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A Rhetoric Of Technology: The Discourse In U.S. Army Manuals And Handbooks

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A RHETORIC OF TECHNOLOGY: THE DISCOURSE IN U.S. ARMY MANUALS AND HANDBOOKS

by

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ABSTRACT

This dissertation examines the historical technical publications of the United States Army from 1775-2004. Historical research in Army technical communication reveals the persuasive characteristics of its technical publications. Elements of narrative, storytelling, and anthropomorphism are techniques writers used to help deliver information to readers. Research also reveals the design techniques writers adopted to unite the situated literacies of the troops. Analyses of print, comic, and digital media expose the increasing visualization of information since the eighteenth century. The results of such historical research can be applied to new media designs. Automating processes captured in paper-based technical manuals and adding intelligent functionality to these designs are two of many possible design options. Research also dispels a myth concerning the history of modern technical communication and illustrates the development of many genres and subgenres. Modern technical communication was not born of World War II as many scholars suggest, but was a legitimate field in eighteenth-century America. Finally, historical research in Army technical communication shows the systematic progression of a technological society and our increasing dependence on machine intelligence.

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LIST OF ABBREVIATIONS

AEF ..... Army European Forces

AI ..... Artificial Intelligence

AMC ..... Army Materiel Command

AR ..... Army Regulation

BIT ..... Built In Test

CD ..... Compact Disk

COTS ..... Commercial off the Shelf

DA ..... Department of the Army

DOD ..... Department of Defense

DTD ..... Document Type Definition

ETM ..... Electronic Technical Manual

IET ..... Initial Entry Training

IETM ..... Interactive Electronic Technical Manual

IT ..... Information Technology

FM ..... Field Manual

FOSI ..... Formatting Output Specification Instance

GPO ..... Government Printing Office

GO ..... General Order

HCI ..... Human Computer Interaction

HET ..... Heavy Equipment Transporter

HQDA ..... Headquarters Department of the Army

HTML ..... Hypertext Markup Language

LAN ..... Local Area Network

LCCS ..... Life Cycle Contractor Support

LOGSA ..... Logistic Support Activity

MOS ..... Military Occupational Specialty

NCO ..... Non-Commissioned Officer

PC ..... Personal Computer

PLS ..... Palletized Loading System

PM ..... Preventive Maintenance

PMA ..... Portable Maintenance Aid

PS ..... Post Script

RGL ..... Reading Grade Level

SAIC ..... Science Applications International Corporation

SGML ..... Standard Generalized Markup Language

SMM ..... System Maintenance Manual

TIFF ..... Tagged Image File Format

TM ..... Training Manual, Technical Manual

TR ..... Training Regulation, Technical Regulation

TRADOC ..... Training Regulation and Doctrine Command

UH ..... Utility Helicopter

USA ..... United States Army

USAPA ..... United States Army Publishing Agency

USCONARC..... United States Continental Army Command

USMA .....United States Military Academy

WAN ..... Wide Area Network

XML..... Extensible Markup Language

CHAPTER ONE: INTRODUCTION

Contemporary technical manuals in the Army of our day are often not as effective or usable as expected. This dissertation seeks an explanation for this difference between expectation and practical reality. As we will see, part of the problem is that too much is expected of technology itself. Another part of the problem, which goes hand-in-hand with the first part, is the erroneous assumption that technical manuals are a new phenomenon which has arisen as a result of modern technology and therefore needs to be as heavily invested technologically as possible.

My experience as a practitioner of military technical communication led me to this research. Watching users reluctantly give up paper manuals for new forms of media and then struggle with assimilation caused me to question the transformation process. A good number of these users are old guard: "tough-minded and very pragmatic . . . [they] had learned technical writing from individual study of practice in the field" (Harris as quoted in Staples 1999, p. 158). The old guards are technical writers with prior military service, no formal education, and often low levels of computer literacy. These practitioners began their technical writing careers in the last decade of the Army's analog era, after Vietnam but before the first Gulf War.

Others who are computer literate have problems assimilating too. Engineers and technologists familiar with digital media and online design techniques often abandon the interface and read the SGML markup to find the information. For example, the Multiple Launch Rocket System IETM is organized in a nodal hierarchy based on the layout and

section numbering of the paper manual. Because each numbered paragraph represents a node, users must navigate several layers deep to find information. Of course, the nodal hierarchy is not the only challenge. While the Department of Defense (DoD) enforces standards for the design of digital data and electronic data interchange requirements, no standards for technologies are imposed. Every contractor can and will use different technologies in a new media design so a standard look, feel, and use are impossible.

In this study, I examine the technical communication practices of the U.S. Army from the eighteenth century to the modern age. My assumption is that technology and culture informed Army technical publications from the beginning. My first goal is to determine those qualities, if any, of legacy data that we should consider in the design of new media and technical communication products. My second goal is to provide a brief history of U.S. Army technical communication. Such a history reveals the truth about modern technical communication and dispels the modern myth that "the character and extent of technical writing broadened in the early 1940's with the explosive growth of technology during WWII" (Smith 1988, p. 84). My research will show that the field of technical communication was legitimate as far back as eighteenth-century America.

By examining the past, I identify those qualities of legacy data we lost in modernizing the Army, moving from the analog age to the digital age. Why do some continue to think the old way is better? What useful qualities of legacy data, if any, have we lost in the modernization process? In what way have advancements in technology, if at all, informed these publications? Are these technical publications a reflection of our culture, and if so, to what extent? Was modern technical communication a result of the

World War II technology explosion, as some scholars suggest? What is the Army's role, if any, in defining modern technical communication? What is the future of the Army technical manual, and how can experts in texts and technology help define this future?

To answer these questions, I focus on Army technical publications, specifically soldier's handbooks and technical manuals, published from 1775-2003. I chose not to analyze military science textbooks and officer's handbooks and manuals since, I believe, these texts, and users, represent the minority of U.S. soldiers. Instead, I focus on the texts written for the majority audience, privates and non-commissioned officers (NCOs) who represent the average American in skill and education. I have two initial premises.

1. In soldier's handbooks and technical manuals, Army technical communication is primarily expository and instructional. Its purpose is to inform and instruct recruits in the ways of Army life, and it helps users complete their work. Technical communication includes practical, useful instructional material to help troops learn the rules and regulations of Army life, that is, how to wear a uniform, recognize the chain of command, and perform first aid. Technical communication also provides instructions for the operation and maintenance of technology—for example, how to operate a weapon systems and replace faulty components if they fail. Contemporary soldier's handbooks are categorized as Field Manuals. Technical Manuals provide supplemental information for the subjects contained in Field Manuals.
2. Technology is not neutral. Users define a need and specific use for technology. Technology is then designed to best suit this need. Technology is

> the totality of the tools, machines, people, processes, systems and applications of an institution. Technology in this respect helps the institution achieve its goals. For the Army, the goal is to be fast, light, and lethal.

Advancements in electronic and information technologies in the last two decades of the twentieth century moved the Army from the analog age to the digital age. Legacy data, that is, data inherited from older technologies, were candidates for transformation under the Army's new modernization edict, "Force XXI" (now called "Objective Force"). Paper technical manuals, which presented storage, logistical, and usability challenges, were converted to electronic images of static pages capable of being retrieved and displayed on portable computers in strategic environments. These static images, or Electronic Technical Manuals (ETMs), helped solve storage and distribution problems but did little for the automation of work-related tasks. In the last few years of the twentieth century, innovations in information and digital technologies provided an electronic environment capable of completing multiple tasks and allowed for the integration of media, print, and electronic technologies through a single user interface. The Army and its contractors found themselves "in the middle of a new media revolution—the shift of all culture to computer-mediated forms of production, distribution, and communications" (Manovich 2001, p. 19).

As practitioners of military technical communication, we transform this legacy data into new forms of media with confidence that the new will surpass the old in usefulness; however, we know from experience this is not always a reality. Despite the benefits of interactive, intelligent, and digital texts, new forms of media may not socialize

as we predict. For example, early users of Interactive Electronic Technical Manuals (IETMs) were optimistic about the shift from paper to an online media but were soon frustrated with interface and navigation challenges. Alpha and numeric keypads combined with the point and click navigation features of portable, rugged computers were often located on the physical medium surrounding the display area rather than as individual plug and play devices (mouse or keyboard). This awkward design forced users to adapt to an unfamiliar and uncomfortable interface. Usability was further complicated by the complex navigational structure and data organization of the text that was accessible only through an SGML browser. These browsers included independent navigation controls in addition to the text options. In making the transition from the familiar media of print to this integrated data environment, "the medium" quickly became "the message" (McLuhan 1999, p. 7). Users spent an enormous amount of time stumbling through the interface and less time finding and retrieving information.

The concept of new media is viable, yet we know from experience and our interaction with the user-community that technology can meet social resistance in complicated technical and strategic environments. Five major factors contribute to the difficulty in assimilation.

First, the design of technology, including media, can be system-centered. The design is "based upon models of technology that focus on the artifact or system as primary, and on the notion that the inventor or developers of the technology know best its design, dissemination, and intended use" (Johnson 1998, p. 25). For example, one simulator, the UH-1N Huey Aircrew Procedures Trainer, allows pilots to hone their

flying skills without risk to life or equipment. Two major components of the device, the instructor station and the cockpit, allow users to simulate flight parameters, tactical situations, weather conditions, terrain and landing environments, ammunition loads, and countermeasures. The user selects conditions in a Windows environment using standard point, click, and drag features, and option buttons. Resources were focused on setting up relational database tables to store user variables and code that interfaced the cockpit to the instructor station and the instructor station to the tactical database. Further, some parameters cannot be loaded into the mission scenario unless set in the cockpit first. The user can reload countermeasures at the main screen, but to load the initial number of countermeasures requires the user to first input this number in the cockpit. Once the stores are expended, the user can reload the initial number using a reset button located on the main window. Designers assumed everyone was familiar with the Windows PC environment and offered no further explanation in setting up the initial load of countermeasures. An online help system was not included, and users were forced to learn how to operate the simulator through trial and error.

Second, engineers with no knowledge of technical communication or user documentation often convert paper technical publications to new forms of media and focus on the "underlying system rather than the users' needs" (Hackos 1997, p. 99). IETMs, at one extreme, are electronic page-turners, or static images of the print page. Web-based IETMs allow a user to scroll through a complete chapter, which offers little in the way of automating work. In both environments, human agency is required to complete the majority of the work. At the other extreme, the IETM can look and act like

an electronic maintenance aid; the user may interact with fault tolerance tables while using a digital voltmeter. Troubleshooting is automated; however, the support and reference data is hidden or is not easily accessible. The computer is the smart machine and the user only passively responds to computer instructions.

Third, we should not assume that legacy data or "information written for paper can be transferred without change into online forms, nor should we assume that the paper documents were themselves effective" (Hackos 1997, p. 99). The use of Commercial off the Shelf (COTS) components instead of proprietary components is just one of many contributions to the deficiencies found in paper technical manuals. When a proprietary component is developed for the military, the contractor is required to provide a support technical data package. When a contractor includes COTS components in a design, generally a reference to the vendor data is all that is required. Converting a paper publication that includes a reference to vendor documentation or to a specific procedure located within another manual offers nothing in the way of automating tasks. In fact, these references require the user to look up the reference before proceeding, for example, "LCCS performs the DT system corrective maintenance. Refer to SMM, TD 06-6920-705. However, the Instructor may perform minor maintenance procedures." Located a page or two later might be, "Engine/Transmission oil must be sampled every 90 days as prescribed by DA Pam 738-750." In these cases, the user must stop working on a task, locate the reference, and complete the instructions given by the reference before returning to the original task.

Troubleshooting procedures that instruct the user to "initiate BIT and follow the instructions on the screen" replace human knowledge with computer skill. BIT, or built-in test, is meant to assist in the troubleshooting of a system or system components, but often is the single point of failure for a system. When BIT fails, the system shuts down, and the user no longer has access to the information source. Instructions for manual troubleshooting are not included in the manual since it is assumed that BIT will succeed in troubleshooting the system.

Fourth, our culture, while technologically informed, can have unrealistic expectations of what technology can do in place of human action (Zuboff 1988). Users believe technology is autonomous and expect the computer to "take over" and do the work for them after the IETM is installed. Automated technical information requires human intervention at some level, whether it is in the form of a query, full-text search, or in knowing the appropriate troubleshooting procedure to execute. Even if an IETM could walk a user through a series of tasks, human agency is required to move from step to step and to complete the work.

Finally, and perhaps most importantly, engineers and technical communicators involved in the transformation and design process may lack a historical perspective of the field and may only know new techniques and practices (Brockmann 1988, 1998). Many high-tech contractors underbid or undervalue technical publications. Some contractors do not develop technical publications until the engineering effort is in the test phase and, in some cases, complete. Some reformat the design data for use as operator and maintenance reference manuals. Others "outside of the profession," as Dan Jones writes,

"have no idea what technical communication is or what technical communicators do" (1996, p.1). These contractors undervalue technical writing and assign the task to those unskilled in technical communication, often the engineers who designed part of the system. In some cases, the task will be assigned to administrative personnel currently not assigned to anything else. User wants and needs are of no concern, and the finished product serves only to meet a contractual requirement. Technical communicators, on the other hand, who only know new techniques and practices, often ignorantly dismiss legacy data that appears antiquated and outdated, especially if the new media was developed to support a system rehost or an upgrade.

Developing this historical perspective of technical communication has been a subject of study for the past three decades (for a comprehensive review of scholarship in the history of technical writing and technical communication see Brockmann 1983; Connor 1991; Rivers 1999). Studies in Army technical communication focus on the process and techniques adopted for data conversion and data capture (for specific case studies in electronic technical manual development see Bosco et al 1987, 1996; Brown 1993, 1994; Kincaid et al 1988; Nolan et al 1997; and Baudhuin 1996). As Brockmann and others have pointed out, historical research of an organization that produces technical publications can show us how a culture and its technology has shaped and developed a discourse community throughout its life. We may not understand the value of these studies until practitioners can apply the results to modern applications and technical communication problems—new forms of media, for example, and allow practitioners to consider those qualities of the legacy data that have survived over time.

Before we can fully appreciate the principles of Army technical communication, I believe we should understand the genre's development from its original to its contemporary form, considering those factors that allowed one media to consume another. These factors not only include advancements and innovations in technology, but also cultural changes in our society.

In Chapter Two, I dispel a myth about modern technical communication concerning its history and its legitimacy in this country before World War II and offer a brief history of Army technical publications. I explore the evolution of the soldier's handbook and the technical manual, beginning with the American debut in the eighteenth century, by examining the conditions that fostered the development of these two genres. I also show the development of the modern technical publication knowledge management system.

In Chapter Three, I examine the rhetorical qualities of Army technical handbooks and manuals throughout its history. I show how Army technical communication is fundamentally persuasive technical communication, which supports and reflects a rhetoric of technology and power. I examine stylistic features of the texts, for example, prose style, diction, anthropomorphism, and elements of narrative. I identify the qualities of legacy data, which can be either enduring or transitory.

In Chapter Four, I show how practitioners of Army technical communication simplified complex technical information and doctrine to unite and reach audiences with situated literacies. Literacies are situated in relation to a particular social, political, cultural, or power institution with each institution having its own standards for literacy. I

illustrate the design characteristics of print, comic, and new media as a goal to meet specific reading grade levels and reach less skilled audiences.

In Chapter Five, I discuss the design concepts of two forms of new media: Electronic Technical Manuals and Interactive Electronic Technical Manuals. Conceptually, these new forms of media are promising, but they do not live up to expectations in reality. I illustrate the differences between conceptual design and practical reality.

Finally, in Chapter Six, I conclude by presenting my research findings—the qualities of legacy data to be considered in the design of new media. I compare these findings with the five known assimilation factors discussed earlier in this chapter. I also offer an interim solution to the usability issues associated with the current media and discuss the long-term design goals of future media. Topics worthy of further research will follow this discussion.

CHAPTER TWO: A MYTH ABOUT MODERN TECHNICAL COMMUNICATION

The myth of modern technical communication alleges that technical writing, as we know it today, is the result of the technological developments of World War II (Brockmann 1988, 1998; Smith 1988; and Gresham 1977, 1978). These developments not only required large defense development and production contracts to fulfill the war demand but also the knowledge required to train, operate, and maintain these systems wherever the Army mobilized. The phrase "modern technical communication" is relative to a specific era. All American wars have introduced and influenced the development of new technology. It is understandable that such a myth could develop over time. Multiple printing and publication practices, an unstable numbering system, and the adaptation of foreign texts to fit American service are factors that obstruct a clear view of Army technical communication before the modern system emerged in the early twentieth century.

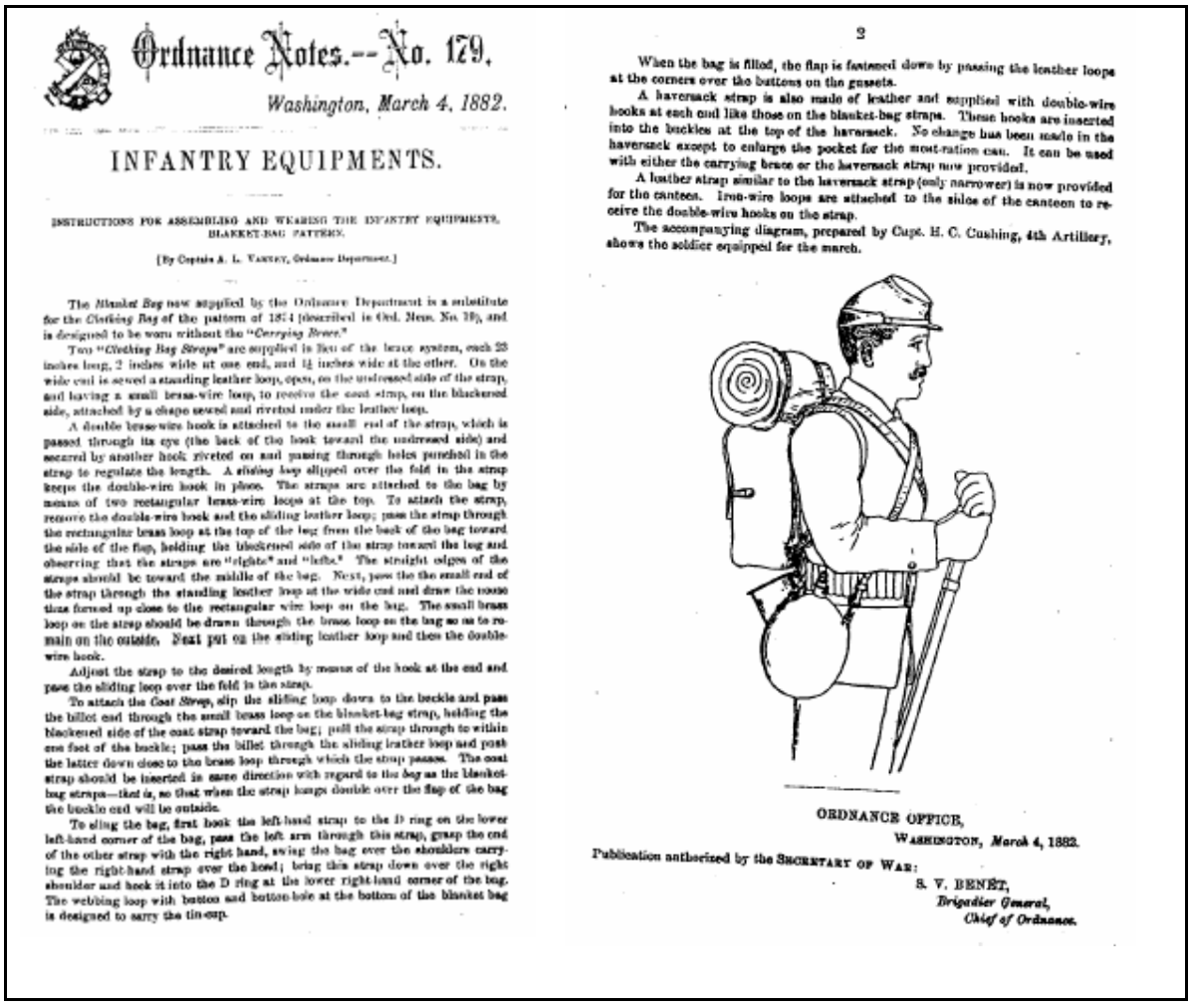
Unlike the anonymous publications of the modern Army, early publications funded and distributed by the War Office, and subsequently War Department, were published in the author's name. Publications issued before 1900 were organized by informal War Department document numbering schemes until 1900, when the Army initiated a knowledge management system. Before the late nineteenth century, War Department documents were not numbered or categorized in any particular order. Some editions of *The Soldier's Handbook* (1886, 1889, 1893) were issued as War Department

documents, numbers unknown, but the 1900, 1905, and 1908 editions were issued as number 126, 241, and 332, respectively. The assignment of new document numbers indicates that no formal change or revision process was established for existing documents; revised documents were simply issued a new War Department document number.

To confuse matters further, "documents were numbered consecutively (1, 2, 3 and so on) with no variation concerning subject matter" (Hanesalo 2003, p. 1); documents used by more than one agency included a unique agency identifier. For example, War Department Document No. 541 could be Signal Manual No. 3 (Hanesalo 2003, p. 1). War Department document number TM5-5034, *Maintenance Manual and Parts Catalog, Generating Set, Model HRUA*, published by the Homelite Corporation, was also Technical Bulletin L-313.

The Ordnance Department published hundreds of numbered notes and documents resulting from technical innovations introduced between 1880 and 1930. These innovations included the automobile, tank, airplane, gun, and advancements in communications. The maintenance and repair of these innovations, along with the procedures required for use, care, and operation, resulted in a myriad of new technical publications. These documents were not limited to weapon technologies but were also used for the systemic application of the Army's doctrine, ideas, and principles. As shown in Figure 1 (the wearing of personal infantry equipments), soldiers are treated impersonally and uniformly for the sake of dependable performance in the field. Like weapons and other military technologies, a soldier requires a system of use and care, or

preventive maintenance, to maintain a mission ready status. In publications such as the one shown in Figure 1, the Army provides each soldier with the instructions to maintain themselves in prime condition in accordance with Army rules and regulations. Examples of such publications includes instructions for the wearing of shoes and socks, caring for the feet, health and hygiene, physical education, caring for the teeth, recipes and cooking, and forms for recording marksmanship skill statistics.



Ordnance Notes.--No. 179.

Washington, March 4, 1882.

INFANTRY EQUIPMENTS.

INSTRUCTIONS FOR ASSEMBLING AND WEARING THE INFANTRY EQUIPMENTS, BLANKET-BAG PATTERN.

[By Captain A. L. Varney, Ordnance Department.]

The *Blanket Bag* now supplied by the Ordnance Department is a substitute for the *Clothing Bag* of the pattern of 1874 [described in Ord. Mem. No. 10], and is designed to be worn without the "*Carrying Straps*."

Two "*Clothing Bag Straps*" are supplied in lieu of the brace system, each 23 inches long, 2 inches wide at one end, and 1¼ inches wide at the other. On the wide end is sewed a standing leather loop, open, on the undressed side of the strap, and having a small brass-wire loop, to receive the coat strap, on the blackened side, attached by a shape sewed and riveted under the leather loop.

A double brass-wire hook is attached to the small end of the strap, which is passed through its eye (the back of the hook toward the undressed side) and secured by another hook riveted on and passing through holes punched in the strap to regulate the length. A *sliding* loop slipped over the fold in the strap keeps the double-wire hook in place. The straps are attached to the bag by means of two rectangular brass-wire loops at the top. To attach the strap, remove the double-wire hook and the sliding leather loop; pass the strap through the rectangular brass loop at the top of the bag from the back of the bag toward the side of the flap, holding the blackened side of the strap toward the bag and observing that the straps are "right" and "left." The straight edges of the straps should be toward the middle of the bag. Next, pass the the small end of the strap through the standing leather loop at the wide end and draw the loose thus formed up close to the rectangular wire loop on the bag. The small brass loop on the strap should be drawn through the brass loop on the bag so as to remain on the outside. Next put on the sliding leather loop and then the double-wire hook.

Adjust the strap to the desired length by means of the hook at the end and pass the sliding loop over the fold in the strap.

To attach the *Coat Straps*, slip the sliding loop down to the buckle and pass the billet end through the small brass loop on the blanket-bag strap, holding the blackened side of the coat strap toward the bag; pull the strap through to within one foot of the buckle; pass the billet through the sliding leather loop and push the latter down close to the brass loop through which the strap passes. The coat strap should be inserted in same direction with regard to the *bag* as the blanket-bag straps—that is, so that when the strap hangs double over the flap of the bag the buckle end will be outside.

To sling the bag, first hook the left-hand strap to the D ring on the lower left-hand corner of the bag, pass the left arm through this strap, grasp the end of the other strap with the right hand, swing the bag over the shoulders carrying the right-hand strap over the head; bring this strap down over the right shoulder and hook it into the D ring at the lower right-hand corner of the bag. The webbing loop with button and button-hole at the bottom of the blanket bag is designed to carry the tin-cup.

When the bag is filled, the flap is fastened down by passing the leather loops at the corners over the buttons on the gussets.

A haversack strap is also made of leather and supplied with double-wire hooks at each end like those on the blanket-bag straps. These hooks are inserted into the buckles at the top of the haversack. No change has been made in the haversack except to enlarge the pocket for the meat-ration can. It can be used with either the carrying brace or the haversack strap now provided.

A leather strap similar to the haversack strap (only narrower) is now provided for the canteen. Iron-wire loops are attached to the sides of the canteen to receive the double-wire hooks on the strap.

The accompanying diagram, prepared by Capt. H. C. Cushing, 4th Artillery, shows the soldier equipped for the march.

ORDNANCE OFFICE,
WASHINGTON, *March 4*, 1882.

Publication authorized by the SECRETARY OF WAR:

S. V. BENÉT,
Brigadier General,
Chief of Ordnance.

Figure 1: Ordnance Notes No. 179, Infantry Equipments

The independent numbering schemes of the early Ordnance Department and War Department and the numerous foreign document translations make it difficult to trace an historic lineage before World War II. An examination of historic Army Regulations (AR), General Orders (GO), and military specifications and standards offers a timeline of technical publication development. Table 1 briefly outlines the organization of manuals since 1775. A Review of the *Cumulative Title Index to United States Government Public Documents, 1789-1976* shows that official Army handbooks and manuals were available in the United States as early as the eighteenth century. Other historical indexes show that military publications were in use by the militia of the colonies before the U.S. Army organized in 1775.

In this chapter, I briefly illustrate the development and distribution of two important genres in technical communication: the soldier's handbook, or field manual, and technical manuals. Soldier's handbooks, or field manuals, are issued to a soldier during basic training and provide all the information required for initial entry. Technical manuals supplement subjects covered in field manuals. The basic skills involved in map reading are covered in the soldier's handbook for example, but expert skills and detailed instructions for map reading and sketching are provided in a technical manual. Technical manuals are assigned to soldiers who need more information on a subject than what is given in the soldier's handbook. In the case of map reading, the supplemental technical manual is more applicable to a soldier with a Military Occupational Specialty (MOS) code of reconnaissance than one with a medical MOS.

Table 1: Document Numbering Schemes

CENTURY	PUBLICATIONS	AGENCY
Seventeenth	Treatises, Manuals, Handbooks	Privately published, or pirated from foreign armies
Eighteenth	Treatises, Manuals, and Handbooks	Privately published, pirated from foreign armies, War Office
Nineteenth	Instruction Manuals, Handbooks, Treatises	Privately published, translated from foreign works, War Department
	Ordnance Department Documents	War Department (1880-1930's)
	Ordnance Department Notes	War Department (1880-1930's)
Twentieth	Training Regulations	War Department (1920-1925) War Department (1926-1939)
	Technical Regulations	War Department (1926-1940)
	Training Manuals	War Department (1920-1947) Department of the Army (1948 – Present)
	Technical Manuals	War Department (1939-1947) Department of the Army (1948 - Present)
	Basic Field Manuals Field Manuals	War Department (1926-1939) War Department (1939 – 1947) Department of the Army (1948 – Present)
	Technical Bulletins	War Department (1920 – 1947) Department of the Army (1948 – Present)
	Technical Circulars	War Department (1920 – 1947) Department of the Army (1948 – Present)
	Firing Tables	War Department (1920 – 1947) Department of the Army (1948 – Present)
	Lubrication Orders (old world style) Lubrication Orders	War Department (before 1920) War Department (1920 – 1947) Department of the Army (1948 – Present)
Twenty-first	Technical Manuals	Department of the Army
	Electronic Technical Manuals	Department of the Army
	Technical Bulletins	Department of the Army
	Firing Tables	Department of the Army
	Lubrication Orders	Department of the Army
	Training Manuals	Department of the Army

By illustrating the timeline of Army technical communication development, my research shows that modern American technical communication began in colonial America as a legitimate goal.

Evolution of the Knowledge Management System

Research proves technical communication existed during the Greek and Roman era and the Middle Ages. Elizabeth Tebeaux and Jimmie Killingsworth have shown that technical writing, including military science texts, existed during the Renaissance (1992). These European conventions first informed Army technical communication. Manuals and handbooks focusing on a military audience also existed in the American colonies before the eighteenth century. These publications can be loosely categorized as works of training and doctrines, and artillery and ordnance treatises. The first official Army manual, *Regulations,* was published in 1779 by Order of Congress and was "commonly called the 'Blue Book' after the color of its cover" (Nelson et al 1999, p. 78). *Regulations* describes the rules for the order and discipline of the troops as required to shape and maintain the institution. Instructions for drill, march and parade, setting up camp, dress, and treatment of the sick are among the many subjects found in Steuben's *Regulations.* The manual is significant in that it provides the framework for all future Army doctrine and training.

Unlike technical manuals, which have a life expectancy equal to the life of the technology they are meant to support, soldier's handbooks, or manuals of training and

doctrine, began with the militia and have evolved over time, superceding or rescinding the previous version (see Table 2).

Table 2: Lineage of Soldier's Handbooks

PUBLICATION	AUTHOR	PUBLISHER/AUTHORITY	DATES OF ISSUE & REVISION
Regulations	STEUBEN	Thomas & Sturtevant/Congress	1778, 1794
The Soldier's Book	Anonymous	General Orders	1835
A Concise System of Instructions	Cooper	War Department	1836, -39, -55
The Military Hand-book	Le Grand	Beadle & Company Publishers	1861
Customs for NCO's	Kautz	Lippincott	1865
Soldier's Handbook	Hershler	War Department/GPO	1884-1913
A Private's Manual	Moss	George Banta	1914, 1917
A Manual for NCO's & Privates	Anonymous	War Department/GPO	1917
The Private's Manual	Anonymous	El Paso Publishing Co.	1918
Soldier's Handbook	Anonymous	Infantry Journal	1934, -35
FM 21-100 Soldier's Handbook	Anonymous	War Department/GPO	1941, -42
FM 21-13 Soldier's Guide	Anonymous	Department of the Army/GPO	1952, -61
DA Pam 21-13 Soldier's Handbook	Anonymous	Department of the Army/GPO	1964, -66
DA Pam 21-13 Soldier's BCT Handbook	Anonymous	Department of the Army/GPO	1968, -69
TRADOC Pam 600-4 IET Soldier's Handbook	Anonymous	Department of the Army/GPO	1985, -86, -89, -98, 2001

Soldier's handbooks illustrate the application of institutional doctrine and how it effects change in the individual. Beginning with Steuben's *Regulations,* each issue of the soldier's handbook contributed to the lineage of the modern IET Soldier's Handbook. Contemporary handbooks replaced elaborate text descriptions with visualizations. Jonathan Rawson, John Campbell, Samuel Cooper, William Duane, John Nesmith, Richard Cavan, and Joseph Lord wrote many of the more notable militia handbooks of the late eighteenth and early nineteenth century. The rhetorical qualities and design elements of these handbooks are discussed in Chapters Three and Four, respectively.

A treatise provides exhaustive knowledge of a subject, in this case, technical or scientific. Eighteenth century treatises provide the model for contemporary technical manuals. Treatises, although not readily available to the American army until the 1790s, were organized by artillery or ordnance type: light artillery, heavy artillery, and gunnery. Heavy artillery manuals contained instruction for cannon, howitzers, and mortars along with the carriages, ancillary equipment, and support equipment. Donald Graces writes, "During the American Revolution, the Continental Artillery had relied on a pirated edition of John Muller's *A Treatise of Artillery,* the standard 18th century English ordnance text" (De Scheel 1984, p. ix). (Muller's manual, like many others of the day, was stolen from the British to help American troops operate artillery.) Muller's *Treatise of Artillery* is a precursor to modern Army operation and maintenance technical manuals. In addition to providing a brief history of artillery and theories of operation for artillery, shot, and the science of ballistics, the manual also described test results, construction

specifications and instructions for each unit of artillery, operating instructions, dimensions and physical characteristics, and firing tables.

Publications by William Stevens, Henri De Scheel, Louis De Tousard, and John Tidball followed. The War Department's translation of Henri De Scheel's *Mémoires d'artillerie* (Treatise of Artillery) in 1800 became the first official artillery and ordnance manual in the United States. Unlike the title page of Muller's *Treatise,* De Scheel's manual announces the modifications to the artillery configuration that were implemented since the alterations made by the French in 1765. Like Muller's earlier manual, De Scheel included the theories of operation for each unit of artillery along with the fabrication specifications, equipment characteristics, dimensions, and specifications for construction. De Scheel's *Treatise of Artillery* remained the standard until technical innovations in artillery and ordnance shortly before the Civil War required a new manual.

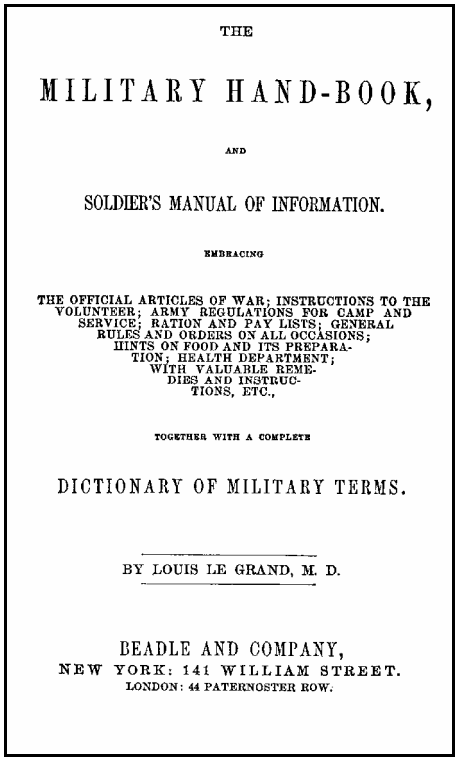
In 1861, *Instruction for Heavy Artillery for the use of the Army of the United States*, written by "a general board of officers," became the new Army standard. As shown on the title page, *Heavy Artillery* was reduced in subject matter. Distinct changes in the genre are reflected in the nomenclature. Artillery manuals were no longer called treatises, but manuals of instruction.

Manuals provided only the instruction for the equipment depicted in the manual. The manual was organized into three parts for reference. Part 1 provided a description of each unit of artillery. Part 2 provided the operator instructions as a series of lessons. Part 3 provided physical specifications for each unit of artillery including the dimensions and weight.

In addition to the official War Office and War Department documents, private citizens who formed local militia and volunteer regiments wrote a good number of eighteenth and early nineteenth-century handbooks. These individuals were obligated to provide the regiment's training, doctrine, and supplies. Militia and volunteer officers wrote, funded, published, and distributed these texts to their own regiments. Texts were often published by the businesses that published official works before the Government Printing Office (GPO) was established in 1860. The GPO outsourced printing to a series of government contractors (a practice that continues today), many of which published Army handbooks and manuals before the establishment of the GPO. Lippincott and Desilver of Philadelphia, Van Nostrand and Putnam & Sons of New York, and George Banta of Wisconsin were a few of the more notable printers. Today, although the GPO continues to outsource the printing of manuals to government contractors, the name of the printer no longer appears on the manual. Army regulars, August Kautz for one, also wrote "how to" manuals to help users, or soldiers, with daily tasks. These texts were not funded by the War Department nor were they included in the War Department numbering scheme. Soldiers in need of these texts were often required to make these purchases out of their own pockets.

Before the Civil War, publication writers were aware of the low literacy levels of the recruits. Manuals were written for "officers to train the enlisted man" (Clemens 1988, p. 155); privates and new recruits were not expected to read the text, but they were expected to know it. In 1861, Louis Le Grand published *The Military Hand-book, and Soldier's Manual of Information.* To reach the target audience of Civil War recruits, Le

Grand announced the purpose and subjects covered in the handbook on the title page (see Figure 2). Presenting this information was important to its sales; no handbook before Le Grand's targeted the recruit as the primary reader[1]. In addition to providing the standard record of general orders, regulations, and articles of war, *The Military Hand-book,* unlike its predecessors, provided information soldiers needed to survive Army life. Health precautions, cooking, washing uniforms, personal hygiene, and following orders were just a few of the topics contained in the manual. Additionally, Le Grand's manual provided one of the first dictionaries to help explain military terminology to new recruits.



THE

MILITARY HAND-BOOK,

AND

SOLDIER'S MANUAL OF INFORMATION.

EMBRACING

THE OFFICIAL ARTICLES OF WAR; INSTRUCTIONS TO THE VOLUNTEER; ARMY REGULATIONS FOR CAMP AND SERVICE; RATION AND PAY LISTS; GENERAL RULES AND ORDERS ON ALL OCCASIONS; HINTS ON FOOD AND ITS PREPARATION; HEALTH DEPARTMENT; WITH VALUABLE REMEDIES AND INSTRUCTIONS, ETC.,

TOGETHER WITH A COMPLETE

DICTIONARY OF MILITARY TERMS.

BY LOUIS LE GRAND, M. D.

BEADLE AND COMPANY,
NEW YORK: 141 WILLIAM STREET.
LONDON: 44 PATERNOSTER ROW.

Figure 2: Le Grand's *The Military Hand-Book and Soldier's Manual of Information*

[1] The handbook was sold to Union volunteers in the first year of the Civil War for twenty-five cents a copy and contained four pages of advertisements, which no doubt partially funded its publication.

Later in 1864, August Kautz, "recognizing that the greater number of [troops] could read" (Clemens 1988, p. 155), wrote *Customs and Service for Non-Commissioned Officers and Soldiers.* Like Le Grand, Kautz also announced the purpose and subjects covered in the handbook. Kautz targeted privates and NCOs who may seek promotion and status within the Army's ranks[2]. Among the many topics provided in Kautz's manual, the handbook described the roles and responsibilities of rank, provided a pay scale, listed the principles of firing, discussed health precautions, and gave cooking instructions.

Around 1830, West Point graduates (for example, Winfield Scott, John Kelton, George Patten, Egbert Viele, and William Gilham) began publishing handbooks and military science textbooks. Many of these works were later reprinted by the War Department of the Confederate States of America. In 1861, William Gilham's Manual of *Instruction for the Volunteers and Militia of the United States* was reprinted later that year as the *Manual of Instruction for the Volunteers and Militia of the Confederate States* when Gilham, like many other USMA graduates, swore allegiance to the South. Samuel Cooper's *Concise System of Instructions and Regulations,* first published in 1836, was revised to include instructions for the revolver and was published in 1861 by order of the Confederate Congress. The majority of these works were concerned with drill, tactics, and military science, and many of the texts became the official textbooks used at West Point and the Virginia Military Institute.

[2] According to Clemens, Kautz's *Customs* made tacit knowledge available to the troops, but economic conditions created by the war resulted in low sales.

From 1880 to 1899, a series of new publications emerged which included documents and notes issued by the newly formed Ordnance Department. In addition, the War Department began assigning document numbers to each new publication. The War Department issued the first official soldier's handbook in 1884, "during a period of Army reform activity, when the authorities sought to make the service life more attractive to men in the ranks (and thereby reduce the high desertion rates)" (Vetock 1981, p. 73). *The Soldier's Hand-Book for the Use of the Enlisted Men of the Army* was "expressly intended for the use of enlisted personnel" (Vetock 1981, p. 73). By 1883, the Soldier's Handbook adopted a contemporary form. The GPO controlled the publication and distribution of texts. The handbook provided the standard record of army regulations, articles of war, and military organization (by this time a one hundred year-old standard topic in soldier's handbooks), along with health precautions extracted from *Dr. Hall's Journal of Health*, a popular health journal of the period, and rifle use and care instructions as extracted from *Laidley's Rifle Firing* (Laidley was an expert in firearms). Forms were included to record the service, pay, and marksmanship skills of the soldier; a few issues included a form for a last will and testament. The handbook was revised and reissued thirteen times between 1883 and 1914.

Around 1900, the War Department assigned new technical and training manuals as numbered Training Regulations and set out to incorporate "the technical subjects of the earlier Ordnance Documents … into the Training Regulation system" (Hanesalo 2003, p. 1). In 1925, the War Department issued TR 1-10, *Training Regulations Published to Date*, which instituted a revised training regulation numbering system and

listed all numbered Training Regulations to date (all publications not included in the War Department or Ordnance Department numbering scheme). The April 1925 issue lists 139 publications issued from December 1921 through April 1925; however, TR 1-10 did not include previously numbered War Department Documents or Ordnance Department Documents and Notes still in use. In 1926, TR 1-10 issued changes again to the Training Regulation system: "War Department publications pertaining to training are, as a general rule, issued in the form of Training Regulations, Technical Regulations, Training Manuals, or Field Manuals" (1926 p.1).

Before TR 1-10 was issued in 1925, changes to Training Regulations were "printed on one side only and of a size to permit of cutting and pasting each changed paragraph or subparagraph over the paragraph of the original" (see *Changes in Training Regulations for the Year 1923*). Revised publications were no longer assigned a new document number. The process of issuing changes to existing publications suggests the Army intended on using and maintaining its technologies and processes for an indefinite period.

From 1926 through 1939, the Army began merging the original Training Regulations into a series of unnumbered Basic Field Manuals. These Training Regulations were completely phased-out before 1945. The majority of these publications were the result of innovations created by World War I and were rapidly becoming obsolete by pre World War II era technological and manufacturing advancements.

The new system established by TR 1-10 lasted only until 1939, but it provided the foundation for the modern system. TR 1-10 defined four basic technical publication

genres: Training Regulations, Field Manuals, Technical Regulations, and Training Manuals. Training Regulations "consist primarily of a series of pamphlets containing only those regulations which govern the training of units … or in part with so much of the training of the individual and the technique of the arm or service as considered essential to secure the purpose degree of unit or team training" (1926, p. 12). TR 25-10, *Instruction with the Saber*; TR 113-5, *Principles of Personal Hygiene*; and TR 430-15, *Service of the Piece, 75-mm Gun, Model 1897* are just a few of the Training Regulations listed in TR 1-10.

TR 1-10 defines Technical Regulations, a precursor to the technical manual, as "covering subjects of a technical nature" (1926, p.1) and includes:

- Pamphlets describing arms, materials, and equipment, and containing instructions for the operation, care, and handling thereof.
- Information and instructions as to technical procedure, exclusive of those of an administrative nature.
- Especially needed treatises on technical subjects, exclusive of those of an administrative nature.

Besides the numerous weapon system Technical Regulations, TR 1-10 also included the management of non-tactical knowledge, for example, *1170-265 Balloon and Airship Hangars* (issued May 31, 1929); *1230-5 The Buzzerphone, Type EE-1-A* (issued December 6, 1929); and *1255-1 The Homing Pigeon* (issued October 30, 1936).

Training Manuals consist of a series of pamphlets "containing the instructions on methods of procedure to be followed in the performance of or instructions in certain duties" (1926, p. 2). These pamphlets include:

- Guidebooks for the specialist
- Self-instructions pamphlets for the student in a specialist duty
- Guidebooks for the instructor

In addition to listing manuals pertaining to unit and regiment training, *2100-151 The Army Baker,* was issued September 1, 1926, and *2100-152 The Army Cook* was issued December 31, 1935. The Manual of Army Cooking was previously published by the War Department in 1879.

Field Manuals "consist of a series of pocket-size volumes, containing in convenient and condensed form for ready reference in the field the approved principles, doctrines, and methods governing the training and employment of the arms of the Army" (1926, p. 2). TR 1-10 was revised nearly every year until it was superceded by FM 21-6 in January 1940. The last issue of TR 1-10 indicated a total of one hundred thirty-three Training Regulations, one hundred thirty-four Technical Regulations, thirty-two Training Manuals, and fifty-four Basic Field Manuals (unnumbered).

FM 21-6, first issued in January 1940, replaced TR 1-10. War Department Circular No. 36, issued April 6, 1940, revised the system again, and in October 1940, introduced the "technical manual." The lineage of the technical manual[3] started with eighteenth century treatises followed by nineteenth century ordnance documents and

[3] Today, the genre of the technical manual is in a transition state, that is, paper-based media has been replaced with new digital media.

manuals of instruction, turn-of-the century Training Regulations, post-World War I Technical Regulations, and pre- World War II Basic Field Manuals.

By 1940, not only had technical communication been a legitimate field within the Army, but it was also spawning genres and subgenres from earlier established technical communication products. FM 21-6 defined the following genres of technical publications:

- Army Regulations
- Firing Tables
- Instruction Charts
- Mobilization Regulations
- Mobilization Training Programs
- Tables of Basic Allowances and Allowances
- Tables of Organization
- Training Circulars
- Training Films and Film Strips (sound, silent, and film)
- Training Publications
    - Field Manuals
    - Technical Manuals
    - Technical Regulations
    - Training Manuals
    - Training Regulations

By 1945, the Army combined the existing Training Manuals and Technical Regulations to form one of twelve technical publication genres (War Depart. 1945, p. 5):

- Combined Communication Board Publications
- Commercial Traffic Bulletins
- Field Manuals
- Firing Tables
- Lubrication Orders
- Modification Work Orders
- Supply Bulletin
- Technical Manuals
- Technical Regulations (nearly phased-out by this time)
- Training Circulars
- War Department Circulars, General Orders, and Bulletins
- War Department Pamphlets

Technical Manuals, or TMs, are defined as follows in FM 21-6:

> Technical Manuals supplement Field Manuals, covering subjects the separate treatment of which is considered essential to a full accomplishment of the training prescribed in Field Manuals. This series includes manuals describing matériel, and containing instructions for its operation, care, and handling; guidebooks for instructors and specialist; material for extension courses; reference books; administrative materials; and similar specialized subject matter. (War Depart. 1945, p. 7)

This system remained in authority until 1948 when the Department of the Army assumed responsibility of the publication system. Different commands within the Army were assigned the responsibility for managing and distributing the publications. For example, in 1941, the War Department published the *Soldier's Handbook;* in 1952, the *Soldier's Handbook* was published by the Department of the Army, then by USCONARC in 1964, and later by TRADOC in 1985, the present day authority.

Today, major Army Commands enforce "regulations, and instructions governing publications, field printing, binding and related activities" (AR 25-30 2002, p. 6) under the guidance of the United States Army Publications Agency (USAPA). The U.S. Army Materiel Command (AMC) is responsible for developing Army-wide equipment and technical publications; the U.S. Army Training and Doctrine Command (TRADOC) is responsible for developing Army-wide doctrinal and training publications. LOGSA, or the Logistics Support Activity for the Army, is the repository of all equipment technical publications including *PS Monthly*; USAPA holds all administrative publications; and TRADOC maintains and stores all training and doctrinal publications.

Official publications of the modern Army are numbered and organized into six categories (AR 25-30 2002, p. 14):

- Numbered DA and HQDA directives (policy and information memorandums)
- Eight types of DA administrative publications
- Eleven types of doctrinal, training, training support, and organizational publications and products
- Ten types of agency and command administrative publications

- Four types of other categories of official publications

These publications must also comply with the Army's electronic/digital media requirements. These requirements include SGML data tagging compliance, CD-ROM distribution, and Internet/Intranet development and distribution. Few manuals of today are developed specifically for traditional print use and distribution.

While this may seem like a comprehensive system, manuals that do not require mass publications and distribution, like simulator and training device manuals, are not included in this system. Additionally, throughout history, ad hoc publishing occurred by various commands, the A.E.F. in France, for example. Numerous foreign translations, special service manuals, combined forces manuals, and manuals of miscellaneous subject matter are also absent from this system. We may never really know the number of manuals published in the Army's history.

European Origins

Until the early twentieth century, handbooks written for European armies eventually migrated to the American colonies with foreigners in support of early expeditions or campaigns, and sometimes war—for example, the French Indian Wars (1755-1760), the American Revolution (1775-1783), and the Civil War (1861-1865). Some of the handbooks were translated to English; others were translated and adapted to

American service. *The Manual of Exercise*, published in London in 1764 for the British Army, was one of the more commonly used manuals by both the British Army and the American militia before the Revolution. General Alexander Smyth's 1812 publication of *Regulations for the Field Exercise, Maneuvers, and Conduct of the Infantry of the United States* is an abridgment of *Réglement concernant l'exercise et les manoeuvres de l'infanterie, du premier août* (Wolf's Head 1993), published in 1791 by Frances Ministère de la guerre, the ministry of war.

Like soldier's handbooks and manuals of tactics and drill, treatises of artillery and ordnance were also converted to English from foreign languages and were assigned as War Department and, later, Ordnance Department Documents. For example, De Scheel's *Mémoires d'artillerie* was translated from French to English in 1800; *Memorial de Artillera* was translated from the Italian *Revisia Militar Italiana* to Spanish and from Spanish to English in 1882 and then converted to a series of Ordnance Notes, one of which is No. 224 *Rifled Howitzers and Mortars*, for example. Ordnance Note No. 177, *Friction Primers for Cannon*, was translated from German to English in 1882. Many examples of translations occurred during this era, and are too numerous to mention here.

Other publications, although authored by American officers, were written in the native language of the officer and then translated to English by Americans. During the war, Washington commissioned Baron Wilhelm von Steuben, a Prussian Army officer, to train the American troops and shape them into a formidable force. In 1778, during the Battle of Monmouth (New Jersey), Steuben, who spoke little English but fluent French, wrote *Regulations for the Order and Discipline of the Troops of the United States* in

"French and had it translated into English by his secretary, Pierre Etienne Duponceau, with the assistance of his loyal aide-de-camp, Captain Benjamin Walker. Alexander Hamilton edited the text while Captain Pierre Charles L'Enfant provided illustrations" (Wright 2003, p. 11). The practice of translating and adapting foreign texts to American service continued until after World War I. By World War I, American businesses began defense contracting and supplied the Army with wartime technologies. The drop in foreign translations was the result of the drop in the purchase of military equipment by foreign manufacturers. American manufacturers of defense technologies were required to supply technical publications and technical data packages to their military customers.

Problems with the System: The Army Adopts New Media

By the late 1880s, a significant number of manuals, handbooks, treatises, and ordnance notes and documents were in circulation. In an effort to control and manage the Army's knowledge, the War Department initiated a numbering system. This system quickly became obsolete. It was revised after World War I, in 1926, 1938, and 1940, and finally expired in 1948. By 1941, so many manuals were in circulation that it was increasingly difficult to maintain the manuals; equipment upgrades surpassed the speed at which manuals were revised[4]. This process left large gaps in the equipment modification

[4] Today, it generally takes a year to contract, change, and disseminate revisions wherever technical manuals are required.

and TM revision process. The 1946 issue of FM 21-6 contained a one hundred fifty-eight page double-column list of publications issued to date, all of which needed to be maintained in a mission-ready status.

During World War II, the Army introduced a new technical publication, *Army Motors,* and brought timely maintenance and repair technical information to the troops stationed in Europe. Unlike the previous manuals, *Army Motors* was an experiment in comic media. The comic included three major characters: Private Joe Dope, an incompetent soldier; Connie Rodd, a by-the-book Army Corporal designed in the likeness of Lauren Bacall (Eisner as quoted in Henderson, 2003); and, SGM Half-Mast McCanick, a goofy, Sad Sack-like, incompetent (half-assed as the name implies) mechanic. *Army Motors* vanished in 1945 at the end of World War II.

The three main characters, Dope, Rodd, and Half-Mast, were revived a few years later in the Army's new technical manual, *PS Monthly*, sent to assist troops assigned to maintenance tasks in support of the U.S. Army in Korea. Connie Rodd was now a civilian and technical expert; SGM Half-Mast was an authoritarian and competent mechanic. As Dan Andree writes, "In June 1951 Army Field Forces (now U.S. Army Training and Doctrine Command) decided that it needed a way to quickly move maintenance information to soldiers and deliver it an easily understood format" (Andree 2001, p. 30). The Army introduced *PS Monthly,* a monthly maintenance publication designed as comic media. A captivating cultural theme, generally based on themes in literature, film, holidays, and superheroes delivers the maintenance lesson every month. *PS* helps troops "take better care of their equipment" (USA 2001, p. 5) and provides them with timely up-

to-date maintenance information. As depicted in Figure 3, Army writers looked to Spiderman to capture audiences. *PS Monthly* fills the gap created by the lengthy change page process.

Figure 3: Spiderman in *PS Monthly*

By the 1970s, the Department of Defense funded research focused on replacing paper technical manuals. Their goals were to reduce storage requirements, speed up the change page process, reduce maintenance downtime and costs, and automate maintenance tasks to help novice technicians. Eric Jorgensen and Joseph Fuller write,

> In addition to contributing to the serious long-term logistics problems involved in producing, stocking, controlling, modifying, and using large quantities of paper, TMs as currently constructed are inherently incapable of incorporation into an automated, standardized, interactive, real-time system for the transfer and sharing of logistic-support information. (Jorgensen et al 1993, p. 1)

Jorgensen and Fuller claim that modern paper technical manuals are deficient in three areas. Paper-based technical manuals:

- Are costly to produce and manage. Paper manuals require additional personnel and facilities are required for physical control of information.
- Prevent full integration among many activities of required technical information during a given process.
- Are of such poor usability and comprehensibility as to seriously slow up the maintenance process, increase false part-removal rates, and significantly increase training time.

In the 1960s, the Navy experimented with microfilm as a possible solution but "it proved to be only partially effective; it did reduce storage requirements and provided limited benefits in maintaining the technical manuals" (Fuller 1993, p. 2); however, the new electronic publications did not help in the automation of work. The Air Force converted a

600-pound paper technical manual set to a set of twelve CD-ROMs around 1990 (Major 1997, p. 23). Implementation of the technology onboard an aircraft required "a laptop computer, a (CD) Jukebox, an inkjet printer, and the library in 12 CDs" (Major 1997, p. 25).

In the mid 1980s, the Army looked to new computer technologies as a possible solution in the automating of technical information. The goal was to develop a logistics support system, which would integrate the processes to "create, store, retrieve, use, and exchange weapon systems procurement and support data" (Kincaid et al 1988, p. 8). Technical manuals were continuing to develop into a distinct genre reflecting the complexity of the Army's new technology. As technology grew more sophisticated, so did the maintenance and troubleshooting tasks, with lengthy maintenance intervals impacting operational readiness and sustainment. Peter Kincaid writes, "As equipment is modified, technical information updates are slow to reach users in the field, and correcting technical manuals with update sheets is so awkward and time consuming that it is frequently not done correctly" (Kincaid et al 1988, p. 9). Much like the challenge of distributing changes to the field during World War II, the process of developing and disseminating updates in the last half of the twentieth century was nearly unmanageable.

In the early 1990s, the Army experimented with "multimedia presentation software, PC-based test instruments and the Microsoft Windows interface" (Brown 1993, p. 315) in an effort to automate technical information. What resulted is an electronic technical manual ETM. An ETM provides automatic referencing of paper-based images

(see Figure 4). Like microfilm, however, these technologies only solved a paper storage problem and the constraints of moving large amounts of paper globally.

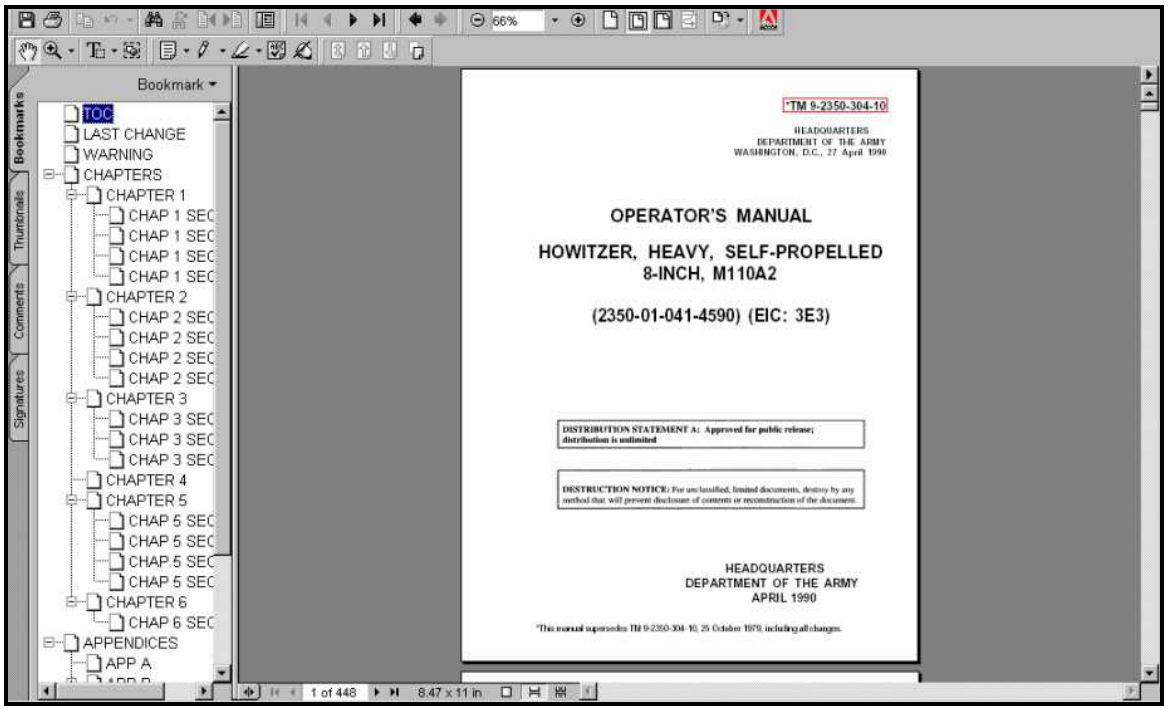


Figure 4: Typical Electronic Technical Manual

Automation of maintenance tasks was a growing problem in addition to problematic usability of complex documents. Charles Bosco et al of the U.S. Army Test, Measurement, and Diagnostic Equipment Activity claims that "scanning a paper manual into a digital form for use . . . only solves a volume problem. A paper manual that is simply digitized and requires scrolling to view page by page is more difficult to use than the original paper manual" (Bosco et al 1997, p. 21), and it may not justify the costs of the conversion. Finally, in the late 1990s advancements in publishing, web,

communication, transmission, and computer technologies allowed the Army to integrate these texts with digital technology and, in some cases, the weapon platform. Digital technology made it possible for static procedures in the manual to be automated through a single interface known as an IETM, or Interactive Electronic Technical Manual. IETMs provide a hypermedia environment and a nonlinear approach to retrieving and accessing data (see Figure 5).

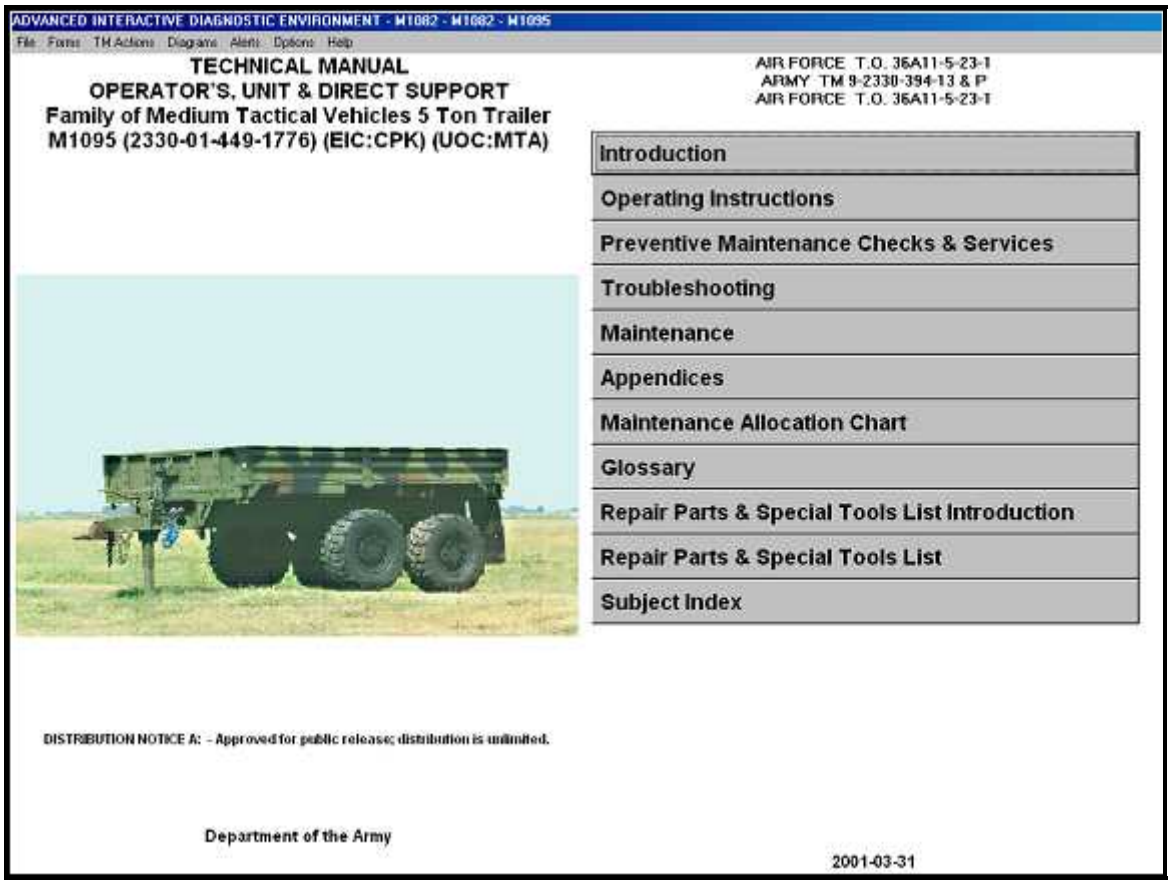


Figure 5: Typical Interactive Electronic Technical Manual

According to the U.S. Army Logistics Transformation Agency, "IETMs are based on the computing principles of hypertext and hypermedia" (USA 1998, p. 22). An IETM combines hypermedia, artificial intelligence, embedded diagnostics, sensors, expert systems, knowledge-based systems, and user interaction to improve performance, learning, and maintenance or operator efficiency. In 1993, SAIC produced a capable O-level (organizational maintenance level) electronic manual for the Heavy Equipment Transporter (HET) and Palletized Loader System (PLS). James Brown, SAIC Principal Engineer, writes, "The IETMs for the HET and PLS each contain the equivalent of 2,500 pages of a paper technical manual with over 1,500 drawings, and complete troubleshooting and maintenance instructions" (Brown 1993, p. 316). Though the HETS/PLS IETM helped meet many of the Army's goals, early Web and digital media technologies were limited in capability.

Despite the advancements in publishing technologies, digital media, and electronic technologies, true automation of work is not a reality because the manual labor remains. The same advancements that allowed ETMs and IETMs to solve the storage, dissemination, and modification problems created a new set of challenges for the Army. For developers, these challenges include standardizing technologies and electronic data interchange protocols. Users are challenged with new forms of literacy and computer-interaction. The Army is challenged with operation, maintenance, and sustainment of these technologies and their advancement to the next generation of digital media.

The Value of Historical Research in Army Technical Publications

As I have illustrated in this chapter, technical communication was not born of World War II, as many scholars suggest, but rather when General Washington set out to record and execute a doctrine according to the rules and regulations of the new army, and to operate and maintain wartime technologies effectively. For more than a century after the Revolutionary War, Army writers worked to make these texts accessible to the private and NCO, transforming the knowledge from a community of tacticians and technical experts to the less adept community of the illiterate and semi-literate privates and NCOs. Officers with expert knowledge of a subject generally wrote early texts, or foreign texts were translated to English and adapted to military service.

By the time the Civil War began, Army writers were targeting literate soldiers, privates mostly, as readers of handbooks and manuals. By the late nineteenth century, the vast amounts of doctrine, training, and technical instruction accumulated by the Army pressed for document numbering schemes and technical publication organization. The loosely organized document numbering scheme was reinvented after World War I when innovations such as the tank, airplane, and radio communications created a surge in technical publications. Translating foreign texts was no longer necessary; American defense contractors were providing wartime technologies and user documentation. Anonymous authors now generated texts once produced by officers and technical experts. The new numbering system organized and catalogued each manual by a genre and subgenre hierarchal order.

World War II technologies created yet another surge in technical publications, and the numbering system again reorganized to account for the addition of new genres. Since World War II, the numbering system has changed a few times. In the late twentieth century, the system was revised to include numbering schemes and technical publication requirements for electronic technical manuals and digital data exchange.

The benefits of historical research in Army technical communication are more than just establishing an historic timeline of genre development. As discussed in Chapter Three, modern technical communicators can learn from writers of the past by studying the communication strategies, design techniques, and the stylistic qualities of historic texts. We can learn how expert knowledge was transferred to novice users and readers with poor literacy and technical skills, and how discourse was developed, shaped, and communicated within the organization. Knowing the qualities of historic data that have endured over time can be applied to the designs of new media and help make user transition smooth.

CHAPTER THREE: RHETORICAL QUALITIES OF ARMY HANDBOOKS AND TECHNICAL MANUALS

In Chapter Two, I offered a brief timeline of Army technical publications and discussed the factors that led to a myth about modern technical communication. This timeline illustrated the shaping of an institution and its discourse community along with the development, capture, management, and dissemination of its knowledge. As Jimmie Killingsworth and Michael Gilbertson point out, "discourse is the means by which communities develop and advance their agendas of action, build solidarity, patrol and extend their boundaries, and perpetuate themselves in the life of a general culture" (Killingsworth 1992, p. 162). The goal of the Army is to be fast, light, and lethal. This goal is introduced to society by soldiers who are "simultaneously a part of several discourses, several communities" (Harris as quoted in Kent 1991, p. 425). Soldiers interact with communities of family, friends, neighbors, schools, and through religious and political affiliations. These communities, in turn, interact with other communities and cultures until the goals saturate and empower the general culture. Michel Foucault explains how power spreads through a culture:

> Power is employed and exercised through a net-like organization. Not only do individuals circulate between its threads; they are always in the position of simultaneously undergoing and exercising this power. They are not only its inert or consenting target; they are always also the elements of its articulation. In other

words, individuals are the vehicles of power, not its point of application.

(Foucault 1980, p. 98)

As members of several discourse communities, soldiers spread this language throughout society. It spreads globally through the media, or, television and the Internet, and wherever the U.S. troops are geographically located. The rhetoric of technology and power permeates this discourse community.

On a more fundamental level, the Army achieves these goals through language, that is, specialized terminology now commonplace. A *signal*, or a sign for conveying intelligence and a sign for new code, and *links*, or the men sent out from a support to keep up its connection with skirmishers, are two examples of military terminology used in 1861 (Le Grand 1861). The phrase *knock it off,* meaning "stop what you're doing," and *take a break,* meaning rest 10 minutes or so, are both listed in the 1963 Soldier's Handbook as military terminology. In the late twentieth and early twenty-first century, we have embraced *jettison*—the intent to get rid of something fast; *stealth*—to move unnoticed; and *shock and awe*—the results of the application of military might. While many of these terms date back to the Middle Ages, they did not come into general usage until the Army adopted them.

Language also reflects the authoritative and commanding nature of the discourse community, demanding obedience and loyalty from its readers: *do not, never, you will, keep your hands to yourself, you will be severely punished.* The tone of Army writers also demands the reader to succumb to the needs of technology: *check track tension, protect vehicle, clean oil filter, keep your camouflage intact, look closely for damage, inspect,*

handle your rifle at all times gently, we have the world's best equipment. Carolyn Miller believes that to accurately assess the impact of technology on our culture we must "identify the rhetorical elements of technology, teasing them out of the vast complex of technological culture" (Miller 1998, p. 307).

We can learn much about the agenda and goals of the Army as a discourse community by examining the historical texts. By examining the rhetoric and style of these texts, we can learn how knowledge is acquired and how work is done. An examination of the discourse shows that soldier's handbooks provide the tacit knowledge required for Army survival; technical manuals provide the instructions for the operation of a technology, and the procedures for troubleshooting, maintenance, disassembly, repair, and assembly. Whatever the publication, the beliefs, values, histories, and expectations of the Army discourse community are reflected in these publications. In this chapter, I will examine the rhetorical qualities of Army handbooks and technical manuals.

Persuasive Technical Communication

The discourse contained in Army handbooks and manuals captures the creative nature of technical communication. Although Army technical communication is expository (its purpose is to inform) and instructional (it provides useful information), it is also inherently persuasive. In the design and development of the technical publication

discourse, writers advocate a specific point of view. Army technical writers get readers to accept this point of view by providing a balance of credibility, emotional appeal, and evidence, or ethos, pathos, and logos.

Until shortly before World War I, officers authored the majority of handbooks and manuals. Most of these writers had war experience, and many were educated at West Point. The credentials of these writers gave credibility to early texts. A demonstration of technical expertise achieves credibility in treatises and technical manuals, generally by describing the technology and explaining its use and maintenance. Description in eighteenth and early nineteenth century treatises, and twentieth century training regulations, ordnance documents and technical manuals communicate sensory detail enough to visualize the physical characteristics of a technology and discern its operation. A good description explains the purpose and use of technology, its internal workings, and indicates the disassembly and assembly breakdown order of its components.

Late eighteenth century and early nineteenth century writers knew that some readers were often educated engineers and scientists. Treatises depict highly technical prose characterized by lengthy passages, ornate language, and excessive wordiness. These early works provide a discussion about the science, technology, and history of a subject before describing its current configuration. In *Treatise of Artillery,* De Scheel gives us a visual image of the present howitzer carriage configuration by describing the changes made to the earlier model:

> THESE carriages are different from the old ones in many of their parts, having been made especially for light pieces, as hath been seen in the preceding section

… It only remains to give an account of the alterations made in the other parts of the carriage.

1. With respect to pointing the piece. It was formerly done by means of wedges. At present, the method of doing it is as follows: The breech of the gun rests upon a moveable wooden plate, the fore part of which is connected by a hinge, with the breast transom. The end of this plate is made round, and shaped liked the breech it is raised or sunk by a vice having a male skrew of iron, and a female one of brass. This skrew is placed between the cheeks, about the place where the two iron sockets, fixed by bolts on the inside of the cheeks. The female skrew suspended in this manner, is readily adapted to the direction of the male skrew, and enables the latter to bear perpendicularly on the plate, that the head of the skrew may enter the cavity in the round part of the plate. This cavity is formed by a plate of brass under the head of the skrew, and a key with handles is applied as a turn-skrew. (De Scheel 1800, p. 17)

An understanding of the 1800 model is based on knowing the history of the technology. The practice of describing a technology with respect to its history is a European practice. In one of the first artillery treatises used by the American army, John Muller explained the science of ballistics and gave a history of artillery before describing the current state of the artillery in 1747. This practice was not widespread in the United States and appears to have been abandoned in the early nineteenth century (circa 1800). The War Office, and later, War Department, issued new manuals as technologies were introduced or

enhanced[5]. Certainly by 1860 manuals of instruction for artillery no longer provided a history of modifications. By the mid-nineteenth century, treatises, or instruction manuals, reflected a highly technical prose style; however, unlike the eighteenth-century texts, it was enumerated in a system of instructions and descriptions for reference and learning.

Modern technical manuals illustrate slightly technical prose enumerated in a primer system and a plain style. In some publications (*PS Monthly*), prose is informal, conversational, and often humorous. Writers use both sarcasm and wit to help make their points. Language in modern descriptive texts reflects clarity, conciseness, and simplicity as illustrated in this explanation of changes made in 1991 to the 1980 model of the howitzer carriage:

> The carriage mounts the cannon and recoil mechanism and provides the means of transporting and emplacing the weapon. The carriage is composed of the top carriage and the bottom carriage assemblies and attached subassemblies.
>
> a. Top Carriage Assembly. It supports the cannon and recoil mechanism and the following assemblies are mounted on it; the travel lock assembly, equilibrator cylinders, the cradle assembly (including variable recoil parts), elevating mechanism, and traversing mechanism. The outside race of the internal gear is bolted to its base.

[5] Revised or modified descriptions of early twentieth century texts were issued as official changes: "The changes have been printed on one side only and of a size to permit of cutting and pasting each changed paragraph or subparagraph over the paragraphs of the original" (War Dept. 1924, p. 1). This practice continued until after World War II when change bars and pointing hands were used to denote modified text and graphics. Obsolete descriptions were removed from the manual altogether. Twentieth and twenty-first century technical manuals do not explain technical modifications, but indicate changed descriptions using the change bar method. Only the current description of the technology is available to the user.

(1) Travel Lock Assembly. The travel lock assembly is an H-shaped strut attached to the lower section of the cradle assembly which supports the mount while in travel mode. (TM 9-1025-211-20&P 2003, p. 1-16)

Unlike manuals of the early nineteenth century, late twentieth and early twenty-first century ETMs and IETMs give readers access to these historical changes. The number of changes available to a user depends on the number of configurations available for a fielded technology. For example, if three different versions of a weapon system are in use, all three manual versions can be included in the IETM database. Tagged SGML modules separate content from format and are stored in a database. When executing an IETM, users are prompted to select a version of the manual. Based on user selection, the appropriate version is configured for presentation.

Credibility is also achieved through explications of tacit knowledge showing readers that writers are knowledgeable, sincere, and commanding. These writers validated their position by offering stories, anecdotes, vignettes, and examples. In the twentieth century, the personifying of technology, or anthropomorphism, is a key strategy in Army technical communication. Will Eisner claims, "A process is most easily taught when it is wrapped in an "interesting package" … a story, for example" (Eisner 1996, p. 24). The elements of narrative help writers deliver instructional information to readers but depend on reader empathy for success. Appeals are also made to the reader's emotions, patriotism, duty, and sense of responsibility:

When you entered the Army, you raised your right hand and swore that you would bear true faith and allegiance to the United States of America, and that you

> would serve them honestly and faithfully against all their enemies whomsoever. This is a sacred oath by you and there is a great trust placed in you by the people of America that you honor this oath. (DA PAM 21-13 1961, p. 2)

In another example, writers appeal to the reader's sense of self-image and self-worth by defining the qualities that make a *good character* or a *soldier's character*. "Honesty, courage, self-control, decency, and conviction of purpose" are a few of these qualities. This is by no means a complete list, but these are the qualities that most good soldiers possess (FM 21-13 1952, p. 121).

Arguments focus on convincing readers to follow procedure, understanding the importance of complying with established protocol, adopting new technology, and taking responsibility not only for themselves, but also for their equipment. Writers let readers know that they are personally responsible for the consequences of their behavior. In this case, Army writers imply a rhetoric of blame.

Writers present historic examples to persuade readers to follow the proper safety procedures:

> In 1992, an American soldier was killed in an ambush in Panama. In 1991, another soldier was killed in Panama in a drive-by shooting. Also in 1991, a bomb in the entryway of his Korean apartment house killed an Air Force sergeant. Personal animosity did not cause these incidents. These soldiers were killed simply because they were American military personnel. As symbols of United States power, soldiers are always at risk from criminals and terrorists. While the level and type of threat vary from place to place and time to time, you can do

> several things to make yourself less likely to be the target of a criminal or terrorist. By practicing these principles at all times, you will be better prepared for that time when you are living and working in an elevated environment. (TRADOC PAM 600-4 2001, p. 3-43)

In demonstrating the importance of effective communication, writers provide historic examples of ineffective and failed communications. The story of Napoleon's defeat at Waterloo is used often along with Robert E. Lee's loss of communication with Stuart's Cavalry on the eve of the battle of Gettysburg (FM 21-13 1952; PAM 21-13 1961, p.187).

Examples of failure, disaster, and loss of life are not limited to the basic tasks found in soldier's handbooks. Writers of technical manuals provide evidence of potential disaster, humiliation, and defeat resulting from the abuse or the inadequate care of technology. As shown in Figure 6, writers again offer a Napoleonic analogy when stressing to readers the importance of maintaining a power generator in a mission ready status. Generated power is not only used to fight wars, but it also allows soldiers to communicate with loved ones. A failed generator not only destroys our war capability and prevents personal communication, but it also makes these soldiers powerless against their enemy. As the ad suggests, the soldier who does not maintain their equipment properly is responsible for the consequences.

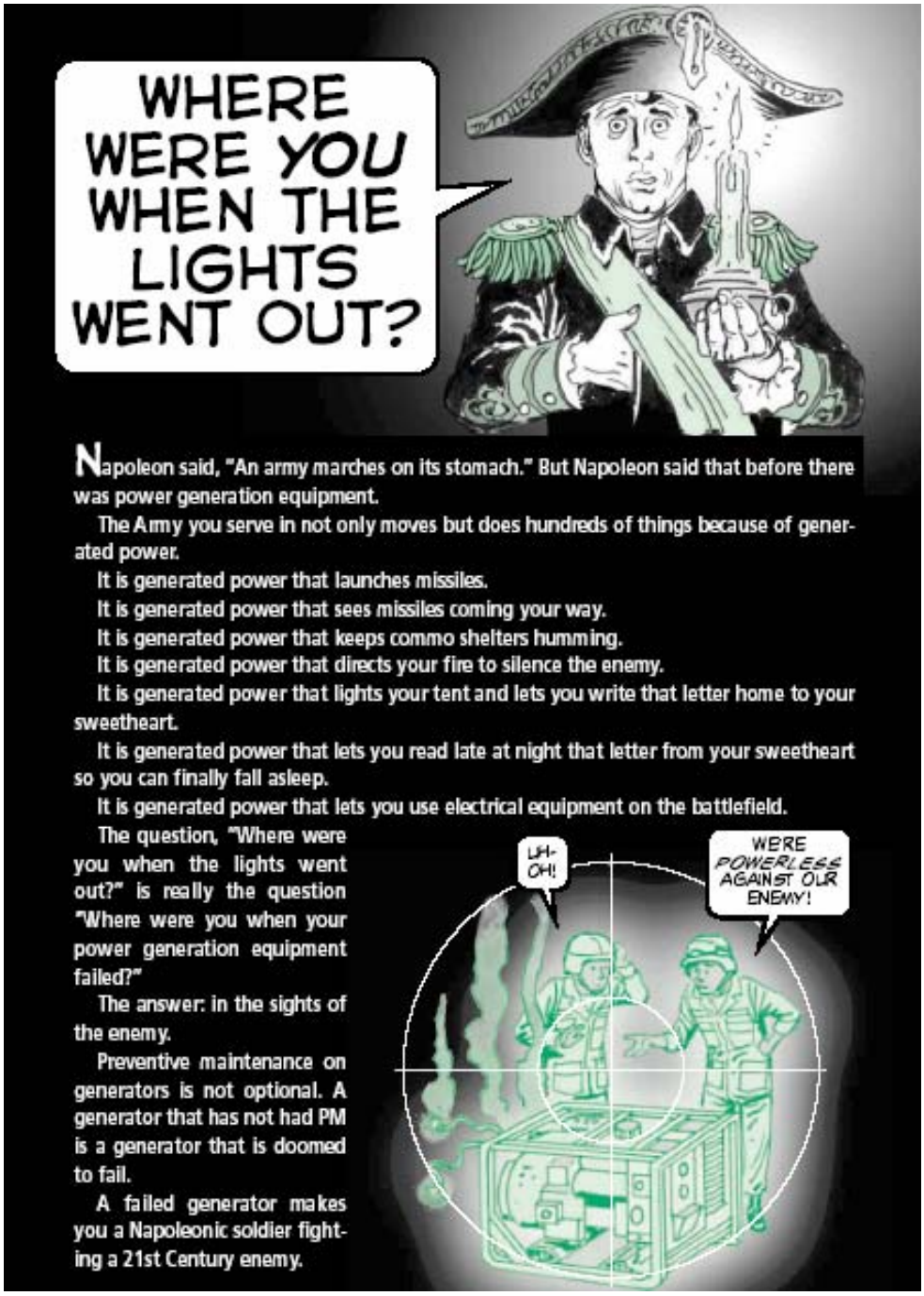


Figure 6: Example of the Potential Results of Improper Care of Technology (Source: *PS Monthly*, Issue 608, July 2003)

Writers also provide historic evidence to persuade readers of the benefits in adopting new technologies:

> In one of Colonel Steptoe's encounters with the Indians of Washington Territory, his men were armed with the old musket, and they soon expended their ammunition in ineffectual firing against enemies mounted on fleet horses, armed partly with rifles, partly with bows and arrows, whose deadly shaft was shot with astonishing accuracy, and at a rate exceeding the rapidity of an expert hand with a revolver. Charges of cavalry against them failed, and our men retreated to avoid annihilation. Some weeks subsequently the same troops met the same Indians, but having in the interval procured the rifle instead of the musket, the Indians were totally routed. (Le Grand, 1861, p. 68)

Anecdotes too are offered to help writers add an amusing spin to procedures. In one example, Le Grand adds a bit of trivia to a recipe for Thieves Vinegar, a concoction used to cleanse a sick area: "There is a legend connected with this preparation (called in French *Vinaigre a quartre Voluers*), that during the plague at Marseilles certain robbers plundered the infected horses with impunity, and being apprehended and condemned to death, were pardoned on condition of disclosing the secret of their preventive" (Le Grand 1861, p. 93). By using elements of narrative such as the anecdote described above, writers add a literary quality to manuals of instruction and doctrine.

Narrative techniques are not limited to historic tales, examples, analogies, and anecdotes. In the maintenance publication, *PS Monthly,* writers persuade readers of the importance of proper care of equipment by including a short story, or continuity, each

month. Continuities are short stories, presented in sequential visual art, and generally reflect a literature or film theme, a sporting event, or a holiday theme. Among the many literature themes are *The Wizard of Oz, The Great Gatsby,* and *Hercules.* Popular themes in film (many of which were derived from literature) include *The Private Truman Show, The Sixth Sense, Jurassic Park, Goldfinger,* and *The Mark of Zorro.* Popular culture themes includes a Siskel and Ebert spoof, *Who Wants to be a Millionaire, The X Files, What Really Happened at Roswell,* and *Spiderman.* Holiday themes usually focus on Veteran's Day events, Thanksgiving, Christmas, and July Fourth.

The continuity, designed in the likeness of the eight-page insert in MAD Magazine, presents a saga in which soldiers on a mission did not take care of their equipment and so face possible disaster. For example, the following continuity (Figure 7) shows that "even superheroes can run into big trouble if they don't do good PM [preventive maintenance]" (TB 43-PS-592 2002). In the continuity shown in Figure 7, soldiers are introduced to a new super weapon, which deafens the enemy with sound waves. This weapon requires special preventive maintenance, which a soldier promptly performs. When Dr. Octopus attempts to steal the weapon, Spiderman is called to help. Because Spiderman did not take care of his web shooters, he was unable to defeat Dr. Octopus. Like Spiderman, Dr. Octopus did not lubricate his many arms and was too exhausted to fight. SGT Half-Mast, an example of technology maintained in pristine condition, saved the day. Technology, like humans (and superheroes), requires care for longevity and health.

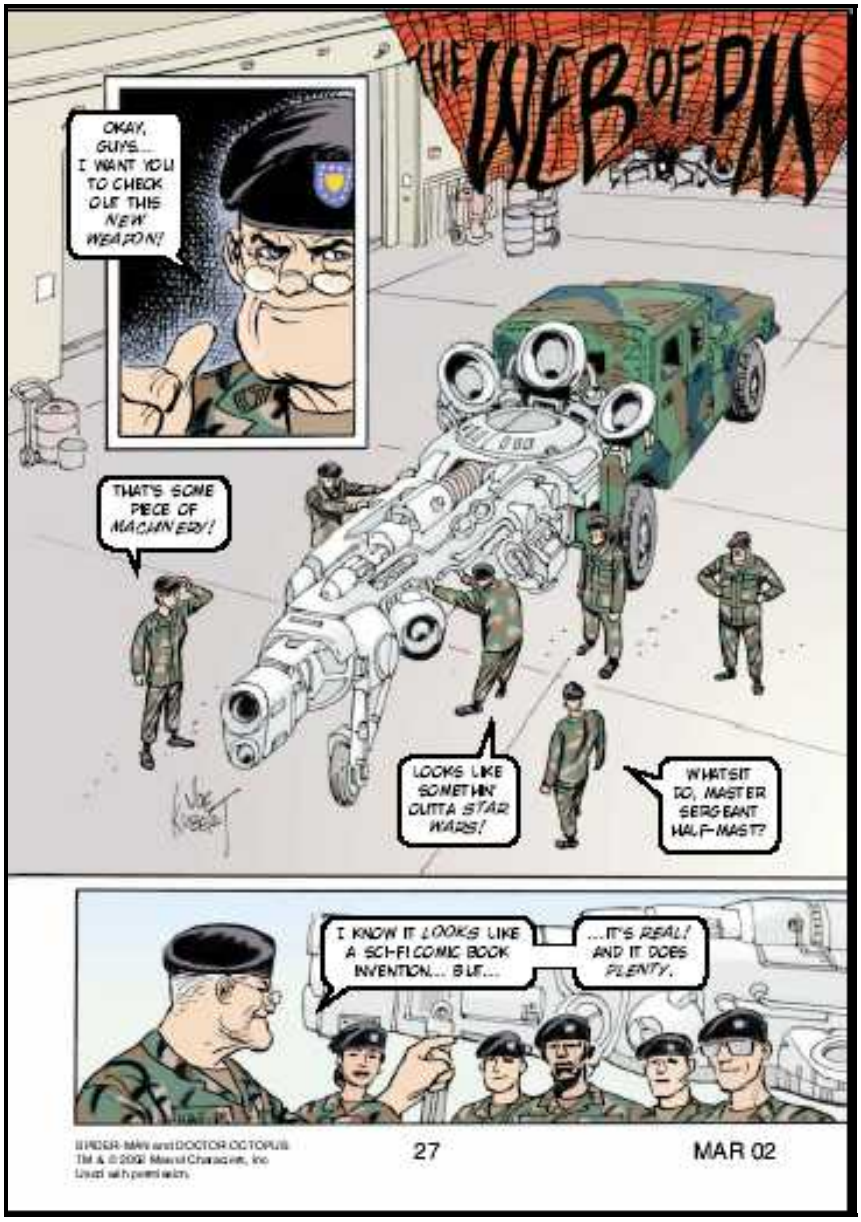


Figure 7: The Web of Pm (Preventive Maintenance)

Anthropomorphism, or the personification of technology, is a rhetorical device writers use to help readers build serious relationships with technology. As shown in Figure 8, personified equipment often reflects emotions of anger, sadness, fear, and

happiness to appeal to the reader's sense of responsibility. Personified equipment illustrates the results of irresponsible and negligent use and care of technology. Uncared for equipment depicts expressions and states of physical and mental illness.

Figure 8: Personification of Technology in Army Technical Manuals

Writers also appeal to their audience by using cultural themes. As shown in the following (Figure 9) writers juxtapose the theme of preventive maintenance against a popular ad, *got milk*. As the ad implies, drinking milk helps to maintain a healthy body. Following routine PM will help maintain the healthy body of the equipment.

Figure 9: Cultural Ad Juxtaposed with Preventive Maintenance Message

Topics in Handbooks and Manuals

Analyses of Army technical publications expose much more than the stylistic qualities and goals of a discourse community. Tebeaux and Killingsworth claim, "We can learn about technologies and job tasks that were important to readers of that particular period" (1992, p. 27) by collecting technical writing samples over a specific historic period. An examination of eighteenth and early nineteenth century publications reveal practitioners looked to capture, organized, manage and disseminate expert technical tacit knowledge. Practitioners of Army technical communication understood the importance of helping users accomplish routine and specific tasks.

Topics found in soldier's handbooks gave readers the information needed to survive daily Army life and maintain basic skills. *Regulations*, written for officers to train enlisted men, introduced many subjects that would later become separate manuals. Topics introduced in 1778 include the wearing of uniforms and insignia, setting up camp, and preparing for drill. Other topics focus on care of the sick, cleanliness, and setting up field hospitals. Le Grand's *Military Handbook* of 1861 was the first manual written expressly for privates and enlisted men, providing information to help recruits survive Army life. Le Grand acknowledges this need in the publisher's note:

> The great need for a Hand-Book of popular and useful Information for the Soldier, adapted to the exigencies of a soldier's many wants, has impelled the publishers to have prepared, at great trouble and expense, this Manual of Instruction and Information. It will be found very complete in all departments,

> and contains, beyond doubt, more truly desirable material for the soldier and officer than any two works yet presented to the public. (Le Grand 1861)

Le Grand provided many subjects not covered before and expanded on many others: pay allowance tables, health care and formulas for home made remedies, recipes and cooking instruction, a dictionary of military terms, and personal "hints" to volunteers. Later in 1864, Kautz included separate sections on health care, cooking, pensions, letter writing, or "rudiments" he claims were long overdue (Kautz 1865, p. 5). These subjects along with drill, march, the wearing of uniforms and insignia, and instructions for the rifle are standard topics. Many of these subjects expanded greatly over the years and have since been issued as separate publications, for example: TR 11305, *Principles of Personal Hygiene* (1921); the *Manual of Army Cooking* (1879; TM 2100-152 in 1935); TM 2100-151, *The Army Baker* (1926); TR 112-5 *First Aid—Outlines of First Aid for the Injured or Sick* (1921), and TM 10-228 *Fitting of Shoes and Socks* (1946).

Basic skills in eighteenth and early nineteenth century manuals appeared to be more concerned with survival and less about technical skill. Early basic skill tasks included the proper way to use and care for a rifle, but grew to include instructions for Morse Code, signaling, preparations for gas attacks—and later, atomic, nuclear, biological and chemical—navigational technologies, and a variety of weapons including grenades, claymore mines, and concealment, and camouflage techniques.

Eighteenth and nineteenth century treatises and technical manuals contain the theory of operation for the cannon, howitzer, and mortar (and carriage) followed by a discussion of the operating instructions. Equipment dimensions and physical

characteristics, and laboratory works, which when examined included the procedures for repair, follows the chapter concerning operation. Twenty and twenty-first century manuals provide relatively the same topics along with troubleshooting, repair, and preventive maintenance procedures. Some manuals include parts catalogs and procedures for test. Twentieth-century digital media or IETMs provide topics to help users navigate and retrieve information. The general organization and structure of technical manuals have remained relatively unchanged since the late eighteenth century treatise. Advancements in military technology, publishing technology, and media have changed the skills a reader must have to use a modern technical manual.

An examination of texts revealed the majority of topics found in soldier's handbooks and manuals, once introduced, endured throughout history although on occasion, the Army has deleted topics that did not conform to the cultural norm at the time of writing only to reintroduce many of them later. One such topic, Army History, introduced in 1941, was deleted before 1968 and reintroduced in 1985. Nineteenth century and pre World War I manuals included songs and bugle calls—Taps, for example, but these songs did not appear again until the late twentieth century. Many topics were deleted and then later reintroduced. Sniping was introduced in World War I, forgotten shortly after the war ended, and reintroduced again during the Vietnam conflict. Camouflage was also introduced in World War I, deleted by the end of World War II, and then reintroduced in the 1980s. Pack mules used in World War II were forgotten by the end of Korean War, but reintroduced again just lately (the information is now classified).

Chemical warfare, Special Forces, and stand off armor are a few more of topics that were deleted and revived throughout history (Hanesalo 2003, e-mail).

Many topics, once introduced, have expanded over time. Treatment of the sick, which first appeared in Steuben's *Regulations* in 1779, has expanded into the separate topics of health, hygiene, and first aid. Steuben gives instructions for the care of the sick and the dying, and rules for hospital organization and cleanliness, but does not provide health care precautions, first aid techniques, or remedies for specific ailments. By 1861, subjects of health care and first aid were separate chapters in handbooks. Both Le Grand and Kautz provided guidelines from the Sanitation Commission, Dr. Hall's health advice, recipes to cure various afflictions, and hospital remedies. It is also important to note that by 1861, writers were including nonmilitary and outside sources in their works. Both Le Grand and Kautz included Dr. Hall's health care precautions (Dr. Hall published *Hall's Journal of Health* in 1854 and *Hall's Medical Adviser* in 1875), recipes and advice from Soyer's Crimean Hospital, and rules from Laidley's Rifle Firing. Excerpts from *Hall's Journal of Health* appeared in soldier's handbooks until shortly after the turn of the twentieth century. Ultimately, manuals providing the procedures and instructions for health and hospital care became a distinct genre and part of the Medical Corp. The Corp of Engineers followed suit with manuals of civil engineering practice.

Transitory topics reflect social issues, technological obsolescence, and cultural needs[6]. For example, in 1865, Kautz provided the provisions for African-American troops:

> The officers appointed by the President are white men, and selected by a board of examiners, as stated in par. 579. The non-commissioned officers may be either white or colored. Colored soldiers receive the same pay, allowances, and bounties and are in all respects on the same footing as white troops. The administrant of colored troops is, therefore, the same as that of white troops. (Kautz 1865, p. 199)

In 1952, the Army included an entire chapter about the Women's Army Corp, which did not appear in subsequent revisions since women were now integrated into the regular army. Statements concerning the use of gender-biased language also appeared in technical publications. By 1985, the soldier's handbook included the following statement: "Unless this handbook states otherwise, masculine nouns and pronouns do not refer exclusively to men" (TRADOC PAM 600-4 1985). *PS Monthly*, a maintenance publication, also issued the following statement: "Application of the information is optional with the user. Masculine pronouns may refer to both genders" (TB 43-PS-597 2002, p.1).

Subjects concerning specific technologies endure only as long as the technology is in use. Procedures for United States Telegraph Code, The Myer System, and Morse Code appeared in turn of the century manuals but are not included in soldier's handbooks

[6] The 2001 issue of the *IET Soldier's Handbook* provides the "Homosexual Conduct Policy" which demands a "Don't Ask, Don't Tell, and Don't Harass" (TRADOC PAM 600-4, p. 3-28) environment. Policies for drug and alcohol abuse, body piercing, tattoos, making ethical decisions, rape, and suicide prevention are also included in this issue. It is difficult to know yet whether these topics will endure. It is possible that they may be omitted in the next issue of the IET.

after 1917 although Morse Code was not officially retired until 1999. Signaling, which also appeared in manuals after the 1880s, eventually was the subject of independent publications. Different configurations of pistols, rifles, grenade launchers, and mines are depicted over time along with changes in the uniform and personal equipments.

Foreign wars also required specific cultural needs, which were deleted from the handbook after the war. The 1917 *Manual for Non-Commissioned Officers* included an English-French dictionary along with foreign money conversion tables and the metric system, tools needed in Europe during World War I. The 1914 *Manual for Non-Commissioned Officers* contained a Spanish-American vocabulary list and currency conversion tools. The 1911 and 1917 *Infantry Drill Regulations* provided a French, Italian, and Russian vocabulary section along with money equivalents and English linear measure and metric equivalents. Like many technologies and previous topics, foreign language manuals were and still are published and numbered as independent texts.

Text Analysis

An analysis of soldier's handbooks and manuals reveals more than the rhetorical qualities of a discourse community. The military manual mills, or organized technical publications groups, believed by many scholars to be the result of World War II, were actually established before World War I, at the latest. James Moss's *A Private's Manual written* while Moss was in the Canal Zone in 1914, *The Soldier's Handbook* of 1905,

Infantry Drill Regulations of 1911, and *A Manual for Non-commissioned Officers*, 1917, provided figures illustrating first aid techniques and equipment location and nomenclature that were identical. This sharing of data suggests that a central organized technical communication and publishing group—Smith's "manual mills"—was responsible for the editing, organization, and publication of turn of the century Army manuals.

Handbooks and manuals capture the progression of a technological society and reveals our increasing dependence on technological capability. Four important factors can be seen in these publications.

First, the value of maintaining and protecting the life of technology is shared equally with the value of preserving human life. Early writers use precautionary language to warn readers of possible danger to life and technology. This practice is more prevalent in the twentieth and twenty-first centuries. Writers use Warnings, Cautions, and Notes and hazard icons (radiation, chemical, fire) to alert readers to the possibility of health and technology dangers. These notices appear before a user takes any course of action. As shown in Figure 10, users are cautioned against the potential dangers of improperly using equipment.

Warnings, Cautions, and Notes appear in the text before any procedure where the possibility of harm or damage to technology exists. As Figure 11 suggests, these safety warnings also indicate possible injury or death to users.

CAUTION

Do not hold steering wheel at full left or right position for longer than 10 seconds. Oil overheating and pump damage can result. Failure to comply may result in damage to equipment.

Figure 10: Example of a TM Caution Statement

WARNING

Completely deflate tires before removing from axles only if there is obvious damage to wheel components. Removing damaged tires from axles without deflating tires may cause wheel components to separate. Failure to comply may result in serious injury or death to personnel.

Figure 11: Example of a TM Warning Statement

Warnings, cautions, notes, and hazard icons appearing throughout the manual are presented in the Safety Summary. The summary appears shortly after the table of contents and is meant to be read before engaging in any procedure. A review of *PS*

Monthly and many other technical manuals suggests the institution places more value on the health of its technology than on its members. Improperly working technology generally results in catastrophic failure and defeat.

Second, technology, particularly computerization, replaces human knowledge. Writers assume technology capabilities will take care of many faults before a problem actually occurs. Readers, then, do not need this information. The faith we place in technology is evident in digital age publications. In many modern systems, BIT, or built-in test, is a common function of the technology. BIT is initiated automatically when the equipment is turned on, or the user can manually initiate BIT in a troubleshooting mode. BIT is a self-diagnosing and in some cases self-repairing application. BIT, however, often does not work properly because of other undetected system problems. Users then must result to their own knowledge to begin a manual troubleshooting process. Manuals reflect our faith in programs like BIT. Procedures in the text instruct users to initiate BIT-type programs whenever an error is encountered. Writers assume BIT will perform properly and instruct the user to follow the directions on the BIT display screen. If BIT does not work, users are generally left with no further instruction. Experts may have the knowledge to continue the troubleshooting process, but novice users will not have access to this source.

Third, technology creates the need for more technology. To repair technology, more technology is needed. BIT is just one example. If a computerized piece of equipment is not functioning properly, BIT is initiated to identify any faults. Finding a broken wire often requires a voltmeter and an oscilloscope to measure electrical volts.

Avionics equipment may require a test set or an entire test station where a communications unit is connected into another unit for diagnosis. Visual systems in simulators require a photometer, or light meter, and computer generated instructions and tests to align a visual scene. Additionally, techniques or procedures, which fail to produce results generally requires revisions or a new technique. Adding a "Don't Ask, Don't Tell, and Don't Harass" policy suggests that previous policies were no longer effective.

Finally, historic technical manuals show our increasing dependence on technological capability. Publications written in the eighteenth century provide complete knowledge of a subject including its history and origins and the science that made it all possible. Readers during this historical period needed the knowledge to train less educated and skilled in the dynamics of a particular piece of artillery.

Nineteenth-century publications provide thorough information on a subject including instructions for its use and repair, but the science and history of the technology are no longer included. Modifications in equipment since the eighteenth century, along with the increased use of mechanical parts, allowed an audience of less skilled and less educated users to perform operation and maintenance functions.

Twentieth-century publications issued before the Digital Age (World War I through Vietnam), provided adequate knowledge to operate and maintain a technology. Complex electrical and mechanical equipment required specific information about its functioning components and their internal workings. Instead of presenting the knowledge of a subject, manuals contained only relevant information, a small part of the knowledge base once available to users. A modern howitzer technical manual only provides the

information required to operate and maintain that particular howitzer configuration. The user does not know the science of ballistics, the history of artillery and the cannon, previous howitzer modifications and why they were implemented.

Publications developed during the Digital Age (1980s to present) assume technology will do a good portion of work and assume that digital technology is intelligent technology. Publications developed during this era have a tendency to reference outside sources and assume these sources are available in electronic form. Most often, this information is not accessible to the user. This assumption and our increased faith in the capability of self-diagnosing applications are major contributors to deficiencies in modern technical publications. Despite the advantages of the digital age, writers fail to recognize the number of legacy systems still in use today. These systems all work on the principles of analog design and require paper-based manuals for support.

Media size too has remained relatively consistent over time. Eighteenth century treatises and handbooks were generally 5 x 7 inches. Since then, technical manuals and handbooks are 3 x 5, 4 x 6, and 5 x 7 inches. In the late twentieth century, 8½ by 11-inch manuals were produced along with 11 x 17-inch maintenance-drawing volumes. ETMs and IETMs generally reside on a portable medium where the screen image area is no larger than a printed page: PDAs, Compaq or HP handheld computers, laptop computers, and desktop computers. In Chapter Four, I show how Army writers and technical communicators and experts in texts and technology design these media. I examine visual aspects of media designs and show how these designs are meant to unite situated literacies.

CHAPTER FOUR: DESIGN CHARACTERISTICS OF ARMY HANDBOOKS AND MANUALS

In Chapter Three, I showed how Army technical communication is fundamentally persuasive communication. I argued the goal of the Army discourse community is to empower its readers through a rhetoric of technology, and I demonstrated how writers achieved these goals using narrative elements. In addition to including stories, anecdotes, analogies, and historical examples, visual elements—layout and organization, drawings and diagrams, cartoons, and color techniques—help technical communicators adapt complex technical tasks to users with novice skills and situated literacies. Literacies are situated in relation to the particular social, political, cultural, or power institution that sustains them (Barton et al 2000, p. 1) with each institution having its own standards for literacy. The symbols and words of each institution communicate different messages to the community. As Barton points out, literacy in a third world country is not the same as literacy in the United States.

Beginning with the Continental Army of the eighteenth century, American troops have and currently represent many situated literacies. Many of the officers in the eighteenth and nineteenth century U.S. Army were recruited from foreign armies and did not speak, read, or write English; the average troop was mostly the illiterate colonial farmer. Throughout American history, large populations of immigrants joined the Army, all with their own literate practices. Native Americans and free Africans were recruited as scouts during the American Revolution along with Hessians who switched sides during

the war. Later, Mexicans, Irish, Italians, Spanish, Japanese, Chinese and Arab soldiers would be added to the population of American soldiers. The process of uniting the literacy practices of these soldiers into a universal language can be seen in the Army's technical publications.

An analysis of the design characteristics of historic texts uncovers several important design trends, one of which is the long process of transforming texts from highly technical and expert users to users with novice skills and situated literacies. Carolyn Marvin sums up this process well: "A recurring theme in the study of literacies past and present is how skills and techniques for performing particular literate practices are transferred from communities of adepts to less skilled communities" (Marvin 1988, p. 14). Historic texts show how Army technical communicators simplified texts from the highly technical and literate texts of the eighteenth century as complex tasks and knowledge was transferred from a community of adepts to the less skilled recruits of the nineteenth and early twentieth centuries. In this chapter, I show how Army technical communicators used visual designs and graphical elements to unite the disparate literacies of American troops.

Print Media

In the eighteenth century Army, skilled soldiers verbally disseminated basic skills training along with instructions for using and maintaining artillery. As the Army matured,

knowledge had to be passed on, shared, and disseminated to maintain the life of the institution. Walter Ong states, "In an oral culture, knowledge, once acquired, had to be constantly repeated or it would be lost: fixed, formulaic thought patterns were essential for wisdom and effective administration" (Ong 1982, p. 24). Eventually, an increase in troops, the maturation of technology, and the institution's need for recordkeeping made it necessary to capture this knowledge and record it in print. The more sophisticated and complex the technology, the more documentation an army required for its training, and the more difficult it became to measure the amount of knowledge it owned.

Writers of eighteenth century treatises and handbooks were concerned with the literate and the expert. Eighteenth century treatises and handbooks were written for officers who trained recruits, or who themselves designed, modified, maintained and operated artillery and equipment. Officers were often engineers, scientists, and mathematicians; some were medical doctors. After the Revolutionary War in the eighteenth century, the technical knowledge pertaining to weapons and ancillary equipment began the transformation from the adept audience of technical experts to the semi-literate ranks. The process of transferring this knowledge from a technical community to the privates and NCOs began after the Revolution and occurred over a one hundred twenty-five year period.

Although eighteenth century treatises, or technical manuals, were written for the expert, the arrangement of these texts suggest that writers understood the importance of organizing technical knowledge into manageable units for reference and for completing tasks. Manuals were organized by part, chapter, and section as a way of categorizing and

managing technical knowledge into hierarchical units, allowing a breakdown of a topic into coherent and manageable nodes. Eighteenth century manuals include an Introduction that provides a discussion of the science and brief history of the subject, often giving credit to the work of others in the field. The Introduction also introduces the subject to the reader by explaining the theory of operation, for example, the internal workings, and operation of artillery. Often several parts followed the Introduction, provided the instructions for construction, explained test results, and depicted the nomenclature and location of components. The remaining parts contained a general discussion of ancillary or support components such as carriages, followed by preparation for fielding and operation.

In early eighteenth century treatises, the use of figure and table numbering and labeling was inconsistent until the War Office published De Scheel's *A Treatise of Artillery* in 1800 (written in 1787). Before De Scheel's publication, many texts produced figures and tables with labels while other texts organized figures and tables for reference by consecutively numbering the figure or table as it appeared in the text. De Scheel's publication provided consecutively numbered figures and tables with captions. Figure numbering was presented in Arabic numerals; table numbering in Roman numerals.

Eighteenth century writers used lists to present brief but important information, for example, the chain of command and conditions for pay stoppages. Numbered lists outlined the steps in a procedure or instruction. The order for drill and marching and the procedures of firing a weapon are just two examples. Spatial diagrams and brackets within lists help organize and group data. Data presented in tabular form were used to

indicate quantities of resources, for example, the number of guards assigned to officers, company rosters, pay stoppages, and the leading particulars of artillery. These particulars presented the weight, height, length, width, and calibration of each unit of equipment.

Treatises included flat 2D locator views of each unit of equipment described in the manual. Each view provided a nomenclature legend, which corresponded to callouts assigned to each part (see Figure 12). In some treatises, fabrication drawings were included to show how to cut material to build a duplicate unit. Drawings were strategically placed next to the text description for easy reading and visual access.

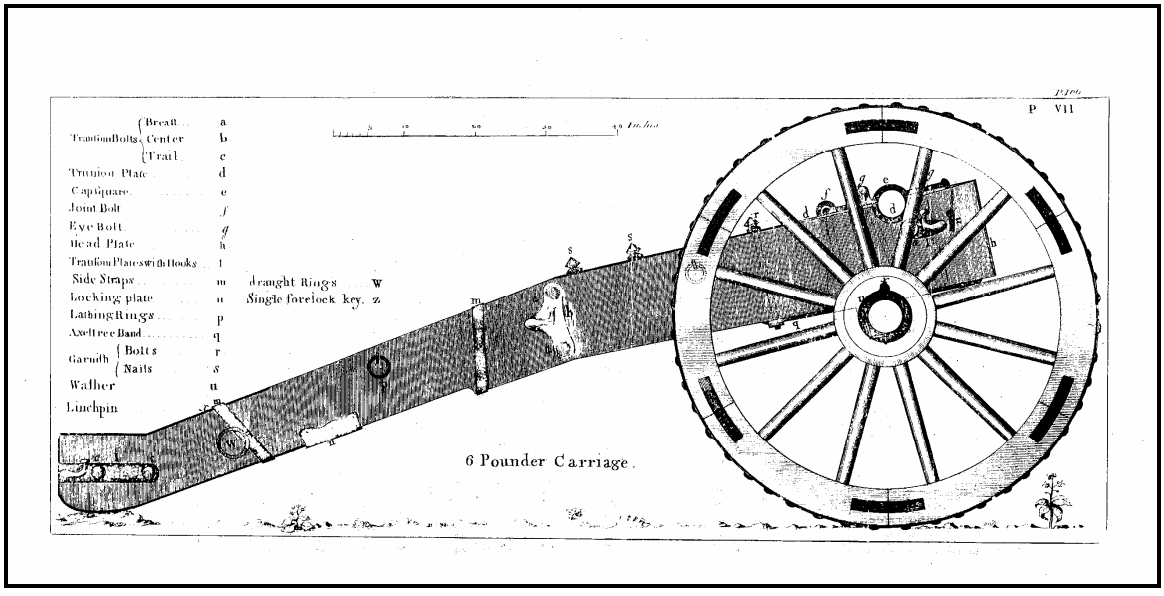


Figure 12: Eighteenth Century Treatise Locator Diagram

Modern technical manuals, for the most part, reflect the design features established in the eighteenth century manuals. Modern manuals are organized by chapter, section, and paragraph order. Like the eighteenth century manuals, modern manuals

contain an Introduction, Theory of Operation, Maintenance, and Troubleshooting chapters (formerly called Laboratory Works), and in many cases, Parts Catalogs. Because of the complexity of electronic technology, parts today number in the hundreds and thousands for a unit of equipment, and are stored and organized in catalogue list fashion.

The figure and table numbering scheme established by De Scheel's publication in 1800, along with the addition of figure and table captions, is a practice evident in modern technical manuals. In one variation of the modern technical manual, figure and table numbers are organized by chapter or section and then figure number—for example, Figure 3-4 refers to the fourth figure shown in Chapter 3. In the same variation, pages are also numbered by chapter and page number order.

In addition to the fabrication cut-out drawings and 2D locator drawings, 3D disassembly/assembly drawings support maintenance tasks provided in modern technical manuals. Using exploded views, these drawings illustrate the interconnection of each part in a unit along with the interconnection between units. Schematic and data flow diagrams illustrate the logic and data flow of signals within the electronic circuits and aid the technician in completing troubleshooting tasks. Further, advancements in printing and publishing technologies have allowed for the use of modern fonts, which provides for easier reading. Word processing and graphic applications allowed writers to manipulate the visual characteristics of the text although the final product had to comply with the military specifications for technical manual development.

The most significant changes in Army technical manuals are not in design, but in content. Much knowledge was lost during the process of simplifying practices to reach

the user audience. Eighteenth century manuals provided exhaustive information on a topic while manuals produced after World War I provided minimal information. The user was no longer the knower. The user was no longer given the science and history of the subject, test results, a list and history of modifications and upgrades, or fabrication and design specifications. Modern manuals provide minimum information. The Introduction states the equipment nomenclature, provides information about the contractor and contracting agency, and introduces the remaining chapters and their contents. The Theory of Operation is limited to the equipment identified in the Introduction in its current configuration. For example, a user today will not know the history of the howitzer or of artillery and ballistics, the previous modifications and the reasons for the modifications, the history of equipment malfunctions and the solutions to these malfunctions, previous tests results, and the number of obsolete or refurbished parts. The user will only be given the information for the current model having no historical frame of reference or pool of knowledge to access when needed.

John Seely Brown and Paul Duguid point out that three distinctions exist between knowledge and information (Seely et al p.119). First, knowledge entails a knower whereas information is treated as an independent entity. Second, knowledge is difficult to separate from the knower but information is treated as a self-contained substance. Because of this, it is difficult to transfer knowledge detached from the knower, but information can be moved freely. Mostly, knowledge is difficult to transfer because it requires more by way of assimilation. Expert users not only have expert technical knowledge, but also the tacit knowledge collected over time. Information presented in

technical manuals is just that—independent self-contained substances separated from the original source of knowledge. Users faced with this information cannot access its source if they do not understand what it is they are lacking in information.

Although the audience shifted from officer to private during the nineteenth century, soldier's handbooks remained mostly text until shortly before World War I. All paragraphs were numbered for reference; instructions were numbered in the sequential order in which they should be completed. Eighteenth century handbooks provided diagrams illustrating drill patterns and the position of the soldier during drill and march such as "about face" and "at attention." As shown in Figure 13, the majority of these diagrams included a human figure positioned in relation to text instructions. Steuben indicated location and position in relation to a colonial soldier as positioned in the diagram. The practice of including a human subject in diagrams to support text descriptions continues today.

Innovations in photography helped writers transition soldier's handbooks from a text-based environment to a visual environment. Around 1900, writers used photos to support text descriptions. These photos generally illustrated a soldier performing a series of tasks as described in the text. In Figure 14, the soldier is performing the task of splicing tactical field lines as shown on the corresponding page. Later, instructions such as the splicing of tactical field lines would be written in procedural form, with each step accompanied by a graphic depiction of the instruction.

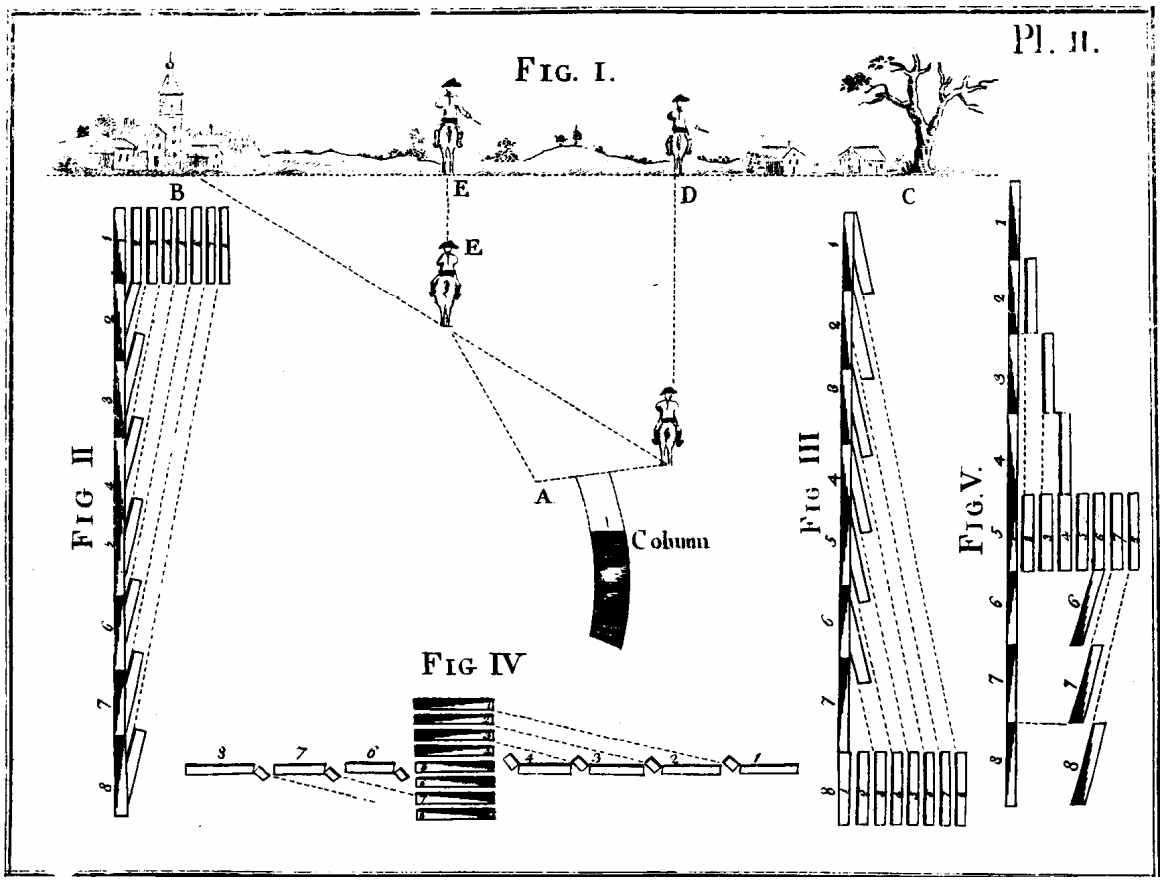
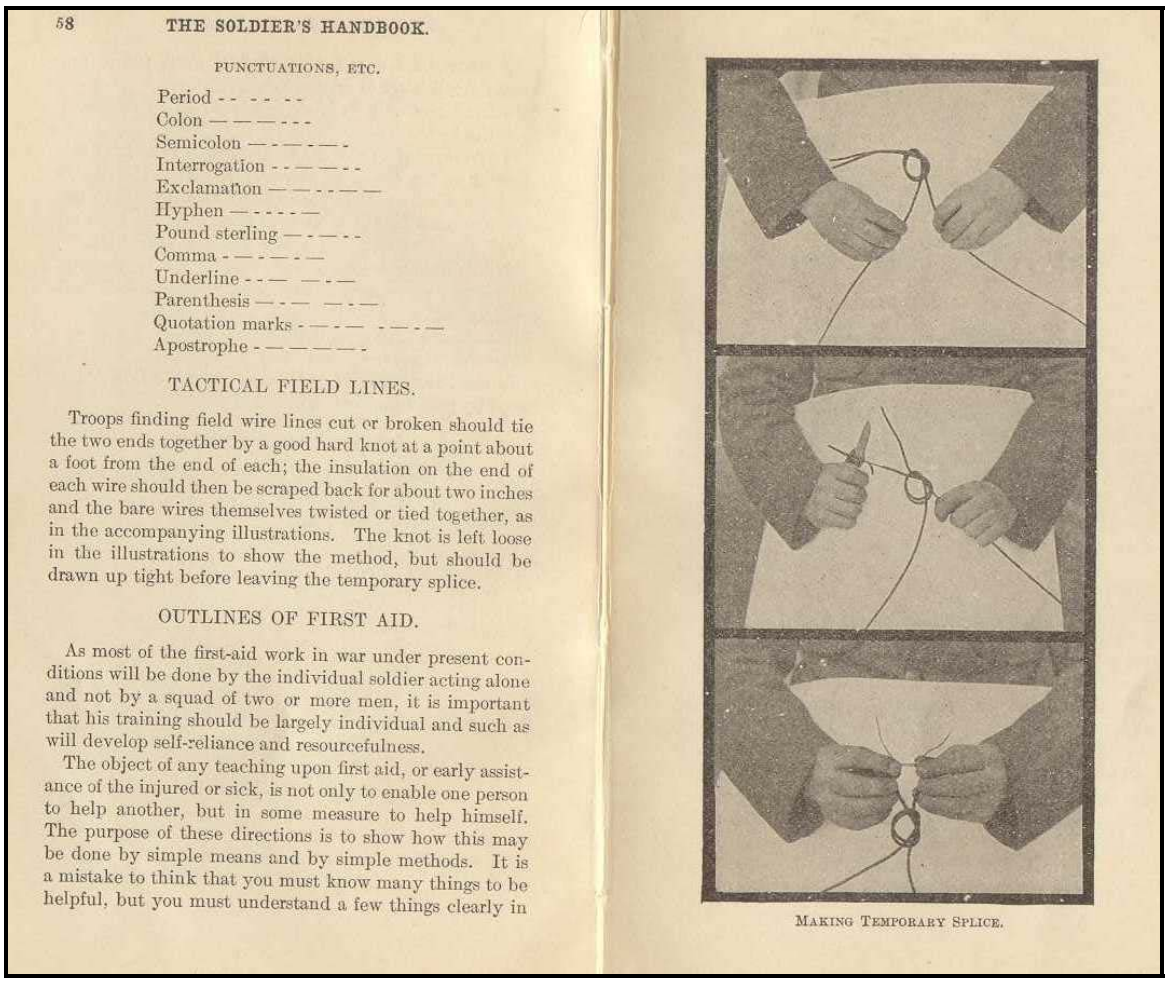


Figure 13: Eighteenth Century Locator Diagram

Writers organized eighteenth century training and doctrine handbooks into distinct parts—for example, Army regulations, the manual exercise, and instructions—and used chapter divisions and major headings to organize the content of topics within each part. The format and print characteristics of each part, chapter, and topic heading reveal a hierarchy of manageable topics designed for use as reference. The content of training and doctrine publications was organized by order of importance, that is, the first part provided Army regulations followed by training specifications and instructions specific to each rank appeared last.



58 THE SOLDIER'S HANDBOOK.

PUNCTUATIONS, ETC.

Period - - - - - -
Colon — — — - - -
Semicolon — - — - — -
Interrogation - - — — - -
Exclamation — — - - — —
Hyphen — - - - - —
Pound sterling — - — - -
Comma - — - — - —
Underline - - — — - —
Parenthesis — - — — - —
Quotation marks - — - — - — - —
Apostrophe - — — — — -

TACTICAL FIELD LINES.

Troops finding field wire lines cut or broken should tie the two ends together by a good hard knot at a point about a foot from the end of each; the insulation on the end of each wire should then be scraped back for about two inches and the bare wires themselves twisted or tied together, as in the accompanying illustrations. The knot is left loose in the illustrations to show the method, but should be drawn up tight before leaving the temporary splice.

OUTLINES OF FIRST AID.

As most of the first-aid work in war under present conditions will be done by the individual soldier acting alone and not by a squad of two or more men, it is important that his training should be largely individual and such as will develop self-reliance and resourcefulness.

The object of any teaching upon first aid, or early assistance of the injured or sick, is not only to enable one person to help another, but in some measure to help himself. The purpose of these directions is to show how this may be done by simple means and by simple methods. It is a mistake to think that you must know many things to be helpful, but you must understand a few things clearly in

MAKING TEMPORARY SPLICE.

Figure 14: Photos Supporting Text Description, 1908

James Moss's *A Privates Manual,* published in 1914, is one of the first manuals published to advocate a visual approach to training. Moss notes in the *Prefatory* of the 1916 edition:

> The same conditions of activity and complexity of modern life that crowd into one day what our forefathers used to do in one week, and which have brought the

> stereopticon machine, moving pictures and other inventions into use to facilitate instruction in schools, these same conditions make necessary a greater use of the printer's art in training and instructing the enlisted men of today, everyone of whom can read. (Moss 1916, p. ii)

Writers advocated this visual approach by supporting complicated tasks with figures or by replacing these descriptions altogether with diagrams, drawings, and sketches. The chain of command, previously a multiple page description in the eighteenth, nineteenth, and early twentieth centuries, was replaced in 1952 with a figure of a chain, each link indicating a position of hierarchy (see Figure 15) within the Army. In the twenty-first century, a blank line shown next to each title indicates the reader should know and list the person by name (see Figure 16).

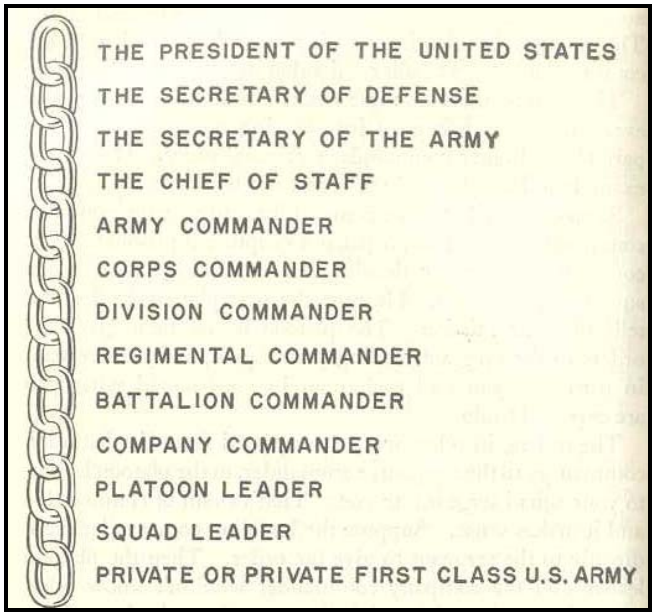
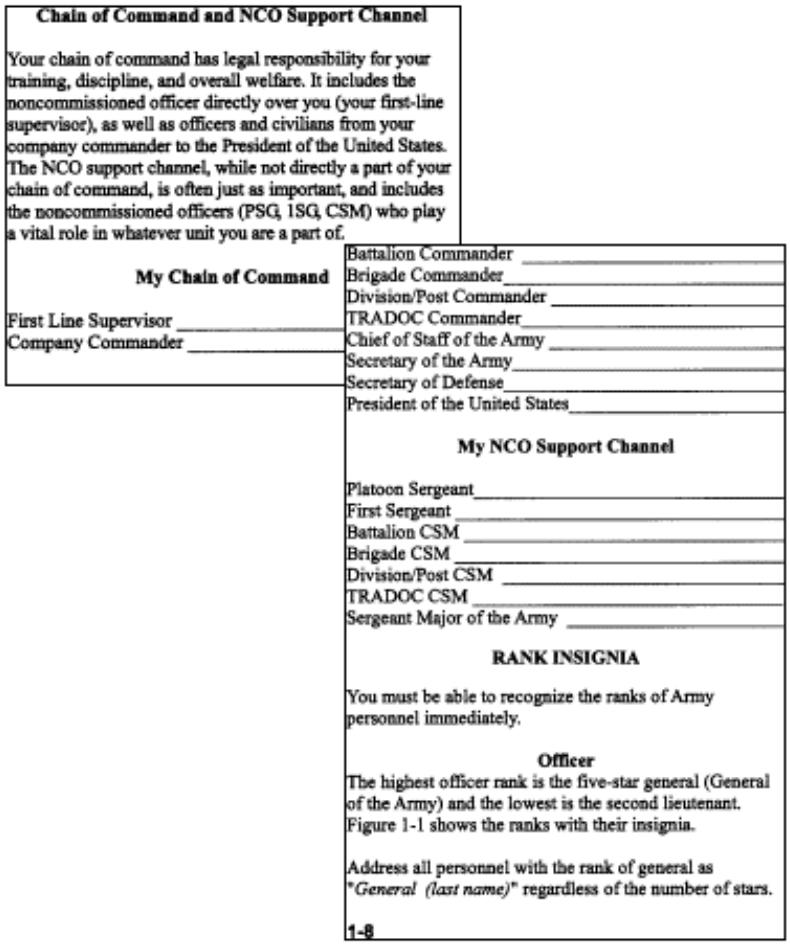


Figure 15: The Chain of Command, 1952-1985



Chain of Command and NCO Support Channel

Your chain of command has legal responsibility for your training, discipline, and overall welfare. It includes the noncommissioned officer directly over you (your first-line supervisor), as well as officers and civilians from your company commander to the President of the United States. The NCO support channel, while not directly a part of your chain of command, is often just as important, and includes the noncommissioned officers (PSG, 1SG, CSM) who play a vital role in whatever unit you are a part of.

My Chain of Command

First Line Supervisor _____
Company Commander _____
Battalion Commander _____
Brigade Commander_____
Division/Post Commander _____
TRADOC Commander_____
Chief of Staff of the Army _____
Secretary of the Army_____
Secretary of Defense_____
President of the United States_____

My NCO Support Channel

Platoon Sergeant_____
First Sergeant _____
Battalion CSM _____
Brigade CSM _____
Division/Post CSM _____
TRADOC CSM _____
Sergeant Major of the Army _____

RANK INSIGNIA

You must be able to recognize the ranks of Army personnel immediately.

Officer

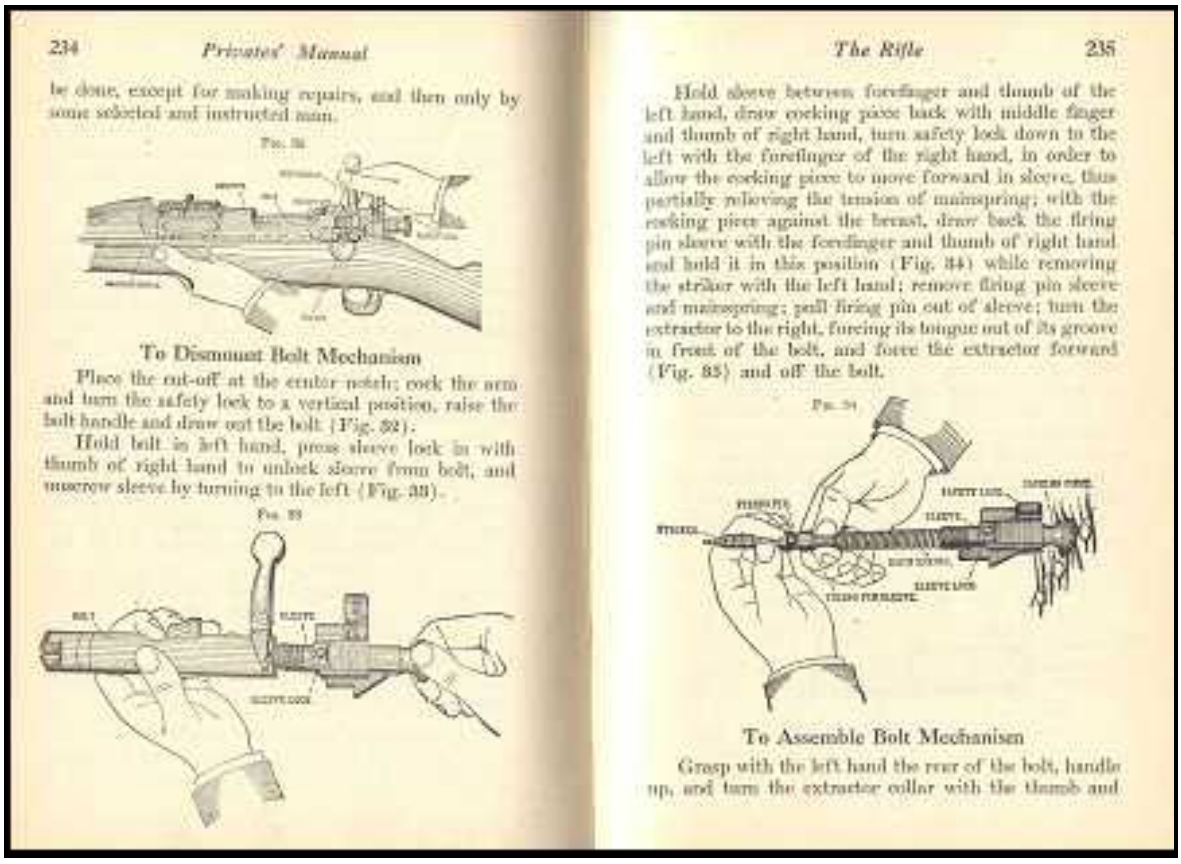
The highest officer rank is the five-star general (General of the Army) and the lowest is the second lieutenant. Figure 1-1 shows the ranks with their insignia.

Address all personnel with the rank of general as "*General (last name)*" regardless of the number of stars.

1-8

Figure 16: The Chain of Command, 2002

Caring for the Rifle, a topic averaging ten pages of text in the eighteenth and nineteenth centuries, slowly integrated text and graphics (see Figure 17) until visuals replaced multiple page descriptions altogether in the twenty-first century (see Figure 18). In Figure 17, writers positioned locator diagrams within the text for easy access. By the 1980s, text descriptions were replaced altogether with visualizations.



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be done, except for making repairs, and then only by some selected and instructed man.

Fig. 32

To Dismount Bolt Mechanism

Place the cut-off at the center notch; cock the arm and turn the safety lock to a vertical position, raise the bolt handle and draw out the bolt (Fig. 32).

Hold bolt in left hand, press sleeve lock in with thumb of right hand to unlock sleeve from bolt, and unscrew sleeve by turning to the left (Fig. 33).

Fig. 33

The Rifle 235

Hold sleeve between forefinger and thumb of the left hand, draw cocking piece back with middle finger and thumb of right hand, turn safety lock down to the left with the forefinger of the right hand, in order to allow the cocking piece to move forward in sleeve, thus partially relieving the tension of mainspring; with the cocking piece against the breast, draw back the firing pin sleeve with the forefinger and thumb of right hand and hold it in this position (Fig. 34) while removing the striker with the left hand; remove firing pin sleeve and mainspring; pull firing pin out of sleeve; turn the extractor to the right, forcing its tongue out of its groove in front of the bolt, and force the extractor forward (Fig. 35) and off the bolt.

Fig. 34

To Assemble Bolt Mechanism

Grasp with the left hand the rear of the bolt, handle up, and turn the extractor collar with the thumb and

Figure 17: Caring for the Rifle, 1914

Other standard topics remained as text descriptions but were supported with multiple illustrations. Foldout locator drawings were introduced shortly before World War I. These drawings named and depicted the specific location of components on a given unit of equipment. Figure 19 illustrates the location and nomenclature of the rifle, helping users quickly identify locations of components as described in the text descriptions.

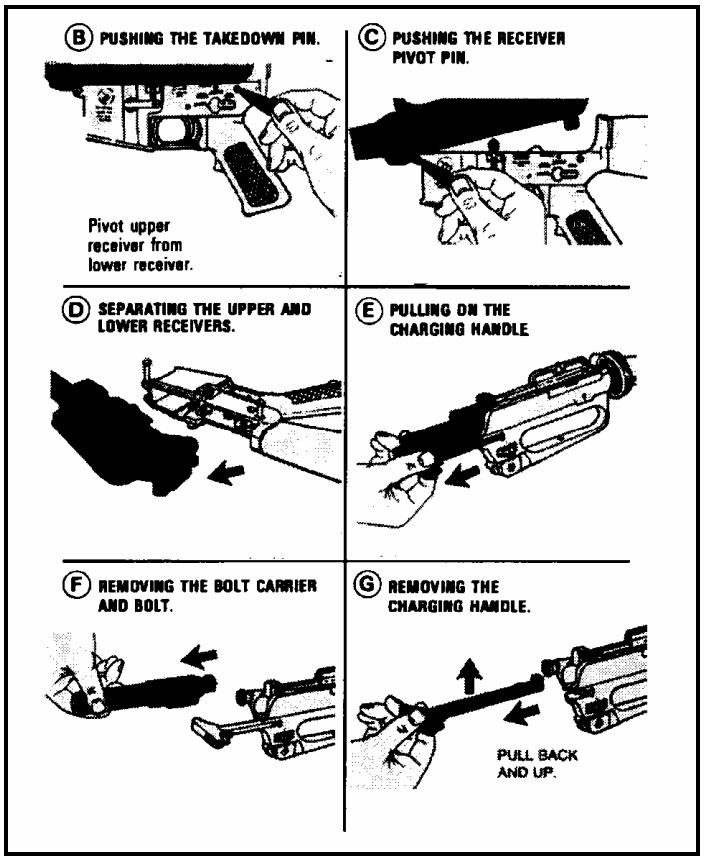

Figure 18: Caring for the Rifle, 2002

After World War I, official technical publications were simplified to meet specific reading grade level (RGL) requirements; by the 1930s, the eighth grade reading level was the official Army audience reading grade level. Reading grade levels are based on the national reading grade level average. In 1942, African-American soldiers were expected to score at the fourth RGL. In 1984, the average RGL for the U.S. soldier was at the 10 RGL; and at the 11 RGL in 2001. RGL applies only to narrative text but not procedures. According to MIL-M-38784C, readability is achieved by complying with the government's rules for writing style. Briefly, these rules include the following:

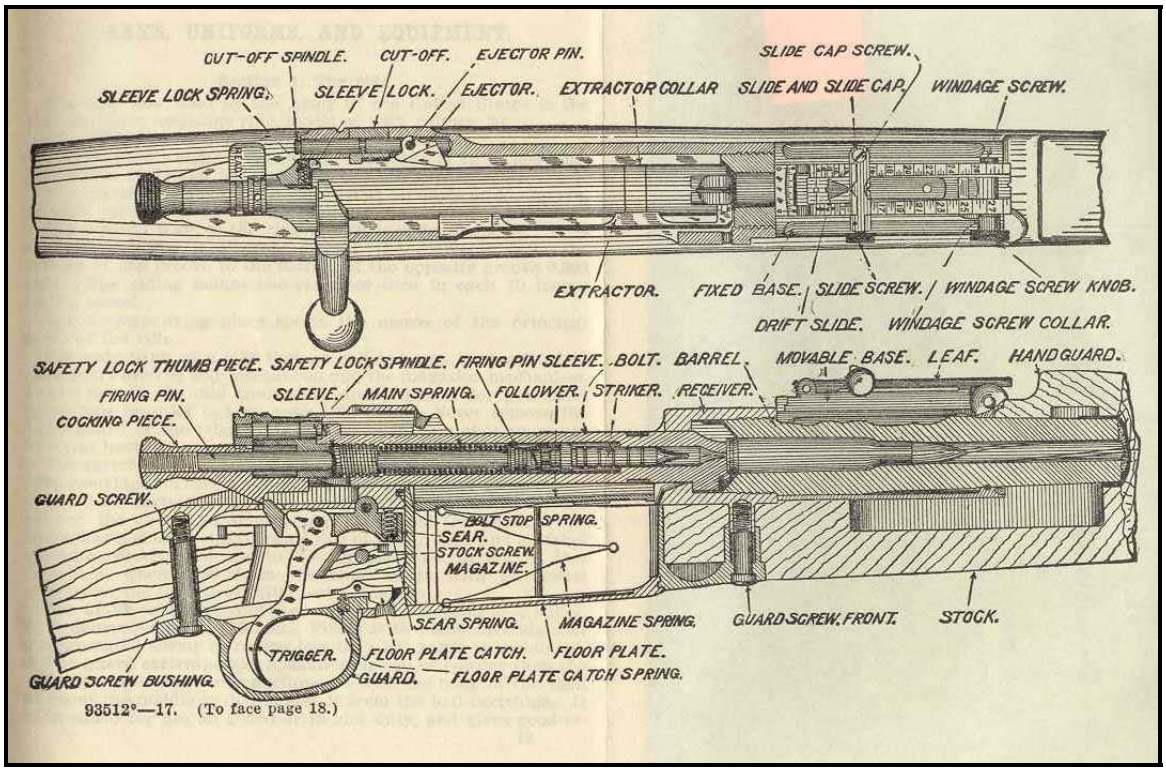

Figure 19. Caring for the Rifle, Foldout Locator Diagram, 1914-17

- Narrative must be free of vague and ambiguous terms, using only simplest words and phrases to convey the intended meaning.
- Essential information will be included either by direct statements or by reference.
- Sentences are short and concise.
- Technical words can only be used when no other word can convey its intended meaning.

Today, the RGL is at the eighth, ninth, or tenth grade, depending on the acquiring branch of service and the technical publication genre. Meeting these RGL requirements is a

challenge. For example, the nomenclature associated with modern technology and the naming of technical processes with technical terminology makes it difficult to simplify texts below the 12 RGL. *Potentiometer*, *linear regulator*, *resistor*, and *microprocessor* are common components located on a *circuit card assembly*. Software terminology is just as complex as hardware terminology. A user must understand specific *parameters*, execute *algorithms*, understand *mnemonics*, and *traverse* menu structures of *routines* and *subroutines*. The technical operation of equipment can also make meeting RGL requirements difficult. Nested procedures accompanied by multiple-page electrical schematics and the hierarchical breakdown of assembly and subassembly locator drawings complicate the reading and comprehension of these procedures.

Comic Media

Cartoons, icons, and comic media provide another method of uniting situated literacies. Cartoons depict the exaggerated features of humans. These features are symbolic, and send messages to the reader visually. The visual designs of comic media retain the attention of troops with poor reading skills. The Army adopted comics in 1941 as a way of reaching audiences labeled with specific military occupational specialty (MOS) classifications. A few of the MOS classifications include readers and users with poor literacy and attention deficits. “Since comics are easily read,” writes Will Eisner, “their reputation for usefulness has been associated with people of low literacy and

limited intellectual accomplishment" (Eisner 1996, p. 3). Using cultural themes, cartoons, color, and conversational language, a technical comic "gives instruction in procedures, process, and task performance generally associated with such things as assemblies of devices or their repair" (Eisner 1985, p. 144). A technical comic presents a procedure to be learned from the reader's point of view and depends on reader experience and empathy for success.

As Eisner points out, the arrangement of panels, balloons, explanatory text, and characters on a page are all calculated to involve the reader (Eisner 1985, p. 144). Panels depict the flow of narrative and allow designers to move the reader through the narrative in a specific direction. The shape of the panel border helps the reader place objects in time. Straight edged borders indicate that the actions contained therein are set in the present (Eisner 1985, p. 44). Army writers use these panels to indicate critical information or tasks. The wavy or scalloped border indicates past time. Army writers use these panels often to show the thoughts (in hindsight) of characters. Jagged panels illustrate emotions and are used for people and personified technology. Explanatory text explains visuals where dialogue and characterization is not present. Balloons capture and make visible sound and are positioned in relation to action (Eisner 1985, p. 26). In Army comics, balloons are arranged either to present instructions or to show blame after a maintenance mishap.

The Army uses comic media to disseminate technical information to those troops tasked with maintenance and repair of equipment and for instruction. *PS: Preventive System Monthly* (*PS* is a post script to Army technical manuals), the most popular Army

comic, is a technical manual issued monthly to disseminate up-to-date technical information fast. The success of *PS* depends entirely on its visualizations. Characterization, symbolism, iconography, anthropomorphism, and color strategies help writers deliver important maintenance information to audiences often with low literacy and poor attention skills.

Cartoons, or character icons, allow artists to focus on exaggerated character details. These character details help writers make universal appeals. Characters provide an appeal to pathos and are the primary rhetorical devices for retaining readership. In *PS,* characters include soldiers who engage in poor PM practices, female technical experts, senior ranking NCOs who enforce the prescriptions of the technical experts, and personified technology. In the 1950's, two goofy Sad Sack or Beetle Bailey-type GIs, Privates Joe Dope (see Figure 20) and Fosgonoff, provided the source for most of the maintenance mishaps presented in *PS.* As shown in the figure, Private Joe Dope never completed any task correctly, and as a result, a disaster occurred. Here, Dope disregards Army regulations for the proper handling and care of government issued equipment. The jeep is demolished and is a maintenance nightmare. The implicit message here is "don't be a Dope." In the late 1950s, the Army decided it did not want soldiers depicted as incompetent or stupid, and forced Army writers and designers to replace the two characters with more competent and professional images of soldiers.

Figure 20: Depiction of Joe Dope in Action, circa 1950

After the termination of Dope and Fosgonoff, writers focused on Connie, the Army's attractive and sexually provocative technical expert. Connie provides maintenance expertise and technical guidance in a nurturing and caring manner. SGM Half-Mast, a gruff and intimidating enforcer, supports Connie's instruction. Half-Mast makes sure soldiers comply with the appropriate PM procedure. In the Army's continuing effort to reach audiences, Connie was transformed as a calendar pinup and was later given an African-American colleague named Bonnie as the number of African-American soldiers increased in the 1970s. As calendar girls in the 1960s, 70s, and early 80s, "their scanty outfits were designed to lure male readers to the maintenance stories" (TB 53-PS-583 2001, p. 6). Adorned in swimsuits and hot pants (see Figure 21), Connie and Bonnie added sex appeal to technology and technical skill, making "the pathetic appeal largely of female to male, a rhetoric of seduction" (Bernhardt 1992, p. 220). As shown at the bottom of the figure, Army writers gave instructions for using this technical manual page as a centerpiece.

According to Stuart Henderson, *PS* Publications Manager, *PS* was designed to catch the attention of the male GI until about twenty years ago. In the 1980s, Senator Orrin Hatch believed the provocative images of women were insulting and insensitive to female officers and ordered the Army to stop. Unlike Privates Dope and Fosgonoff who were retired, Connie and Bonnie were reinvented, "transformed from pinups to modestly dressed, intelligent maintenance experts" (TB 43-PS-583 2001, p6). Connie and Bonnie are attractive and intelligent maintenance experts.

Figure 21: Connie and Bonnie, Issue 242, January 1973

Forced to find new ways to appeal to their audiences, Army writers applied human characteristics to weapons technology. Scott McCloud says "We see ourselves in everything. We assign identities and emotions where none exist. And we make the world over in our image" (McCloud 1994, p. 33). Anthropomorphism allows Army writers to gig[7] the GI for improper maintenance and use of equipment (Henderson 2003, email). By assigning body language, facial expressions, and voice to technology, Army writers create an environment for reader empathy because, as Marshall McLuhan claims, our

[7] A "gig" is a military demerit. By personifying technology in technical manuals, Army writers can informally give demerits to those troops who do not follow the proper PM procedures.

technologies are extensions of ourselves. Soldier's too are conditioned and trained to be fast, light, and lethal technologies accompanied by material artifacts.

Expressions of pain and despair generally represent broken or permanently damaged equipment letting users know that poor maintenance practices can have disastrous and sometimes terminal or irreversible damage in equipment and in a mission outcome (see Figure 22). Soldiers who practice poor PM or who do not handle equipment properly—Private Joe Dope, for example—are generally punished and held accountable by their comrades and superiors. Damaged or destroyed equipment means the soldier is helpless, careless, and unprepared.

Figure 22: Improperly Cared for Technology

The depiction of anguish, sadness, and panic show the fear of neglect and possible dysfunction or termination of the equipment's life. These technologies plead with the

reader to complete preventive maintenance while there is still time to save the equipment and themselves (see Figure 23). These images suggest the soldier may have good intentions, but perhaps is too busy to complete maintenance. In this case, the user recognizes that there is still time to prevent a disaster. These soldiers, like their technology, are not mission-ready and are poor performers.

Figure 23: Technology Begging a Soldier for Preventive Maintenance

Technology that is properly cared for is shown elated, smiling, and often beaming with happiness (see Figure 24). Soldiers here practice good PM. The soldiers, like the equipment, are in top-notch condition and dependable in performance.

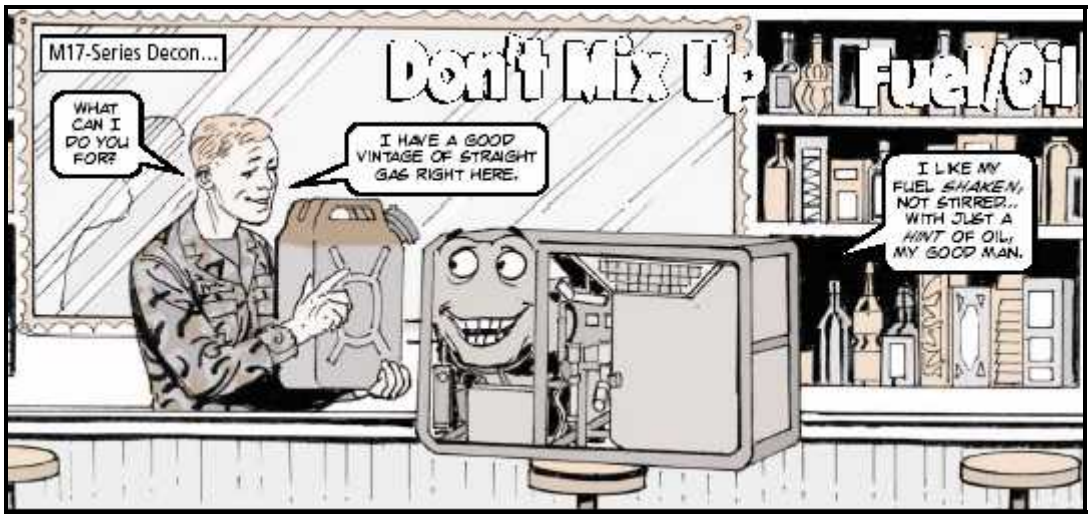

Figure 24. Properly Cared for Technology

Because PS is designed as comic media, the front and back covers are full color along with the monthly continuity. The remaining pages are designed in a two tone color scheme one of which provides a stark contrast. The use of the second color allows designers to select specific focal points for readers. Black and shades of black and one other color (usually blue, green, yellow, or red) and shades of that color provide the remaining color scheme for the media.

Digital Media

Since Moss' 1914 publication of *A Private's Manual,* writers have taken advantage of advancements in printing and media technologies as one method of uniting

the situated literacies of audiences. Photographs were integrated after 1900, and the replacement of the gas and steam printing press with electric motors and automatic ink refillers provided rapid printing at reduced costs allowing for the integration of more drawings, diagrams, sketches, and maps. In the second half of the twentieth century, offset printing and desktop publishing technologies provided an economically viable method of producing media-integrated technical publications. Hand sketches and drawings were replaced with computer-generated images and were embedded within the text of the publication.

Ronald Diebert points out that advancements in the last decades of the twentieth century in digitization, computerization, and in transmission capabilities made way for a hypermedia environment (Deibert 1997, p. 125). Digitization allowed Army writers to integrate previously separate media in the same system, accessible through a single interface or browser, by encoding, transforming, and transmitting audio, video, graphics, and text into a series of binary numbers. The ability to interpret and use these technologies, along with the ability to read and write, defines literacy in the modern age. Brian Street claims that many technologies are associated with situated literacies:

> The particular technologies associated with different literary forms [include] … the use of manuscripts, print and telescreen: alphabets, ideographs, syllabaries and various combinations of them: slate and chalk, quills, and biros, typewriters and word processors; parchment, linen, computer paper. (Street 1984, p. 97)

To Street's list we can add graphical user interfaces (GUIs), interactive 3D, animation, video, searches and queries, iconography, PDAs, laptops, and touch screens. We can add

too LANs, WANs, intranets, Intranet, modems, T1s, DSL, web casting, data capture, data conversion, and data mining.

Literacy in today's Army means more than reading and writing at a specific RGL. A user must be politically and socially literate in that they understand and practice political correctness and sensitivity, and they understand how power permeates their institution and the religious, political, cultural, or social interests of others. Users must know how to interpret visual information, whether it is in understanding the message communicated by personified technology or in the ability to interpret locator drawings to complete a given task.

Users must also be information and computer literate as well. David Bawden points out that the simplest form of literacy is the ability to read and write and understand one's own native language; however, literacy has many forms. Bawden claims literacy falls into one of three categories: skill-based literacy, information literacy, and digital literacy. Skill-based literacy includes library, media, and computer literacy. Skill-based literacy is the ability to accomplish specific tasks using technology. These tasks include finding, accessing, and using cataloged information; assessing information gained from the mass media; and, the ability to operate a variety of computer applications—word processors, databases, spreadsheets, along with general IT skills such as copying disks, burning CDs, and printing (Bawden 2001, p. 226), and in knowing how to search and retrieve information online. Information literacy refers to a user's ability to access, evaluate, and use information from many different sources, including electronic sources (Doyle as cited in Bawden 2001, p. 231). Digital literacy includes digital information

literacy, network literacy, Internet literacy, multimedia literacy, and hyper-literacy. Digital literacy is the ability to read and understand hypertextual and multimedia texts (Bawden 2001, p. 246).

Uniting situated literacies and helping users with novice skills to access information and complete tasks are among the benefits of electronic technical manuals. Despite these benefits, users literate in computer, information, and language skills find these digital texts problematic. ETMs and IETMs of the twentieth and twenty-first century offer digital representations of fixed information not unlike the original eighteenth century originals. The preservation of print legacy data causes assimilation problems in new media, in this case electronic and interactive technical manuals. New media designs of ETMs and IETMs remediate the print media so users can access and interface with what is recognizable and familiar. Jay Bolter sums this up well: "Although each medium promises to reform its predecessors by offering a more immediate or authentic experience, the promise of reform inevitably leads us to become aware of the new medium as a medium" (Bolter 2000, p. 19). In addition to the traditional text options—a table of contents and index, for example—users are now presented with new media capabilities along with the choices we are given by the computer medium. In Chapter Five, I illustrate the design concepts and application of ETM and IETM media and show why these media do not live up to expectations.

CHAPTER FIVE: PROPERTIES OF NEW MEDIA

Advancements in the modes of communication—transmission, digitization, and computerization—provided the means for the Army to solve the logistical challenges created by large amounts of documentation. In some ways, modern Army technical publications are the products of these advancements. Conceptually, electronic technical manual media should eliminate the need for paper, automate manual processes, and perform intelligent functions that will help users complete tasks more efficiently. Technology as extensions of human capabilities continuously increases the need for automation and machine intelligence. As Jacques Ellul points out in *The Technological Society,* "a technical problem demands a technical solution" (Ellul 1964, p. 429), one of which is the "creation of new technical instruments able to mediate between man and his technical milieu" (p. 429). IETM media, founded on the principles of computerization, should provide this automation and intelligent functionality. Realistically, though, the new media replacing the paper technical manuals does not live up to expectations.

The digitization of paper technical manuals does make technical information more accessible. The reference process and searching through a large number of texts is certainly faster, but the digitized texts are fixed and limited unlike the properties of pure digital data. Pure digital data can be manipulated, is transportable, can be made intelligent, and it can be measured. While the new media does have some digital properties, other features of new media compound the problems of the paper technical manuals. New media creates new challenges, those of usability and skills-based literacy

since users are now interacting with more than one media and medium. Marshall McLuhan states, “Language is metaphor in the sense that it not only stores, but translates from one mode into another” (McLuhan 1999, p. 5). Challenges created by the new medium can be attributed to the idea of using the new medium like the old, and partially because we expect the new media to be automatic and intelligent.

The unique properties of the different modes of communication, that is, the properties of the book or the properties of digital media, affect the way information is stored, transmitted, and distributed through these media and focus on the material properties of communication rather than the content of the message (Deibert, 10). The layout and organization of a paper technical manual is based on a user completing work manually. A user understands how to find information in a paper manual by searching the table of contents and the index and then proceeding to the desired page. The user then follows the instructions on the page to complete a task manually. The paper technical manuals convey manual processes and require the user to understand its contents and how they apply to a given task.

New Media designs are based on digital data properties and on a user completing work virtually in an integrated data environment. In this environment, interacting with the digital data, the medium, and the underlying computer operating system force the user to deal with the properties of communication rather than the content of the message. The user must understand how to interact with the computer and its operating system before approaching the media. In many cases, the user will spend time navigating and interacting with the media before locating the information needed to complete a task.

Many users believe that hypermedia and interactivity—two properties of new media—equals intelligent functionality. In intelligent functionality, the machine and its software programs are intelligent and do the work in place of human agency. Intelligent programs collect and assess data, compare it against expert rules, formulate conclusions and a recommended course of action. Based on the system design, the program is either self-repairing or prompts for user intervention. Completing a task may require the user to do nothing more than clicking on a start button since the functionality of the system will do the work. Less intelligent systems, or older systems with simple electronics, rely more on human intervention than on machine intelligence.

Realistically, new media remediates paper technical manuals in layout and organization and in the way information is searched, retrieved, and in some cases, used. While the Army's IETM concept reflects both automated and intelligent functionality, IETMs remediate the paper media. Remediation is the mode of representing a new media through an older media. New media can only claim to be new in comparison to older media because it replaces the older media. Further, a new medium always replicates parts of the old medium that it is remediating. Jay Bolter and Richard Grusin look at this process as one technology not replacing the older technology, but taking a part in its life. An ETM and IETM replicates parts of the paper technical manual, and in some cases, the entire manual. Hypermediacy creates a dialectical tension, that is, the tensions created between the two conflicting media, and makes users want to get rid of one or the other. A user expects a digital technical manual to have the properties of digital data, computer, and electronic transmission capabilities but not the properties of a paper technical

manual. Because the new media in this case remediates the majority of the paper manual, users approach and attempt to interact with the new media as if it were the older media, in this case paper. The idea of an IETM is an example of hypermediacy since these manuals call attention to their own medium (the PMA and the SGML viewer). The original new media designs were to account for situated literacies and disparate skills in novice users through intelligent functionality. In this chapter, I will discuss the design concepts of ETM and IETM media and illustrate how these designs do not live up to expectations in practical application.

Electronic Technical Manuals

ETMs are most commonly captured and stored in PDF (portable document file) format. PDF files retain the appearance, colors, fonts, graphics, and layout as in the printed documented. PDF files can be read online, or be saved and printed (USA 1998, 24). Additionally, a PDF can contain hyperlinks, notes, and embedded media, that is, video clips and sound files that help to enhance user understanding. A user finding a task difficult may launch a training video or animation of this task while the file is open. As shown in Figure 25, ETMs are fundamentally electronic page-turners, where the page images are recorded on an electronic imaging system. According to the Army's Logistics Transformation Agency, ETM media is an:

Electronic representation of the instructions for the installation, operation, maintenance, training, and support of weapon systems, weapon system components, and support equipment. The digital information is stored on a magnetic or optic media (CD-ROM) and used in conjunction with a weapon system processor, a Portable Maintenance Aid (PMA) or an approved computer system. (USA 1998, p. 6)

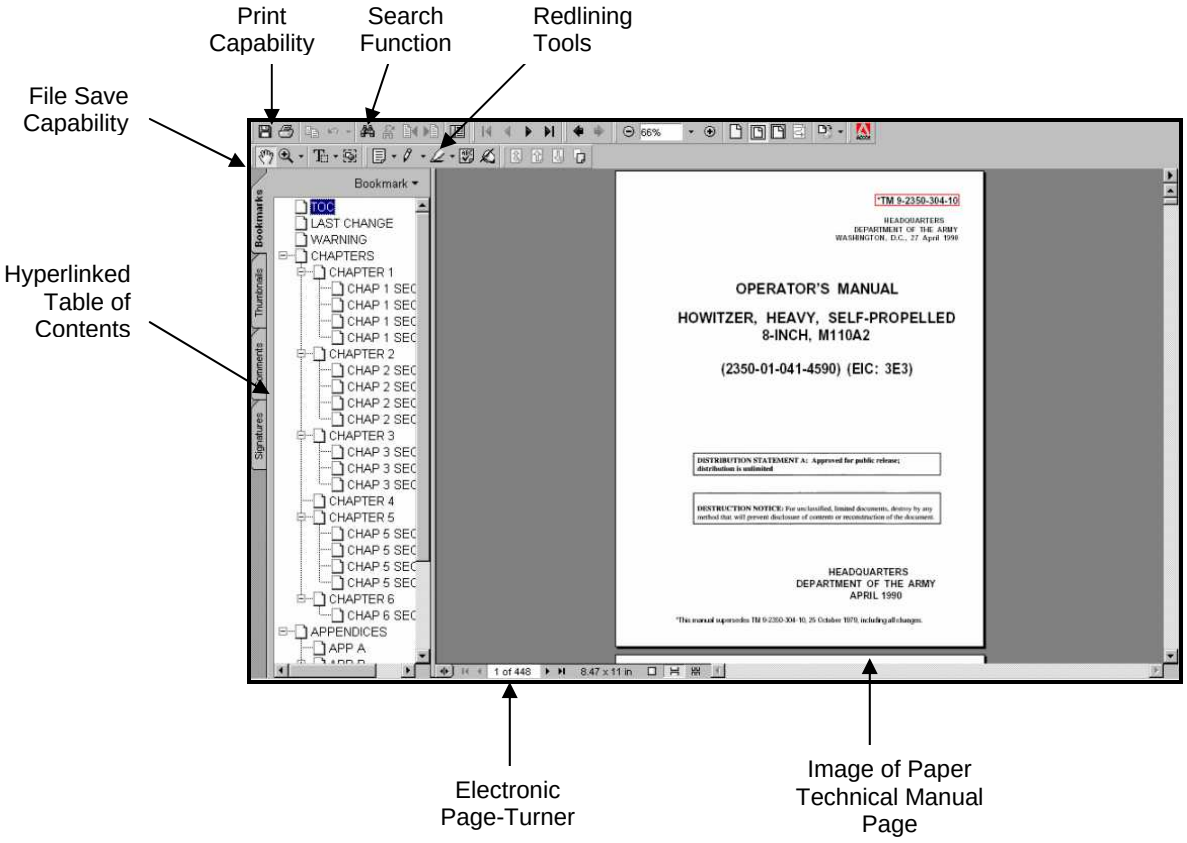

Figure 25: ETM Layout, Organization, and Automated Features

Key word searches of the document are also possible and help users locate information much faster than in a paper technical manual. ETMs can also be stored and presented using a Web browser. HTML tagged ETMs, like the PDF versions, format, and present information as it appears in the paper technical manual. Some HTML ETMs present one chapter of information per screen while others are tagged in a page-oriented format, that is, one page per screen as it formatted for the paper manual. Most HTML ETMS, Figure 26 for example, are presented in a two-frame screen: the table of contents or subject index appears in the left frame while the selected content, in this case a 3D graphic, appears in the right frame. The organization of the subject frame shown on the left is based on the specifications for paper Army Work Package technical manual formats. A work package is a hierarchical arrangement of each system and subsystem of a system. Each work package contains the theory of operation, description, parts information, troubleshooting, and maintenance procedures for a given system. Work Packages are the equivalent of mini technical manuals located within a larger technical manual. The idea is that a user can remove the package from the technical manual and carry it to the maintenance environment without carrying the entire manual.

In a few systems, paper pages are captured in a TIFF image format and are electronically indexed. Each page of the technical manual is an individual TIFF image and is capable of being viewed independently of the remaining pages. The problem here is that users must retrieve and view each page individually if they have the need to print a specific section.

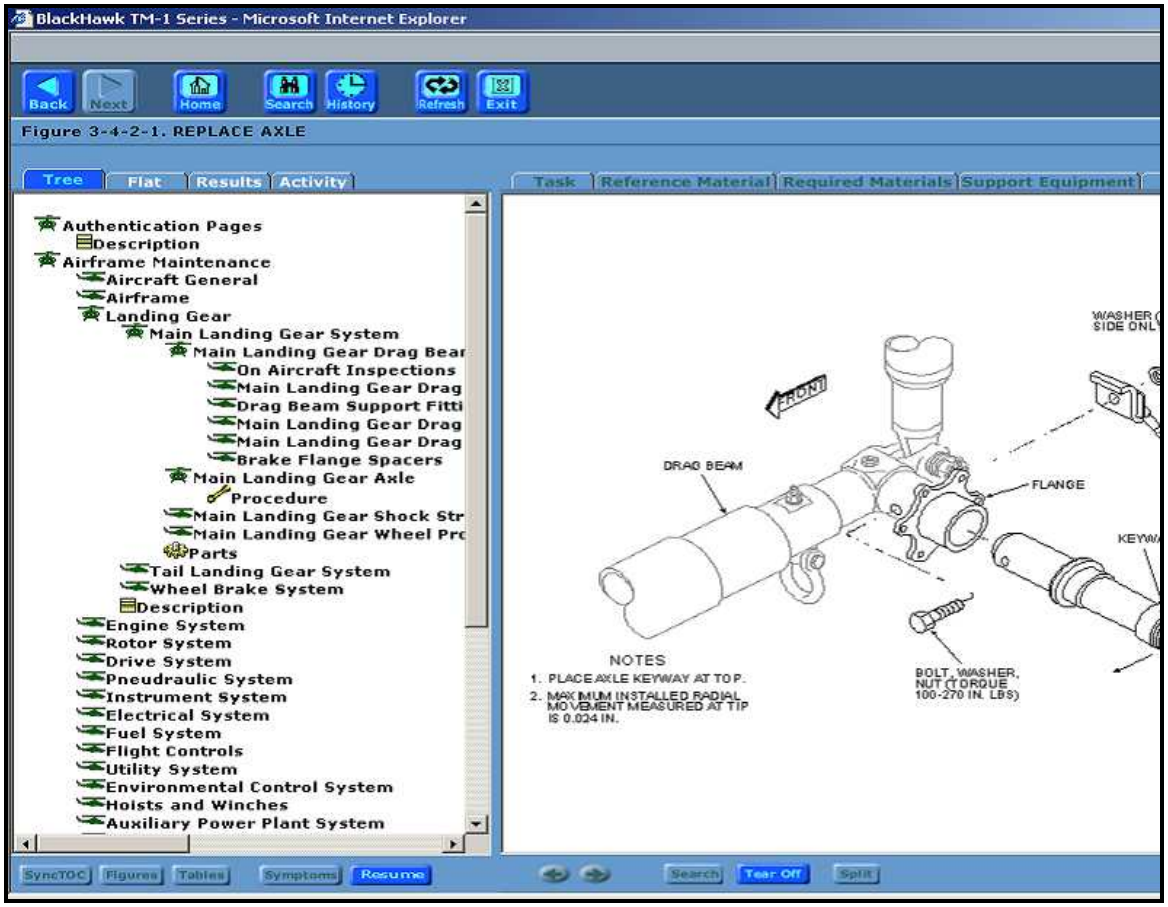

Figure 26: Web-Based ETM

Although a user can execute media in a separate window, using an ETM is much like arranging each piece of information on a desk, and through inference, making sense of it. ETMs make the process of retrieval faster in the sense that a user only needs to point and click to display information. To use the information in the completion of task, however, may require the user to print a page from the ETM and carry the page with them to the task environment. The form and quality of this information is based on the

print original since no changes occur to content during the conversion process. Incomplete or deficient paper manuals are also incomplete and deficient ETMs.

Locating information in an ETM is not unlike locating information contained in a paper technical manual. In a paper technical manual, users locate information by searching for specific keywords or topics in the index or table of contents. Users locate the words and then proceed to the indicated page. In an ETM, users also find information by searching the electronic images of the table of contents or index. Once the word is located, users click on the entry and the information is presented. Unlike the paper technical manual, users can find information embedded in the technical manual by using advanced search functions that reads through the file in search of a key word or phrase. ETM media provides an inexpensive method of storing and updating large numbers of technical publications. The media allows readers to locate and retrieve information quickly.

Interactive Electronic Technical Manuals

IETMs are founded on the principles of computerization. An IETM conceptually consists of digital data, LMI, embedded sensors, and artificial intelligence in the form of an expert system or artificial neural network. One soldier I worked with summed up the current IETM conceptual design well: “Great concept, but poor implementation.” The Army defines an IETM as a:

> Computerized screen-based interactive diagnostic tool used to troubleshoot and isolate faults and identify the maintenance processes for weapon systems and other equipment. These diagnostic devices employ software that show the soldier mechanic how to repair the malfunctioning subsystem, and automatically determine—and—order the correct parts. (USA 1998, p. 6)

Digital data in the case of an ETM or IETM are generally the paper technical manual information, tagged in SGML or XML, or captured in an image format like PDF or TIFF. Tagged SGML files are parsed against the Document Type Definition (DTDs) to ensure tagged data conforms to the rules and structure as defined by the military specifications for electronic technical manuals. The majority of the DTDs used for the development of an IETM structure the SGML or XML to remediate the qualities of a paper technical manual by chapter, section, and paragraph order.

The ability to create simple and complex navigational structures, and interactivity is based on the IETMs digital architectures. Digital architecture provides the foundation in which artificial intelligent components, expert systems, if-then rules, inference engines, and knowledge bases can function within an IETM. These are the necessary components of an effective interactive and intelligent system. Gary Heba defines digital architecture as the "complex system of electronic coding that underlies the creation and distribution of all online documents" (Heba 1997, p. 277). SGML or XML provides the digital architecture of an IETM.

Logistics Management Information, or LMI, is a database of the failure codes, failure rates, parts data, and historic failure data of a given component. These databases

are maintained by Army logisticians, but are now available via network communications and an SGML or XML interface. LMI helps users determine technological obsolescence, predict failures, and plan for future equipment modifications. LMI information is collected and analyzed throughout the life cycle of a technology development. The information determines the troubleshooting and maintenance procedures located in the technical manuals along with any spare part requirements.

Embedded sensors are integrated, or embedded, into the hardware of a system, an engine for example. Using cables, laptops, and portable maintenance aids allow a user to collect fault codes in real-time. A user connects a portable maintenance device to a sensor, executes an intelligent program coded into the digital architecture, retrieves the fault codes, compares the codes against the LMI database, and completes the recommended course of action assigned to the fault code.

In a conceptual IETM design, artificial intelligence is the major component of IETM functionality (USA 1998, p. 36). Embedded diagnostics, as defined by the Army, include several "systems that monitor the health of complex, dynamic equipment" (USA 1998, p. 21). These components include:

> Sensors to monitor the relevant physical variables, a data acquisition system, software to validate the sensor data, diagnostic software, and a computer interface for communicating high-level information to the user. The diagnostic process follows the general scheme of extracting pattern characteristics from sensor data and using the characteristics as the input to diagnostic software. The statistical movements are used to characterize steady-state sensor data. (USA 1998, p. 21)

Ideally, weapon systems should be fully capable of troubleshooting themselves. Software designs allow automatic fault isolation and will automatically search the database to present all information related to repairing the faults (USA1998, p. 36). Functionality is also achieved through knowledge-based expert systems, or expert systems. Donald Waterman defines expert systems as:

> Computer program[s] that uses expert knowledge to attain high levels of performance in a narrow problem area. These programs typically represent knowledge symbolically, examine and explain their reasoning processes, and address problem areas that require years of special training and educations for humans to master. (Waterman 1986, p. 390)

Expert systems help capture human expertise especially when the risk of losing this expertise is high. Not all expert systems are knowledge-based systems. Many are independent training (computer based training), troubleshooting (diagnostics), maintenance tasks, and supply operations (parts ordering capability), just to name a few.

Expert systems are equipped with an inference mechanism, that is, forward chaining, backward chaining, and case-based reasoning. In backward chaining, the system starts with a statement (what it wants to prove) and only executes rules that are relevant to establishing proof. The system works backward, comparing the sets of rules against the expert system until the statement is proved to be correct or incorrect. Forward chaining problem solving begins with a set of rules within the expert system and works forward in the inference chain until a conclusion is reached based on the facts. In other words, forward chaining is an inference method where rules are matched against facts to

establish new facts. Case-based reasoning, used in diagnostic programs, compares the statement against previously solved problems and reaches a conclusion. In a diagnostic program, known faults are captured in the expert system. When the diagnostic is executed, fault data is collected through the data bus and is compared against known fault codes stored in the database.

According to James Anderson, neural networks, or brain-like computation, "is based on the wistful hope that we can reproduce at least some of the flexibility and power of the human brain by artificial means" (Kosko 1992, p. xix). Neural networks are collections of mathematical models, or computing elements, connected together in a structure similar as the biological nervous system. An IETM neural network collects data from sensors via an electronic control unit (a connection from the IETM laptop or PMA to an electronic sensor embedded in a piece of hardware, for example, an engine). The diagnostic data derived from these sensors are compared against stored data. Prognostic capabilities depend on the data extracted from these sensors and expert systems to predict in real-time the failure of components. Data collected through the electronic control unit is evaluated against the rules of the expert system, and then it presents a solution based on the result of the evaluation.

Like ETM designs, the presentation of SGML tagged technical manual information may be frame-or page-oriented. Frame-oriented IETMs present only the information, which can fit into a display area without the use of scrolling. Page-oriented IETMs present one page per screen just as the page appears in paper technical manuals. Frame-oriented IETMs present navigation problems, many of which are based on SGML

or XML viewing environments. The browsers are similar to Web browsing environments; however, there are restrictions. Navigation is based on the last or next tagged “frame” in an SGML file and not the last page the viewed. Users completing a task or in need of more information may click on a link, but will often not return to their point of origin.

In addition to providing a rich hypermedia environment, IETMs automate processes through a number of devices. Dialog boxes help users find information faster. IETMs generally provide full text search capabilities, which allow users to search across an number of separate files, including graphics files, for a specific reference. These searches, though, are predefined during the IETM design process. Designers develop a search file and list the domains available for full text searches. Files not included in the predefined search file will not be visible to the user.

Other manual processes are also automated—for example, troubleshooting flow charts. Paper visual flow charts are replaced with dialog boxes that walk the user through a series of steps based on the if-then rules of the flow chart. These rules describe a problem or situation, and based on the response (yes or no), moves the user to the next logical step in the process by traversing the rules.

The creation of log files by the browser allows a user to return to previous actions. Log file record the user’s actions in sequential order during a given IETM session. Since log files are generic text files, they can be transferred to almost any program. Users can also redline text and drawings, set bookmarks, add comments and notes, and create problem or action reports. The capturing and storing of knowledge in this manner is limited and often requires more time than the manual processes. IETMs also allow users

to execute other applications, but like ETMs, these applications either run in separate windows leaving the page image of the ETM or IETM in the background, or instead of the ETM or IETM in the common display area.

Expectation versus Reality

As I illustrated in this chapter, ETMs and IETMs do offer many benefits. They are easy to update, accessible, and transportable and portable. They are not, however, intelligent technologies. There are three reasons why IETMs as a new media do not live up to expectations.

First, ETM and IETM media remediate paper technical manuals to a fault. The goal in the case of an ETM is to capture as many qualities of the print manual as is technologically possible. A page printed from an ETM will look exactly as it does in the print version of the manual. ETMs are excellent candidates for populating a documentation and knowledge management system.

IETMs too remediate paper manuals. Unlike an ETM, however, IETM media does not have to present an exact image of the paper manual. An IETM is tagged in SGML or XML so that chunks of content can be separated from format and style. The properties of these tags organize the screen presentation of IETM data to closely represent the print version of the manual. The difference here is that stylistic qualities of the text can be altered based on the browser capabilities.

While the goal of an ETM is to capture the image of a paper technical manual page, IETMs are an interactive media, tagged in SGML or XML, chunked into nodes, stored in a database format, but the designs of IETMs, like ETMs, are based on the design of the print media. Data tagged and stored in SGML nodes are organized by the hierarchical order of the paper technical manual by chapter, section, and paragraph organization. Each SGML file is comparable to a paper chapter in a technical manual. Locating information is not unlike locating information in a paper technical manual. As shown in Figure 27, the user (1) clicks on the Introduction button to display the section choices, that is, Section 1 General Information, Section 2, Equipment Description and Data, and Section 3 Principles of Operation. By clicking on the General Information hyperlink (2), the section will expand and reveal its contents. Clicking on the Scope hyperlink (3) reveals the information as it appears in the technical manual (4). Some of this remediation is due to excessive costs of labor and new technology productions, and the Army's desire to salvage costly legacy data investments.

Second, as I discussed in Chapters Two and Three, the quality of legacy data is poor and the content is deficient. As a technological society, we assume that technology, or digital applications like the BIT program, will replace the need for manual human labor. We also assume information is easily accessible if it is digital information. We believe that a computer medium must have an Internet connection and with this connection, we can find missing information. Because of these assumptions, needed information is often omitted from the manual.

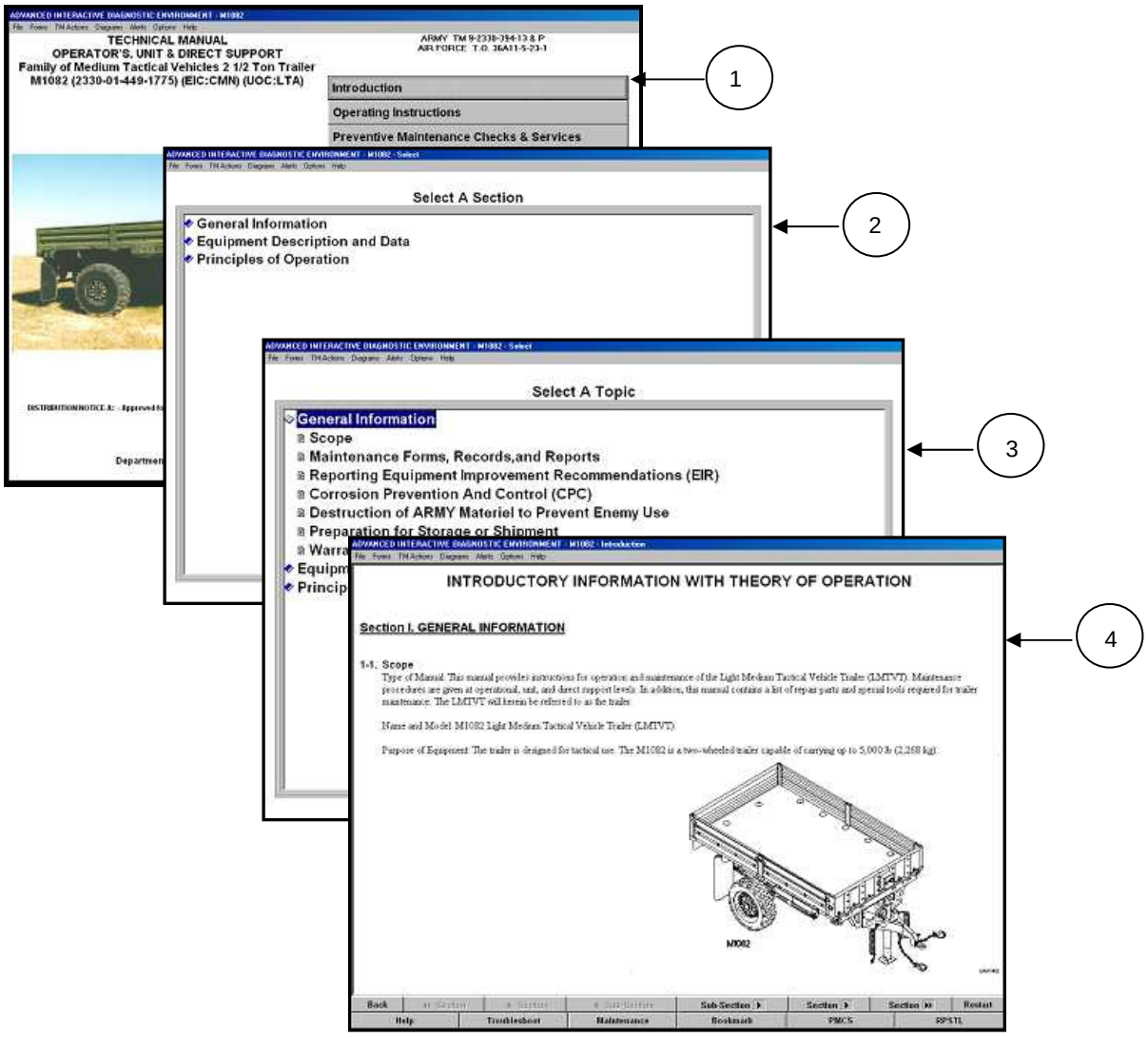

Figure 27: Organization of IETM data

Finally, digitized information is often fixed in content. Information stored in IETM databases are not pure digital data in the sense that it can be manipulated, mined, measured, and made intelligent. Data communicated and transferred from machine to IETM should be intelligently evaluated, or inferenced, as in the conceptual model.

Electronic manuals in an ideal state automate processes, and through intelligent functionally, make up for user expertise and knowledge.

Technical manuals, once transformed into ETMs and IETMs, are fundamentally information technologies with search and system queries, transmission capabilities, data capture functions, data import and export options, and data integration. Despite these technology options, information capabilities in ETMs and IETMs are fixed and limited; they are not raw, or true, digital data. Peter Lyman states that digital information differs from analog information media (such as print and film) because it is searchable, interactive, and accessible. Lyman defines three qualities of digitized texts:

- digitized texts allows searches as if they are databases
- digitized texts read differently because the are searchable
- digitized texts allow for interactivity which allows new relationships between the reader and text

Although ETMs and IETMs do provide these qualities, they are not pure digital data in that the search capabilities and limitations were defined by the designer not the user, and the searchable text is the remediated paper manual. As Lyman writes, "a vast amount of the new digital information is raw data: data do not become information until an inference is made from them; information does not become knowledge until contemplated by a mind" (Lyman 2001, p. 4). Information in ETMs and IETMs is predetermined: the order, arrangement, search and query capabilities were fixed and defined during the media transformation process. IETM features (search, query) help users search in a different way—they no longer need the index or table of contents, but

search and query data is predetermined by the designers. Information can only be interpreted one way—the way it appears in the analog paper technical manual. In this case, the value of the digital data is only equal to the value of the printed page.

In addition to the issues created by the remediation of print, using an ETM or IETM requires a user to be multi-literate. They must know how to read and use a print technical manual, know how to complete tasks using a computer, and they must know how to interpret and interact with the hypermedia. IETMs require too a familiarity with technical manuals and the functions of an SGML browser, text files, and in some cases, data transfer. Users must also learn the keyboard and navigation controls of specialized computers like those physically located on portable maintenance aids and PDAs. In other words, users of IETMs must first learn the hardware interface, then SGML interface, before reaching the display of a remediated technical manual.

The use of embedded sensors, expert systems, and artificial neural networks are not science fiction, but reality. Many current weapon systems, particularly fighter jets, depend on AI systems to monitor system health. These systems, however, are independent of ETMs and IETMs and work in conjunction with them. IETMs are included with the system, but the AI functionality is executed separately. We have not yet successfully integrated analog (paper information) and digital data (AI) derived from machine intelligence. These challenges are mostly the result of converting deficient legacy data, or paper technical manuals, into new media and remediating too much of the old. In Chapter Six, I will discuss the key assimilation problems encountered with this new media.

CHAPTER SIX: CONCLUSION

Clearly, our assumption that legacy data, or information written for paper, can be converted without change is one of the major design flaws of new media. Perhaps the idea that the information worked well in print legitimizes the conversion of paper technical manuals with little change. Those of us working in this field and helping users cope with print deficiencies know that it does not really work in print all that well, but rather we know well how print works, and we approach the technical manuals and work with this knowledge and how to use it to complete tasks. We are so consumed by the print paradigm that it is the basis for new media designs. New knowledge is captured within the framework of this paradigm. Because new IETMs are based on print and how print is used, new media designs are not pure digital data but rather are fixed in structure and predefined in content.

If technologies are extensions of our human capabilities and nervous systems as McLuhan suggests, then users finding this media problematic will ultimately effect change and press for advancements in machine intelligence. As extensions of human capabilities, new media must be functionally intelligent, that is, the media must work like human intelligence. To be truly digital, we must give up the print paradigm. In its current state, ETM and IETM media are in transition from paper to what will be. For IETMs to help users complete work and provide self-diagnosing and repairing capabilities, we must base new media designs on the principles of digital data rather than on the designs of print. Print manuals are written for analog environments where human agency provides

the interactive element in completing work and collecting and analyzing information. Information designed for analog environments cannot succeed in a digital environment.

It is the quality of legacy data that prevents us from completing our tasks more so than the logistical challenges created by large amounts of paper. Using paper technical manuals is difficult especially if we are in a remote or confined environment. The larger and more complicated the system, the greater chance of having multiple volumes of manuals. Despite the logistics of manipulating large amounts of paper in awkward spaces, we understand how to locate information and use it to complete a task. As I discussed in the Introduction, we cannot assume print information is complete or accurate. After World War II, it became costly and difficult to maintain technical publications. Users may not have received and inserted the most current change pages into the manual, so the technology or process is probably more current than the manual used to support it.

In the case of electronic technical manuals, we assume more information is available and accessible just because new media is electronic. Because of this assumption, information that might be costly to produce is often omitted from the manual with the idea that users can search other online sources for this information if it is needed. In practical application, few soldiers in the field who are issued IETMs are given a computer medium with full Internet capabilities. To do so is costly, and in the case of small devices, only the required software is installed for the sake of saving computer memory and increasing the speed at which information can be searched and retrieved.

Those of us who assume a user has access to online data are unaware of the user and their working environment.

The simplifying of texts over the last two centuries has resulted in a narrow presentation of information pertaining to any given technology. The science behind the technology, along with a history of modifications and enhancements, has been omitted from the manual and is no longer available to users. Users with expert skills and tacit knowledge can work through situations where expert and tacit knowledge is required, but novice users are left in a quandary.

Our expectations of technology, particularly computerization, are evident in what is not included in technical manuals. We assume technology will take care of many problems before they actually occur and believe that technology is self-diagnosing and self-repairing. As users, we are only needed if technology fails completely to the point of replacement. However, to repair technology, more technology is needed. As revealed in an analysis of historic technical manuals, finding a broken wire often requires a voltmeter and an oscilloscope. Avionics equipment may require a test set or an entire test station. Visual systems in simulators require a photometer, or light meter, and computer generated instructions and tests to align a visual scene.

The goal, then, is to complete the transition from one media to what will be, and press for more intelligent systems. Machine intelligence can help recover lost knowledge and then make this knowledge available to users. In the case of an unexpected technical malfunction, the machine can record the conditions of the fault, record the corrective actions, and store this new knowledge in its internal expert systems. By continuously

learning, the machine can keep up with technological innovations and the evolving information these innovations require.

Implications for the Field

As educators, engineers, technical communicators, and experts in texts and technology, we must keep ourselves from unknowingly contributing to the usability problems of IETM new media. We should be aware of our tendency to place too much faith and expectation in the capabilities of technology. By doing so, we will not omit important information our users will need to complete their tasks. We should also remember that not all mediums and the environments in which they are used will have all the capabilities we take for granted with our desktop computers. Strategic and tactical environments are often burdened with constraints and limitations.

Until a time where new media has improved in capabilities, we can smooth out a few of the usability issues by integrating collective knowledge capture capabilities into the media. By doing so, we can help recover lost technical expertise on a given subject and perhaps capture tacit knowledge, which will allow users to supplement the information provided in electronic technical manual media. The log file and redlining capabilities of ETMs and IETMs provide a small element of a collective knowledge capture capability, but it is nearly too limited to be useful. Using embedded editing tools such as highlighters, colored pens, drawing tools, and sticky notes, allows users to point

out errors in the manual and share them with others. To truly capture expert technical knowledge, these functions must be expanded to include a narrative capability. Users can record shared experiences and problem-solution stories about deficiencies found in paper and electronic technical manuals. As Brown writes, "stories moreover, convey not only specific information but also general principles. These principles can then be applied to particular situations" (Brown et al 2000, p. 107), in this case, novices involved in the operation and maintenance of technology. Narrative and storytelling proved to be highly successfully in print for over two hundred years, but ironically was not considered in the design of new media.

We can also re-evaluate the content of paper technical manuals before we convert them to ETM or IETM media. Incomplete knowledge should be accounted for either by generating it anew or by reworking the context for effectiveness. Failure information, troubleshooting trees, and even parts catalogues can populate the knowledge base of an expert system. We should be careful converting this information—incorrect or incomplete knowledge in the technical manual can lead to the same deficiency in an expert system. Independent expert maintenance and training systems can also help novice users complete complex tasks. Virtual reality simulations prompted by user requests can show users, one step at a time, how to complete specific tasks. Speech recognition can help users locate components within the system without manual or electronic searching, for example, *show me the electronic control unit*. Then the system will retrieve and present all available information related to the electronic control unit.

In addition to addressing the usability problems of the current media, the development of machine intelligence also provides an opportunity for experts in texts and technology. Machine designs and intelligent mathematical models are likely designed and coded by electrical engineers and computer scientists, but the knowledge base should be the territory of technical communicators and experts in texts and technology. Our skills in rhetorics, information designs, document usability, audience analysis, and data collection make us by far the most qualified profession for capturing, understanding, organizing, and disseminating knowledge. The data collection activity must focus on capturing current knowledge, correcting deficiencies, and recovering lost information. Experts in texts and technology should participate in the architectural designs of expert systems. Knowing how users approach tasks and use information to complete work allows experts in texts and technology to help define the best logic for expert rules. The if-then logic rules, chaining conventions, and case-based reasoning inference engines are based on the data collection and task analysis process. These are standard processes in the development of user information.

Topics for Further Research

During the research process of collecting and analyzing historic texts, I discovered several topics of interest. These topics are worthy of further investigation and research.

One topic concerns the social assignment of work. During the eighteenth, nineteenth, and early twentieth centuries, many of the tasks traditionally assigned to women in civilian life were assigned to men in the Army. Cooking, collecting recipes, washing and mending clothes, and caring for the sick and wounded are just a few of the topics provided in handbooks and technical manuals. Why did the Army assign these tasks to its soldiers? I suppose one can argue that the Army is mobile and moves around in less than desirable environments, and it was not acceptable during this era for women to be involved in these activities. Many military installations, however, were permanent installations and were located in or near large geographical populations. These installations typically provided housing for the families of the troops stationed at the base. Why were women in this case not hired for these tasks? How did the assignments of other tasks differ by gender in civilian life?

The simplifying of texts to reach the audiences of situated literacies is another important topic worthy of investigation. Uniting situated literacies helps maintain control and discipline within the institution and allows for successful training, but the idea of having a universal literacy has implications for the survival of individuality and human thought. Situated literacies account for diversity in American culture. If we all communicated one way, how would our culture be different? Will the Army behave like futuristic robots void of individual thought and ideas?

Technical publication groups were organized before World War I, but how they operated within the government is unclear. The use of common graphics, style, and procedures in manuals written abroad and in the United States indicates that technical

publication development was an organized process. At least three World War I era handbooks were written in three geographical locations. Despite the distance between the three writers, the handbooks shared many of the same descriptions, procedures, and graphics. How did these writers accumulate these texts and graphics? During the 1880s, the Army published a series of Ordnance Department Documents and Notes, hundreds or even thousands, in fact. These notes and documents all reflect an established layout and format. Who developed these standards, and how were they derived? Were they based on European practices of the period or did the Army institute rules and regulations for technical writing before the modern era? The sharing of texts and graphics suggests that either an editor or central editing group was responsible for the final production of published texts, or at the very least, standards were imposed for documentation developments. How were the standards develop and on what basis?

Studying the rhetorical qualities of the early Army writers can show how each individual author contributed to the progress of the handbook and manual genre. These assessments can give us a better understanding of how the institution circulated power before the modern age. James Moss wrote several manuals for officers, privates, and NCOs between 1914-1917, around the time modern technical communication emerged. What influence did Moss have on modern technical communication? On the genre of soldier's handbooks? August Kautz wrote manuals for Army clerks, officers, NCOs, and privates shortly before and after the Civil War. What influence did Kautz have on technical communication after the Civil War? How did Kautz's early works influence the first official soldier's handbook published in 1883? Steuben's *Regulations,* first published

during the American Revolution, is a model for doctrine and training in the modern Army. Clearly, Steuben understood the importance of audience analysis. What rhetorical qualities of this handbook are appealing to modern technical communicators?

The introduction of defense contracting changed the nature of technical publication development. Anonymous writers replaced credible Army authors and many new genres were based on American technical communication practices and not on the conventions found in foreign translations. How were the anonymously written publications received differently from those written by named officers and technical experts? How were the texts themselves different? The separation of these foreign conventions and the style established by technical writers in the nineteenth century can show us the differences between American and European technical communication. What European practices informed early American technical writing? Which practices were abandoned and which practices are evident in the modern Army technical manual? What are the cultural elements separating American technical communication from European technical communication? How did the situated literacies of the troops influence American technical communication?

Comparing Army technical communication with other forms of writing during the eighteenth, nineteenth, and early twentieth centuries will reveal how Army technical communication shaped the technical communication practices of non-military publications and the field today. As research shows, many technical communication genres emerged during eighteenth and nineteenth-century America. Some of these texts focused on shipbuilding, millwrights, sewing machines, the cotton gin, mower reapers,

cash registers, and early transportation and communication technologies. It would be beneficial to compare these texts with military texts of the period. Were writers of these consumer texts more concerned with adapting technical knowledge to an audience of less adept and less skilled users? Were these texts, like early Army texts, more concerned with the skilled and expert user? If these writers focused on making expert technical knowledge available to a community of less adept users, how did the rhetorical qualities and design elements of these texts differ from Army texts of the same period? Since soldiers are simultaneously part of several discourse communities, were consumer technical publications influenced by Army technical communication practices, or did consume practices influence the Army?

Finally, the U.S. Navy has a history at least as long as the Army's history. How is information communicated within the Navy as an institution? How is knowledge captured and disseminated? Like the Army, the Navy also develops and publishes technical publications. Since the environment of the ship and the environment of the field are radically different, it would be worth comparing the historic texts of the two services for commonalities and differences in technical communication practices, rhetorical qualities, visual design elements, and IETM media designs.

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