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THESIS

A MODEL FOR TRAINING, EDUCATION AND DEVELOPMENT OF U.S. NAVY PATROL COASTAL BOAT (PC) PERSONNEL USING DISTRIBUTED LEARNING TECHNOLOGIES

by

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June 2001

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This research will define, assess, and evaluate current training, education and development practices and recommend cost effective measures for improvements at U.S. Naval Patrol Coastal Boat (PC) facilities. The objective is to propose a model for training technology infusion in Patrol Coastal Boats (PC) which will enable all sailors and officers assigned to these units to engage in training, education, and development activities without leaving the confines of the ship. Research will include conducting a detailed analysis of current training policies, conducting in-depth reviews of the current educational infrastructure, identifying and recommending pertinent distributed learning programs, and conducting a cost and benefits analysis of implementing distributed learning technologies onboard a PC.

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A MODEL FOR TRAINING, EDUCATION AND DEVELOPMENT OF U.S. NAVY PATROL COASTAL BOAT (PC) PERSONNEL USING DISTRIBUTED LEARNING TECHNOLOGIES

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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ABSTRACT

This research will define, assess, and evaluate current training, education and development practices and recommend cost effective measures for improvements at U.S. Naval Patrol Coastal Boat (PC) facilities. The objective is to propose a model for training technology infusion in Patrol Coastal Boats (PC) which will enable all sailors and officers assigned to these units to engage in training, education, and development activities without leaving the confines of the ship. Research will include conducting a detailed analysis of current training policies, conducting in-depth reviews of the current educational infrastructure, identifying and recommending pertinent distributed learning programs, and conducting a cost and benefits analysis of implementing distributed learning technologies onboard a PC.

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I. INTRODUCTION

A. INTRODUCTION

The U.S. Navy is continuously being transformed by global competition and the power of technology. An understanding of the interaction of information and technology contributes to the competitiveness of both individuals and institutions. The Navy's competitiveness and enablement of its missions through information technology will increasingly require that higher education meet its needs and that the training center of the future embody distributed learning technologies.

The Navy's Patrol Coastal Boat (PC) community is a small but integral part of the Navy's mission of sustained maritime superiority. The nature of the Navy's PC can be described by it's relatively small crew with highly technical skill sets, which require constant upgrading, before, during, and after operational activities. It is essential during these periods that such training, education, and development occur onboard ship, despite the ability to bring aboard either instructors or paper-based learning materials.

With the rapid growth of distributed learning technologies, including distributed learning using the Internet, and given the capability of the PCs to utilize computers for multiple functions aboard ship, the extent to which the PCs can develop and sustain a distributed learning environment should be examined.

This thesis will conduct an overview of distributed learning systems used in organizations similar to the functions of a PC. Those organizations meeting or approximating the mission/skill set mix of PCs will be analyzed to determine procedures for identifying training, education, and development requirements of personnel as well as

identifying the information technology infrastructure to enable a distributed learning environment. An analysis will examine current practices and procedures for training, education, and development, determine the technical and cultural feasibility for proposing a distributed learning environment, and identify resource requirements. Following this analysis, multiple designs of distributed learning environments for the PCs will be articulated based on different management systems models. Each model designed will prove sufficiently robust to allow decision makers flexibility and breadth. A recommended model for establishing and sustaining a distributed learning environment for PCs will be detailed identifying the training, education, and development needs of all crew members, sources for these distributed learning programs, cost data, training schedules, and measures of learner and system effectiveness.

B. AREA OF RESEARCH

The purpose of this thesis is to define, assess, and evaluate current training, education and development practices and recommend cost effective measures for improvements at U.S. Naval Patrol Coastal Boat (PC) facilities. The objective is to propose a model for training technology infusion in Patrol Coastal Boats (PC) which will enable all sailors and officers assigned to these units to engage in training, education, and development activities without leaving the confines of the ship.

C. RESEARCH QUESTIONS

- What is Distributed Learning (DL)? What are the advantages and disadvantages of DL?
- What military training protocols are used and how do they function in current training environment?
- What is the current education infrastructure for transitioning/stationed PC personnel?
- What are the training, education, and development needs for PC personnel?
- How can the DL technologies enhance training, education, and development experience for student and instructor?
- Can PCs accommodate DL infrastructure (hardware/software) onboard?
- What impact will a DL upgrade have on the current training, education, and development system?
- What are the costs and benefits of upgrading the existing architecture with DL standards?
- What maintenance skills will be required to maintain a new learning system?
- What is the impact in terms of staff and equipment?
- Will maintenance personnel require special skills? If so, how much will training cost?
- What system management procedures should be implemented to monitor training, education, and development status, gather completion statistics for reporting, and maintain education development documentation?
- Will the upgrade to DL technologies onboard easily interconnect with available external learning resources?

D. BENEFITS OF STUDY

The Navy's PCs comprise a small but significant component of the fleet. By definition, a small crew must remain with the ship to maintain its function. As a result, training for the crew particularly must remain a key concern of the Commanding Officer. In addition, the education and development needs of both officers and sailors require attention to promote the continuous professional growth for all members. Since the ability of the crew to engage in training, education and development away from the ship is severely constrained, due to mission requirements, a distributed learning environment aboard ship may provide a key component to ensure crew readiness.

E. METHODOLOGY

To identify the required elements for designing and developing a model for distributed learning technology infusion in Patrol Coastal Boats (PC) the following steps were taken: (1) conduct interviews of PC Commanding Officers and crew; (2) conduct a needs assessment of particular training, education, and development requirements; (3) conduct a thorough review of PC's training protocols, hardware requirements, system management requirements, compatibility issues, and standards; (4) conduct a visit of training/education systems of other similar organizations, examine the physical and software components that comprise their systems and discuss management and maintenance issues, requirements, implementation and maintenance costs, and lessons learned; and (5) evaluate the benefits and costs of implementing DL technologies.

F. ORGANIZATION

This study consists of seven chapters. Following the introduction in Chapter I, Chapter II shall provide a general overview of Distributed Learning and its application to the Navy. Chapter III describes the Patrol Coastal Boat Community and other similar organizations and how training and education programs are structured. Chapter IV provides a model for Distributed Learning in a military setting, Chapter V illustrates post-implementation analysis of DL resources, and Chapter VI discusses the viability of DL technologies onboard PCs. Finally, Chapter VII provides conclusions and recommendations.

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II. DISTRIBUTED LEARNING

A. METHODOLOGY

Multimedia-based learning provides an environment that is self paced, learner-controlled, and individualized, and as such has become an increasingly popular instructional delivery system. However, merely supplying the hardware and software for learning does not make an effective learning atmosphere. The success of the technology is related directly to the effectiveness of its implementation. Identifying the correct form of instruction combined with multimedia technology is critical to the dissemination of pertinent information to the individual learner.

Recent improvements in the costs and capabilities of hardware and software, combined with the growth of the World Wide Web and connectivity, encourage the development of new teaching environments. To provide a flexible, collaborative learning experience requires tools that allow learners to access various sources of information in a variety of media and work at their convenience. Distributed learning allows students to manage their time and learn while interacting with other students and instructors and as such are now presented with new opportunities for professional and personal development.

For organizations, such as the U.S. Navy, distributed learning is a way to increase the speed, flexibility and reach of training and education, reduce costs associated with offering classroom training as the only delivery vehicle, leverage instructors' expertise to a broader population of participants, and leverage team learning and collaboration to change mental models.

The development of high-performance computing and communications is creating new media, which enables new types of messages and experiences. The innovative kinds of pedagogy empowered by these emerging media, messages, and experiences make possible a transformation of conventional distance education, which replicates traditional classroom teaching across barriers of distance and time, into an alternative instructional paradigm: distributed learning.

B. ROLE OF TECHNOLOGY

Through the years, the practice of correspondence study took advantage of current technologies, incorporating into the teaching and learning environment the telecommunication technologies of radio and television broadcasting as well as audio and video recording. Today, distributed learning environments continue to evolve with advancing technology, moving toward virtual classrooms where instruction from a host site is delivered to distant sites using a combination of live, two-way interactive audio, video, or both synchronous/asynchronous computer-based interactions that take advantage of local area networks (LANs), wide area networks (WANs), the Internet, and the World Wide Web (WWW) (Williams, Paprock, and Covington, 1999).

Figure 2.1 illustrates the way multi-media based learning has evolved through the years and highlights the development of two-way interactive video delivery environments.

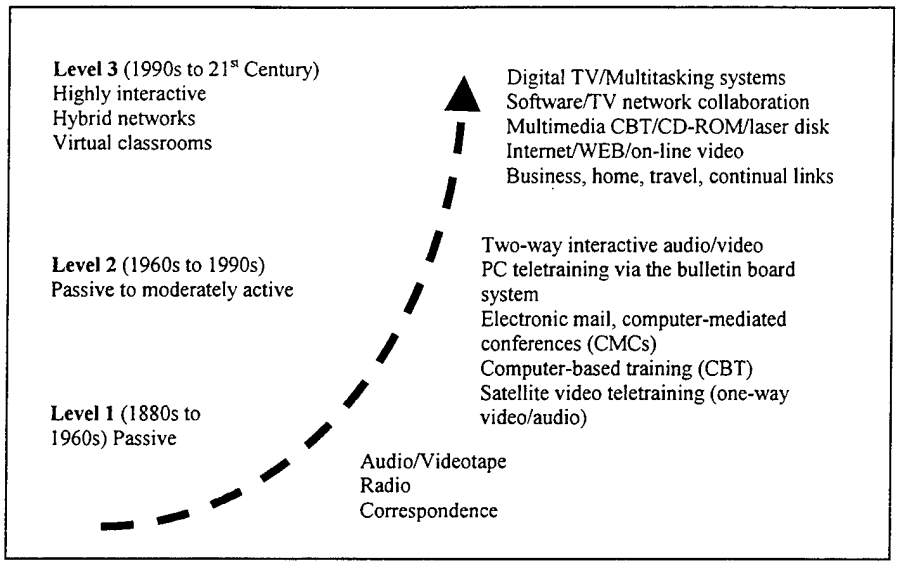

Figure 2.1 Distance Education Continuum From Ref. [Williams, Paprock, and Covington, 1999]

Level 1 consists of printed material, audio/videotapes, and radio transmissions. This level is considered to be a *passive* form of distance learning because of the lack of real time interface between the instructor and student. This type of knowledge or information acquisition is considered *asynchronous* because the instructor and student transmit messages one-way and receive responses after a lengthy delay of time.

Level 2 consists of two-way audio teletraining, one-way video/two-way audio teletraining, computer-based training (CBT) disks, CD-ROMS, laser disks, personal computer teletraining via the bulletin board system (BBS), electronic mail, computer-mediated conferencing (CMC), audio graphics, and two-way interactive audio/video transmission. This level is considered to be passive to moderately active. This type of knowledge/information acquisition is considered synchronous because both the instructor and student have the ability to transmit messages simultaneously (two-way) and receive immediate feedback and interaction among remote sites.

Level 3 consists of hybrid environments that combine in one "virtual" classroom elements of all the distributed learning technologies previously mentioned including the Internet and the World Wide Web (WWW). This level is considered to be a highly interactive learning environment. In this form of distributed learning, there is no primary mode of information delivery. The content of the course being taught determines which technologies will be the "primary" or "instructional" form of delivery and which will be the "secondary" or "support" forms of delivery.

As education and technology move into the 21st century, there are more and more open and distributed learning networks being created to meet the needs of rapidly changing educational environments. A reason for this occurrence is a generation of increasingly reliable, flexible, and affordable telecommunications technologies. Applicable to the Navy is the concept that training and education could be delivered where and when necessary. Developing a technological and educational climate of instruction which offers course content delivery on demand, anytime, anywhere is critical to the success of military readiness.

C. DYNAMICS OF THE DISTRIBUTED LEARING ENVIRONMENT

A distributed learning environment (DL) is a virtual space where students, instructor(s), and information interact from geographically dispersed locations, at different times (although it can happen in real time as well) through the power of a digital network. Distributed learning is frequently used interchangeably with distance learning, but the concept differs in terms of community and the purpose for the communicative

connection. In a distributed learning environment the purpose for the communication is not just prompted by a formal course offering, as is the case in distance learning. Similarly, the sense of community is not just created for the short time span of one course. Learning communities and collaborative environments exist and evolve independent of the time parameters of a course offering. A distributed learning environment also decentralizes instruction, frees learning from time and place constraints, is responsive to on-demand needs, adjusts to individual needs (adaptive), integrates interactivity, and is learner-centered.

In addition, a DL environment has the potential to help instructors recover time and enhance their professional growth, support professional development, support collaboration, streamline academic work, reduce continuous attention to the student, increase accessibility of instructional materials, assist in assessing students' progress, and provide access to diverse forms of information resources (Williams, Paprock, and Covington, 1999). A distributed learning approach will offer a wide range of flexible learning models appropriate to course content and student learning needs. These models might include a single computer in a room, electronic classrooms with networked computers, traditional television-based classes, tele-webs with electronic communication options, desktop video, many classes enhanced by World Wide Web components, as well as, classes offered entirely online. This learning-centered philosophy of distributed learning values the creation and exchange of information to support lifelong learning and encourages innovative approaches to instruction in the classroom and at a distance. New technologies have a role to play in distributed learning by bringing together two capabilities: they allow students to have direct access to the growing distribution of

cultural knowledge across diverse resources; and they provide means for the distribution of an immeasurable amount of information, by giving students media through which to construct and share their ideas about these materials in a whole range of public learning contexts. A distributed learning environment is an approach to education and training that is intended to be learner-centered, enabling both synchronous and asynchronous interaction through the integration of pedagogically appropriate technologies.

A distributed learning model is based on blending suitable educational technologies with aspects of campus-based delivery; open learning systems and distance education. The approach gives instructors the flexibility to customize learning environments to meet the needs of diverse student populations, while aiming to provide both high quality and cost-effective learning opportunities.

Because today's students often have full-time jobs while pursuing professional and personal development, working and learning are no longer mutually exclusive activities. A distributed learning environment incorporates the richness of group learning with the flexibility to support individual learning, all enabled by collaborative technologies. It is a unique approach that allows new and rich forms of education to be offered by higher education institutions, corporations, and other DOD organizations to a diverse and distributed population of learners. Distributed learning uniquely responds to the needs of these learners for flexible, collaborative learning, which can be accessed anytime, anywhere, by anyone.

To really appreciate the new dynamics of operations associated with distributed learning technologies, there is a need to see what makes this emerging form of learning so useful and attractive at a personal level. Once the personal dimension is understood,

administrators and users of DL technologies will be able to apply DL to the roles and activities of naval organizations and their people. The current form of cyberspace turns out to be very different from the standard communications network of telephones that people are used to. Traditional communication devices used for distance learning typically are point-to-point and accommodate one user at a time. Distributed learning, in contrast, is a many-to-many environment where multiple, simultaneous access is the standard. This changes fundamentally the way people operate.

Although there is currently an explosion in the number of applications that can transmit and receive streaming audio and video to and from a personal computer (PC) over the Internet, there continues to be significant interoperability, protocol and architectural issues that must be addressed if distributed learning is to become common place from the desktop.

D. BENEFITS & CHALLENGES

Preparing to use DL technologies requires a shift in pedagogy, a movement from a teaching paradigm to a learning paradigm. Instructional design using collaborative technologies must integrate more group work, problem solving, and mentoring as the new fundamentals of continuous learning. To implement successfully these new teaching methods, facilitators will need training and support. The role of the facilitator would be to structure learning experiences that move students from their assimilating of inert facts to their generating of mental models. However, access to data does not automatically expand students' knowledge; the availability of information does not intrinsically create an internal framework of ideas that learners can use to interpret reality. To be motivated

to master concepts and skills, students need to see the connection between what they are learning and the rest of their lives and the mental models they already use. To move students from assimilating inert facts into generating mental models, teachers must structure learning experiences that highlight how new ideas can provide insights in intriguing and challenging situations.

Changes in technology have spawned new ways of working, new business processes and new ways of delivering education. Within this context of rapid technological change, training and education is seen as an ongoing necessity, enabling personnel to remain current with required skills and knowledge. A number of underlying social, economic and technological forces are coming together to drive demand for continuing education and training. Literature reviews suggest that the U.S. is entering a period when the training that workers receive will become obsolete within three to five years. The need for lifelong learning is also reinforced by the frequency with which people change careers. According to the Department of Labor estimates, the average person entering the labor market can anticipate six to seven career changes in their lifetime (www.stats.bls.gov/oco/cg/cgs034.htm). Employees value the opportunity to develop their skills and increase their marketability, whether to remain employable in their current organizations or to prepare for future opportunities. The convergence of these various forces has created a situation in which corporations require employees to learn new skills and acquire new knowledge quickly and continuously. While individuals are motivated to learn for personal and professional development, the logistics of attending classroom education are increasingly difficult to manage. Distributed learning technologies provide access to a sizeable market of nontraditional students who are older,

have family responsibilities, are employed, wish to remain in their geographic areas and need continuing education to succeed more effectively at work (Minoli, 1996).

In a military setting, organizations face a population of learners who are dispersed in terms of time and geography. The costs of training facilities and lost work time contribute to the need for less expensive, more effective solutions. The expertise of instructors is not being utilized to the fullest because of the limited number of learners they can reach using traditional methods. Distributed learning options reduce costs of instructor and student travel while leveraging instructor productivity. By implementing distributed learning solutions, the Navy and the PC Community could differentiate itself from other military organizations by being at the leading edge of technology, which consequently will allow its personnel to upgrade their skills level to effectively compete in a skill-based economy.

The cost of technology has at times prohibited widespread use of distributed learning, but recent reductions in the cost of hardware and software have lowered that barrier. The huge growth in the installed base of networked and inter-networked computers presents an opportunity now to create an electronic environment for learning any time at any place.

E. STRATEGIC ISSUES AND CONSIDERATIONS

The U.S. armed forces, through Joint Visions (JV) 2010 and 2020, have said that "superior information converted to superior knowledge" will transform 21st century military operations. JV2010 and 2020 couple information superiority with the need for technological, organizational, and conceptual innovation. Attaching a Navy emphasis to

networking and network-centric warfare creates a potential for adaptable, and responsive naval performance.

The acquisition of superior knowledge is quickly becoming a skill, which all military personnel must hone, in order to remain competitively marketable in an organization where promotion is rewarded for technical proficiency and sustained superior performance at sea.

The need to identify acceptable alternatives for education and training is increasing because: (1) budget pressures are reducing funds to operate centralized schoolhouses; (2) with modernization and technology enhancements that increase the complexity of military equipment and support systems, training demands are ever increasing; and (3) national strategies have increased dependence on reserve call-up for military operations (Metzko, Redding, and Fletcher, 1997).

For a distributed learning program to be successful in any organization, senior management must be the proponents for institutional change. To have a DL program designed, implemented, and utilized successfully in an organization, such as the Patrol Coastal Boat community, requires continued dedication to resource expenditures and commitment from leadership to support changes that must occur with regards to training and education. Senior leadership must remain actively involved in supporting and facilitating the use of technology for education and training purposes. According to Bates' book on Managing Technological Change, leadership is not so much a strategy as a quality. Senior managers or heads of department must have leadership quality and an understanding of the strategic importance of applying new technologies to teaching and

learning. As a team, senior management should either directly or through delegation ensure the following is adhered to (Bates, 1999):

- Define a vision for teaching and learning and define where technology fits within that vision
- Identify new target groups that could be reached through the use of technology
- Define priority target groups and appropriate programs for the use of technology-based delivery
- Identify areas of support outside the department, faculty, or institution, and determine the organizational and support staffing for technology-based teaching that still needs to be provided in-house
- Ensure that innovation and the skilled use of technology for teaching is properly recognized and rewarded
- Identify the role of and priorities for face-to-face teaching in an increasingly sophisticated technology-based learning environment
- Decide on key areas of investment and resource allocation for technology-based teaching

Distributed learning in the PC Community can be beneficial in two important areas; cost and global reach. In a decreasing defense budget, the allocation of MILPERS dollars, which pay for travel and education, is ever decreasing. Besides costs, the naval environment requires personnel to be deployed at remote or isolated settings that are far from traditional educational resources. A more time efficient delivery of course material and feedback to the student can markedly improve the dedication of the student to complete the course of instruction (Glover, 1998).

Many senior leaders worry that the pursuit of knowledge superiority may erode the human strengths needed for military success, such as willpower, creativity, unit cohesion, and judgment. To the contrary, a concentration on human factors should help

find ways to bolster these strengths. The Navy has pursued these enhancements in shipboard combat information centers; now it needs to leap forward into entire distributed learning networks.

F. MAKING THE TRANSFORMATION

Today, distance education is primarily used in selective situations to overcome problems of scale (not enough students in a single location) and rarity (a specialized subject not locally available). Such instruction is often thought of as sufficient pedagogy--it is better than nothing but not as good as face-to-face teaching. However, the global marketplace and emerging information infrastructures are changing this situation. Educators must help all students become adept at distance interaction because skills involving information-gathering from remote sources and collaborating with dispersed team members are as central to the future workplace as learning to perform structured tasks quickly was to the industrial revolution (www.ncrel.org). Also, by increasing the diversity of human resources available to students, distributed learning can enhance equity and increase knowledge to prepare them for competition in the world's marketplace. Virtual classrooms have a wider spectrum of peers with whom learners can collaborate than any local region can offer and a broader range of teachers and mentors than any single educational institution can afford. In a few years, high-performance computing and communications will make knowledge utilities, virtual communities, shared synthetic environments, and sensory immersion as routine a part of everyday existence as the telephone, television, radio, and newspaper are today. Distributed learning experiences will be seen as vital for all learners even when the same content

could be taught face-to-face, and all teaching will have some attributes of distance education. However, keeping a balance between virtual interaction and direct interchange will be important. Technology-mediated communication and experience supplement, but do not replace, human interaction in formal classroom settings.

High-performance computing and communications will not solve all problems of education; thoughtful and caring participation is vital for making these new capabilities truly valuable. New media complement existing approaches to widen the existing structures of communication; properly designed, they need not eliminate choices or force high-tech, low-touch situations.

How a medium shapes its users, as well as its message, is a central issue in understanding the transformation of distance education into distributed learning. As the American society moves beyond naive "superhighway" concepts to see the true potential impact of information infrastructures, the Navy will face powerful new interactive media capable of influencing the Sailors of the future. The most significant influence on the evolution of distributed learning in the military will not be the technical development of more powerful devices but the professional development of wise designers, educators, and learners.

Before an organization pursues the development of a distance learning or distributed learning program, it needs to make a number of decisions regarding the marketplace and to define a clear business plan and strategy. Clearly, technology is having dramatic effects on higher education. New technology affords exciting opportunities for more effective learning, and offers scalability that is greatly needed.

The idea that technology is a panacea and that it is applicable across all types and sizes of institutions is an extraordinarily dangerous assumption. Institutional planners need to apply core content embedding them in the strategic planning that needs to be done before pursuing a distributed education strategy. The distributed learning approach is as applicable in a displaced military as it would be in a residential learning atmosphere. In fact the "anywhere-anytime-anyplace" character of this new set of electronic educational opportunities may well have a great impact on military education and training structures as we know them today. Whereas one dimension of education and training is the distance or remoteness of the learner, customization may also be needed because of differences in backgrounds or differences in basic academic preparation.

Customization may take the form of consideration of learning challenges and disabilities and differing learning styles. A distributed learning environment may be reinforcement -- providing the opportunity to explore something in much greater depth, as learners study the material on their own time, outside of the traditional classroom and homework assignments. It is important to formulate this new arena of distributed learning in a far more inclusive manner, whether these opportunities occur in a shore or afloat military environment.

The educational opportunities that the new technologies afford are exciting and technically feasible, but institutions face significant obstacles that need to be addressed before such opportunities can be made operationally feasible. The purpose of raising such concerns is not to dissuade Navy institutions from getting actively involved in distributed learning approaches, but merely to try to identify the organizational, business, and cultural challenges that need to be considered in order to effectively implement such

initiatives. To implement distributed learning opportunities that are effective and sustainable, the U.S. Navy must develop viable organizational and business strategies.

G. CONCLUSION

Institutions need to seriously consider all of the relevant issues as they enter the exciting new marketplace of distributed learning. A military institution cannot be naive in such a venture, assuming a "build it and they will come" philosophy. If an organization lacks a clearly defined business plan and a well-thought-out strategic plan, developing such initiatives becomes essential before financial resources and effort is spent on a distributed learning effort.

These concerns should not be misunderstood to suggest that distributed learning is something that a military should avoid, and they must not be used as reasons to do nothing. Military institutions must carefully define their distributed learning strategies in light of the economics and within the context of the unprecedented pressures and accountability issues that higher education is facing today.

Collaboration where distance is conquered on a global scale means that all of our military's intellectual resources can be brought to bear on any issue. The speed at which this occurs enables improved operational and strategic speed overall - a distinct advantage in any competition. Accuracy is another key feature in the technological transactions taking place in this evolving learning environment. This results in better operational and tactical precision. The interaction of collaboration, speed, and accuracy is critical to the success of any military and can be further supported by use of distributed learning technologies.

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III. U.S. NAVY PATROL COASTAL SHIPS (PC)

A. INTRODUCTION

While deployed at sea, Sailors are typically offered traditional means of education through correspondence or Program for Afloat College Education (PACE) courses. But with recent technological developments in distributed learning applications, it is now feasible to deliver real-time, educational content to individuals anywhere in the world whether at sea or ashore. Advancements in technology, such as the Internet and video teleconferencing, now offer Sailors the prospects of taking advantage of learning opportunities that never before seemed possible.

Applying distributed learning innovations to existing training and education programs can add numerous personal and economic benefits and improved operational capabilities for the Navy and the Navy PC as well. This chapter describes the PC community, identifies who the PC Sailor is, and assesses the PC's ability to harness the growing trend of using distributed learning technologies for improving shipboard training and education programs.

B. SPECIAL WARFARE ORGANIZATION

The PC community is unique in design, which is immediately identified when conversing with any of the assigned shipboard personnel or support staff. PC personnel identify themselves as being part of an exclusive organization within the U.S. Navy, particularly associating themselves with the Special Forces organization of Naval Special Warfare Command.

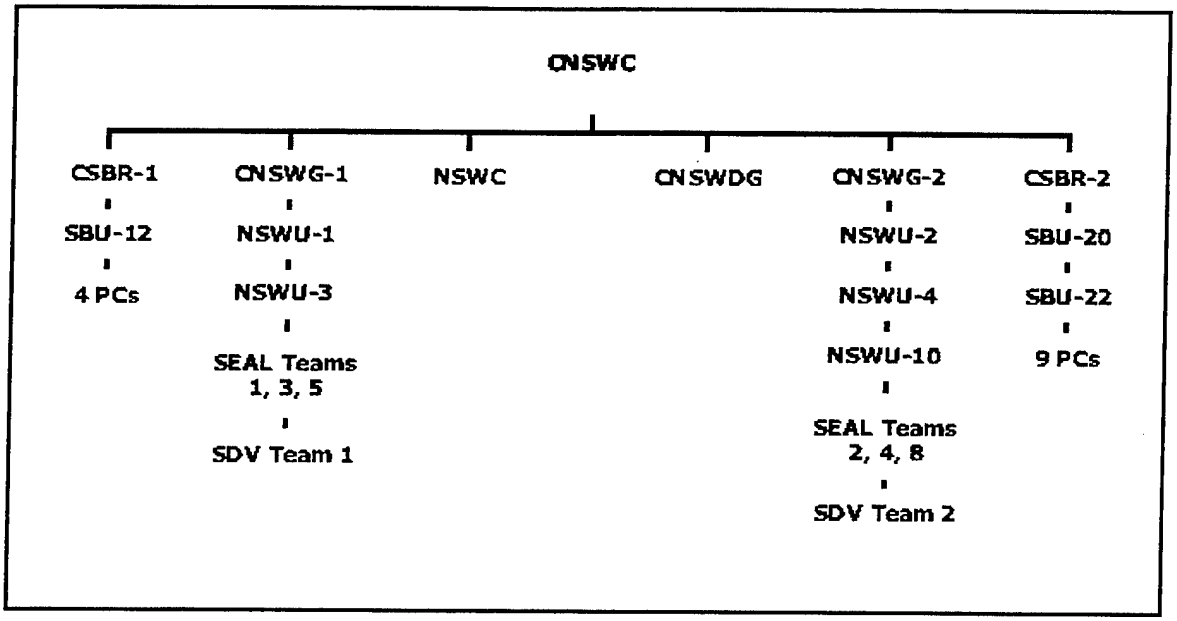

Figure 3.1 Naval Special Warfare Command Organizational Chart From Ref. [www.docsnavyseals.com]

Commander, Naval Special Warfare Command (CNSWC) exercises operational control and is responsible for the administration, training, maintenance, support and readiness of all U.S. active and reserve Naval Special Warfare forces. Figure 3.1 illustrates the major operational components of Naval Special Warfare Command (NSWC). They include Naval Special Warfare Group ONE (CNSWG-1) and Special Boat Squadron ONE (SBR-1) in Coronado, CA, and Naval Special Warfare Group TWO (CNSWG-2) and Special Boat Squadron TWO (SBR-2) in Little Creek, VA (www.docsnavyseals.com/navspecwarcom.html).

Special Boat Squadron ONE (SBR-1), commanded by a Navy Captain (O-6), is based at the Naval Amphibious Base, Coronado, California and is one of the six major operational components for NSWC. SBR-1 exercises operational and administrative control of Special Boat Unit TWELVE (SBU-12), and four *Cyclone* class Patrol Coastal (PC) ships. They are the USS Hurricane (PC-3), USS Monsoon (PC-4), USS Squall (PC-7) and USS Zephyr (PC-8) (www.chinfo.navy.mil/navpalib/factfile/ships/ship-pc.html).

SBR-1 deploys PCs and SBU detachments worldwide to meet training, exercise, contingency and wartime requirements of theater commanders. SBR-1 operates in the Pacific and Central areas of responsibility (AOR) (www.docsnavyseals.com/special boat squadron one.html).

Special Boat Squadron TWO (SBR-2) is based at the Naval Amphibious Base, Little Creek, Virginia. SBR-2 is also commanded by a Navy Captain (O-6) and is also one of the six major operational subordinate commands of the NSWC. SBR-2 maintains operational and administrative command of Special Boat Unit TWENTY (SBU-20), Special Boat Unit TWENTY TWO (SBU-22) and nine PC ships; USS Tempest (PC-2), USS Typhoon (PC-5), USS Sirocco (PC-6), USS Chinook (PC-9), USS Firebolt (PC-10), USS Whirlwind (PC-11), USS Thunderbolt (PC-12), USS Shamal (PC-13) and USS Tornado (PC-14) (www.chinfo.navy.mil/navpalib/factfile/ships/ship-pc.html).

SBR-2 deploys PCs and SBU detachments worldwide to meet training, exercise, contingency and wartime requirements of specific theater commanders. SBR-2 geographically supports the Atlantic, Southern and European AORs (www.docsnavyseals.com /special boat squadron two.html).

Other major component commands include Naval Special Warfare Development Group (NSWDG) in Dam Neck, VA, and Naval Special Warfare Center (NSWC) in Coronado, CA.

C. *CYCLONE* CLASS SHIP

The Navy's PC (see image Figure 3.2) measures 170 feet from bow to stern and is designed to fulfill interdiction, patrol, and surveillance roles of littoral areas as its primary missions. Its unique capabilities in the littoral battle space includes the ability to transition from the blue water, open ocean environment to operating within inland riverine environments.

These vessels also provide full mission support for Navy SEALs and other special operations forces as necessary. The PC is expected to operate primarily in low-intensity conflict (LIC) environments (e.g. Counter Narcotic Operations/Interdiction) and engage in contingency scenarios which range from permissive Non-Combatant Evacuation Operations (NEO) to counterinsurgency of coastal sea lines of communication (SLOCs) (for more information on mission capabilities see www.navsea.navy.mil/folders/frame-search.html).

PCs are limited in range based on fuel, sea state, and ocean currents. They are also limited in size and amount of equipment and weapons they can carry. Because of such limitations, PCs require a support base or platform for an extended deployment and require extensive air and/or sealift to deploy to a forward theater or an area of operations.

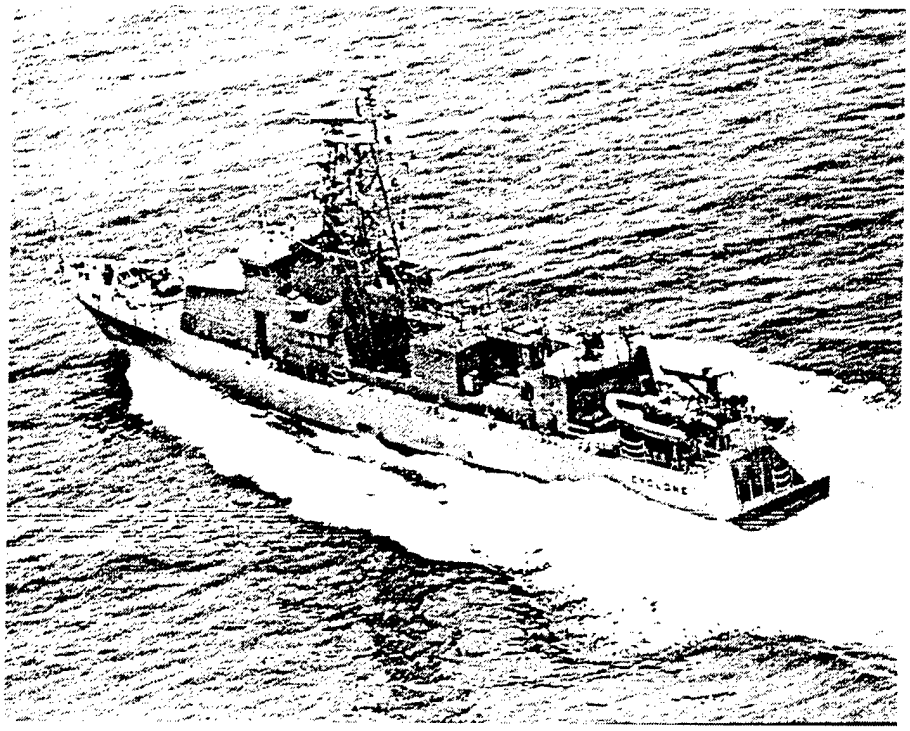

Figure 3.2 Cyclone Class Patrol Coastal (PC) Ship From Ref. [www.navsea.navy.mil/navspecwar]

Because of the unique set of mission capabilities which a PC and crew must be able to execute rapidly, assigned shipboard personnel undergo measurable amounts of stress which stems from continuously working 10 to 12 hour days to maintain the ship and its systems 100% operational. The PC is designed and intended to be operationally ready for at sea operations at least within a 24 to 48 hour notice. This feature is unlike any of its counterparts in the Cruiser/Destroyer communities where a ship typically takes anywhere from 5 to 7 days to prepare for normal underway operations. Also, because the PC must make itself operationally ready for its own missions as well as those for Navy SEALs and Special Forces, a PC typically spends over 70% of the year conducting underway operations[1]. For this reason, according to interviews conducted during this study, assignment to a PC unit is now considered "arduous sea duty"[2]. To the individual

[1] Based on underway operations whether deployed or not.
[2] At time of research, official document was not available for reference.

assigned to a PC, this assignment offers no preferential treatment other than priority housing for those with families, and a better selection of follow-on orders for the individual's next billet assignment.

A PC's male crew is comprised of approximately 24 enlisted, 4 officers, and 9 Navy SEALs (during special operations or exercises). Because PCs contain such small crews, each unit is limited to three inport duty sections, which adds another reason why the quality of life for a PC Sailor may not appear as attractive as his counterpart onboard a larger combatant which may be dealing with an 8 or 10 inport duty section rotation (for explanation of duty sections see appendix A). Because the PC community is so small, personal arrangements between two ships may be made to increase the watch rotation for officers and chiefs.[3]

Each PC unit is supported with a detachment that offers mechanical and technical support as well as personnel augmentation in the event that a vessel must get underway during a period of reduced manning. In addition to providing maintenance assistance, these support activities, also known as Maintenance Action Teams (MAT), offer PC personnel classroom areas to conduct training and education when necessary. Because their sole purpose is to assist PCs in preventative and corrective maintenance of shipboard systems, MATs do not provide any classroom education or training for PC personnel.

The personnel demographics mirror that of any other Naval organization in that the Sailors vary in rates from seaman recruit up to senior enlisted and officers. What makes this community of Sailors different from others is that the personnel assigned to

[3] As was identified in homeport San Diego, two units on the same pier shared one individual as Command Duty Officer.

serve onboard a PC are expected to excel as Naval professionals at a much faster pace than a typical Navy Sailor serving onboard a Cruiser or Destroyer. For example, the PC Commanding Officers interviewed maintained that newly assigned PC Sailors are expected to complete their Enlisted Surface Warfare (ESWS) qualification at a much faster pace than their counter-parts on other combatants[4].

Also, because a PC must meet the same mission readiness requirements that a vessel of a Cruiser/Destroyer squadron must meet, PC personnel find themselves under extreme pressure to ensure levels of training and operational readiness are at the highest levels attainable.

D. PC SAILOR

Assessing the nature of the adult learner onboard a PC would show that each individual is different with different educational needs and/or requirements[5]. Each Sailor, whether it be officer or enlisted, fulfills a required billet which necessitates numerous job tasks. The characteristics of a PC's crew can be described as a small size crew with highly technical skill sets which require constant upgrading whether inport or at sea.

Crewmen are trained extensively in craft and weapons tactics, techniques, and procedures. Focusing on clandestine infiltration and extraction of SEALs and other special operations forces, PC personnel provide dedicated, rapid mobility in littoral areas where larger ships are unable to navigate. Like the Navy SEALs, these Sailors must be highly motivated, physically fit, combat-focused and responsive in high stress situations.

[4] Crew ESWS qualifications average approximately 80% to 85% onboard a PC.
[5] Based on formal interviews conducted onboard two PC units. For questions see appendices B and C.

For a ship to function to the best of its ability, PC personnel must remain mentally and technically proficient, which is accomplished through constant education and training. Total shipboard training subjects typically include engineering and weapon systems, seamanship, navigation, combat tactics, emergency scenarios, first-aid, security, and Special Forces and clandestine operations. Outside of total shipboard training, Sailors also focus on physical fitness, study rating information for advancement, and accomplish enlisted surface warfare (ESWS) and watch standing Personnel Qualification Standards (PQS). PC Officers must meet similar training and education requirements with the exception of working towards a Surface Warfare (SWO) qualification versus the ESWS for enlisted personnel.

Because PCs fall under the jurisdiction of SPECWARCOM, the community emphasizes the need for physical fitness training (PT) of its personnel whether assigned to a PC or support staff. Both enlisted and officer personnel undergo rigorous physical fitness and acclimatization training to develop high levels of stamina and endurance to meet the demands of the maritime combat environment. Crewmembers also participate in intensive training in survival swimming and lifesaving techniques to develop confidence in their abilities to survive in the ocean, and, if necessary, assist a crewmate in an extreme situation.

During inport periods, each Sailor is expected to conduct, at a minimum, three hours of PT a week, which is twice the minimum standard set forth by the Chief of Naval Operations (NPC-60, 1998). Physical fitness training is kept at a minimum during normal underway operations because of the instability of a PC.[6]

[6] Examination of two PCs found exercise locations to be very confined and only one exercise bicycle onboard each ship.

Thus, physical fitness training remains an integral part of the PC Community, and exercise requirements are set in a manner conducive to good morale while ensuring continued operational readiness.

A PC Sailor experiences similar dissatisfying attributes of shipboard life like any other combatant Sailor. Interviews (see appendix B and C for questions) conducted with experienced PC personnel suggest that the nature of the habitability (mechanical and technological systems layout) onboard a PC causes a crewmember to experience more mental and physical fatigue compared to a Destroyer or Cruiser Sailor. Because PCs are unstable platforms at sea, and personal space is very limited onboard, Sailors at sea experience higher levels of exhaustion vis-à-vis inport periods.

The design of a PC requires maximum use of every available square foot of space to support systems essential to mission area effectiveness. The continuous addition of technological advancements to limited shipboard space results in the further removal of a Sailor's personal area and, therefore, removes the possibility for shipboard spaces to be designated as learning resource centers. Regarding available computer systems onboard a PC, all Officers onboard are well equipped with laptop computers, and personal data assistants (PDA), or pocket personal computers. For the enlisted personnel only two to four computers are made available for the management of shipboard database programs because space is limited onboard. Onboard the two PC units where interviews were conducted, only one computer connection to an Internet Service Provider (ISP) existed during the inport period for enlisted personnel to use. Local area networks (LAN) do exist onboard several PCs, but not all ships within this community possess such networks linking all available computers to a central server.

The process of installing new systems, updating user-interface policies, conducting training on system integration functionality, and fulfilling the required watch assignment rotations further restricts a Sailor's personal time with respect to continuing education.

When attempting to understand who the PC Sailor is, one must consider the environment that affects the Sailor's capability to further his education. The crew dynamics vary not only in socio-economic levels but also in education levels (from high school diplomas to masters degrees) as well. Although PACE courses and other published learning materials may be brought aboard ship, a PC crewmember is further restricted from being able to participate in continued education because of typical operation tempo (OPTEMPO) constraints which dictate job task requirements.[7]

The education levels of a PC's crew vary so much that one type of learning program could not realistically support the needs of an entire crew. The majority of enlisted personnel have completed studies for the G.E.D. or hold high school diplomas. Research found few examples where enlisted personnel arrive onboard with a bachelor or associates degree. Of the thirty Sailors interviewed, eight had completed some education courses via PACE and correspondence courses, and one had earned an associates degree.

Officers by nature of their career paths typically arrive onboard with a bachelor or masters degree, but instances occur when personnel are assigned to support staff or PC units without ever having attained a college degree (as is the case in Limited Duty Officers or Chief Warrant Officers).[8]

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[7] PACE Professors do not go onboard PCs because of instability and mission requirements of a PC platform.

[8] Education completion data of all shipboard personnel was not available at the time of research.

Thus, when attempting to identify what type of adult learner the PC Sailor is, research suggests numerous aspects such as the person's background (personal, academic, career status), familial status, and work environment affect the decision to continue the pursuit for higher education.

An education and human development program using DL technologies which may be implemented onboard a PC not only must deal with monetary constraints, but also the limitations of individual academic aptitudes, available productive learning environments, uncontrollable time constraints, and upper echelon leadership support.

Based on thirty interviews of PC Sailors and seven PC Officers, PC personnel demonstrate a subject-centered orientation to learning. Their learning experiences are organized and focused according to their perceived logic of subject matter contents being used to increase their knowledge. What is learned is only done to meet needs such as career or pay advancement, specialized training, and technical skills. They are motivated to learn as they experience work specific needs and interests that learning will satisfy.

E. OTHER ORGANIZATIONS

Because the use of distributed learning technologies for military applications is a fairly new concept for the Navy, this study attempted to identify organizations with similar attributes as the PC to build a baseline DL infrastructure from which to work with. Extensive research of library materials and Internet sites identified no other American military units with similar job task functions as the Navy PC.[9] Several commercial shipping firms and maritime organizations were evaluated, but of those

[9] Four Foreign Navies having Coastal Patrol Crafts were contacted - none responded in support of this project.

reviewed, none of them had similar mission or underway requirements as those within the PC community.

The only units found to have similar traits as the Navy PCs are the United States Coast Guard (USCG) Coastal Patrol Boats. Although the USCG does not have a 170 foot Patrol Boat, it does maintain three types of Coastal Patrol Boats: the Point Class - 82 foot Patrol Boat with a crew of 10, the Marine Protector Class – 87 foot Patrol Boat with a crew of 10, and the Island Class – 110 foot Patrol Boat with a crew of 16.

These Patrol Boats all concentrate on law enforcement - mainly drug and illegal alien interdiction duties, and they are also involved in Port Security, Search & Rescue, and Defense Readiness operations. Although these vessels serve a multitude of mission areas, they typically do not participate in extended six-month deployments like the Navy PCs do. Also, unlike the PC community, these Coast Guard (CG) Patrol Boat Communities do not consider physical fitness as an integral part of operational readiness. Although there are individuals whose job tasks require high levels of physical readiness, such as search and rescue swimmers, research found no indications of physical fitness programs onboard CG Patrol Boats that match or surpass that of a Navy PC.

Regarding computer technology capabilities within the Coast Guard, in general, there is more emphasis placed on shore-based education classrooms than shipboard learning resource centers.[10] Because CG Patrol Boats are smaller, have less space for learning resource centers, and usually are affected by funding limitations, computer structures onboard a Patrol Boat are typically limited to two to four antiquated computers for enlisted personnel use and one to two laptops for upper echelon use. Pier-side

[10] Reference COMDTINST M 3502.4E for all training requirements for CG ships. This instruction establishes minimum Training and Qualification Requirements for all Coast Guard Cutters."

Internet access is limited and varies according to the computer capabilities of individual units. Also, because computer infrastructures vary in capabilities from unit to unit, Local Area Networks are virtually non-existent. A DL infrastructure does not seem feasible for vessels of such limited computer capabilities.

F. CONCLUSIONS

This chapter illustrates the uniqueness of the Navy's Patrol Coastal Boat Community, and describes who the PC Sailor is. When interviewing assigned shipboard personnel, I felt an elite war-fighter spirit throughout the ranks, from the lowest of enlisted ranks to the Commanding Officers. The individuals onboard understand that the PC's capabilities are only as good as the personnel who are assigned to complete specific task functions. Although these units must endure high levels of personnel and operational readiness, and are faced with arduous OPTEMPOs, the crews of these vessels remain dedicated to the ship's mission and strive to ensure maximum readiness at a moment's notice.

My research suggests that no other U.S. military maritime organizations possess such unique requirements as those levied on the Navy PCs. Although the Coast Guard Patrol Boats share similar attributes of the PC, they do not compare to the manning expertise and technological capabilities that the Navy PCs maintain. Thus. a PC's uniqueness is shown through its people and its capabilities.

Implementing a DL environment within this community of warfare experts would further promote the continuous professional growth for all members and may provide a key component to ensuring personnel readiness.

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IV. MODELS FOR DISTRIBUTED LEARNING

A. INTRODUCTION

With the rapid growth of distributed learning (DL) technologies, including distributed learning using the Internet, and given that PC personnel demonstrate the capabilities of utilizing computers for multi-purpose functions onboard ship, this chapter examines the process by which a DL environment may be developed and implemented onboard a PC unit.[11]

This chapter addresses three models for designing and implementing a DL infrastructure onboard a seagoing vessel. The first is a theoretical foundation of Adult Learning model to illustrate a strategy for an Adult Learning Planning Process; the second is an Organizational Manpower model which links distributed learning with personnel distribution; and the third, is a Systems Perspective model for distributed learning in a military environment.

B. BACKGROUND

Today's Navy is continuously being transformed by global competition and the power of technological advancements. An understanding of the interaction of education and technology contributes to the competitiveness of both the individuals and institutions they are associated with. Therefore, the Navy of the future must undoubtedly embody distributed learning processes. In doing so the Navy will position itself as a viable

[11] DL technologies may include two-way interactive audio, video, or both synchronous/asynchronous computer-based interactions that take advantage of local area networks (LANs), wide area networks (WANs), the Internet, and the World Wide Web (WWW).

competitor in the war for talent in today's competitive economic market. Not knowing how to harness the growing trend of adults seeking higher education will undoubtedly cause the Navy to lose its talented personnel assets.

Many scholars question whether today's educational institutions prepare students to be lifelong, adaptable learners (Cross, 1981, Knowles, Holton, & Swanson, 1998, Bates, 2000). With distributed learning capabilities, learning and knowledge will come from a broader range of sources to be able to suit the needs of all students provided they are motivated to exploit such opportunities. Offering technology alone will not motivate an individual to learn. Correct job design, effective reward system, and mentoring a student must also take place to ensure the individual stays challenged and focused on his or her educational goals.

While adults are responsive to some external motivators (better jobs, promotions, higher salaries), the most potent motivators are internal pressures (the desire for increased job satisfaction, self-esteem, and quality of life) (Knowles/Holton/Swanson, 1998). Tough (1979) found in his research that all adults are motivated to keep growing and developing, but this motivation is frequently blocked by such barriers as negative self-concept as a student, inaccessibility of opportunities or resources, time constraints, and programs that violate principle of adult learning.

Information-age networking technology gives higher education an opportunity to improve its ability to deliver quality education virtually anywhere. Two potential solutions for training shipboard deployed adult learners are through the use of computer-based training (CBT) and/or the Internet. Both options/alternatives can provide stand-alone or tethered (synchronous/asynchronous connections) mediums for physically

dispersed learners and can be used to accomplish a wide range of instructional objectives based on the individual's personal educational needs or the organization's requirements.

C. ADULT LEARNING MODEL

Before the implementation of a distributed learning environment occurs, certain critical actions must occur for a DL program to operate at its maximum capabilities. Merely placing computers with preinstalled software packages onboard a ship does not make a recipe for success, nor would such an action encourage a need to seek further training, higher education, or personal development. Whether the need for learning is based on the acquisition of information for advancement purposes, warfare qualifications, or degree attainment, there must be a standard set of steps that an institution must take before implementing a DL program.

Adult learning can best be described as the process of adults gaining expertise and knowledge. The Foundation of Adult Learning Model (illustrated in Figure 4.1) serves as a tool to identify what is known about adult learners controlling their own learning processes.

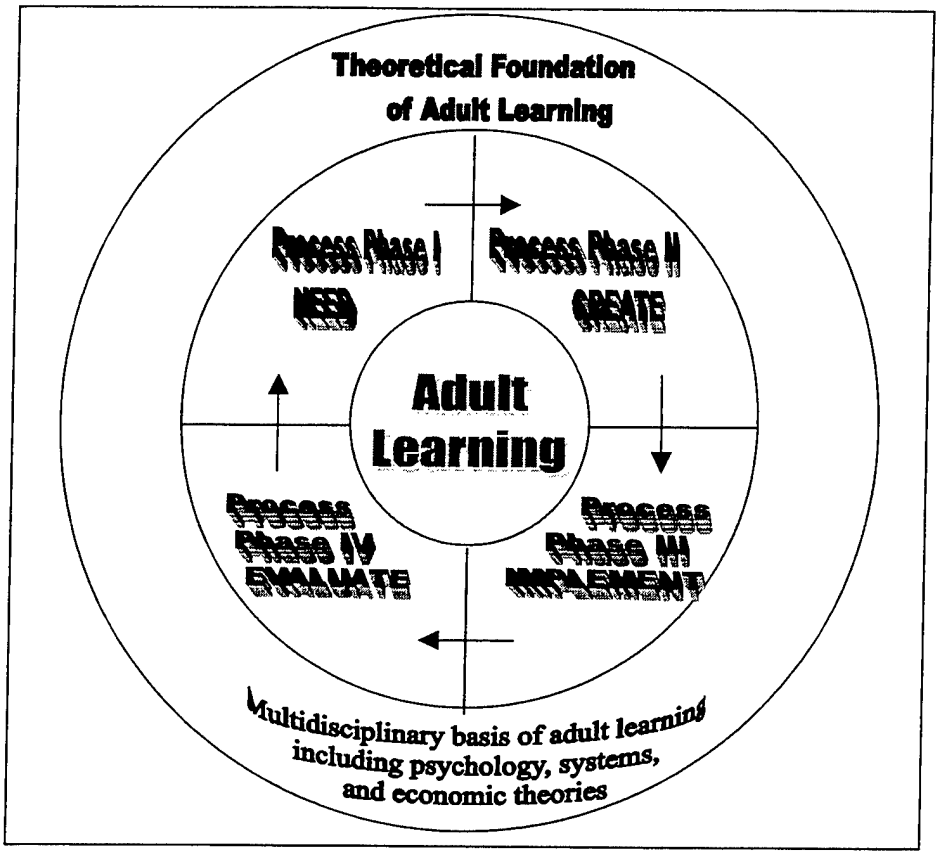


Figure 4.1 Adult Learners Controlling Learning Process From Ref. [Knowles, Holton, & Swanson, 1998]

This model identifies four basic principles from which adult learning programs can be developed and implemented. The four phases of the adult learning planning process are:

- **Need**. Determine what learning is needed so as to achieve goals.
- **Create**. Create a strategy and resources to achieve the learning goal(s).
- **Implement**. Implement the learning strategy and use the learning resources.
- **Evaluate**. Assess the attainment of the learning goal and process of reaching it.

At first glance this model appears to be generic in nature, but it is necessary to understand the concepts which surround the process of planning for the adult learner. Because each individual is different and aspires to different learning goals supported or

limited by differing learning skills and abilities, a learning environment must be able to offer varying applications from which to choose to best fit not only the needs of the individual, but also support the organization the person is associated with.

According to Knowles, Holton and Swanson (The Adult Learner), individuals are categorized into four generally accepted categories of learners; dependent, interested, involved, and self-directed. As a person matures, his self-concept moves from one of being a dependent personality toward one of being a self-directing human being, and accumulates a growing reservoir of experience that becomes an increasing resource for learning. Readiness to learn becomes increasingly oriented to the development tasks of a person's work and social roles, and time perspective changes from one of postponed application of knowledge to immediacy of application and accordingly orientation towards learning shifts from one of subject centeredness to one of problem centeredness (Cross, 1981).

To assist in the translation of the Adult Learning Model to a Navy application, the following list of items may be considered when applying the four phases of the Adult Learning Process. The phases offer a foundation from which a DL program manager may begin to gather the necessary information to develop a suitable DL environment.

If care in researching each phase of the planning process is not taken, and support from upper echelon not received, a DL program would improperly provide services to Sailors and eventually become a useless tool and an unnecessary use of limited shipboard resources.

1. Strategy for Adult Learning Planning Process

a. Process Phase I: *Needs Assessment*

(1) Survey ship's crew. Identify learning goals for individual, group, team, or ship.

(2) Evaluate historical data. Determine what learning programs are/were necessary for training and developing individual or team success. Determine how useful existing programs are/were.

(3) Compare program to other programs established on other commands.

(4) Identify possible resource sponsors.

b. Process Phase II: *Create Model for DL Program*

(1) Construct a model of competencies requiring performance (Knowledge, Skills, and Aptitude) by rate/rating.

(2) Specify Learning objectives (What will be learned vice what will be done-e.g. rate training, team training, bachelor/masters degree studies).

(3) Identify learning objective validating criteria (module completion, tests, oral boards).

(4) Specify Learning resources & strategies (materials & mentors; techniques & tools).

(5) Specify Learning environment (classroom/space, allotted times for training).

c. Process Phase III: *Implement DL Program*

After resources and strategies are identified:

(1) Execute plan for learning using objectives as guidelines to accomplish required tasks.

(2) Advertise program availability to entire ship's crew.

(3) Recruit interested adult learners.

d. Process Phase IV: *Evaluate DL Program*

(1) Assess the completion of the learning goals and the process of accomplishing them.

(2) Collect evidence that indicates the degree to which each objective was met, the adequacy of learning resources and strategies.

(3) Evaluate the accomplishment of each objective by established validating criteria.

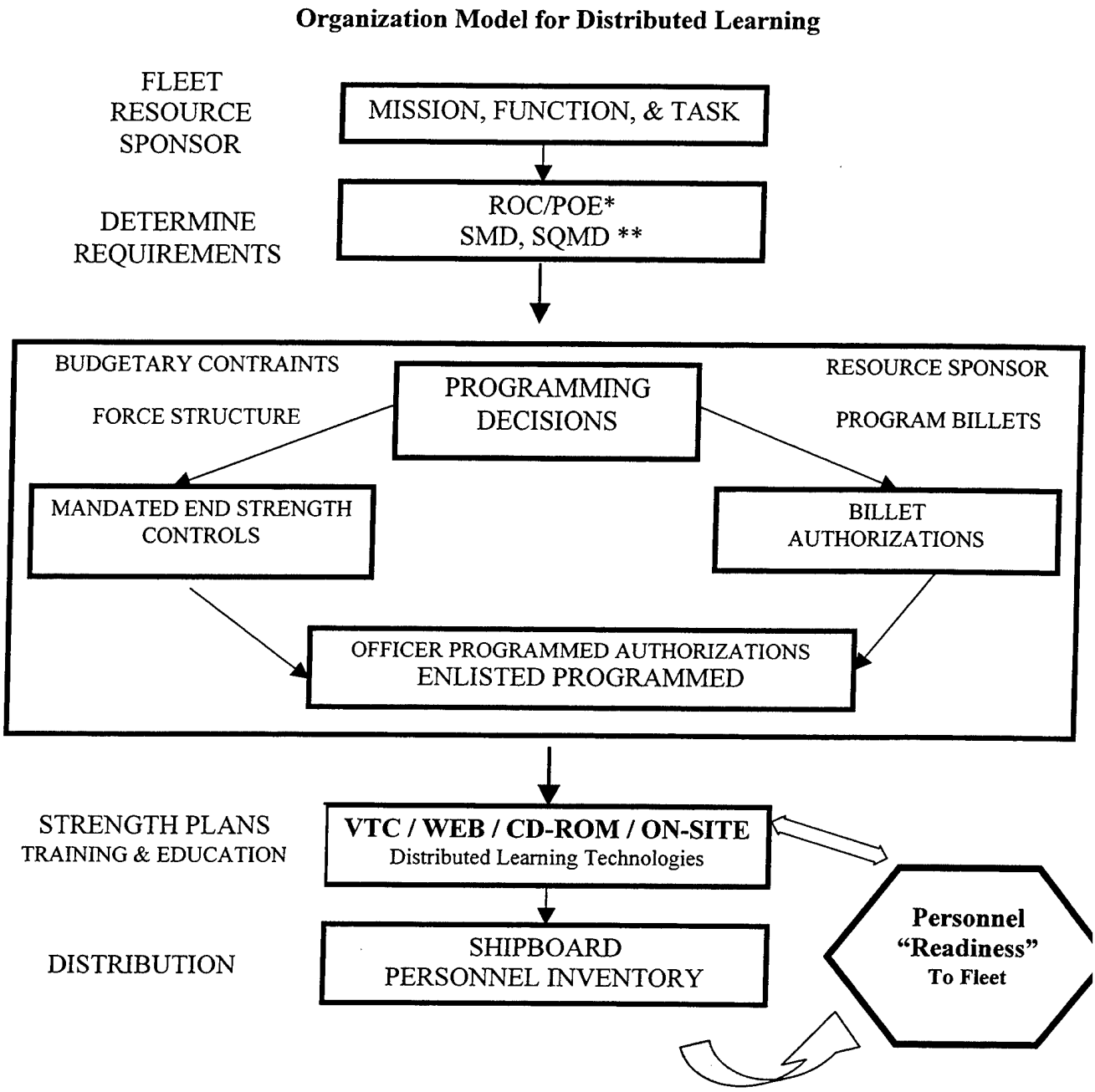
(4) Ascertain whether or not personnel placed any value in the program. Was the program effective?

D. ORGANIZATION MODEL FOR DISTRIBUTED LEARNING

This next model is designed from a manpower systems perspective on the implementation of distributed learning for training, education and human development. The personnel distribution process is a complex system that has many stakeholders and information systems used for the processing of newly recruited individuals as well as redistributed personnel.[12] To understand how Sailors arrive onboard a ship, Figure 4.2 represents the personnel distribution process from Resource Sponsors to Personnel Distribution and unit Readiness.[13]

[12] Redistributed personnel are reenlistees or in the case of officers, contract extensions, that are transferred from one command to the next.

[13] This Manpower Systems Model was derived from the Naval Postgraduate School Manpower, Personnel and Training course. The model illustrates the infusion of DL technologies for Education and Training in the manpower distribution process.



* ROC - Req'd Operational Capability; POE - Projected Operational Environment
** SMD - Ship Manpower Document; SQMD - Squadron Manpower Document

Figure 4.2 Manpower Systems Perspective Model From Ref. [CDR Bill Hatch, 16 May 2000]

The Navy manpower process begins with the National Military Strategy.[14] Once this strategy is defined, warfare platforms are built to execute military strategy; then manpower requirements are determined. The stakeholders at this stage of the manpower process are Fleet Resource Sponsors, Navy Manpower Analysis Center (NAVMAC), and resource Claimants. Using standardized publications pertinent to each individual class and type of ship, personnel requirements are determined. Publications used include: the Required Operational Capabilities (ROC), Projected Operational Environment (POE), Ship's Manpower Document (SMD), and Squadron Manpower Document (SQMD). The interaction between all these players results in Determination, Validation, and Authorization of manpower requirements (OPNAVINST 1000.16J, 1998).

Once the requirements are determined, Planning, Programming, and Budgeting Systems (PPBS) take place to allocate funding to determined requirements. Decisions made as part of the PPBS result in the programming and reprogramming of manpower. Programming manpower includes adding or deleting end strength, where reprogramming manpower includes transferring end strength from one activity to another. At this point the Total Force Programming and Manpower Division (N12) has the authority to reprogram end strength, which may or may not affect the PPBS cycle (OPNAVINST 1000.16J, 1998).

Once execution and budget year manpower authorizations are fully balanced to programmed resources, planning in the aggregate takes place. At this point Military

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[14] According to Army Gen. Henry Shelton, chairman of the Joint Chiefs of Staff, National Military Strategy is based on the military's capability to defend against two simultaneous major theater wars (www.defenselink.mil/news/Nov2000/n11172000_200011172.html).

Personnel Plans & Policy Division (N13) along with the divisions of Chief of Naval Reserve Centers (CNRC) and Chief of Naval Education and Training (CNET), focus on military personnel strength planning, new personnel recruitment and training, and incentive programs to support recruitment and retention (e.g. Surface Warfare Bonus, Selected Reenlistment Bonus).

The final steps leading to military and unit readiness rely on the Manning Control Authorities (MCA), Navy Personnel Command (NPC), Bureau of Personnel (BUPERS), and the Enlisted Personnel Management Center (EPMAC). The interaction of these departments results in the allocation, placement, and assignment of personnel to specific unit billets.

The need for constant upgrading in training and education capabilities is essential to ensuring that personnel maintain up-to-date technical proficiencies at all times. The purpose of illustrating the personnel distribution process is to show how training and education are integral parts to unit readiness and where the infusion of DL technologies would be most effective. In the personnel planning stage, planning in the aggregate should involve the need to develop distributed learning technologies for training and education to emphasize the need for continued learning. Using distributed learning technologies during this stage may offer an individual better preparation for what lies ahead at his or her next duty station. Likewise, for the individuals attached to seagoing units (e.g. PCs) using DL technologies may allow direct interaction and transfer of information to expected personnel gains. Creating an environment where experience and technical knowledge can be shared on an ongoing basis not only contributes to unit

readiness but also enhances information distribution for improving the development of newly reporting personnel.

E. SYSTEMS APPROACH

Organizations must engage in strategic planning to define the direction they must take to accomplish long-term goals and expected outcomes. In the process of building a strategy for a learning program within an institution such as the Navy's PC, direction is set based on environmental factors influencing the design of the organization. The environment for distributed learning in the military is politically charged with many stakeholders and virtually limitless access to global information. The need for stakeholders to be informed drives the need to provide the kinds of education that can be obtained by all military personnel, not just military officers. Several key success factors are identified as being viable to the design of the system in which DL technology will thrive. Collaboration across communities, countries, agencies, students, and instructors is necessary for an individual or unit to succeed in an information-based organization such as the United States Navy.

In order to formulate a plan to implement distributed learning in a military atmosphere, decision makers must have a template or model from which policies are to be designed and put into place. The model for Education, Training, and Human Development via distributed learning technologies (Figure 4.3) addresses the numerous items, which must be examined when attempting to accept or disregard improvements in

current training and education of military personnel.[15] This systems model approach clearly defines the process that a decision maker must go through to be knowledgeable in all the facets of using DL technologies for military applications. The model identifies *inputs, throughputs,* and *results* and places them in a proper order from which any individual may begin to inform themselves on the process of making changes to current training and education practices.

The *input* column includes environmental issues, system direction, and key success factors to implementing a distributed learning environment within a military institution. The *throughput* column addresses all the design factors that influence a DL environment. Factors such as tasks, technology, structure, people, and process/subsystems are all affected by the implementation of DL technologies for education and training. The *results* column identifies the cultural issues surrounding the individual organization and its use of distributed learning. Output and Outcomes point out the resultant factors that develop as a result of using DL technologies for military training and education.

[15] I designed this model based on McCaskey's Model for Analyzing A Work Group, to illustrate the numerous factors that may affect Education, Training, & Human Development using distributed learning technologies.

A Model for Education, Training & Human Development

Input

Environment
- Political: Nat'l Military Strategy
- State, federal, judicial regulations
- Economic: taxpayers, special interest funding
- Social: culturally rich environment, community of technology experts
- Technological: information easily accessible, global connectivity
- Legal: highly regulated entrance, low probability of litigation

System Direction
- Mandate to provide education and training anywhere, anytime, to anyone
- Strategic vision to provide education and training on a unit level enhancing mission readiness to accomplish objectives

Key Success Factors
- Collaborative effort
- Continuous dialog
- Efficient use of recourses
- Committed instructor/ students
- Innovation
- Involvement
- Responsible use of government spending
- Low legal restraints
- Highly competitive environment
- Flexibility

Throughput

Design Factors

Tasks
- Enlisted, Officer Training & Education
- Development of new services/ product delivery system
- New thinking mechanisms
- Non routine/ constant changes
- Cultural adaptation

Technology
- Highly coordinated
- Non routine
- Cost efficient

Structure
- Geographically dispersed
- Organization Centralized
- Consumer ownership
- Reciprocal interdependencies

People
- PC Personnel
- Instructors
- Technology representatives
- Local / Global partnerships

Process/ Subsystems
- Needs Determination
- Central accounting system
- Learning support services
- Formal training at every level
- Increased connectivity with other resource partners
- Communication with other organizations regarding training & education in the global market
- Teams for innovation/ enhanced learning techniques

Results

Culture
- No demographic barriers
- Highly intelligent
- Media consumers
- Highly innovative
- Stakeholder loyalty

Output
- Education/Training
- Innovative consumers
- Quality unit forces
- Broader delivery of information
- Future technology

Outcomes (ROI)
- Increased unit readiness
- Highly skilled personnel
- Lower material costs
- Improved/updated training environments
- Increased morale
- Increased retention

Figure 4.3 Systems Perspective Model

By taking into account the emphasis decision makers place on expenditures of financial resources, the systems model approach identifies all the return-on-investment (ROI) issues that will affect the end results of implementing a DL environment within a military organization. The expected ROIs would be increased unit readiness, highly skilled personnel, lower material costs, improved and updated training environments, increased morale, and increased retention. An organization that understands its ever-changing environment, and is aggressive in maintaining its personnel active in the pursuit of information acquisition for improved training and education, will undoubtedly remain ahead of its competition.

One very important aspect of understanding how to use this systems model is that an organization's leadership controls over 80% of the items illustrated in Figure 4.3.[16] It is understandable that unit leadership cannot control external environmental factors, but from the Systems Direction setting to Culture and Outcomes, leadership plays a pivotal role in the success of a meaningful and supportive distributed learning atmosphere.

Technological capabilities exist in today's competitive market to develop and implement a DL environment onboard a seagoing vessel such as the PC.[17] The challenge is to find the person(s) who may be able to harness existing capabilities and create a program which may benefit the future of the individual Sailor and the future of a unit's success.

Thus, this systems model perspective illustrates numerous factors that must be considered when designing and implementing an improved method of learning.

[16] Successful implementation of Figure 4.3 relies heavily on the leadership's understanding of all of the issues which affect a DL program.
[17] Technologies such as Pocket PCs, Web Pads, Palm Pilots, PAVICs, Digital Wallets, Handheld PCs, and Laptops make a DL environment possible onboard a vessel as small as the Navy PC.

Although various issues are addressed in this systems perspective it is important to note that other issues such as human behavior and best learning practices require further review and discussion.

F. STRATEGIC INTERNET ISSUES

An indispensable strategic principle of high performance management systems is that organizations perform at a higher level when they are able to tap the ideas, skills, and efforts of all of their employees.

The skills of knowledge and information acquisition are critical, and too few organizations harness such available resources. Training and education are essential components of high performance work systems because these systems rely on frontline personnel skill and initiative to identify and resolve problems, initiate changes in work methods, and take responsibility for action to ensure quality. All of this requires a skilled and motivated work force that possesses the knowledge and capability to perform requisite tasks.

While training and education using DL technologies represents an investment in an organization's personnel, in the military it virtually begs for some sort of return-on-investment calculations. The difficulty that exists in using DL technologies is that up-front costs can exceed short-term results, which may not make investment efforts seem worthwhile. Successful organizations that emphasize such technologies for training and education do so almost as a matter of faith and because of their belief in the connection between people and mission success.[18]

[18] Merrill Lynch is an example of one such organization. Merrill Lynch relies on DL technologies for on-site employee training in business, finance, and technology (HOME OFFICE COMPUTING, 2000).

It grows ever clearer that the Internet has forever transformed the way that organizations and employees learn about each other, communicate, and transact business. Few organizations can escape the need to integrate the Internet into their daily operations. Key strategic issues of using DL technologies are: how and to what extent can such technologies be made a core part of a "traditional" company's education and training programs? Using the Internet to compete successfully depends on the following key strategic factors:

- An innovative Internet learning model – This newness is only partly attributable to the creative nature of Internet entrepreneurs. The fact is that Internet technology is conducive to doing business in radically different and innovative ways-the rules of business in an Internet world are different from traditional business rules.
- The capability to adjust the organization's Internet learning model and strategy quickly in response to changing conditions and emerging opportunities - Operating on the Internet is essential because the pace of technological advancements is so fast. Rapidly evolving learning models and strategies are thus the norm, not the exception.
- Focusing on a limited number of competencies and performing a relatively specialized number of value chain activities – Conducting only mission critical tasks. The remaining value chain activities can be delegated to outside specialists. Outsourcing enhances organizational speed and flexibility, and allows an organization to concentrate on what it can do best. Outsourcing provides

personnel with added time available during the workday, which in turn could best be used to participate in distributed learning programs.

- Staying on the cutting edge of technology – Technological change is a dominant and pervasive driving force. No organization can hope to succeed for long without moving first or early to incorporate state-of-the-art DL technology for education and training of its personnel. Technological expertise has to be developed and maintained internally, provided by suppliers, or accessed via new acquisitions or strategic partnerships (Thompson & Strickland, 2001).

G. CONCLUSION

This chapter addressed the necessity for infusion of distributed learning technologies into existing personnel distribution, training, and education programs. Through the use of three separate models, I have attempted to show the methodical process of instituting a distributed learning atmosphere within a military organization. It is important to note that although these models are provided to support the implementation of a DL infrastructure onboard a Navy PC, the models are generic enough in nature to be used in any military organization whether ashore or at sea.

At the rate that technology is changing in today's competitive market, actions must take place within the Navy PC community to ensure that Sailors and Officers are offered the opportunity to access immeasurable amounts of information to be able to stay ahead of global competition.

This chapter has drawn links from the growth in continuing education to the needs for new models, and methods that support an existing need for higher learning.

Distributed learning and associated technologies offer significant new capabilities in the flexible creation and delivery of high-quality learning environments.

To provide a flexible, collaborative learning experience requires tools that allow learners to access sources of information in a variety of media at their convenience. For an organization like a PC unit, distributed learning may be a way to foster an atmosphere of team learning and enhance the speed, flexibility and reach of training and education for all its personnel.

V. NAVY DL PROGRAMS: AN OVERVIEW

A. INTRODUCTION

Throughout the Navy, many organizations provide essential training and education programs to Officers and Enlisted personnel.[19] Because such agents exhibit varying mission requirements, each one provides education and training programs that are not conducive to meet the needs of all or separate Navy communities (e.g. Aviation, Surface, Subsurface, Logistics, Special Ops, etc…).

Because a central authority within the Department of Navy does not exist that exercises control over all distributed learning initiatives, many Navy organizations find themselves disjointed from one another in their efforts to providing enhanced distributed learning opportunities to their Enlisted and Officer personnel.

Because a database of DL initiatives throughout the Navy does not exist, it is difficult to quantify the exact number of such programs instituted Navy-wide. As such, this chapter provides a brief analysis of distributed learning programs throughout the Navy. Key DL initiatives in the Navy will be addressed in this chapter; however, because there is a lack of quantitative data available regarding DL initiatives, this thesis does not offer an in-depth analysis of every existing distributed learning program within the Navy.

The following examples of DL technology infusion will be addressed to support the growing need for organizations such as the Navy PCs to institute advanced training, education, and human development programs.

[19] Examples of agents are Chief of Naval Education and Training (CNET), Fleet Commanders, Type Commanders, etc.

B. BACKGROUND

The Navy has undertaken diverse types of missions over the last two decades. American Naval forces have participated in missions ranging from combat operations to disaster relief, humanitarian assistance, and civilian evacuations. Although Naval forces have operated successfully in operations in the past, the Navy will need to adapt even more to the challenging operations of the future.

The 21st Century may bring about more missions, requirements, and increased joint/allied operations to undertake rapidly unfolding, ambiguous scenarios. Advanced technologies will increasingly become commonplace with new software-dependent systems and technologies that will undoubtedly enhance future training and education systems.

The infusion of computer technologies to support combat operations continues to transform the way militaries conduct warfare. Computer capabilities available today were not considered possible two decades ago (e.g. SMART Ship Technologies).

Internet-based learning is a vast and growing market. According to International Data Corporation, distributed learning expenditures are expected to grow from $1.1 billion in 1999 to $11.4 billion by 2003. Technology advancements and the emergence of the new knowledge-based economy are driving demand for new models of training away from traditional instructor-led, classroom-based formats. Because of this, it is clear that the growth rate of computer technologies and distributed learning programs will continue to accelerate (Bates, 2000). This phenomenon of rapid expansion in technology requires that the Navy develop expertise in the innovative application of emerging technology to

new and existing training and education systems. Innovation is critical in order to transform the aggregate impact of leading-edge technology into battlespace dominance.

Joint Visions (JV) 2010 and 2020 highlight the critical role that information plays in the success of military operations. Increased processing power, networking capabilities, and software enhancements will have a dramatic and decisive impact on future warfighting.[20]

JV 2010 and 2020 recognize that high quality people, innovative leadership, and the right organization structures are essential to preparing warriors for the challenges of the future. To develop the concepts articulated by JV 2010 and 2020 for network centric operations, the Navy needs a higher percentage of enlisted and officer personnel with skill sets obtained from secondary and post-secondary education institutions including expertise in understanding topics including: human resource management, Naval and computer science, information technology, systems engineering, integration, and leadership. Future Navy personnel must develop strong analytical and technical skills in numerous areas such as simulation science, operational analysis, and information management to support the unforeseen future of a technologically advancing Naval organization.

Under the Information Technology-21 (IT-21) concept, the Navy is building communication-and-networking infrastructures that will support the rapid exchange of information between naval and joint-warfare platforms. New doctrine and organizations are being developed to allow the Navy warfighter to exchange classified and unclassified,

[20] For Joint Visions 2010 & 2020 see Web site (www.dtic.mil/jv2020).

tactical and non-tactical information from a single desktop/personal computer, to shorten timelines and increase combat readiness.

IT-21 is one of the Fleet's responses to adapt and develop new operational concepts in an ever-changing environment. IT-21 is an available means to achieving rapid response. The principal elements of IT-21 are Asynchronous Transfer Mode (ATM) protocols, local area networks (LANs) afloat, and LANS/wide area networks (WANs) ashore, populated by off–the-shelf desktop/laptop computers. As the commercial world shifts and adapts to technology, the military must also adapt. The warfare analogue is the shift from platform centric to network centric warfare.[21]

This capability results in speed of command, which reduces the operational pause associated with decision-making and eliminates an enemy's opportunity to regain initiative. IT-21 is not ultimately about the technology; it is about how the warrior uses it (www.hq.navy.mil/IT-21).

C. EXPLOITING TECHNOLOGY

Distributed learning must be executed through various settings that customize education to suit the learner. Non-traditional classroom settings, video, electronic and virtual environments will be the springboard for future growth of training and education in the Navy. The Strategic Vision of an organization should be an optimal delivery of

[21] Platform centric warfare is mass on mass requiring extensive physical infrastructure, large overhead and immense capital expenditure. Conversely, networks leverage intellectual capital, focus information, and increase combat power. Network centric warfare uses a reduced infrastructure and overhead, and a non-traditional shift in the use of capital expenditures. The result is a shift from attrition based warfare to speed of command (www.nwc.navy.mil/press/review/1999/autumn/ pn%2Da99.htm).

learning to meet participants' training and educational needs and desires, while reducing economic, social and political disparities.

By increasing the use of distributed learning technologies the potential exists to dramatically change the way Sailors and Officers are trained and educated. Just as modern weaponry has influenced warfighting, investments in education technology will shape the way our future force is taught and trained. Sailors anywhere in the world will gain continuous access to instructors and educators previously available only to resident students. The Chief of Naval Education and Training (CNET) Department training and education plans emphasize that an investment in modernization and recapitalization in education technology will improve training effectiveness for better performance and operational readiness of our fighting force (http://www.cnet.navy.mil/mission.html).

The following is a list of current and future programs that may benefit the Navy through the use of computer technology for education, training, and human development:

- Automated electronic classrooms: integrated systems that allow use of multi-media instruction, electronic course materials, access to electronic references/data, electronic team training.

- Video teletraining: taking interactive training to the fleet or other shore establishments.

- Computer Based Training: education being moved onboard ship allowing reductions in shore training infrastructure (PC familiarization software).

- Use of embedded on-board training capability.

- Modeling & Simulation: Deployable simulation: low-level simulation, logistics games (e.g. USMC "DOOM"), tactical games (e.g. USN "HARPOON", USA "Peace Keeping Solution")

- Learning Resource Centers (LRC) onboard ship
  - All electronic/Web-based Learning
  - Self-paced w/ facilitator/mentor
  - CBT for refresher/remedial/qualification & pre-requisite training

D. NAVAL POSTGRADUATE SCHOOL

The Naval Postgraduate School (NPS) is aggressively engaged in revision of its curricula to address the educational needs of current military Officers. Some of these changes include increased emphasis on interdisciplinary education and information technologies, integrating academics and professional military educational (PME) curricula, and incorporating new information technologies for delivery of selected instructional materials (web.nps.navy.mil/dlrc/NPS_plan/).

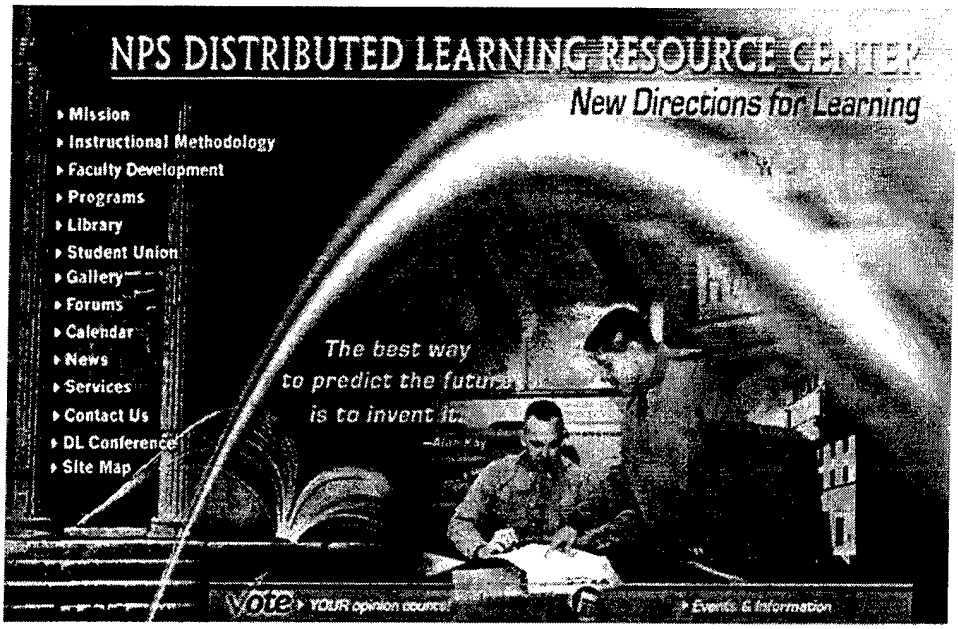

Figure 5.1 NPS Distributed Learning Program From Ref. [www.dlrc.nps.navy.mil]

NPS recognizes the need to establish an institution of interdisciplinary technical competencies with a focus on military applications of information technology. The *Professional Military Education* (PME) provides the coursework in military leadership, issues of national security and military strategy and the essential immersion with peers to provide a culture emphasizing Navy military officer values of honor, courage, and commitment. The Naval Postgraduate School will maintain its primary mission focus,

which is to contribute to the combat effectiveness of our military forces and our allies, by providing high quality graduate education and research opportunities.[22]

NPS is outlining a distributed learning program to offer Officers from all over the world high quality learning opportunities without ever having to physically attend classroom instruction. The mission to raise readiness through unique and relevant education is reflected in the NPS operational motto, *"from technical to tactical"*, which reflects the NPS emphasis on the importance of a focused technical education for today's military leaders (web.nps.navy.mil/dlrc/NPS_plan/).

NPS recognizes that the fields of education and training are evolving to include systematic methodologies which address all performance issues, including those solved by increased knowledge, skills, and aptitude. NPS understands the necessity to evolve as a learning institution and is doing so by offering enhanced learning experiences through distributed learning technologies.

NPS's plans include the use of new information technologies that will enable delivery of selected instruction via electronic media. NPS plans to capitalize on emerging electronic technologies, including: multimedia computers, portable high-capacity storage media, broad-bandwidth telecommunications, and local and global computer networks (Intranet & Internet) as alternate and supplementary methods to present instruction. These same information technologies will be used to complement and enhance library and other educational resource services, in order to realize its vision of the "University of the Future" (web.nps.navy.mil/dlrc/NPS_plan/).

[22] See NPS DL Migration Plan (web.nps.navy.mil/dlrc/NPS_plan/)

E. NAVY LEARING NETWORK

The Navy Learning Network (NLN) is a Chief of Naval Education and Training (CNET) program that is being designed to provide Navy wide connectivity via a single, integrated on-line learning network with access throughout the world. It is expected to provide "on demand" access to web delivered courses, libraries of courses delivered in schoolhouses, CD ROM, Video Tele-training (VTT), and links to available education and training information and on-line group discussion capabilities (www.navylearning. navy.mil/).

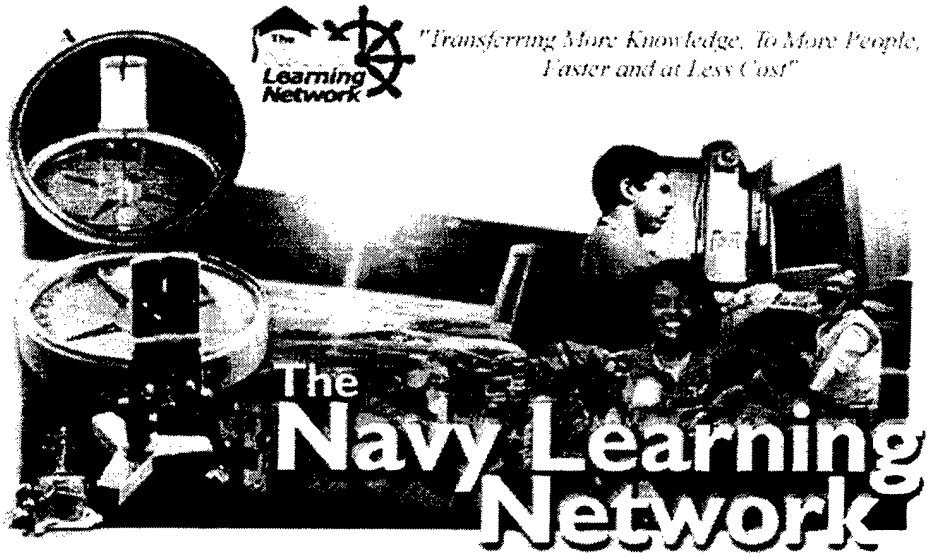

Figure 5.2 Navy Learning Network From Ref. [www.navylearning.navy.mil/]

Implementation will initially provide students access to the following web-based courses: NETg Information Technology and SkillSoft Leadership, Management and Financial courses (commercial, off-the-shelf courses), and several Navy courses developed for web delivery. Additional courses will be added incrementally as they are procured and/or converted from current paper-based (www.navylearning.navy.mil/).

The first year goal of NLN sought to identify the best means of employing distributed learning on a large scale and to clearly define Navy's requirements. FY01's focus includes determining how ships and remote sites can best leverage NLN. This activity includes defining "how" ships will "pull" desired courses or pre-load the data, pass student completion data to a central database, receive/request additional and updated courses, resolve band-width issues, and identify appropriate training/education that afloat personnel have time/opportunity to access (www.navylearning.navy.mil/).

This program expects to offer training materials to an almost limitless audience. Students will only be required to possess or access a computer with Internet connection to be connected to NLN. The training material's controlling organization could make changes and updates to course content and almost immediately provide the updated course information for use by the next user/student with a minimum cost of distribution.[23]

F. UNIT APPLICATION

Distributed learning technologies are slowly permeating the Navy culture. Isolated examples exist throughout the Navy illustrating how Officers and Sailors use DL technologies to accomplish training, education, and human development. For this reason, further research must be conducted to ascertain existing DL programs to establish unitary protocols for implementing DL technologies for education and training.

The following cases offer examples of current applications of DL technologies and Internet Access throughout the Navy:

[23] Controlling organization of training material includes, but not limited to CNET, Fleet Commanders, Type Commanders, etc.

- Sailors onboard the USS Constellation use handheld computers (Palm Pilots) to store data about jet landings for later entry into the ship's main network. Before handheld computers were used, a Landing Signal Officer (LSO) would record onto a paper notebook how well an incoming pilot negotiated the 600-by-200 foot landing strip. When he left the deck, he would have to copy the information into a large binder, then later type the information on a desktop computer.[24] Automating the record keeping process allows the streamlining of critical data and enhances the education and training process through the evaluation of structured, pertinent information.
- When Admiral Gerald Hoewing took the aircraft carrier *USS John C. Stennis* to the Pacific Ocean for a six-month tour of duty, he followed an old Navy custom known as the fireside chat. Each night after dinner, Hoewing debriefed the commanding officers of the ships in his battle group in a nontraditional way. Instead of talking by radio, as commanders have done for decades, the admiral and his captains sat at personal computers and conducted their conversations using Lotus instant-messaging software running over an encrypted satellite link. Navy Leadership was so impressed with the idea that they ordered similar setups for every ship at sea. In the future everyone from ensigns to admirals will be using instant messaging to communicate within ships, across the Navy and even back to the Pentagon in Washington D.C.[25]

[24] See article "*Handheld Computers Used by Navy*" (dailynews.yahoo.com/h/p/ap/20010221/us/navy_handheld_computers_mo1.html).
[25] See article "***Business Gets the Message***" (TheStandard.com).

- The battle to attract young, Internet connected Americans into the Navy brought about a new way of recruiting future Sailors. The Navy, along with all the other services, is moving into online recruiting in hopes of reaching a new generation of prospective military individuals who thrive on technological advancements and Internet connections. According to the Chief of Naval Personnel, Vice Admiral Norbert Ryan, "the Internet is the wave of the future with regards to providing real-time Navy information for advertising and recruiting."[26]
- Other projects of the future that encompass the use of computer technology onboard ship are exemplified in the Navy's actions of building twelve new ships with numerous ports for Internet access or wireless Internet capabilities. Captain Charles Hamilton, assisting in the design of the Zumwalt class of Navy destroyers says, "It is imperative that all the ships of this class are fully wired for Generation 'Y' Sailors. The idea is to provide every Sailor with desktop computer access and broadband connection to the Internet to be able to talk with families or take college courses onboard ship during deployments."[27]

The previously mentioned basic examples of using computer technology for education and training demonstrate the possibilities that exist for creating improved learning systems. DL technologies would certainly enhance learning opportunities for both PC Enlisted and Officer personnel. The following cases are provided to illustrate the feasibility of using DL technologies onboard a Navy PC:

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[26] See article "*Military engaged in high-tech war for young recruits.* " (www.usatoday.com/life/cyber/tech/cti484.htm).
[27] See article "*Military uses Net to connected with Gen Y". (www.usatoday.com/life/cyber/tech/cti485.htm).*

- Many Junior Officers today are provided laptops and Palm Pilots during their initial tours at Sea. A distributed learning environment that uses laptops as learning tools my provide the PC Junior Officer the capability to connect with the Navy Postgraduate School to complete prerequisite courses prior to attending instruction at NPS. Of some concern for Officers returning to school after prolonged absence is the issue of having to acclimate one's self to the academic environment after being away from school for at least four years. As is typical in many of the Navy communities once an individual receives a commission, learning in the form of post-secondary education is virtually non-existent. The Officer usually spends 4 to 5 years gaining fleet experience, thereby interrupting his/her education continuum. Using DL technologies during the period of gaining fleet experience would provide an Officer the means to continue formal education and assist in the transitioning process of going from sea duty on a PC to shore duty at NPS.
- Offering DL programs and technologies such as personal laptops for every enlisted person would enhance the training and education that a Sailor must accomplish during their time of service. Employing the right technology available would assist PC Sailors in accessing available NLN courses that would further their education while ensuring technical proficiencies are maintained. Continuing their education would in turn increase a Sailor's self-confidence, morale, and "esprit de corps."
- Regarding Enlisted Surface Warfare (ESWS) and Surface Warfare Officer (SWO) qualifications, PC personnel could use DL technologies to create a learning

environment that all could benefit from. Imagine a network of information from which individuals could log on and exchange information with members from PC units from both the East and West Coasts. Even greater would be the ability to exchange information via a learning network with members of other Navy communities such as Aviation, Amphibious units, SEALs, etc. Such an environment would create an atmosphere that would foster a greater awareness of the Navy organization and provide all users with a plethora of information that could be used for obtaining "warrior" qualifications.

- Language courses could be offered to PC Sailors from remote locations like the Defense Language Institute in Monterey, California, prior to deploying to mission areas where a second language would be a necessity for conducting successful operations. For example, six months prior to conducting Counter Narcotics Operations in the Caribbean or Eastern Pacific AORs, several Sailors could take Spanish language courses online to prepare for such military operations without ever having to go on Temporary Assigned Duty (TAD). Completing such courses could provide members with linguistic subspecialties which could further promote the individual as a military professional and once again, support the individual's desire to remain in active service.
- A central database onboard ship can maintain all available information regarding engineering, navigation, combat systems, damage control, condition assessment, medical, command & control, maintenance, administration, and career advancement, thereby reducing the amount of administrative paper materials as well as technical manuals that consume limited space onboard a PC. Making a

central location accessible via DL technologies can provide PC personnel a more streamlined approach to documenting education and training completion as well as offering an individual desired information at a moment's notice.

- Enhanced learning environments could provide extensive cross-training capabilities for PC personnel, thereby allowing crewmembers to cover more than one shipboard function. Also, technology-enabled just-in-time training could allow personnel to be trained on systems as required to complete specific job task functions.
- Distributed learning programs can be designed to provide general military training, own ship team training, mission rehearsal and simulation-based battle force tactical training for all PCs. A suitable DL infrastructure could ultimately provide operational, proficiency, skill maintenance, and training for individuals, teams, and ship-wide training scenarios in order to maintain operational readiness at the highest levels possible.

G. CONCLUSIONS

The task of training in the Navy is immense. On any given day, there are 43,800 students in training: (35,600 military; 7,000 civilians; 1,200 International). The training is conducted through 169 activities nationwide requiring 29,635 employees (17,854 military, 4,959 civilians, 6,822 contractors). This scope translates to an offering of more than 3,400 courses nationwide (web.nps.navy.mil/~kishore/mpt/planning.process. training. htm).

The complexity of such an immense education system begs for a more complete, universal learning network that enables all DON personnel to access pertinent information regardless of location or time constraints.

The focus of this chapter was to illustrate DL technology initiatives that are being used to support education and training programs throughout the fleet. Examples provided illustrated current use of computer technology and addressed the magnitude to which DL technologies may assist in the learning process while streamlining the tasks of accumulating information. Finally, seven examples were exhibited to identify possible applications of DL programs and technologies onboard a Navy PC.

The underlying premise to the successful implementation of DL programs onboard a Navy PC relies heavily upon leadership and its support for institutional change. To remain a dominant maritime power within the technologically advancing U.S. Navy, a PC unit's leadership and personnel must actively engage in life-long learning and pursue improved methods of education and training to ensure sustained operational readiness for unforeseen Naval missions of the future.

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VI. FEASIBILITY OF DL TECHNOLOGIES

A. INTRODUCTION

Traditionally, training in the classroom and laboratory environments improved human performance by providing individuals with skills and subject matter information. However, some scholars find this approach limiting in that other solutions are more appropriate and cost-effective in meeting a wide variety of human performance needs in the workplace (Bates, 2000, Williams, Paprock, Covington, 1999, Minoli, 1996). To be fully responsive to the education and training needs of Navy PC personnel now and into the future, the PC community needs a training system that can take full advantage of new training technologies and new human performance improvement methodologies while balancing expenditures of limited financial resources.

This chapter provides an overview of investment considerations, barriers and challenges, and return-on-investments of instituting distributed learning technologies for education, training, and human development onboard a Navy PC.

B. INVESTMENT CONSIDERATIONS

Education and training programs are evolving due to the opportunities for improved instructional delivery systems that advanced computer and communication technologies offer. The consequences of such program growth during the Information Age are requiring organizations to reexamine constrained resource expenditures on maintaining and improving physical and human resources as well as intellectual capital.[28]

[28] The "Information Age" characterizes a society in which there is widespread use and adoption of Information and Communications Technologies and where information is the key determinant of economic

Assessing the benefits of using distributed learning technologies proves to be a daunting task in the short-term because it is difficult to design adequate measures of effectiveness when using DL technologies (Bates, 2000). The intrinsic benefits to the individual Sailor, having the capability of accessing a plethora of information on a particular subject matter within seconds, are immeasurable. However, because all outcomes of technology-based learning are not quantitatively measurable, it is difficult to attach monetary values to learning and establish specific metrics to gauge DL program effectiveness.

There are intangible benefits to enhancing a learning experience that cannot be weighed through traditional means of dollar cost savings (Cross, 1981). Developing increased motivation, morale, self-awareness, confidence, and critical decision-making skills are but a few indicators that may result from participating in technologically enhanced education and training programs. Because such indicators cannot be effectively measured monetarily, distributed learning must not be discounted as a viable form of learning worthy of financial investment.

Course completion, productivity levels and output are examples of factors that can be quantitatively measured, but they do not realistically encompass the possible benefits that may evolve as a result of instituting an enhanced learning environment onboard a PC.

While at sea, focusing on the ship's daily routine, a crewmember may not think about self-enrichment. However, my research showed that both Officers and Enlisted felt it would be beneficial to engage in the opportunities to participate in DL programs to

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success. The Information Age brings about unparalleled opportunity and change while breaking down traditional barriers to technological growth (For more information see Howkins and Valantin, 1998).

further their education and develop critical decision-making skills during personal "downtime."

During inport periods, for Officers and Sailors unable to attend classes at institutions located considerable distance from the parent command, DL programs offer the participant the flexibility of completing educational requirements during a break in the individual's daily routine or even at home after work.

For the command that must incur the costs of sending teams to training facilities, it must account for travel and per diem for each individual as well as the cost of educating each crewmember. There is also the issue of lost productivity time when crewmembers are away from the ship to complete required education and training. For example, if five Sailors from a PC's crew attend a training course away from the ship, then the total ship's manning and productivity levels are reduced by twenty percent. The reduction of manning availability and loss of productivity may lead to unqualified personnel completing weekly routine maintenance (e.g. Damage Control equipment preventative maintenance), rescheduling of watch rotations, inability of handling emergency situations (e.g. flooding or fires), disruption of shipboard training. and/or reduced operational readiness for underway operations.

Some of the benefits to the individuals who travel to the training facilities may be increased knowledge, hands-on application of rating skills in a lab environment. and time-away from the ship, but as previously mentioned, ship's routine may be severely affected by temporarily assigning shipboard personnel away from the command.

Fiscal savings in travel and per diem (which are relatively easy to estimate), and reductions in time to train, training material costs, instructor costs, and materials

preparation and modification costs potentially can be realized from use of DL technologies for education and training purposes.

C. BARRIERS/CHALLENGES TO USING DL TECHNOLOGIES

Increased readiness and workforce productivity obtained from comprehensive use of DL technologies is difficult to estimate because a standard set of measurements do not exist within the Navy with regards to distributed learning for education and training. Although many DL initiatives are taking place within the DON (e.g. NPS, and NLN), my research found that a central point of contact or database of DL projects does not exist. Because DL projects vary from the unit level up to the CNET level, no one organization within the Navy is responsible for setting standards which may measure DL effectiveness on productivity success or operational readiness.

Conversion to DL courseware, instructional and faculty development, investing in hardware and software, and accounting for operational costs all requires up-front investments while resident training programs continue (Bates, 2000). The financial payback from reduced travel, per diem, and schoolhouse cost begins as DL comes online and resident courses are phased out or reduced.

Challenges to both the "champion" of DL programs aboard a PC as well as to the Officers and Sailors who stand to benefit from distributed learning programs may also come from within the command. The success of a DL program stems from strong support at the leadership level as well as the participatory level. The PC infrastructure remains complex due to the nature of highly technical systems with high preventative maintenance schedules, typical manning shortfalls, high deployment schedules and lack

of learning resource capabilities. With such obstacles to deal with, to the adult learner (Officer/Sailor), the idea of participating in DL programs appears to be nothing more than a remote, futuristic concept. With upper-level leadership not offering subordinates time to participate in DL programs, and not possessing adequate computer resources onboard, Sailors are deprived of enriched learning opportunities to prepare for a future within the PC community as well as the Navy of the 21st Century.

Other barriers affecting the recruitment of Sailor into DL programs onboard a PC are command climate, peer pressure, individual skills/aptitude level, and ignorance of what programs exist. Each one of these factors must be addressed effectively when attempting to meet the demands of a PC's crew for enhanced education and training opportunities. If such barriers are ignored, a Sailor cannot successfully engage in a new learning environment and will therefore fail to thrive as a professional in a Navy organization that depends on sustained military performance at sea.

Lack of information is also a barrier to adoption and growth. Utilizing DL technology, the Navy PC can broaden perspectives, promote cultural awareness, and begin to cultivate global connections with open dialogue and education. The end product will be the use of information - not necessarily degree completion. The innovations of distributed learning will engage participants in deep inquiry about the Department of Navy, global affairs, other learning institutions, and themselves.

Getting a new idea adopted, even when it has obvious advantages, is often very difficult. Many innovations require a lengthy period, often many years, from the time they become available to the time they are widely adopted (e.g. VTT and at-sea email). Resistance to change seems universal and often seems almost ingrained in the human

psyche (Rogers, 1996). Therefore, common problems for many individuals and organizations are how to speed up the rate of diffusion of an innovation and overcoming resistance to change.

D. RETURN ON INVESTMENT

When attempting to implement change to an organization's culture the idea of measuring the return-on-investments (ROI) of the change always becomes a primary issue especially for upper level management (Bates, 2000).

There are times when program implementation may produce better production rates, lower costs of production, or reduce labor costs, but in a society that thrives on tradition, bringing about change to the ways of "doing business" usually meets resistance at the senior leadership levels (Bates, 2000, Sorge, Russell, & Weilbaker, 1996).

In an age when information acquisition and application are pivotal to staying ahead of the competition, human development through distributed learning technologies may prove to be a viable avenue from which the combination of experience, learning instruction, technology, and information results in increased knowledge.

Using the World Wide Web/Internet offers a PC Sailor any type of information, anywhere in the world, at any time. The benefits of being able to earn a degree online, in a significantly shorter amount of time instead of traditional in-class methods, further supports the idea of increased productivity not only for the individual but for the unit as well.

For the Navy PC, the return on investment could be obtaining a more informed, better skilled individual who can produce at a level far superior to those who have not

attained higher education. Also, a DL network between all Navy PCs can offer a means of direct communication between all PC Officers and Sailors thereby facilitating the exchange of information and experience in one centralized location. This strategy in turn could add to operational readiness, quick communications between units and Type Commanders, and an overall highly skilled and intelligent community of Navy Professionals.

The concept of "just-in-time" learning using DL technologies also provides the PC and PC personnel the right information, at the right time, and further reduces the costs of training, travel time to training destinations, and productivity loss of an individual attending any such required training.

The idea of quantifying learning through distributed learning processes in dollars does not seem feasible when the benefits of learning a new skill or trait are immeasurable (Cross, 1981, Minoli, 1996). To the individual, having the ability and support from upper level management to seek higher education is a motivation factor that cannot be measured monetarily. To see Sailors come to work, eager to perform required job tasks, and enthusiastic to take advantage of opportunities to advance their education during the workday, may not only increase crew morale but also improve operational readiness, and information superiority.

Allowing personnel to spend off-duty time with their families not worrying about continued studies at home produces another benefit to the individual that cannot be measured monetarily. According to my research, if an Officer or Sailor is able to participate in a DL program onboard ship during working hours, a sentiment of greater

appreciation for leadership support and a desire to accomplish job tasks as expeditiously as possible would be created.[29]

Financial limitations and scarce resources coupled with a multitude of missions represent the most obvious obstacles for Navy PCs as military budgets continue to decline while mission requirements escalate throughout the globe. Individual service members face rigorous work schedules and frequent deployments as a result of increased operations as well as routine temporary duty and constant relocation from base to base. When interviewees were asked if they would use opportunities to further their education if new technologies were brought onboard to aid in training and education, the respondents overwhelmingly agreed to pursue higher education provided available time during the normal work day was allocated and suitable technologies were brought onboard that were conducive to operating within the PC environment.

E. CONCLUSIONS

This chapter addressed several issues that must be considered when attempting to institute a new learning strategy and its auxiliary technologies onboard a Navy PC. My research found that a traditional form of cost-benefit analysis of conducting training and education via distributed learning does not necessarily work.

A primary reason for being unable to accurately measure the effectiveness of DL technologies on education and training onboard a PC is that the Navy does not have a uniform set of standards to measure distributed learning effectiveness. My research could not find a department within DON or DOD that is tasked with accounting for all the

[29] See Appendix E for PC Personnel Interview Summary.

existing DL programs within the Navy, and as such there are no DL protocols that govern the administration of distributed learning networks that may exist throughout the fleet.

Also, monetary values cannot be placed on intrinsic benefits unique to each individual (e.g. morale, motivation, self-confidence, etc...). Because pecuniary values cannot be directly associated with such intangible factors, it does not mean that they can be discounted as benefits to the Sailor or to the PC unit.

Several perceptions exist about the effectiveness and the costs of distributed learning (Williams, Paprock, Covington, 1999, Knowles, 1998).[30] To complete a full cost-benefit analysis of technology implementation for distributed learning takes time, patience, and acceptance in changing instilled organizational cultures.

On the effectiveness side, DL education practitioners maintain that the quality is at least as good as face-to-face instruction and, since it provides access to a broader group of students, there is a net benefit (Bates, 2000, Cross, 1981). On the cost side, practitioners often admit the technology is expensive and requires major "start-up" costs but that investments in the technology are necessary and inevitable in order to improve access and keep DL curriculum up-to-date (Bates, 2000, Sorge, Russell, & Weilbaker, 1996).

Without obtaining suitable Internet connections (ashore or at sea) or upper echelon support, a DL environment onboard a PC cannot provide PC personnel an enhanced learning experience. This limitation could possibly limit their success in a technologically advancing organization such as the US Navy.

[30] For a list of perceptions regarding distributed learning see previously mentioned citations.

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VII. SUMMARY AND RECOMMENDATIONS

A. SUMMARY OF RESEARCH

This thesis was initiated to research the feasibility of using various distributed learning technologies to provide enhanced training, education, and human development for PC personnel. Research found a high demand exists for expanded training and education programs onboard ship, and that instituting a DL environment onboard a Navy PC is possible, although numerous obstacles must be addressed before such a venture is taken.

Interviews of PC personnel conducted onboard two Navy PCs identified a need for comprehensive education and training systems that are conducive to the unique characteristics (e.g. systems layout, OPTEMPO, limited computer infrastructure, instability, space limitations) of a Navy PC.

Research also found three major issues affecting PC personnel's desires to seeking higher forms of education/training: not having enough time to partake in higher education opportunities while inport or at sea, limited DL technology capabilities onboard, and lack of Internet connectivity. Of the three issues identified, the most vexing limitation to instituting a learning atmosphere onboard a PC using DL technologies is the lack of dedicated data links that can transfer data at the necessary data rates during underway operations.

During inport periods, connectivity to the Internet is possible, but in order for a DL environment to be successfully implemented onboard a PC, connectivity issues while at sea need to be addressed. Even though capable routers, switches and modems may be

used to deliver course content while sitting pierside, during underway operations providing coherent end-to-end video or audio stream supported course information across the Internet remains a major obstacle due to the lack of guaranteed bandwidth.

Lack of adequate bandwidth may be resolved by having the appropriate SIPRNET and/or NIPRNET access installed onboard a PC. According to two messages (DTG 281500ZNOV00 and 152130ZNOV00) regarding USSOUTHCOM deployment communications "lessons learned," the lack of SIPRNET/NIPRNET connectivity has limited a PC's ability to expedite the transfer of administrative and operational information during underway operations. Research found that although such connection capabilities are officially used for disseminating pertinent Tactical and Administrative information and directives for effective operations, NIPRNET connectivity presents a feasible means to overcoming connectivity issues to using the Internet for distributed learning while at sea. For additional information regarding NIPRNET connection at sea, a Master's Thesis was dedicated to establishing research about connectivity issues (See NPS Master's Thesis, "Internetworking: Distance Learning "To Sea" via Desktop Videoconferencing Tools and IP Multicast Protocols", by Mark V. Glover, 1989).

Higher education opportunities were certainly one of the most important "Quality of Life" issues for both Enlisted and Officer PC personnel. If some form of higher education could be delivered in another way (e.g. Internet based, VTC, CBT, etc.), the Navy PC could possibly provide the requisite education desired by personnel despite economic constraints, thereby increasing crew morale and contributing to each individual's professional military growth.

B. RECOMMENDATIONS

Technology innovation is increasing at a faster rate than society as a whole can implement it. Individuals, regardless of age, economic status, location, society, or culture must access information or take courses from their homes, at sea, or anywhere in the world. Not doing so would place DON personnel at a disadvantage when competing with other organizations that harness technological capabilities for enhanced training and education systems.

These and other considerations must be initially addressed for this concept of a distributed learning environment onboard a PC to become a reality. As part of the strategic planning process of implementing a distributed learning program onboard a Navy PC, the following recommendations are provided:

- **First and foremost, the Navy PC mindset and culture must change.** Even today, with all the discussion about technology and the Internet, many military officers perceive that continuing education, although important to the individual, has no place during the normal workday. Because the Navy is technologically advancing in its warfare capabilities, it should also change its culture with regards to training and education programs. In today's Information Age, traditional forms of classroom instruction just aren't enough to meet developing needs of Navy personnel for better, faster, more unique forms of learning.
- **Navy leadership must change.** Continuing education is acceptable as long as it does not interfere with the ship's mission. This frame of mind must change; providing opportunities for life-long learning must be part of the ship's mission. Leaders must change their views on continuing education and become brokers for

lifelong learning. Becoming a broker will dramatically improve recruiting, training, retention, and readiness, provided that leaders seek the best and brightest of individuals. Today's leaders need to evolve from the old hierarchical, command and control management models in order to be competitive in the 21st Century.

- **Assess the need for enhanced education and training programs onboard a Navy PC.** Giving Sailors/Officers the opportunity to work and educate themselves during normal working hours not only increases productivity in the day by ensuring the completion of important job task requirements but also increases morale by showing upper level management support and by maintaining the individual's capability to spend off-duty time with family. To offset previously mentioned barriers to implementing a DL environment, a command climate must focus on the positive aspects of adult education. As Bates wrote in his book "*Managing Technological Change: Strategies for College and University Leaders*" "positive attitudes toward education appears to be contagious; individuals catch the interest from others around them, and the closer the contagious person is to the potential learner, the greater the likelihood of his coming down with the bug for learning." Regarding issues of peer pressure, and self-perception of academic aptitude and ignorance, once the needs are ascertained and programs are created, implemented, and advertised, the ship's crew would eventually become curious and knowledgeable in all aspects of higher education.

- **Determine suitable technology to support a distributed learning environment.** Given the availability of DL, the availability of the Internet as a communications channel, and the potential of courseware to be delivered and mediate student-centric learning, the Navy PC should perform cost and learning outcome studies to make sound decisions regarding the use of new technologies for education, training, and human development. Technologies such as Pocket PCs, Web Pads, Palm Pilots, PAVICs, Digital Wallets, Handheld PCs, and Laptops may offer technological possibilities to making a DL environment possible onboard a vessel as small as the Navy PC.
- **Conduct further Cost-Benefit Analysis of DL technologies for education and training.** Examine all cost hindrances to include: schoolhouse infrastructure, DL infrastructure, travel and per diem costs, costs associated with resident training, and a thorough review of the costs of converting conventional classroom/shipboard courses to DL programs. Expected improvement in both training efficiencies and personnel readiness must also be assessed. All benefits to both the PC unit and personnel must be accounted for when addressing investment consideration.
- **Determine underway Internet accessibility via SIPRNET/NIPRNET systems.** Examine the extent to which SIPRNET/NIPRNET systems may be installed onboard and to what extent these communication systems provide access to distributed learning using the Internet while maintaining secure communication protocols during underway operations. The issue of sufficient bandwidth must be

addressed if a DL program is to be successfully implemented during underway periods.

- **Establish a test-bed site for implementing a DL program.** Once the previously mentioned recommendations are addressed, testing the feasibility of establishing a DL program onboard a PC must take place. In order to do that, time in the workday must be allocated to accomplishing training and education using DL technologies. Regarding required training time during working hours, supervisors and personnel should schedule, at a minimum, one hour a day during daily routine for personal education requirements. Although the return-on-investment (short-term) of such a program may be difficult to measure, the non-tangible indicators that develop through improving or adding to an Officer's or Sailor's "quality-of-life" may be significant.
- **Identify "Lessons Learned" from researching, developing, and implementing a DL program onboard a Navy PC.** Once a DL program is tested onboard a test platform, assess the effects of providing enhanced learning opportunities for PC personnel. Building a database from issues identified throughout the entire DL process allows leadership and program managers to tailor future endeavors in DL to individual or team members' desires or necessities.

Strategic planning for distributed learning in the PC organization is necessary to define the direction it must take to accomplish long-term goals and expected outcomes. The environment for distributed learning within the Navy PC Community is politically charged with many stakeholders and endless access to global information. The need for

stakeholders to be informed drives the need to provide the kinds of education that can be obtained by all interested personnel, not just military officers. Several key success factors, identified throughout this thesis, are identified as being critical to the design of the system in which distributed learning will thrive.

Collaboration across communities, agencies, learners, and education mentors or brokers is necessary for the successful implementation of a DL environment onboard a Navy PC. Distributed learning must be executed through various settings that customize education to suit the learner. Education and training programs using the latest technological advancements will be the springboard for future growth and development of critical thinking skills of PC personnel. The orienting Strategic Vision of a PC organization should be an optimistic delivery of learning to meet participants' educational desires and needs, while reducing economic, social and political differences.

Developing PC Officers and Sailors as lifelong learners must be done to allow them to reach their fullest potential to produce innovative ideas that are implemented and applauded to benefit not only the individual or PC unit, but also the PC Community as a whole. Enhancing the training and education process through the use of distributed learning programs and associated technologies will undoubtedly ensure the Navy PC and its people remains a viable entity within the future of the United States Navy.

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APPENDIX A. GLOSSARY

Adult Learner: Adult learners are diverse, bringing a wealth of life experiences to the learning situation. Active forms of learning help connect the content to the learners' own meaning structures. They: a) vary widely among ages, abilities, job experiences, cultural backgrounds, and personal goals; b) range in educational backgrounds from no formal schooling through many years of schooling; c) carry well-developed personal identities; and d) carry reservoirs of personal experiences, which are learning resources.

Analog: A format in media, which captures and presents information in a continuous signal or stream. Unlike digital format, which encodes information into discrete bits, analog formats are continuous.

Andragogy: The art, profession, or study of teaching adults.

Asynchronous: Transmission that does not occur simultaneously with the video and audio associated with the broadcast. Also refers to a DL delivery method that is learner-centered and does not require live student-instructor or student-student interaction.

Bandwidth: The frequency width required to transmit a communications signal without excessive distortion. The more information contained in a broadcast signal, the more bandwidth is required for distortion-free transmission.

Budgeting: A plan for accomplishing an organization's program objectives through planning, decision-making and management control for specified period of time.

Combat Readiness: When applied to organizations or equipment it means availability for combat operations; when applied to personnel it means qualified to carry out combat operations in the unit to which they are assigned.

Compact Disk: An optical disk on which digital text, audio, video, and graphics data is stored.

Computer Based Training (CBT): Using personal computers for course delivery. Courseware may be provided via floppy disks, CD-ROMs, or Internet.

Compact Disk-Read Only Memory (CD-ROM): A disc designed to hold a higher capacity of data in a digitized format. Because it is "read only," users may not alter over data previously stored on the CD.

Computer Mediated Conferencing (CMC): A way of conferencing using the personal computer and telephone lines as the means of communication. Provides synchronous mode of interaction.

Digital: Any information that is translated into binary code (e.g. audio, video, and text).

Digital Media: Physical objects on which digital information is stored or collections of digital objects that provide a technological service.

Distance Learning: Distance learning uses advanced technologies to deliver course content over the Internet. Instruction from a host site is delivered to distant sites and uses asynchronous computer-based interactions. Instruction is not real-time.

Distributed Learning: distributed learning uses advanced technology to deliver course content over the Internet. Instruction from a host site is delivered to distant sites using a combination of live, two-way interactive audio, video, or both synchronous/asynchronous computer-based interactions that take advantage of local area networks (LANs), wide area networks (WANs), the Internet, and the World Wide Web (WWW).

Downlink: A location where equipment receives a satellite or ground based signal(s) for display on video, audio, or data receiving equipment.

Duty Sections: The assignment of individuals, usually for a 24-hour period, which requires their presence onboard the activity to meet any demands with respect to security, safety, or mission fulfillment, especially during periods which are other than normal working hours (i.e., weekends and the hours from 1630 one day until 0800 the following day.

Education: Teaching and learning processes that lead to stimulating or developing the mental or moral growth of an individual.

Educational Level: Formal education attainment identified by a certificate, diploma, or degree.

End Strength: The number of active-duty military and civilian personnel in the Navy on the last date of the fiscal year or end of accounting period.

Enlisted Distribution and Verification Report: A monthly report, issued by Enlisted Personnel Management Center (EPMAC) and updated by each activity, which displays each enlisted manpower authorization by Chief of Naval Operations (CNO) within a given naval activity and indicates the name and other pertinent information concerning the incumbent of that requirement.

Fatigue: A physical and/or mental weariness, real or imaginary, existing in a person, adversely affecting the ability to perform work.

Function: The aggregation of occupationally related tasks within a mission.

Human Development: Based on two frames of thought: 1.) Human growth based on the responses people make to age and changing social expectations as they advance from through the phases of childhood to adulthood, and 2.) Continuous growth from simple to higher or more complex forms of life and from immaturity to maturity.

Hyper Text Mark-Up Language (HTML): The Internet language that allows users to link to specific items.

Internet-based Learning (IBL): Receiving instruction via the Internet on a particular subject matter to increase knowledge.

Internet Based Training (IBT): Refers to course delivery via the Internet to improve related job skills.

Lifelong Learning: The distribution of educational opportunity over the entire life experience so as to maximize both the individual and the system interests that are involved-with particular recognition of the potentially reciprocal values of education and other human experiences. So the distribution and allocation of work and service and leisure as well as educational opportunities are to be taken into consideration.

Local Area Network (LAN): A system that connects computers and peripheral equipment within a specific location.

Manning: The specific inventory of personnel at an activity in terms of numbers, grades, and occupational groups.

Manpower Claimant: In the Resource Management System, the major commanders or bureaus that are authorized manpower resources directly by Chief of Naval Operations (CNO) for the accomplishment of the assigned missions and tasks.

Manpower Requirement: The minimum quantitative and qualitative resource needed to perform a specific mission, function, or task.

Mission: The highest generalized level of descriptive official tasking by higher authority required to accomplish the Navy's assigned war fighting and support capability.

Multimedia: Anything that includes the use of several media for communication purposes. Combined with HTML or CBT, it becomes interactive multimedia.

Navy Learning Network: The Navy Learning Network (NLN) is a Chief of Naval Education and Training (CNET) program that is being designed to provide Navy wide connectivity via a single, integrated on-line learning network with access throughout the world. It is expected to provide "on demand" access to web delivered courses, libraries of courses delivered in schoolhouses, CD-Rom, Video Tele-training (VTT), and links to available education and training information and on-line group discussion capabilities.

Navy Enlisted Classification (NEC): A code that identifies a specialized knowledge or skill obtained by an Enlisted service member.

Officer Distribution Control Report (ODCR): A monthly report, issued by Chief of Navy Personnel (CHNAVPERS) and updated by each activity, which displays each officer manpower authorization by Chief of Naval Operations (CNO) within a given naval activity and indicates the name and other pertinent information concerning the incumbent of that requirement.

Optical Disks: Disk formats that store digital data; read using a concentrated light beam.

Pedagogy: The art, profession, or study of teaching children.

Personnel Assigned: A tabulation of all officer and enlisted personnel charged to an activity. This information is presented in the unit's ODCR and EDVR.

Planning, Programming, Budgeting Systems (PPBS): A system designed to assist the Secretary of Defense in making choices about the allocation of resources among numerous programs to support the National Military Strategy. Force requirements are developed to support the strategy; programs are developed to provide over a period of time the ships, aircraft, weapons systems and manpower for the force requirements.

Postgraduate Education: A course of study beyond the baccalaureate level which may or may not lead to the awarding of an advanced degree.

Program Manager: An individual who has the responsibility of managing resources assigned to their program and ensuring the program is accurately priced, balanced, and executable; that knows the policy and history regarding those assigned resources.

Projected Operational Environment (POE): The environment in which the ship or squadron is expected to operate, including the military climate (e.g., at sea, at war, capable of continuous operations at readiness Condition III).

Rate: Identifies enlisted personnel occupationally by paygrades E-1 through E-9.

Rating: A broad enlisted career field identifying an occupational specialty that encompasses related aptitude, training experience, knowledge, and skills for the purpose of career development and advancement.

Required Operational Capability (ROC): Statements prepared by mission and warfare sponsors which detail the capabilities required of ships and squadrons in various operational situations. The level of detail sets forth which weapons will be ready at varying degrees of readiness (e.g., perform anti-air warfare with full capability condition of readiness I; partial capability in condition of readiness III).

Requirement: A specific manpower space which is assigned qualifiers that define the duties, tasks, and function to be performed and the specific skills and skill level required to perform the delineated functions.

Ship Manpower Document (SMD): Quantitative and qualitative manpower requirements for an individual ship or class of ships and the rationale for determination of the requirements. Requirements are predicated upon a ROC/POE, ship configuration, specified operating profile, computed workload, and established doctrinal constraints such as standard workweeks, leave policy, etc.

Squadron Manpower Document (SQMD): Quantitative and qualitative manpower requirements for an individual aviation squadron or a class of squadrons and the rationale for the determination of the manpower requirements. Manpower requirements are predicated upon statements of ROC/POE, aircraft configuration, specified operating profile, computed workload, and established doctrinal constraints.

Strategy: Consists of the competitive efforts and business approaches that managers employ to please customers, compete successfully, and achieve organizational objectives.

Synchronous Instruction: The simultaneous participation of students and instructors. Interaction is real time.

System: A group of interacting, interrelated, or interdependent elements forming a collective entity.

Task: A subdivision of work within a particular category.

Training: Instruction that provides the learner with knowledge and skills required for immediate application in the accomplishment of a specific task or combination of tasks.

Training Agent: The Training Agency (TA) is an office, bureau, command or headquarters exercising command of and providing support to some major increment of the Navy's formalized training effort, e.g. CNET, FLTCINCs, COMNAVMEDCOM, COMNAVRESFOR, etc.

Uplink: The location where equipment permits the transmission of video, audio, and data signals up to a satellite. Uplinks may have multiple channels to transmit information.

Video Teletraining (VTT): Job site training delivered via satellite.

Watch: That period during a duty day wherein an individual is assigned and required to be at a specific place to carry out such functions as security, safety, and communication. Total work-hours expended in the watch category are counted as productive work in the computation of the minimum manpower requirements.

Web Based Training (WBT): Refers to a course delivered via the Internet.

World Wide Web (WWW): System for sharing information over the Internet.

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APPENDIX B. PC COMMANDING OFFICER INTERVIEW QUESTIONS

Purpose: This survey will be used to collect information directly from PC Commanding Officers about their ideas, plans, beliefs, towards education and training programs currently employed onboard their PC units. It is a questionnaire that will support results which shall focus on developing a model for distributed learning processes onboard a Patrol Coastal Boat Unit.

1. Describe your unit's typical yearly OPTEMPO? (Periods of underway-deployed/not deployed)

2. When conducting operations with other units, do any problems evolve from a lack of training and education?

3. What military training protocols are used and how do they function in current training environment?

4. What are the training, education, and development needs for PC personnel?

5. What type of training/education is conducted onboard?

6. How is training/education effectiveness measured?

7. What are your expectations of newly reporting personnel with respect to their level of training readiness?

8. If newly reporting personnel do not attend schoolhouse training, what different expectations exist of these individuals?

9. What is the current education infrastructure for transitioning/stationed PC personnel?

10. What is the perception of schoolhouse training for attached personnel?

11. Are all attached personnel surface warfare qualified? If not, who tracks the qualification process and how is the qualification completion process designed and documented?

12. If DL technologies are used for training and education, how important is continuing education to the success of the ship's mission?

13. What percent of onboard personnel have attained higher education? (Beyond H.S.degree)

14. What do your Sailors desire with respect to higher education?

15. Is education a Quality of Life (QOL) issue onboard?

16. Can PCs accommodate DL infrastructure (hardware/software) onboard?

17. What changes would you like to see/recommend regarding training and education aids for development of assigned personnel?

18. While underway/inport, is a Sailor's daily routine flexible enough to allocate time for continuing education?

19. What is your perception of a proposed CNO mandate dictating the allocation of a minimum number of hours to be set aside for continuing education during normal working hours?

APPENDIX C. PC PERSONNEL INTERVIEW QUESTIONS

Purpose: This survey will be used to collect information directly from PC personnel about their ideas, plans, beliefs, and educational background. It is a questionnaire that will support results which shall focus on developing a model for distributed learning processes onboard a Patrol Coastal Boat Unit.

1. Describe your unit's typical yearly OPTEMPO? (Periods of underway-deployed/not deployed, inport, daily routine)

2. When conducting operations with other units, do any problems evolve from a lack of training and education?

3. What are the training, education, and development needs for PC personnel?

4. What type of training/education is conducted onboard?

5. How is training/education effectiveness measured?

6. What is the current education/training infrastructure for transitioning/stationed PC personnel?

7. What did your training pipeline consist of prior to arriving onboard?

8. If you did not attend schoolhouse training prior to reporting onboard, what different expectations of your performance do you feel exist?

9. What is the perception of schoolhouse training?

10. What kind of training/education have you received while attached to this command?

11. Are all attached personnel surface warfare qualified? If not, who tracks the qualification process and how is the qualification completion process designed and documented?

12. If DL technologies are used for training and education, how important is continuing education to the success of the ship's mission?

13. What is the highest level of education you have received?

14. What do you desire with respect to higher education?

15. Is education a Quality of Life (QOL) issue onboard?

16. Can PCs accommodate DL infrastructure (hardware/software) onboard?

17. What changes would you like to see/recommend regarding aids for training and education?

18. If new technologies were brought onboard to aid in training and education, would you partake in the opportunities to further your education?

19. While underway/inport, is your daily routine flexible enough to allocate time for continuing education?

20. Do you think continuing education should/can be accomplished during normal working hours and/or underway periods?

21. What is your perception of a proposed CNO mandate dictating the allocation of a minimum number of hours to be set aside for continuing education during normal working hours?

APPENDIX D. PC COMMANDING OFFICER INTERVIEW SUMMARY

Purpose: This appendix provides information obtained from interviews conducted with two Navy PC Commanding Officers. Other PC units or Commanding Officers were unavailable at the time of this project.

1. Describe your unit's typical yearly OPTEMPO? (Periods of underway-deployed/not deployed)

Both Commanding Officers attested to typical deployment schedules (6 months deployed abroad/18 months home-based) with numerous short underway periods to conduct training, and local area operations in support of Navy SEAL training missions.

2. When conducting operations with other units, do any problems evolve from a lack of training and education?

According to both COs, problems do not exist with regards to training, but the most prominent deficiency in being prepared to work with other units is the lack of real-time messaging capabilities. This results from working with legacy systems to send/receive secure/non-secure message traffic and not having SIPRNET/NIPRNET systems installed onboard.

3. What military training protocols are used and how do they function in current training environment?

Both COs stated that personnel's training is similar to training protocols of other Navy surface units. The major difference in training between PCs and other surface combatants is the emphasis PCs place on physical fitness training, craft and weapons tactics, techniques, and procedures, and clandestine infiltration and extraction of SEALs and other special operations forces. Such training issues are considered critical to unit operational readiness.

4. What are the training, education, and development needs for PC personnel?

Both Commanding Officers recognize that PC personnel require rate training for advancement, ESWS/SWO training, education opportunities to increase knowledge and skills for sustained superior performance at sea, and increased levels of physical fitness training to endure increased instability of a PC during underway operations. Although higher education opportunities are offered to PC personnel, due to the high OPTEMPO of a PC, both COs suggest that there is limited time for personnel to partake in any academic curriculum.

5. What type of training/education is conducted onboard?

Both COs identified only training programs that support operational readiness (e.g. Navigation, ship handling, engineering, underway/inport watch station training, etc.) Education programs for higher learning were not identified as part of shipboard daily routine either inport or underway.

6. How is training/education effectiveness measured?

COs did not identify measures of effectiveness for education. Regarding measurement of training readiness, measures of effectiveness identified by COs include: written exams, team evaluations, physical readiness tests, and warfare qualification boards.

7. What are your expectations of newly reporting personnel with respect to their level of training readiness?

Both COs maintained that regardless of rate or rating newly reporting personnel must acclimate as quickly as possible to shipboard environment in order to be an effective part of the ship's crew.

8. If newly reporting personnel do not attend schoolhouse training, what different expectations exist of these individuals?

Both COs did not mention differing expectations. In general, newly reporting personnel must adapt quickly to the high OPTEMPO of a PC in order to be successful as a PC member and an asset to the unit.

9. What is the current education infrastructure for transitioning/stationed PC personnel?

Neither command had a shipboard education infrastructure to support higher learning for shipboard personnel.

10. What is the perception of schoolhouse training for attached personnel?

Both COs found schoolhouse training to be effective and critical to unit readiness.

11. Are all attached personnel surface warfare qualified?

If not, who tracks the qualification process and how is the qualification completion process designed and documented? One unit had 80% of its crew warfare qualified. The other had 85% warfare qualified. For both units, the CO claimed responsibility for tracking personnel warfare qualification. On both units, warfare qualifications are based on completion of Personnel Qualification Standards (PQS), proficiency of watch station duties, illustration of general and specific knowledge of various aspects of the Navy (e.g. platforms, manpower, weapon systems, etc.) during oral boards, and ultimately the Commanding Officers trust which is earned by the individual attempting to obtain a specific warfare qualification.

12. If DL technologies are used for training and education, how important is continuing education to the success of the ship's mission?

Both COs supported the use of DL technologies onboard their units for training and education. Although, because PC Sailors must endure obstacles such as limited time, duty section rotation, underway schedule, preventative maintenance, and shipboard training, both COs did not believe that a DL environment could be effectively implemented onboard a Navy PC.

13. What percent of onboard personnel have attained higher education? (Beyond High School degree)

Information from either PC was unavailable at the time of research.

14. What do your Sailors desire with respect to higher education?

Both COs understood that the Internet is offering more opportunities to their Sailors as new technologies are created. With that in mind, both COs believed that higher education opportunities via DL technologies are what their personnel are seeking.

15. Is education a Quality of Life (QOL) issue onboard?

Both COs identified higher education as a primary quality of life issue for their personnel. According to issues addressed in question 12, they are unable to effectively implement education programs onboard.

16. Can PCs accommodate DL infrastructure (hardware/software) onboard?

Both COs believed it to be possible provided the right kinds of technology were brought onboard to effectively meet the needs of their crews.

17. What changes would you like to see/recommend regarding training and education aids for development of assigned personnel?

With regards to distributed learning, one Commanding Officer mentioned that an effective program for offering language courses would be most supportive for mission readiness (particularly for Counter Narcotics Operations). The other CO would like to have a database from which courses offered by a Squadron Commander could be offered to all shipboard personnel of any unit regardless of time and homeport station.

18. While underway/inport, is a Sailor's daily routine flexible enough to allocate time for continuing education?

Both COs believed it to be possible to partake in continuing education while inport, but during underway periods, mission requirements do not allow for enough "down-time" for a Sailor to participate in life-long learning programs.

19. What is your perception of a proposed CNO mandate dictating the allocation of a minimum number of hours to be set aside for continuing education during normal working hours?

Both COs believed such a mandate could not possibly work in a PC environment. Both Commanding Officers felt that it would add to a Sailor's daily workload, which could ultimately reduce productivity and cause a unit's operational readiness to decline. Once again, because of high OPTEMPO, and reduced stability during underway operations, the Commanding Officers believed that education programs while at sea could not successfully be implemented onboard a PC.

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APPENDIX E. PC PERSONNEL INTERVIEW SUMMARY

Purpose: This appendix provides information obtained from interviews conducted with thirty Navy PC Sailors and seven PC Officers. Other PC personnel were unavailable at the time of this project.

1. Describe your unit's typical yearly OPTEMPO. (Periods of underway-deployed/not deployed, inport, daily routine)

100% of personnel interviewed attested to typical deployment schedules (6 months deployed abroad/18 months home-based). During home-based periods numerous short underway periods are experienced to conduct training, and local area operations in support of Navy SEAL training missions. During underway periods, Sailors experience different watch station rotations. Of the personnel interviewed, 60% stand four hours on watch and four hours off (Port & Starboard watch rotation). 40% stand three section watch rotations (5 hours on and 10 hours off). The underlying premise to watch rotation is that mission task functions are what drive the underway watch schedule for all personnel. If the unit is at General Quarters (GQ) (the highest condition of combat readiness) then all the watch positions are manned completely for the duration of the GQ period, otherwise a minimum number of watch stations are manned to ensure safety of navigation of the ship. As for daily routine, responses varied according to rating or seniority. In general, during inport periods, all the respondents attested to long working hours (0600 to 1600) with minimum personal time in between. During an underway period, personal downtime is spent sleeping or working on warfare, rating, or watch station qualifications. Because of ship instability while at sea, 80% of the respondents used downtime to eat and sleep. 20% used downtime for sleeping and studying for the above-mentioned qualifications.

2. When conducting operations with other units, do any problems evolve from a lack of training and education?

None of the interviewees mentioned any problems with training when working with other units. Regarding education, outside of personal qualifications, not one respondent completed a higher education course during an underway period.

3. What are the training, education, and development needs for PC personnel?

Each respondent identified own specific needs along with Navy and ship specific requirements for training, and education. Some of the needs that were suggested were:

a.) Onboard trainers for engineering personnel
b.) Training scenarios that provide real-time communication capabilities such as instant messaging for administrative or operational purposes.
c.) Higher education programs that could lead to degree attainment.
d.) A central database from which information may be obtained to assist in warfare qualifications.
e.) Education programs that offer language studies.

4. What type of training/education is conducted onboard?

The following training topics were identified throughout the interview process: navigation, shipboard handling, basic/advanced fire fighting, shipboard security, clandestine operations, insertion/extraction of Special Forces, weapons handling, rate training, warfare qualification, watch station functions, underway replenishment operations, man-overboard scenarios, first-aid, chemical warfare, surface/air combat, and Visit, Board, Search and Seizure (VBSS).

5. How is training/education effectiveness measured?

All respondents attested to a combination of the following items: Team evaluations, written exams, completion of Personnel Qualification Standards (PQS), Physical Readiness Tests (PRT), and Warfare qualification boards.

6. What is the current education/training infrastructure for transitioning/stationed PC personnel?

60% of the respondents attended schools (prior to arriving onboard a PC) that are applicable to the ratings required onboard a PC (e.g. Diesel mechanic and Quartermaster). 40% of the respondents did not attend any training prior to reporting for duty onboard a PC. 100% of the interviewees attended some sort of formal training some time after arriving onboard a PC.

7. What did your training pipeline consist of prior to arriving onboard?

Each respondent had a different training pipeline prior to arriving onboard. Because not all PC billets are Navy Enlisted Classification (NEC) driven a Sailor does not necessarily require A or C school training prior to arrival onboard. For example, three of the Sailors interviewed arrived onboard their respective ships directly from boot camp. In each instance, all three Sailors were Striking for specific ratings onboard because they did not receive any preparatory training. Another example would be the Gunner's Mate billet. In this instance a Gunner's Mate Missiles (GMM) or Gunner's Mate Guns (GMG) Technician can fulfill a PC Gunner's Mate billet. Conversely, Diesel Engineers require formal training prior to arriving onboard. In this case, a specific training pipeline is required in order to fulfill an NEC driven PC billet.

8. If you did not attend schoolhouse training prior to reporting onboard, what different expectations of your performance do you feel exist?

100% of the respondents attested to superiors placing high expectations upon them to acclimate to the PC environment as quickly as possible regardless of prior training or experiences.

9. What is the perception of schoolhouse training?

100% of the respondents stated that schoolhouse training was effective in providing the necessary information for performing their job functions effectively. Also, attending training away from the unit gave the Officers and Sailors time away from the ship, which was found to be another benefit to schoolhouse training.

10. What kind of training/education have you received while attached to this command?

Of the thirty Sailors interviewed, eight completed some education courses via PACE and correspondence courses and one earned an associates degree. 100% of the Officers interviewed arrived onboard with at least a Bachelor's Degree. Regarding training, 100% of the respondents received training on various topics such as those mentioned in question 4 above.

11. Are all attached personnel surface warfare qualified? If not, who tracks the qualification process and how is the qualification completion process designed and documented?

Onboard one PC 80% of the Sailors were ESWS qualified and 85% of the Officers were SWO qualified. Onboard the other PC 85% of the Sailors were ESWS qualified and 85% of the Officers were SWO qualified. Both PC Commanding Officers claimed responsibility for tracking and supporting an aggressive qualifications program. Each warfare qualification program is based in PQS completion, watch station proficiency, illustrating superior knowledge of all facets of the Navy (e.g. platforms, warfare tactics, amphibious warfare, etc.) during oral boards, and finally, obtaining the Commanding Officer's trust as a fellow Surface Warfare expert. Once the qualification is obtained, the Commanding Officer authorizes the individual Officer or Sailor to wear the appropriate insignia and an official entry is made into the serviceman's military record.

12. If DL technologies are used for training and education, how important is continuing education to the success of the ship's mission?

Because higher education is not presently connected to mission readiness, none of the respondents could place any such importance to mission success.

13. What is the highest level of education you have received?

Of the thirty Sailors interviewed, 27 had high school diplomas, 2 had G.E.D.s, and 1 had an Associate's Degree. Of the seven Officers interviewed, 1 was a Limited Duty Officer with a high school degree, 5 earned Bachelors Degrees, and 1 had a Master's Degree.

14. What do you desire with respect to higher education?

100% of the Sailors interviewed seek degree attainment programs that are available especially during normal working hours. All the respondents addressed the need to spend personal time with family as a primary "quality of life" issue. All of the five Officers who earned Bachelor's Degrees seek Master's Degree opportunities during their tours onboard their respective PCs.

15. Is education a Quality of Life (QOL) issue onboard?

100% of the Sailors interviewed agreed that higher education opportunities were certainly one the highest QOL issues. For the Officers, because of heavy workloads and long working hours either inport or at sea, higher education was not a primary QOL issue (Other QOL issues identified were Personal Family time, pay, skills

acquisition, and advancement and travel opportunities).

16. Can PCs accommodate DL infrastructure (hardware/software) onboard?

100% of the respondents agreed that DL technology could be supported onboard a PC provided the equipment is compact, flexible to meet the needs of the crew and durable to withstand the instability of a PC during underway operations. Also, several of the respondents attested to the possibility of DL technologies aiding in the reduction of paper materials throughout the ship thereby providing more space for hardware/software storage.

17. What changes would you like to see/recommend regarding aids for training and education?

With regards to distributed learning, 50% of the respondents mentioned that an effective program for offering language courses would support mission readiness during Counter Narcotics Operations. 30% of the respondents recommended establishing a central database of Naval information from which any individual could access at any time to support higher learning and training for warfare qualifications or rating advancements. 20% of the respondents offer no recommendations for changes in training and education onboard a PC.

18. If new technologies were brought onboard to aid in training and education, would you partake in the opportunities to further your education?

90% of the respondents agreed to take advantage of DL programs onboard provided time is made available to them to participate in higher education. 10% of the respondents were uncertain if they would take advantage of DL opportunities. 100% of the respondents agreed to not having enough time in the daily schedule either inport or at sea to participate in higher education programs.

19. While underway/inport, is your daily routine flexible enough to allocate time for continuing education?

100% of the respondents agreed that underway periods do not offer enough time to participate in any continuing education programs. Daily routine is filled with typical training scenarios, watch rotations, and mission tasks that there does not seem to be enough time in the underway daily schedule to support continuing education programs. Likewise, during inport periods the workday is filled with preventative maintenance schedules, meetings, quarters, physical fitness and shipboard training, and watch rotations. Thus, allocating time for higher education during the inport workday also does not seem feasible.

20. Do you think continuing education should/can be accomplished during normal working hours and/or underway periods?

Again, 100% of the respondents did not believe there was enough time in the workday to effectively pursue a higher education program.

21. What is your perception of a proposed CNO mandate dictating the allocation of a minimum number of hours to be set aside for continuing education during normal working hours?

100% of the respondents did not believe that such a mandate could be made possible and that if such an action were to take place, it would be viewed as another task being added to an individual's difficult daily schedule. Although, if upper echelon within the PC aggressively supported such a program and did allocate time during the work day without elongating work hours, 100% of the respondents would aggressively seek higher education opportunities.

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