.1.

[42] Ibid., Section 5.19.

[43] Regional Contracting Office Southwest, *Government Commercial Purchase Card (GCPC) Program Internal Operating Procedures*,(Marine Corps Base Camp Pendleton, California) (September 2003). http://www.rcosw.com/RCO-SW%20%20IOP.pdf (accessed October 18, 2007).

1. Using NAVSUPINST 4200.99 or other official guide books which prohibit un-priced services and sets limits to the purchase price.
2. Using Purchase Card Policy Notice (PCPN) 7 to identify that the purchase exceeded the recently increased purchase limit established.
3. Using the Regional Contracting Office – Southwest (RCO-SW) website was accessible at www.rcosw.com. to see that the 'repair or alteration of a GSA-leased vehicle' is prohibited for card holders under their purview.

e) Verbal Data

Verbal data are qualitative measurements collected in accordance with the protocols identified later in this section. Verbal data, to include both think-aloud commentary and interview responses (discussed at length in the Protocol section, below), were assessed and attributed to specific problem areas where applicable.

f) System Usability Scale (SUS)

The SUS survey tool was developed in 1986 by usability practitioner John Brooke.[44] The survey consists of a series of ten questions, each using a five-point Likert scale to rate varying aspects of usability. Scoring is combined to provide a single measure of overall usability. To determine the SUS score, I used the standard scoring process described by the designer of the SUS, resulting in a usability rating on a 0% - 100% scale. The protocol and its specific scoring mechanism are discussed fully in the Protocol section below.

g) Number of Paths Followed

Two types of paths were tracked—searching and navigating. Searching different keywords within a single search technique was not considered a different approach. However, applying a different search filter or different search engine was considered a different search approach. Additionally, if a search approach was used and

abandoned for another search approach, returning to the original approach would qualify as an additional instance when calculating the number of search paths used.

The other approach possible was a navigational trail. An instance of a navigational trail was recorded for each "wrong" path of navigation. "Wrongness" was determined by the participant's election to 'go back' and begin a different navigational trial, or by simply abandoning the location for another method.

In total, the number of paths used consists of the combined number of instances for both approaches.

h) Failed Keyword Searches

A failed keyword search was recorded each time a participant's keyword did not bring him to a location which could provide success as identified in each of the task areas.

In addition to the above metrics, I employed several different protocols which are discussed in the next section.

C. PROTOCOLS

Protocols used, in addition to the above metrics, include surveys, semi-structured interviewing, and "think-aloud" verbalizations as data sources.

1. System Usability Scale (SUS) and Other Subjective Scale Questions

In 1986, usability practitioner John Brooke developed the System Usability Scale (SUS), as a reliable, low cost scale that can be used for global assessments of systems usability.[45] Each question on the SUS uses a five point Likert scale, soliciting the degree to which a participant 'strongly agrees' or 'strongly disagrees' with statements regarding

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[44] John Brook, "SUS: A 'Quick and Dirty' Usability Scale." In *Usability Evaluation in Industry*, ed. Patrick W. Jordan (London: Taylor and Francis, 1996), 189-195.

[45] See note 49.

system usability. In the 1996 book, *Usability Evaluation in Industry*, the SUS developer contends that the most effective questions utilizing a Likert scale are those which solicit the most extreme responses:

> The items leading to the most extreme responses from the original pool [of 50 potential questions] were then selected…items were selected so that the common response to half of them was strong agreement, and to the other half, strong disagreement. This was done in order to prevent response biases caused by respondents not having to think about each statement; by alternating positive and negative items, the respondent has to read each statement and make an effort to think whether they agree or disagree with it.[46]

Due to the alternating positive and negative items, the SUS requires a scoring technique that accounts for the resulting numerical variance in raw scores.[47]

Results from the SUS are presented in terms of percentages with 100% indicating perfect usability. As stated, this SUS scoring method is the standard manner described by the test's designer to give an overall assessment of usability. The SUS questionnaire is provided in Appendix A.

In addition to the SUS questions, participants were asked to respond to three additional statements using the same five point Likert scale. The responses were evaluated in relation to specific research issues of effectiveness and were not included in the SUS score calculation. The additional statements were:

- I found the system supports my work
- I was fairly confident that the information was the most current available
- I was fairly confident that I found all the information by using this system

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[46] See note 49.

[47] First, raw scores are converted to a SUS contribution score for each individual question. SUS contributions are calculated differently depending on whether the question is worded positively or negatively. Questions in which positive answers generate high scale ratings were scored by subtracting one from the scale rating marked. Questions in which positive answers generate low scale ratings were scored by subtracting the scale rating marked from five. This method gives equal contribution opportunity for each question with a range of zero to four and thus equates to a total forty possible points from the ten question survey. The total contribution, then, is multiplied by two point five in order to put the SUS score on a 100 point scale.

2. Think Aloud

Think-aloud protocol is widely accepted for the collection of verbal data in a variety of disciplines including cartography, engineering and reading comprehension.[48] This type of protocol calls for participants to verbalize their thought processes while conducting a task, which a researcher can later analyze to gain insight into a user's cognitive process. Researchers Ericsson and Simon are accredited with the core research for this type of verbal data in their 1980 article "Verbal Reports as Data."[49]

Usability studies often rely on this method for the collection of data. Respected usability practitioner, Joe Dumas, indicated in a recent review of the practice that, "Think aloud is the most important method we have in the toolkit of usability evaluation. It uncovers more problems than any other measure."[50]

There is some debate in the field, however, over appropriate use of the protocol, and the validity of data, if it is not administered carefully. In a 2000 review of the method, authors Boren and Ramey indicate that practitioners can avoid these pitfalls by carefully adhering to four basic principles of the original research by Ericsson and Simon:

- Participant introspection, inference or opinion must not be valued or actively elicited
- Give detailed instructions for thinking aloud
- Remind participants to think aloud
- Otherwise, do not intervene[51]

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48 Judith Ramey and others, "Does think aloud work?: how do we know?" In *CHI '06 Extended Abstracts on Human Factors in Computing Systems* (Montréal, Québec, Canada, April 22 - 27, 2006). CHI '06. ACM, New York, NY, 45-48. DOI= http://doi.acm.org/10.1145/1125451.1125464

49 K. Anders Ericsson and Herbert A. Simon, "Verbal Reports as Data", *Psychological Review*, 87, no. 3 (1980): 215.

50 See note 48.

51 Ted Boren and Judith Ramey, "Thinking Aloud: Reconciling Theory and Practice," *IEEE Transactions on Professional Communication,* 43, no. 3 (2000): 261.

These principles guided the protocol application for this usability test. Participants were told about the think aloud protocol and given a detailed description of the process prior to conducting the scenarios. I further described the process by conducting a practical example with each participant. Using a website, I described my actions while navigating the site. For example, I might state, "I'm looking for information on shopping so I think I will click on this shopping button…Oh, that didn't work like I thought. OK I'll try…." Participants were then asked to confirm their understanding of thinking aloud.

While participants conducted tasks, I did not intervene in any way. Participants were, however, reminded to continue thinking aloud when they discontinued doing so. I employed a neutral, standard prompt, asking participants, "Can you tell me what you are doing now?" This method was employed in order to solicit continued verbalization without interjecting bias.

The think aloud sessions were video recorded and I later transcribed observations and participant statements for trend analysis. Where trends were found, selected verbal data from the think aloud process were combined with post-completion interview data for incorporation into the analysis and findings.

3. Qualitative, Semi-structured Interview

Upon completion of the scenarios, participants were asked to discuss what they had experienced while working with the system. I maintained a neutral approach to interviewing in order to reduce potential bias. I accomplished the neutrality by refraining from leading questions which may have driven participants toward a particular response.

The interview period began with the question, "Can you talk about your experience with the system?" Follow up questions were asked in reference to participants' specific actions while completing the task. These follow up questions focused on suspected problem areas the participant had experienced during the test. However, these questions were presented in an open-ended syntax, also to avoid bias and solicit richer responses. For example, I would state, "While you were reading, you commented, 'I need to go back up a little,' could you discuss that a bit?" Furthermore, I

avoided using affirmations that might suggest agreement or otherwise influence a participants' thought process. The interviewer typically acknowledged statements by using non-evaluative remarks such as, "OK," or "mmmhmm," and then continued to the next area of interest.

III. ANALYSIS OF RESULTS

In this chapter, I discuss the findings from my analysis of trends in the user data. The findings relate to three areas: using the system in general, locating documents, and using documents themselves. Verbal analysis was conducted in three stages. First, the video recordings were reviewed to get an overall sense of participant actions and commentary. Second, the videos were reviewed again and activity and commentary were transcribed. Third, the transcriptions were analyzed to isolate potential themes. Last, the transcriptions were reviewed again to refine the data and ensure that the emergent themes held constant.

Overall, I found that users felt the system is adequate and supports their work, yet search limitations as well as incomplete and inconsistent document libraries erode their confidence in using it. The data also show that users were not able to complete all tasks within the time limit by using this system. Further, it was evident that search and navigation deficiencies were a contributing factor.

Additionally, I found that users are seeking some capabilities that do not exist in the current system. Specifically, users desire a capability to make documents personalized and portable so that they can easily access documents they use repeatedly, and users want to make notes or annotate areas within documents that they commonly use. Each finding is presented in a detailed data/discussion format which follows.

A. USERS RANKED THE EXPERIENCE AS MODERATELY EASY

The data show that users believe that the system supports their work and is not prohibitively difficult to use. However, usability rankings, user comments, and observation of problem areas indicate that users had a moderate level of difficulty overall.

1. User Data

My survey data indicate that users found the system moderately easy to use:

- Participants ranked the overall usability (SUS) 71.5% on a 0%-100% scale
- "I found the system supports my work." (Mean response of 4.0 on a 5 point scale)

Users commented positively that the Marine Corps website (www.usmc.mil) assists their efforts in locating information:

- "I knew where to go….I've used that [www.usmc.mil] before…If you click on publications it brings you to everything, forms, orders, directives…That's not hard to navigate"
- "I know immediately to go to the Marine Corps website….It breaks it down pretty clearly how you want to look them up…If I'm able to do keyword searches it saves a lot of time"

Users expressed some difficulty with locating information on the site:

- "It's all right there if you can find it…. I usually use Google…once I figure out what I'm looking for then I can go to [www.]usmc.mil because it has the information out there"
- "I didn't feel it was bad….Once I found what I was looking for …..I had to search around a little bit….I didn't think it was bad"
- "…Not sure where it is on here…I'm sure it's on here somewhere."

And users often left the site to conduct keyword searches:

- 5 of 5 participants abandoned the site to use commercially available tools (Google) when searching for keywords (2 after failed attempts to first use the keyword search on the site)

2. Discussion

Results from the SUS questionnaire and users' general reaction to using the system were relatively positive. The SUS score (71.5%) and the subsequent user comments suggest that users are tolerant and accepting of the current system which, as indicated by the positive assessment, does help support their work (mean score 4.0). In large part, this positive attitude seems to be centered on the idea that users felt confident that the documents could be found from the official USMC website, citing, "*I knew where to go,"* and *"it has the information out there*."

Some aspects of the user comments may indicate that while the overall experience was positive, elements affecting its ease of use may need improvement. For example, when interviewed, users inserted qualifiers such as "it's all right there *if you can find it*," "*I had to search around a little bit.*" and "I'm sure it's on here *somewhere."* Yet another user pointed out the site's limited ability to help determine which documents were needed to accomplish a task, "I usually use Google. Once I figure out what I'm looking for, then I can go to usmc.mil."

Another indication of user difficulty was evident because users often abandoned looking for documents from the USMC site after encountering unexpected or blank search results or anytime a keyword search needed to be conducted. The use of qualified statements and abandonment of the site indicates that while users expressed overall optimism about the system, some elements of effectiveness and efficiency reduce the users' overall satisfaction with using it.

B. USERS SEEK REASSURANCE THAT INFORMATION IS CURRENT AND COMPLETE

The survey results and user comments also indicated that users may lack confidence that the system will provide complete and current information, although some positive data exist in this area as well. Users tended to indicate that they *thought* the information would be current, but expressed some concern as to whether it actually was, in fact, current.

1. User Data

Collectively, users responded neutrally in the post-test survey when asked to report on their confidence in finding all of the salient information by using the system:

- "I was fairly confident that I found all the information by using this system." (Mean response of 3.0 on a 5 point scale)

User comments further identified a lack of confidence that simply retrieving information online will provide complete and reliable answers to their work-related questions:

- "I choose the paper version because there is a choice…..I think that bleeds over into the confidence in the documents."
- "…I would probably take more time to be sure of that [information found] and bounce it off what I find in other documents before I confirm anything."
- "I would have gone to the chief to make sure… [What are you doing now?] Going back through to double check… If I'm going to talk like an expert I wanted to reread it"

Post-test survey data were more positive in regard to the currency of information, but still indicates mild reservations:

- "I was fairly confident that the information was the most current available." (Mean response of 3.6 on a 5 point scale)

User comments generally supported that they thought information would be current due to the fact that it is electronically updated and maintained, but they were not assured of this currency, which they felt to be important:

- "Maybe it's just blind faith, but it seems like it's updated pretty regularly….the USMC site…I don't know if it's just trust….I never felt like I would get the wrong thing….I have confidence."
- "You'd want to make sure it's up to date….. this type of information changes on a yearly basis….I feel that having the most up to date is important….electronic documents are going to be the most up to date."
- "I didn't check the date but I have to assume through the USMC site they'll publish the most up to date stuff."
- "…the last time I was doing supply stuff, it wasn't really updated. I thought about going here [www.usmc.mil]….but didn't because it wasn't a real positive experience."
- "I don't know how old this document is… Maybe it's updated more often than this… [referring to RCO site]…I would assume these guys are the head…they've got the [most current info]."
- "This document is not up to date…it's talking about [limit of $2500] when I know its up to $3000…But I'll use it nonetheless… that would make me a little nervous that information I take out of here may not be entirely accurate …. I would follow up with a call to the contracting office."

- "I feel this is current and up-to-date… [www.]usmc.mil everything is up-to-date. The latest and greatest…. I feel more confident on here than what I would find in a pub binder [printed]."

2. Discussion

As participant four accurately points out, trust is a key factor in using information. Policy providers therefore need to ensure that their information supports "*confidence in the documents*" and "*having the most up-to*-date" information. Yet users found information which '*may not be entirely accurate*,' '*maybe…updated more than this*,' and were uncertain as to '*how old this document is*.' These comments indicate some concern exists over currency of information, particularly during scenario two, when users retrieved information from locations other than www.usmc.mil. Overall, however, users indicated that they felt www.usmc.mil provided '*the latest and greatest* and they expressed confidence through a marginally positive survey response (3.6). This marginal confidence is apparently representative of user reliance on '*blind faith*,' and "*assuming"* that the sites are up-to-date, rather than an explicit understanding that the information is current.

Another aspect of trust is the completeness of the information. Users indicated in the survey that they somewhat lacked confidence that all information had been located (mean response 3.0). This shortcoming is evidenced in user comments indicating they would 'choose paper,' 'bounce off other documents,' or consult other sources to ensure reliability and completeness of information.

C. USERS WERE UNSUCCESSFUL IN LOCATING POLICY DOCUMENTS FOR A MARINE-CORPS- SPECIFIC TASK

Although I have noted that users indicated knowledge of the www.usmc.mil web site as a primary source, users experienced difficulty using the site to locate the document required to complete a Marine-Corps-specific task. This was evidently the result of inadequate search functionality and a mismatch between the site layout and the way users view the content. Both items will be discussed further in later sections.

1. User Data

Users had difficulty locating documents within the USMC web site:

- 4 of 5 participants failed to locate the policy document required to complete the property control scenario within the time limit.

Most users did not use the site search function, and those that did were unsuccessful:

- 5 of 5 participants used www.usmc.mil in combination with Google as their primary search mechanism
- 2 of 2 participants failed when using the www.usmc.mil search box as a primary method for searching
- 3 of 5 participants did not attempt to use the www.usmc.mil search box

Only one user was able to find a document through site navigation:

- 2 of 3 participants failed when using general site navigation as a primary method augmented by Google keyword searches
- 1 participant succeeded by using navigation, choosing the option to browse 'all MCOs by SSIC'

2. Discussion

Users attempted to retrieve documents by navigating within the site (3 users), by using the site's internal search capability (2 users), and by augmenting their search with Google.com (5 users). All three methods proved to be ineffective, resulting in the high

failure rate (4 of 5 users). The one user that was successful navigated to the document and located it by its document number. The other four users, who did not know or search by document number, were unsuccessful. This indicates two things: first, that document number knowledge is useful for searching, but second, most users do not search in this way. The other four users searched instead using key terms drawn from the task, such as "CMR," "SL-3" and "accountability." In subsequent sections, the discussion of specific search and navigation difficulties provides additional observations, which may clarify the users' view of the task and problem space.

D. USERS WERE MODERATELY SUCCESSFUL IN LOCATING POLICY DOCUMENTS FOR A NON-MARINE-CORPS-SPECIFIC TASK

Users had greater success with a wider topic area by employing broad internet search capability via Google. All users were guided by the awareness of a potential source for the information (Regional Contracting Office (RCO)). However, users did not seem to know how to get to the source directly. Only one user relied on the www.usmc.mil site, and that user was unsuccessful.

1. User Data

Users experienced greater success in locating a document that was not specific to the Marine Corps:

- 3 of 5 participants succeeded in locating a policy document required to complete the financial management scenario within the time limit

The increased success was not attributable to www.usmc.mil. In fact, users either didn't consider it as an option or failed by using it:

- 2 participants never considered the site
  - "I never think to look on USMC site for credit card info….I didn't even look on USMC site…it could very well be there" (participant succeeded using Google)
  - "Is it the FAR?…I'll try DoD…Which agency would be in charge of that…I'll go to DAU…" (participant failed using DAU)
- 1 participant failed by attempting to navigate to the RCO site through www.usmc.mil)

Successful users primarily used broad internet search capability (Google) and user knowledge of a potentially viable source (Regional Contracting Office (RCO)). One user found the site immediately:

- 1 used Google to search for the RCO and then navigated to a card holder (CH) desk guide on the site

However, two other users were either 'lucky' or used a back-door method to find a source:

- 1 participant used Google to search for 'regional contracting southwest,' then opened a PowerPoint file returned by the search, then identified the RCO URL embedded in the Power Point, and only then retrieved the Approving Official (AO) desk guide.
  - The participant commented, "The USMC publications…it's just hard to search if you don't know the exact title or number, which I

will usually try to find it through Google or my paper documents…"

- 1 participant used Google to search for 'government commercial purchase card,' then followed a link to the HQMC GCPC SOP.
    - The participant commented, "I could have searched all day and not found it…..I just got lucky that exactly what I want popped up….I could have gone back to USMC….I don't know exactly where it is on there…. I guess I got lucky really…. I just did a Google search…and I got lucky a current SOP came up when I clicked on the link"

2. Discussion

Interestingly, only one user attempted to retrieve a policy document for this scenario by using the www.usmc.mil website and that user was unsuccessful. Of the three users that were successful in attaining a valid document, none used the USMC site. One used the HQMC GCPC SOP retrieved via Google, and two used GCPC desk guides retrieved through the RCO web site, also located via Google. These methods, combined with user comments, indicate that while the policy information is available from within the Marine Corps, users are not confident on where to obtain it:, "*I could have gone back to USMC…I don't know exactly where it is on there...I guess I got lucky,"* or "*I never think to look on the USMC site for credit card info,"* and "*it's just hard to search if you don't know the exact title or number."* Users, then, resort to internet searching, despite the designation of www.usmc.mil as the official site for policy within the Marine Corps. One user even resorted to a back-door method, locating the website from a PowerPoint file loaded on a server. While users should have options available to them and may still choose to search for policy in familiar ways (like Google), the utilization of www.usmc.mil may prove more effective if all available policy guidance were current and available there.

E. LACK OF A SINGLE, REPUTABLE, CONSOLIDATED SOURCE CONTRIBUTED TO INEFFICIENT SEARCH AND NAVIGATION

Users, on average, used between three and six pathways in their attempts to locate documents. Users that did not know the source document by title or numerical identifier had difficulty determining the location of the document. Users commented that a 'one stop shop' would be a preferred addition to the current organization to help alleviate this problem.

1. User Data

Users commonly resorted to inefficient methods of locating documents:

- An average of 6 pathways were used to locate documents for scenario one:
  - Units => by location => North Carolina => MCCSSS;
  - Publications=>Marine Corps Publications=>PLMS;
  - Publications=>Marine Corps Publications=>Technical Manuals;
  - Publications=>Orders/Directives=>Misc Pubs;
  - Searchbox using 'Orders' filter;
  - Searchbox using 'Directives' filter
  - Publications (from the drop menu – clicking directly as if it were a link, when it is not)

- An average of 3 pathways were used to locate documents for scenario two:
  - Google=>DAU web site:
  - Units=>Alphabetically=>Camp Pendleton (looking for contracting office);

- Publications (from the drop menu – clicking directly as if it were a link, when it is not)
- Google=>(in search of RCO web site)

Only one user knew the document number and was successful in navigating the USMC web site to find the document, other users were unsuccessful on the site:

- 1 of 6 navigational paths followed on www.usmc.mil resulted in the successful location of a document [browse by SSIC (participant knew the document number)].
  - The successful participant commented, "I think it's actually organized really well right now….you do have the options and it's all very clear, straightforward."
- 5 of 6 navigational paths followed on www.usmc.mil were unsuccessful. Paths included Publication Library Management System (PLMS), miscellaneous pubs, Technical Manuals, and others.

Users further commented on the need to know document identifiers:

- "I'm looking for the order/pub, for the one that lists the TAMs….I don't know what that is…[checks paper document, goes to Google]…the other thing is, just call division."
- "I'm going on a wild goose chase I have no idea…Just googling random [things] to see what I can find… I don't know the name of the pubs."

Users also expressed that a consolidated listing of all documents would help meet their needs:

- "I prefer a reputable one-stop shop…maintained with semblance of authority"
- [If you could organize how you wanted?]… "Listed by the SSIC code[52] regardless of whether it's a user manual, or P-directive[53] or category….listing all by code it might be easier like if you didn't know exactly what you were looking for……not to get rid of everything else but just another option……so it's geared toward each person's preference"
- "I thought there was a way you could just list them all here," [and later, after two failed site searches and attempting to use the 'Publications' menu option]… 'Is this the way you get the entire listing?'
- "….I think my only problem is not all the pubs are on there [www.usmc.mil]…What I really want is the [user manual#] 124 and I don't know where to get it…I've looked for some pubs that were not listed there [www.usmc.mil] and I'm not sure why."

2. Discussion

In looking for policy documents, users did not seem to have an efficient means through which they could locate the document desired, when looking for Marine Corps specific documents (average of 6 methods used). The only successful navigation method on the site was to seek a document by its numerical identifier (1 of 6 site navigation attempts), yet most users did not know the document identifier. For example, "I'm

[52] SSIC is the Standard Subject Identification Code, a taxonomy used throughout Naval documentation to organize documents by operational category. SSIC is itself controlled by regulation. See Department of the Navy SECNAV M-5210.2, *Standard Subject Identification Code (SSIC) Manual* (December 2005).

[53] Under the current organization, P-directives are listed separately and do not fall in numerical sequence with other directives and documents which are not preceded by a 'P' in the document number.

looking for the order/pub, for the one that lists the TAMs….*I don't know what that is"* and, "I'm going on a wild goose chase…*I don't know the name of the pubs.*" Thus, document identifiers alone do not support the manner in which users look for information.

Users sought documents in varying ways based on the information from the scenario or other key identifying information relative to the task. However, users did not always have a clear concept of where that information might be located: "I thought there was a way you could just *list them all here."* And "I've looked for some pubs that *aren't listed there, and I'm not sure why.*" Users also requested a complete, consolidated view of the information that is available, stating, "I prefer a *one stop shop* from a reputable source*."* These findings are consistent with usability best practices which suggest that sites should maintain multiple methods of entry to information and be consistent with the ways people do their work.[54]

F. USERS LACKED CONFIDENCE THAT THE USMC WEBSITE (WWW.USMC.MIL) SEARCH ENGINE WOULD PROVIDE ADEQUATE RESULTS

Users verbally stated their lack of confidence in the USMC search tool. Users that attempted to use the search tool found no relevant results. As a result, most users frequently relied on Google to conduct searches when looking for policy documents, despite commonly acknowledging that the www.usmc.mil site is the primary resource for policy documents.

[54] U.S. Department of Health and Human Services, *Research-Based Web Design & Usability Guidelines,* Chapter two. http://www.usability.gov/pdfs/guidelines.html#2 (accessed December 1, 2007).

1. User Data

Users generally expressed a lack of confidence that the search box on www.usmc.mil would be helpful:

- "You have to know exactly what you're looking for….It's hard to search….the search engine on the website…I haven't had much success with…I usually will go to Google or look in my [paper-based] pubs."
- "You generally don't use [the www.usmc.mil search tool] because it's never really done what I wanted…To me, as a user, it seems like the search engine is kind of weak."
- "The times I have used the search box hasn't brought up what I want….it's not the most user friendly…"
- [What would make your experience better?] "Maybe a Google-type search engine on usmc.mil where it brings up kind of what I'm looking for…..a stronger, more user friendly search engine on the USMC website…"

This lack of confidence led users to rely primarily on Google for searching:

- 5 of 5 participants eventually abandoned the www.usmc.mil site for Google when attempting to search by keyword
- 2 of 5 participants attempted the www.usmc.mil search box first, and then immediately abandoned the site for Google after getting zero results

Users that attempted to use the search capability were confused by the search filters, and abandoned it due to lack of search results:

- 1 participant tried to search without a keyword [seeking a full list of publications], and then with the keyword 'supply manual' using the orders filter and then again by using the directives filter – all three returned zero results
    - The participant commented [after zero search results], "I'd stick with Google at this point…I'm getting something"
    - And later, during the interview, "I was looking for orders and the dropdown menu reset to directives… until you get results it's not clear …did it search for orders or did it search for directives?"
- 1 participant attempted to search for 'accountability,' first using the orders filter, then again with the directives filter. Both returned zero results…the user abandoned the site for Google

2. Discussion

Users avoided using the search tool on the www.usmc.mil website, indicating that they "*haven't had much success with [it],*" "*it's never really done what I wanted,*" or "*it's not the most user-friendly.*" All of the users in the study primarily used Google to search, presumably in part due to this impression of the site's '*kind of weak*' search capability.

The search capability of the website should be easy to use and provide expected results. In this study, the search tool was deficient in both areas. First, users did not find the tool easy to use. The two users that chose to use the tool both had difficulty with the search filter, first applying the 'orders' filter, and then, after no results,

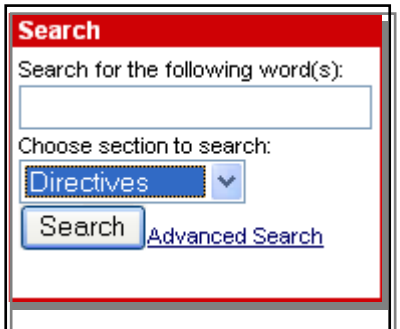

Figure 1. USMC Search

applying the 'directives' filter, which also returned zero results for their search terms (See Figure 2). One user noted that regardless of the filter applied, the tool defaulted back to 'directives' after the search was complete and he commented, "*It's not clear…did it search for orders or did it search for directives?"* Additionally, since both users attempted the search for their keyword using each filter successively, it would appear that users do not understand what areas of the site correspond to the different search filter selections 'orders' and 'directives.' detracting from the search tool's ease of use. These data suggest that the search filter may need improvement to alleviate user confusion.

Second, the search tool did not provide expected results. The users conducted the searches using terms they suspected to be in the target document title or text. On each occasion that the search tool was used, zero results were returned (both users, either filter). The search term '*accountability*,' for example, is prevalent throughout the target document, yet the search engine did not return any results for this search term. The term '*supply manual'* should have returned the intended source document (from the title – Marine Corps Consumer Level *Supply* Policy *Manual*) yet it did not. These examples highlight that the search engine does not perform the way users expect and causes users to leave the site. As one user indicated, "*I'd stick with Google at this point. I'm getting something."*

G. USERS NEED BETTER WAYS TO ACCESS AND EASILY RETURN TO THEIR FREQUENTLY USED DOCUMENTS

Some users indicated the repetitive nature of their research and expressed a desire to maintain availability of their commonly used documents without searching again or downloading them each time.

1. User Data

Users repeatedly use the same source documents for information:

- "There's like two pubs used for 99% of stuff we did… for the majority of answers you go through…you go to the same stuff over and over again."

Additionally, users seek ways to globally access those documents:

- "I'll use Google or USMC [www.usmc.mil] because I may not be at my computer…I won't have my document with me…. Maybe [if it brought up my desktop…] that way I can reference it."

Without this feature available, users attempt to create portability in their own way:

- "I usually use my own stuff…" [referring to paper documents]
- "Normally, a lot of this stuff is bookmarked"

The nature of the military environment also reinforces the need for global access:

- "When I was at my old unit, I actually had that downloaded to my desktop [while observer retrieved the primary source doc]… I didn't want to take time to download everything."

2. Discussion

In addition to the 'one-stop shop' previously identified, users are concerned about document organization and availability as it relates to their common needs. As one user commented, "You go to the same stuff over and over again." Naturally, then, users do not want to repeatedly search for the same documents. These data imply that efficiency may be increased by giving users an option to customize a policy screen, which would allow them to electronically create the personalized, portable access desired and "use their own stuff". Another option might be a 'frequently used' component for the interface where people can quickly see the most frequent items used.

H. USERS WERE NOT SUCCESSFUL IN QUICKLY LOCATING ALL THE INFORMATION NEEDED FOR DECISION-MAKING

The data show that users who referred to procedural documents had more success in locating information to answer questions than those that strictly used policy documents. Those users who were seeking procedural information in policy documents, (a common occurrence as we have shown) were unsuccessful in locating answers.

1. User Data

In scenario one, most users found partial answers but were not able to answer the Commander's question regarding how to properly account for UURI items:

- 4 of 5 participants correctly identified the Commanding Officer as the proper authority to establish allowances
- 5 of 5 participants consulted MCO P4400.150E (either located or provided to them) as the source document for UURI
- 0 of 5 participants located the information on how to account for UURI component items within this policy document

In scenario two some users found enough information to advise the Commander against the purchase by using guides and SOPs, but none found all the information requested:

- 0 of 5 participants located all information requested
- 3 of 5 participants determined that the purchase was unauthorized by using desk guides or the HQMC SOP (procedural documents) as a source document
    - 1 of the 3 participants commented, "I go to CH desk guide because it has 'in the weeds'….answers"

Users provided the policy document NAVSUPINST 4200.99, however, were unsuccessful in making a determination:

- 2 of 5 participants were provided NAVSUPINST 4200.99 as a source document
  - 1 of the 2 participant prematurely advised that their was 'a possibility' that the purchase could be authorized under the necessary expense rule (NAVSUPINST 4200.99 as source)
  - 1 of the 2 participants made no advisement (time expired)

2. Discussion

Users who referred to policy documents (MCO 4400.150E for scenario one and NAVSUPINST 4200.99 for scenario two were unsuccessful in finding all required information to complete the task. Users who referred to procedural documents like desk guides (2 users) or SOPs (1 user) were able to find the information that enabled them to accurately advise the Commander in scenario two. Yet, the tasks required users to cite policy on the subject, not to describe the procedures they would use. This indicates that policy and procedural documents may not be entirely severable, suggesting a need for a more comprehensive, integrated system of information availability. In fact, users seemed to prefer to use procedural documents to find policy answers (3 of 5 users). As one successful user indicated, "*I go to the desk guide because it has 'in the weeds' answers.*"

As previously evidenced from the survey results and validation of the scenarios, the user group is typically driven to policy documents to solve procedural questions to ensure that procedures are in accordance with policy. Since policy documents are not necessarily organized by procedure, users may be more inclined, and more successful, when using procedural documents in place of the source policy document because they reflect the user's goals more directly.

I. USERS HAD DIFFICULTY MOVING WITHIN DOCUMENTS

Users spent a lot of time scrolling within documents to locate information referred to from other references within the document (for example, the Table of Contents (TOC) and chapter headings). To circumvent the problem, users initiated work-arounds, but suggested enhancing documents with better search capability and internal hyperlinking.

1. User Data

Users unsuccessfully attempted to locate information within documents using keyword searches.

- 3 of 5 participants attempted to search for a keyword, but moved to the TOC after receiving ineffective results

Users scrolled between the TOC, the Index, and Headings to locate the information they needed.

- 4 of 5 participants used the TOC and subordinate headings extensively to narrow their search:
    - "I was looking at TOC for a keyword….which chapter, how's it going to break it down, what keywords do THEY use…[then, reading chapter headings]…It's talking about principal end items…I know I need to read through 1005-1007, 1008 too."
    - [After three failed keyword searches]…"I'm going to go to TOC in this case….which is clearer."
    - [reading TOC headings] "TAM authorized materials that are where I'm going to go."

- "….I could get that [keyword (SL-3)] anywhere so I went to the index to try and narrow it down a lot quicker."
- "The document was hard to negotiate…[due to lack of chapter headings]"

- 5 of 5 participants scrolled repeatedly between document locations when they had already determined the location they sought from a TOC or chapter heading:
  - [user finds TOC and then pages down to chapter 5, 'accountability procedures'…then reads chapter headings] "…I might have been wrong…Chapter 5 is what I thought I wanted but maybe not." [scrolls back to TOC]
  - [Scrolls from TOC through to index…TOC led him to inventory control procedures….in index he found 'SL-3'….] "It's different chapters….so I'm going to go here…" [scrolls back up to find the location]

Users had to rely on memory and workarounds for moving between references:

- "It referenced another paragraph…I'm going to go to that…should've wrote that down…I'm going to search that." [copies paragraph number and pastes into search tool]
- [participant types TOC referenced page number in the search tool to locate the page] "…The page numbers are on the bottom, but the forward button takes me to top of page [so I can't see the page when I use it]…It's delaying the process."

Users identified more efficient ways to retrieve information.

- "I think I could go faster….with a paper document…the way I do things…..I flip to the front, I flip to the back, I look for some keywords."
- I really like [keyword searching]...that way I know immediately if what I'm looking for is in that pub or I have to scroll through it…before I knew to do that I used to use the TOC and it would take me a lot longer."
- "I do like the ones where the TOC is linked."
- "The only other thing is….hyperlinking….for example….I love when things are hyperlinked…" [Refers to internal document reference from paragraph 2011 to paragraph 2003 (but no hyperlink)]

2. Discussion

Primarily, users were navigating Adobe pdf files that had produced in a manner which allows keyword searching but mostly had no embedded hyperlinking (except the HQMC SOP which was created in Microsoft Word format). From the user data, it is clear that better navigational aids would increase efficiency. As one user indicated, "*I love when things are hyperlinked."*

Most users (4 of 5) relied heavily on the TOC and subordinate chapter headings to narrow their search. However, the lack of internal hyperlinking or other navigational aids resulted in inefficient navigation when moving between headings and topic areas. The lack of navigational aids caused users to scroll a lot, take notes to remember document areas, and cut-and-paste words into the search tool to navigate internally. One user attempted to page through with the page buttons, but found that it was "*delaying the process."* All of these methods proved to be inefficient as users navigated from topical headings to document text and back to topical headings. One user put it simply, stating, "*I could go faster with a paper document*."

J. USERS NEED RICH CONTEXT TO UNDERSTAND SEARCH RESULTS AND IDENTIFY KEY INFORMATION

Several users commented that keyword searching, while beneficial, usually takes them directly to a place in a document that does not allow them to see the greater context in which the finding is presented. This creates inefficiency for users who then attempt to reveal the context by scrolling to the topical heading or by other means.

1. User Data

Four users commented on the need for topical headings to be associated with keyword findings:

- "Sometimes the greater section heading let's you know what context you are looking at that paragraph in….sometimes just going to the instance doesn't give you the answer."
- "If I went right to it [with keyword search] I might have to go back up and re-read so I just decided to read the whole thing" [Re-read?] "Yeah, to get the background…lf you go right to that exact term you might have missed some key information."
- [You said, "well, I need to go up a little bit"] "I wanted to double check to see if I was in the right area."
- [On finding a keyword, then scrolling up] "to see what are we talking about here….what chapter are we in…" [scrolls up to see]

2. Discussion

Users often felt the need to "*double check to see if I was in the right area."* Users found the double-checking inefficient but also necessary to determine "*what context you are looking at"* or to see "*what chapter are we in.*"

Users are looking for contextual information to help them determine whether they have "*missed some key information,"* or "*to see what are we talking about here."* When the search tool would drive users to the exact location of the keyword, with no contextual information about the larger topic area, users were then concerned that it may be the wrong area, or at least needed to understand where they were within the document structure overall.

User comments also indicate that seeing information in context helps them accomplish their goals more effectively and efficiently. Users want to "get the background" and "to double check". Research shows that it is important to layer information so that users who wish to can access rich contextual information.[55] Furthermore, context is beneficial when looking for the answers to a more complex scenario where there is more than one step to a process or the user goal is equally complex.

K. USERS LOOKED FOR INCREASED SEARCH FUNCTIONALITY

Although users primarily resorted to navigating documents through the TOC and subheadings, several attempts to conduct keyword searches were unsuccessful. The frustration users experienced were manifested in their interview responses, expressions during their search, and the resulting abandonment of the search function.

[55] Beverly B. Zimmermann, "Applying Tufte's principles of information design to creating effective Web sites." In *Proceedings of the 15th Annual international Conference on Computer Documentation* (Salt Lake City, Utah, United States, October 19 - 22, 1997). SIGDOC '97. ACM, New York, NY, 309-317. DOI= http://doi.acm.org/10.1145/263367.263406

1. User Data

User searches were ineffective:

- 4 participants attempted a total of 17 keyword searches with only 1 useable result in scenario 2
- Some unsuccessful terms included ‘single-purchase,’ ‘prohibited items,’ and ‘vehicle repair’ and in scenario 1, ‘CMR’

Users were frustrated by search difficulties:

- " ….I can’t type in ‘SL-3’ *and* ‘accounting’ because I don’t get anything…In adobe it will only find the search terms verbatim…It’d be neat to have that feature” [referring to ability to search for chapter/paragraph with multiple search terms]
- [user reverts to search box and types ‘single-purchase’]…”I think it’s hyphenated… [no result]…nope…What if I type in purchase limit….ok it’s not hyphenated.”
- [uses search box again, typing ‘except’…Fist on chin…hmmmmmm grunts] ”…give me exceptions!”
- “CTRL-F wasn’t really working… [uses keyword search for ‘threshold,’ then ‘limit’]…..none of those keywords are in there…I used a poor keyword…should have used prohibited [not ‘unauthorized’]… ….that’s why I just started scrolling.”

2. Discussion

Users experienced frustration with inadequate search results. Specifically, one limiting factor of the search capability is that it only returns verbatim matches when users expect a more robust search that responds to common key words and has some error correction. One user illustrated this, commenting while searching for purchase-limit, "*nope…What if I type in purchase limit….ok it's not hyphenated."* Clearly, the user expects that the search tool should be able to locate the term whether it's hyphenated or not. Similarly, another user sought to find unauthorized items by using the keyword '*unauthorized,'* and upon no results, commented, "*I used a poor keyword…I should have used 'prohibited,' that's why I just started scrolling*." When confronted with poor search results, users reverted to other methods including scrolling and using a commercially available search tool that did provide effective search results (Google).

Additionally, users did not achieve expected search results using terms from their task. One user discussed this limitation and his desire to use keywords that made sense from the task stating, "*I can't type in 'SL-3' and 'accounting' because I don't get anything."* A robust search tool that could provide 'or' search results, rather than searching strictly for the entire phrase would have brought this user directly to the 'SL-3' section where the answer was located. More advanced search tools even provide results based on relevance of the relation of keywords as they appear in proximity in the text. One user referred to this, noting, "*It'd be neat to have that feature*."

Search tools such as these increase the likelihood of finding the keyword in the appropriate context. Additionally, since users draw keywords from their tasks, they may resort to synonyms or related terms. A more advanced search engine would be capable of matching similar words and would have discovered matches for things like 'prohibited items.' This search feature may greatly assist users in finding documents.

L. USERS WANT TO HOLD THEIR CURRENT PLACE WHILE CONTINUING TO CROSS-REFERENCE

As I indicated in previous findings, users in most cases rely on the TOC and subheadings to narrow their search. Additionally, the documents have internal cross-

references that refer to other information or locations. In either case, if the information in the new location is not what users expect, or if, from the new location, they need to go back to the original location, they may not be able to find their way back. In short, the user requires a method to get back to the point of origin easily.

1. User Data

Users' navigation behavior and comments demonstrate inefficient work-arounds to go back to previous information:

- "I feel like I'm close but…It referenced another paragraph…I'm going to go to that…should've wrote that down." [user scrolls between paragraph 2011 and 2001]
- Let me go back up to chapter three [to see what it's about]…maybe I just didn't use the right word…Let me go back to the top and look at my choices again."
- [Uses TOC and then scrolls to chapter 5...looking over chapter headings] "I might have been wrong…chapter 5 is what I thought I wanted but maybe not." [scrolls back to TOC…then chapter 2…then TOC again]

2. Discussion

The data reiterate user reliance of TOC and sub-headings to narrow their search. However, users commented, *"I might have been wrong,"* or *"Maybe I just didn't use the right word*," indicating that users don't always select accurately from the title headings and may need to easily *"go back to the top and look at choices again.*" Additionally, users wanted to investigate internal cross-references but couldn't easily do so because they didn't have a clear method of returning to the current location. Users instead chose to write down references for future investigation, since the capability did not exist.

Enhancing the system to support this need would increase the efficiency of the information retrieval process. Designers may consider adding a "saved file" function or supporting internal bookmarking, otherwise known as anchor points, or anchoring.

M. PERSONALIZATION/CUSTOMIZATION IS IMPORTANT TO USERS

Users commented that some information is referred to repeatedly, and that flexibility with paper-based documents allowed them to tab and highlight frequently used information. Users commented on the desire to replicate these features with electronic documents by providing editing tools that allow highlighting and annotating.

1. User Data

3 of 5 users indicated a desire for personalization features:

- "I don't know if you can make notes…..if that was an option [id like it]."
- [Why use paper based over website?] "It's right there… It's easier… I have everything tabbed….I flip through I know where everything is…"
- "You use it so much we just had it printed off….we all had it highlighted and tabbed and marked….for the majority of answers you go through…you go to the same stuff over and over again."
- "….I have a hard copy to flip through….highlight….for this particular document I would be all about that…In my particular publication….things that are key….I highlight in the publication."

2. Discussion

Users stated that their work repeatedly drives them to the same policy documents, and the same locations within those policy documents. As one user stated, "*You go to the same stuff over and over again.*" Another commented on the frequency of returning to common documents, stating, "*you use it so much."* Naturally, users want to identify these common documents for easy retrieval later.

In the paper-based system, users were able to take advantage of the physical presence of the documents and could use tools which allowed them to identify the "*things that are key"* within documents. Users typically "*had [the document] highlighted and tabbed and marked."* As the users indicated, the ability to personalize the documents made their work "*easier*." Thus, users seek a capability to mimic their paper documents in order to replicate this advantage. Adding the capability to bookmark, highlight and annotate documents could prove to be a significant enhancement to the usability of the system.

IV. RECOMMENDATIONS AND CONCLUSION

My analysis concluded that several actions could be taken to improve the usability of the current system. In this section, I outline those recommendations and discuss possible implementation considerations, limitations, and the need for further testing.

A. RECOMMENDATIONS

Based on my findings and applicable industry best practices, a consolidated listing of recommendations to improve the usability of the electronic supply policy document system is provided below, followed by an discussion of each recommendation in the sections that follow.

- Provide a single point of entry to all documents and ensure content is current and complete
- Improve the www.usmc.mil search engine
- Provide users with both site and document customization options that support their work
- Provide a collapsible structure for navigating and hyperlink internal references
- Enhance documents with contextual aids
- Improve internal document search capability by moving away from current document format
- Consider implementing a more robust database
- Conduct further research to help identify additional problem areas, underlying users' needs, and best practices

1. Provide a Single Point of Entry to All Documents and Ensure Content is Current and Complete

The document system will be more effective if it allows users to search for documents in ways that support their work. The www.usmc.mil website is an established, reputable authority for Marine Corps Directives. However, the document collection was incomplete and documents were not organized in ways that supported user's mental models. This resulted in several users abandoning the site.

When going to the USMC site, users were looking for a complete list of relevant documents. My first recommendation is to make sure that the content on the site is current and complete. First, include all types of documents (a user manual, Marine Corps Order, Marine Corps Bulletin, P and non-P-type orders, standard operating procedures and guidebooks, etc.). Second, if the relevant content is available on other sites and it is not feasible to include it on the USMC site, I recommend that you provide a "see also" feature that indicates other reliable sources for each topic. Finally, all content should be dated and source referenced in a manner in which users can ascertain whether additional or more current information exists elsewhere.

Users demonstrated a variety of mental models and key words for locating relevant information. To aid them, I recommend an overview page be designed that provides a "one-stop shop" for navigating to needed content. This page should be the first option on the drop-down menu labeled "Publications." The page should contain a comprehensive list of policy and procedure documents organized according to users' mental models rather than primary office of responsibility or other means. Some of the users' mental models uncovered during this study were to search by topic, search by SSIC code, and to view documents by task relevancy. Further research is recommended to detail these models more completely.

2. Improve the www.usmc.mil Search Engine

Users that used the search box on www.usmc.mil found it to be highly ineffective and abandoned the site for better search capability elsewhere. Improving the search engine would make the site more effective and increase users' confidence.

First, users employed common keywords that were driven by the task requirements. These common keywords were logical and should have returned meaningful results. However, the search results on the USMC site did not do this. For example, a search for '*supply manual*,' and another for '*accountability*,' returned zero results even though the Marine Corps Consumer Level *Supply* Policy *Manual* (which discusses *accountability* at length) is located on the site. I recommend that the search engine be improved or replaced by one that is more robust.

Additionally, users expect the search results to clearly identify what parts of the site were searched and were confused when it did not do this. I recommend that the search filter clearly identify what area of the site was searched. Further, the distinction between searching directives and orders should be removed unless it is significantly relevant to another user group.

3. Provide Users with Both Site and Document Customization Options that Support Their Work

Users often know which documents they need to consult, and they want those documents to be available to them wherever they go. Providing the option for a user to create a policy page that is customized to their preferences would enhance the user's experience and better support their work. In this manner, a user who commonly refers to only three Marine Corps orders regularly could have a personalized policy homepage where those three documents reside. The Federal Acquisition Regulation (FAR) homepage even has an option for users to subscribe to receive policy update notices by e-mail whenever there is a change. These types of enhancements simplify the users' tasks when accessing policy documents and provide the portability they desire.

Users would also benefit from document customization options. Specifically, I recommend that the site include the ability to highlight text areas, make notes, and bookmark pages within a document. These features would provide a useful means for users to replicate their paper-based experience and build confidence in using the electronic documents.

Anchoring and grouping is another customization tool that could provide the same, if not better, functionality as the ability to tab pages. Anchoring allows users to mark locations in text for future retrieval and some tools allow for inline annotations as well. Grouping merely refers to the ability of a user to 'name' a group of anchors that are related in ways that are meaningful to the individual user. For example, if users frequently refer to a document that discusses UURI accountability, and that discussion is spread out in different chapters or even different documents, as is the case, a user could use an anchor tool to mark those locations and tie them together by grouping them under a title 'UURI accounting'. This tool would allow the user to collate information digitally so that the answers to frequently asked questions could be referred to easily.

As a more long-term goal, consideration may be given to a shared knowledge system where, collectively, best practices and interaction within the user-community could enhance the support system overall. For example, users in this study were asked to search for information on how to properly account for UURI SL-3 items. This is not the first time this debated subject has plagued a supply officer and required him to refer to policy documents to find the answer. A shared knowledge system would not only give the user access to the policy documents, but may alleviate the need for him to conduct exhaustive research for best practices already established elsewhere.

4. Provide a Collapsible Structure for Navigating and Hyperlinking Internal References

Users primarily navigated within documents by using a document's table of contents (TOC) as a guide to get them to a section that they thought would be useful. However, the current document design proved to be inefficient and required a lot of scrolling and returning to the TOC or subheading area to search for alternatives when the

user did not find the information they needed. Additionally, when references to another part of the document were encountered in the reading, users had no way to easily move to that area.

Providing an internal menu structure, with collapsible headings and brief content descriptions, would allow users to scan topic headings and investigate details easily while still maintaining an overall view of the entire document structure. Also, providing hyperlinks would allow users to investigate other related material easily. This is especially useful since information is typically parsed.

5. Enhance Documents with Contextual Aids

Users often cited that they needed to 'check' or 'double check' to find the location of the document in which they were currently located. Headings and subheadings are a good way to indicate this context, and this contextual problem can be partially averted by employing a collapsible structure as discussed. However, contextual cues can be made in other ways that are beneficial to the user. One example would be to add a navigation frame adjacent to the document which shows the heading and subheading structure and highlights the current location.

Another contextual enhancement option might be to provide 'preview' information which would show the first few lines of the paragraph that a user was contemplating when merely placing the mouse pointer over the heading. This would help diminish unnecessary searching and would keep the anticipatory context in perspective.

Whatever contextual aid is employed, it should allow the user to have an understanding of the document structure, allow them to see their current location within that structure, and set their expectations on what content can be expected when they go to a specific section.

6. Improve Internal Document Search Capability by Moving Away From Current Document Format

Currently, most electronic policy documents are scanned versions of paper policy documents. Many, but not all, have undergone some object character recognition to

enable searching. However, Adobe pdf files have a finite search capability that is limited by the Adobe software. Improving the search capability, then, would require the policy documents to be migrated to a source format that lends itself to being searched more effectively (for example, html or xml). Additionally, search engine companies like Google have products available to enhance document search capabilities. Any enhanced search capability considered should take into account the users mental models and need for context awareness as indicated above.

7. Consider Implementing a More Robust Database

Users, when looking for information, used the USMC site, Google, and other locations that seemed likely to have the answers. Not only do users want access to all the information necessary to answer their questions, the Marine Corps also wants their supply officers to have information that is accurate. A consolidated DoD database of policies and procedures may be the answer to both of these needs. This change may seem difficult at the surface due to the fact that many different agencies are responsible for different portions of the overall publication system. However, many industries have incorporated database formats that allow multiple sources to be effectively integrated into a single user interface for presentation to the end user. This is not uncommon and could be accomplished for policy documents as well. Additionally, this redesign effort should address users' goals, tasks, and mental models consistent with the findings of the current study.

8. Conduct Further Research to Help Identify Additional Problem Areas, Underlying Users' Needs, and Best Practices

This study was an exploratory study that revealed a number of usability issues. Additional user testing can expand our understanding of the issues and help prioritize their impact. As changes are made to the system within an overall redesign effort, I recommend that on-going testing be conducted. If a major redesign is planned, I recommend that on-going testing be combined with preliminary user needs analysis and iterative user input to help guide the design process.

In addition, I recommend that the Marine Corps investigate best practices of others to help guide site design. One resource for best practices is found on the website http://www.usability.gov, which provides comprehensive guidelines on the usability of web sites. In addition, I recommend looking at other web sites that are intensively policy driven. For instance, some of the issues addressed in this report can be seen in a current USMC site: USMC Contract Management Process Guide (CMPG) located at http://hqinet001.hqmc.usmc.mil/i&l/v2/CMPG/index.htm. This web site supports management of the contracting process, including the GCPC, and implements some features that may be useful. Specifically, the CMPG site allows users to access policy guidance in html format augmented by links to other contributing source information. A comprehensive flowchart of the process can be accessed to guide users to the correct area where processes are discussed step-by-step with appropriate references available. The context tools and improved search capability are also present on this site, which does not rely on Adobe files. Additionally, the site provides common templates and other resources useful to the user. The site is not customizable, but definitely moves toward the knowledge-sharing type system discussed in the current study.

B. CONCLUSION

This was an exploratory study, focused on high level usability aspects of a complex system. In this study, I chose a specific user group to perform specific tasks using a 'discount' approach to usability. I have shown how a limited number of participants can reveal many significant usability problems that can lead to improved design of a product or system. This does not mean that the system is currently unusable or that implementation of these recommendations would correct all usability concerns. The results of the testing should be considered within the purpose of usability testing itself – to make a product or system *more* usable. To that end, the study has made several recommendations for the system under evaluation.

Recommendations with a low cost-high benefit ratio may be considered relatively risk-free to implement and may not require any further research prior to implementation. Significant or costly recommendations may benefit from further testing and problem

triangulation, where data collection is conducted under multiple methods, measures, or approaches to determine possible convergence in perceived problem areas.[56] Triangulation can be accomplished through various means including employing different research methods (questionnaires, focus groups), multiple evaluators, or multiple user groups within a single method.[57]

Iterative testing is recommended either as a method of triangulation, to conduct a more thorough examination of a particular usability area of interest identified within the scope of this project, or as a next step after addressing the major findings of this exploratory research.

[56] Chauncey E. Wilson, "Triangulation: the explicit use of multiple methods, measures, and approaches for determining core issues in product development," *interactions* 13, 6 (November 2006), 46-ff. DOI= http://doi.acm.org/10.1145/1167948.1167980

[57] Ibid.

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APPENDIX A. SUS TEST

Post Test Questionnaire

SUS

Mean Score Response indicated in Bold

	Strongly Disagree				Strongly Agree
1. I think that I would like to use this system frequently				4.2	
	1	2	3	4	5
2. I found the system unnecessarily complex		1.6			
	1	2	3	4	5
3. I thought the system was easy to use			3.2		
	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1.2				
	1	2	3	4	5
5. I found the various functions in this system were well integrated			3.2		
	1	2	3	4	5
6. I thought there was too much inconsistency in this system			3		
	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly				4	
	1	2	3	4	5
8. I found the system very cumbersome to use		1.8			
	1	2	3	4	5
9. I felt very confident using the system			3.4		
	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system		1.8			

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APPENDIX B. SURVEY

SUPPLY AREA IMPORTANCE

1. Do you consent to this survey?

	Response Percent	Response Count
I consent	99.0%	98
I DO NOT consent	1.0%	1
answered question		99
skipped question		10

2. In the conduct of duties as a supply officer, how much of your time do you spend looking for information in electronic publications?

	Response Percent	Response Count
<10%	22.7%	22
10%-20%	41.2%	40
20%-30%	20.6%	20
30%-50%	12.4%	12
>50%	3.1%	3
answered question		97
skipped question		12

3. What are the three most common reasons you look for information in electronic reference publications? (Select only three)

	Response Percent	Response Count
Develop training for Subordinates	12.8%	13
Develop internal procedures	23.5%	24
Verify personal action/procedure complies with reference(s)	53.9%	55
Advise Commander	**59.8%**	61
Advise peer(s) / commodity areas	24.5%	25
Correct or influence Subordinate action(s)	21.6%	22
Prove/justify procedures to an interested party	57.8%	59
Understand a required task	22.6%	23
Planning	17.7%	18
Other (please specify)	0.0%	0
	answered question	**102**
	skipped question	7

4. When looking for information in electronic publications, in which subject area do you feel you have spent the most time?

	Response Percent	Response Count
Property Control	29.4%	30
Requisition Management	10.8%	11
Financial Management (GCPC, contracts, budget, fiscal standing)	**30.4%**	31
Miscellaneous (POR, ammo acctng, personal effects, publication mgmt, clothing, etc)	22.6%	23
Combat Service Support (plan operations support, MPF, etc)	4.9%	5
Storage and Distribution	2.0%	2
	answered question	**102**
	skipped question	7

5. When looking for Property Control information, which two tasks require you to refer to publications most often? (select only two)

	Response Percent	Response Count
Allowances	17.2%	5
T/O&E Changes	17.2%	5
Redistributions	3.5%	1
Equip Disposal	3.5%	1
Controlled Items	10.3%	3
Rollbacks	0.0%	0
CMRs	44.8%	13
Inventory	10.3%	3
Money Value Gain/Loss	13.8%	4
Subsidiary records (non-issued serialized gear)	0.0%	0
Crane Report	10.3%	3
Temporary loan files	0.0%	0
non-T/E assets	6.9%	2
Control of Individual Equipment	13.8%	4
Investigations	27.6%	8
Assist in maintaining MCGERR items	3.5%	1
Analyze property accounting reports	17.2%	5
Other (please specify)	6.9%	2
answered question		29
skipped question		80

6. When looking for Requisitioning information, which two tasks require you to refer to publications most often? (select only two)

	Response Percent	Response Count
Processing additional demands (requisitions)	27.3%	3
Uniform Movement Issue and Priority System (UMMIPS)	0.0%	0
Maintenance of Requisitions - follow up	45.5%	5
Manage Daily Maintenance Transactions List	18.2%	2
Reconcile MOV/backorder validation	18.2%	2
Manage supply discrepancy report	27.3%	3
Analyze requisition management reports	36.4%	4
Other (please specify)	9.1%	1
answered question		**11**
skipped question		**98**

7. When looking for Financial Management information, which two tasks require you to refer to publications most often? (select only two)

	Response Percent	Response Count
Prepare budget	16.1%	5
Execute budget/spending plan	22.6%	7
midyear review	3.2%	1
Manage fiscal accountability	9.7%	3
Annual closeout	6.5%	2
Manage fiscal for unit funded exercises	3.2%	1
Manage fiscal for externally funded exercises	3.2%	1
Manage reimburseable funding	3.2%	1
Government credit card program (GCPC)	**64.5%**	20
Direct purchases using the government credit card	12.9%	4
Initiate purchasing and contracting requests	41.9%	13
Manage procurement of supplies from DSSC	0.0%	0
Validate collection and turn in of government funds	0.0%	0
Other (please specify)	3.2%	1
	answered question	**31**
	skipped question	**78**

8. When looking for Miscellaneous information, which two tasks require you to refer to publications most often? (select only two)

	Response Percent	Response Count
Supply officer and CO certificate of relief	21.7%	5
Endorse outgoing supply officer certificate of relief	8.7%	2
Letters of appointment and revocation	8.7%	2
Maintain results of audits and verification	13.0%	3
MLSR reports	30.4%	7
Ammunition accountability	4.4%	1
PORs	8.7%	2
Personal effects	**65.2%**	15
Manage permanent issue of special equipment	0.0%	0
Individual clothing records	21.7%	5
Publications management	0.0%	0
MOS sustainment training	4.4%	1
Brief CO on status of supply operation	17.4%	4
Other (please specify)	0.0%	0
	answered question	**23**
	skipped question	**86**

9. When looking for CSS information, which two tasks require you to refer to publications most often? (select only two)

	Response Percent	Response Count
Develop a supply support plan to support MAGTF operations	**60.0%**	**3**
Provide supply focused combat service support input in MPF operations planning	20.0%	1
Conduct supply support operations within a combat service support element	**60.0%**	**3**
Preparation of supplies for deployment	0.0%	0
Accountability of unit MPF assets	20.0%	1
Establish a field warehouse	0.0%	0
Other (please specify)	20.0%	1
	answered question	5
	skipped question	104

10. When looking for Storage and Distribution information, which two tasks require you to refer to publications most often? (select only two)

	Response Percent	Response Count
Maintenance of stored assets	50.0%	1
Warehouse safety procedures	50.0%	1
Hazardous material	**100.0%**	**2**
Electrostatic discharge sensitive devices	50.0%	1
Radiological control program	0.0%	0
Other (please specify)	0.0%	0
	answered question	2
	skipped question	107

11. Thank you for your contribution. Camp Pendleton / San Diego area personnel only -- we would appreciate your participation in a usability study (which takes no more than one hour). This study is being conducted to better understand issues in accessing electronic documents and supply policies, and user participation is critical to gaining that understanding. If you would like to participate, please enter your e-mail address in the box below so we may provide you with additional information. Volunteers selected will be asked to complete a task requiring publications use, followed by a short interview.

	Response Count
	0
answered question	0
skipped question	109

APPENDIX C. PRE-TEST QUESTIONNAIRE

What is your age group?

18-25
26-35
36-45
46+

What is your current billet?

_____

Describe your familiarity with the internet?

Very Familiar – I use it to look for information, make purchases, download applications
Familiar – I use it to look for information, make purchases
Somewhat Familiar – I use it primarily to look for information

In the conduct of your duties as a supply officer, how much of your time do you spend looking for information in electronic publications?

0% - 10%
10% - 20%
20% - 30%
30% - 50%
More than 50%

How long have you been a supply officer?

0 – 4 years
4 – 10 years
10 – 15 years
15 + years

What is your level of education?

High school only
Some College
BA/S degree
Some post-graduate education
Graduate degree or higher

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APPENDIX D. TEST PLAN

Scope

The test will focus on Marine Corps supply Captains using electronic policy and regulatory documents related to financial management and property control functions.

Purpose

The purpose of this test is to answer the research questions:

- Can users easily and efficiently locate financial management and property control regulations?
- Can users easily and efficiently locate all necessary information to answer work-related questions?
- Can users determine if they have the most current information?
- How do users look for information?

Schedule

The test will be conducted on Monday, 5 November and Tuesday, 6 November 2007, in accordance with the following schedule:

Participant 1: _____
Participant 2: _____
Participant 3: _____
Participant 4: _____
Participant 5: _____
Participant 6: _____

Participants

Participants will represent the user population, validated by the pre-test questionnaire.

- **Education**

  Predominantly hold a BA degree, some higher, but none lower.

- **Job Experience**

  Between two and ten years of active duty supply officer experience

- **Computer Experience**

  Familiarity with internet use

- **Demographic**

  Predominantly between 26-35 yrs old

Scenarios

- **Scenario 1**

  Lt Umptyfratz, the commO went to the CO about a disagreement with you on his CMR, which contains the following three items:

  TAMCN H2067, serial # 4536
  TAMCN H2067, serial # 4537
  TAMCN A0267, serial # M80300001

  The Lt claims that the H2067 items are listed as SL-3 items in the TM for TAMCN A0267. Therefore, he says, they should not be listed separately on his CMR because he's already accounting for them in the SL-3 inventory. He argues that it is the same situation as a MRC-138, where the vehicle is SL-3 to the radio system and the vehicle is not accounted on the CMR separately.

  You discover through initial research that the items are, in fact, SL-3. They are listed as UURI, and the quantity says AR.

  The CO called down to your office just now: "Captain, I'm headed to lunch in five minutes, and I'd like to look at the regulations

regarding this matter while I'm out. We'll discuss it further when I get back."

- Task 1

  Electronically locate all applicable policy/regulation document(s) that will help properly guide you in accounting for the SL-3 items

- Task 2

  "Hey Captain, my lunch partner canceled on me. Meet me up here in ten minutes to discuss the CMR situation."

  Using the electronic policy document(s), identify how to properly account for this SL-3 item.

- **Scenario 2**

You are the supply officer at an infantry battalion located at Camp Pendleton. Your battalion has been mobilized and is conducting work-up training in 29 Palms, CA, so no maintenance personnel are available. A GSA vehicle is broken and requires service. The CO doesn't want to wait for you to send it somewhere on base for repair, so he suggests taking it to the commercial GM dealer down the road and using the GCPC card to pay for the service instead. The GM dealer estimates the cost at $2600, but couldn't guarantee it wouldn't be more than that. The CO is pretty strict and always wants to see the exact verbiage and the reference source when you provide information to him. Using only electronic access to policy documents as your source, what would you advise the CO?

Key data:

Estimated Cost: $2600, no ceiling price established
Purchase Type: unpriced Service
Item: GSA vehicle repair

- Task 3

  The CO just called and said he'll be down in five minutes. He asked you to electronically locate all applicable policy/regulation document(s) that you think will apply to this situation.

- Task 4

  The CO tells you he spoke to a friend who told him that the key concerns with this purchase would be to:

  Determine whether the purchase exceeds the GCPC purchase amount threshold?

  Determine if the GCPC regulations/policy prohibit or limit a purchase of this type?

  Determine if any authority prohibits or limits the purchase for this particular item?

- Completion

  This completes scenario 2.

Data collected

- **Questionnaires**

  - PRE-TEST QUESTIONNAIRE [APPENDIX C]

    The purpose of the questionnaire is to record information about the participants of this study as they compare to characteristics of the entire user population to ensure a representative group is tested.

  - Post Test questionnaire (SUS) [APPENDIX A]

    The purpose of the SUS is to solicit the user's general assessment of overall usability.

  - Videotape

    Video tape all sessions

  - Observation Notes

    Make observation notes during testing to refer to during interview

- Interview Questions

  Not 'was it easy' – can you talk about your experience with….?

  Tell me how you know…..how you…..

  Can you talk about that more?

  How confident are you….?

Execution

- **Pre-test**

  Setup

- **Test**

  - Introduction

    Welcome, and thank you for participating today. My name is Captain Scott Stahl. I am a student at the Naval Postgraduate School, and I'm working on a project to evaluate how well electronic publications assist you in doing your work. As part of this project, I am observing a variety of supply officers conduct various tasks using electronic publications to see what elements of the design might need to be improved.

    I'd like to stress that I'm testing the publication system, and not your abilities. Also, I do not represent your command, or any other command, for that matter. So don't worry about making mistakes. There is no right or wrong answer. If you find parts of the system difficult to use or understand, it is likely that other people do also, and my purpose here is to identify these items and make appropriate recommendations for changes to improve the system.

    If you ever feel that you are lost or cannot complete a scenario with the information that you have been given, please let me know. I'll ask you what you might do in a real-world setting and then either put you on the right track or move you on to the next scenario.

Finally, as you use the system, please do so as you would at work. I do ask that when looking for information, you do so as quickly and as accurately as you can.

- Overview

  During this test, I will first ask you to fill out consent forms and a pre-test questionnaire.

  Next, you will be presented with 2 scenarios containing 4 tasks each. The scenarios will require you to navigate electronic publications. Each scenario will be presented individually and last 10 minutes. As you work through them, I will observe and ask you to 'think aloud' as you work.

  I will also videotape the session, recording only the computer screen for analysis in depth at a later time.

  Upon completion, a final interview and questionnaire will be administered.

  In total, the session should only last about one hour. If you would like to take a break at any time, just let me know.

  Do you have any questions at this time?

- Consent and Pre-Test Forms

  At this time, I would like to ask for your consent to participate and be videotaped.

  Consent Form
  Videotaping Consent

  Next, this pre-test questionnaire asks about characteristics that will be compared with the user population to validate that participants actually represent the users.

  Pre-Test Questionnaire

- Discuss Think Aloud

  [think aloud example here].

- Initiate Scenario 1

  At this time, we are ready to begin. You will be given 10 minutes to complete the scenario. During the scenario, if you reach a point where you would normally stop and phone a colleague for assistance or quit altogether, please state that and we will move on to the next item.

  [ensure videotape]
  [Present scenario 1]
  [keep time]
  [notes]
  [end time]

  Thank you. That completes scenario one.

- Initiate Scenario 2

  We will now conduct scenario 2. You will be given 10 minutes to complete the scenario. During the scenario, if you reach a point where you would normally stop and phone a colleague for assistance or quit altogether, please state that and we will move on to the next item.

  [ensure videotape]
  [present scenario 2]
  [keep time]
  [notes]
  [end time]

  Thank you. That completes scenario two.

Post-test

- **Questionnaire**

  I have a brief questionnaire here that I'd like you to complete also. The information you provide is for our use only. Your name is not stored with the questionnaire data.

- **SUS TEST**

- **Interview**

  Now that we have completed the scenarios, I have a few questions about what you experienced during the test.

  Interview Questions

Debrief

This concludes our session. Once again, I'd like to say thanks for coming today.

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