Training Program Review:

Theater Battle Management Core Systems (TBMCS)

Training Program Evaluation

v.1.0.1

1 May 2001

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REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (FROM - TO)
01-05-2002	Program Review Final	xx-xx-2000 to xx-xx-2001

4. TITLE AND SUBTITLE
Theater Battle Management Core Systems Training Program Evaluation v.1.0.1
Unclassified

5a. CONTRACT NUMBER
F19628-02-F8162

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Zaharee, Marcie E. ;

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME AND ADDRESS
Dynamics Research Corporation
60 Frontage Road
Andover, MA01810

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS
Electronic Systems Center
50 Griffiss St.
Hanscom AFB, MA01731

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APUBLIC RELEASE
,

13. SUPPLEMENTARY NOTES

14. ABSTRACT
This report provided an in-depth analysis to assist future decision makers in determining the conditions necessary for effective distributed learning for future C2 systems. A synopsis of findings are presented in terms of (a) a summative evaluation that identifies strengths, weaknesses, lessons learned (b) best practices of the TBMCS training program, and (c) a holistic view of the TBMCS distributed training program that shows the impact of training not only on the individual but on the USAF as well.

15. SUBJECT TERMS
Distributed Training; Distance Learning; Online training; training lessons learned; courseware development; HTML; ADL initiative

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19. NAME OF RESPONSIBLE PERSON
			Public Release	76	Fenster, Lynn lfenster@dtic.mil
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER International Area Code Area Code Telephone Number 703767-9007 DSN 427-9007

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39.18

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EXECUTIVE SUMMARY

Purpose—This report provides an in-depth analysis to assist future Command and Control (C2) decision makers in determining the conditions necessary for effective distributed learning for future C2 systems. A synopsis of findings are presented in terms of (a) a summative evaluation that identifies strengths, weaknesses, lessons learned; (b) best practices of the Theater Battle Management Core Systems (TBMCS) training program; and (c) a holistic view (context, input, process, and product evaluation) of the TBMCS distributed training program that shows the impact of training, not only on the individual but on the United States Air Force (USAF) as well.

Background—To met the learning requirements of the future force, the Secretary of Defense stated:

> *"DOD personnel will have access to the highest quality training that can be tailored to their needs and delivered cost effectively, anytime and anywhere. Furthermore to achieve this vision anytime, anywhere learning must be distributed, just-in-time and on-demand and enabled with resources, development and exploitation of learning technologies".*

The Department of Defense (DOD) Strategic Plan for Advanced Distributed Learning (ADL) dated April 30,1999 identifies an ADL initiative intended to implement the Secretary of Defense's training vision.

Electronic Systems Center (ESC) Combat Air Force Command and Control (CAFC2) Distributed Learning Initiative—ESC was proactive in meeting the learning and technology needs identified in the ADL initiatives and DOD Strategic Plan when developing TBMCS training material. A great deal of progress was made in shifting from a paper-based, instructor-led training program established in 1995, to a distributed web based training program led by facilitation upon fielding in 2001. Meeting the requirements of anywhere, anytime, and anyplace learning requires solutions to many technical, security, and financial barriers. As users from locations worldwide attempted to access TBMCS materials located on distributed servers, three problems emerged. The first problem was accessing materials from remote locations; the second was NIPRNET bandwidth; and the third was local computer security initiatives hindering the use of web servers at user locations.

Data Collection Techniques—Due to the numerous training baseline changes conducted during the overall software development evolution, inconsistencies of data collection, and lack of raw data, this study did not lend itself to a hypothesis testing approach. Instead, an exploratory research methodology was chosen to support Systems Program Director (SPD) concerns. Seven research questions presented in this report were identified by the SPD as the basis for determining the effectiveness of the TBMCS distributed training program. Kirkpatrick's theory of evaluation [satisfaction, learning, transfer, and Return on Investment (ROI)] was used to categorize the data collected. Overall data was gathered using four collection methods: surveys, focus groups, pre-/post-tests, and a student self-assessment.

Findings—A major goal of this study is to determine the impact of training. For purposes of this study impact was viewed as "measurable learning" and "student perception" of learning. Spiral development encourages user participation and involvement and assessment of software and training development. A major emphasis placed on military and industry training evaluations are student reactions known as "happiness indicators". These are categorized as user perception. Perception drives motivation and emotion. Emotion is often a more powerful influence on behavior than logic or empirical data. Thus, it is an important indicator of course satisfaction. End of course critiques suggested that students were not "satisfied" with the concept of self-paced distributed learning with little human interaction; however, measurable pre-/post-test scores revealed that students understood facts and concepts, suggesting that knowledge "achievement" resulted from the training. Focus groups revealed that students perceived training would be greatly enhanced if the implementation approach reverted back to the traditional use of mobile training teams. This requirement was identified to the Training Planning Team (TPT) for validation, and ESC was requested to shift from a distributed learning environment back to a traditional, instructor- led, "hands-on" approach to training. The change in scope was a costly decision to the SPD.

Recommendations for Future ADL Training—Seven barriers are identified as impediments to a successful implementation of the TBMCS distributed learning program. They are: inconsistent funding, change of training requirements, lack of established evaluation criteria, inconsistent On-the-Job-Training (OJT) programs after fielding, lack of technology planning, unknown factors for determining ROI, lack of local distance learning policy and management enforcement, and lack of awareness and understanding of changing roles and responsibilities for students and instructors in distance learning environments. These can be overcome if known in advance by the SPD and emphasis is placed on establishing processes to overcome these barriers.

1.0—INTRODUCTION

1.1 PURPOSE

DODI 5000.2, The Defense Acquisition System states that the SPD shall ensure that the design and acquisition of systems will be cost effectively supported and shall ensure that these systems are provided to the user with the necessary support infrastructure for achieving the user's peacetime and wartime readiness requirements. Support resources include operator and maintenance manuals, tools, equipment, and training. Furthermore, the SPD shall consider the use of embedded training and maintenance techniques to enhance user capability and reduce life cycle costs. Air Force Instruction (AFI) 63-123, Evolutionary Acquisition for Combat and Control Systems, states that prior to system fielding, the SPD shall ensure sufficient training is complete to fulfill approved operational concepts of employment and sufficient support in place to fix failures and sustain the system.

In accordance with (IAW) the policies stated above, the SPD for TBMCS ESC, CAFC2 is responsible for managing, preparing, and conducting training for the TBMCS system as it is fielded. How does the SPD ensure the adequacy of TBMCS training? What criteria is TBMCS training evaluated against? What data should be collected? AFI 36-2211 identifies the Instructional Systems Development (ISD) process as a systematic approach to developing and conducting training. The ISD process includes five phases—analysis, design, development, implementation, and evaluation. ESC utilized this process in the development of TBMCS training materials. Worthen, Sanders, and Fitzpatrick (1997) stated that SPDs face the following kinds of education and training evaluation considerations:

- *Context evaluations* that serve as planning decisions to determine what needs are to be addressed
- *Input evaluations* to serve structuring decisions in determining what resources are available and what training strategies should be considered
- *Process evaluations* to serve as implementing decisions such as how well the plan is being implemented and what barriers threaten its success
- *Product evaluations* to serve future product decisions

The goals of this paper are to provide:

- A summative evaluation that identifies strengths, weaknesses, lessons learned, and best practices of the TBMCS training program
- An in-depth analysis in assisting future Command and Control (C2) decision makers in determining under what conditions distributed learning is likely to be effective for future C2 systems
- A holistic view (context, input, process, product evaluation) of TBMCS training that shows the impact of training, not only on the individual but on the USAF as well

2.0—DEFINITIONS

Adult Learner. One who (1) performs social roles that our culture assigns to adults (e.g., worker, spouse, soldier, responsible citizen), and (2) perceives himself to be responsible for his life.

Advanced Distributed Learning Initiative. The DOD strategy for using learning and information technologies to modernize education and training. A key requirement is the ability to reuse instructional components in multiple applications and environments regardless of the tools used to create them.

Distanced Learning. A general term used to cover the broad range of teaching and learning events in which the student is separated from the instructor, or other students, by distance and/or time.

Learning. A change, or the capacity to change, one's level of ability or knowledge.

Spiral Development. Software development spirals facilitate more precise and rapid maturation of new technologies and refinement of user requirements with high operational utility into a complete capability for one increment. The key intent is for the system and the fidelity of its requirements to evolve together with iterative feedback.

Type-1 Training. Contract training or factory training that Air Education Training Command (AETC) arranges for Air Force and other DOD personnel and contractors to conduct at either the contractor's location or a DOD facility.

Legacy Systems. This term refers to the older Air Force software applications that TBMCS replaced. Major systems consisted of Wing Command and Control System (WCCS), Combat Intelligence System (CIS), and Contingency Theater Air Planning System (CTAPS).

Mobile Training Team. A cadre of instructors who travel to military locations to provide TBMCS training to users of the system.

Multi-service. For purposes of this study, multi-service refers to the US Navy, Air Force, Marines, and North American Aerospace Defense (NORAD) personnel who utilize TBMCS.

TBMCS. Provides automated C2 and decision support tools to improve the planning, preparation, and execution of joint air combat capabilities.

3.0—ORGANIZATIONAL ACTIVITIES

The creation of a distributed learning environment, which can support multi-service requirements of anywhere, anytime, and anyplace learning, requires solutions to many technical, legal, security, and financial barriers. To overcome these barriers and to develop and implement standards, numerous DOD organizations have instigated distance learning efforts. Some of the DOD organizations and their respective projects are described below.

3.1 SECRETARY OF DEFENSE

Executive Order 13111 was released January 1999, which required DOD to provide flexible learning opportunities, use technology to improve training opportunities, and place emphasis on lifelong learning. The creation of an advanced information infrastructure, which can support an educational environment on a national basis, requires solutions to many technical, legal, security financial, and regulatory barriers.

To met the learning requirements of the future force, the Secretary of Defense listed the following training technology vision in The Report to the 106th Congress*:*

> *"To ensure that DOD personnel have access to the highest quality education and training that can be tailored to their needs and delivered cost effectively, anytime and anywhere". To achieve this vision anytime, anywhere learning must be distributed, just-in-time and on-demand and enabled with resources, development and exploitation of learning technologies*".

3.2 JOINT VISION (JV) 2010 AND 2020

JV 2010 provides the conceptual template for how we will channel the vitality of our people and leverage technological opportunities to achieve new levels of effectiveness in joint warfighting. Specifically, the armed forces of the future must be able to fight in joint, combined, and interagency environments enabled by information superiority – the gathering, processing, fusion, and dissemination of more accurate and timely information and knowledge, anywhere, anytime and every time. Our future forces must be highly adaptive, learning forces that organize to meet threats effectively and rapidly. They must continuously learn, simulate, and rehearse, whether they are in school, at home station, at home, en route to or in the theater of operations. Providing anytime anywhere training is a key to maintaining military readiness in the information age and is one of our foremost priorities (Shalikashvili, 1996). JV2020 requires what the military must apply to achieve full spectrum dominance as introduced in JV2010 and focuses on three factors (interoperability, innovation, and decision superiority) as central to success in the four original cornerstone JV2010 operational concepts of dominant maneuver, precision engagement, focused logistics, and full dimensional protection. Training anytime, anywhere, and anyplace will continue to be the key to enable commanders to make better and faster decisions than their opponents. (http://www.defenselink.mil/news)

3.3 DOD ADVANCE DISTRIBUTED LEARNING INITIATIVE

The DOD Strategic Plan for ADL dated April 30,1999 identifies the DOD ADL initiative. This initiative sets forth a new paradigm intended to implement the Secretary of Defense's training vision. In short, the strategy is to: pursue emerging network-based technologies; create common standards that will enable reuse and interoperability of learning content; lower development costs; promote widespread collaboration that can satisfy common needs; enhance performance with next-generation learning technologies; work closely with industry to influence Commercial-Off-the-Shelf (COTS) product development cycle; and establish a coordinated implementation process. The following five elements are needed to develop and successfully implement ADL:

- common industry standards
- interoperable tools and content
- a robust and dynamic network infrastructure for distribution
- supporting resources
- cultural change at all levels of command, recognizing that learning is an official requirement of the duty day

3.4 DEFENSE ACQUISITION UNIVERSITY (DAU)

The DAU is committed to providing high-quality education and training to the members of the DOD acquisition community. Emerging technologies provide DAU with the ability to increase access to its courses while promoting effective learning experiences for individuals. DAU's overall curriculum transition strategy is based on the ADL mandate to use technology to deliver quality training to learners in a cost-effective way. To meet the mandate, DAU identified 10% of DAU courses to be converted to the use of information age technologies before the end of FY97 and an additional 15% by the end of FY98 (Johnson 1997). To assist the Acquisition Workforce in meeting the requirements of this continuous learning policy, in 1999 DAU created an online Continuous Learning Center (CLC). The CLC, through a single point of access, offers continuous learning modules; regulation, policy, and guidance resources; and collaboration tools that provide expertise from peers and other professionals. It is designed around the metaphor of a campus map, which links to buildings that house functions one would typically find on a campus (http://clc.dau.mil).

3.5 US ARMY

In the past decade, the Armed forces experienced significant force adjustments and resource reductions. Army forces were tasked to deploy for operational missions that varied from providing humanitarian relief to engaging in major conflicts such as Operation Desert Storm. More reliance was placed on the reserve components to support the active component. Additionally, state-of-the-art digital equipment was fielded. This combination of a smaller army operating with new technology to accomplish expanded missions, dictated the upgrading of current training methods and procedures to ensure a combat-ready force. To meet these needs the Total Army Distance Learning Program (TADLP) (http:/www.tadlp.monroe.army.mil/) was created The TADLP system consists of three different distance learning facilities connected by a worldwide communications network. (US Army Training and Doctrine Command, 2001).

3.6 US MARINE CORPS

The transition to Interactive Multimedia Instruction (IMI) has wide-reaching implications across the Marine Corps. The increasing reliance on distance learning to meet broad training requirements addresses critical problem areas including the limited capacity of schools, outdated paper-based training materials, and the expense of sending active-duty Marines to formal schools for specialized and professional military education training. As a key component of the Marine Corps Training Modernization Initiative, MarineNet helps transform the way training and education are delivered to active and reserve Marines around the world. The MarineNet program establishes both a distributed learning network infrastructure and a program for development of IMI. To build this distributed learning infrastructure, the Marine Corps is rapidly investing significant resources towards upgrading telecommunications and instructional facilities. (Tyler and Harper, 1999).

3.7 US NAVY

The Navy distance learning vision is to deliver training on demand, to the right people to meet rapidly changing mission tasks in the increasingly complex, network-centric warfare environment. Navy training will be viewed as a career long learning continuation that involves technical skills and warrior training, and professional and leadership development and education. Availability and diversity of professional and continuous education will increase significantly. The training and education community will leverage off the Navy's enterprise/corporate information network, to deliver training and education to the entire force, active duty and reserve, anywhere and anytime. Education for the officer, enlisted, and civilian workforce will be provided through a "Virtual Navy University" providing an array of Navy-specific and professional development curricula. The results produced from the Navy's restructured training and education system will be a technically skilled and agile workforce and network-centric warriors who are prudent risk takers and innovators; adaptive and continuous learners; and effective leaders, mentors, and teachers (http://www.ott.navy.mil/).

3.8 US AIR FORCE

The Air Force Distance Learning Office (AFDLO), located at Maxwell AFB, was established as the focal point within the Air Force for implementation of Distance Learning (DL) policy and emerging technology (http://www.au.af.mil/au/schools/afiadl.html). As the hub for Air Force DL, the office provides policy and guidance, as well as consultation and support for the planning and development of distance learning programs. Air Force distance learning goals are to:

- create an environment that recognizes the value of distance learning
- ensure availability of resources to meet education and training requirements
- ensure Total Force interoperability for all distance learning instructional technology
- capitalize on appropriate leading edge technology
- improve educational and training efficiencies where practical and cost effective

3.9 ESC CAFC2 INITIATIVES TO SUPPORT THE ADL INITIATIVE

ESC CAFC2 was proactive in meeting the learning and technology needs identified in JV2010 as well as the ADL initiatives in the DOD Strategic Plan when developing TBMCS training material. Much progress was made in shifting from a paper-based instructor led training program established in 1995, to a distributed web-based training program led by facilitation upon fielding in 2001. TBMCS training materials were developed using COTS technology and are interoperable/platform independent in a Unix and PC environments. The ESC CAFC2 training development contractor maintained unclassified Hypertext Markup Language (HTML) training material covering TBMCS operations on a stand-alone web server. Eight additional servers were built as “clones” of the master server. The cloned servers were dispersed to military installations worldwide and act as stand-alone regional web servers. Each regional web server is connected to the web through the local host installations network configuration architecture.

In April 2000, an electronic Computer Managed Instruction (CMI) software application was purchased and distributed to the cloned servers to track student progress/completion of the distributed training. The CMI program organizes the online training lessons through a learner-profile customized for each student based on their course registration. Completion statuses of individual training lessons are maintained in the database and accessible to the individual students, supervisors, or training administrators. Student records are replicated to the cloned servers through database replication protocols.

3.10 CORRELATION OF DOD AND ESC CAFC2 INITIATIVES RELATING TO THE TBMCS TRAINING REPORT

The ESC CAFC2 TBMCS training division is on the leading edge of utilizing the most current technology available for designing and developing training for TBMCS. During this period of technology implementation ESC CAFC2 needs to ensure compliance with current policy, newly developed standards, and established COTS products. ESC CAFC2 has the responsibility to ensure the distributed training is effective. Zane and Mrzowski (2001) stated the research in distance education conducted to date has received harsh and consistent criticism. Criticism often focuses on: (1) lack of control for extraneous variables, (2) lack of use of randomly selected subjects, (3) lack of validity and reliability of the instruments used to measure student outcomes, and (4) inadequate control or the feelings and attitudes of the students and faculty. Champagne, Pawluk, Wisher, and Curnow (1999) stated that published literature on the effectiveness of distance learning is overwhelmingly anecdotal. A review of the approximately 200 papers published in the 1996-1998 proceedings of the annual DL conference found only 8% concerned with empirical studies of DL. To echo this point, none of the 50 military DL studies that ESC CAFC2 obtained via the Defense Technical Information Center (DTIC) between 1995-2000 included empirical data on the effectiveness of DL in a web-based environment. This study will be one of the first to track USAF distributed learning effectiveness in a C2 environment.

4.0—TBMCS TRAINING CONCEPT, DESIGN AND DEVELOPMENT

Kemp, Morrison, Ross (1998) suggested before starting an instructional development project, management should ask themselves "Why do we need instruction?" For TBMCS, it was evident that users needed to learn how to use the software application when it arrived at their desktop. Specific job training has precise, immediate requirements with identifiable and often measurable outcomes. The training material development must stress the teaching of knowledge and skills for the performance of assigned tasks. Kemp, Morrison, & Ross (1998), US Air Force Instruction 36-22 (1997), and Clark (2000) all identify a common ISD process consisting of the following:

- ***Analysis***—identifying tasks and skills requiring training
- ***Design***—identifying the objectives, test questions, and sequencing of instruction
- ***Development***—creating the courseware and activities
- ***Implementation***—conducting the training
- ***Evaluation***—reviewing the training design, development, and implementation of the course

Since the ISD process provides a structured, systematic means of providing training, the TBMCS training development contractor was required to follow the process to complete the distributed training effort. The following best practices and lessons learned are identified from each phase of the ISD process:

4.1 REQUIREMENTS IDENTIFICATION-THE ANALYSIS PHASE

Due to cost constraints at ESC, the developing contractor was not requested to conduct a Task and Skill Assessment (TASA) to determine the precise tasks and skills required for training on TBMCS. Instead, the key tasks identified as training requirements from the legacy TASAs were deemed adequate to transfer to the TBMCS training development contract. Jonassen, Hannum and Tessmer (1989) stated that the TASA is probably the most important component of the ISD process. All future instructional strategies and decisions are based upon the results of the TASA. Thus, the quality of the task analysis determines the quality of instruction. Wolfe et al. (1991) stated that once job tasks are identified they must be prioritized to focus on key tasks that are most critical, difficult, and frequently used. Without an original TBMCS TASA, the developing contractor was required to provide training materials supporting all 2,140 tasks identified from the legacy TASAs. This decision is critical in understanding the direction of the training contract from its conception. This proved to be a poor decision that resulted in additional costs to the training contract.

4.2 THE COST OF PAPER-THE DESIGN PHASE

DOD I 5000.2 states that training for major weapon system components shall not be procured before the weapon system hardware and software design stabilizes. However, the software acquisition life cycle identified in AFI 63-123 requires prototypes, tests, and low rate initial production of C2 applications during a 6-18 month spiral development schedule. Each TBMCS spiral test requires hundreds of testers to be trained. As a result, training materials must be developed simultaneously with software development. This poses a significant problem for the training developer. Each time the software is modified there is an equal and parallel effort required in updating and distributing the training materials. Paper-based training materials for a large C2 system are costly. During the time of contract award in 1995 the estimated number of users (operators, system and network administrators) was approximately 2700. It was assumed at this time that all students would receive copies of all training materials (student materials, programs of instruction, and lesson plans). Figure 4.2-1 depicts the cost to produce one hard copy of the full set of TBMCS training materials

Cost of Paper Based Training Materials		
Paper-based Training Materials for Operators, System Administrators and Network Administrators	107 modules x 500 pages x.07 per page for reproduction * 2700 students	$10,111,500.00
Paper-based Program of Instructions (POIs) for Operators, System Administrators and Network Administrators	5 POIs x 60 pages x.07 per page for reproduction * 2700 students	$5,670,000.00
Paper Based Lesson Plans (LPs) for Operators, System Administrators and Network Administrators	5 LP x 60 pages x.07 per page for reproduction * 2700 students	$1,890,000.00
Total Paper-based Training Efforts		**$17,671,500.00**

Figure 4.2-1. The Cost of Paper

When training requirements are identified early in a program life cycle, development costs can be budgeted in incremental amounts over the life of the contract. The original cost estimate of TBMCS training material development and implementation was expected to be no greater than 10% of the overall software development effort. TBMCS training development costs upon contract conception in 1995 were anticipated to be $40 million dollars that were to be divided into progressive increments over the five-year contract. With an estimated $17 million in reproduction costs alone by 1997, ESC quickly realized that a major change in software functionality requiring updates and dissemination the training materials would seriously affect the TBMCS training development budget. Campbell and Bourne (1997) stated that at some point educators and trainers will use the web to reduce costs, increase quality and increase the rate of new knowledge and innovation about how to support learning—or disappear themselves. With the high cost of reproduction, it appeared the web—a technology that enables students to access materials in a timely manner without distribution costs—was the delivery mechanism of choice for TBMCS. By mid 1999, the TBMCS material conversion from MS Word to HTML was completed. Customers of this distributed training were anticipated to be 5,000 multi-service operators and system administrators who use TBMCS in their wartime duties. The goal was justifiable—users had immediate access to training material anytime, anywhere, and anyplace as required by Joint Vision 2010 and the DOD strategic plan/ADL initiative.

4.3 THE TECHNOLOGY CHASE-THE DEVELOPMENT PHASE

In theory, web-based training provides immediate access to training materials as the acquisition life cycle progresses, and the software is updated. Although the materials were completed and accessible to multi-service personnel anytime, anywhere, and anyplace, there were still unresolved problems. In developing TBMCS training materials, the "knee jerk" reaction of converting to HTML as a media selection without a technology assessment of supporting architecture was a serious problem, which ultimately led to the cancellation of the web site. Ely (2000) stated that the rush to jump onto the distance education bandwagon is understandable in light of several factors: (1) everyone is doing it, (2) the promise of income and/or savings, (3) the ubiquitous presence of computers and networks available for users, and (4) the number of users who are not being reached by conventional education. Conversely, McNabb (2000) stated that historically implementing technology for technology's sake without regard for how the use of the technology will be integrated with the curriculum has failed. She further stated that a lesson learned from past technology implementation efforts is that a technology needs assessment is as critical as a TASA.

Somewhere in the quest for technology and the desire to "hop on the web bandwagon", the TBMCS technology/infrastructure plan was forgotten. As users from worldwide locations attempted to access the materials, three problems became apparent. The first was accessing materials from remote locations, the second problem was "bandwidth" (the real end-to-end communications speed for users), and the third was local computer security initiatives hindering the use of the web server at user locations. These issues significantly affected the success of the distributed learning initiative. The number of server hops required by users in locations such as Korea, Hawaii, and Germany to access the Colorado server were so numerous that most attempts were timed out, students became frustrated and often quit before completing the training. To resolve the problem three additional servers were placed at worldwide locations to lessen the geographic distance between the clients and servers. This effort was completed in August 2000. The cost of this effort is shown in Figure 4.3-1.

Training Infrastructure for servers			
HW For Servers			
Distributed Servers	22,835.11	9	$205,516.00
Duplex Ultra 2 Chasis Upgrade			$427.00
Hot Plug Power Supply			$943.00
Prolieant 6000 Internal Drive Gage, SCSI-3			$298.00
Ram up-grades			$3,591.00
Redundant Fan Kit			$309.00
Smart Array 3200 Controller			$1,737.00
Laptops for MTTs	3,541.05	20	$70,821.00
Total HW for Severs			**$283,642.00**
SW For Servers			
Microsoft Windows NT 4.0 server doc kit, server license, service pack CD			$15,577.00
McAfee Anti-Virus v4.03			no cost
Netscape Navigator v4.07			no cost
Netscape security certificates		8	$2,000.00
Oracle Enterprise Edition v8i	12,444.00	9	$111,996.00
Plateau Enterprise v3.1		9	$172,750.00
WebTrends Professional Suite v4.0		8	$7,664.00
Misc Server SW			$1,023.00
Total SW for Servers			**$309,987.00**
Total HW/SW for Servers			**$821,368.00**

Figure 4.3-1. Infrastructure Costs

Bandwidth (response times for end users over the available communications path) was a great concern on the military bases containing the newly placed distributed servers. During an independent assessment conducted January through March 2001 by MITRE Corporation, with users initiating access via private internet service providers, access times to the training server at Hurlburt AFB in Florida were more than three times as slow as access times to the contractor's server in CO. In another specific test, simple "ping" commands were transmitted between the Colorado Springs, CO facility's training server and the corresponding server at Hurlburt AFB FL to assess the round trip communication time over the NIPRNET network. Round trip times were repeatedly documented as taking 10 seconds. Conversely, when simple "pings" were transmitted between civilian locations (MITRE's Bedford, MA facility through numerous routers, over a dedicated T3 communications line, to a server at the MITRE Washington, DC office) round trip times were 10 milliseconds. Plateau required Oracle replication of the student databases between locations. However, with the military facility NIPRNET infrastructure taking 1,000 times as long to accept and return simple ping transmissions, the feasibility of expanding database synchronization to a worldwide set of servers was judged to be very doubtful.

Student database transmission also requires ports in the firewalls to be accessible to exchange data. Local military base firewall policies hindered successful operation of the distributed servers. Security managers at certain locations would not allow Oracle database exchanges to occur through their firewall. Without an approved certification and accreditation package, distributed servers could not be used for training.

4.4 SUMMATIVE REVIEW OF THE IMPLEMENTATION—THE EVALUATION PHASE

The TBMCS C2 software system and associated web-based training was fielded October 2000 through June 2001 based upon System of Record (SOR) decision by the Joint Configuration Control Board (JCCB). Mobile Training Teams (MTTs) traveled to force level locations to facilitate the distributed training for the various system administrators, operators, and Perimeter Security System (PSS) network administrators. A preliminary evaluation was conducted October-December 2000 at the first four fielded locations. As users began to access the training materials, student feedback was negative due to scrolling text pages and lack of interactivity. This design defied many aspects of learning theory and web design. Nielson (1997) identified long scrolling pages as the sixth most common mistake in web design. He stated only 10% of users scroll beyond the information that is visible on the screen when a page comes up. All critical content and navigation options should be on the top part of the page. Moore (1989) defined interactivity in distance learning as: a) between the learner and the content; b) between the learner and the instructor; and c) between the learner and peers. TBMCS distributed training lacked all levels of interactivity. Results of the student End of Course (EOC) critiques, student achievement tests and focus groups are shown in Figure 4.4-1:

Location	Legacy Experience	TBMCS Experience	Satisfaction Means	Average Pre Test Scores Before Training	Average Post Test Scores After Training	Focus Group Comments
Shaw	50%	60%	74% overall 63% materials	61%	86%	Training lacked interactivity. Facilitators lacked operational knowledge of the system.
Osan	-	-	-	75%	89%	Training lacked interactivity. Facilitators lacked operational knowledge of the system.
Miramar	0%	23%	80% overall 75% material	52%	88%	Training lacked interactivity. Facilitators lacked operational knowledge of the system.
Elmendorf	38%	0%	72% overall 65% material	58%	89%	Training lacked interactivity. Facilitators lacked operational knowledge of the system.

Figure 4.4-1. Preliminary Feedback Distributed Learning

Although the data was preliminary, the EOC critiques suggest that the students were not "satisfied" with the concept of self-paced distributed learning with little human interaction; however, pre-/post-test scores revealed that students understood facts and concepts, which suggests that knowledge "achievement" resulted from the training. To better understand why the user satisfaction was low, ESC focus groups were conducted with the students at the training events. The largest single improvement the users wanted to see was facilitator-led interactivity with the "TBMCS system" versus the "TBMCS training materials". Students believed training would be greatly enhanced if they had facilitator-led, hands-on exercises versus facilitating web-based training. User perception weighs heavily on ESC training acquisition strategy. Although distributed learning environments are dictated by DOD policy, user preferences are for MTTs.

This requirement was identified to the TPT for validation. ESC was requested to a) enhance the web-based training by adding interactivity, and b) shift from a distributed learning environment back to a traditional instructor-led, "hands-on" approach to training. The type of interaction chosen was between the "learner and the content". Roblyer and Ekhaml (2000) defined this type of interaction as "reciprocal events requiring two objects and two actions". They identified an instructional goal of interaction as encouraging reflection and/or discussion on course topics and concepts by utilizing instructional design to increase the participation and feedback. The tool of choice to implement interactivity for the TBMCS training materials was Macromedia's Dreamweaver. Vora (1998) stated What You See is What You Get (WYSIWYG) editors function like word-processing or desktop publishing programs, allowing authors to lay out pages as they want, and the WYSIWYG editors write the necessary HTML code in the background. The updated training materials were posted on the web server in June 2000. Technology insertion/conversion efforts include new hardware, software and training. Cost for the Hardware/Software (HW/SW) material updates are shown in Figure 4.4-2.

	Cost Per Unit	*Number of Units*	*Total*
Development & Integration			
HW For 46 training developers	2,065.00	46	**$94,990.00**
SW For training developers			
Web Trends	499.00	46	$22,954.00
Astra Site Manager	499.00	46	$22,954.00
Dreamweaver HTML Editor & Course Builder	722.00	46	$33,212.00
Replacement SW from Unix to PC			$25,168.00
Paint Shop	46.00	46	$2,116.00
Total SW For Servers			**$106,404.00**
Total Development & Integration costs for infrastructure			***$201,394.00***

Figure 4.4-2. Cost to Upgrade HW/SW and Skill Training

Facilitator-led Practical Exercises (PEs) were added to the course curriculum to fulfill the requirement for instructor-led, hands on. Instructors who participated in the earlier fielding gained valuable insight into the user requirements. An important discovery was that not all operators (operations, plans, intelligence) required training on all products. PEs were designed to focus on duty positions and job tasks within the AOC. This allowed a clearer division to be made between the training provided within the AOC cells. The tasks and skills that were used most frequently were identified as candidates for facilitator-led PEs.

4.5 TBMCS 1.0.1 ¾ FIELDING AND TRAINING PROCESS

The primary objective of TBMCS training is to attain and maintain the capability to operate and administer the system. A secondary objective is to develop advanced skills that facilitate increased effectiveness of the system. These objectives are met through type-1 training. AFI 36-2201 identifies type-1 training as "contract training" or "factory training" that AETC arranges for Air Force and other DOD personnel and contractors to conduct at either the contractor's location or a DOD facility. Due to large numbers of geographically dispersed personnel requiring TBMCS training, surge training of 100 percent of the TBMCS user population was not economically or physically possible. Thus, a train-the-trainer philosophy was chosen and approved by the Joint Air Operations (JAO) Training Planning Team (JAOTPT). Initial train-the-trainer training for TBMCS 1.0.1 was provided for personnel with previous legacy system experience. In theory, this approach provides training to a core cadre of personnel from all locations, which then relied on those students to train remaining unit personnel through On-the-Job-Training (OJT).

Limited initial cadre training was provided to operators and system administrators via MTTs at selected regional sites worldwide based on the train-the-trainer concept. Training was targeted for experienced legacy operators and system administrators. The degree of training was constrained to differences between the SOR of the legacy systems and TBMCS 1.0.1. A fielding decision + 300 days was anticipated for the services to complete installation, training, system accreditation, OJT, and system cutover. Type-1 training for system administrators and operators began at selected locations 30 days after the SOR decision. System administrators were trained on TBMCS installation processes by means of loading and configuring a training suite. Upon successful build of the training suite, operators were then provided hands-on training on the training suite. Type-1 training also included PSS installation and training for network administrators, and exercise support for operators. Training was fielded as shown in Figure 4.5-1.

Day + x From Fielding Decision	Duration of Event	Event	Comment
0	--	Fielding Decision	
30	100 day total	SW Kit distribution	This is only first SW shipment
30	180 day total 10 days ea site 5 days ea site 3-5 days ea site	Type-1 Training (Build Training Suites and Conduct Initial Operator Training Sys Ad Operator PSS	Sys Ad and Operator to be scheduled sequentially
100	--	S/W delivered to all locations	SW Kits completed
210	--	Type-1 Training Completion	
210	Units are given 90 days as part of fielding to complete OJT	Begin OJT	
300	--	Complete OJT	
300	--	System Ready for Cutover	

Figure 4.5-1. Training Process

TBMCS System Administrator Training—consisted of two weeks of lectures and hands-on installation training facilitated by two MTT SysAds. As part of the training, MTTs provided guidance as the SysAds loaded the TBMCS software. On completion of training, trainees are expected to assist in establishing a training program to train remaining unit SysAds. All users will maintain proficiency through OJT or other subsequent training.

TBMCS Force Level Operator Training¾consisted of five days of MTT facilitator-led practical exercises augmented by web-based training. MTTs consisted of one plans, one operations, and one intelligence trainers at regional locations. During this time services were encouraged to utilize local Subject Matter Experts (SMEs) to assist with the training. Due to the complexity of the TBMCS system it was advantageous to have SMEs knowledgeable in local doctrine/mission orientation to assist personnel being trained.

This training focused on the functionality required to perform joint air operations in the AOC and consisted of three separate tracks. Service training representatives separated students into operations, plans, and intelligence tracks. The tracks focused on a job specific/tasked based approach as follows:

Force Level Combat Operations ¾ Specific positions within the operations cell were grouped together into the following training categories that focused the training on applications and concepts of employment required to perform their positional duties in an AOC. Force-level combat operations training tasks were mirrored with their respective TBMCS application with supporting operations checklists to assist operators.

- Director/Chief Combat Operations (DCO/CCO), Deputy CCO, and Senior Offensive Duty Officer (SODO)
- Offensive Duty Officer
- Time Sensitive Targeting/Time Critical Targeting
- Defensive Duty Officer
- Air Tasking Order Replanning
- Weather
- Reports
- Airspace

Force Level Combat Plans ¾ Specific positions within the plans cell were grouped together into the following training categories that focused the training on applications and concepts of employment required to perform their positional duties in an AOC. Force-level combat plans training tasks were mirrored with their respective TBMCS application with supporting plans checklists to assist operators.

- Chief Combat Plans/Deputy Chief Combat Plans
- Air Tasking Order Production
- Air Tasking Order Planner
- Air Tasking Order MAAP Development
- Airlift
- Airspace

Force Level Combat Intelligence**—**Specific positions within the intelligence cell were grouped together into the following training categories that focused the training on applications and concepts of employment required to perform their positional duties in an AOC. Force-level combat intelligence training tasks have been mirrored with their respective TBMCS application with supporting intelligence checklists.

- Analysis Cell
- Operations Intelligence

- Imagery Intelligence
- ELINT/Analyst
- Data Base Manager
- Plans Intelligence
- Combat Assessment
- Targeteer/Plans
- ATO Execution Intelligence
- ELINT/ATO Execution
- Targeteer/ATO Execution
- Analyst/ATO Execution

Perimeter Security System Training—PSS training consisted of two weeks of SW training and installation of the PSS HW. PSS is the security enclave embedded in TBMCS. MTTs assisted the network administrators in installing the PSS HW, and provided briefings on the individual components (external routers, virtual private network, safenet enterprise management components, and internal routers) that comprise the PSS for TBMCS.

5.0—DATA GATHERING

The purpose of this section is to describe the:

- Research questions answered in this study
- Population of this study
- Evaluation model used in this study
- Instruments used to collect data relevant to the study
- Procedures used to collect the data

Due to the numerous training baseline changes conducted during the overall software development evolution and the inconsistencies of data collection this study did not lend itself to a hypothesis testing approach. Instead, an exploratory research methodology was chosen to support the research questions.

5.1 RESEARCH QUESTIONS

- *Research Question 1*: Were the majority of students satisfied at the completion of training?
- *Research Question 2:* Will there be a difference in the students test scores after completing the training?
- *Research Question 3*: Will users be confident in their ability to perform key tasks upon completion of the training?
- *Research Question 4:* Is there a correlation between user experience and EOC satisfaction?
- *Research Question 5:* Will the students perceive the facilitator as knowledgeable about the course content?
- *Research Question 6:* Will students perceive that the course covered the key TBMCS skills specific to their work center?
- *Research Question 7:* Will students perceive that their units provided a workspace that supported a successful training environment?

5.2 STUDENT POPULATION

Upon system fielding, the total TBMCS user population is anticipated to be 5,000 multi-service system administrators, operators and network administrators. The train-the-trainer methodology trained a limited cadre of approximately 800 with MTTs at 21 locations. The trainees are geographically dispersed throughout multiple locations in the Continental United States (CONUS), and Pacific and European countries. AFI 131-AOC, Volume 3, identifies the duty positions associated with the force-level operation of an air operations system. TBMCS operators, system administrators, and network administrators include contractors, military enlisted personnel, and officers. Students are both female and male, and range in age from 20-45 years with various educational backgrounds and experience levels. Training was conducted at the students home station.

A force-level operator course, a system administrator course and a PSS course were taught at 21 locations. The total Trained Personnel Requirement (TPR) is better understood based upon focus group discussions and System Program Office (SPO) observation during fielding. TPR for total joint operators is approximately 1350, joint system administrators is 300, and joint network administrators is 100.

5.3 DATA COLLECTION MODEL

The reason for evaluation is to determine the effectiveness of a training program. When the evaluation is done, we can hope that the results are positive and gratifying, both for those responsible for the program and for upper-level managers who will make timely decisions based on evaluation results. To demonstrate the effectiveness and value of the TBMCS distributed training program, Kirkpatrick's theory of evaluation was used. The following theories were evaluated prior to selecting a model:

- Kirkpatrick's Theory of Evaluation
- Stufflebeam' CIPP model
- Stakes Countenance Model
- Sanders and Nifziger Checklist
- Gowin and Millman QUEMAC model
- Worthen and Sanders - Scriven's MEC (meta-evaluation checklist)

Kirkpatrick's model was designed for practitioners in the training field who plan, implement, and evaluate training programs. It was primarily chosen over the other models due to high usage rates, and validity for use by industry and Government. Figure 5.3-1 shows the Kirkpatrick IV Levels of Evaluation.

Level	Evaluation	Explanation	TBMCS Data Gathering
I	Reaction	Assesses participants' initial reactions to a course. This in-turn, offers insights into participants satisfaction with a course, a perception of value.	A questionnaire was used to gather quantitative data. A focus group was conducted to gather qualitative data
II	Learning	Assesses the amount of information that participants learned.	A knowledge-based pre- and post-test was used to assess the amount of information learned.
III	Transfer	Assesses the amount of material that participants actually use in everyday work after taking the course.	Students were asked to rate their ability to perform key tasks after training
IV	Business Results	Assesses the financial impact of the training course on the bottom line of the organization six months to two years after course completion.	Collecting data to identify experience levels, turnover rates, changing experience levels during test, and operational readiness inspection results is a longitudinal study not included in this report.

Figure 5.3-1. Kirkpatrick IV Levels of Evaluation

5.4 INSTRUMENTATION

Overall data was gathered using four collection methods:

- Surveys
- Focus Groups
- Pre-/Post-tests
- Student Self Assessment

5.4.1 Survey

Instructors were tasked to prepare an EOC survey to collect data on the effectiveness of the training program. This survey can be found in Appendix 1 of this document. The specific objectives of the survey were to obtain:

- valuable feedback to help evaluate the program
- comments and suggestions for improving the program
- quantitative information that can be used to establish standards of performance for future programs as explained in Kirkpatrick's Level I Evaluation-Reaction
- quantitative feedback to be used with the survey to validate user satisfaction as explained in Kirkpatrick's Level I Evaluation-Reaction

5.4.1.1 Data Gathering Procedures of the Survey

At the beginning of training, MTT facilitators requested students to annotate their reactions to training on an EOC critique. The students were informed of the location of the critique and encouraged to document their comments throughout the duration of the course. Instructors informed students that their input provides feedback on the effectiveness of the course and their comments/suggestions help to plan future courses to meet the students' needs and interests. At the end of the course, MTT facilitators again informed students of their obligation to provide feedback as to the effectiveness of the TBMCS training.

5.4.2 Focus Group

Focus groups are moderated group discussions designed to encourage free-flowing disclosures between students. TBMCS focus groups included ESC training representatives and students. Focus groups collect qualitative data and offer rich insights into the subject matter. Group dynamics and shared ideas provide results not obtainable from other research methods.

Specific objectives of this focus group were to:

- Obtain qualitative feedback to be used with the Survey to validate user satisfaction as explained in Kirkpatrick's Level I Evaluation-Reaction
- Identify a) user expectations, b) the satisfaction level, c) problems occurred, and d) areas for improvement.

5.4.2.1 Data Gathering Procedures of the Focus Group

1. The TBMCS training representative met with the instructors whose classes where selected for the study to introduce the project as well as to inform the instructor what questions were to be asked during the focus group.
2. TBMCS training was given to all students, thus the focus group included all students participating in the course. MTT facilitators were asked to leave the room.
3. The TBMCS training representative met with the students and asked: a) what their learning expectations were, b) to provide feedback on the course, and c) to provide areas for improvement (if any) for follow-on courses. These questions were open ended to allow for student collaboration amongst the group.

5.4.3 <u>Pre -test</u>

Standardized tests are designed to fairly measure student achievement in different academic subjects. TBMCS test questions supporting training objectives were originally identified in the design phase as the TBMCS training material was developed.

The specific objectives of the pre-test were to:

- obtain initial data to compare with the post-test to validate the transfer of knowledge as explained in Kirkpatricks Level II Evaluation–Learning
- Help instructors determine the strengths and needs of students in order to work with them to improve their individual academic skills
- Provide information to instructional designers to help determine how well training assisted users in learning

5.4.3.1 Data Gathering Procedures of the Pre-Test

1. ESC met with the instructors whose classes were selected for the study to introduce the project as well as to verify how the instructor will administer the instrument.
2. MTT facilitators administered computer-generated pre-tests to all the students participating in the course.
3. Answers to pre-test questions were collected electronically for each student involved in TBMCS training.

5.4.4 <u>Post-test</u>

At the completion of training, the pre-test, administered prior to the training, was re-administered as a post-test to all students to determine if the students' knowledge had improved.

The specific objectives of the survey were to:

- Correlate pre- and post-test scores to validate if a learning transfer took place as explained in Kirkpatrick's Level III–Learning

5.4.4.1 Data Gathering Procedures of the Post-test

The same procedure followed during the pre-test was followed to administer the post-test.

5.4.5 Self-Assessment

The self-assessment allows the instructors to gain an awareness of the confidence a student has in their ability to complete key tasks. It is not necessarily an accurate evaluation of an individual's ability, but does indicate how confident the training has left them. It is an indirect indication of satisfaction with the training and how well they learned what was taught. A likert scale of 1-5 was utilized. 1=Can't perform; 2=Perform with over-the-shoulder assistance; 3=Perform with only on-line help; 4=Perform without assistance; 5=Did not attempt task. Questions identified in the self-assessment are shown as appendix 2. Specific objectives of the self-assessment were to:

- determine the extent to which a change in behavior occurred because of the training as explained in Kirkpatricks Level III Evaluation-Behavior
- determine students perceived ability to complete tasks after training
- help instructors determine the strengths and needs of students
- assist students in improving their individual academic skills
- assist in predicting if a change in behavior will occur during the first opportunity to utilize the skill set

5.4.5.1 Data Gathering Procedures of the Self Assessment

- Upon completion of training, paper copies of the rating form were distributed to the students.
- Rating forms identify key tasks. Students were asked to annotate how much assistance they thought they needed to perform each task

6.0 ¾ PRESENTATION OF DATA

The EOC survey contains 30 questions for each of the operator, system administrator and network administrator courses. Individual responses for all 30 survey questions for operator, system administrator, and PSS courses are not listed in this report due to size and length of files. Instead, only the responses to questions that assist in determining the effectiveness of the training and those that directly answer the SPD's stated research questions are presented. In particular, responses to the following are reported:

- amount of TBMCS experience
- amount of Legacy experience
- facilitator's knowledge of the overall course
- course provided training necessary to enable students to complete the TBMCS software application tasks specific to their work center.
- overall the course met expectations
- length of course was appropriate
- classroom environment

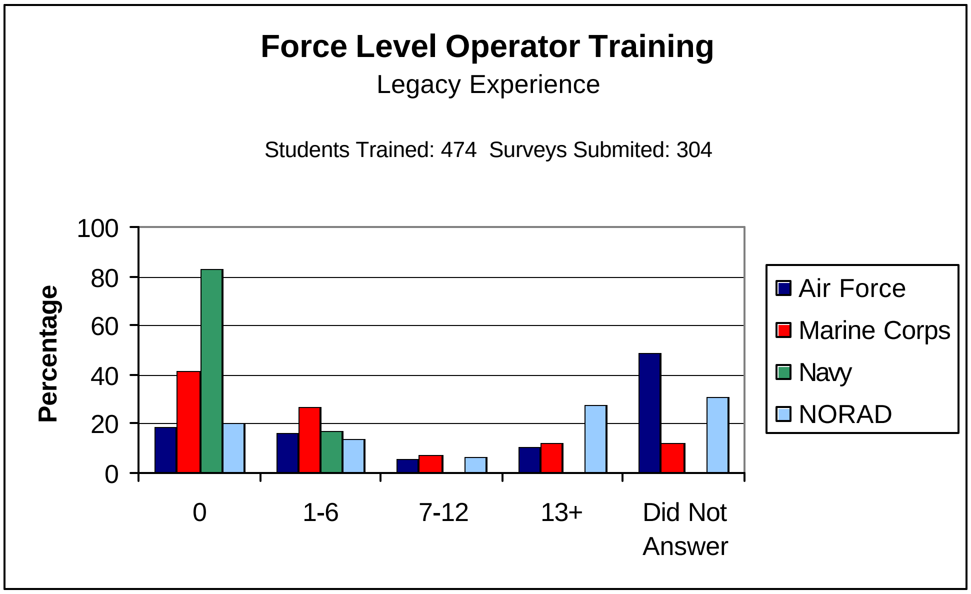
6.1 TOTAL FORCE LEVEL OPERATORS

A sample of n = 293 for Air Force, force-level operators participated in the courses. A total of 148 Air Force surveys were received. Response rate was 50%. A sample of n = 146 Marine force-level operators participated in the courses. A total of 124 Marine surveys were received. Response rate was 84%. A sample of n = 6 for Navy force-level operators participated in the courses. A total of 6 Navy surveys were received. Response rate was 100%. A sample of n = 29 for NORAD force-level operators participated in the courses. A total of 20 surveys were received. Response rate was 69%. Total multi-service course participation was 474. Total multi-service response rate was 63%. This is a sufficient response rate for this report.

6.1.1 Force Level Operator Responses to Surveys

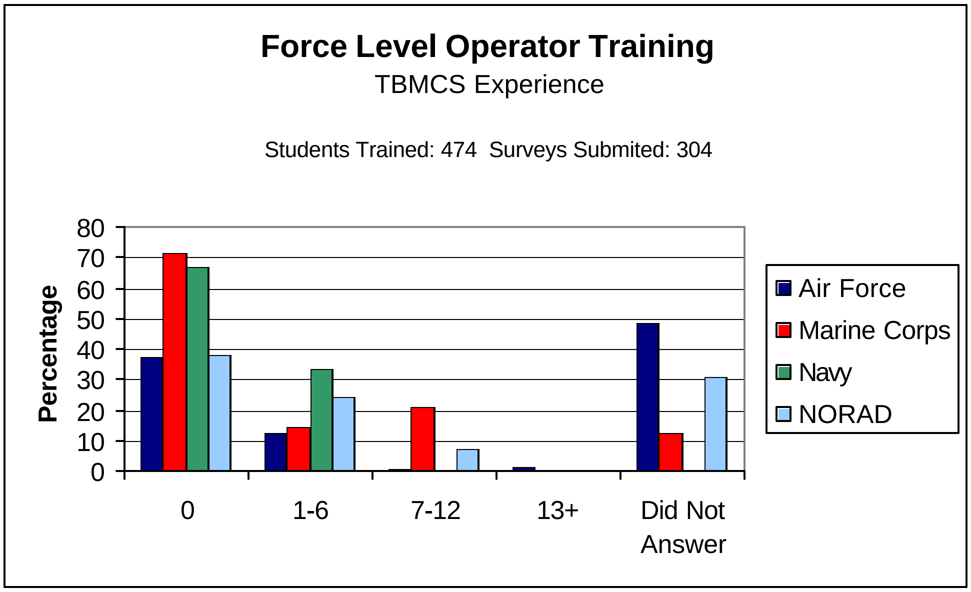
Tables 6.1-1 through 6.1-9 represent operator responses to survey questions

Table 6.1-1. TBMCS Multi-Service Responses for Legacy Experience



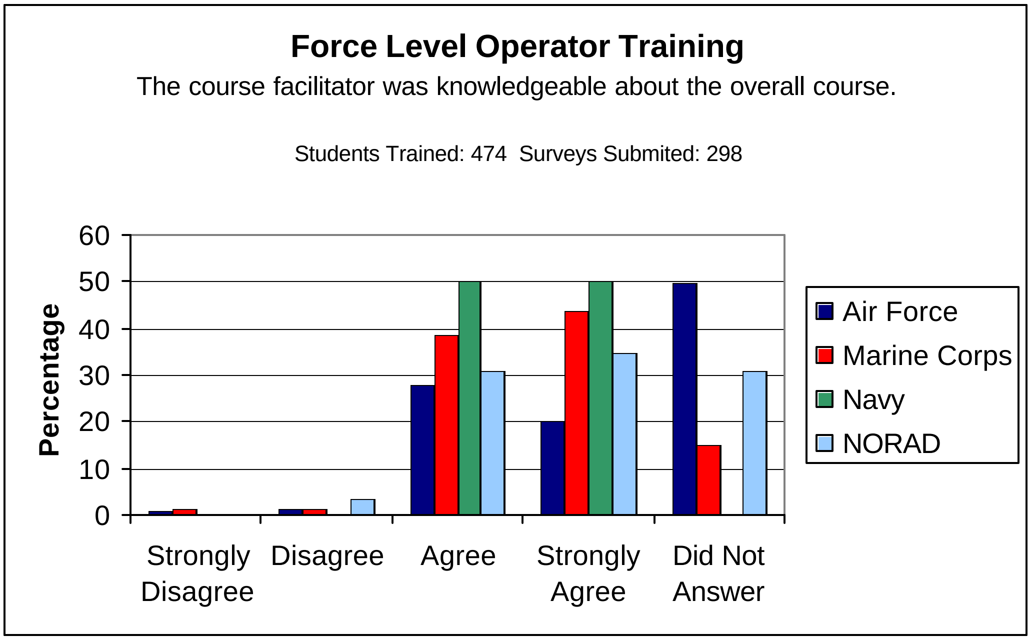
Note: Table 6.1-1 reveals operator legacy experience. An average of 23.02% of the students did not respond to this question. An average of 41% of the students had no legacy operator experience. An average of 18.3% of the students possessed 1-6 months legacy experience. An average of 5.05% of the students possessed 7-12 months legacy experience. An average of 12.54% of the students possessed over 13 months legacy experience. With a cumulative total of 64.35 % of students who possessed less than 12 months legacy experience compared to 12.54% of students who did possess legacy experience it is apparent that most students did not meet the minimum course prerequisite of one year legacy experience prior to attending the course.

Table 6.1-2. TBMCS Multi-Service Responses for TBMCS Experience



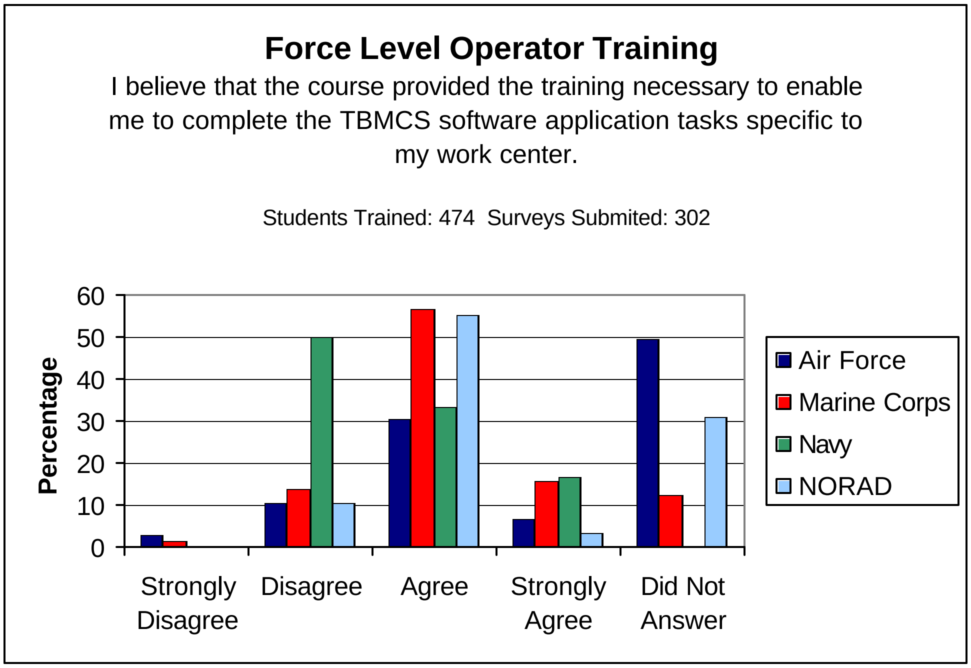
Note: Table 6.1-2 reveals operator TBMCS experience. An average of 23.02% of the students did not respond to this question. An average of 53.2% of the students had no TBMCS experience. An average of 21.02% of the students possessed 1-6 months TBMCS experience. An average of 7.01% of the students possessed 7-12 months legacy experience. An average of .25% of the students possessed over 12 months TBMCS experience. With a cumulative total of 81.23 % of students who possessed less than 12 months TBMCS it is apparent that most students did not meet the minimum course prerequisite of one year TBMCS experience prior to attending the course.

Table 6.1-3. TBMCS Multi-Service Responses for Facilitator Knowledge



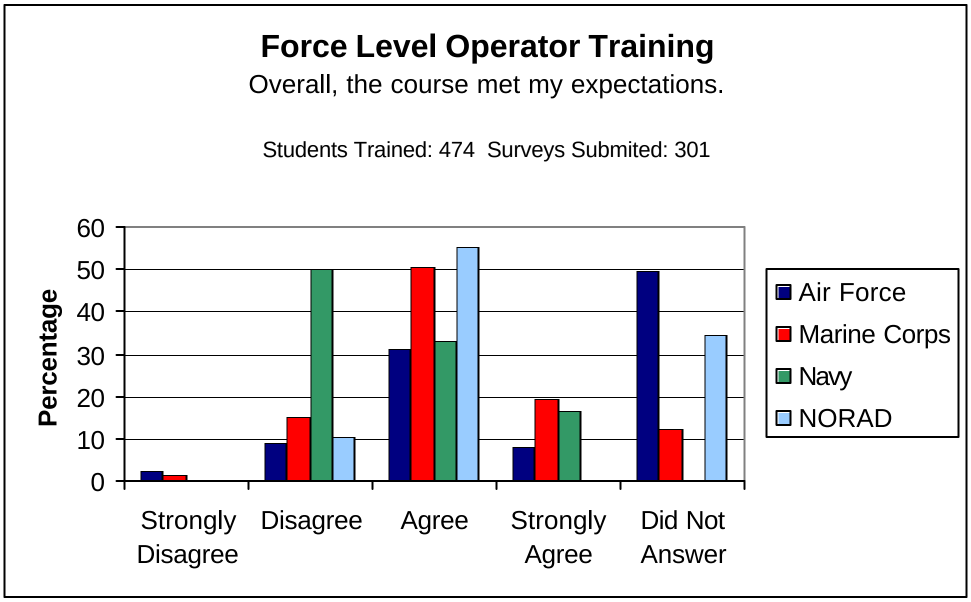
Note: Table 6.1-3 reveals force level operator perceptions regarding facilitator knowledge about the overall course. An average of 31.8% of the students did not respond to this question. An average of 37.1% of the students strongly agreed that the facilitator was knowledgeable of the overall course. An average of 36.8% of the students agreed that the facilitator was knowledgeable of the overall course. An average of 1.2% strongly disagreed that the instructor was knowledgeable of the overall course. An average of 2.6% disagreed that the instructor was knowledgeable of the overall course. With a cumulative total of 73.9% of students who strongly agree or agree that the instructor was knowledgeable about the subject matter versus a cumulative total of 3.2% of students who strongly disagree or disagree that the instructor is knowledgeable about the overall course, this information suggests that the students perceived the course instructors to be highly knowledgeable of the course content.

Table 6.1-4. TBMCS Multi-Service Responses for TBMCS Work Center Training



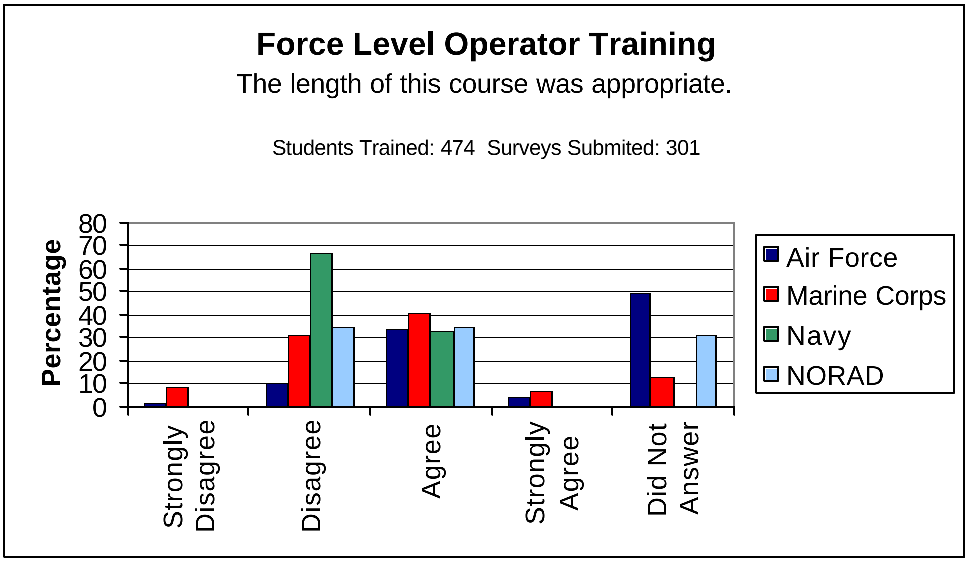
Note: Table 6.1-4 reveals force level operator perceptions regarding TBMCS training applicability specific to an operator's duty center. An average of 23.2% of the students did not respond to this question. An average of 10.6% of the students strongly agreed that the training provided was specific to their duty center. An average of 44.02% of the students agreed that the training provided was specific to their duty center. An average of 1.02% strongly disagreed that the training provided was specific to their duty center. An average of 21.15% disagreed that the training provided was specific to their duty center. With a cumulative total of 54.62% of students who strongly agree or agree that the training provided was specific to their duty center versus a cumulative total of 22.17% of students who strongly disagree or disagree that that the training provided was specific to their duty center, this information suggests that most students perceived that the training provided was specific to their duty center.

Table 6.1-5. TBMCS Multi-Service Responses for Course Expectation



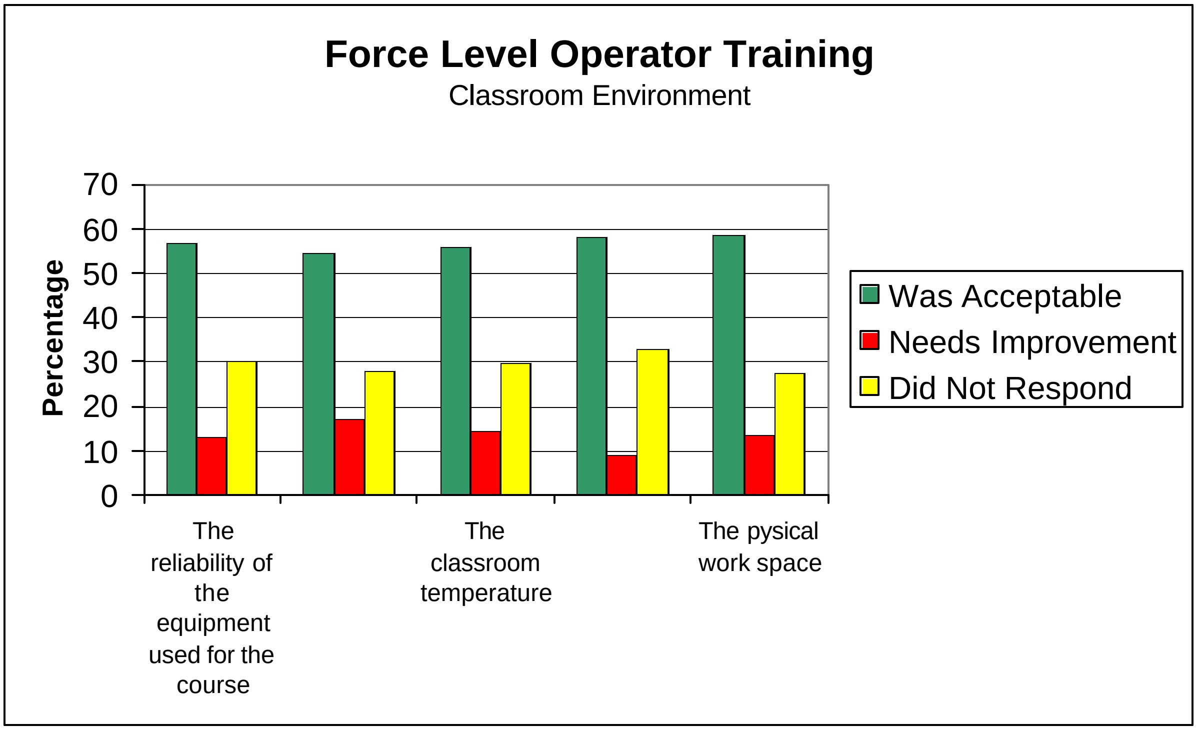
Note: Table 6.1-5 reveals force level operator expectations about the overall course. An average of 24.07% of the students did not respond to this question. An average of 10.92% of the students strongly agreed that their course expectations were met. An average of 42.65% of the students agreed that their course expectations were met. An average of .95% strongly disagreed that their course expectations were met. An average of 21.07% disagreed that their course expectations were met. With a cumulative total of 53.57% of students who strongly agree or agree that their course expectations were met versus a cumulative total of 22.02% of students who strongly disagree or disagree that their course expectations were met, this information suggests that most students perceived that their course expectations were met.

Table 6.1-6. TBMCS Multi-Service Responses for Course Length



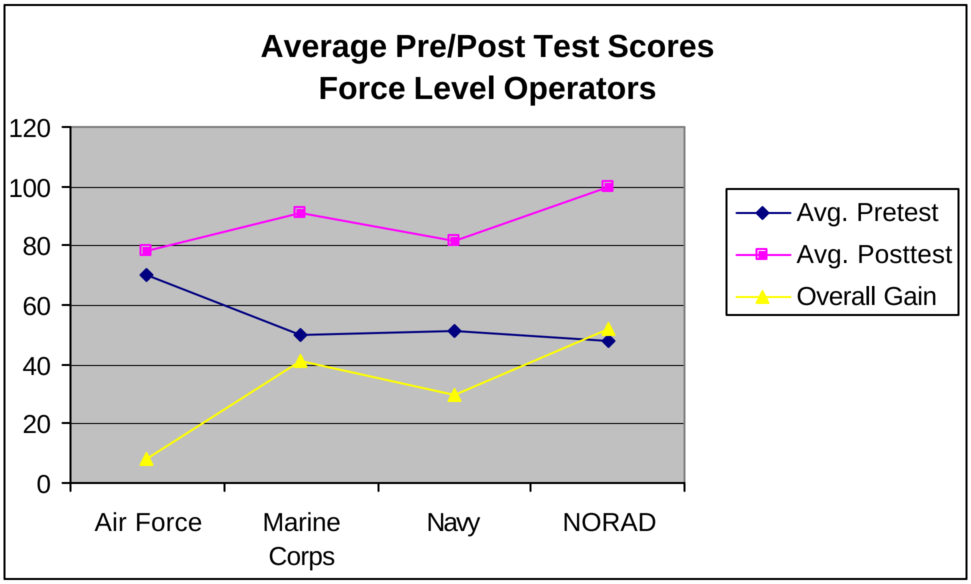
Note: Table 6.1-6 reveals force level operator perceptions about the overall course length. An average of 23.37% of the students did not respond to this question. An average of 2.72% of the students strongly agreed that the length of the course was appropriate. An average of 35.67% of the students agreed that the length of the course was appropriate. An average of 2.55% strongly disagreed that the length of the course was appropriate. An average of 35.67% disagreed that the length of the course was appropriate. The cumulative total of 38.39% of students who strongly agree or agree that the length of the course was appropriate versus a cumulative total of 38.22% of students who strongly disagree or disagree that the length of the course was appropriate suggests that there was equal "disagreement" on the course length, thus the length of the course should be reviewed prior to the next fielding.

Table 6.1-7. TBMCS Multi-Service Responses for Class Environment



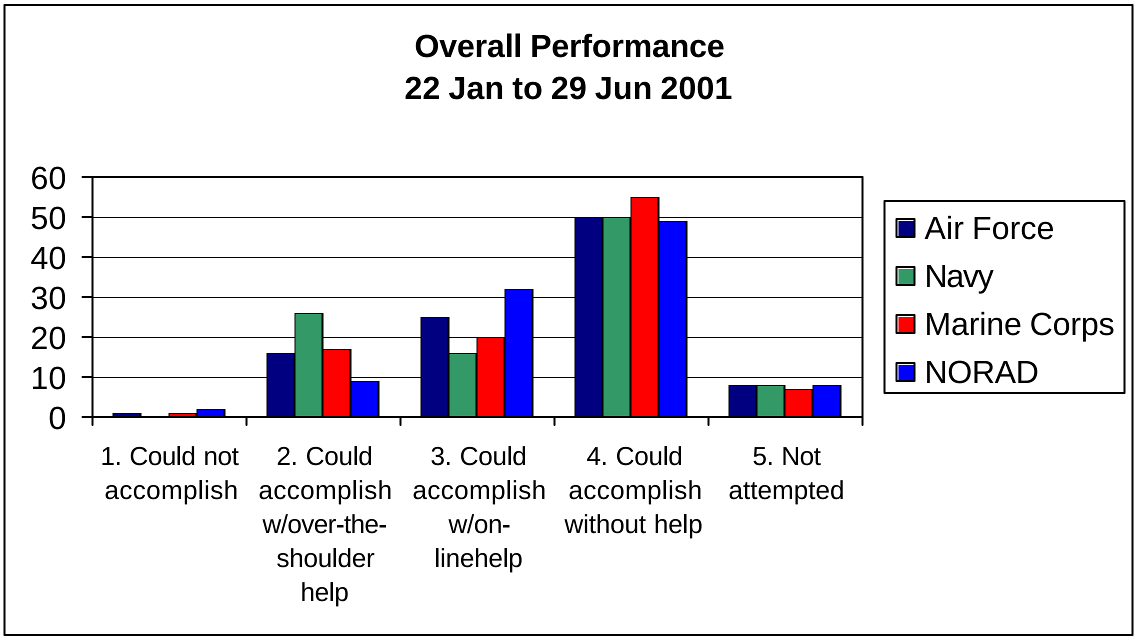
Note: Table 6.1-7 reveals force level operator perceptions about the course environment (equipment, network connection, temperature, noise level, and work space). An average of 29.84% of the students did not respond to this question. An average of 56.74% of the students agreed that the course environment was acceptable. An average of 13.54% of the students agreed that the course environment needed improvement.

Table 6.1-8. TBMCS Multi-Service Responses for Pre/Post Test



Note: Table 6.1-8 reveals differences between service pre and post test scores. AF averaged an 8% increase, MC averaged a 41% increase, Navy averaged a 30% increase, and NORAD averaged a 52% increase. Cumulative pre test average was 54.87%. Cumulative post test score was 87.62%. Cumulative average gain was 32.7%. Student test questions are identified as learning objectives as the course is designed. With all students shifting from a below average score (<75%) to above average it can be presumed that learning objectives were met as a result of the instruction.

Table 6.1-9. TBMCS Multi-Service Responses for Force Level Operator Self Assessment



Note: Table 6.1-9 reveals operator self-assessment data. A sample of n = 248 total students participated in the operator course. Total ops/plans key tasks evaluated = 66. Total possible responses = 16,949. Total responses received = 7,645. Response rate = 45%. Of the 45% who responded, 1.4% stated they could not accomplish the tasks, 15.3% stated they could accomplish with over-the-shoulder help, 24.1% stated they could accomplish with on-line help, 52% stated they could accomplish without help, and 7.3% did not attempt the task. With 76.1% stating that they could accomplish the tasks by themselves versus 1.4% who stated they could not accomplish the task, this information suggests that a significant portion of the operators can use TBMCS independently.

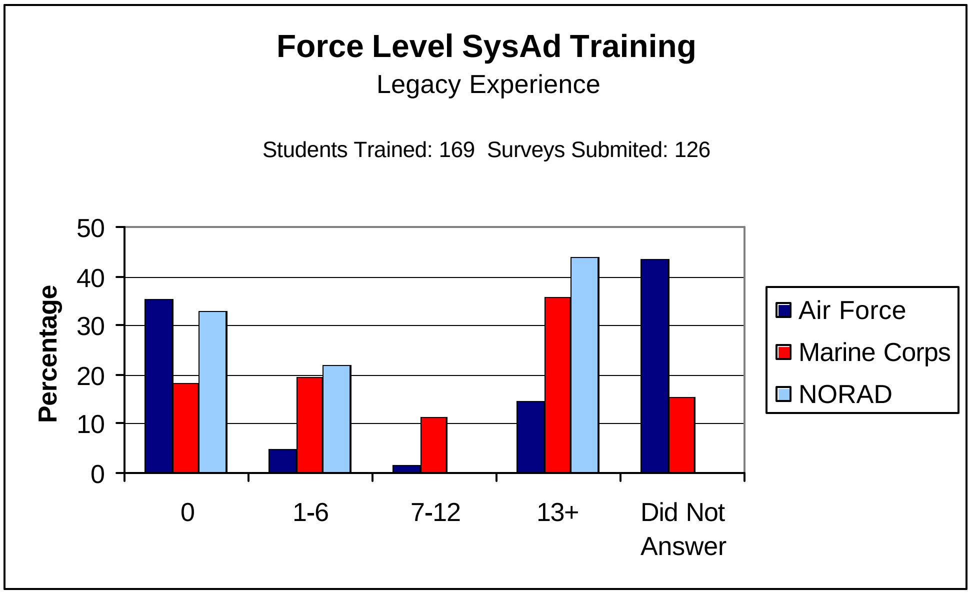
6.2 SYSTEMS ADMINISTRATOR

A sample of n = 62 for AF force level system administrators participated in the courses. A total of 35 AF surveys were received. Response rate was 56%. A sample of n = 98 Marine force level system administrators participated in the courses. A total of 82 Marine surveys were received. Response rate was 84%. A total of n=9 NORAD force level system administrators participated in the courses. A total of 9 surveys were received. Response rate was 100%. Navy force level system administrators did not participate in the courses.

6.2.1 System Administrator Responses to Surveys

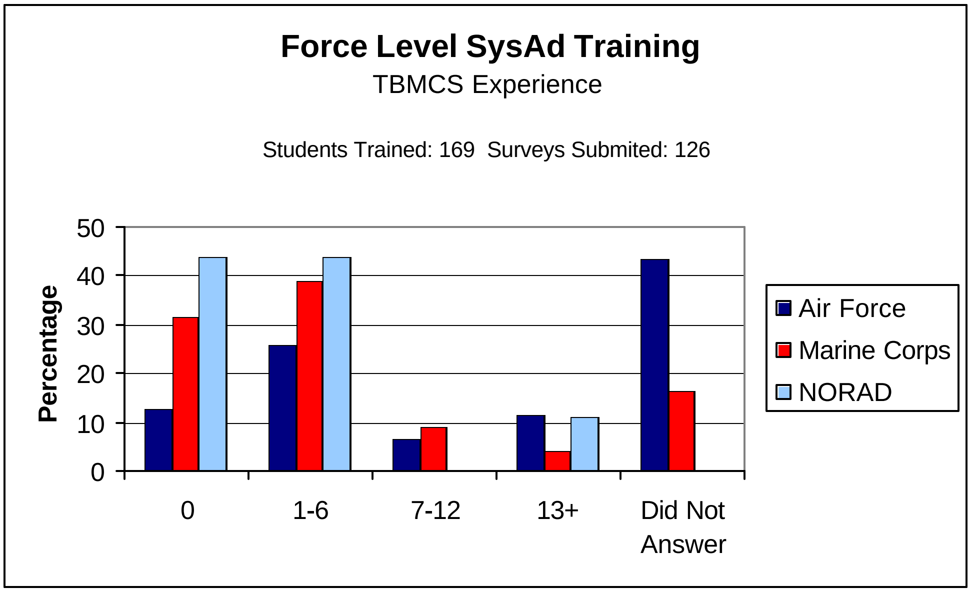
Tables 6.2-1 through 6.2-8 represent system administrator responses to survey questions.

Table 6.2-1. TBMCS Multi-Service Responses for Legacy Experience



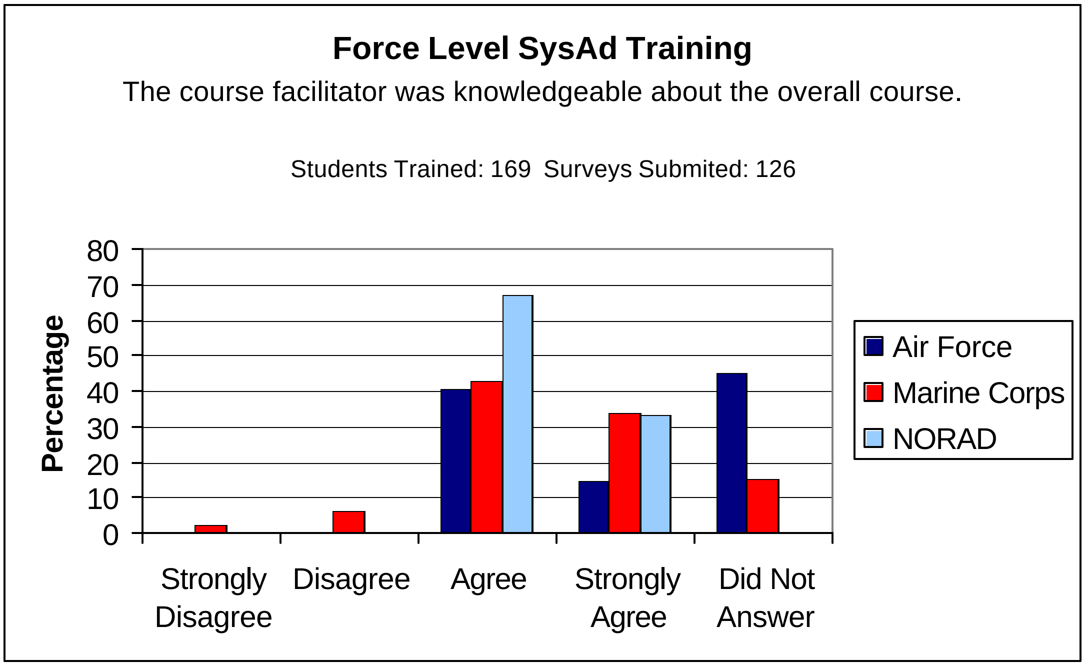
Note: Table 6.2-1 reveals system administrator legacy experience. An average of 19.6% of the students did not respond to this question. An average of 28.96% of the students had no legacy system administrator experience. An average of 15.4% of the students possessed 1-6 months legacy experience. An average of 4.26% of the students possessed 7-12 months legacy experience. An average of 31.43% of the students possessed over 12 months legacy experience. With a cumulative total of 48.96 % of students who possessed less than 12 months of legacy experience compared to 28.96% of students who possessed more than12 months of legacy experience it is apparent that most students did not meet the minimum course prerequisite of one year legacy experience prior to attending the course.

Table 6.2-2 TBMCS Multi-Service Responses for TBMCS Experience



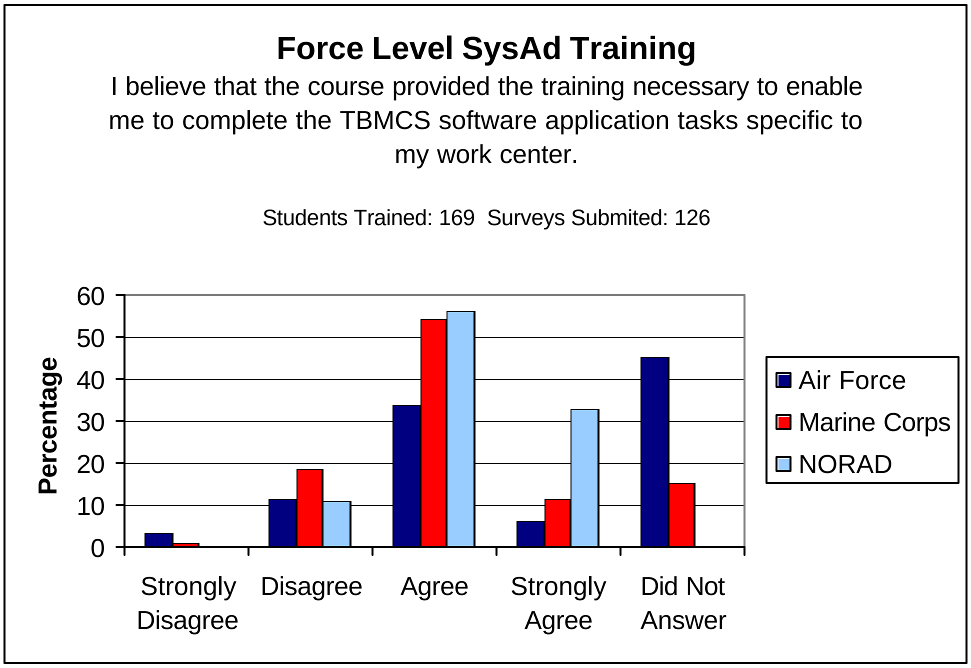
Note: Table 6.2-2 reveals system administrator TBMCS experience. An average of 19.93% of the students did not respond to this question. An average of 29.5% of the students had no TBMCS experience. An average of 36.2% of the students possessed 1-6 months TBMCS experience. An average of 5.23% of the students possessed 7-12 months legacy experience. An average of 8.8% of the students possessed over 12 months TBMCS experience. With a cumulative total of 70.93 % of students who possessed 0-12 months TBMCS experience compared to 8.8% of students who possessed more than 12 months TBMCS experience it is apparent that most students did not meet the minimum course prerequisite of one year TBMCS experience prior to attending the course.

Table 6.2-3. TBMCS Multi-Service Responses for Facilitator Knowledge



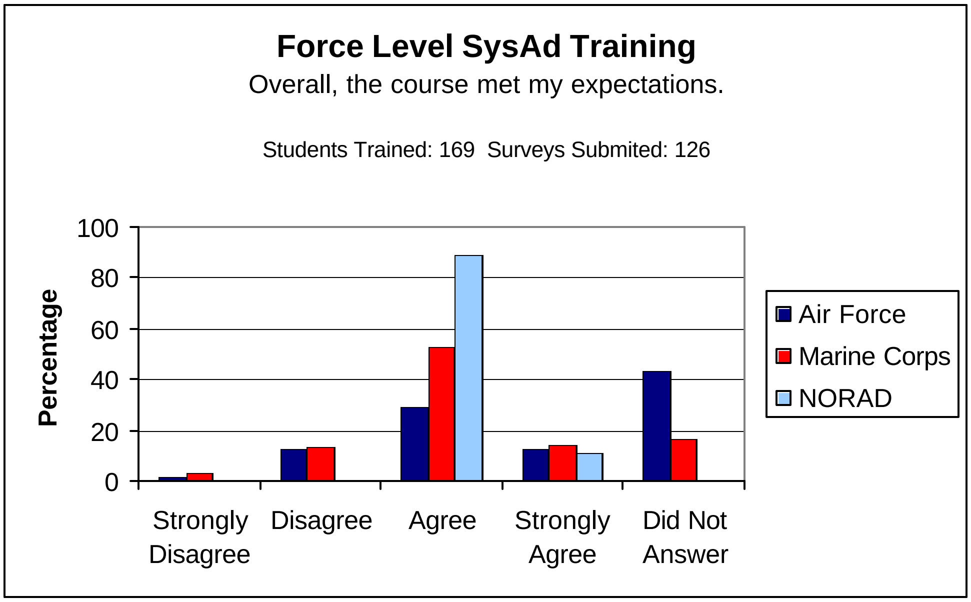
Note: Table 6.2-3 reveals system administrator perceptions regarding facilitator knowledge about the overall course. An average of 20.16% of the students did not respond to this question. An average of 27.06% of the students strongly agreed that the facilitator was knowledgeable of the overall course. An average of 50.06% of the students agreed that the facilitator was knowledgeable of the overall course. An average of .6% strongly disagreed that the instructor was knowledgeable. An average of 2.03% disagreed that the instructor was knowledgeable. With a cumulative total of 77.12% of students who strongly agree or agree that the instructor was knowledgeable about the subject matter versus a cumulative total of 2.63% of students who strongly disagree or disagree that the instructor was knowledgeable about the overall course, this information suggests that the students perceived the course instructors to be highly knowledgeable of the course content.

Table 6.2-4. TBMCS Multi-Service Responses for Work Center Training



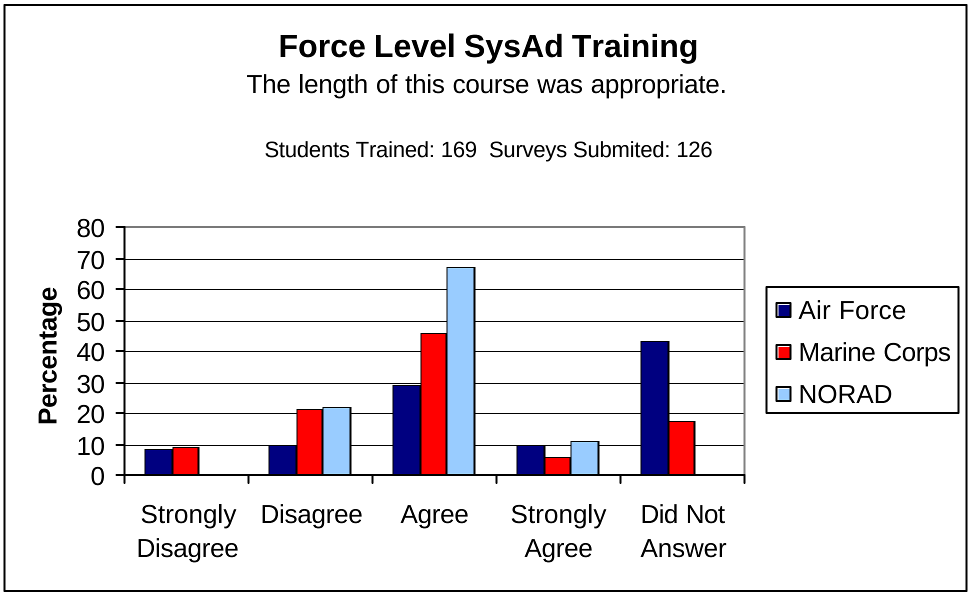
Note: Table 6.2.4 reveals force level system administrator perceptions regarding TBMCS training applicability specific to an system administrator's duty center. An average of 20.16% of the students did not respond to this question. An average of 16.86% of the students strongly agreed that the training provided was specific to their duty center. An average of 48% of the students agreed that the training provided was specific to their duty center. An average of 1.3% strongly disagreed that the training provided was specific to their duty center. An average of 13.56% disagreed that the training provided was specific to their duty center. With a cumulative total of 64.86% of students who strongly agree or agree that the training provided was specific to their duty center versus a cumulative total of 14.86% of students who strongly disagree or disagree that that the training provided was specific to their duty center, this information suggests that the majority of students perceived that the training provided was specific to their duty center.

Table 6.2-5. TBMCS Multi-Service Responses for Course Expectation



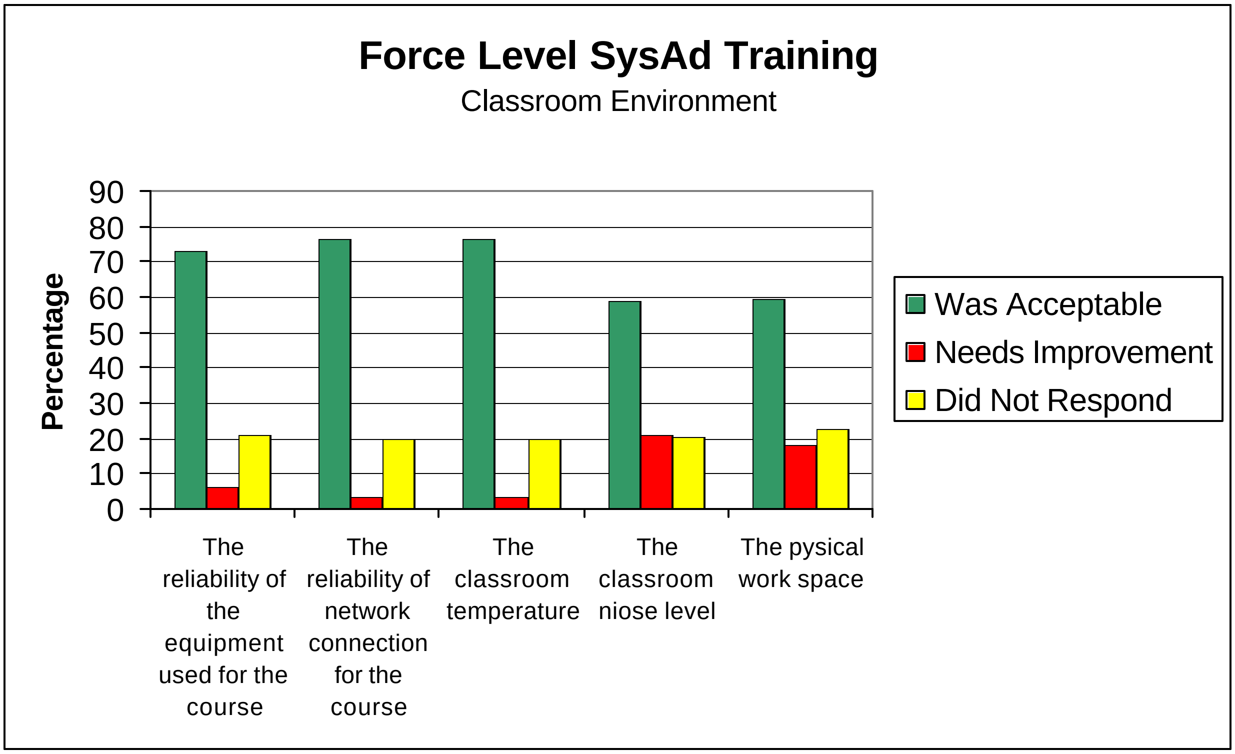
Note: Table 6.2-5 reveals force level system administrator expectations about the overall course. An average of 19.9% of the students did not respond to this question. An average of 12.7% of the students strongly agreed that their course expectations were met. An average of 57.06% of the students agreed that their course expectations were met. An average of 1.5% strongly disagreed that their course expectations were met. An average of 8.73% disagreed that their course expectations were met. With a cumulative total of 69.76% of students who strongly agree or agree that their course expectations were met versus a cumulative total of 10.23% of students who strongly disagree or disagree that their course expectations were met, this information suggests that the majority of students perceived that their course expectations were met.

Table 6.2-6. TBMCS Multi-Service Responses for Length of Course



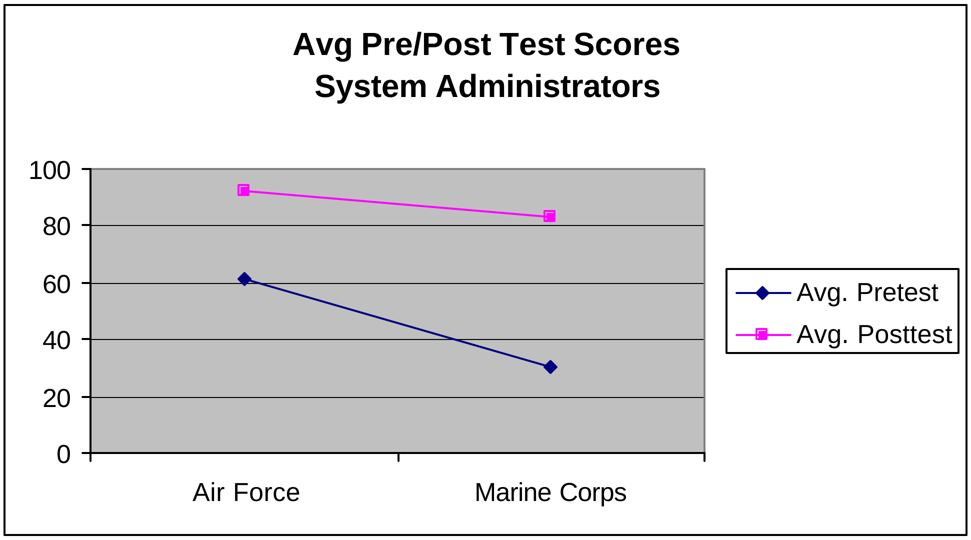
Note: Table 6.2-6 reveals force level system administrators perceived about the overall course length. An average of 20.3% of the students did not respond to this question. An average of 8.93% of the students strongly agreed that the length of the course was appropriate. An average of 47.3% of the students agreed that the length of the course was appropriate. An average of 5.76% strongly disagreed that the length of the course was appropriate. An average of 17.7% disagreed that the length of the course was appropriate. With a cumulative total of 56.23% of students who strongly agree or agree that the length of the course was appropriate versus a cumulative total of 23.46% of students who strongly disagree or disagree that the length of the course was appropriate, this information suggests that most students perceived that the length of the course was appropriate.

Table 6.2-7. TBMCS Multi-Service Responses for Classroom Environment



Note: Table 6.2-7 reveals force level system administrator perceptions about the course environment (equipment, network connection, temperature, noise level, and work space). An average of 20.74% of the students did not respond to this question. An average of 68.84% of the students agreed that the course environment was acceptable. An average of 10.42% of the students agreed that the course environment needed improvement.

Table 6.2-8. TBMCS Multi-Service Responses for Pre/Post Test



Note: Table 6.2-8 reveals differences between pre and post test scores for system administrators. AF averaged a 31% increase and Marine Corps averaged a 53% increase. Navy and NORAD did not participate. Cumulative pre test average was 45.5%. Cumulative post test score was 87.5%. Cumulative average gain was 42%. Student test questions are identified as learning objectives as the course is designed. With all students shifting from below average score (>75%) to above average (<75%) it can be presumed that learning objectives were met as a result of the instruction.

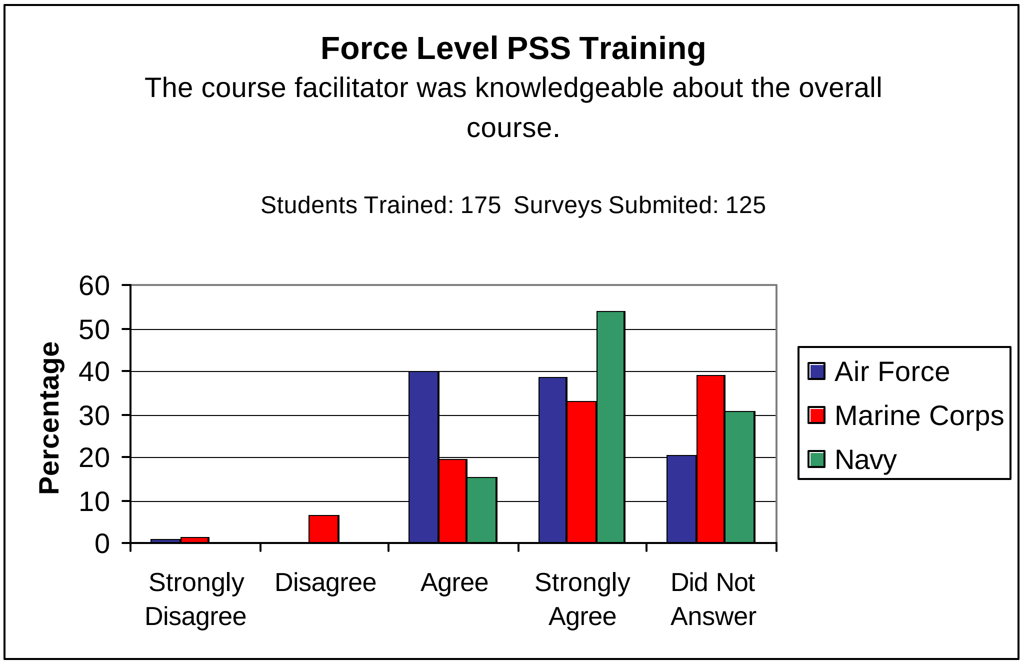
6.3 PERIMETER SECURITY SYSTEM

A sample of n = 88 for AF force level PSS network administrators participated in the courses. A total of 69 AF surveys were received. Response rate was 78%. A sample of n = 61 Marine Corps PSS network administrators participated in the courses. A total of 38 Marine Corps surveys were received. Response rate was 62%. A sample of n = 28 for Navy PSS network administrators participated in the courses. A total of 18 Navy surveys were received. Response rate was 69%. Total multi-service course participation was 171. Total multi-service response rate was 73%.

6.3.1 Perimeter Security System responses to Questions

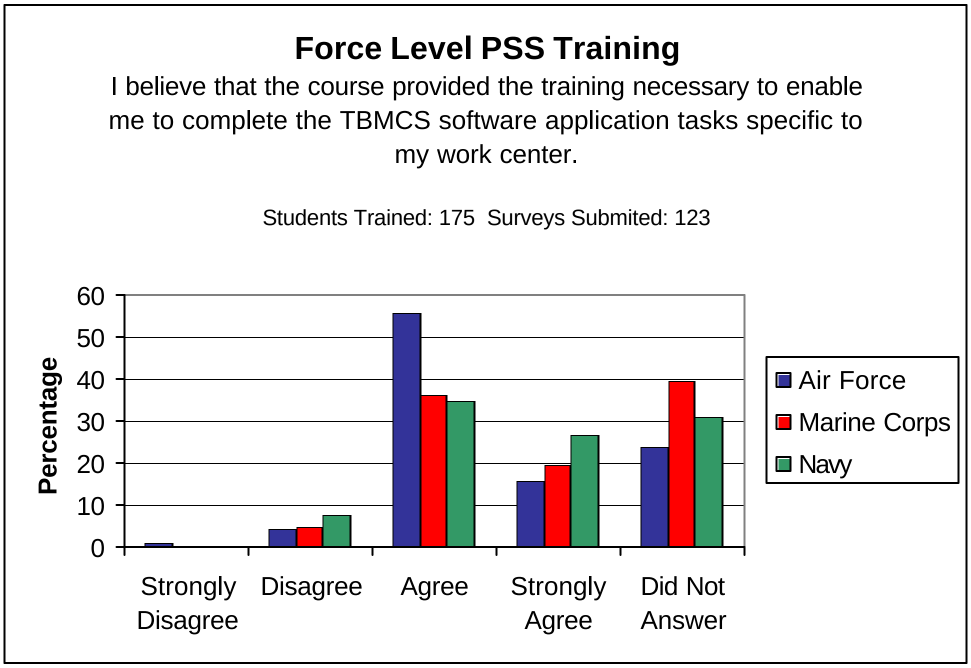
Tables 6.3-1 through 6.3-5 represent network administrators' responses to survey questions

Table 6.3-1. TBMCS Multi-Service Responses for Facilitator Knowledge



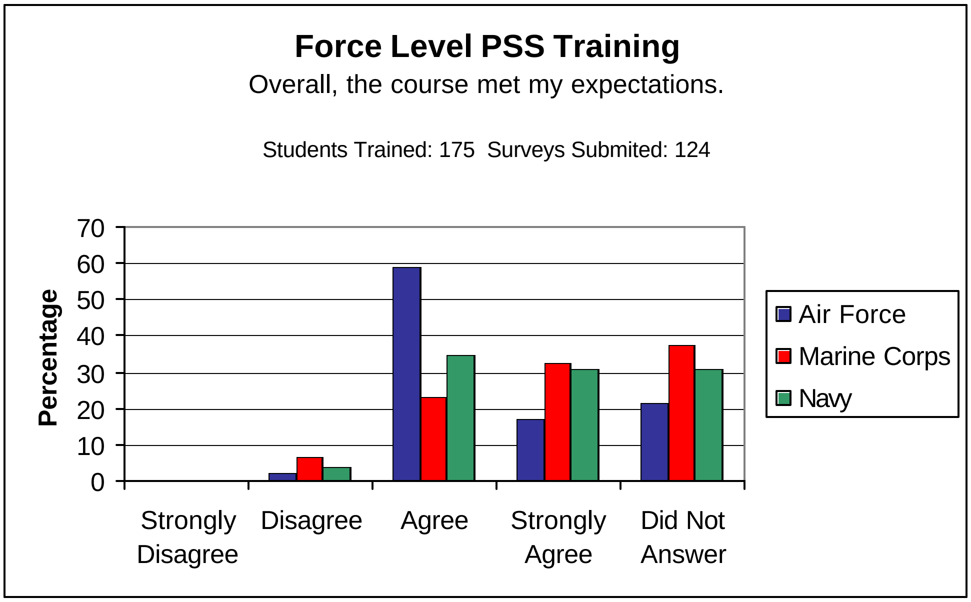
Note: Table 6.3-1 reveals perimeter system security network administrator perceptions regarding facilitator knowledge about the overall course. An average of 30.20% of the students did not respond to this question. An average of 41.73% of the students strongly agreed that the facilitator was knowledgeable of the overall course. An average of 24.9% of the students agreed that the facilitator was knowledgeable of the overall course. An average of .8% strongly disagreed that the instructor was knowledgeable. An average of 2.2% disagreed that the instructor was knowledgeable. With a cumulative total of 66.63% of students who strongly agree or agree that the instructor was knowledgeable about the subject matter versus a cumulative total of 3.06% of students who strongly disagree or disagree that the instructor is knowledgeable about the overall course, this information suggests that the students perceived the course instructors to be highly knowledgeable of the course content.

Table 6.3-2. TBMCS Multi-Service Responses for TBMCS Work Center Training



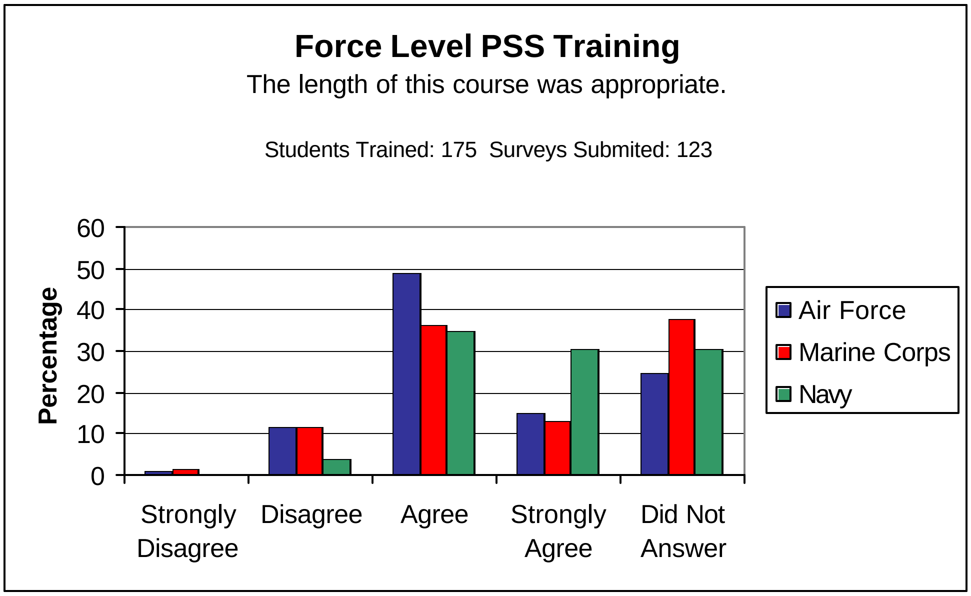
Note: Table 6.3-2 reveals force perimeter security system network administrator's perceptions regarding TBMCS training applicability specific to an their duty center. An average of 31.3% of the students did not respond to this question. An average of 20.8% of the students strongly agreed that the training provided was specific to their duty center. An average of 42.1% of the students agreed that the training provided was specific to their duty center. An average of .33% strongly disagreed that the training provided was specific to their duty center. An average of 5.7% disagreed that the training provided was specific to their duty center. With a cumulative total of 62.9% of students who strongly agree or agree that the training provided was specific to their duty center versus a cumulative total of 6.03% of students who strongly disagree or disagree that that the training provided was specific to their duty center, this information suggests that the majority of students perceived that the training provided was specific to their duty center.

Table 6.3-3. TBMCS Multi-Service Responses for TBMCS Work Center Training



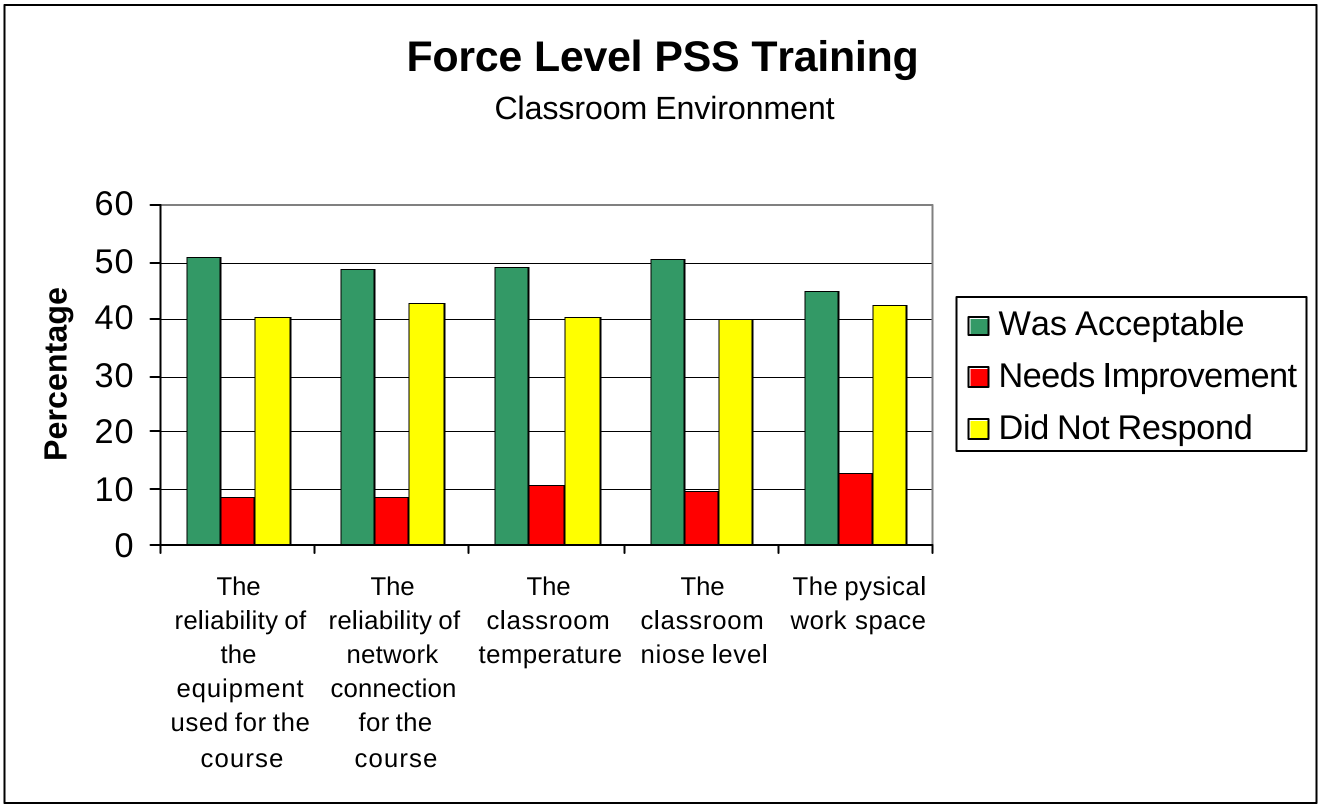
Note: Table 6.3-3 reveals force level perimeter system security network administrator expectations about the overall course. An average of 30% of the students did not respond to this question. An average of 26.8% of the students strongly agreed that their course expectations were met. An average of 38.9% of the students agreed that their course expectations were met. An average of 0% strongly disagreed that their course expectations were met. An average of 4.26% disagreed that their course expectations were met. With a cumulative total of 65.7% of students who strongly agree or agree that their course expectations were met versus a cumulative total of 4.26% of students who strongly disagree or disagree that their course expectations were met, this information suggests that the majority of students perceived that their course expectations were met.

Table 6.3-4. TBMCS Multi-Service Responses for Length of Course



Note: Table 6.3-4 reveals force perimeter security systems network administrators perception about the overall course length. An average of 31.06% of the students did not respond to this question. An average of 19.53% of the students strongly agreed that the length of the course was appropriate. An average of 39.9% of the students agreed that the length of the course was appropriate. An average of .86% strongly disagreed that the length of the course was appropriate. An average of 8.93% disagreed that the length of the course was appropriate. With a cumulative total of 59.43% of students who strongly agree or agree that the length of the course was appropriate versus a cumulative total of 9.79% of students who strongly disagree or disagree that the length of the course was appropriate, this information suggests that most students perceived that the length of the course was appropriate.

Table 6.3-5. TBMCS Multi-Service Responses for Classroom Environment



Note: Table 6.3-5 reveals force level perimeter security system network administrator perceptions about the course environment (equipment, network connection, temperature, noise level, and work space). An average of 41.18% of the students did not respond to this question. An average of 48.84% of the students agreed that the course environment was acceptable. An average of 9.9% of the students agreed that the course environment needed improvement.

7.0 ¾ FINDINGS

A major goal of this study is to determine the impact of training. For purposes of this study impact is viewed as "measurable learning" and "student perception" of learning. Perception drives motivation and emotion. Emotion drives attention and, in turn, memory. Abell (2000) stated emotion is often a more powerful influence on behavior than logic. Thus, it is an important indicator of course satisfaction. The research questions below have been supported with quantitative data from the end of course critique, pre-/post-test scores, focus groups and observable behavior by the program office.

Research Question 1: Were the majority of students satisfied at the completion of training?

Data revealed in tables 6.1-5, 6.2-5 and 6.3-3 pertaining to operator, system administrator and PSS course expectations indicate that 53.57% operators, 69.76 of system administrators, and 65.7% of PSS network administrators agreed that their expectations were met. Although the data reflect the majority of students being satisfied, the range is low, which means that training can continue to improve. Qualitative information from focus groups and observations conducted by the SPO reflected that many students had pre-conceived and/or negative attitudes in regard to the training. A common misconception was that the "TBMCS system" was unstable and difficult to use. Common observable negative attitudes appeared when students were required to learn via web-based training instead of instructor led. Students were often hostile, had short attention spans, and showed resistance to learn without the instructor. Additionally, when the instructor-led approach was used many students had "anti-contractor" preconceptions, which interfered with learning. Observable behaviors such as increased persistence and voluntary engagement in the task was seldom noticed by the Program Office.

Research Question 2: Will there be a difference in the students test scores after completing the training?

Cumulative average gain for operators and system administrators was 37.5%. Student test questions are identified as learning objectives as the course is designed. With all students shifting from below average score (<75%) to above average (>75%) it can be presumed that learning objectives were met as a result of the instruction.

Research Question 3: Will users be confident in their ability to perform key tasks upon completion of the training?

The student self-assessment instrument was used to determine the confidence level of the users in performing key tasks. Response rate of the student self-assessment was 45%. Of the 45% who responded, 1.4% stated they could not accomplish the key tasks, 91.4% stated they could complete the key tasks with over-the-shoulder help, on-line help, or without help, leaving 7.3% who did not attempt the task after training. Students' perception of their ability to perform key tasks is high. The key to maintaining this perception is to refresh these skills with OJT and continuous exercises.

Research Question 4: Is there a correlation between user experience and EOC satisfaction?

Data in Table 6.1-1 indicate 64.35 % of force-level operators possessed less than the required 12 months legacy experience compared to 12.54% of operators who did possess the course prerequisite of 12 months legacy experience. Data in Table 6.1-5 indicate that 53.57% operators stated the course met their expectations. Data revealed in Table 6.2-1indicate an average of 48.96% of system administrator students possessed less than 12 months of required legacy experience compared to 31.43% of system administrators who did possess the 12-month legacy experience prerequisite. Data in Table 6.2-5 indicate that 69.76% of system administrators stated the course met their expectations. Although the majority of operators and system administrators did not meet the required course prerequisites of 12 months of legacy experience, there appears to be a correlation between higher experience and higher course satisfaction as indicated by the system administrators.

Research Question 5: Will the students perceive the facilitator as knowledgeable about the course content?

A cumulative total of 72.55% of operator, system administrator and PSS students strongly agreed or agreed that the instructor was knowledgeable about the subject matter versus a cumulative total of 3.15% of students who strongly disagreed or disagreed that the instructor was knowledgeable about the overall course. This information reveals that the majority of students perceived the course instructors to be highly knowledgeable of the course content. Observations and focus groups indicated that students were frustrated with facilitator lack of knowledge when method of instruction was 100% web based; however, instructor credibility increased when method of instruction changed to instructor-led practical exercises.

Research Question 6: Will students perceive that the course covered the key TBMCS skills specific to their work center?

Data in Tables.6.1-4, 6.2-4, and 6.4-3 reveal that a cumulative total of 61.73% of students strongly agreed or agreed that the training provided was specific to their duty center versus a cumulative total of 13.92% of students who strongly disagreed or disagreed that the training provided was specific to their duty center. This information reveals that most students perceived the training provided was specific to their duty center. Observations and focus groups indicate a correlation between user experience and user perception of the training being specific to their work center. Those students who did not meet the 12-month legacy experience prerequisite exhibited a lack of understanding of the TBMCS system, data flows between cells, and how their duty position related to the tasks and skills supported by TBMCS.

Research Question 7: Will students perceive that their units provided a workspace that supported a successful training environment?

Cumulative perceptions about the course environment (equipment, network connection, temperature, noise level, workspace) revealed an average of 57.93% of the students agreed that the course environment was acceptable. An average of 11.31% of the students agreed that the course environment needed improvement. Focus groups and observations revealed that students were often unhappy about the physical work environment due to lack of air conditioning, close proximity of other students, and high noise.

8.0 ¾ BARRIERS AND ISSUES

A major goal of this study is to provide an in-depth analysis to assist future C2 decision makers in determining what conditions distributed learning is likely to be effective for future C2 systems. Based on the experience in managing TBMCS training, ESC has identified the following barriers and issues as obstacles for an effective implementation of a distributed learning environment. It is recommended that C2 program managers understand the respective impacts and consequences of these limitations as part of their decision making progress when allocating training budgets, identifying resources, and establishing processes.

- ***Funding.*** A significant issue in providing effective training is the inconsistency of funds allocated for training. On average 10% of the total TBMCS software development program was allocated to training over the life of the contract. During Program Objective Memorandum (POM) and Amended Program Objective Memorandum (APOM) reviews funding was often removed from the training budget due to management misconception and lack of understanding of the associated cost and the importance of designing, developing, and implementing web-based training.
- ***Evaluation*.** Multi-service criteria and standards for evaluating C2 weapon system specific training were not established for: a) summative reviews of training materials and course implementation, b) multi-service test activities and c) OJT training plans.
  (1) AF Policy Directive (AFPD) 36-22 and supporting AFI identify the design and development of training. These regulations provide a structured systems design framework to identify training needs and to design the most effective and efficient means of providing training. These regulations are limited in their applicability since they primarily focus on the material design and development process. A systems/holistic training evaluation approach to include a summative course evaluation is needed for C2 managers to make judgments regarding the current training program and decisions for future training programs.
  (2) Developmental Test/Operational Test (DT/OT) leads did not identify training standards or performance criteria; thus, training evaluations during test events are unstructured and personality dependent. A deficiency exists in obtaining quantitative data to validate the effectiveness of training.
  (3) MTT facilitators have identified key tasks and EOC objectives for students. For most students TBMCS is a wartime application and is not used during peacetime operations; thus, when returning to their duty station, their newly learned skill sets are not immediately

applied. As a result, skill decay takes place. Knowledge retention refers to the remembrance of facts, terminology, concepts, and rules similar to the knowledge level of Blooms' (1956) taxonomy. The variability of key tasks can be substantial if students do not repeat them after they are learned. For example, in field research with soldiers who have been recalled to service after being away for more than a year, Sabol and Wisher (2001) report skill losses ranging between 27% and 83% for hands-on tasks. Such procedural tasks at the application level are of major concern to the proficiency of TBMCS.

Performance criteria for TBMCS users are not documented upon completion of training. Without adequate performance criteria as identified in Figure 8.0-1, the training program at whole is at risk.

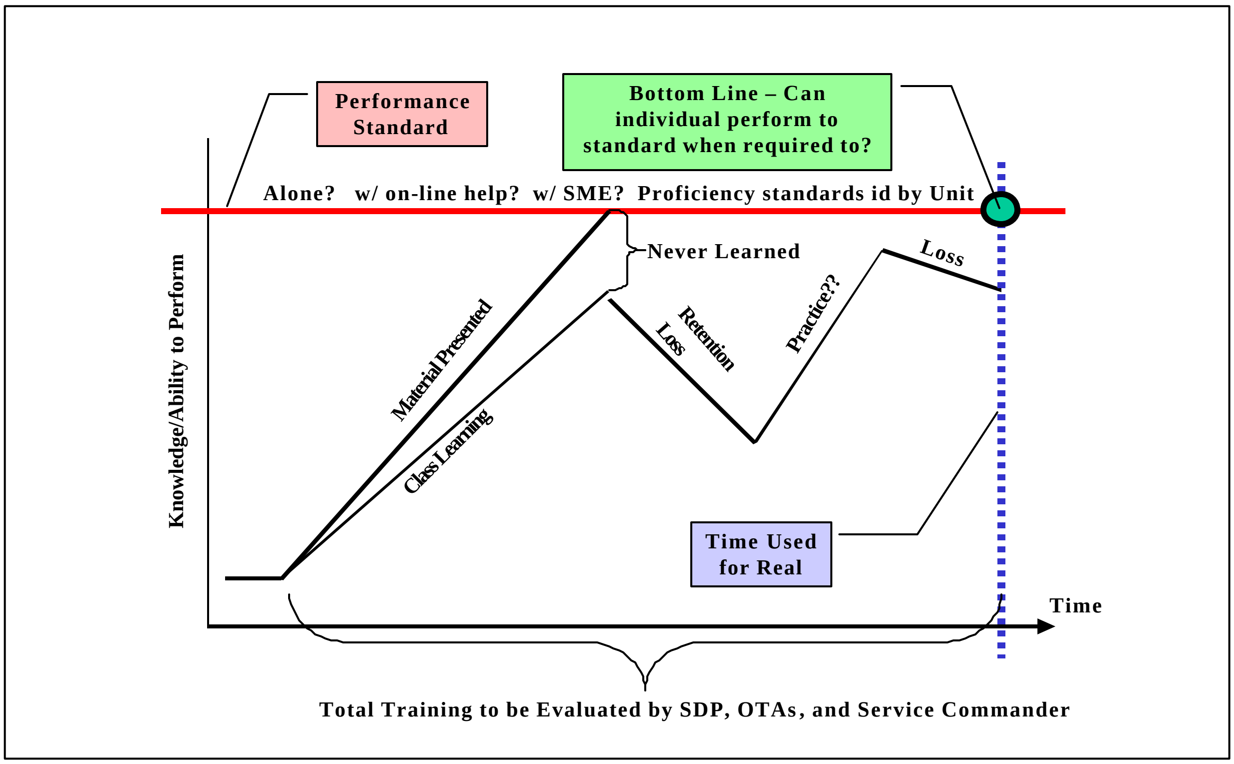


Figure 8.0-1. Performance Criteria

Lack of OJT and Continuation Training Plans. Many service locations lack a documented training plan identifying continuation training requirements and training manager responsibilities. When a training program is not established, or when a training manager has not been appointed at the users home station, the user cannot maintain proficiency. AFI 33-2201 identifies training Major Command (MAJCOM) requirements. Although training requirements are clearly stated in Air Force regulations, most commanders have not implemented an OJT program that includes TBMCS continuation training as part of the curriculum. When this happens, TBMCS training as a whole is affected and ESC CAFC2 is frequently identified as providing poor training.

Technology Planning. A key lesson learned in achieving an efficient distributed training environment is in "technology planning". Valuable TBMCS resources were utilized in the chase for advanced distributed learning technology. A technology plan would have provided a road map for the implementation of technology and would result in more efficient expenditure of limited resources and budgeting for additional technology early in the contract. The North Central Regional Technology in Education Consortium identifies technology planning as an ongoing process that translates organizational policy, and technology needs into concrete actions. Technology planning allows educational and training organizations to take advantage of technology innovations while minimizing the negative impact of unexpected challenges. (http://www.netc.org/cdrom/guide/html/gqhome.htm).

Return on Investment. Smith (2000) stated that the DOD spends $14 billion per year on classroom education for military and civilian personnel. She believes that distributed teaching modules could cut costs and make it easier to share training modules that are applicable to numerous departments. Webb (1999) stated that ROI is all about accountability predictions and tying training to your company's bottom line. Unfortunately, there were limited empirical studies that concentrate on the cost benefits of DL at the conception of the contract. Hassett (1992) identified costs in Computer-Based Training (CBT) as including developer salaries and benefits pay, management time required to hire and supervise employees, the hours charged to overhead between projects, quality assurance reviews, CBT maintenance, and graphic support. He also stated that the average time for creating an hour of CBT ranges from 140 to 316 developer hours. He quoted a study in which 61% of the respondents stated that CBT took more than 400 development hours, 27% stated it took more than 1,000 development hours, and 5% stated it took 4,000 development hours to develop a single hour of CBT. In a review of research of 890 articles in distance education from 1990 to 1999 Berge and Mrowski (2001) reported only eight reflected cost data for DL. Of the eight reports two were written in 1998, one in 1995, one in 1994 and three in 1991. The latter studies were prior to the advent of the web. Identifying the range of possible costs for a distributed learning training program by utilizing the web as the means for distribution was a mere estimation at the time of contract award in 1995.

Policy and Management

1. Chute, Thompson, and Hancock (1999) state that people in an organization fill three important roles in the change process: change stakeholder, change agent, and change target. The change stakeholder is the individual or group within the organizational power to legitimize the change, the change agent is the individual or group responsible for implementing the change, and the

change target is the individual or group whose knowledge, skills attitudes, or behaviors will be altered as a result of the change. Although national level policy dictates an ADL concept, local policy does not enforce distributed learning. Change stakeholders and agents are clearly needed to enforce a distributed learning environment.

2. AFI 13-108 identifies a Training Planning Team (TPT) as an action group composed of representatives from all pertinent functional areas, disciplines, and interests involved in the life cycle design, development, acquisition, support, modification, funding, and management of a specific defense training system. The TPT uses the system training plan to ensure training considerations are adequately addressed in the defense system acquisition and modification processes. The TBMCS TPT charter, dated 1997, defines membership and tasks. The primary purposes are to obtain user requirements, ensure a sound structured approach to training development, and ensure all service requirements are met as effectively and efficiently as possible. The TBMCS TPT by definition lacks a common DL vision and authority to enforce a DL environment.

Changing Roles of Presentation Media, Instructors, and Students. The widespread use of the computer technology in all fields has helped the virtual classroom to gain acceptance among students, educators and employers as a means for distance education. However, the concept of distributed learning has far to go before it is accepted as equal to the traditional education format. The change to a virtual classroom requires a paradigm shift with upper management, students, and instructors. Evans (1997) stated that the paradigm shift includes issues such as student authenticity far beyond plagiarism, the convergence of professional and personal time produced by 24-hour, on-line teleconferencing availability, the dependency on a team of connectivity technicians to communicate with students and instructors, a virtual higher education world, which is less faculty-centered and where curriculum is interdisciplinary. The issues involved in this paradigm shift bring about challenges, not the least of which is how to develop a military culture that accepts distance learning. TBMCS focus groups revealed that students clearly did not want to learn solely from web-based instruction, but instead desired the assistance of the instructor.

Design of Web-based Training Materials. Cohen (1999) revealed that generation X (born between 1965-1976) and generation Y (born between 1977-1999) prefer fast paced information that flood them with information and want their education to be combined with entertainment. These generations also want to review frequent feedback and a daily sense of accomplishment. They want latitude in when and where they study and a choice of assignments. Designing instruction to meet these criteria is both time consuming and costly.

9.0 ¾ SUMMARY

The goals of this paper were to provide: a) a summative evaluation that identifies strengths, weaknesses, lessons learned, and best practices of the TBMCS training program, b) an in-depth analysis in assisting future C2 decision makers in determining what conditions distributed learning is likely to be effective in for future C2 systems, and c) a holistic view (context, input, process and product evaluation) of TBMCS training that shows the impact of training, not only on the individual but on the USAF as well.

9.1 SUMMATIVE EVALUATION

A summative evaluation that identifies strengths, weaknesses, lessons learned, and best practices is best summarized as follows. Strengths are identified as having a flexible contract and training development contractor. The TBMCS procurement strategy was a cost plus contract with a best effort clause. Although this acquisition strategy resulted in considerably more risk on the government, it allowed for changes in scope as more COTS technology became available. A fundamental weakness was managing the contract due to the high attrition of military personnel from Permanent Change of Station (PCS) rotations and in-house transfers. The Air Force does not maintain a training Air Force Specialty Code (AFSC) for officer personnel. As a result, most Air Force personnel lacked skills in applying the ISD process and evaluating the various products. A significant lesson learned was in the evaluation of the course. To avoid controversy and scrutiny from the services, neither the developing contractor nor the office responsible for managing the contract should be in the position to administer and assess survey results. It would be advantageous to all services if an independent party conducted the evaluation of a multi-service training program. Best practices are identified as utilizing the ISD process as the basis to obtain requirements and to design/develop the most cost effective and efficient training to meet users' needs. It allows for user validation of requirements, multiple reviews of templates, prototypes, demos, and end products, and opportunities for stakeholder decisions when technical and cost trade offs are required.

9.2 DL ENVIRONMENT

Determining the best condition for a distributed learning environment is challenging. A C2 SPD can have adequate funding, the best training materials, and deliver a quality product on time to all users in a traditional training environment. However, there are a myriad of obstacles that can contribute to the failure of the same training in a distributed learning environment. Prior to establishing a distributed learning environment decision makers must do their homework. The following questions are guides in determining if a supportive environment exists. Negative responses can quickly change a supportive environment into a hostile learning environment.

- Do distributed learning policies exist at national and local levels?
- Does my senior leadership embrace a vision that supports distributed learning?
- Do I have adequate and experienced personnel to administer and execute a training program in a distributed learning environment?
- Does my training contractor have experience in developing training and administering distance learning programs?
- Do I have control over the training budget?
- What is my commitment to a distributed learning initiative if my budget is cut?
- Does my network infrastructure support anytime, anywhere, anyplace learning?
- What are the network bandwidth, security constraints, and latency rates at the distributed locations?
- Does the military culture support distributed learning environments?
- Do the training managers at the distance locations have a process in place to support a distributed learning environment?
- What organizations can I collaborate with, share lessons learned and best practices of distributed learning?

9.3 HOLISTIC VIEW OF TRAINING

A model for a holistic view of training is best described by Deming (2000). He identified a systems theory as "a network of interdependent components working together to achieve a common aim." Figure 9.3-1 tailors the systems theory to the training process. Input is defined as the requirements and regulations that feed the system. The ISD and MTT process is defined as the key processes to training during fielding. Process owners are defined as; AC2ISRC to ensure personnel receive Initial Qualification Test (IQT) prior to arriving at their duty station, ESC training contractor to design, develop and implement type-1 training, and the MAJCOMs to ensure processes are in place for OJT and continuation training after type-1 training. Output is defined as a qualified C2 warfighter. Feedback is defined as qualitative and quantitative data provided by students after a course that is used to enhance future courses. The key to the systems theory is accountability. All process owners must complete their respective portion of the process in order to support the overall aim of the system. The aim of the system is defined as "a qualified C2 warrior". When process owners are not accountable, the system becomes dysfunctional and training objectives are not met. Without a proper training infrastructure the system as a whole cannot survive.

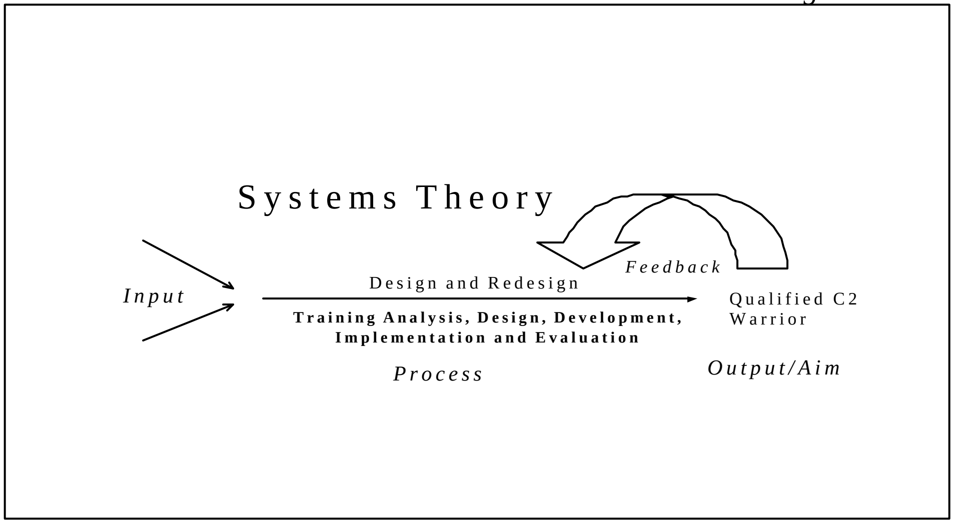


Figure 9.3-1. Deming System Theory as it Applies to Training

10.0¾ GLOSSARY

ADL	Advanced Distributed Learning
AETC	Air Education Training Command
AFDLO	Air Force Distance Learning Office
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AFSC	Air Force Specialty Code
AOC	Air Operations Center
APOM	Amended Program Objective Memorandum
C2	Command and Control
CAFC2	Combat Air Force Command and Control
CBT	Computer-Based Training
CCB	Configuration Control Board
CCO	Chief Combat Operations
CIS	Combat Intelligence System
CLC	Continuous Learning Center
CONUS	Continental United States
COTS	Commercial-Off-the-Shelf
CMI	Computer Managed Instruction
CTAPS	Contingency Theater Air Planning System
DAU	Defense Acquisition University
DCO	Director Combat Operations
DL	Distance Learning
DOD	Department of Defense
DT	Developmental Test
EOC	End of Course
ESC	Electronic Systems Center
FY	Fiscal Year
LP	Lesson Plan
HTML	Hypertext Markup Language
HW	Hardware
IMI	Interactive Multimedia Instruction

IQT	Initial Qualification Test
ISD	Instructional Systems Development
JAO	Joint Air Operations Center
JAOTPT	Joint Air Operations Training Planning Team
JV	Joint Vision
MAJCOM	Major Command
MTT	Mobile Training Team
NORAD	North American Aerospace Defense
OJT	On the Job Training
OT	Operational Test
PC	Personal Computer
PE	Practical Exercise
POI	Program of Instruction
POM	Program Objective Memorandum
PSS	Perimeter Security System
ROI	Return On Investment
SME	Subject Matter Expert
SODO	Senior Offensive Duty Officer
SOR	System of Record
SPD	Systems Program Director
SPO	System Program Office
SW	Software
TADLP	Total Army Distance Learning Program
TASA	Task and Skill Assessment
TBMCS	Theater Battle Management Core System
TPR	Trained Personnel Requirement
TPT	Training Planning Team
USAF	United States Air Force
USMC	United States Marine Corp
USN	United States Navy
WCCS	Wing Command and Control System
WYSIWYG	What You See Is What You Get

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APPENDIX 1—END OF COURSE CRITIQUE

TBMCS 1.0.1 TRAINING
END OF COURSE CRITIQUE

Directions:

Please answer all questions.

Enter up to 50 characters in text entry fields.

When a field has an arrow at the right, click the arrow to display a list of options and select one.

When answering a question select the one button that best expresses your opinion.

When you have finished, press the Submit button to register the completed critique. You may reset the form (clear it) by pressing the Reset button.

A. Profile Data:

Name (Last, First)

Course title(select one)
Unit Intelligence Course

Pay Grade
Civilian

Branch of Service
USA

Duty Location (name of duty station)

Military Occupation position (MOS/AFSC)

Time at current occupation position (months)
0

CIS experience (months)
0

Number of operations/exercises performed using CIS system.
0

If more than one operation/exercise performed, the additional positions held were:
N/A

TBMCS experience (months)
0

B. Training Evaluation

B-1. Presentation Effectiveness

The course facilitator ensured that training materials/equipment were ready and operational before the class started.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The course facilitator began the class on time.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The course facilitator was knowledgeable about the overall course.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The course facilitator clarified questions well.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The course facilitator gave relevant guidance when needed.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The course facilitator interacted well with the trainees.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

B-2 Course Quality

Task completion: I believe that the course provided the training necessary to enable me to complete the TBMCS software application tasks specific to my work center.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

Skill enhancement: I believe that the course improved my ability to correctly perform TBMCS software application tasks when I return to my work center.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

This course was well organized.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The level of difficulty of this course was appropriate.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The length of this course was appropriate.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

B-2.1. Course Materials

This course included appropriate supporting materials (e.g., checklists, CBT, interactive practice, etc.).

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

The course materials were useful.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

B-2.2. Classroom Equipment/Environment

The reliability of the equipment used for the course:

☐ Needs improvement ☐ Was acceptable

The reliability of network connection for this course:

☐ Needs improvement ☐ Was acceptable

The classroom temperature: (hot, cold, humid)

☐ Needs improvement ☐ Was acceptable

The classroom noise level: (beepers, phones, loud talking)

☐ Needs improvement ☐ Was acceptable

The physical work space:(elbow room)

☐ Needs improvement ☐ Was acceptable

C. Overall Satisfaction

Overall, the course met my expectations.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

I believe I can use this course material, in its present form, to train other personnel when necessary.

☐ strongly disagree ☐ disagree ☐ agree ☐ strongly agree

Comments:

[ ]

[Submit] [Reset]

APPENDIX 2—TBMCS FORCE TRAINING SELF-RATING FORMS

ABP/ATO Planners Rating Form

After completing the exercise, rate your ability to accomplish the following tasks if you were placed in a real-world exercise or contingency Rate your performance using the following: 1. If you could not accomplish this task. 2. If you could accomplish the task with some over-the-shoulder help. 3. If you could accomplish the task with only the on-line help. 4. If you could accomplish the task without help. 5. You did not attempt to learn this task.	Could not accomplish 1	Could accomplish w/over-the-shoulder help 2	Could accomplish w/on-line help 3	Could accomplish without help 4	Not attempted 5

Using TAP

		1	2	3	4	5
	Build the following air missions					
1.	Ground/Maritime Target Missions					
2.	RECCE Missions					
3.	Maritime Target - Ground/Maritime Target Tasking					
4.	Air Location - Air Location Tasking					
5.	Ground Alert - Ground Alert Tasking					
6.	Tanker - Tanker Tasking					
7.	AETACS - AETACS Tasking					
8.	EC - Electronic Combat Tasking					
9.	Air Move - Air Move Tasking					
10.	Air Drop - Air Drop Tasking					
11.	WAG Missions					
12.	Build escorted or packaged missions					
13.	Submit Refueling, Close and Detached Escort Requests					
14.	Fill Refueling, Close and Detached Escort Requests					
15.	Publish an ABP					
16.	Create a new ABP from a previous ABP					

Comments:

ABP/ATO Replanners Rating Form

After completing the exercise, rate your ability to accomplish the following tasks if you were placed in a real-world exercise or contingency Rate your performance using the following: 1. If you could not accomplish this task. 2. If you could accomplish the task with some over-the-shoulder help. 3. If you could accomplish the task with only the on-line help. 4. If you could accomplish the task without help. 5. You did not attempt to learn this task.	Could not accomplish 1	Could accomplish w/over-the-shoulder help 2	Could accomplish w/on-linehelp 3	Could accomplish without help 4	Not attempted 5

Using EMR

	Build the following air missions					
1.	Ground/Maritime Target Missions					
2.	RECCE Missions					
3.	Maritime Target - Ground/Maritime Target Tasking					
4.	Air Location - Air Location Tasking					
5.	Ground Alert - Ground Alert Tasking					
6.	Tanker - Tanker Tasking					
7.	AETACS - AETACS Tasking					
8.	EC - Electronic Combat Tasking					
9.	Air Move - Air Move Tasking					
10.	Air Drop - Air Drop Tasking					
11.	Submit Refueling, EC or Escort Requests					
12.	Publish an ATO Change					
13.	Replan single, unescorted missions					
14.	Replan escorted or packaged missions					

Comments:

ABP/ATO Execution Monitoring Rating Form

After completing the exercise, rate your ability to accomplish the following tasks if you were placed in a real-world exercise or contingency Rate your performance using the following: 1. If you could not accomplish this task. 2. If you could accomplish the task with some over-the-shoulder help. 3. If you could accomplish the task with only the on-line help. 4. If you could accomplish the task without help. 5. You did not attempt to learn this task.	Could not accomplish 1	Could accomplish w/over-the-shoulder help 2	Could accomplish w/on-linehelp 3	Could accomplish without help 4	Not attempted 5

Using EMC

1.	Filter the ABP to look at only specific missions.					
2.	Interpret Sortie Flow symbology					
3.	Arrange Sortie Flow Table columns					
4.	Obtain mission information by rolling over the Sortie Flow pictograms					
5.	Obtain mission information via the Mission_Status_Filter					
6.	Change mission status from task through mission complete					
7.	Enter mission deviations					
8.	Update runway statuses					

Using SAA

9.	Change chart colors					
10.	Zoom, center and pan chart.					
11.	Plot selected airspaces from within SAA.					
12.	Plot selected airbases from within SAA.					
13.	Build an overlay containing selected airspaces and bases from within SAA					
14.	Display selected overlays.					
15.	Plot selected targetes from within SAA.					
16.	Plot politcal borders and other Features					
17.	Plot friendly missions from within SAA.					

Comments:

Airspace Planners Rating Form

After completing the exercise, rate your ability to accomplish the following tasks if you were placed in a real-world exercise or contingency Rate your performance using the following: 1. If you could not accomplish this task. 2. If you could accomplish the task with some over-the-shoulder help. 3. If you could accomplish the task with only the on-line help. 4. If you could accomplish the task without help. 5. You did not attempt to learn this task.	Could not accomplish 1	Could accomplish w/over-the-shoulder help 2	Could accomplish w/on-linehelp 3	Could accomplish without help 4	Not attempted 5

Using AD

1.	Create an ACM					
2.	Modify an ACM					
3.	Publish an ACO					
4.	Build filters to look at airspaces for a group of missions, e.g. DCA airspaces.					
5.	Delete ACMs					
6.	Copy ACMs					
7.	Move location of ACMs					
8.	Change state of ACMs					
9.	Shift time of ACMs					

Comments:

Reports Rating Form

After completing the exercise, rate your ability to accomplish the following tasks if you were placed in a real-world exercise or contingency Rate your performance using the following: 1. If you could not accomplish this task. 2. If you could accomplish the task with some over-the-shoulder help. 3. If you could accomplish the task with only the on-line help. 4. If you could accomplish the task without help. 5. You did not attempt to learn this task.	Could not accomplish 1	Could accomplish w/over-the-shoulder help 2	Could accomplish w/on-linehelp 3	Could accomplish without help 4	Not attempted 5

Reports

Using EM Reports

1.	Generate a Data Report using a predefined template.					
2.	Generate a Detailed Mission Data Report.					
3.	Print a report.					
4.	Create and save a Custom Report Template.					
5.	Retrieve a saved Custom Report Template and use it to generate a report.					
6.	Save a EM Reports file in the appropriate format for import into either Microsoft					
7.	Open a saved EM Reports file in either Microsoft Excel, Microsoft Word or Microsoft Access (if Office applications are available).					

Comments:

User Alert Setup Rating Form

After completing the exercise, rate your ability to accomplish the following tasks if you were placed in a real-world exercise or contingency Rate your performance using the following: 1. If you could not accomplish this task. 2. If you could accomplish the task with some over-the-shoulder help. 3. If you could accomplish the task with only the on-line help. 4. If you could accomplish the task without help. 5. You did not attempt to learn this task.	Could not accomplish 1	Could accomplish w/over-the-shoulder help 2	Could accomplish w/on-linehelp 3	Could accomplish without help 4	Not attempted 5
1. Explain the importance of building an alert distribution matrix to your senior leadership (CCP, CCO, SWO or others).					
Using DLM					
2. Build distribution lists for global/internal addressees (profilename).					
3. Build distribution lists for local/internal addressees (localprofilename@hostname).					
4. Build distribution lists for any of the nine reserved alerts.					
5. View and edit a distribution list.					
Using User Alerts					
6. Test distribution lists built in DLM.					
Using EMR					
7. Build an air mission alert (CNX/DEL/ABT/DIV, MISSION LOST, ACK/ORD/ACR).					
8. Build distribution lists for alerts other than air missions.					
9. Start Alert Monitoring					
10. Subscribe to an ABP.					
11. Interrupt ABP monitoring to make a database change (enter Setup Mode).					

Comments: