10TH INTERNATIONAL COMMAND AND CONTROL RESEARCH AND TECHNOLOGY SYMPOSIUM

THE FUTURE OF C2

Amphibious Expeditionary Warfare C4I Modernization

Topic Areas:

C4ISR/C2 Architecture

Decisionmaking and Cognitive Analysis

Policy

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 2005		**00-00-2005 to 00-00-2005**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Amphibious Expeditionary Warfare C4I Modernization	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **OPNAV N75 ,Expeditionary Warfare Branch,2000 Navy Pentagon Rm 5A478,Washington,DC,20350-2000**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
2005 International Command and Control Research Technology Symposium

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**		**24**	

Abstract

This paper describes a methodology for Amphibious Expeditionary Warfare C4I Modernization that that is intended to achieve the tenets of Network Centric Operations and Warfare, attempts to balance the diametrically opposed forces of Moore's Law, the acquisition process, and advanced warfare concepts of Seabasing, Surface to Objective Maneuver (STOM) and Network Centric Warfare.

Three functional areas of change were identified: Cultural and Social, Physical and Process, and Technological Change and a methodology was developed to facilitate change in those areas that would produce a C4I capability that is integrated, scaleable, additive, and flexible to respond to the immediate needs and preferences of the commander. In order to accomplish any military objective, effective C4I is the primary enabler. By examining the imperishable capabilities that are projected to exist in 2020, baselining existing systems that provide those capabilities, identifying gaps and influencing the emerging systems in the near term (2008-2015), we will be able to establish the requirements for the long term (2015-2020) solutions. This is an on-going and likely continued effort with immediate short term results.

The applications of science have built man a well-supplied house, and are teaching him to live healthily therein. They have enabled him to throw masses of people against one another with cruel weapons. They may yet allow him truly to encompass the great record and to grow in the wisdom of race experience. He may perish in conflict before he learns to wield that record for his true good. Yet, in the application of science to the needs and desires of man, it would seem to be a singularly unfortunate stage at which to terminate the process, or to lose hope as to the outcome. Vannevar Bush, Atlantic Monthly, 1945.

Introduction.

This paper describes a methodology for Amphibious Expeditionary Warfare C4I Modernization that that is intended to achieve the tenets of Network Centric Operations and Warfare, FORCEnet, and Coalition Information Exchange that attempts to balance the seemingly diametrically opposed forces of Moore's Law, the acquisition process, transformation and advanced warfare concepts of Sea Basing, Surface to Objective Maneuver (STOM) and Network Centric Warfare. Although applied specifically to Amphibious Expeditionary Command and Control, this approach has potential applicability to all C4I spaces, processes and environments regardless of service affiliation. The motivation behind this work is a 21 year experience from the operator perspective, an 11 year experience with Commercial Off The Shelf environment that largely supports a 70% solution to software and hardware performance characteristics and a 2 year experience with the resource and requirements process that attempts to balance an insatiable appetite for technological solutions to current and future warfighting capabilities and concepts against limited resources. In a fiscally unconstrained environment it may be possible to answer the demands of the operational forces independently, providing current management solutions, provide interim and future solutions developed "off-line" in controlled environments, with measured and balanced input from operators and technologists. However, we are not in a fiscally unconstrained environment and it is unrealistic for forces tasked with conducting a three front war, Afghanistan, Iraq, and the "40 year war" Global War On Terrorism (GWOT) to operate with current systems until a laboratory or "off-line" product is developed and implemented. Absent coordinated, broad perspective integration, vice interoperability efforts, many activities, organizations

and commands are reverting to “home-grown” solutions to fill gaps, either in performance or training that existing programs do not fill, introducing the possibility of manifold unintended consequences to the overall effectiveness of the system as a whole.

The scientific merits of this work can be argued, yet there are fundamental truths exposed in the following discussion and based on those truths demands further exploration. The precept for this work is acceptance of the notion that we are in the midst of a Revolution in Military Affairs (RMA) that includes Information Systems, Information Operations both offensive and defensive, and technological advances across the widest spectrum ever experienced in the history of warfare and directly focused on Command and Control. Unlike previous RMAs, there is no directly attributed battlefield operational imperative that makes clear the operational impact or benefit. Rather, it presents the opportunity to build a comprehensive warfighting capability of a nation around a modern command and control architecture that takes advantage of the classical weapons of warfare: bullets, bombs, armor, navies and air forces. Unlike the Pike and Square or the Tank, this RMA provides the opportunity to create central core of command and control advances that reside at the tipping point that lend it to flexibility, presence, mutual support, adaptability, sustainability, and economical employment of military power in support of national security objectives. The methodology presented here is multi-disciplinary, incorporating the dynamics of social psychology, organizational theory, complexity theory, process engineering, visualization, technological advances and supports both current tactics, techniques, and procedures as well as the concepts of future warfighting, Network Centric Operations and Warfare (NCOW), FORCEnet and Sea Basing.

Background.

Most seasoned commanders will acknowledge that at the core of successful operations is the ability to effectively command and control the forces under their control. History has demonstrated that commanders will acknowledge that success or failure on the field of battle was partially if not wholly dependent upon their ability to effectively command and control their forces. Although the majority of these observations surface in the retrospective, it is somewhat surprising that many of our modern forces operate in an environment where command and control operates more on the periphery of warfighting capabilities vice the core. History is replete with examples of battles and wars lost due to missed opportunities, guidance not received or lack of coordination within a force. Absent the ability to plan, communicate, disseminate, and adjust orders and directions to subordinates and receive the same from higher commands, core warfighting skills are relatively moot. The best-trained forces are unable to achieve maximum effectiveness or claim the initiative without effective command and control. This has long been the axiom of the warfighter and the commander. In order to achieve the potential of the current RMA and to achieve the DoD goals of transformation, a new paradigm of approaching C2 and our acquisition of C4I systems is required.

In particular, this is prevalent within the Naval Amphibious Expeditionary Warfare environment. Arguably, the environment in which Naval Expeditionary Warfare Forces operate is as demanding as that of a Joint Task Force. Given the multi-dimensional force capabilities, the range of missions performed and the forward presence of these forces, the Navy and Marine Corps organization known as the Expeditionary Strike Group (ESG) conducts operations in the littoral, that transitions from open ocean to the land and sea interface and beyond into the landward sector. Reorganized from the traditional Amphibious Ready Group that was composed of 3-7 amphibious ships that provided amphibious dock for launch of amphibious vehicles, assault craft and vessels, and embarking an integrated force of Marines and Sailors, the ESG now possesses 3 traditional amphibious ships (LHA/LHD, LSD and LPD), a guided missile Cruiser (CG), and

a Submarine, both of which may be capable of planning and launching Tomahawk Land Attack cruise missiles (TLAM). Tides, bathymetry, currents, subsurface mines and obstacles, air threats, and surf are all dynamics that influence the force while afloat. The proximity to shore that this force maintains presents myriad threat susceptibility, ranging from the unsophisticated to highly advanced coastal self protection weapon systems. The incorporation of four dimensions of warfare, surface, subsurface, land and air suggest that the C2 challenges in this environment are as demanding and daunting as any joint environment (save for coalition, multiple service interactions and significant higher headquarters command and control interfaces) and serves as the backdrop of this study.

Description of the Problem

Ship warfighting spaces include ship combat spaces such as the Combat Information Center that historically supports ship defense of surface, sub-surface and air threats, the Tactical Air Control Center, typically staffed by the Tactical Air Control Squadron (TACRON) that provides Air Traffic Control, additional Anti-Air Defense coordination, and the Helicopter Direction Center that is staffed by Ship personnel to coordinate helicopter operations on the flight deck and immediate proximity of the ship., Primary Flight (PRIFLY) for launch and recovery and the ship's Combat Cargo Officer to coordinate the logistics, craft and personnel moving from the ship. The Supporting Arms Coordination Center (SACC) is the traditional space for the coordination of air and surface fires, tactical air request processing and to address the immediate lift, fires and strike requirements of the forces engaged in operations and staffed by a combination of the senior Marine Fire Support Coordination Center, elements of the senior Marine Combat Operations Center, the Direct Air Support Center, TACRON staff Air Officer and Naval Surface Fires Officer. The Landing Force Operations Center serves as the Combat Operations Center of the Marine Command Element afloat and coordinates the operations of the Ground Combat Element, Combat Service Support Element and the Aviation Combat Element within the MAGTF structure

and provides the integration point for Navy and Marine Corps operations. Recent manifestations include the adoption of the Joint Operations Center (JOC) that provides the ESG Commander and select staff members to coordinate operations and Joint Information Center (JIC) that processes intelligence and combat information. The purpose of these spaces, save the JOC and JIC, were to support classical amphibious operations that included transit from a friendly port, an amphibious assembly and operations area, pre-landing operations, amphibious assault, land operations and a process of phasing control from the ship based spaces to the MAGTF ashore to sustain operations. The relationship between the Commander of the Amphibious Task Force and Commander of the Landing Force was one of parity with doctrinally defined and mutually accepted terms that delineated span of control of various resources in the process of the amphibious operation and subsequent phasing control ashore process. Over the years, systems have been procured, installed and maintained from a systems and program perspective with little influence by external inputs other than ship availability windows and individual program lifecycle support. The result is an uncoordinated collection of information and weapon systems that vary from ship to ship and yields a Naval Amphibious Expeditionary Force operating in a command and control environment that is at best, controlled chaos. In many respects the amphibious operation has always been chaotic and is therefore not an epiphany to state such, however the current situation is exacerbated by a number of factors that include absence of hardware and software configuration management aboard L-Class ships, a pervasive impression that ship systems do not support Marine Corps and Naval warfighting capabilities, absence of standardized ship space configurations, and competing priorities of preparing for advanced concepts such as the Sea Base, MPF(F), FORCEnet, and Network Centric operations.

Shipboard C4I systems continue to exist in stovepipe and legacy applications with little movement to create a common or standardized configuration or capability baseline due to myriad permutations of individual program, system, and local command priorities rather than an institutional priorities.

It is believed that the core issue is the systems/program approach to the various Navy systems, a divergent course of Marine Corps development of warfighting systems and a lack of a cohesive, coordinated Navy and Marine Corps or Naval plan to establish a capabilities based, integrated warfighting system. The Navy and Marine Corps have taken different paths to modernize and sustain existing and emerging programs. The result is that the Naval Command and Control capability, while advancing to automation and the electronic information highway, is in reality two separate highways with very few “on-ramps” to enable fusion, coordination or common view of the battle. The different systems employed by the two forces are disparate enough that e-mail serves as the primary means of communicating between systems aboard the same ship. A loosely arranged concept of “Blue-in Support-of-Green” program suggests that the Navy will provide certain levels of support to the Landing Force Operations Center and provide a degree of program support to infrastructure communication needlines established by the Marine Corps. However, the realities are that with a large disparity between resources and requirements, Marine Corps communication requirements aboard ship often fall short of funding priorities.

The problem is at once both exponentially large yet blatantly succinct, a tangled web of inter-related cross-domain issues, yet once stated, intuitively obvious. In an era that suggests that there is a decreased likelihood of employing Amphibious Expeditionary Forces in classical amphibious operations and subsequent phasing control ashore of ground forces, it is incumbent that the Navy and Marine Corps achieve both parity and consonance with a capability based, integrated approach to near, mid, and future warfighting systems that will more and more operate from the sea and remain afloat. Macro level DoD initiatives that define the transformational process are significant and helpful in defining the areas within which change must take place the definition of Mission Capability Packages (MCPs), the development of Communities of Interest (COIs), and identification of the Global Information Grid Enterprise Services (GIG ES) are positive elements for enterprise-wide transformation. At the Department of the Navy level, definition of FORCEnet capabilities, compliance initiatives and

Navy specific issue areas are also supportive of both the DoD wide efforts, but scoped to specific Naval issues and to provide opportunities to draw from Navy wide products of the various Navy wide processes. Navy-wide review and resources applied to these efforts do not address the specific needs of Amphibious Expeditionary Warfare, and it became necessary to create a focus group dedicated to this unique environment, provide consolidated input to the larger Navy and DoD wide transformation processes and establish specific requirements and capabilities necessary to operate in the both in the present and the postulated threat environments.

This “micro” Community of Interest would have the mission to be the convergence point for Navy and Marine Corps warfighting capability with a distinct Naval perspective. The Director of the Expeditionary Warfare Branch of the Chief of Naval Operations staff OPNAV N75 serves as the Advocate and Title X arbiter of Navy and Marine Corps fusion, supported and represented through a combination of OPNAV staff branches, program sponsors, Fleet Forces Command, Network Warfare Command, Headquarters Marine Corps, Marine Corps Combat Development Command, Systems Commands, and Doctrine Branches.

The current situation confronting the operational forces is daunting by and of itself, but exacerbated by the demands of future warfare concepts of Maritime Prepositioned Forces (Future) (MPF(F)), Sea Basing, and Distributed Operations. The variables and potential costs of fully developing viable operational concepts and the associated Command and Control structures individually are prohibitive, as is the current cost of replicating individual systems at successive levels of command. It is also unlikely that a laboratory grown system can be developed with a set cut-over, given the training, transitional nature of the operational environment and the inability to adequately determine the needs of the end user.

The challenges facing Naval Amphibious Expeditionary Warfare forces can be reduced to a single, albeit very large, problem:

Naval Amphibious Expeditionary Warfare forces do not possess a plan to create a network centric C4I environment that is conducive to conducting operations from the Sea Base. This problem statement can be further broken down into four focus areas that include: Absence of integrated Navy and Marine Corps systems capable of meeting service unique requirements yet operate seamlessly together, a lack of standardization across the Amphibious Fleet (ship to ship, ESG to ESG, ESG to JTF), the requirements for C4I capabilities of the MPF(F) ships, and the specific requirements of the ESG as it evolves into the next stage of organizational acceptance.

Cycles of Change

The obvious conclusion that was drawn early in this process was that clearly, change was required; however it was also obvious that change within a complex organization takes more than a few supporters to become established. Additionally, a single functional change would not suffice as the problem touches too many critical areas to become established and it was also clear that the solution does not reside in a technology only insertion to affect the level of change required. It was therefore determined that problem area needed to be addressed from a multi-faceted approach. The focus areas revealed that the solution process needed to be applied to three functional areas of change: Social and Cultural Change, Process and Physical Change and Technological Change. Each of these areas is inextricably linked to the other, is mutually supportive of the other and needs to be applied with equal focus and merit. Review of the nature of each change cycle determined that the rate of technological change was both easier to provide and supported by Moore's Law, a faster cycle, it is also the most fiscally challenging. Process and Physical change is only slightly slower to affect or implement and involves the majority of DOTMLPF (doctrine, operations, training, maintenance, logistics, personnel, and facilities) issues and is only slightly less expensive to implement. Finally, the most challenging and slowest rate of change is Social and Cultural change and although relatively absent of cost, the most difficult to achieve. The goal was and is to speed the rate or cycle of cultural and social change, maintain the rate of

process and physical change, and slow the rate of technological change to one that is more sustainable. Not to suggest that we eliminate technological growth, but to become more efficient and cogent in the application of technology to ensure that it supports both the social and process change and supports operational concepts. By reducing the rate of technological insertion, lifecycle costs decline and allow process modifications that allow user interaction and discovery of the full power/capability of the technology. As users share ideas and enter process change discussions, other areas of DOTMLPF adjust, and the social and cultural relations improve. By slowing technological investment through the insertion of network centric principles, more resources are available to train operators and allows time for sharing of ideas and improvements which yields better requirements which improves the emerging systems that are responsive to user input. The cycle of multiple feedback loops becomes synergistic and facilitates the social and cultural change which accelerates to meet the rate of process and technological change. At the same time the large investment in technology decreases over time as new processes and minor technology adjustments have to be made, increasing the return on investment and the knowledge value added.

Implementation

Given that the area of social and cultural change is the slower of the cycles and a facilitator of gaining mutual understanding of the process, the first area to be addressed was the cultural acceptance of different views of east and west coast amphibious forces. Socialization with the Amphibious Warfare Operator Advisory Group of the fiscal and capability based requirements approach was undertaken to develop a single voice to address critical combat capabilities and warfighting functions. Additionally, efforts are ongoing to include Marine Corps stakeholders in enhancing the solidarity of the priorities and to provide a complete Naval capability set that will further leverage Amphibious Expeditionary Warfare inputs to Navy wide program inputs. Similarly, discussions and workgroups have been undertaking the initial review of the existing systems, determining the adequate baseline capabilities of fielded systems, the emergence of system upgrades and

new technologies that are in the process of fielding to identify the near-term operational capabilities. Gaps identified in the capabilities required and the systems that are currently fielded are being identified and are being translated into new requirements to be leveraged against systems with incremental development or new technologies sought to fill the near-term needs. Once this process is completed, prior to the end of FY 2005, the effort to standardize platforms and ESGs will be undertaken through a program of software and hardware configuration management. From the systems that are currently fielded that do not fit into the standardization plan or baseline will provide the opportunity to capture necessary funding to further investigation to mid-term system configurations and leverage requirements against technologies currently in development expected to be fielded in the 2010-2015 timeframe. It is expected that the speed of technology infusion will be reduced, and will equate to a more sustainable rate of technology consumption that will enable operators to become more fully aware of the fielded technology, become more efficient in their use, and be able to share lessons learned and enter into a period of discovery with the fielded systems. This is one of the first feedback loops that allows for cross-functional area support to each change category.

Simulated Environment

To further address these functional areas of change, provide insight and validation of proposed technologies, develop quantitative means of evaluating capability sets, address operator concerns and refine the determination of new requirements, the revitalization of the Expeditionary Warfare Testbed (EWT) at the Naval Surface Warfare Center, Panama City Coastal Systems Station needed to occur. Guided by N75, the EWT provides an operationally reflective environment in which to evaluate, experiment and develop the virtual environment that most fully satisfies the requirements of the Naval Amphibious Expeditionary Forces. It serves as the means that the COI implements change, explores the validity and concepts of future capabilities and the basis for requirements validation and generation. This facility stands as but one of a network of similar environments that have been developed across the country in

both the Navy and Marine Corps and provides a unique opportunity to combine the efforts of many focus groups to a collective whole that can be applied to the larger concepts and processes that are on-going within DoD. The local laboratories and experimentation efforts that have been established contribute significant insight into the specific communities which they serve and the problem areas most prevalent on the minds of local commanders. Most of the facilities address a specific area of concern or capability set that particularly problematic for the geographic region they service. The combined computing power and brilliant minds that service the facilities joined together through land based networks that generate huge quantities of data that expose potential problem areas, reinforce findings of studies and provide unprecedented insight into the specific warfighting needs of the current and future force. The creation of this "micro-environment" allows for a series of cascading events to unfold that facilitates additional functional areas of change. With a plan in place, guided by the COI, multiple feedback loop will be created and naturally form that will completely explore issues, encourage requirements not previously identified to emerge, establish common terminologies and definitions, recommend force structure adjustments, and facilitate process change to emerge. The total effort allows the system as a whole to become more flexible, adaptable, and prevalent. The multiple locations of this network of laboratories provides unprecedented opportunity to gain access and insight into the new areas of discovery, develop harmonization with shared capabilities and technology and allows more user input and access to the "art of the possible". With visibility into what is technologically possible, coupled with potential economies presented by structure and process change, the potential for changing paradigms and doctrinal approaches to Amphibious Expeditionary Warfare to shift dramatically. With this simulated environment, requirements can be more rapidly and completely vetted, combining the user, the technologist and the developer to better envision the desired output and is the embodiment of transformation.

Functional Change Areas

Social and Cultural Change.

The history of the Navy Amphibious Fleet has been one of little formalization, minimal doctrine, and limited standardization. Likely drawing from the roots of Naval history, the Ship's Captain has always enjoyed near limitless powers while at sea. Some of this culture has shaped and permeated the Navy culture, the manner in which Naval warfighting capabilities have been addressed and likely contributes to a spirit of individuality from ship to ship, command to command, force to force. Little standardization exists in the physical construct and in the culture or social relationships aboard ship and with other services. The various Amphibious Squadrons (PHIBRONS) have maintained degrees of individuality that have afforded little common view or perspective. One could certainly argue that if a latent historical carryover is the explanation of the current situation why then did it not manifest itself as a problem area in the past and classical Amphibious operations? This question was a troubling element, but given the means of coordination in more classic amphibious operations, voice and handwritten communication, less of the culture needed to be exposed to view than the level of integration required for network centric operations. Only recently has the Amphibious Operators Advisory Group been able to present a consolidated list of priorities to Flag level leadership to promote key area of concern. Philosophical differences remain entrenched however and serve as an obstacle until a social and cultural change can be achieved within the amphibious Navy. "Doctrine", such as it is, is guided by local Tactical Memorandum (TACMEMO) that provides instructions on higher command level approaches to various circumstances or situations. Currently there is no forum for Navy and Marine Corps consolidation of perspectives, issue vetting, or proposals for doctrinal change other than at the Fleet level of Pacific and Atlantic and only through liaison officers that may or may not have a wider view of the requirements or broader perspective. The Community of Interest is expected to create such an environment that allows for new levels of socialization, expression of issues, and consonance of objectives to be fed back into the higher level

working groups and DoN/DoD efforts dedicated to FORCEnet or GIG ES transformation. Because human relations and social change is often a slow and somewhat deliberate process, the effort must begin early to allow for relationships to become forged. In many respects, the social change has been occurring for several years now and the personalities and levels of understanding that the current Navy and Marine Corps leadership possess are especially conducive to facilitating this change.

Process and Physical Change.

Commencing with the beginning of the social and cultural change effort is a linked effort to evaluate and assess the capabilities provided by the existing suites of systems that are resident in the amphibious warfare command and control spaces. This process targets the identification of redundancies, gaps and overlaps that may exist in the current systems afloat. Included in this review is the evaluation of how information flows through the command and control system, which systems provide pathways and linkages to other systems, how the shared view of the battlespace is processed and who are the key personnel that require access to the information. From this work, a notional baseline of systems can be drawn that provides the necessary information, currently available, to the various users afloat and begin the process of eliminating overly redundant systems. The existing Navy process of Command, Control, Computers, Communications , Cryptologic, Intelligence Modernization Process (C5IMP) currently reviews the systems and programs in this area and certainly can provide data and Navy wide perspective on these programs, but as in most Navy wide reviews do not maintain the specific needs of the amphibious fleet as the highest priority. Any review of these types of systems would include the work of the C5IMP, but would add to this review from the dedicated perspective of the amphibious perspective and then provide input back into the C5IMP as a consolidated Navy/Marine Corps input.

Force structure analysis is an ongoing process that looks at the types of missions performed by a force and the various processes are undertaken to perform those

missions and ensure adequate staffing. Automation and information technology has long promised increased efficiencies and economies but have yet proven effective in this area. It is held that the systems alone will not provide a more efficient or economical means to perform warfighting functions, however when coupled with a doctrinal basis for the missions, adapting tactics, techniques and procedures that allow for the streamlining of information flow and operations in a network centric environment Force Structure will undoubtedly be effected. The current staffing, based on classical operations is perhaps not best suited for the current mission and the virtual environment, especially when teamed with the Subject Matter Experts in our Doctrine and Training Branches, new staffing and procedures may be revealed. The baselining process discussed above contributes to this process and can identify further adjustments to staffing based on the results of detailed program reviews.

The third area that this functional change element touches is the physical construct and arrangement of the existing fleet. With a notional baseline in hand, a notional force structure that will operate in the space to facilitate the movement and processing of information, how the ship spaces should be arranged, constructed and operated can be undertaken. Employment of Human Systems Interface and Engineering subject matter experts, the optimal layout and configuration can be determined in concert with significant input from the operational users and the training and doctrine SMEs. This will allow for ships across the fleet to follow similar guidelines in the arrangement of systems and personnel in command and control spaces to ensure the productivity, health and well-being of the operators and the timely management of tasks assigned to those individuals. It would also enable a level of standardization heretofore unrealized across the fleet to the unique construction elements of the various platforms of the amphibious ships. The immediate goal of this undertaking, working in concert with Fleet Forces Command and the agencies that evaluate and measure performance objectives of the operating forces in addition to significant operator input is focused on the immediate, near term performance of the force. Secondarily, this process is designed to identify systems that have

either outlived their utility or have reached the end of lifecycle management and can pass funding resources on to the modernization effort without requiring additional sources or subjecting the effort to the budget process. In viewing the warfighting spaces as a complete system, rather than an amalgamation of various systems, the holistic perspective can look at performce objectives and warfighting capabilities without the jaundice that systems perspective may incur. The laboratory and the virtual environment represented there suggests that there is the possibility that the older outlived systems may be able to be preserved with a virtual front end that would allow the older tool sets and associated functionality and repositories continuing to support the warfighter until data can be migrated over into new repositories or functionality replaced by emerging systems. Additionally, the newer baselined system can identify continued or new gaps in capabilities, operate emerging system solutions and influence those programs to better satisfy the needs of the amphibious forces. The standardization process would better support concepts such as Sea Swap, reduce overall costs in preparing forces to deploy and implement a coordinated configuration management plan that would remain consistent across the Fleet. Finally, it would significantly reduce the amount of money spent on modifications to ship spaces that is time consuming, operationally unsuitable, and costly with minimal return on investment.

Technological Change.

The third and final element of change is to introduce and influence technological growth at a more sustainable rate. Our current hunger for technology, partially driven by self-fulfilling prophesy of Moore's Law and our cultural propensity to believe that the answer to our problem lies in the next material panacea has driven us to a point that there is a horde of vendors on the piers advocating a true understanding of the operator issues and promising a solution. Running in the shadows of the acquisition process, priced to remain under the threshold of the Joint Capability and Development System (JCIDS) process these "solutions" perpetuate the systems and program approach and continue our legacy of

stovepipe systems. The theory that underlies this prevailing marketing strategy is that if put into the hands of the operator, the need will be established and given possession is nine tenths of the equation operators will be unwilling to have systems removed from the environment. By creating the warfighting command and control environment in the laboratory, networked across the agencies that the operators can see on a frequent basis, the operator has an opportunity to confront the future and experience the art of the possible early in the developmental process. As they are better able to comprehend the value of the networked environment, accept the notions of scaled, planned and informed analysis of the capabilities that emerging and developmental applications provide, they are better able to determine and express requirements. Technology becomes an enabler of the previous two elements of change, supporting the cultural and social change through a shred view of the battlespace and active participants in the process of creating and implementing process change that discovers new mechanisms in providing the efficiency they as warfighters demand.

By reducing our consumption of technological solutions but rather refining the environment that the operators perform their missions, reduced capital investments improve the return on investment of the existing systems and increased the level of knowledge value added by discovering new means to process information. By demanding that warfighters operate from a shared view of the battlespace, encouraging the growth of network centric systems that operate within the current limited bandwidth afforded the operational forces. Leadership can better influence the policies and enterprise wide standards of performance that the networks provide. Only the dedicated focus on the Naval Amphibious Expeditionary Warfare COI will provide the necessary improvements in doctrine, process, and technological change that is required to achieve the ability to perform from the Sea Base in a network centric environment. The technological solutions can not be provided off-line and implemented with a pre-established cut-over date, due to high costs and impractical implementation due to the risk of operational effectiveness. The appropriate user interface and

modification of the processes and staffing adjustments from a holistic perspective is essential to the development and implementation of technological advance. It is the social and cultural change that becomes the primary driver and establishes the environment for the cooperative desire for change to occur.

Emerging and Enabling Technology.

This work has consciously avoided naming specific technologies that must be implemented in the near term, if at a minimum in the laboratory environment, but an example of a necessary technology to effectively operate in a network centric environment, secure mobile wireless routing is a key enabler to move away from our traditional single channel connectivity and low data rate communications systems and the ability to move to semantic and knowledge networks. Current certification processes and policy limitations prevent the development and input necessary to explore the risk benefit analysis necessary to influence acceptance of wireless operations. Network configurations, the speed of forces and the data requirements of newer weapon systems require the ability to allow data exchange on the move. The current practice of risk avoidance in the policies forbidding wireless technology exploration and implementation place operators and future programs at risk and reduce the return on investment of necessary network upgrades to current ships. Placement of wireless technologies in the EWT would enhance and allow the means to evaluate and mitigate the anticipated risks and develop processes that will ensure information security. Another example of the benefits of this simulated environment allows for the opportunity to share with defense related academic institutions that are working on coalition information and data exchange. By creating realistic shipboard computing environments, the needs and inputs necessary to develop intelligent and collaborative agents that would operate in a semantic and information centric web environment is enhanced. Similarly, the inputs from operators and SMEs would enhance the creation of libraries and glossaries of terms and use cases that will create libraries of re-usable and adaptable code and the exportability of functionality from one system to the next.

Current development of a means to add virtual “front-ends” to existing individual systems allow for participation in a shared environment, allow users in a network to access the functionality of disparate systems and introduce the ability to retain the repositories and functionality absent the legacy lifecycle costs. In the process of evaluation, the value added will determine if repositories are migrated to newer formats or retained in the current form.

The Command and Control Information Exchange Data Model is a means to open doors to Coalition partners that we undoubtedly operate with in the future. Although not a panacea, the concepts of a semantic web where data in context moves through a netted force to the commander is an exciting and valuable prospect that deserves study, reflection and participation. The movement from the semantic web to a fully functional knowledge network that employs the use of intelligent and cooperative agents is similarly exciting.

Operational Mission Planning

What is hoped to be an early success in networked applications specific to the ESG and the deployed MAGTF is an early attempt at fully collaborative operational mission planning capability named Expeditionary Staff Planning Folder that is currently under development in the virtual environment addressed earlier. Currently a gap in capability, this tool will allow the commander to capture and disseminate operational plans through visualization tools on a map that will translate to data tables and a variety of display formats. Building on existing capabilities of a number of systems, it benefits from the “best of breed” tools currently fielded, leverages the current technology and distributes the costs associated with developing a new system across a number of closely related planning and execution capabilities. This capability provides the flexibility to maintain information sharing across the ship mix and allow the operational commander the visibility into the planning process heretofore unavailable. It will also enable a means to find a critical path through the Rapid Reaction Planning Process that moves critical information up and down the chain of command that allows for unprecedented depth of planning and early movement of critical information to detailed mission planners at the tactical level of warfare. With the

most precious commodity to the deployed force in a six hour planning process being time, minutes and hours of additional time to rehearse explore viable courses of action and to wargame in a simulated environment will be the metrics by which the effectiveness of this tool will be measured. Combining the innovative approach of military acquisition professionals, developers, vendors and cross-functional organizations in the Navy and Marine Corps, a unique team has been developed for this project, dedicated to providing a inexpensive, yet powerful tool to the operational force that will likely be absorbed by the programs that are currently participating in the developmental process. We are looking forward to the introduction of this capability in the mid-summer and perform experimentation with the tool throughout the fall.

Conclusions.

This is a methodology that addresses a very small part of the collective might of the United States military power, but as a microcosm of that collective whole, is as complex as the larger Joint Task Force. The applicability of this methodology can be argued and exercised as an academic pursuit, but it is clear that change must occur and that the warfighter must have a means to influence the process to maintain operational capability.

When we are able to clearly state our needs, achieve a means to effectively command and control our forces in a shared, network centric environment we will have created and economical and efficient means of operating as a Naval team with unprecedented levels of integration throughout the force. This achievement will yield additional benefits as we build new ships and remove the prevailing attitude that one service is trying to meet service specific needs at the expense of the other. The arbitration process of evaluating new ship construction specific to command and control spaces will undoubtedly become more efficient and allow planners to develop concepts of modular command and control spaces that are shared across the ships involved in operations. The Sea Base can truly be a collection of available ships that may include any mixture of capabilities, task organized to meet the mission at hand without prior planning or modification to

perform those missions. Creation of a core C4I capability on amphibious ships need not affordably replicated on platforms such as Maritime Pre-positioned Ships (Future). However, utilizing the benefits of network centric and GIG enterprise services can be added together to provide a tailorable force package that aggregates the individual and organic C4I capabilities of each ship to become a larger and more robust command and control system. This would reduce the number and quantity of individual systems and rather than build into the design of ships that will not appear for ten years or more have adaptable spaces that can be equipped by embarked resources and configured to meet the demand of the specific mission at hand. The long term cost savings is exceptionally large and provides opportunities yet unrealized for presence, persistence, and flexibility to operate in any environment in support of national security objectives.

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Although no direct quotations were used from any sources other than the introductory quote from Vannevar Bush in the June, 1945, Atlantic Monthly article he wrote, I would be remiss if I did not acknowledge the fine works that have influenced my thinking and the writing of this paper. Many have been part of my continued reference for nearly 20 years, others have only recently become frequent travelers in and out of my bookshelves.

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